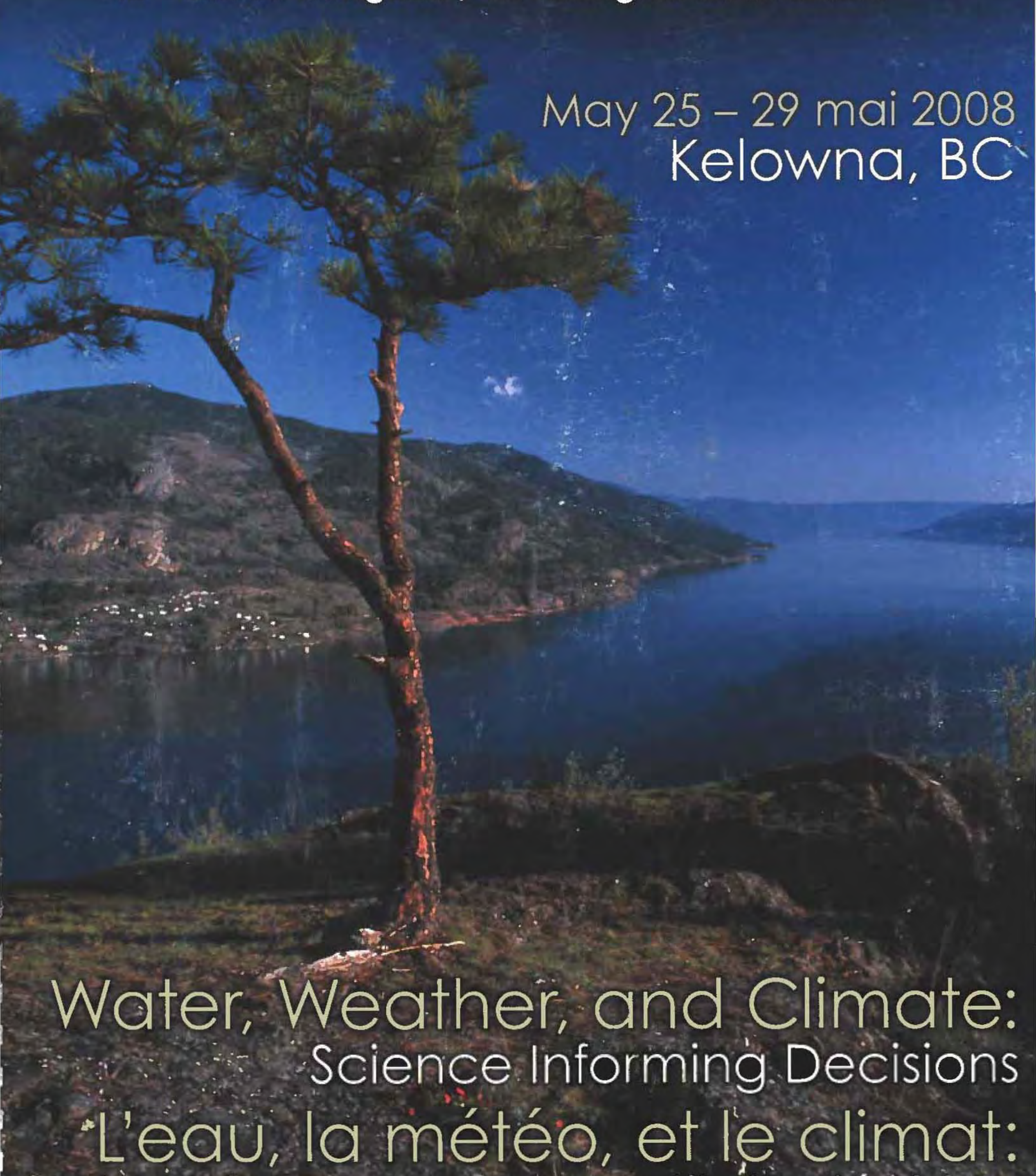
42nd CMOS Congress / 42e Congrès de la SCMO



May 25 – 29 mai 2008
Kelowna, BC

Water, Weather, and Climate:
Science Informing Decisions

L'eau, la météo, et le climat:
La science comme outil de décision

Canadian Meteorological and Oceanographic Society
La Société canadienne de météorologie et d'océanographie

CMOS

www.cmos2008.ca

2008 Congress   Congrès 2008

Canadian Meteorological and Oceanographic Society
La Société canadienne de météorologie et d'océanographie

May 25-29, 2008 Kelowna, B.C.
25-29 mai, 2008   Kelowna, C.-B.

**Water, Weather, and Climate:
Science Informing Decisions**

**Eau, météo, et climat:
La science comme outil de décision**

The Grand Okanagan Lakefront Resort and Conference Centre
(www.grandokanagan.com)
www.cmos2008.ca

Canadian Meteorological and Oceanographic Society (CMOS)
La Société canadienne de météorologie et d'océanographie (SCMO)

42nd Congress / 42e Congrès

Kelowna 2008

25–29 May / 25 au 29 mai, 2008

Water, Weather and Climate: Science Informing Decisions
L'eau, la météo et le climat : La science comme outil de décision

Editor / Rédactrice : Lisa Vitols

PROGRAM / PROGRAMME

www.cmos2008.ca

Abstracts available online at / Les résumés sont disponibles à
https://www1.cmos.ca/abstracts/congress_schedule.asp

ISBN 978-0-9732812-5-5

Front cover designed by / la couverture a été créée par : Danielle Prevost, Vancouver, BC

Cover photo / Photo de couverture : Gabor Fricska, Kelowna, BC

We would like to thank / Nous désirons remercier :

- Rosalie Rutka for producing the program / Rosalie Rutka pour la production du programme
- Robert Mailhot for translation services / Robert Mailhot pour traduction et révision
- Carl Dubeau : Congress photographer / photographe du Congrès

Program printed by / le programme a été imprimé par : Source Graphics, Kelowna, BC

May / mai 2008

Contents

Event Partners / Nos associés

CAMPBELL SCIENTIFIC CANADA CORP.

The Weather Network Météo Média

theweathernetwork.com ■ meteomedia.com

BRITISH COLUMBIA The Best Place on Earth | Ministry of Environment

UBC OKANAGAN

Canada

City of Kelowna *Office of the Mayor*

Welcome from the Mayor of Kelowna / Mot de bienvenue de la mairesse de Kelowna

May 2008

Welcome to Kelowna – A Natural Choice!

On behalf of the Kelowna City Council, I am happy to write this letter welcoming all the delegates attending the Annual Congress of the Canadian Meterological and Oceanographic Society from May 25 to 30, 2008 at the Grand Okanagan Lakefront Resort and Conference Centre.

We are honoured and privileged that your society has chosen to hold your annual congress in our city. Your congress theme of "*Water, Weather and Climate: Science Informing Decisions"* will attract many interested society members and will also appeal to members of the public. The presentations offered by leading researchers and scientists cover many fascinating and topical subjects that will undoubtedly provide a valuable exchange of information and education for everyone involved. We trust that this important gathering of your society will provide an opportunity to share information, meet new people, and enjoy your visit to Kelowna.

Kelowna is a dynamic and vibrant city renowned for our hospitality and friendliness. If time permits, we hope you will enjoy exploring our parks and waterfront esplanade, and experience the many unique restaurants, shops, golf courses and wineries in our area. Kelowna's Cultural District, located in the downtown area near the Grand Okanagan Lakefront Resort, is evolving into a vibrant artistic and recreational centre.

While you are here I know you will receive the traditional warm Kelowna welcome from our citizens, a welcome that I hope will encourage you to return.

Yours very truly,

Sharon Shepherd

Sharon Shepherd
MAYOR

Welcome from the President of CMOS

On behalf of the CMOS Council and Executive, it is my pleasure to welcome you to the 42nd Congress of the Canadian Meteorological and Oceanographic Society in Kelowna, British Columbia. With a theme of Water, Weather, Climate: Science Informing Decisions, our society and its members can continue to show the importance of meteorology and oceanography to all Canadians and the country as a whole.

Several years of hard work by many people behind the scenes have led to this congress, which should be an extremely successful event. This congress would never have been possible without the hard work of people in the main CMOS office in Ottawa, as well as the many dedicated volunteers from Kelowna and beyond. Despite Kelowna being a smaller centre, we are looking at a program for this congress that is second to none. We have many people to thank for this, but for now I'd like to acknowledge those leading the way: Kent Johnson, Chair of the CMOS 2008 Local Arrangements Committee, and Peter Jackson and Diane Masson, Co-Chairs of the CMOS 2008 Scientific Program Committee.

Additionally, the Congress is not just a scientific and social event but also an occasion for the Council and the CMOS committees to meet and carry out some essential business for the society. These meetings are open to all interested members, and I strongly encourage people to attend as many such meetings as they are able. It is only through strong interactions and involvement of its members that the society is able to grow and prosper.

Paul Myers

President
CMOS

Mot de bienvenue du président de la SCMO

Au nom du Conseil de direction de la SCMO, il me fait plaisir de vous souhaiter la bienvenue au 42e Congrès de la Société canadienne de météorologie et d'océanographie à Kelowna en Colombie-britannique. De par le thème choisi : « eau, météo et climat: la science comme outil de décision », notre Société et ses membres continuent de souligner l'importance de la météorologie et de l'océanographie pour tous nos concitoyens.

Des années d'efforts soutenus de la part de plusieurs personnes dans les coulisses ont mené à ce congrès qui s'avérera un succès. Ce congrès n'aurait pas été possible sans le travail constant du personnel de la SCMO au siège à Ottawa, et sans le dévouement des bénévoles de Kelowna et d'ailleurs. Bien que Kelowna ne soit qu'un petit centre, il ne le cède en rien aux plus grands si l'on considère le programme proposé. J'aimerais remercier tous ceux qui ont organisé ce congrès et plus particulièrement ceux qui ont ouvert la marche : Kent Johnson, président du comité des dispositions locales de la SCMO en 2008 ainsi que Peter Jackson et Diane Masson, coprésidents du programme scientifique de la SCMO.

Qui plus est, le congrès est non seulement un évènement scientifique et social, mais il fournit aussi l'occasion au Conseil et aux comités de la SCMO de tenir des réuions et de vaquer aux affaires de la société. Ces réunions sont ouvertes à tous et je vous encourage fortement à assister à autant de ces rencontres que possible. La Société progressera et prospérera dans la mesure où ses membres s'y intéressent et s'impliquent profondément.

Paul Myers

Président
SCMO

Local Arrangements Committee welcome

On behalf of the Local Arrangements Committee (LAC), it is my pleasure to welcome you to the 42nd Congress of the Canadian Meteorological and Oceanographic Society. The theme of our Congress this year is Water, Weather and Climate: Science Informing Decisions. I am looking forward to hearing and viewing the many diverse presentations. The Congress will start with an icebreaker reception at the Laurel Packinghouse. The Packinghouse is a significant piece of history in Kelowna. It is a former centre for sorting, packing and shipping of fruit like apples, pears, peaches and apricots. The building was constructed in 1918 and it continued to function as a packinghouse until 1970. It contains a small museum and a wine shop. It will give us a perfect location to unofficially open our Congress. We hope that you will be able to join us for the Icebreaker.

Three years ago, in Vancouver, we noted the schedule of upcoming Congresses - Toronto then St. John's. We decided that the Congress should come back west and proposed Kelowna as the host city. The offer to host came easily at the time and seemed to be a simple choice. However, many things have changed since we last hosted the Congress in Kelowna in 1995. Fortunately, we have an excellent group on our local arrangements committee. It consists of MSC members, science committee members, several former employees who have retired and several others who are neither scientists nor CMOS members. The success of the Congress is entirely due to their efforts as well as those of our Science Program Committee.

Our Science Program Committee, led by Peter Jackson and Diane Masson, has assembled an excellent set of sessions and an intriguing set of internationally renowned plenary speakers. The plenary speakers will be interesting no matter what your specific discipline. In particular, we have relied extensively on Diane Masson. Kelowna is not exactly a centre of oceanographic excellence. Thanks to Diane and the many contributors, this will likely be the greatest concentration of oceanographic expertise ever gathered in Kelowna.

For those who are fortunate to be accompanied by family or friends, we have a very interesting social program. Please look for the schedule later in this congress program.

All of our sessions will be held at the Conference Centre of the Grand Okanagan Lakefront Resort. For the first time ever, a CMOS Congress session will be held outdoors. Our poster session will take place on the terraces where you will be able to meet others and view the posters while taking advantage of the fresh Okanagan Valley air.

You will be able to recognize members of our Local Arrangements Committee, as well as volunteers, by our bright yellow vests. If you require anything or have any questions, do not hesitate to stop one of us. I wish you a wonderful visit to the Okanagan Valley. We hope that you learn a lot, that you enjoy the region, that you reconnect with old friends and that you develop new friendships. Please do not hesitate to find me personally and say hello. I would be happy to meet you.

Kent Johnson

Chair
Local Arrangements Committee
CMOS Congress 2008

Mot de bienvenue du comité des dispositions locales

Au nom du Comité des dispositions locales, j''ai le plaisir de vous accueillir au 42e Congrès de la Société canadienne de météorologie et d'océanographie. Cette année, notre thème est « Eau, météo, et climat : La science comme outil de décision » et nous avons hâte d'écouter les présentations sur d'autant de sujets variés.

Le Congrès commencera avec une réception d'accueil ouverture qui aura lieu au "Laurel Packinghouse". Cet édifice est un ancien centre de triage, d'entreposage et d'expédition de fruits (les pommes, les poires, les pêches et les abricots, etc.). Construit en 1918, il a servi de centre d'emballage jusqu'à 1970. C'est donc un endroit idéal pour y rencontrer amis et collègues et ouvrir, officieusement, notre Congrès. Nous espérons que vous vous joindrez à nous à cette occasion.

Il y a trois ans, à Vancouver, lors du congrès, nous avons décidé de proposer Kelowna comme hôte du Congrès de 2008. À ce moment-là, l'enjeu nous semblait aisé. Plus tard, nous nous sommes aperçus du niveau d'effort nécessaire. Certains d'entre-nous avaient fait partie du comité local lorsque le Congrès a eu lieu à Kelowna en 1995 mais l'organisation d'un Congrès a beaucoup changé entre 1995 et 2008. Heureusement, nous avons un excellent Comité des dispositions locales. Le Comité comprend des membres du SMC, des retraités, des membres du comité scientifique et quelques autres personnes qui ne sont ni scientifique ni membre de la SCMO. Le succès de notre Congrès est entièrement dû à leurs efforts et à ceux du comité scientifique.

Le Comité du programme scientifique, dirigé par Peter Jackson et Diane Masson, a mis sur pied plusieurs excellentes sessions scientifiques et invité un groupe remarquable de conférenciers de plénières de renommée internationale. Bien particulièrement, nous remercions Diane pour ses efforts. La ville de Kelowna n'est guère un centre d'excellence océanographique mais, grâce à Diane et à plusieurs contributeurs, nous aurons probablement la plus grande concentration d'expertise océanographique jamais réunie à Kelowna.

Pour ceux qui sont venus accompagnés de parents ou d'amis, nous avons planifié des activités intéressantes. Veuillez consulter l'horaire dans le programme pour en apprendre davantage.

Toutes les sessions auront lieu au centre de conférence de l'hôtel "Grand Okanagan Lakefront". Pour la première fois à un Congrès de la SCMO, la session d'affichage aura lieu à l'extérieur et vous pourrez profiter de l'air bienfaisant de la vallée de l''Okanagan.

Vous reconnaîtrez les membres du Comité des dispositions locales à leurs vestes jaunes. N'hésitez pas à les contacter pour de plus amples renseignements. Je vous souhaite un bon séjour à Kelowna. Nous espérons que vous apprendrez beaucoup, que vous apprécierez la région, que vous renouerez de vieilles amitiés et que vous en ferez de nouvelles. Venez me trouver sans hésitation. Je serai heureux de faire votre connaissance.

Merci.

Kent Johnson

Président
Comité des dispositions locales

Science Program Committee welcome

On behalf of the Science Program Committee, we are pleased to welcome you to CMOS Congress 2008. The theme of this 42nd Annual Congress, “Water, Weather, Climate: Science Informing Decisions”, seems most appropriate given rising societal concerns over a changing climate and its implications for water and energy resources. The CMOS membership, with expertise spanning the atmospheric, oceanographic and hydrological sciences, is centrally placed to address these issues, and to advise the public and decision makers as we move into an increasingly uncertain future. This is reflected in the stimulating plenary presentations by leading experts, as well as excellent contributed presentations that you will be able to enjoy over the four days of the congress.

We would like to give special thanks to all of the volunteers who made this Congress possible, including the members of the Science Program Committee, the members of the Local Arrangements Committee, the session convenors, the volunteers here at the congress who are ensuring that everything runs smoothly, as well as to the CMOS Head office staff for their time and expert advice. There simply wouldn’t be a congress without them.

Welcome and enjoy your Congress!

Diane Masson and Peter Jackson

Co-Chairs
Science Program Committee

Mot de bienvenue du président du programme scientifique

Au nom du Comité du programme scientifique, nous aimerions vous souhaiter la bienvenue au congrès de la SCMO 2008. Le thème de ce 42e congrès « *Eau, météo, et climat : La science comme outil de décision* », semble des plus appropriés étant donné les préoccupations sociétales grandissantes par rapport aux changements climatiques et à ses conséquences sur les ressources en énergie et en eau. Grâce à leur vaste expertise en sciences atmosphériques, océanographiques et hydrologiques, les membres de la SCMO occupent une place de choix pour se pencher sur ces questions et conseiller le public et les décideurs face à un avenir de plus en plus incertain. Ceci est mis en évidence par la série de présentations plénières stimulantes par de grands spécialistes ainsi que par la qualité de l’ensemble des présentations au programme.

Nous aimerions remercier tous les bénévoles qui ont fait de ce congrès une réalité, soient les membres du comité du programme scientifique, les membres du comité des dispositions locales, les responsables de session, les bénévoles ici au Congrès qui s’assurent que tout se déroule rondement, ainsi que le personnel du siège de la Société pour leur temps et leurs conseils judicieux. Sans eux, il n’y aurait tout simplement pas de congrès.

Bienvenue et profitez bien de votre congrès!

Diane Masson et Peter Jackson

Co-présidents
Comité du programme scientifique

A word about the Society

The Canadian Meteorological and Oceanographic Society (CMOS) is the national society of individuals and organisations dedicated to advancing atmospheric and oceanic sciences and related environmental disciplines in Canada. The Society's aim is to promote meteorology and oceanography in Canada, and it is a major non-governmental organisation serving the interests of meteorologists, climatologists, oceanographers, limnologists, hydrologists and cryospheric scientists in Canada. CMOS was officially created in 1967 as the Canadian Meteorological Society and adopted its present name in 1977, following an invitation by the Canadian Meteorological Society to the oceanographic community in Canada to join the Society. However, CMOS has a rich history dating back to 1939 when it was known as the Canadian Branch of the Royal Meteorological Society.

Quelques mots à propos de la Société

La Société canadienne de météorologie et d'océanographie (SCMO) est une société nationale de personnes et d'organisations vouées à l'avancement des sciences atmosphériques et météorologiques et aux disciplines environnementales connexes au Canada. Un des principaux organismes non gouvernementaux à servir les intérêts des météorologues, océanographes, limnologues, hydrologues et scientifiques cryosphériques, la Société vise à promouvoir la météorologie et l'océanographie au Canada. La SCMO a vu le jour officiellement en 1967 et a adopté son nom actuel en 1977 après que la Société météorologique du Canada eut invité la communauté océanographique du Canada à se joindre à elle. Toutefois, la SCMO a une riche histoire qui remonte à 1939 alors qu'elle était connue sous le nom de Section canadienne de la « Royal Meteorological Society ».

2008 Student travel bursary recipients / Récipiendaires 2008 des bourses de voyage pour étudiants

Student / étudiant(e)	University / université	Supervisor / superviseur
Bronwyn Brock	*University of Waterloo*	Brent Wolfe
Matthew Corkum	*Dalhousie University*	Harold Ritchie
Linda Genovesi	*Université du Québec à Montréal*	Benoit Thibodeau
Shama Kalia	*York University*	Peter Taylor
Yuehua Lin	*Dalhousie University*	Jinyue Sheng
Zhaoshi Lu	*Memorial University of Newfoundland*	Guoqi Han
Khalid Malik	*York University*	Peter Taylor
Jennifer Mecking	*Dalhousie University*	Jinyue Sheng
Gail Millar	*University of Northern British Columbia*	Peter Jackson
John Postma	*University of Alberta*	John Wilson
Maja Rapaic	*Université du Québec à Montréal*	Rene Laprise
Sarah Roberts	*University of British Columbia*	Tim Oke
Brian Rose	*Massachusetts Institute of Technology*	John Marshall
Babak Tavakoli-Gheynani	*York University*	Peter Taylor
Jinjun Tong	*University of Northern British Columbia*	Stephen Dery

Local arrangements committee / Comité des dispositions locales

Dan Antunes
Brian Bowkett
Cheryl Bowkett
Gabor Fricska
Peter Jackson
Kent Johnson
Ross Klock
Oscar Koren
Dave Lahn
Terri Lang
Doug Lundquist
Lyn Mainwaring
Diane Masson
John Mullock
Ian Rutherford
Tom Shalansky
Henry Stanski
Lisa Vitols
Charlene Wollen

Scientific program committee / Comité du programme scientifique

Peter L. Jackson
Co-chair / Co-président
University of Northern British Columbia

Diane Masson
Co-chair / Co-présidente
Fisheries and Oceans Canada / Pêches et Océans Canada

Philip Austin
University of British Columbia

Jeff Curtis
University of British Columbia

Stephen Dery
University of Northern British Columbia

Fes De Scally
University of British Columbia

Howard Freeland
Fisheries and Oceans Canada / Pêches et Océans Canada

Blair Greenan
Fisheries and Oceans Canada / Pêches et Océans Canada

William Hsieh
University of British Columbia

Kent Johnson
Environment Canada / Environnement Canada

Trudy Kavanagh
University of British Columbia

Louise Nelson
University of British Columbia

Michael Pidwirny
University of British Columbia

Nadja Steiner
Environment Canada/ Environnement Canada

Ian Saunders
University of British Columbia

Robert Young
University of British Columbia

Ian Walker
University of British Columbia

Information

Bureau d'inscription

Heures d'ouverture du bureau d'inscription et de renseignements

le dimanche 25 mai :	13h00–18h00
le lundi 26 mai :	07h30–16h00
le mardi 27 mai :	07h30–16h00
le mercredi 28 mai :	07h30–16h00
le jeudi 29 mai :	07h30–12h00

Information touristique

Les informations touristiques sont disponibles auprès du concierge à l'Hôtel Grand Okanagan ou du Kelowna Visitor Info Centre au 544 Harvey Avenue (l'autoroute 97, à 5 intersections de l'Hotel Grand Okanagan) ou sur l'internet à www.tourismkelowna.com. N'hésitez pas à vous renseigner auprès d'un membre du comité des dispositions locales (ils portent d'élégantes vestes jaunes).

Salle de préparation

Dans le but de faciliter le déroulement des sessions, nous mettons la salle Cariboo à la disposition d'orateurs pour leur permettre de vérifier et de pratiquer leurs présentations. Les renseignements au sujet de l'équipement technique, du format, des instructions et du téléchargement sont disponibles ci-dessous ou en ligne. Il y aura également un ordinateur et un projecteur dans la salle de préparation. Cette salle sera ouverte :

le dimanche	de 15h à 17h
les lundi, mardi, mercredi	de 9h à 18h
le jeudi	de 9h à 11h.

Les présentations doivent être téléchargées au moins deux heures avant l'heure de la session.

Normes pour les présentateurs :

Votre présentation doit être téléchargée sur le réseau d'ordinateurs du Congrès dans la salle des conférenciers au moins deux heures avant votre session. Des bénévoles seront disponibles si vous avez besoin d'aide. Les ordinateurs du congrès utilisent Windows XP et disposent des logiciels suivants : Web Browser, Acrobat Reader 8, Flash Player 9, Quicktime Player 7, Windows Media Player 11, PowerPoint Viewer 2007. Veuillez avoir votre présentation sur un des média suivants : USB à minidisque dur (lecteur de poche, baladeur à disque dur), clé USB à mémoire flash, disquette 3,5 in, CDROM, CD inscriptible ou DVD. Évitez l'utilisation de CD réinscriptibles (CD-RW) car on ne peut garantir entièrement la compatibilité. Les orateurs qui utilisent un ordinateur portatif ayant un port USB et qui voudraient éditer leur présentation sur place devront copier leurs fichiers de leur ordinateur sur le réseau de l'ordinateur du Congrès en utlisant une clé USB. Notez que si les graphiques ou les clips ne sont pas incorporés dans une présentation, ils devront être aussi téléchargés. Les présentations créées sur un Macintosh et converties pour fonctionner sur un ordinateur personnel PC devraient être vérifiées sur un ordinateur personnel avant d'arriver à la rencontre. Tous les liens devraient être vérifiés à la rencontre pour s'assurer qu'ils restent fonctionnels. Veuillez noter que les ordinateurs des présentations ne sont pas reliés à Internet.

Directives pour les président(e)s des sessions orales

Il y aura un/une assistant(e) à chacun des sessions. L'assistant(e) sera disponible pour résoudre les problèmes audiovisuels, d'ordinateur ou autres. Chaque ordinateur sera muni des logiciels suivants : Web Browser, Acrobat Reader 8, Flash Player 9, Quicktime Player 7, Windows Media Player 11, PowerPoint Viewer 2007 et Putty. Consultez d'abord votre assistant(e) en cas de problème technique.

Avant le début de la session, le/la président(e) de la session doit s'assurer que toutes les présentations orales sont sur l'ordinateur et que les orateurs sont présents dans la salle. Il/elle devrait consulter l'assistant(e) pour organiser le déroulement de la session et s'assurer que l'orateur est bien au programme en tant qu'un des auteurs ou qu'il connaît suffisamment bien le travail pour pouvoir répondre aux questions.

Information

Registration desk

The registration and information desk in the Conference area will be staffed daily:

Sunday, May 25	13:00–18:00
Monday, May 26	07:30–16:00
Tuesday, May 27	07:30–16:00
Wednesday, May 28	07:30–16:00
Thursday, May 29	07:30–12:00

Tourist information

Tourist information is available at the hotel Concierge desk, down the street at the Tourism Kelowna Visitor Info Centre, 544 Harvey Ave. (the highway), or online at http://www.tourismkelowna.com/. You can also ask any LAC member wearing a yellow vest.

Speaker Ready Room

To ensure presentations run smoothly and on time, we have booked a Speaker Ready Room in the Cariboo Room of the Conference area. Instructions on equipment, format, guidelines and uploading are available below and online. The Speaker Ready Room, with a laptop and projector, will be open 15:00–17:00 Sunday, 09:00–18:00 Monday through Wednesday and 09:00 to 11:00 on Thursday. Presentations must then be uploaded in the Internet Café at least two hours before they are scheduled.

Guidelines for presenters

Your presentation must be uploaded to the congress computer network in the Internet Café at least 2 hours prior to your session. Volunteers will assist in downloading your presentation. The congress computers run Windows XP with the following software: Web Browser, Acrobat Reader 8, Flash Player 9, Quicktime Player 7, Windows Media Player 11, PowerPoint Viewer 2007. Please bring your presentations on one of the following media: USB hard drive (Pocket Drive, iPod), USB flash drive, 3.5-in diskette, CD-ROM, CD-R, or DVD (Use of rewritable CDs (CD-RW) should be avoided, as compatibility problems can occur). Presenters seeking to edit their presentations on site using a laptop that has a USB port will need to copy their files from their laptop to the congress computer network using a USB storage device. Note that if graphics or video clips are not embedded in a presentation, they must be downloaded as well. Presentations created on a Macintosh and converted to run on a PC should be tested on a PC before arriving at the meeting. Any links should be checked at the meeting to ensure that they remain functional. Please note that there is no internet connection on the presentation computers.

Guidelines for chairpersons

Oral session

One assistant will be present in each of the session rooms. The assistant will be available to help with any A/V or computer technical problem. Each computer will be equipped with the following software: Web Browser, Acrobat Reader 8, Flash Player 9, Quicktime Player 7, Windows Media Player 11, PowerPoint Viewer 2007.

The chairperson is responsible for opening and closing the session on time. The time allocated for a presentation includes the time for questions and discussions as well as the change over. In consideration of many parallel sessions, the time schedule of the session should be strictly kept. A timer will be available in each session room. Should an unforeseen gap in the schedule appear, it should be filled with a standby paper, an extended question period on previous talks or a short description of the poster sessions associated with the session.

Le/la président(e) doit s'assurer que la session débute et prend fin à l'heure prévue. La durée de chaque présentation comprend quelques minutes pour des questions et le temps de transition pour la prochaine présentation. L'horaire doit être strictement suivi puisque les sessions sont en parallèle. Il y aura un chronomètre dans chaque salle de session. Si un impondérable devait perturber l'horaire, le/la président(e) veillera à combler le temps avec une présentation supplémentaire, une période de questions plus longue sur les présentations précédentes ou un résumé des affiches associées avec la session.

L'horaire de session le plus récent sera affiché à la porte de la salle de session bien avant le début de la session. L'assistant(e) fournira une copie de l'horaire au/à la président(e).

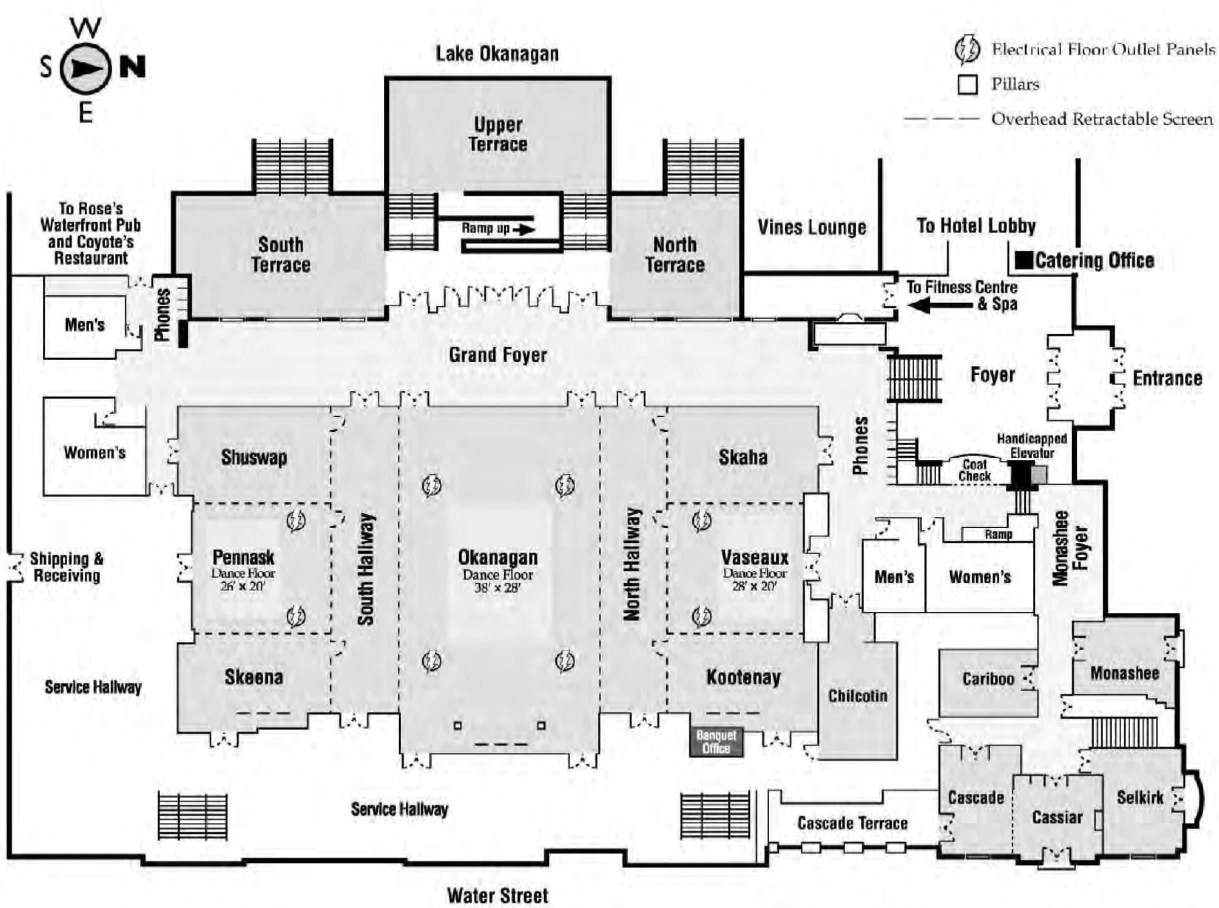
Les sessions d'affichage

Les sessions d'affichage auront lieu sur un patio couvert au rez-de-chaussée de l'hôtel. Les affiches seront exposées pendant la durée complète du congrès. Un espace d'environ 4 pieds sur 8 pieds sera alloué pour chaque affiche. Les affiches seront placées sur un panneau Velcro et des collants velcro seront disponibles. On demande aux auteurs d'affiches d'être présents, à côté de leurs affiches, pendant la session dédiée aux affiches pour discuter de leur recherche.

Horaire de la session d'affichage : le mercredi 28 mai de 16h00 à 17h30

Salles de réunion

Si vous avez besoin d'une sale de réunion en soirée, veuillez contacter un des membres du comité des dispositions locales (ils portent les vestes jaunes).



Before the session starts, the chairperson should touch base with the assistant, check if all talks are loaded in the computer and if all speakers are in the session room. Before the start of the session, the chairperson should verify that the person to speak is listed in the program as the presenter, or one of the authors, or otherwise is sufficiently acquainted with the work in order to answer questions.

The updated session program will be shown outside of the session room well before the session starts. The chairperson will receive a copy from the assistant.

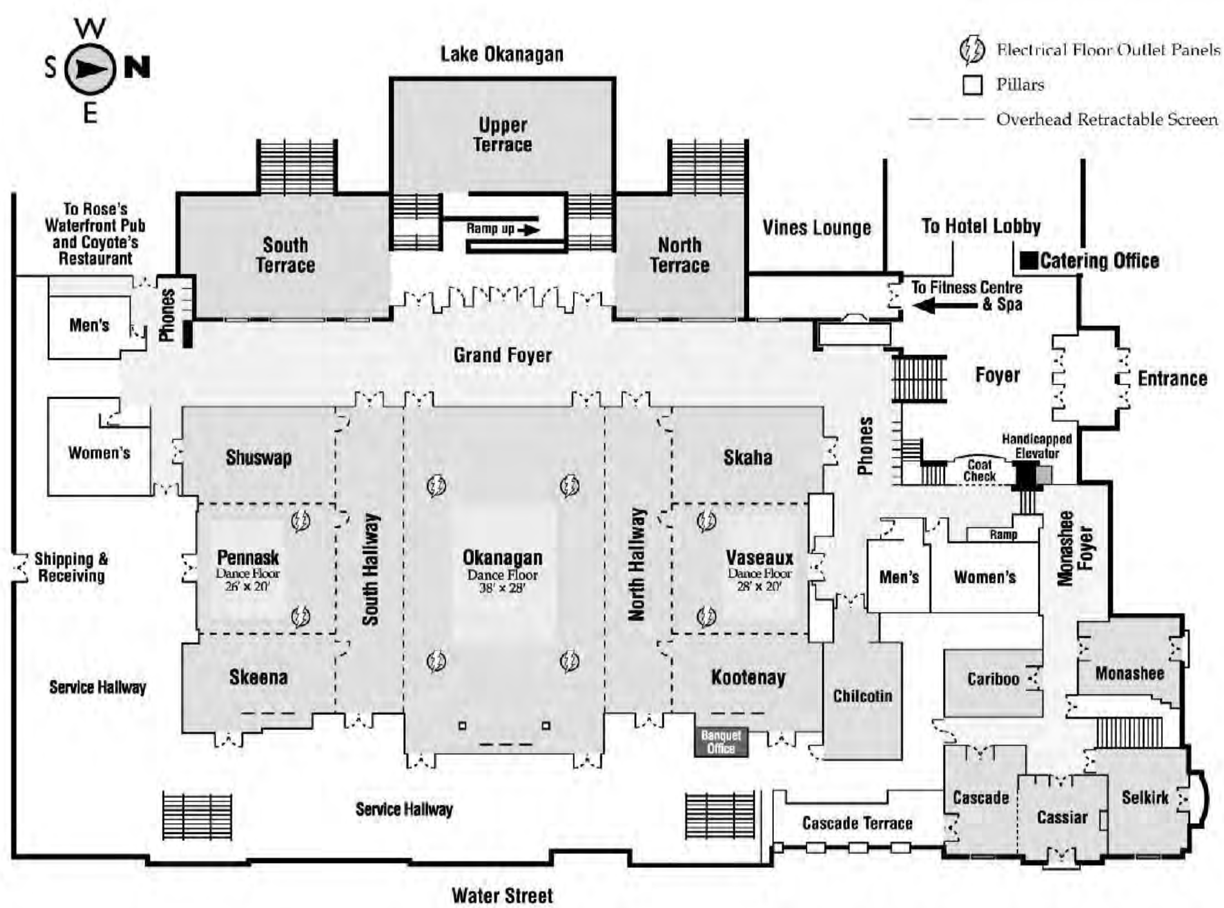
Poster session

The Science Posters for the Congress will be located on a sheltered outdoor patio on the main level of the Conference area. The posters will be on display for the duration of the Congress. Each poster is allocated a space of approximately 4 by 8 feet. The poster boards are Velcro and a supply of stick-on Velcro tabs will be supplied. Presenters will be required to be beside their posters to discuss their work during the scheduled poster session.

Poster Session authors present: Wednesday, May 28 between 16:00–17:30

Meeting rooms

If you require an evening meeting room, please contact one of the L AC members (in the yellow vests). For meeting rooms, please refer to the floorplan.



Réunions

Date	Heure	Salle	Réunion
dimanche 25 mai	8h-16h	Skaha	GOAPP
dimanche 25 mai	8h-18h	Cascade/Cassiar	Comités de la SCMO
dimanche 25 mai	13h-19h	Chilcotin	API – GEOTRACES
lundi 26 mai	18h-21h	Pennask	AGA de la SCMO et présentation du CRSNG
lundi 26 mai	19h-21h	Chilcotin	Prévision de la qualité de l'air
mardi 27 mai	19h-21h	Okanagan	Conférence publique
mardi 27 mai	17h30-19h	Chilcotin	Argo
mercredi 28 mai	9h-16h	Chilcotin	Le jour des enseignants
jeudi 29 mai	13h-15h	Vaseaux	Atelier FCSCA

Café Internet

Le café Internet est ouvert à tous les délégués. Il est situé dans le corridor sud du Centre de conférence près de la salle Vaseaux. Les heures d'ouverture sont
le dimanche 25 mai, 14h00 à 17h00
le lundi 26 mai, 07h30 à 18h00
le mardi 27 mai, 07h30 à 18h00
le mercredi 28 mai, 07h30 à 18h00
le jeudi 29 mai, 07h30 à 13h00

Un service d'internet est offert dans les chambres à l'Hôtel Grand Okanagan moyennant supplément. L'accès à Internet sans fil est disponible gratuitement aux participants dans le foyer du centre de congrès.

Panneau de Messages

Vous pourrez laisser et cueillir des messages personnels à l'intention d'autres congressistes sur le panneau identifié à cet effet à l'extrémité du foyer du centre du congrès.

L'impact environnemental du Congrès

Nous avons fait des efforts pour réduire l'impact environnemental de notre congrès :

- Les porte-badges d'identification sont réutilisables, laissez-les au bureau d'inscription lors de votre départ.
- Les résumés sont disponibles sous forme électronique sur le site web de la SCMO à l 'adresse (https://www1.cmos.ca/abstracts/abstracts_search.asp)
- Le « Grand Okanagan Lakefront Resort and Conference Centre" est un établissement sans fumée. Veuillez noter aussi que la loi provinciale sur le contrôle du tabac, récemment amendée, interdit de fumer dans les lieux intérieurs publics et à moins de trois mètres des entrées, fenêtres, bouches de ventilation, etc.
- Tout surplus alimentaire lors de la réception d'accueil sera donnée à un centre local pour sans abri.
- L'eau sera disponible dans des verres, et non dans des bouteilles de plastique, dans les salles de réunion.
- Il y aura des contenants de recyclage dans tout le Centre de congrès.

Meetings

Date	Time	Room	Event
Sunday, May 25	8am–4pm	Skaha	GOAPP
Sunday, May 25	8am–6pm	Cascade/Cassiar	CMOS Committees
Sunday, May 25	1–7pm	Chilcotin	IPY – GEOTRACES
Monday, May 26	6–8pm	Pennask	CMOS Annual General Meeting
Monday, May 26	7–9pm	Chilcotin	Air Quality Prediction
Tuesday, May 27	7–9pm	Okanagan	Public Lecture
Tuesday, May 27	5:30–7pm	Chilcotin	Argo Users
Wednesday, May 28	9am–4pm	Chilcotin	Teachers Day
Thursday, May 29	1–3pm	Vaseaux	CFCAS Workshop

Internet café

We are pleased to provide an internet café in the Conference area hallway (follow the signs). The staffed hours of operation are:

Sunday, May 25	14:00–17:00
Monday, May 26	07:30–18:00
Tuesday, May 27	07:30–18:00
Wednesday, May 28	07:30–18:00
Thursday, May 29	07:30–13:00

Rooms at the Grand have internet access available for a daily fee but the Congress will have wireless accessible within the Conference area.

Message board

A message board will be available at the far end of the Conference Centre foyer for your convenience to leave and receive messages from other attendees.

Conference Greening

Our efforts to reduce the footprint of this conference include the following measures:

- Reusable lanyard and badge holders – please drop off at Registration as you leave the Congress
- Abstracts available in an online searchable format through the CMOS website at https://www1.cmos.ca/abstracts/congress_schedule.asp
- The Grand Okanagan Lakefront Resort and Conference Centre is 100% smoke-free. Please be aware that the recently amended BC Tobacco Control Act bans smoking in indoor public places and work places; bans smoking near public doorways, open windows, and air intakes; and limits the display and sales of tobacco and tobacco products.
- Any leftover food from the Icebreaker will be donated to a local homeless shelter
- Water and glasses provided in meeting rooms
- Recycling boxes located around Conference area

Les événements sociaux

Vous pouvez acheter des billets additionnels pour la réception d'accueil, le déjeuner Patterson-Parsons et le banquet au bureau d'inscription.

L'ouverture official du pont William R. Bennett

Le nouveau pont sur le lac Okanagan sera inauguré le 25 mai. Il y aura des activités et un spectacle sure les rives en journée et, vraisemblablement, un feu d'artifice en soirée. Visitez www.tourismkelowna.com ou informez-vous à votre hôtel pour l'horaire des activités.

Le programme social

Veuillez contacter le bureau d'inscription pour plus de renseignements et pour vous inscrire à une activité. Le nombre de participants est limité pour certaines d'entre elles. Ces derniers devront assumer les coûts minimes exigés pour certaines visites et repas s'il y a lieu. Les événements sont

26 mai – jour culturel au centre-ville
27 mai – dégustations de vins et fromages
28 mai – parcs et jardins (occasions pour photos)

Les détails sont disponibles sur le site web du congrès à http://www.cmos2008.ca/fr/programme-dactivites-pour-epouxepouses-et-partenaires/. Nous vous suggérons d'autres activités touristiques à l'adresse http://www.cmos2008.ca/fr/quoi-visiter/.

La réception d'ouverture

La réception d'accueil aura lieu le dimanche 25 mai de 17h à 20h à l'édifice Laurel Packinghouse, situé à une intersection de l'Hôtel Grand Okanagan. Cet édifice est un ancien centre pour le triage, l'entreposage et l'expédition des fruits (pommes, poires, abricots, etc.). Construit en briques d'argile provenant de la montagne Knox au nord du centre-ville en 1918, il a continué à fonctionner comme centre d'emballage jusqu'à 1970.

Il est le plus vieux et le plus grand centre d'emballage de Colombie-Britannique. Aujourd'hui, on y retrouve le musée « BC Orchard Industry » et le musée du vin de la C.-B. Ils seront ouverts pendant la réception.

Social events

Extra tickets for the Icebreaker, Awards Luncheon and Banquet are available for purchase at the Registration desk.

William R. Bennett Bridge Official Opening

Kelowna's new bridge is having its official grand opening on Sunday, May 25. There will be entertainment and activities along the waterfront and in the city to commemorate this special occasion. Check http://www.tourismkelowna.com/ or local media for details.

Social program

Please see the Registration desk for details and to sign up for activities as there will be a limited number of seats at some of these events. There will be a minimal cost for some tours. Lunches will be paid for by the participants at the various locations.

May 26 – Downtown Cultural Day
May 27 – Wine and Cheese (tasting)
May 28 – Parks and Gardens (photo ops)

Details are available on the Congress website at http://www.cmos2008.ca/en/social-program/. Further activities are available through the links under "Things to Do" on the Congress website: http://www.cmos2008.ca/en/things-to-do/.

Icebreaker

The annual Icebreaker is being held at the historic Laurel Packinghouse, around the corner from the Grand Hotel from 17:00–20:00 on Sunday, May 25.

The historic Laurel Packinghouse, a nationally-designated heritage landmark, is the oldest and largest standing fruit packinghouse in British Columbia. It was built over the winter of 1917/18 of bricks made locally from clay from Knox Mountain and was a working packinghouse until the 1970s.

The BC Orchard Industry Museum, BC Wine Museum, and VQA Wine Shop attached to the Laurel, will also be open for touring (and purchases!).

Le déjeuner Patterson-Parsons

Le déjeuner Patterson-Parsons et la présentation des prix auront lieu dans la salle Okanagan, le mardi 27 mai, de midi à 14h.

La conférence publique

Le mardi le 27 mai, deux conférenciers bien connus donneront une conférence publique. David Phillips, climatologue principal d'Environnement Canada et Mike Roberts, expert de la météo de CHBC-TV à Kelowna, partageront leurs expériences de la météo et du climat d'aujourd'hui. L'endroit ? dans la salle Okanagan à 19h.

La Journée des enseignants

Le mercredi 28 mai, dans la salle Chilcotin, aura lieu la journée des enseignants. Ce jour est consacré aux éducateurs et aux enseignants de la C.-B. et comprend des activités d'apprentissage en météorologie, en océanographie, en climatologie en limnologie et en science du cryosphere. Nous remercions les délégués qui contribueront au jour des enseignants comme présentateurs. Nous vous encourageons tous à visiter la session d'affichage à la fin de la journée.

8:30	**Making Weather Literacy Part of Every Child's Education**
	David Phillips. Senior Climatologist, Environment Canada
9:15	**Interactive Multimedia Modules for Environmental Education**
	Greg Byrd, Senior Project Manager and Warren Rodie, Meteorologist, UCAR/COMET
10:00	Health Break
10:15	**Web-based Weather Forecasting for Kids**
	Dwight Owens, Alphapure Design Studio/COMET
11:15	**EnerAction & eCards - Integrated Energy and Climate Change Education**
	Johan Stroman, BC Director of GreenLearning, Pembina Institute
12:15	Buffet lunch, Networking and Poster Viewing
12:45	**Icebergs Ahead!**
	Sheila Bourque, Canadian Ice Service
1:30	**Mission to the Clouds - Canadian Space Agency/NASA CloudSat Satellite Mission**
	Bill Batycky, GLOBE Canada, Cloudsat, SEEDS Foundation
3:00	Health Break
3:30	**Ocean News and Climate Change**
	Anne Stewart, Public Education Program Coordinator, Bamfield Marine Station
4:30/5:00	**Wrap up and poster viewing**

Le banquet

La remise des prix annuels de la SCMO aura lieu dans la salle Okanagan lors du banquet du mercredi 28 mai à 18h30.

Awards luncheon

The Parsons–Patterson Luncheon and Awards Ceremony will be held in the Okanagan Ballroom on Tuesday, May 27 from 12:00–14:00.

Public lecture

On Tuesday, May 27 at 19:00 in the Okanagan Ballroom, two well-known speakers will make public presentations. David Phillips, Senior Climatologist with Environment Canada, and Mike Roberts, award-winning weathercaster from CHBC Kelowna, will share their perspectives on weather and climate today.

Teachers' Day

Wednesday, May 28, in the Chilcotin Room, CMOS is hosting a learning day with presentations for teachers and educators in BC on aspects of meteorology, oceanography, climatology, limnology and cryospheric science. Many thanks to those CMOS attendees who have also volunteered as presenters! The teachers are also invited to visit the Poster Session area during the day.

8:30	**Making Weather Literacy Part of Every Child's Education**
	David Phillips. Senior Climatologist, Environment Canada
9:15	**Interactive Multimedia Modules for Environmental Education**
	Greg Byrd, Senior Project Manager and Warren Rodie, Meteorologist, UCAR/COMET
10:00	Health Break
10:15	**Web-based Weather Forecasting for Kids**
	Dwight Owens, Alphapure Design Studio/COMET
11:15	**EnerAction & eCards - Integrated Energy and Climate Change Education**
	Johan Stroman, BC Director of GreenLearning, Pembina Institute
12:15	Buffet lunch, Networking and Poster Viewing
12:45	**Icebergs Ahead!**
	Sheila Bourque, Canadian Ice Service
1:30	**Mission to the Clouds - Canadian Space Agency/NASA CloudSat Satellite Mission**
	Bill Batycky, GLOBE Canada, Cloudsat, SEEDS Foundation
3:00	Health Break
3:30	**Ocean News and Climate Change**
	Anne Stewart, Public Education Program Coordinator, Bamfield Marine Station
4:30/5:00	**Wrap up and poster viewing**

Banquet

The annual CMOS Awards Banquet will take place Wednesday, May 28 at 18:30 in the Okanagan Ballroom.

Our exhibitors / Nos exposants

Aquatic Informatics Inc.

ATS Services

AXYS Technologies Inc.

Campbell Scientific Canada Corp.

Canadian Broadcasting Corporation (CBC)

Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)/Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA)

Canadian Ice Service/ Service canadien des glaces

Canadian Meteorological and Oceanographic Society (CMOS)/ La Société canadienne de météorologie et d'océanographie (SCMO)

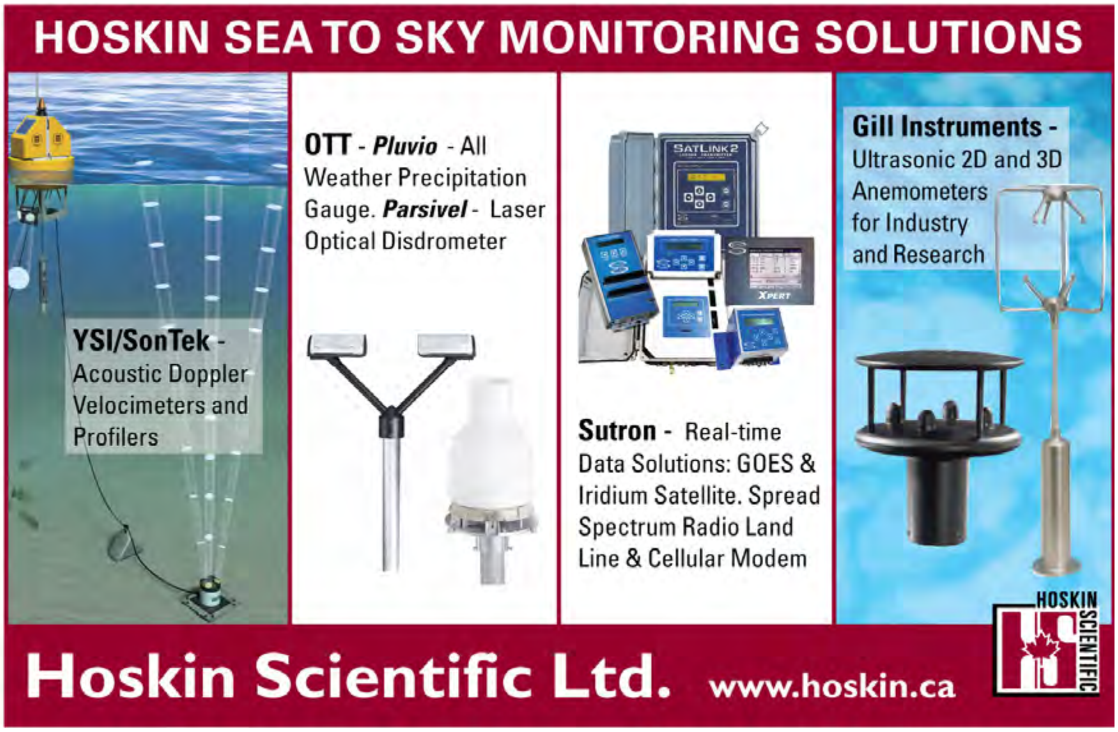
Cooperative Program for Operational Meteorology, Education and Training (COMET)

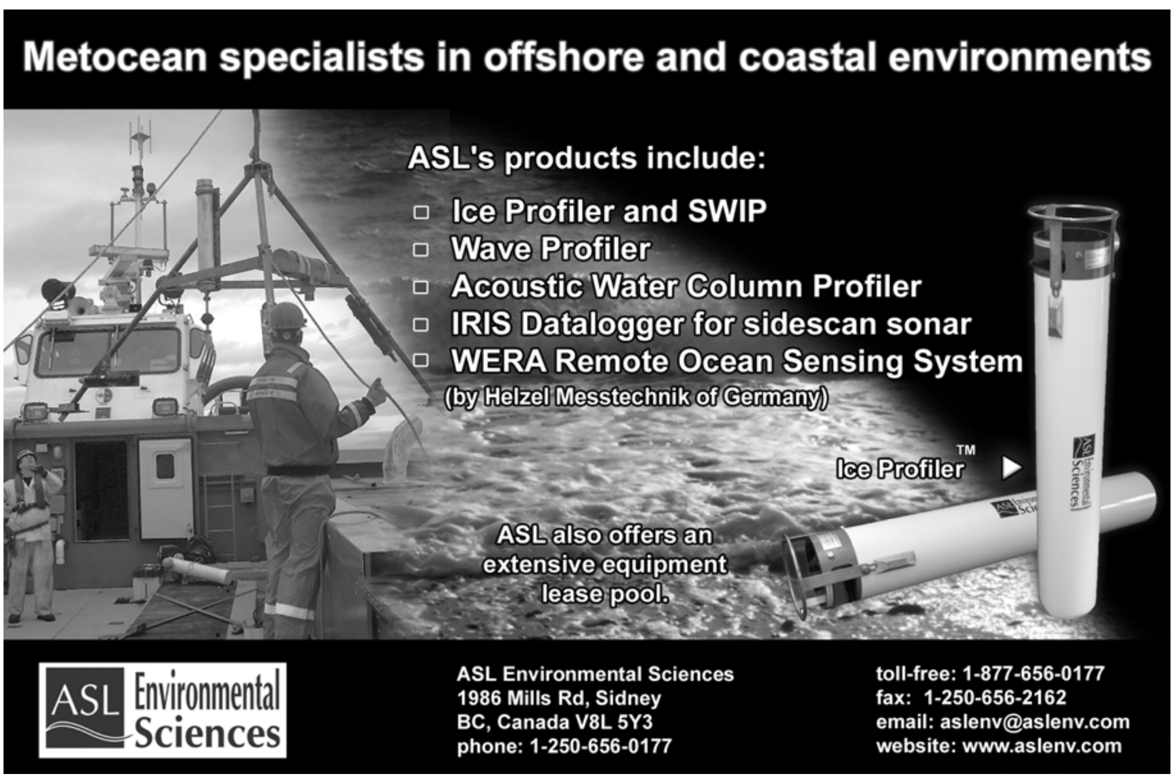
Government of British Columbia

Hoskin Scientific Limited

Info-Electronics Systems Inc./Systemes Info-Electroniques Inc.

SW Audio Visual


HOSKIN SEA TO SKY MONITORING SOLUTIONS
YSI/SonTek - Acoustic Doppler Velocimeters and Profilers
OTT - Pluvio - All Weather Precipitation Gauge. Parsivel - Laser Optical Disdrometer
Sutron - Real-time Data Solutions: GOES & Iridium Satellite. Spread Spectrum Radio Land Line & Cellular Modem
Gill Instruments - Ultrasonic 2D and 3D Anemometers for Industry and Research
HOSKIN SCIENTIFIC
Hoskin Scientific Ltd. www.hoskin.ca


Metocean specialists in offshore and coastal environments
ASL's products include:
Ice Profiler and SWIP
Wave Profiler
Acoustic Water Column Profiler
IRIS Datalogger for sidescan sonar
WERA Remote Ocean Sensing System
(by Helzel Messtechnik of Germany)
Ice Profiler™
ASL also offers an extensive equipment lease pool.
ASL Environmental Sciences
ASL Environmental Sciences
1986 Mills Rd, Sidney
BC, Canada V8L 5Y3
phone: 1-250-656-0177
toll-free: 1-877-656-0177
fax: 1-250-656-2162
email: aslenv@aslenv.com
website: www.aslenv.com

Environment Canada Environnement Canada

Canadian Ice Service

World Leader in Ice Information Service

Every year, the Canadian Ice Service obtains and analyses vast amounts of data covering the Arctic, Hudson Bay, the Eastern seaboard and the Great Lakes. Its team of highly experienced meteorologists, geographers, climatologists, and computer scientists gathers to offer a comprehensive ice information service.

These experts know the Arctic and all other ice-invaded waters across Canada very well. Together, they help the Canadian Ice Service accomplish its mission: to provide the most timely and accurate ice information. The information and services available from the Canadian Ice Service are extensive. They include: specialized charts, bulletins, and maps; radar and satellite imagery image analyses; weather analyses; tailored forecasts; warnings, and briefings. Ice information is essential to a range of people and industries, from researchers, inshore fishermen, and tourists to large shipping companies, offshore oil and gas companies, and cruise ship operators.

Visit the Canadian Ice Service display or Web site. In it, you will find a wealth of information, including atlases, image archives, links to other notable sites, catalogues, and price lists. Most products and services are available free of charge.

Discover the Canadian Ice Service today.

Canadian Ice Service
Web site: http://ice-glaces.ec.gc.ca

Environnement Canada Environment Canada

Service canadien des glaces

Chef de file en Service d'information des glaces

Chaque année, le Service canadien des glaces obtient une grande quantité de données sur l'Arctique, la baie d'Hudson, la côte est canadienne et les Grands Lacs. Son équipe chevronnée de météorologues, de géographes, de climatologues et de spécialistes en informatique se réunit afin de faire l'analyse de ces données et d'offrir un service d'information des glaces hors pair.

Ces experts connaissent très bien l'Arctique de même que toutes les autres régions couvertes de glace dans tout le Canada. Ensemble, ils aident le Service canadien des glaces à réaliser son mandat, soit de fournir des renseignements appropriés et exacts sur les glaces. Les renseignements et les services offerts par le Service canadien des glaces sont nombreux. Ils comprennent des cartes et des bulletins spécialisés, des analyses d'imagerie radar et satellitaires, des analyses météorologiques, des prévisions adaptées, des avertissements météorologiques et des breffages. Les gens et les industries qui utilisent les renseignements sur les glaces sont nombreux. Ils vont du chercheur, du pêcheur côtier et du touriste aux grandes compagnies de navigation, aux compagnies d'exploitation pétrolières et gazières en mer, ainsi qu'aux croisiéristes.

Rendez-vous au site du Service canadien des glaces ou à sa page web. Celui-ci renferme une mine de renseignements parmi lesquels vous trouverez des atlas à consulter, des archives d'images, des liens vers d'autres sites importants, des catalogues et des listes de prix. La majorité des produits et services vous sont offerts gratuitement.

Découvrez dès aujourd'hui le Service canadien des glaces.

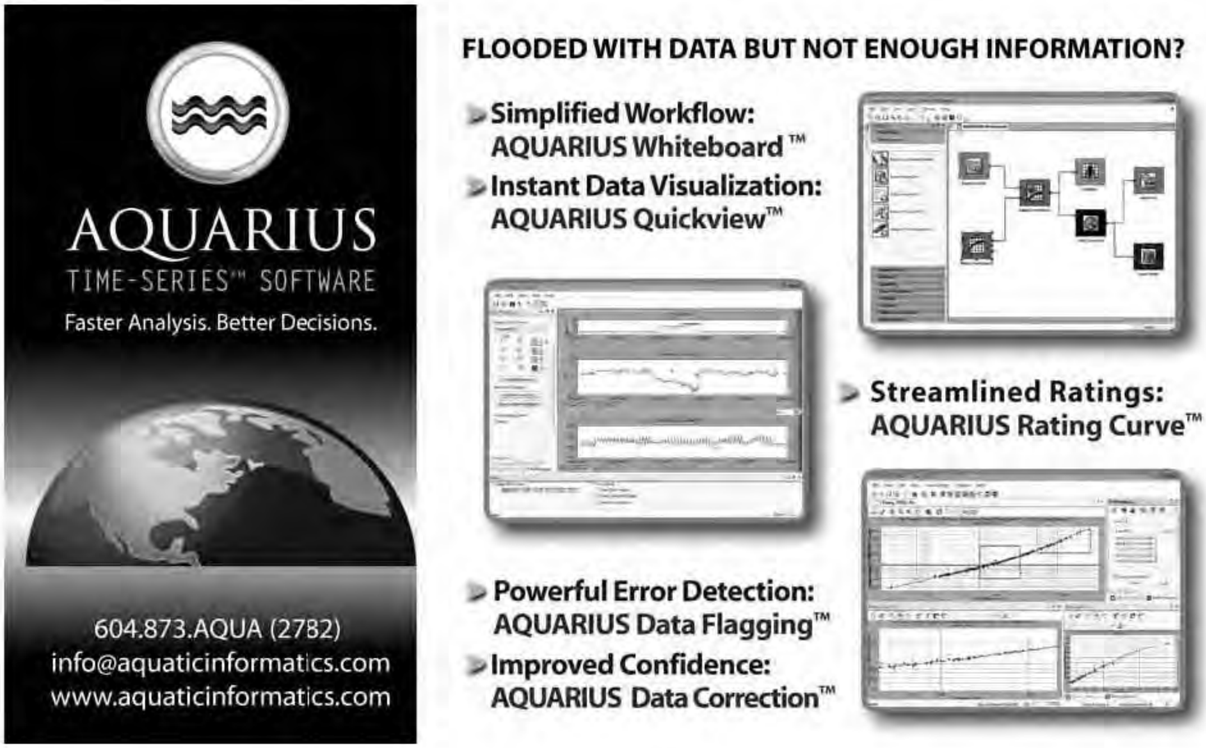
Service canadien des glaces
Site web: http://glaces-ice.ec.gc.ca

The Weather Network and MétéoMédia

Canadians have a favorite topic of conversation - the weather. Pelmorex Media Inc. the parent company of The Weather Network and its French counterpart, MétéoMédia, have been providing weather-related information to Canadians for 20 years. They are the undisputed leaders of weather information services in Canada across all media including TV, online, mobile and newspapers. One of the core strengths of The Weather Network and MétéoMédia is product and service innovation. Consumers and clients receive added value through the on-going development of in-house meteorological and weather-related content. Over 35 meteorologists are on staff, making Pelmorex Media Inc. the largest employer of meteorologists in the Canadian private sector. The Weather Network and MétéoMédia issue forecasts several times a day for over 5,000 locations in Canada and internationally.

MétéoMédia et The Weather Network

La météo est de loin le sujet préféré des Canadiens. Depuis 20 ans, MétéoMédia et The Weather Network s'engagent à fournir aux gens de partout au pays l'information météorologique dont ils ont besoin. Les deux chaînes sont les leaders incontestés des services d'information météorologique partout au Canada, tant à la télévision que sur Internet, sur les réseaux sans-fil et dans les quotidiens. Toujours à l'affût quant aux nouveaux médias et outils de communication, MétéoMédia et The Weather Network sont à l'avant-garde du développement et de la création de produits et services météorologiques. Avec une équipe de 35 professionnels, Pelmorex Media inc., la société mère des deux chaînes, constitue l'entreprise du secteur privé employant le plus grand nombre de météorologues. Les utilisateurs de ses produits et services ainsi que ses clients profitent continuellement du développement d'outils météorologiques et des prévisions les plus dignes de confiance pour plus de 5 000 villes situées tant au Canada qu'ailleurs dans le monde.


AQUARIUS
TIME-SERIES™ SOFTWARE
Faster Analysis. Better Decisions.
604.873.AQUA (2782)
info@aquaticinformatics.com
www.aquaticinformatics.com
FLOODED WITH DATA BUT NOT ENOUGH INFORMATION?
Simplified Workflow: AQUARIUS Whiteboard™
Instant Data Visualization: AQUARIUS Quickview™
Streamlined Ratings: AQUARIUS Rating Curve™
Powerful Error Detection: AQUARIUS Data Flagging™
Improved Confidence: AQUARIUS Data Correction™


CAN YOU SHINE ON RAINY DAYS?
We invite you to visit our CBC News: Weather Centre booth during the congress to talk job opportunities with Meteorologist Claire Martin and Senior Producer Mike Prokopec. Trends suggest weather coverage on CBC will continue to rise and we'd like you to consider joining our team.
For more information contact: mike.prokopec@cbc.ca
CBCnews

Workshops and meetings

International Polar Year - GEOTRACES Research Project Principal Investigators' Meeting

GEOTRACES is an international study of the global marine biogeochemical cycles of trace elements and their isotopes. Its mission is to identify processes and quantify fluxes that control the distributions of key trace elements and isotopes in the ocean, and to establish the sensitivity of these distributions to changing environmental conditions.

Where: Chilcotin Room **When:** Sunday May 25th 1:00 p.m. – 7:00 p.m.

Smoke Forecasting in Canada: Past, Present and Future

A number of interesting developments in the area of smoke forecasting have taken place over the past year and a half. The Edmonton Smoke Forecasting Workshop was held in February 2007, the BlueSky Western Canada Extension Project begain in fall of 2007 and the inaugural issue of the Canadian Smoke Newsletter was sent in March of 2008. All point to an increasing interest in making a Canadian-based smoke forecasting system work. As part of CMOS 2008, some of the main participants in the BlueSky Extension project are holding a special evening meeting on Monday, May 26th to present ongoing work and possible future developments in the smoke forecasting arena. We invite all who are interested to join us for this meeting, currently scheduled for the Chilcotin room at 7 pm. We expect to adjourn to informal discussions at 8 pm.

Where: Chilcotin Room **When:** Monday, May 26, 7:00 p.m. – 9:00 p.m.

SPECIAL CFCAS SESSION

Communications Boot Camp - Getting the message out

Conveners: Kelly Crowe (crowe@cfcas.org), Dawn Conway (conway@cfcas.org)

Communication of results is an essen tial element in the research enterprise: publicly funded scientists have a responsibility to get their results known – and do, in scientific fora. Step outside that context and it can be a minefield. What if the press gets the message wrong, sceptics ridicule your work, or undermine its credibility? What if you – or your family – are attacked for your opinions? How to you respond to unanswerable questions? This special session will review effective messaging; interview techniques and presentation; dealing with bad press; preparing op-ed articles or letters to the editor; organizing public events; handling 'loose cannons'; influencing decision makers; and other 'popular' science communications. The session is organized in three parts: Who, what and how?; The interview; and the Weird and wacky.

Where: Vaseaux Room **When:** Thursday, May 29, 1:00 p.m. – 3:00 p.m.

Canadian Argo Users Group meeting

Anyone at the CMOS-2008 congress with an interest in the Argo project of drifting-profiling floats in the world ocean is invited to attend a meeting of the "Canadian Argo Users Group". This meeting will be hosted by the group of people responsible for supplying the Canadian contribution to the international Argo program. At the meeting those who supply the program will present their plans and invite comments, feedback, complaints etc about the program and its delivery.

Where: Chilcotin Room **When:** Thursday, May 29, 5:30 p.m. – 7:00 p.m.

National Research Council of Canada presentation

Where: Pennask Room **When:** Monday, May 26, 6:00 p.m.

Ateliers et réunions

Année Polaire Internationale –GEOTRACES projet - Réunion de chercheurs principaux

GEOTRACES est une initiative internationale visant à étudier les processus biogéochimiques marins d'oligo-éléments et de leurs isotopes. La mission de GEOTRACES est d'identifier les processus et de quantifier les flux qui contrôlent la distribution d'oligo-éléments isotopes importants dans les océans ainsi que d'établir leur sensibilité aux changements environnementaux.

Endroit: Salle Chilcotin **Les date et heure :** le dimanche mai 25, 1300 à 1900 h

La prévision de la fumée au Canada… du passé à l'avenir

D'intéressants développements ont eu lieu dans les dix-huit derniers mois dans le domaine de la prévision de la fumée. Il y a eu l'atelier d'Edmonton sur la prévision de la fumée en février 2007, l'extension du projet « Bluesky Western Canada » qui a débuté à l'automne 2007 et la publication du premier numéro du « Canadian Smoke Newsletter» en mars 2008. Ensemble, ils révèlent un intérêt accru à développer un système canadien de prévision de la fumée. Dans le cadre du congrès 2008 de la SCMO, certains des principaux participants à l'extension du projet « Bluesky Western Canada » présenteront les travaux en cours et à venir lors d'une rencontre spéciale qui aura lieu le lundi 26 mai de 19h jusqu'à vers 20h, dans la salle Chilcotin. Nous vous invitons tous à vous joindre à nous à cette occasion.

Endroit: Salle Chilcotin **Les date et heure :** le lundi mai 26, 1900 à 2100 h

SÉANCE SPÉCIALE DE LA FCSCA

Atelier de communication – Faire passer le message

Animateurs: Kelly Crowe (crowe@cfcas.org), Dawn Conway (conway@cfcas.org)

Dans toute entreprise de recherche, la communication des résultats est un élément essentiel. Les scientifiques disposant de fonds publics ont la responsabilité de faire connaître leurs résultats, ce qu'ils font dans des tribunes scientifiques. Cependant, hors du milieu scientifique ils risquent de se retrouver en terrain miné. Qu'arrive-t-il si les médias saisissent mal le message, ou si des sceptiques ridiculisent votre travail ou minent votre crédibilité? Que se passe-t-il si vous-même – ou votre famille – êtes attaqués pour vos opinions? Comment répondre à des questions impossibles à répondre? Cette séance spéciale sera consacrée aux thèmes suivants : messages efficaces; techniques d'interview et de présentation; comment réagir à la mauvaise presse; préparation d'articles d'opinion ou de lettres au rédacteur; organisation d'événements publics; comment faire face aux "électrons libres"; influencer les décideurs; autres communications scientifiques « populaires ». Cette séance est structurée en trois parties : Qui, quoi et comment? l'interview; aspects insolites.

Endroit: Salle Vaseaux **Les date et heure :** le jeudi 20 mai, 1300 à 1500 h

Réunion du groupe canadien des utilisateurs d'Argo

Tous les participants au congrès 2008 de la SCMO intéressés par le projet Argo de flotteurs-profileurs dans l'ensemble des océans sont invités à assister à la réunion du groupe canadien des utilisateurs d'Argo. Cette réunion sera dirigée par le groupe de personnes responsables de la contribution canadienne au programme international Argo. Pendant la réunion, ces personnes présenteront leurs plans futurs et inviteront l'audience à formuler commentaires, questions, plaintes, etc. au sujet du programme et de sa livraison.

Endroit: Salle Chilcotin **Les date et heure :** le jeudi 27 mai, 17h30 à 19h00

Présentation par le Conseil national de recherches Canada

Endroit: Salle Pennask **Les date et heure :** le lundi 26 mai, 1800 h

Public lecture / La conférence publique

Wild about BC weather: Yesterday, today and tomorrow

David Phillips, the well recognized Senior Climatologist with Environment Canada and author of the "Canadian Weather Trivia Calendar", will bring his encyclopedic knowledge of Canada's weather and climate to Kelowna. David will re-live some of British Columbia's long and glorious weather past and speculate on whether today's seemingly wild weather is an indicator of things to come in the future.

Fou de la météo de la C.-B. : hier, aujourd'hui et demain

David Phillips, le climatologue bien connu d'Environnement Canada et auteur de « l'Almanach météorologique canadien », partagera sa connaissance encyclopédique de la météo et du climat canadien à Kelowna. David parlera de la longue et glorieuse histoire de la météo en Colombie-Britannique et spéculera si la météo de plus en plus perturbée que nous connaissons est un indicateur de ce qui se passera à l'avenir.

Grand Okanagan Lakefront Resort and Conference Centre

Tuesday, May 27th / le lundi 27 mai

7:00 pm / 1900 h

Okanagan Ballroom / salle de bal Okanagan

Fluvage, cats' paws and mystical spouts: Weather wonders of the Okanagan

Mike Roberts, the renowned Weathercaster from CHBC TV in the Okanagan, will use his extensive knowledge of local weather and footage from a local web cam to show the beauty and diversity of the weather in the Okanagan. Mike has developed not only his own weather watcher network, but he has also developed his own weather vocabulary for Okanagan weather. Ask any Okanaganite what Fluvage is!

« Fluvage », des pattes de chat et des trombes marines mystiques: des merveilles météorologiques de l'Okanagan

Mike Roberts, télé-présentateur renommé de la météo de CHBC dans l'Okanagan, utilisera sa vaste connaissance de la météo locale et des enregistrements d'une webcaméra locale pour montrer la beauté et la diversité de la météo dans l'Okanagan. Mike a développé non seulement son propre réseau d'observateurs de la météo mais aussi son propre vocabulaire pour la météo dans l'Okanagan. Demandez à n'importe quel habitant de l'Okanagan ce qu'est le « Fluvage »!

Public speakers

Tuesday, May 27, 19:00–21:00, Okanagan Ballroom

David Phillips

MSC Senior Climatologist
Environment Canada

David Phillips, who has worked with MSC for 36 years, is well recognized as a skilled communicator, known for his ability to promote awareness and understanding of our country's weather and climate. Through the mass media, public appearances and educational tools, he has helped to focus public attention on critical issues, such as climatic change. A recipient of the Andrew Thomson Prize in Applied Meteorology, he is also a respected author who contributes to many scientific and popular publications.

Dave is best known for his encyclopaedic knowledge of Canada's weather and climate. He has a rare ability to communicate this knowledge with enthusiasm and in such a way that even the dullest statistics become fascinating and relevant to the listener. Dave's talents and dedication have made him an outstanding spokesperson for MSC, and he is known throughout the Canadian media as "Canada's weather guru". As the author of the ever-popular "Canadian Weather Trivia Calendar", his name has practically become a household word. He has also written two best-sellers: "The Day Niagara Falls Ran Dry", and "Blame it on the Weather".

Mike Roberts

Weather Reporter
CHBC Television

Mike Roberts has worked at CHBC Television since September 3, 1973. During the day Mike travels the valley collecting stories for Roberts on the Road seen Thursday on the CHBC News at 5:00 and on Okanagan Now Sunday at 5:30. Then at 5:00, 6:30 and 11:00 p.m., Monday to Friday, Roberts becomes the weather reporter on CHBC News. He's held that job since 1980. The southern interior is one of the most challenging geographical areas in the country to deal with. That is one of the reasons why the Canadian Meteorological and Oceanographic Society honoured Mike in 1992 by naming him as one of Canada's Top Weather Reporters. In the mid-1980s Roberts created the CHBC Volunteer Weather Team, 18 persons from smaller communities in our coverage area who phone CHBC on a daily basis with maximum and minimum temperatures and sundry weather and community anecdotes. In the mid-1990s Roberts began featuring the video obtained from the Environment Canada camera installed by Peter Schwarzhoff in a segment called Weather of the Week. The camera recorded a panorama of weather 24 hours a day over the city of Kelowna recording everything from wind squalls to lightning strikes, mystical spouts to a meteorite explosion. After a six month hiatus for renovations at the host site Weather of the Week is making a comeback.

Roberts' weather is the only telecast in the country that features Teddy Bears. The Good News Bears Food Bank Fundraiser started in 1989 and since then the bears have raised over two and a half million dollars for food banks in our coverage area.

La conférence publique, nos conférenciers

Le mardi 27 mai, de 19h00 à 21h00 dans la salle de bal Okanagan

David Phillips

Climatologue principal du Service météorologique du Canada (SMC)

Dave Phillips, qui travaille au SMC depuis 36 ans, est un communicateur hors pair bien connu pour son habileté à rendre les Canadiens conscients et avertis de la météo et du climat de leur pays. Par le truchement des média, de causeries et d'autres moyens éducatifs, il a aidé à attirer l'attention du public sur les questions de l'heure comme les changements climatiques. Récipiendaire du prix Andrew Thomson en météorologie appliquée, il est aussi un auteur respecté qui a contribué à plusieurs publications scientifiques et de vulgarisation scientifique.

Dave est mieux connu pour ses connaissances encyclopédiques des conditions atmosphériques et du climat canadien. Il les communique si habilement et avec un tel enthousiasme qu'il rend les statistiques, mêmes les plus ennuyeuses, fascinantes et pertinentes à son auditoire. Les talents de Dave et son dévouement en font un porte-parole exceptionnel pour le SMC. Il est aussi connu par tous les média comme « le guru de la météo canadienne ». Comme auteur du très populaire « Almanach météorologique canadien » son nom est pratiquement connu de tous. Il est aussi l'auteur de deux succès de librairie: « The Day Niagara Falls Ran Dry » et « Blame it on the Weather ».

Mike Roberts

Reporter, Météo
Station CHBC

Mike Roberts travaille à la chaîne télévisée CHBC depuis le 3 septembre 1973. Le jour, Mike parcourt la vallée pour récolter des récits pour l'émission « Roberts on the Road » présentée aux nouvelles de CHBC à 17 h le jeudi et pour l'émission "Okanagan Now" à 17h30 le dimanche. De plus, depuis 1980, Roberts couvre la météo au bulletin de nouvelles de CHBC du lundi au vendredi à 17h, 18h30 et 23h. Le Sud de l'intérieur de notre province est l'une des régions géographiques les plus difficiles à traiter au Canada. C'est une des raisons pour laquelle la Société canadienne de météorologie et d'océanographie a honoré Mike en 1992 en le déclarant l'un des meilleurs reporters de météo au Canada. Au milieu des années 80, Roberts a créé le « CHBC Volunteer Weather Team », une équipe de dix-huit bénévoles de petites communautés de la zone de couverture de CHBC qui téléphonent quotidiennement pour rapporter les températures minimale et maximale, d'autres détails pertinents ainsi que des anecdotes concernant leur communauté.

Au milieu des années 90, Roberts a commencé à présenter la vidéo provenant de la caméra d'Environnement Canada installée par Peter Schwarzhoff dans un segment appelé « La météo de la semaine » La caméra enregistre les conditions atmosphériques dans tout Kelowna 24 heures sur 24 allant des rafales de vent à la foudre, des trombes brumailleuses à l'explosion de météorites. Après une absence de six mois due à des rénovations au site hôte « La météo de la semaine » reviendra sous peu.

Since arriving at CHBC in 1973 Mike's experience has been extensive as producer and host of entertainment, current affairs and documentary programs – Gold Trails and Ghost Towns (ten years), Pioneers and Places (seven years), Anchors Away, OutWest, People of Vision, CrimeStopper re-enactments, Nightwatch, Focus, and Eco-Watch.

His commitments to the community include serving as honourary chair of the Central Okanagan United Way, media liaison with the Central Okanagan Crimestoppers Society, The South Okanagan Child Development Center, and helping out wherever he can.

Mike is the happily married father of three grown sons, and grandfather to four grandchildren with whom he can be found playing on the weekends. He has been obsessed with golf for 10 years but has been known to play fastball, fish and four-wheel drive. He loves apples and Okanagan wine and would one day love to own a boat but, as he says, "Sometimes it is cheaper to have a dream than to own one."

La météo avec Roberts est la seule émission au pays qui utilise, depuis 1989, des oursons en peluche, "The Good News Bears Food Bank Fundraiser", comme moyen de financement pour les banques alimentaires. Depuis ce temps, ces oursons ont permis de réunir plus de deux millions et demi de dollars au bénéfice des banques alimentaires du territoire.

Depuis son arrivée à CHBC en 1973, Mike a accumulé une vaste expertise en tant que réalisateur et hôte d' émissions récréatives, d'actualité et de magazines telles "Gold Trails and Ghost Towns (10 ans), Pionneers and Places (7 ans), Anchors Away, OutWest, People of Vision, reconstitutions de criminodrames, Nightwatch, Focus et Eco-Watch.

Très engagé dans sa communauté, il a été président honoraire de Centraide pour Okanagan Centre, agent de liaison entre les médias et la Société de criminodrames de l'Okanagan Centre et le Centre de développement de l'enfance de l'Okanagan Sud et s'implique là où il peut être utile. Mike est l'heureux père de trois fils adultes et grand-père de quatre petits-enfants avec lesquels il joue la fin de semaine. Obsédé de golf depuis dix ans, il joue aussi à la balle rapide, à « fish » et s'amuse à conduire un véhicule à quatre roues motrices. Il aime les pommes et les vins de l'Okanagan et aimerait un jour posséder un bateau, mais comme il dit "Rêver d'un objet coûte quelquefois moins cher que de le posséder."

Plenary speakers

Humfrey Melling

Research oceanographer
Department of Fisheries and Oceans

Day 1, 9:30 a.m.

Dr. Melling has a PhD (Physics) from the University of Toronto for studies in boundary-layer meteorology. He has been a research oceanographer with the federal Department of Fisheries and Oceans at the Institute of Ocean Sciences since 1980.

His research interests include polar oceanography and sea ice. He pioneered the application of aircraft-based techniques to the study of ice-covered oceans. He also developed and proved techniques for the recovery of recording instruments moored in ice-covered waters, which have enabled year-round observations of northern sea ice and oceans. Dr. Melling has carried out a wide variety of ocean research in the Arctic Ocean, the Beaufort Sea and the Canadian Archipelago.

His recent work has documented inter-annual variation in the Arctic coastal ocean, over seasonal and longer time scales. This outcome is assisting the detection of trends in the Arctic and their interpretation in terms of human-induced climate change. His research also explores the processes which make the Arctic Ocean the way it is: its ice cover, water circulation, temperature and salinity structure, interactions with the World Ocean. He is principal investigator of the CAT Study, a Canadian IPY initiative within an ambitious multi-national project known as ASOF to measure the exchanges of ice and freshwater between the Arctic and temperate oceans. In addition, he is co-investigator in the AIM Study (Arctic Ice Monitoring), a long-term multi-national project to maintain ice-thickness monitoring sites throughout the Arctic.

David W. Schindler

Professor
University of Alberta

Day 2, 8:30 a.m.

David Schindler is Killam Memorial Professor of Ecology at the University of Alberta, Edmonton. From 1968 to 1989, he founded and directed the Experimental Lakes Project of the Canadian Department of Fisheries and Oceans near Kenora, Ontario, conducting interdisciplinary research on the effects of eutrophication, acid rain, radioactive elements and climate change on boreal ecosystems. His work has been widely used in formulating ecologically sound management policy in Canada, the U.S.A. and in Europe.

His current research interests include the study of fisheries management in mountain lakes, the biomagnification of organochlorines in food chains, effects of climate change and UV radiation on lakes, and global carbon and nitrogen budgets.

Dr. Schindler teaches limnology, the philosophy, sociology and politics of science/science and public policy in Canada, and environmental decision making.

Les conférenciers des plénières

Humfrey Melling

Chercheur en océanographie
Institut des sciences océaniques

Jour 1, 9h30

Doctorat (en physique) de l'Université de Toronto pour des études en météorologie de la couche limite et océanographe chercheur à l'Institut des sciences océaniques au Ministère fédéral de Pêches et Océans depuis 1980.

Intéressé aux recherches en océanographie polaire et sur la glace de mer, il a fait oeuvre de pionnier en techniques aériennes appliquées à l'étude d'océans couverts de glace. Il a développé des techniques reconnues pour la récupération d'instruments amarrés dans des eaux couvertes de glace, qui permettent l'observation de la glace des mers polaires et des océans à l'année longue . Il a fait un grand nombre de recherches variées sur l'océan polaire, la mer de Beaufort et l'archipel arctique canadien.

Travaux récents : il a documenté la variation pluriannuelle du littoral de l'océan Arctique, pour des échelles de temps saisonnières et plus longues. Ses résultats aident à détecter les tendances dans l'Arctique et à les interpréter en fonction des changements climatiques d'origine humaine. Sa recherche explore aussi les processus qui font de l'océan Arctique ce qu'il est : sa couverture de glace, sa circulation, sa température, sa salinité et ses interactions avec l'ensemble des océans. Chercheur principal pour ce qui est de l'étude des eaux traversant l'archipel arctique canadien (CAT-Canadian Archipelago Through-flow), une initiative canadienne dans le cadre de l'Année polaire internationale au sein d'un ambitieux projet multinational connu sous le nom de ASOF visant à mesurer les échanges de glace et d'eau douce entre les océans tempérés et l'océan polaire. Co-chercheur de l'étude AIM (Arctic Ice Monitoring) un projet multi-national à long terme qui vise à maintenir les sites surveillant l'épaisseur de la glace dans l'Arctique.

David W. Schindler

Professeur à l'Université de l'Alberta

Jour 2, 8h30

David Schindler est professeur d'écologie au Killam Memorial à l'Université de l'Alberta à Edmonton. De 1968 à 1989, il a fondé et dirigé le Projet "Experimental Lakes" de Pêches et Océans Canada près de Kenora, en Ontario, où il a mené des recherches interdisciplinaires sur les effets de l'eutrophisation, des pluies acides, des éléments radioactifs et des changements climatiques sur les écosystèmes boréaux. Le Canada, les États-Unis et l'Europe ont beaucoup utilisé ses recherches pour formuler une politique de gestion écologiquement saine.

Ses recherches courantes incluent l'étude de la gestion des pêches dans les lacs de montages, la bioamplification des organoschlorés dans les chaines alimentaires, les effets des changements climatiques et du rayonnement ultraviolet sur les lacs et les inventaires globaux de carbone et d'azote.

Dr Schindler enseigne la limnologie, la philosophie, la sociologie et la politique de la science/la science, l'ordre public au Canada et la prise de décision environnementale.

Michael Glantz

Director, Center for Capacity Building
NCAR

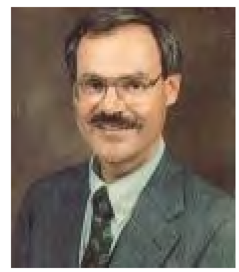
Day 1, 8:30 a.m.

Michael (Mickey) Glantz is a Senior Scientist and was the Director of the Environmental and Societal Impacts Group, a program at the National Center for Atmospheric Research (NCAR) for 17 years. He is interested in how climate affects society and how society affects climate, especially in how the interaction between climate anomalies and human activities affect quality of life issues.

Roland Stull

Professor of Atmospheric Sciences
University of British Columbia

Day 4, 8:30 a.m.



As director of the Geophysical Disaster Computational Fluid Dynamics Centre, Dr. Stull focus on making high-resolution, real-time, operational numerical weather forecasts for western Canada. His 15-member team operates a 256-processor IBM Linux cluster computer, optimized for studying weather-related disasters in mountainous, coastal terrain. Their pure research includes predictability (ensemble prediction, data assimilation, Kalman filtering, boundary-layer parameterizations, etc.), and natural disasters (forest fire storms, flooding precipitation, cyclones, snow avalanches, windstorms, air quality, etc.).

David Hughes

Leader, National Coal Resource Inventory
NRCan

Day 3 9:30 a.m.

David Hughes is a geologist with 35 years experience studying the energy resources of Canada for the Geological Survey of Canada and the private sector. He is the Leader of the National Coal Inventory, which is a digital knowledge base on coal used to determine the availability of resources for conventional and non-conventional uses, including coalbed methane production and the sequestration of CO_2. He is also Team Leader for Unconventional Gas for the Canadian Gas Potential Committee, an organization which publishes Canada's most authoritative assessments of National natural gas potential.

David's evolving analysis of global and North American energy issues has been presented across Canada, the United States and Internationally to Federal, State, Provincial and Municipal agencies, to industry groups and to the general public. Aspects of his analysis have also been taken up by the popular press and trade journals including the Toronto Star, Canadian Business Magazine, the Canadian Press wire service, Globalpublicmedia and innumerable internet sites.

Michael Glantz

Directeur, Centre pour le renforcement des capacités
NCAR

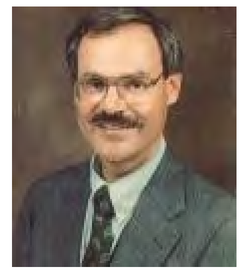
Jour 1, 8h30

Michael (Mickey) est chercheur principal après avoir été directeur du groupe des impacts environnementaux et sociétaux, un programme du National Center for Atmospheric Research (NCAR) pendant 17 ans. Il s'intéresse aux effets qu'a le climat sur la société et la société sur le climat, particulièrement à savoir comment l'interaction entre les anomalies climatiques et les activités humaines affecte les questions de la qualité de vie.

Roland Stull

Professeur de sciences atmosphériques à l'Université de la Colombie-Britannique

Jour 4, 8h30



En tant que directeur du « Geophysical Disaster Computational Fluid Dynamics Centre », Dr Stull vise à faire des prévisions numériques opérationelles à haute définition et en temps réel. Son équipe de quinze membres gère une grappe d'ordinateurs Linux IBM de 256 processeurs optimisée pour étudier les désastres reliés aux conditions atmosphériques en montages et dans les régions littorales. Leur recherche de base inclut la prévisibilité (prévision d'ensemble, assimilation de données, filtre de Kalman, paramétrages de la couche limite, etc.) et les désastres naturels (feux de forêts causés par la foudre, inondations résultant de précipitations, ouragans, avalanches, violentes tempêtes, qualité de l'air, etc.).

David Hughes

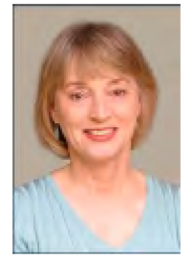
Chef, Inventaire des ressources nationales du charbon, Conseil National de recherche du Canada

Jour 3, 9h30

J. David Hughes est géologogue et a plus de 30 ans d'expérience dans l'étude des ressources énergétiques du Canada pour la Commission géologigue du Canada et pour le secteur privé. Il est le chef de l'inventaire des ressources nationales du charbon, base numérique de connaissances sur le charbon utilisée pour déterminer les ressources disponibles pour usages conventionnels et non conventionnels incluant la méthanogénèse de gisement du charbon et la séquestration de CO_2. Il est aussi chef d'équipe pour le « Non-conventional Gas for the Canadian Gas Potential Committee », une organisation canadienne qui publie les évaluations les plus réputées du potentiel national de gaz naturel.

L'analyse évolutive de David concernant les problèmes énergétiques globaux et nord-américains a été présentée au Canada, aux États-Unis et, internationalement, à des agences fédérales, d'états, provinciales et municipales ainsi qu'à des groupes industriels et au public. Des aspects de son analyse ont aussi été relevés par la presse populaire et les revues professionnelles telles le Toronto Star, le Canadian Business Magazine, l'agence de transmission de la presse canadienne, les médias publics de Global et d'innombrables sites Internet

Kathryn A. Kelly



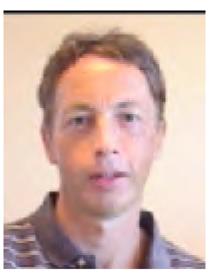
Physical Oceanographer
APL-UW

Day 2, 9:30 a.m.

Dr. Kelly is a Principal Oceanographer at the Applied Physics Laboratory of the University of Washington and an Affiliate Professor in the School of Oceanography. She received her PhD in Physical Oceanography from the Scripps Institution of Oceanography in 1983 for research into the causes of SST anomalies in the California Current using satellite infrared data.

Dr. Kelly was a scientist at the Woods Hole Oceanographic Institution from 1988 until 1995, where she was awarded tenure in 1995. She has been at the Applied Physics Laboratory at the University of Washington since 1996. In 2006 she was elected a Fellow of the American Meteorological Society. She recently served on the Executive Committee of the Decadal Survey for the Earth Sciences, which was sponsored by the National Academy of Sciences to prioritize Earth observations from space across all of Earth Sciences. She is a member of NASA's Ocean Surface Topography and Ocean Vector Winds Science Teams.

Recently Dr. Kelly has been studying atmosphere-ocean coupling in the North Atlantic Ocean to understand how the ocean transports heat poleward and to understand the impact of oceanic heat fluxes to the atmosphere on climate and weather. She served as co-chair for the implementation plan for the Atlantic Meridional Overturning Circulation multi-agency initiative. Her primary scientific interest is the role of the ocean in climate, which she studies using large data sets, particularly from satellite sensors, in collaboration with numerical modelers and scientists who make in situ measurements. She is also the proud mother of two aspiring scientists.



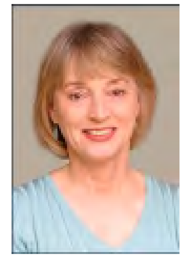
Pierre-Yves Le Traon

French Institute for the Exploitation of the Sea

Day 3, 8:30 a.m.

Pierre-Yves Le Traon, oceanographer, manages the program "Observatoire de l'Océan" at Ifremer (the Institut français de recherche pour l'exploitation de la mer) and previously was the deputy director of Space Oceanography at CLS. Pierre-Yves is a graduate of the School of Mining at St Etienne, and gained his Ph.D. in oceanography from space from the Université de Paul Sabatier in Toulouse and has published 70 papers on oceanography, satellite altimetry and operational oceanography. He is co-chairman of the international experiment on operational oceanography GODAE (Global Ocean Data Assimilation Experiment) and a member of many other international and European groups involved in observing the oceans. He coordinates the European contribution to the global Argo network of profiling buoys (Euro-Argo). Pierre-Yves also assists the space agencies (CNES, ESA and EUMETSAT) for their missions involving ocean observation. In 1999 he was awarded the prize "Science et Défense" for his work on altimetry from space.

Kathryn A. Kelly

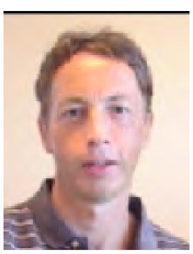


Océanographie physique
APL-UW

Jour 2, 9h30

Dr Kelly est océanographe responsable au Laboratoire de physique appliquée (APL) à l'Université de Washington et professeure (associée) à l'École d'océanographie. Elle a été présidente du département « Air-sea Interaction/Remote Sensing » (AIRS) à APL.

Kathie a reçu son baccalauréat de l'Université de la Californie à Berkeley en 1977 après avoir travaillé comme mécanicienne automobile dans le cadre du « California State Apprenticeship program ». Avant de poursuivre des études avancées, elle a oeuvré comme ingénieure civile conseil sur la qualité de l'eau. Elle a reçu son doctorat en océanographie physique de l'Institut d' océanographie Scripps en 1983. Sa thèse portait sur une analyse de la température superficielle de la mer dans le courant de Californie en utilisant des données satellitaires infrarouges. Après avoir reçu son diplôme, elle a obtenu la bourse Cecil H. et Ida Green à l'Institut de géophysique et de physique planétaire, UCSD. À la fin de 1983, elle arrivait à l'Institut d'océanographie de Woods Hole comme boursière post-doctorale où elle est restée et a élevé ses deux enfants tout en jonglant avec l'obtention d'une titularisation. Pendant son séjour à Woods Hole, Kathie a commencé l'étude des vents mesurés par diffusiomètre et des données altimétriques du niveau de la mer, se concentrant sur la dynamique et la thermodynamique des courants limitrophes de l'Ouest et de l'Est. En 1995, elle est devenue titulaire et a passé une année sabbatique au Pacific Marine Environmental Laboratory. En 1996, elle complétait officiellement son tour des trois grandes institutions océanographiques en entrant au Laboratoire de physique appliquée (APL). En 1997, elle a été nommée professeure visiteuse par le National Science Foundation à l'École d'océanographie à l'Université de Washington où elle a développé un cours pour gradués sur des méthodes pour combiner données et modèles. En 2006, elle a été élue « Fellow of the American Meteorological Society ». Professionnellement, elle s'intéresse principalement aux applications de grands ensembles de données, plus spécifiquement ceux provenant de capteurs satellitaires, aux problèmes du climat, à l'interaction atmosphère-océan et à la circulation océanique. Elle travaille avec des logiciels de modélisation 3D numériques en collaboration avec des modeleurs et des scientifiques qui prennent des mesurements sur place afin de mieux comprendre et d'améliorer la qualité des données satellitaires. Elle est aussi la fière mère de deux scientifiques en herbe.



Pierre-Yves Le Traon

Institut français de recherche pour l'exploitation de la mer

Jour 3, 8h30

Pierre-Yves Le Traon, océanographe, est responsable du programme Observatoire de l'Océan à l'Ifremer (Institut français de recherche pour l'exploitation de la mer). Il a été auparavant directeur-adjoint de la Direction Océanographie Spatiale de la société CLS. Diplômé de l'école des mines de Saint-Etienne, il est titulaire d'un doctorat en océanographie physique et spatiale et d'une habilitation à diriger des recherches (Université Paul-Sabatier, Toulouse). P.Y. Le Traon est auteur ou co-auteur de près de 70 publications dans la littérature scientifique internationale en océanographie, altimétrie satellitaire et en océanographie opérationnelle. Il est co-responsable de l'expérience internationale d'océanographie opérationnelle GODAE (Global Ocean Data Assimilation Experiment) et membre de plusieurs groupes scientifiques internationaux et européens sur l'observation des océans. Il coordonne la contribution européenne au réseau international Argo d'observation des océans par flotteurs profilants (Euro-Argo). Il est aussi expert auprès des agences spatiales (CNES, ASE, Eumetsat) pour les missions d'océanographie spatiale. Il a reçu en 1999 le prix Science et Défense pour ses travaux en altimétrie satellitaire.

Peter Taylor

Professor of Atmospheric Science and Applied Mathematics
Faculty of Science and Engineering, York University

Day 4, 9:30 a.m.

Dr. Peter Taylor, Professor of Atmospheric Science and Applied Mathematics in the Faculty of Science and Engineering at York University, studies wind and blowing snow in the Canadian Arctic, making him an ideal scientist for research into the Martian sub-polar climate. He is currently engaged in wind tunnel testing of the temperature and pressure sensors that will be used on the Mars lander, as well as issues related to sub-surface ice samples and dust concentrations in the lower atmosphere of Mars.

Peter Taylor

Professeur de Sciences atmosphériques et
de Mathématiques appliquées
Faculté des Sciences et d'Ingénierie de l'Université York

Jour 4, 9h30

Dr Peter Taylor est professeur de Sciences atmosphériques et de Mathématiques appliquées à la Faculté des Sciences et d'Ingénierie de l'Université York. Ses champs d'études comprennent le vent et la poudrerie dans l'Arctique canadien, ce qui en fait un scientifique tout désigné pour étudier le climat martien subpolaire. Il teste présentement en soufflerie les capteurs de températures et de pression qui seront embarqués à bord du Mars Lander et travaille sur les problèmes rattachés aux échantillons de glace sous la surface martienne et des concentrations de poussière dans sa basse atmosphère.

Session descriptions

Interdisciplinary (I)

International Polar Year: Early achievements

Barry Goodison – *Science and Technology Branch, Environment Canada*
Robie Macdonald – *Institute of Ocean Sciences, Fisheries and Oceans Canada*
Contact: Barry.Goodison@ec.gc.ca

IPY 2007-2008 is in full swing. It is an extensive international program of coordinated science, research and observations that began March 1, 2007. Canada is taking a leading role in fulfilling IPY aims to determine the present environmental status of the polar regions, quantify and understand these rapidly changing regions, and their linkages with the rest of the globe. The IPY program will leave a rich legacy that includes among others large-scale baseline data sets against which future change can be assessed, new and enhanced observing systems, and a new generation of scientists and leaders trained and enthused to carry this legacy into the future. Contributions to this session provide initial scientific results during the first year of study from IPY investigations in our polar regions addressing all IPY scientific goals. Presentations in this session report progress on the IPY legacy, data management, capacity building, outreach and communication and plans for the next year.

Health issues of weather and climate

Denis Bourque – *Environment Canada*
Contact: denis.bourque@ec.gc.ca

The papers in this session present original work in the area of "Health Issues of Weather and Climate", including Climate / Climate Change and health issues; Weather and Health issues; Operational Weather-based Health Products & Programs; and papers/research which address the policy and economic aspects of weather and climate on health issues.

1 - Climate / Climate Change and health issues
Health and Climate have been associated for centuries, under the guise of healthy and not-so-healthy climates. However, more recently, various studies have researched the relationship between the human body and specific climatic regimes or zones to determine if there are any adaptations or accommodations which the body has endured. This type of research can then be used to anticipate the stresses which various climate change scenarios will impose on mankind.

2 - Weather and Health issues
Day-to-day weather has long been considered to influence the individual and, by extension, the health system. Many studies have been conducted and continue to be conducted to try to ascertain the nature of this relationship, or to determine if this relationship exists at all, often ailment by ailment.

3 - Operational Weather-based Health Products & Programs
As more interest develops about the impact which the atmosphere has on the person and the health system, new products which are in some manner linked to health issues are being developed and promulgated. Examples in Canada are the Humidex, the Windchill and the UV Index. Other parts of the world have developed the Heat Index (Philadelphia), and in Germany they have forecasts of numerous specific health ailments, whereas in the UK they are now producing forecasts of National Health System workload. Heat-Health Alerts are a recent development.

4. Papers/research which address the policy and economic aspects of weather and climate on health issues.

Descriptions des présentations

Interdisciplinaire (I)

L'année internationale polaire : les premiers accomplissements

Barry Goodison – *Direction générale des sciences et de la technologie, Environnement Canada*
Robie Macdonald – *Institut des sciences de la mer, Pêches et Océans Canada*
Personne-ressource : Barry.Goodison@ec.gc.ca

L'année polaire internationale (API) 2007-2008 est en plein essor. C'est un vaste programme international qui coordonne science, recherches et observations et qui a débuté le 1er mars 2007. Le Canada y joue un rôle prépondérant en réponse aux objectifs de l'API qui sont de déterminer l'état actuel de l'environnement des régions polaires afin de quantifier et de comprendre ces régions qui changent rapidement et leurs liens avec le reste du monde. Le programme de l'Année polaire internationale laissera un riche héritage qui comprendra, en autres choses, des jeux de données de base à grande échelle auxquels tout changement ultérieur pourra être comparé, des systèmes d'observation nouveaux et améliorés et une nouvelle génération de scientifiques et de leaders formés et enthousiastes à transmettre cet héritage. Les travaux de cette séance fourniront quelques résultats de la gamme des recherches scientifiques ciblées par l'API dans nos régions polaires en cette première année d'opération. Il y aura également des présentations sur le progrès de l'héritage de l'API, la gestion des données, le renforcement des capacités, la sensibilisation ainsi que sur la communication et les plans pour la prochaine année.

Influence des conditions atmosphériques et du climat sur la santé

Denis Bourque - *Environnement Canada*
Personne-ressource : denis.bourque@ec.gc.ca

Lors de cette séance, nous présenterons des travaux originaux dans le domaine de l'influence des conditions atmosphériques, du climat et des changements climatiques sur la santé : les produits et les programmes de santé basés sur la météorologie appliquée, des articles/des recherches scientifiques sur les politiques et les aspects économiques de la météorologie et du climat reliés aux questions de santé.

1 – Le climat et les changements climatiques et les questions de santé

Santé et climat sont associés depuis des siècles sous le nom de climats salubres et insalubres. Toutefois, récemment, plusieurs études ont examiné la relation entre le corps humain et des régimes ou des zones climatiques spécifiques afin de déterminer si le corps avait enduré des adaptations ou des accomodations. Ce type de recherches peut être utilisé pour anticiper les stress que divers scénarios des changements climatiques imposeraient aux humains.

2 - Conditions atmosphériques et questions de santé

Les conditions atmosphériques quotidiennes sont considérées depuis longtemps comme ayant une influence sur l'individu et, par extension, sur sa santé. Plusieurs études ont été menées et continuent de l'être pour essayer d'établir la nature de cette relation ou pour déterminer si cette relation existe vraiment, maladie par maladie.

3 - Produits et programmes basés sur la météorologie appliquée

Vu l'intérêt grandissant porté à l'influence des conditions atmosphériques sur l'humain et sa santé, de nouveaux produits reliés en quelque sorte aux questions de santé sont développés et adoptés. Par exemple, au Canada il y a Humidex, le facteur vent et l'indice UV. Ailleurs dans le monde, on a aussi développé un indice comme Humidex (Philadelphie). En Allemagne, il y a des prévisions ciblant plusieurs troubles de santé spécifiques, tandis qu'en Grande-Bretagne le Système national de santé produit des prévisions de charge de travail sur le Système de santé. Les alertes à la chaleur fournissent un autre exemple de développement récent.

4 - Des articles ou de la recherche qui touchent à la politique et aux aspects économiques de la météo et du climat des questions de santé.

Scientists’ involvement in decision-making processes

Miguel Tremblay – *Environnement Canada*
Jacques Descurieux – *Environnement Canada*
Simon Hobeila – *Bureau Recherche - Développement - Valorisation de l’Université de Montréal*
Contact: miguel.tremblay@ec.gc.ca

With the reality of global climate change and the growing concern of the Canadian population regarding environmental issues, the efficient translation of scientific and hydrometeorological knowledge into governmental policy is tod ay imposing itself as a necessity. In fact, the situation calls for a new dialogue between scientists, decision-makers at all levels and stakeholders of all areas, incl uding the private sector and consumers. However, translating knowledge into policy raises many issues pertaining not only to the role and social responsibility of scientists, but to the limits of their contribution towards the environmental debate.

Given the c omplexity of the scientif ic, political and econom ical dynamics underlying environmental decision-making processes and the multitude of actors involved, how can scientists inform decision-makers and the public in effective and engaging ways? Should scientists be directly involved in the knowledge exchange and translation processes? And if so, how?

The focus of this session revolves around these following themes:

- Policy decision-making;
- Scientific and hydrometeorological knowledge exchange and transfer;
- Scientific responsibility towards the environmental debate.

First, decision-making processes regarding environmental issues in the context of Canadian institutions will be presented. Second, the question of knowledge exchange and transfer will be addressed by looking at how scientists can effectively communicate their information to decision-makers and the public. Third, the scientist's role as an individual subjected to diverging mandates and pressures will be addressed. An open discussion will end the session, giving an opportunity for everyone to share their thoughts and reflections.

Use, application and impact of satellite based earth observing systems over the ocean

Fraser Davidson – *Fisheries and Oceans Canada*
Keith Thompson – *Dalhousie University*
Laurie Neil – *Environment Canada*
Charles Hannah – *Fisheries and Oceans Canada*
Contact: davidsonf@dfo-mpo.gc.ca

Within Canada, environmental forecasts syste ms are be nefiting more and more from the availability of a variety of satellite based information over the o cean ranging from Gravitational Data (GRACE), Altimetry (Jason-1), SAR (Ra dar sat,Quick Scat), SST and Ocean Color. To encourage future expansion in use of satellite observing systems, this session delves into the analysis, use and/ or impact of satellite obs ervations over the ocean. Pa pers are incl uded on the abov e topics as well as 1) The assimilation of in–situ and satellite data in ocean and atmospheric models 2) The modeling and observation of ocean surface processes including surface wind and waves 3) the use of ocean color information for biological and ocean circulation purposes. The purpose of this session is to expose current research in t he use a nd implementation of satellite data over t he ocean as well a s operational implementations to environmental analysis and forecasting.

Implication des scientifiques dans le processus décisionnel

Miguel Tremblay – *Environnement Canada*
Jacques Descurieux – *Environnement Canada*
Simon Hobeila – *Conseiller en éthique, Bureau Recherche - Développement - Valorisation de l'Université de Montréal*
Personne-ressource : miguel.tremblay@ec.gc.ca

Face à la réalité des changements climatiques et à la préoccupation grandissante de la population canadienne vis-à vis les questions environnementales, une traduction efficiente des connaissances scientifiques et hydrométéorologiques en politiques gouvernementales est devenue une nécessité. De fait, la situation requiert un nouveau dialogue entre scientifiques, décideurs à tous les niveaux, toutes les parties prenantes, secteur privé et consommateurs. Toutefois, cette traduction des connaissances en politiques soulève plusieurs questions non seulement concernant le rôle et la responsabilité sociale des scientifiques, mais aussi les limites de leur contribution au débat environnemental.

Vu la complexité des dynamiques scientifiques, politiques et économiques qui servent de base aux processus de décision sur l'environnement et la multitude d'acteurs impliqués, comment les scientifiques peuvent-ils aviser les décideurs de manière efficace et engageante ? Les scientifiques devraient-ils être directement impliqués dans les processus d'échanges de connaissances et de traduction ? Si oui, comment ?

Cette séance cible les thèmes suivants:
- Prise de décision des politiques.
- Échange et transfert des connaissances scientifiques et hydrométéorologiques.
- Responsabilité scientifique dans le débat environnemental.

Premièrement, on présentera le processus décisionnel des institutions canadiennes vis-à-vis les questions environnementales. Deuxièmement, on abordera la question de la transmission et du transfert des connaissances en examinant comment les scientifiques peuvent communiquer efficacement leurs informations aux décideurs et au public. Troisièmement, on analysera le rôle du scientifique en tant qu'individu soumis à des mandats et des pressions divergentes. Finalement, la séance prendra fin par une discussion ouverte donnant ainsi à tous l'occasion de partager leurs pensées et leurs réflexions.

Emploi, application et impact de systèmes terrestres d'observation de l'océan par satellite

Fraser Davidson – *Pêches et Océans Canada*
Keith Thompson – *Dalhousie University*
Laurie Neil – *Environnement Canada*
Charles Hannah – Pêches et Océans Canada
Personne-ressource : davidson@dfo-mpo.gc.ca

À l'intérieur du Canada, les systèmes de prévisions environnementales bénéficient et disposent de plus en plus d'une variété d'informations sur l'océan provenant de satellites depuis les mesures de gravité (GRACE), l'altimétrie (Jason-1), le radar à ouverture synthètique, la température de la surface de la mer jusqu'à la couleur de l'océan. Afin d'encourager une utilisation accrue des systèmes d'observation par satellite dans l'avenir, nous examinerns et analyserons, lors de cette séance, l'utilisation et/ou l'impact des observations satellitaires de l'océan. On couvrira les travaux sur les sujets mentionnés ci-haut-mentionnés ainsi que sur (1) l'assimilation des données in situ ou satellitaires dans les modèles de l'océan et de l'atmosphère ; (2) la modélisation et l'observation des processus de la surface de l'océan incluant les vents de surface et les ondes superficielles; (3) l'utilisation de l'information sur la couleur de l'océan à des fins de recherche en biologie et en circulation océanique. Le but de cette session est de mettre en évidence les recherches existantes en utilisation et application des données satellitaires sur les océans de même que les implémentations opérationnelles en analyses et prévisions environnementales.

Avalanche science and forecasting

Pascal Haegeli – *Canadian Avalanche Centre*
Contact: pascal@avisualanche.ca

The Congress theme of 'Science Informing Decisions' clearly applies to the field of avalanche research. Every winter, snow avalanches affect recreation, transportation, resource industries and private property in all mountainous regions of Canada. Avalanches are the result of complex interactions between weather influences, the existing snowpack, terrain and people. While an advanced knowledge of the physical system is crucial for improving avalanche safety, effective communication of relevant information and a better understanding of the amateur and professional decision-making process are equally important for improving avalanche safety in Canada and around the world. The presentations in this session cover the full range of topics related to avalanche safety including overviews of the meteorological precursors and resulting avalanche activity during the winter of 2007/8, studies on snowpack modeling and numerical avalanche forecasting, and presentations on the development of efficient communication tools and the decision-making process in avalanche terrain.

Atmosphere

Atmosphere – General

Kevin Strawbridge – *Environment Canada*
Contact: Kevin.Strawbridge@ec.gc.ca

This session covers aspects of atmospheric science that did not fit as well into other sessions, and includes a concentration of presentations on remote sensing methods.

Operational meteorology

Al Wallace – *Meteorological Service of Canada*
Contact: Al.Wallace@ec.gc.ca

This session covers many aspects of operational meteorology including NWP use and assessment, UMOS, forecasting for the 2010 Olympics and the training of operational meteorologists.

Atmosphere, ocean and climate dynamics

Ronald McTaggart-Cowan – *Environment Canada*
Adam Monahan – *University of Victoria*
Marek Stastna – *Waterloo University*
Contact: ron.mctaggart-cowan@ec.gc.ca

This session combines submissions with a focus on atmosphere, ocean and climate dynamics. The title of the session is deliberately broad in order to allow researchers who concentrate on the study of any aspect of the earth system from a dynamical perspective to be included. Other sessions exist for addressing operational issues, numerical modelling, and the acquisition and use of observations. However, dynamical and diagnostic studies of the atmosphere, ocean and climate systems are often difficult to slot into particular sessions. Theoretical studies and analyses of forecast model, climate model, and reanalysis datasets serve the valuable function of increasing our understanding of the important dynamic and thermodynamic processes that drive circulations across time and spatial scales.

La science et la prédiction des avalanches

Pascal Haegeli – *Canadian Avalanche Centre*
Personne-ressource : *pascal@avisualanche.ca*

Le thème du congrès « La science comme outil de décision » s'applique clairement au domaine de recherche sur les avalanches. Chaque hiver, des avalanches affectent les loisirs, le transport, les industries du secteur primaire et les propriétés privées dans toutes les régions montagneuses du Canada. Les avalanches sont le résultat d'interactions complexes entre les influences des conditions météorologiques, la couverture de neige existante, le terrain et les gens. Si on veut améliorer la protection contre les avalanches au Canada et dans le monde, une connaissance préalable du système physique est cruciale, mais une communication efficace de l'information pertinente et une meilleure compréhension du processus de décision amateur et professionnel sont également importantes. Les travaux présentés à cette séance englobent toute la gamme des sujets ayant trait à la protection contre les avalanches et comprennent des vues d'ensemble des paramètres météorologiques précurseurs et des avalanches durant l'hiver 2007/8, des études sur la modélisation de la couverture de neige et sur la prévision numérique d'avalanches de même que le développement d'outils de communication efficaces et le processus de prise de décision en terrains d'avalanches.

Atmosphère

Atmosphère – général

Kevin Strawbridge – *Environnement Canada*
Personne-ressource : Kevin.Strawbridge@ec.gc.ca

Cette séance couvert des aspects de la science atmosphérique qui ne s'agencent pas bien avec les autres séances et comprend des présentations sur des méthodes de télédétection.

Météorologie opérationelle

Al Wallace – *Service Météorologique du Canada*
Personne-ressource: Al.Wallace@ec.gc.ca

Cette séance couvre de nombreux aspects de la météorologie d'exploitation y compris l'utilisation et l'évaluation de la prévision météorologique numérique, UMOS, des prévisions pour les Jeux Olympiques de 2010 et la formation des météorologues opérationnels.

Dynamique de l'atmosphère, des océans et du climat

Ronald Mctaggart-Cowan - Environnement Canada
Adam Monahan - Université de Victoria
Marek Stastna - Université de Waterloo
Personne-ressource : ron.mctaggart-cowan@ec.gc.ca

Nous combinons à cette séance des présentations ciblant la dynamique de l'atmosphère, des océans et du climat. Le titre permet d'englober tous les aspects des recherches faites sur la dynamique des systèmes terrestres. On couvre aux autres séances les questions opérationnelles, la modélisation numérique, l'acquisition et l'utilisation d'observations. Toutefois, les études dynamiques et diagnostiques des systèmes de l'atmosphère, de l'océan et du climat trouvent difficilement leur place dans celles-ci.

Les études théoriques et les analyses des modèles de prévision, des modèles climatiques et les jeux de données utilisés en réanalyse sont précieux car ils servent à accroître notre compréhension des importants processus dynamiques et thermodynamiques qui régissent les circulations aux diverses échelles spatio-temporelles.

Atmospheric modelling for research

Xin Qiu – *RWDI AIR Inc.*
Ron McTaggart-Cowan – *Environment Canada*
Contact: xin.qiu@rwdi.com

Numerical modelling is a vital component of research into atmospheric processes and meteorological prediction. The goal of this modelling session is to bring together atmospheric model users and developers, to communicate results, to exchange ideas, and to facilitate new collaborations. Session topics include model evaluations, new model development, and modelling for research and applications in public, academic and private sectors.

Aviation weather science and service for decision makers

Rob Honch – *MSC – Canadian Meteorological Aviation Center (CMAC)*
Contact: rob.honch@ec.gc.ca

Building on the conference theme: "science informing decisions", this session addresses aviation meteorological science and service for decision makers of Canada's Air Navigation System (ANS). Martin Kothbauer, Chief Dispatcher (Duty) with Air Canada Jazz will pr ovide a "deci sion makers" perspective on some recent cutting edge prototype products developed within the Canadian Meteorological Aviation Centre (CMAC). We also have an invited speaker from Australia, Keith Ross, who will be speaking on automated probabilistic TAFs. The "nowcasting" theme will be covered by a series of presentations on the "CAN-Now" project, funded by NAV CANADA, Transport Canada, and SAR-NIF. In addition, staff from the COMET program in Boulder, Colorado will present the latest on training for aviation weather forecasters. The remainder of the sessions (including the poster session) will consist of a smattering of Meteorological Service of Canada (MSC) work on icing, verification, modeling, case studies, volcanic ash, and training. There will be a special poster on recent activity at a volcano located in Central BC called Nazko Cone presented by Dr. Catherine Hickson, Research Scientist-Volcanologist, Natural Resources Canada.

The safety and efficiency of Canada 's ANS is depe ndent upon the informed decisions of its stakeholders (air traffic managers, major airline chief dispatchers, pilots, etc.). To help us understand their challenges, several stakeholders will be invited to participate on a panel discussion at the close of this session.

Medium term and climate forecasts

Hai Lin – *Recherche en Prévision Numérique (RPN), Environment Canada*
Contact: hai.lin@ec.gc.ca

This session deals with extende d- and long-range weather forecasts,and predictions of climate variability on seasonal, interannual and interdecadal time scales. Topics to be discussed include large-scale atmospheric dynamical processes that influence long-range weather and climate predictions, predictability, ensemble and initialization techniques, forecast skill assessment, downscaling and calibration, and end-user value and applications. Results from both dynamical models and statistical approaches are incuded.

La modélisation atmosphérique en recherche

Xin Qiu - RWDI AIR Inc.
Ron Mctaggart-Cowan – Environnement Canada
Personne-ressource **:** xin.qiu@rwdi.com

La modélisation numérique est une composante vitale de la recherche sur les processus atmosphériques et la prévision météorologique. Le but de cette séance sur la modélisation est de réunir utilisateurs et développeurs de modèles atmosphériques afin de communiquer des résultats, d'échanger des idées et de faciliter de nouvelles collaborations. Les sujets des séances comprennent des évaluations de modèles, le développement de nouveaux modèles et la modélisation appliquée à la recherche et à aux applications dans les secteurs publics, académiques et privés.

La Science et le Service de la météorologie aéronautique, des outils pour les décideurs

Rob Honch – MS – Centre de météorologie aéronautique canadien (CMAC)

Élaborant sur le thème du congrès : « La science comme outil de décision », cette séance sur la science et le service en météorologie aéronautique cible les décideurs du Système canadien de navigation aérienne (SNA). Martin Kothbauer, répartiteur en chef (Service) à Air Canada Jazz donnera un point de vue de décideur sur quelques prototypes de produits de pointe développés par le Centre de météorologie aéronautique canadien (CMAC). Nous avons aussi un conférencier invité, Keith Ross d'Australie, qui parlera de prévisions probabilistes automatiques pour les aérodromes. Une série de présentations au sujet du projet "CAN-Now" fondé par NAV CANADA, Transports Canada et SAR-FNI abordera le thème de la « prévision immédiate ». De plus, un représentant du programme COMET de Boulder au Colorado expliquera les tout derniers développements de la formation des prévisionnistes à l'aviation. Les autres séances (incluant la session d'affichage) couvriront divers travaux effectués au sein du Service météorologique du Canada sur le givrage, la vérification, la modélisation, des études de cas, les cendres volcaniques et la formation. Il y aura un stand d'affiches de Dr Catherine Hickson, volcanologue-chercheuse de Ressources Naturelles Canada au sujet du cône Nazko situé en Colombie-Britannique centrale.

La sécurité et l'efficacité du système canadien de navigation aérienne dépend des décisions averties de ses parties prenantes (gestionnaires de la circulation aérienne, réoartiteurs d'importantes lignes aériennes, pilotes, etc.). À la fin de cette séance, plusieurs parties prenantes seront invitées à participer à un panel pour que nous puissions mieux comprendre les défis qu'ils ont à relever.

Prévisions à moyen et à long termes

Hai Lin – *Recherche en prévision numérique (RPN), Environnement Canada*
Personne-ressource: hai.lin@ec.gc.ca

Cette séance traite des prévisions météorologiques à long terme ainsi que des prévisions de variabilité climatique aux échelles temporelles saisionnières, annuelles et décennales.Les sujets discutés incluront les processus atmosphériques dynamiques à grande échelle qui influencent les prévisions météorologiques et climatiques, la prévisibilité, les techniques d'ensemble et d'initialisation, l'évaluation de l'habileté à prévoir, la réduction et le calibrage, la valeur et les applications pour l'utilisateur final ainsi que les résultats provenant de modèles dynamiques et d'approches statistiques.

Extremes in weather, water and climate

Barrie Bonsal – *Environment Canada*
Richard Lawford – *University of Manitoba*
Contact: Barrie.Bonsal@ec.gc.ca

Society has been experiencing a significant increase in the damages and risks associated with extremes in weather, water and climate. The range of these phenomena extends from longer-scale droughts to short-duration extreme precipitation events and floods. Explanations for these advanced trends range from development policies that have allowed urban growth on the flood plains of many rivers, to poor water management practices in developing countries. However, many scientists argue that these growing impacts are clear evidence of changes in the frequency and intensity of severe events associated with climate change. Over the past decade, knowledge of extreme events has increased due to advanced statistical analyses of past observed climate data, re-analyses products and atmospheric/hydrologic model outputs. In addition, research on drought-related extremes in Canada has recently been advanced through the establishment of the Drought Research Initiative.

This scientific session focuses on the occurrence, causes, impacts and adaptations to extremes in weather, water and climate around the globe with an emphasis on Canada. Presentations explore all aspects of atmospheric and hydrologic extreme events including observational and/or modelling studies of: Past occurrence including trends and variability in frequency and magnitude, Case studies, Projected future changes, Impacts on hydrology and water resources systems, Adaptation strategies, Methodologies for improving monitoring and prediction, and Related topics.

Fire weather and forecasting

Brian Amiro – *University of Manitoba*
Bob Kochtubajda – *Environment Canada*
Contact: brian_amiro@umanitoba.ca

The occurrence, intensity and severity of fire is largely controlled by weather. The session will include recent developments on the weather impacts on ignition, including lightning; fire growth and behaviour; historical analyses; smoke and its impacts; the potential effects of climate change; and meteorological analyses related to the 2003 Kelowna fires.

Air quality in valleys

Douw Steyn – University of British Columbia
Contact: douw@eos.ubc.ca

This special session will focus on particular questions of relevance to air quality in valleys. Submissions describe research into meteorological, chemical and emissions effects that lead to characteristics of spatio-temporal variability of air pollution in valley environments. Work is presented that has particular relevance to the formation of public policy and other air quality management tools in these environments.

Extrêmes météorologiques, hydrologiques et climatiques

Barrie Bonsal – Environnement Canada
Richard Lawford – Université du Manitoba
Personne-ressource : Barrie.Bonsal@ec.gc.ca

La société connaît un accroissement important des dommages et risques associés aux extrêmes météorologiques, hydrologiques et climatiques. La gamme de ces phénomènes va des sécheresses à long terme aux précipitations et inondations sévères de courte durée. Les explications de ces tendances accélérées vont depuis les politiques d'aménagement qui ont permis une croissance urbaine sur les plaines inondables de plusieurs rivières jusqu'aux pratiques médiocres de la gestion de l'eau dans les pays en voie de développement. Toutefois, plusieurs scientifiques soutiennent que ces effets toujours grandissants sont clairement la preuve de changements dans la fréquence et l'intensité d'évènements extrêmes associés aux changements climatiques. Dans la dernière décennie, les connaissances concernant les évènements extrêmes ont augmenté grâce aux analyses statistiques avancées des données climatiques observées dans le passé, aux produits de ré-analyses et aux sorties des modèles atmosphériques et hydrologiques. De plus, les recherches sur les extrêmes associés à la sécheresse au Canada ont permis des avancées grâce à l'établissement de l'initiative de recherche sur la sécheresse (DRI).

Cette séance scientifique cible les faits, les causes, les effets et les adaptations aux extrêmes météorologiques, hydrologiques et climatiques dans le monde et plus particulièrement au Canada. Les travaux présentés explorent tous les aspects atmoshériques et hydrologiques d'évènements extrêmes incluant des études d'observations et/ou de modélisation de faits passés incluant tendances et variabilité dans la fréquence et l'ampleur, des études de cas, des projections de changements anticipés, des impacts sur l'hydrologie et les systèmes de ressources hydrologiques, des stratégies d'adaptation, des méthodologies pour améliorer la surveillance et les prévisions et tout autre sujet connexe.

Conditions d'alerte et prévisions météo-incendie

Brian Amiro – University of Manitoba
Bob Kochtubajda – Environment Canada
Personne-ressource : brian_amiro@umanitoba.ca

L'occurence, l'intensité et la sévérité d''un incendie sont contrôlées en grande partie par les conditions météorologiques. Lors de cette séance, nous examinerons des développements récents concernant les effets des conditions météorologiques, incluant la foudre, sur le déclenchement d'un incendie, sa croissance et son comportement, des analyses historiques, la fumée et ses effets, les répercussions potentielles des changements climatiques et des analyses météorologiques lors des incendies de 2003 à Kelowna.

La qualité de l'air dans les vallées

Douw Steyn – *University of British Columbia*
Personne-ressource : douw@eos.ubc.ca

Cette séance spéciale cible des questions particulières ayant rapport à la qualité de l'air dans les vallées. Les travaux de recherche décrivent les effets météorologiques et chimiques d'émissions menant à des caractéristiques de variabilité spatio-temporelles de la pollution de l'air dans l'environnement des vallées. On couvrira aussi des travaux portant sur le développement de politiques publiques et autres outils de gestion de la qualité de l'air dans ces environnements.

Climate

Climate – General

William Hsieh – *University of British Columbia*
Contact: whsieh@eos.ubc.ca

This session covers aspects of climate that did not appropriately fit into other sessions.

Global coupled atmosphere–ocean modelling and assimilation

C. Harold Ritchie – *Meteorological Research Division, Environment Canada*
Keith Thompson – *Dalhousie University*
Contact: harold.ritchie@ec.gc.ca

There is growing scientific interest in improving and extending the prediction skill of global atmospheric and ocean models on time scales of days to decades. It is generally recognized that this requires the development of coupled atmosphere-ocean modelling and assimilation systems. This presents a number of challenges related to assimilating observations into coupled systems, and identifying and understanding the physical processes that limit and provide predictability. Within Canada there have recently been two related developments, both designed to improve and exploit predictions using coupled global models. A new inter-agency initiative is now underway to develop an operational global coupled atmosphere-ocean data assimilation and prediction system through a collaboration amongst Environment Canada (EC), Fisheries and Oceans Canada (DFO), and the Department of National Defence (DND), and including Mercator-Ocean participation (France). In parallel, R&D capability within Canada is being enhanced through a Global Ocean-Atmosphere Prediction and Predictability (GOAPP) research network funded by the Canadian Foundation for Climate and Atmospheric Sciences since October 2006. This session will include presentations on technical and scientific issues related to prediction and predictability of the global coupled system.

Polar climate stability

Guido Vettoretti – *University of Toronto*
Contact: guido@atmosp.physics.utoronto.ca

The high latitude amplification of climate change in response to greenhouse gas forcing has drawn attention to the future stability of the polar cryosphere, especially in and surrounding the Canadian Arctic Ocean. Polar climate stability is of interest not only under “hot-house” climate conditions but also in past “ice-house” climate conditions. The purpose of this session is to promote the interchange of ideas and understanding of the issue of polar climate stability and variability between those working primarily on the modern system and those working upon the same issues from the perspective of paleoclimatology and paleoceanography. This session includes contributions from the analysis of climate related data and from the modelling of system interactions in each of the terrestrial, oceanographic and atmospheric realms as well as including those interactions that involve responses of continental ice sheets such as that of Greenland. There are also contributions from the modelling and data analysis of past and present internal modes of climate variability. Examples of internally forced variability include the El Niño-Southern Oscillation (ENSO), the Atlantic Multi-decadal Oscillation (AMO) and other coupled or uncoupled atmosphere and ocean basin modes of variability.

Climat

Climat – général

William Hsieh – *Université de la Colombie-Britannique*
Personne-ressource : whsieh@eos.ubc.ca

Cette séance couvre des aspects du climat qui ne cadrent pas bien avec le contenu des autres séances.

Les systèmes de modélisation et d'assimilation atmosphère-océans globaux couplés

C. Harold Ritchie – *Direction de la recherch en météorologie, Environnement Canada*
Keith Thompson – *Université de Dalhousie*
Personne-ressource : harold.ritchie@ec.gc.ca

Les scientifiques s'intéressent de plus en plus à améliorer les prévisions des modèles globaux atmosphère-océans aux échelles temporelles allant de quelques jours à une décennie. Il est généralement reconnu que ceci requiert le développement de systèmes de modélisation et d'assimilation atmosphère-océan couplés Cela présente plusieurs défis liés à l'assimilation d'observations dans des systèmes couplés et à l'identification et à la compréhension des processus qui limitent et fournissent les prévisions. Au Canada, deux développements reliés entre eux ont pris place récemment, les deux créés pour améliorer et exploiter les prévisions en utilisant des modèles globaux couplés. Une nouvelle initiative interorganismes est en train de développer un système opérationnel global couplé d'assimilation de données atmosphère-océans et de prévisions grâce à une collaboration entre Environnement Canada, Pêches et Océans Canada et le Ministère de la Défense nationale avec la participation de Mercator Océan (France). Parallèlement, la capacité canadienne en recherche et développement est accrue grâce au réseau de recherche « Global Ocean-Atmosphere Prediction and Predictability (GOAPP) » financé par la Fondation canadienne pour les sciences du climat et de l'atmosphère depuis octobre 2006. Cette séance inclura des présentations sur des questions scientifiques et techniques reliées à la prévision et à la prévisibilité du système global couplé.

La stabilité du climat polaire

Guido Vettoretti – Université de Toronto

Personne-ressourc: guido@atmosp.physics.utoronto.ca

L'amplification des changements climatiques aux hautes latitudes due au forçage des gaz à effet de serre a attiré l'attention sur la stabilité future de la cryosphère polaire, spécialement dans et autour de l'océan Artique canadien. La stabilité du climat arctique est intéressante non seulement sous les conditions climatiques de "serre" mais aussi sous les conditions climatiques « glaciaires » du passé. Le but de cette séance est de promouvoir un échange d'idées et une meilleure compréhension de la stabilité et de la variabilité du climat polaire parmi les gens qui travaillent principalement sur le système moderne et ceux qui oeuvrent sur les mêmes questions en paléoclimatologie et en paléocéanographie. Cette séance inclut l'analyse de données reliées au climat et la modélisation des interactions des systèmes dans chacun des domaines suivants : terrestre, océanographique et météorologique, aussi les interactions qui impliquent des réponses des calottes glaciaires comme celle du Groenland. S'y ajoutent également des résultats de la modélisation et de l'analyse de données des modes internes de variabilité climatique passés et présents ainsi que des exemples de variabilité interne forcée incluant le phénomène de El-Niño/oscillation australe (ENSO), l'oscillation multidécennales Atlantique (AMO) et autres modes de variabilité couplés et non couplés entre l'atmosphère et le bassin océanique.

Dynamical and statistical downscaling

William Hsieh – University of British Columbia
Van-Thanh-Van Nguyen – McGill University
Philippe Gachon – Environment Canada
Contact: whsieh@eos.ubc.ca

The coarse resolution output from numerical climate and weather models require downscaling (either dynamically through regional numerical models or statistically via statistical methods) to be useful at local or regional scales. Papers will be presented in all areas of dynamical and statistical downscaling from weather to climate time scales.

Topics include:
New downscaling techniques via nonlinear, multivariate, multi-site statistical, probabilistic and stochastic approaches; applications to precipitation and extreme weather forecasts as well as climate change scenarios development.

Water, weather and climate: Serving decision makers in the energy sector

Anne-Marie Valton – *Environment Canada*
Contact: anne-marie.valton@ec.gc.ca

Energy is becoming a very important issue as much as climate change and water. There is a need worldwide to address this issue in the context of a changing climate: we need to find ways to manage energy demand and supply more efficiently. Environmental prediction in water and atmospheric science can address directly these important priorities by helping the decision makers to improve management of energy resources. They also help to match energy supply and demand and to better manage risk to energy infrastructure. They can also improve inventories of greenhouse gases and evaluate renewable energy potential. Environmental predictions can improve the competitiveness & leadership of a clean energy system. As Canada is among one of the world's largest producers of most types of energy, it is important to support this sector and see how we can help decision makers in this area. Presentations in this session address the relationship(s) between the energy sector and climate, weather and/or water. Contributions dealing with weather-based energy Products & Programs in support of the decision maker in this sector are also welcome.

Hydrology

Forest and general hydrometerology: Advances in science and interpretations for management

Todd Redding – *FORREX*
Contact: todd.redding@forrex.org

The purpose of this session is to present the state of the knowledge of hydrometeorology in general as well as forest hydrometeorology as related to forest management. The intent of this session is to provide a venue for current research on the hydrometeorological impacts of forest disturbance and land-use change that have management relevance. Forest hydrometeorology topics covered will include stand level studies of snow accumulation and melt, rainfall interception, stand water balances, stand-level evapotranspiration and model estimates of soil temperature and moisture. General hydrometeorology topics will focus on relations between hydrometeorology and streamflow.

Réduction dynamique et statistique

William Hsieh – *Université de la Colombie britannique*
Van-Thanh-Van *Nguyen – Université McGill*
Philippe Gachon – *Environnement Canada*
Personne-ressource : whsieh@eos.buc.ca

Pour être utile à l'échelle locale ou régionale, le résultat de la résolution grossière des modèles climatiques et météorologiques numériques requiert une réduction, soit dynamique par le biais de modèles numériques régionaux ou statistique via des méthodes statistiques. Des travaux dans tous les domaines de réduction dynamique et statistique des échelles de temps météorologiques et climatiques seront présentés.

Les sujets incluent de nouvelles techniques de réduction via des approches nonlinéaires, multivariables, multisites ou probabilistes, des applications pour les prévisions de précipitations et de conditions atmosphériques extrêmes ainsi que le développement de scénarios de changements climatiques.

Eau, météo et climat : au service des décideurs du domaine énergétique

Anne-Marie Valton – Environnement Canada
Personne-ressource : anne-marie.valton@ec.gc.ca

L'énergie est en voie de devenir une question aussi importante que les changements climatiques et l'eau. Cette question devrait être approchée globalement dans le contexte des changements climatiques : nous avons besoin de trouver des moyens de gérer plus efficacement l'offre et la demande énergétiques. La météorologie et l'hydrologie peuvent aborder directement ces importantes priorités par leurs prévisions en aidant les décideurs à améliorer la gestion des resssources énergétiques. Ces sciences peuvent aussi aider à assortir l'offre et la demande énergétiques, à mieux gérer les risques potentiels à l'infrastructure énergétique, à améliorer les inventaires des gaz à effet de serre et à évaluer le potentiel énergétique renouvelable. Les prévisions environnementales peuvent améliorer la compétitivité et le leadership d'un système énergétique propre. Comme le Canada est l'un des plus grands producteurs de la plupart des types d'énergie, il est important d'appuyer ce secteur et de voir comment nous pouvons aider les décideurs dans ces domaines. Les travaux de cette séance abordent la/les relation(s) entre le secteur énergétique et le climat, la météo et/ou l'eau. Tout article touchant aux produits et programmes énergétiques basés sur la météorologie et supportant les décideurs dans ce domaine sera reçu avec plaisir.

Hydrologie

Hydrométéorologie générale et forestière : progrès en science et interprétations pour fins de gestion

Todd Redding – FORREX
Personne-ressource : todd.redding @forrex.org

Le but de cette séance est de présenter l'état des connaissances actuelles en hydrométéorologie générale et forestière. Cette session veut fournir un lieu de discussion pour les recherches courantes sur les impacts hydrométéorologiques des perturbations forestières et des changements dans l'aménagement foncier qui sont pertinents pour la gestion. Les sujets d'hydrométéorologie forestière incluent des études d'accumulation et de fonte de neige, de perte d'interception de pluie, des bilans hydriques et le niveau d'évapo-transpiration du matériel sur pied ainsi que des modèles de prévision de la température et du bilan d'eau du sol. Les sujets d'hydrométéorologie générale ciblent les relations entre l'hydrométéorologie et le débit de l'eau.

Water resources and climate change

Stephen Dery – *University of Northern British Columbia*
Contact: sdery@unbc.ca

Climate change is having an escalating impact on water resources in Canada and other regions of the world. There is therefore an urgent need to detect and attribute variability and trends in water resources and to establish their environmental, ecological and societal ramifications. Given the ever-increasing demands for freshwater, this session aims to discuss a broad range of topics such as: the spatio-temporal variability and trends in precipitation, river runoff and evapotranspiration, the frequency and intensity of floods and droughts, the role of soil moisture on climate memory, and the implications of changing water resources on the environment, ecology and society. Observational and modeling studies at various spatio-temporal scales are included.

Oceanography

Oceanography – General

Howard Freeland – *Institute of Ocean Sciences, Fisheries and Oceans Canada*
Contact: FreelandHj@pac.dfo-mpo.gc.ca

This session covers aspects of oceanography that did appropriately fit into other sessions.

Coastal and inland waters in a changing climate

Jinyu Sheng – *Dalhousie University*
Ram Yerubandi – *National Water Research Institute, Environment Canada*
Guoqi Han – *Environmental Sciences Division, Fisheries and Oceans Canada*
Contact: Jinyu.Sheng@Dal.Ca

Rapid economic development and population growth in coastal zones and global climate change have been affecting the ecosystems of coastal and inland waters. This session will focus on aspects of physical, biological and ecological processes of coastal oceans, estuaries and inland waters in a changing climate. Topics include: coastal physical oceanography, storm surges, tsunamis, estuarine dynamics, hydrology and hydrodynamics of large lakes, air-lake interactions, mixing and dispersion of material in the coastal waters.

Impact of climate change on biogeochemical cycles in the coastal ocean

William Crawford – *Institute of Ocean Sciences, Fisheries and Oceans Canada*
Angelica Peña – *Institute of Ocean Sciences, Fisheries and Oceans Canada*
Contact: crawfordb@pac.dfo-mpo.gc.ca

Coastal ecosystems undergo major changes when ocean temperatures rise or fall by even a few degrees. Previous observations of ecosystem response provide some insight on how temperature change might impact these ecosystems. However, predictions are complicated by uncertainty of nutrient and oxygen availability, timing of seasonal winds and currents, and interactions among species. This session presents papers on the coastal ocean properties in a changing climate and adaptation of coastal ecosystems to changing oceans, including observations of past changes, and models of these ecosystem processes.

Ressources hydrauliques et changements climatiques

Stephen Dery – *Université de la Colombie-Britannique*
Personne-ressource : sdery@unbc.ca

Les changements climatiques ont un impact grandissant sur les ressources hydrauliques au Canada et dans d'autres régions du monde. Il est urgent de découvrir et de documenter la variabilité et les tendances des ressources hydrauliques et d'en établir les ramifications environnementales, écologiques et sociétales. Vu les demandes toujours croissantes en eau potable, on vise à couvrir lors de cette séance une vaste gamme de sujets tels que la variabilité spatio-temporelle et les tendances en précipitations, l'écoulement riverin et l'évapotranspiration, la fréquence et l'intensité des inondations et des sécheresses, le rôle de l'humidité du sol sur l'histoire du climat et les implications du changement des ressources hydrauliques sur l'environnement, l'écologie et la société. Des études d'observations et de modélisation à diverses échelles spatio-temporelles sont incluses.

Océanographie

Océanographie – général

Howard Freeland – *Institut des sciences de la mer, Pêches et Océans Canada*
Personne-ressource : FreelandHj@pac.dfo-mpo.gc.ca

Cette séance couvre des aspects de l'océanographie qui ne cadrent pas bien avec le contenu des autres séances.

Les eaux côtières et intérieures dans un climat en changement

Jinyu Sheng – *Université de Dalhousie*
Ram Yerubandi – *Institut national de recherches sur les eaux, Environnement Canada*
Guoqi Han – *Direction des sciences de l'environnement, Pêches et Océans Canada*
Personne-ressource : Jinyu.Sheng@Dal.Ca

Le développement économique et la croissance rapide de la population des zones côtières et les changements climatiques globaux affectent les écosystèmes des eaux côtières et intérieures. Cette séance examinera certains aspects des processus physiques, biologiques et écologiques des zones côtières océaniques, des estuaires et des eaux intérieures dans un climat en changement. Les sujets présentés incluent l'océanographie physique côtière, les ondes de tempêtes, les tsunamis, la dynamique des estuaires, l'hydrologie et l'hydrodynamique de grands lacs, les interactions entre air et lac, le brassage et la dispersion de matériel dans les eaux côtières.

Impact des changements climatiques sur les cycles biogéochimiques des eaux côtières

William Crawford – *Institut des sciences de la mer, Pêches et Océans Canada*
Angelica Peña – *Institut des sciences de la mer, Pêches et Océans Canada*
Personne-ressource: crawfordb@pac.dfo-mpo.gc.ca

Les écosystèmes côtiers subissent des changements importants quand la température de l'océan monte ou descend, ne serait-ce que de quelques degrés. Des observations antérieures de la réaction des écosystèmes fournissent un certain aperçu de l'impact que peut avoir un changement de température sur ces écosystèmes. Cependant, la disponibilité incertaine de substances nutritives et d'oxygène, le timing des vents et courants saisonniers et l'interaction entre les espèces compliquent les prévisions. Cette séance présente des travaux sur les propriétés des eaux côtières dans un climat en changement et l'adaptation des écosystèmes côtiers à des océans en changement ainsi que des modèles des processus de ces écosystèmes.

Operational oceanography

Guoqi Han – *Fisheries and Oceans Canada*
Contact: hang@dfo-mpo.gc.ca

Operational oceanography has advanced substantially in the past decade, with many emerging challenges and great opportunities. This session includes papers in all aspects of operationa l oceanography, including but not limited to observational system design and implementation, data management and integration, dynamical model development, data assimilation research and development, results validation, products dissemination, and practical applications.

Océanographie d’exploitation

Guoqi Han – Pêches et Océans Canada
Personne-ressource : hang@dfo-mpo.gc.ca

L’océanographie d’exploitation a progressé de façon substantielle ces dix dernières années relevant de grands défis et profitant d’occasions favorables. Cette séance présente des travaux sur tous les aspects de l’océanographie d’exploitation et plus : conception et implantation de systèmes d’observations, de systèmes de gestion et d’intégration de données, de développement en modélisation dynamique, de recherche et développement en assimilation de données, de validation des résultats, de dissémination des produits et d’applications pratiques.

Week at a Glance

Session Time Code		1 Shuswap Room	2 Pennask Room	3 Skeena Room	4 Skaha Room	5 Vaseaux Room	6 Kootenay Room	7 Cascade / Cassiar Room
Sunday, May 25								
	08:30–18:00	**Committee Meetings (available on-line at https://www1.cmos.ca/abstracts/congress_schedule.asp)**						
	17:00–20:00	*Ice Breaker Reception at the Laurel Packinghouse*						
Monday, May 26								
1A	08:30–10:30	**Opening Session, Plenary Sessions 1 and 2 in the Okanagan Ballroom**						
	10:30–11:00	*Coffee*						
1B	11:00–12:30	International Polar Year: Oceans **(I)**	Atmospheric modelling for research **(A)**	Extremes in weather, water and climate **(A)**	Air quality in valleys **(A)**	Aviation weather science and service for decision makers **(A)**	Oceanography – general **(O)**	
	12:30–14:00	*Lunch*						
1C	14:00–15:30	International Polar Year: Hydrology **(I)**	Atmospheric modelling for research **(A)**	Extremes in weather, water and climate **(A)**	Air quality in valleys **(A)**	Aviation weather science and service for decision makers **(A)**	Oceanography – general **(O)**	
	15:30–16:00	*Coffee*						
1D	16:00–17:45	International Polar Year: Cryosphere **(I)**	Atmospheric modelling for research **(A)**	Extremes in weather, water and climate **(A)**	Climate – general **(C)**	Aviation weather science and service for decision makers **(A)**	Impact of climate change on biogeochemical cycles in the coastal ocean **(O)**	Atmosphere, ocean and climate dynamics **(A)**
	18:00–19:00		CMOS Annual General Meeting					
	19:00–20:00					Smoke Forecasting in Canada: Past, Present and Future **(A)** **(Chilcotin Room)**		
Tuesday, May 27								
2A	08:30–10:00	**Plenary Sessions 3 and 4 in the Okanagan Ballroom**						
	10:00–10:30	*Coffee*						
2B	10:30–12:00	Coastal and inland waters in a changing climate **(O)**	Polar climate stability **(C)**	Extremes in weather, water and climate **(A)**		Health issues of weather and climate **(I)** **(Chilcotin Room)**		Atmosphere, ocean and climate dynamics **(A)**
	12:00–14:00	*Patterson–Parsons Luncheon in the Okanagan Ballroom*						
2C	14:00–15:30	Coastal and inland waters in a changing climate **(O)**	Medium term and climate forecasts **(A)**	Operational meteorology **(A)**		Health issues of weather and climate **(I)** **(Chilcotin Room)**		Atmosphere, ocean and climate dynamics **(A)**
	15:30–16:00	*Coffee*						

Session Time Code		1 Shuswap Room	2 Pennask Room	3 Skeena Room	4 Skaha Room	5 Vaseaux Room	6 Kootenay Room	7 Cascade / Cassiar Room
Tuesday, May 27 (continued)								
2D	16:00–18:00	Coastal and inland waters in a changing climate **(O)**	Medium term and climate forecasts **(A)**	Operational meteorology **(A)**	Polar climate stability **(C)**	Forest and general hydrometeorology **(H)**	Use, application and impact of satellite-based earth observing systems over the ocean **(I)**	Atmosphere, ocean and climate dynamics **(A)**
	17:30–19:00					Canadian Argo Users Group meeting **(Chilcotin Room)**		
	19:00–21:00	**Public Lectures in the Okanagan Ballroom**						
Wednesday, May 28								
3A	08:30–10:00	**Plenary Sessions 5 and 6 in the Okanagan Ballroom**						
	10:00–10:30	*Coffee*						
3B	10:30–12:00	Dynamical and statistical downscaling **(C)**	Operational oceanography **(O)**	Avalanche science and forecasting **(I)**	Polar climate stability **(C)**	Global coupled atmosphere–ocean modelling and assimilation **(C)**	Water, weather, and climate: Serving decision makers in the energy sector **(C)**	
	12:00–13:30	*Lunch*						
3C	13:30–15:30	International Polar Year: Atmosphere **(I)**	Operational oceanography **(O)**	Scientists' involvement in decision-making processes **(I)**	Polar climate stability **(C)**	Global coupled atmosphere–ocean modelling and assimilation **(C)**	Atmosphere – general **(A)**	Operational meteorology **(A)** **(Okanagan Room)**
	15:30–16:00	*Coffee*						
3D	16:00–17:30	**Poster Session on the Terrace**						
	18:30	*Banquet in the Okanagan Ballroom*						
Thursday, May 29								
4A	08:30–10:00	**Plenary Sessions 7 and 8 in the Okanagan Ballroom**						
	10:00–10:30	*Coffee*						
4B	10:30–12:45	Dynamical and statistical downscaling **(C)**	Water resources and climate change **(H)**	Scientists' involvement in decision-making processes **(I)**	Fire weather and forecasting **(A)**	Global coupled atmosphere–ocean modelling and assimilation **(C)**		
	13:00–15:00					CFCAS: Communications Boot Camp – Getting the message out		

I Interdisciplinary, **A** Atmosphere, **C** Climate, **H** Hydrology, **O** Oceanography

Aperçu de la semaine

Heure / code		1 salle Shuswap	2 salle Pennask	3 salle Skeena	4 salle Skaha	5 salle Vaseaux	6 salle Kootenay	7 salle Cascade / Cassiar
dimanche, 25 mai								
	08:00–18:00	**Réunions de comités (disponible à https://www1.cmos.ca/abstracts/congress_schedule.asp)**						
	17:00–20:00	*Réception d'ouverture, Laurel Packinghouse*						
lundi, 26 mai								
1A	08:30–10:30	**Session d'ouverture, Sessions plénières 1 et 2, salle Okanagan**						
	10:30–11:00	*Café*						
1B	11:00–12:30	Anée polaire internationale: Océans **(I)**	Modélisation atmosphérique pour la recherche **(A)**	Extrèmes en météo, eau et climat **(A)**	Qualité de l'air dans les vallées **(A)**	La science et le service de météorologie aéronautique, outils pour les décideurs **(A)**	Océanographie – general **(O)**	
	12:30–14:00	*Déjeuner*						
1C	14:00–15:30	Anée polaire internationale: Hydrologie **(I)**	Modélisation atmosphérique pour la recherche **(A)**	Extrèmes en météo, eau et climat **(A)**	Qualité de l'air dans les vallées **(A)**	La science et le service de météorologie aéronautique, outils pour les décideurs **(A)**	Océanographie – general **(O)**	
	15:30–16:00	*Café*						
1D	16:00–17:45	Anée polaire internationale: Cryosphère **(I)**	Modélisation atmosphérique pour la recherche **(A)**	Extrèmes en météo, eau et climat **(A)**	Climat – general **(C)**	La science et le service de météorologie aéronautique, outils pour les décideurs **(A)**	Impact du changement climatique sur les cycles biogéochimiques des eaux côtières **(O)**	Dynamique de l'atmosphère, de l'océan et du climat **(A)**
	18:00–19:00		Réunion generale annuelle de la SCMO					
	19:00–20:00					La prévision de la fumée au Canada, du passé à l'avenir **(A)** **(salle Chilcotin)**		
mardi, 27 mai								
2A	08:30–10:00	**Sessions plénières 3 et 4, salle Okanagan**						
	10:00–10:30	*Café*						
2B	10:30–12:00	Les eaux côtières intérieures dans un climat en changement **(O)**	Stabilité du climat polaire **(C)**	Extrèmes en météo, eau et climat **(A)**		Santé publique et la météo et le climat **(I)** **(salle Chilcotin)**		Dynamique de l'atmosphère, de l'océan et du climat **(A)**
	12:00–14:00	*Déjeuner Patterson–Parsons, salle Okanagan*						
2C	14:00–15:30	Les eaux côtières intérieures dans un climat en changement	Prévisions à moyen et à long termes **(A)**	Santé publique et la météo et le climat **(A)**		Santé publique et la météo et le climat **(I)** **(salle Chilcotin)**		Dynamique de l'atmosphère, de l'océan et du climat **(A)**
	15:30–16:00	*Café*						

Heure / code		1	2	3	4	5	6	7
		salle Shuswap	**salle Pennask**	**salle Skeena**	**salle Skaha**	**salle Vaseaux**	**salle Kootenay**	**salle Cascade / Cassiar**
mardi, 27 mai (continué)								
2D	16:00–18:00	Les eaux côtières intérieures dans un climat en changement	Prévisions à moyen et à long termes **(A)**	Météorologie opérationnelle **(A)**	Stabilité du climat polaire **(C)**	Hydrométéorologie forestière et générale **(H)**	Emploi, application et impact de systèmes terrestres d'observation de l'océan par satellite	Dynamique de l'atmosphère, de l'océan et du climat **(A)**
	17:30–19:00					Réunion du Comité des usagers de Argo **(salle Chilcotin)**		
	19:00–21:00	**Conférences publiques, salle Okanagan**						
mercredi, 28 mai								
3A	08:30–10:00	**Sessions plénières 5 et 6, salle Okanagan**						
	10:00–10:30	*Café*						
3B	10:30–12:00	Réduction d'échelle statistique ou dynamique **(C)**	Océanographie opérationnelle **(O)**	Science et prédiction des avalanches **(I)**	Stabilité du climat polaire **(C)**	Systèmes de modélisation et d'assimilation atmosphère–océan globaux couplés **(C)**	Eau, météo et climat: au service des décideurs du domaine énergétique **(C)**	
	12:00–13:30	*Déjeuner*						
3C	13:30–15:30	Anée polaire internationale: Atmosphère **(I)**	Océanographie opérationnelle **(O)**	Implication des scientifiques dans le processus décisionnel **(I)**	Stabilité du climat polaire **(C)**	Systèmes de modélisation et d'assimilation atmosphère–océan globaux couplés **(C)**	Atmosphère – général **(A)**	Météorologie opérationnelle **(A)** **(salle Okanagan)**
	15:30–16:00	*Café*						
3D	16:00–17:30	**Session d'affiches, Terrace**						
	18:30	*Banquet des prix et honneurs de la SCMO, salle Okanagan*						
jeudi, 29 mai								
4A	08:30–10:00	**Sessions plénières 7 et 8, salle Okanagan**						
	10:00–10:30	*Café*						
4B	10:30–12:45	Réduction d'échelle statistique ou dynamique **(C)**	Ressources en eau et les changements climatiques **(H)**	Implication des scientifiques dans le processus décisionnel **(I)**	Météo de feu et prédiction **(A)**	Systèmes de modélisation et d'assimilation atmosphère–océan globaux couplés **(C)**		
	13:00–15:00					FCSCA: Atelier de communication – Faire passer le message		

I Interdisciplinaire, **A** Atmosphère, **C** Climat, **H** Hydrologie, **O** Océanographie

Session schedules / Horaires des présentations

(I) Interdisiplinary/Interdisciplinaire, **(A)** Atmosphere/Atmosphère, **(C)** Climate/Climat,
(H) Hydrology/Hydrologie, **(O)** Oceanography/Océanographie

Monday / lundi, 26 May / mai		
	Session 1A, Room / salle Okanagan	
08:30	Opening Session, *Chair:* Kent Johnson	
09:00	Plenary Session 1, *Chair:* Paul G. Myers	Climate, water and weather affairs: "Selling" science to society, *Michael Glantz*
09:45	Plenary Session 2, *Chair:* Paul G. Myers	An observer's view of a changing marine Arctic, *Humfrey Melling*
10:30	*Coffee/Café*	

	Session 1B1 **Room / salle Shuswap**	**Session 1B2** **Room / salle Pennask**	**Session 1B3** **Room / salle Skeena**
	(I) International Polar Year: Oceans, part 1 of 4 *Chairs:* Barry E. Goodison and Robie Macdonald	**(A)** Atmospheric modelling for research, part 1 of 3 *Chair:* Xin Qiu	**(A)** Extremes in weather, water and climate, part 1 of 4 *Chair:* Kit K. Szeto
11:00	Recent observations from the Canada Basin: 2002-2007 *Fiona McLaughlin*	Advances in middle atmosphere modelling *Theodore Shepherd* (Invited)	Extremes and GEWEX *Ron Stewart*
11:15	Seasonal variations of flow and hydrography in Barrow Strait in the Canadian Arctic Archipelago *Youyu Lu*		The Drought Research Initiative (DRI): An integrated approach to addressing Canadian drought problems *Richard Lawford*
11:30	Spatial variability in surface oxygen and nitrogen concentrations between the subarctic Pacific and into the Arctic *Philippe Benoit*	Canadian coupled atmosphere - ocean - ice forecast system for the Gulf of St. Lawrence *Manon Faucher*	Large-scale characteristics associated with the 1999 to 2005 Canadian prairie drought *Barrie Bonsal*
11:45	The organic carbon flux to the margin sediments of Canada's three oceans; redox tracers, stable isotopes and biomarkers as proxies for change *Robie W. Macdonald*	Canadian coupled atmosphere - ocean - ice forecast system for the Gulf of St. Lawrence: Operational validation for ice season 2008 *Serge Desjardins*	The association between extreme canadian temperature and precipitation and interannual and interdecadal oscillations *Amir Shabbar*
12:00	Phytoplankton productivity in surface waters of the Canadian Arctic during the summer of 2007 *Ian Wrohan*	Evaluating the radiative forcing of 3-D aerosol climatology in GEM-Strato model *Irena Paunova*	A series of unfortunate events: Synoptic modulation of the drought *Eyad Atallah*
12:15	Investigating the distribution of dissolved aluminum in the Beaufort Sea: a useful geochemical tracer of the supply of bio-essential trace metals to the Arctic Ocean *Tim Giesbrecht*	Large amplitude internal wavepacket propagation *Bruce Sutherland*	Analysis of intense sub-tropical moisture transports into high latitudes of western North America *Alain Roberge*
12:30–14:00	*Lunch/Déjeuner*		

Monday / lundi, 26 May / mai			
			08:30
			09:00
			09:45
	Coffee/Café		10:30
Session 1B4 **Room / salle Skaha**	**Session 1B5** **Room / salle Vaseaux**	**Session 1B6** **Room / salle Kootenay**	
(A) Air quality in valleys, part 1 of 2 *Chair:* James Sloan	**(A)** Aviation weather science and service for decision makers, part 1 of 3 *Chair:* Rob Honch	**(O)** Oceanography – general, part 1 of 2 *Chair:* Howard J. Freeland	
Review of the Lower Fraser Valley air pollution monitoring network *Douw Steyn* (Invited)	Prototyping new products for the Canadian Air Navigation System: 'TAFPlus' and 'V-CMAC' *Bruno Larochelle*	Recent changes of bottom water oxygenation and temperature in the Gulf of St. Lawrence: micropaleontological and geochemical evidences *Linda Genovesi*	11:00
	Use of new prototype products from the Canadian Air Navigation System: 'TAFPlus' and 'V-CMAC' : the dispatch perspective *Bruno Larochelle* (Invited)	Statistical characteristics of the interannual and decadal variability of the water masses in the Labrador Sea *Jennifer McLarty*	11:15
An analysis of air quality at Osoyoos, British Columbia in the Okanagan Valley *Stephanie Meyn*		Dramatic changes in the dissolved ^{230}Th water column profiles in Canada Basin between 1995 and 2007: a circulation signal? *Roger Francois*	11:30
Ozone air pollution on the Okanagan Valley *Johnson Zhong*	The case for automated, probabilistic TAFs *Ross Keith* (Invited)	Dynamics of the Antarctic Circumpolar Current *Louis-Philippe Nadeau*	11:45
Simulation of particulate matter in Switzerland using CMAQ-MADRID and CAMx regional chemical transport models *James Sloan*		High resolution numerical model of canyon upwelling and comparison to laboratory experiments *Jordan Dawe*	12:00
A comparison of Bayesian and conditional density models in probabilistic ozone forecasting *William Hsieh*	Improving guidance for aerodrome forecasts: Aviation National Lab products and direction *Alister Ling*	Transport variability through the Yucatan Channel: The influence of the Florida Current and flow compensation around Cuba *Yuehua Lin*	12:15
	Lunch/Déjeuner		12:30–14:00

Monday / lundi, 26 May / mai			
	Session 1C1 **Room / salle Shuswap**	**Session 1C2** **Room / salle Pennask**	**Session 1C3** **Room / salle Skeena**
	(I) International Polar Year: Hydrology, part 2 of 4 *Chair:* Anne Walker	**(A)** Atmospheric modelling for research, part 2 of 3 *Chair:* Xin Qiu	**(A)** Extremes in weather, water and climate, part 2 of 4 *Chair:* Barrie Bonsal
14:00	Human-induced Arctic moistening *Xuebin Zhang*	Development, evaluation and validation of a new Operational Air Quality Forecast Model: GEM-MACH 15 *Louis-Philippe Crevier*	Major drought from a hydropower perspective *Bill Girling* (Invited)
14:15	Coupled hydrologic-land-surface-atmospheric modelling for predicting freshwater flux to the arctic ocean *Bruce Davison*	GEM LAM modelling for coastal British Columbia air quality issues *Robert Nissen*	Comparing future/historical GCM climate moisture variability simulations to observed and dendroclimatic records *Suzan Lapp*
14:30	Recent trends in the timing and variability of river discharge in northern Canada *Jason Burford*	CMAQ modelling in coastal Pacific Northwest with GEM-LAM data *Xin Qiu*	A tale of two extremes: An extreme rain event that occurred during an extreme drought episode over the Canadian Prairies *Kit Szeto*
14:45	Quantifying the fundamental physical responses of Great Bear Lake to climate variability and change: Measurement and modelling of temperature and fluxes *William Schertzer*	High resolution wind forecasting along the coast of Nova Scotia *Matthew Corkum*	Analysis of cloud fields during the recent Prairie drought *Heather Greene*
15:00	A study of the meteorological conditions associated with anomalously early and anomalously late openings of a Northwest Territories winter road *Katherine Emma Knowland*	Application of high resolution GEM-LAM in marine fog prediction: Diagnosis *Duo Yang*	Thunderstorm-drought links *Geoff Strong*
15:15	Using water isotope tracers to assess hydrological controls on the water balance of lakes across the Old Crow Flats, Yukon Territory *Kevin Turner*	Comparison of precipitation from weather prediction models and radars using a multicategory approach *Slavko Vasic*	Verification of the prairie agro-meteorological model against in-situ soil moisture and eddy-covariance data: Model sensitivity to soil hydraulic parameters and minimum stomatal resistance *Julian Charles Brimelow*
15:30	*Coffee/Café*		

Monday / lundi, 26 May / mai			
Session 1C4 **Room / salle Skaha**	**Session 1C5** **Room / salle Vaseaux**	**Session 1C6** **Room / salle Kootenay**	
(A) Air quality in valleys, part 2 of 2 *Chair:* Douw G. Steyn	**(A)** Aviation weather science and service for decision makers, part 2 of 3 *Chair:* Rob Honch	**(O)** Oceanography – general, part 2 of 2 *Chair:* Howard J. Freeland	
Quantifying the spatial and temporal variation of ground-level ozone in the Annapolis Valley, Nova Scotia, Canada using nitrite-impregnated passive samplers *Mark Gibson*	Canadian Airport Nowcasting (CAN-Now)project: First results and plans for future *George Isaac*	Spreading of near-inertial energy in a 1/12° model of the North Atlantic Ocean *Xiaoming Zhai*	14:00
A wildfire smoke forecasting system for British Columbia and Alberta: A pilot project *Steve Sakiyama*	Adjusting numerical model point forecasts for nowcasting at Pearson Airport *Monika Bailey*	Examining the effect of stratification on tidal circulation over the Scotian Shelf using a three-dimensional coastal circulation model *Kyoko Ohashi*	14:15
The impact of agricultural burning on air contaminant concentrations in the Creston Valley of British Columbia *Stephanie Meyn*	Determining snowfall rate and visibility from radar reflectivity for winter nowcasting of precipitation and visibility at Pearson International Airport *Faisal Boudala*	Numerical study of circulation and hydrodynamic connectivity on the Mesoamerican Barrier Reef System using a nested-grid ocean circulation model *Jinyu Sheng*	14:30
Cold temperature ozone production in a mountain basin *Russ Schnell*	A short-term verification of GEM and RUC model parameters for the Canadian Airport Nowcasting (CAN-Now) Project *Janti Reid*	Extracting both water and fish velocity from Doppler profiler data *Len Zedel*	14:45
Comparison of WRF and MM5 simulations for air quality applications in Alberta valleys *Yan Shen*	Explicit forecasting of icing conditions with the GEM Model *André Plante*	Can rates of snowfall be estimated by measuring ocean noise levels? *Len Zedel*	15:00
	Monitoring and data assimilation of moisture from aircrafts *Iriola Mati*	The influence of climate changes on the Adriatic Sea along the Albanian coast *Bruno Lumaj*	15:15
Coffee/Café			15:30

Monday / lundi, 26 May / mai			
	Session 1D1 **Room / salle Shuswap**	**Session 1D2** **Room / salle Pennask**	**Session 1D3** **Room / salle Skeena**
	(I) International Polar Year: Cyrosphere, part 3 of 4 *Chair:* Barry E. Goodison	**(A)** Atmospheric modelling for research, part 3 of 3 *Chair:* Xin Qiu	**(A)** Extremes in weather, water and climate, part 3 of 4 *Chair:* Richard G. Lawford
16:00	Variability and change in the Canadian Cryosphere: Early results from a Canadian science contribution to International Polar Year *Anne Walker*	Environmental Prediction in Canadian Cities (EPiCC) Network *Tim Oke*	Case study of a Greenland tip jet *Carling Hay*
16:15		Improvement of the vertical discretization in GEM *André Plante*	Impact of climate variability and change on extreme wind storms and sea levels in southern BC *Dilumie Abeysirigunawardena*
16:30	Simulating the terrestrial cryosphere in a Regional Climate Model *Qiaobin Teng*	Sea fog modelling over the Nova Scotia coast using the GEM-LAM15: Impact of microphysics parameterizations *Junfeng Miao*	Noel - A Canadian perspective on the impacts and the successes *Carolyne Marshall*
16:45	Estimating sea-ice exchange between the Canadian archipelago and the Arctic Ocean and Baffin Bay using enhanced AMSR-E *Tom Agnew*	Cloud-radiation interaction as simulated by the Canadian GEM model compared to ARM observations *Danahé Paquin-Ricard*	An Oklahoma supercell in Ontario *Mitchell Meredith*
17:00	A Radiative Transfer Model for sea ice data assimilation of satellite passive microwave observations *Mingrui Dai*	Large Eddy Simulation of dust devil formation on Mars *Babak Tavakoli-Gheynani*	Canada's first confirmed F5: The Elie Tornado *Jim Slipec*
17:15	Development of a variational data assimilation system for coupled ice-ocean models and sea ice analysis *Alain Caya*	Simulation of concentration fluctuations in an idealised canopy *John Postma*	A Great Lakes sting jet *Bryan Tugwood*
17:30	The Circumpolar Flaw Lead (CFL) System Study *Dan Leitch*		
18:00–20:00		CMOS Annual General Meeting	
19:00–20:00			

Monday / lundi, 26 May / mai				
Session 1D4 Room / salle Skaha	**Session 1D5 Room / salle Vaseaux**	**Session 1D6 Room / salle Kootenay**	**Session 1D7 Room / salle Cascade / Cassiar**	
(C) Climate – general *Chair:* William Hsieh	**(A)** Aviation weather science and service for decision makers, part 3 of 3 *Chair:* Rob Honch	**(O)** Impact of climate change on biogeochemical cycles in the coastal oceans *Chairs:* William R. Crawford and Angelica Peña	**(A)** Atmosphere, ocean and climate dynamics, part 1 of 4 *Chairs* Ron McTaggart-Cowan, Adam Monahan and Marek Stastna	
A new network for monitoring the radiative forcing from greenhouse gases *Wayne Evans*	User-oriented forecast verification *Laurence Wilson*	The Strait of Georgia Ecosystem Research Initiative *Diane Masson*	Patterns of inter-annual climate variability and weather systems: An example of the linking dynamics *Huw Davies* (Invited)	16:00
The high-wind climatology of Vancouver and Abbotsford: an exploration of contrasts over a small spatial scale, and some possible regional trends in windstorm frequency *Wolf Read*	DLAC2 – A blended training experience on creating effective TAFS *Greg Byrd*	Oceanic features that might account for survival of fledgling Rhinoceros Auklets on Triangle Island, British Columbia *Gary Borstad*		16:15
Observations of northern latitude ground-surface and surface-air temperatures *Al Woodbury*		Modelling plankton dynamics on the British Columbia coast: Potential impacts of changes in upwelling, stratification and temperature on biogeochemical cycles *Angelica Peña*	A tale of two tip jets: Case studies of two Greenland tip jets *Rebekah Martin*	16:30
Changes in the lifetimes of northern hemisphere mid-latitude cyclones (1948-2003) *Steven Lambert*	Examination of knowledge transfer in CMAC-West, Edmonton *David Whittle*	A bio-physical model of the Pan-Arctic ocean *Frederic Dupont*	Internal gravity waves forced by isolated topography *Lucy Campbell*	16:45
Homogeneity test and measured trends of monthly surface wind speed in Canada *Hui Wan*	Panel Discussion on Aviation Weather Science and Service *Rob Honch*	Development of a coupled biological-physical model appropriate for prediction in a coastal inlet *Maud Guarracino*	Modelling the boundary-layer flow over changes of surface Conditions: effects of thermal stratification *Wensong Weng*	17:00
Fractal analysis of El Niño/La Niña episodes *Zhiyong Huang*		The estuarine nutrient trap: Evidence for increased diatom production in the Gulf of St. Lawrence *Bjorn Sundby*	A physical scale model to study urban surface temperatures and radiation *Sarah Roberts*	17:15
Improving B.C.'s climate related monitoring networks *Ben Kangasniemi*		Oxygen dynamics in the Slope Water and in the Gulf of St. Lawrence *Denis Gilbert*		17:30
				18:00–20:00
	Smoke Forecasting in Canada: Past, Present and Future **(Chilcotin Room)**			19:00–20:00

Tuesday / mardi, 27 May / mai			
	Session 2A, Room / salle Okanagan		
08:30	Plenary Session 3, *Chair:* Stephen J. Dery	Climate change, human endeavor and water supplies in western Canada, *David W. Schindler*	
09:15	Plenary Session 4, *Chair:* Stephen J. Dery	Atmosphere-ocean interactions in the western North Atlantic Ocean: Weather and climate implications, *Kathryn A. Kelly*	
10:00	*Coffee/Café*		
	Session 2B1 Room / salle Shuswap	**Session 2B2 Room / salle Pennask**	**Session 2B3 Room / salle Skeena**
	(O) Coastal and inland waters in a changing climate, part 1 of 3 *Chairs:* Jinyu Sheng and Guoqi Han	**(C)** Polar climate stability, part 1 of 4 *Chair:* Guido Vettoretti	**(A)** Extremes in weather, water and climate, part 4 of 4 *Chair:* Ron Stewart
10:30	The DalCoast coastal prediction system: Recent progress and plans *Keith Thompson* (Invited)	Polar climate variability during the last glacial cycle – new insights from Southern Ocean sediment cores *Michael Weber*	Atmospheric hazards: Ice storms in Atlantic Canada *William Richards*
10:45	A modelling framework for environmental prediction in the Great Lakes *Ram Rao Yerubandi*	Revisiting implicit relationships between ocean salinity, mass and volume vs. oxygen isotope composition in foraminifers *Claude Hillaire-Marcel*	Major cold-season precipitation events at Iqaluit, Nunavut *Gabrielle Gascon*
11:00	Investigation of circulation and hydrography in stratified coastal waters of Nova Scotia based on observations and numerical model results *Li Zhai*	Late Holocene sea-surface conditions in the Fram Strait *Sophie Bonnet*	On the formation of winter precipitation types *Julie Theriault*
11:15	Moored observations of the 2007 spring bloom on the Scotian Shelf *Blair Greenan*	Holocene terrestrial climate variability in the Canadian North *Andre Viau*	The 1998 Ice Storm flow fields and their relation to precipitation *William Henson*
11:30	Tsunami modelling for the West Coast of Canada: Recent progress and applications *Josef Cherniawsky*	Net carbon drawdown of realizable afforestation from satellite data *Alvaro Montenegro*	GEM-LAM convective forecasts: How can they be used in an operational forecast environment? *Steve Knott*
11:45	A hydrodynamics study of Lake Ontario and the upper St Lawrence River *Erin Hall*	Balancing oceans and emissions: a tolerable windows analysis *Karin Kvale*	Real-time forecast of the 2005 and 2007 summer severe floods in the Huaihe River Basin of China *Lei Wen*
12:00	*Patterson–Parsons Luncheon/ Déjeuner Patterson–Parsons, Room/salle Okanagan*		
	Session 2C1 Room / salle Shuswap	**Session 2C2 Room / salle Pennask**	**Session 2C3 Room / salle Skeena**
	(O) Coastal and inland waters in a changing climate, part 2 of 3 *Chairs:* Ram Yerubandi and Jinyu Sheng	**(A)** Medium term and climate forecasts, part 1 of 2 *Chair:* Hai Lin	**(A)** Operational meteorology, part 1 of 3 *Chair:* Al Wallace
14:00	Upwelling flow dynamics of slow flow in long canyons *Susan Allen* (Invited)	The Coupled Historical Forecast Project, version 1: Formulation, results, and progress towards CHFP2 *William Merryfield* (Invited)	The complexities of establishing a network of automatic weather stations and associated systems in support of the 2010 Vancouver Winter Olympics *Bill Scott*
14:15	Grand Banks white hake recruitment in relation to the Labrador Current and spring bloom *Guoqi Han*		Economic and operational aspects of weather forecast information to the 2010 Olympic Winter Games *Chris Doyle*
14:30	A three-level nested-grid coastal circulation model for the Pearl River Estuary of the South China Sea *Xiaomei Ji*	Climate trends in seasonal forecasts *G.J. Boer*	The Vancouver 2010 Olympic Forecasting Science Plan *Chris Doyle*
14:45	Modelling for tidal power energy and impacts *David A. Greenberg*	Seasonal forecasts at the Canadian Meteorological Centre *Juan Sebastian Fontecilla*	Improving SCRIBE public weather forecasts by using a background field to interpolate point forecasts *Vincent Fortin*
15:00	Tidal power from Minas Passage, NS: Prospects and potential impacts *Peter C. Smith*	Benefits of multimodel ensembles in seasonal forecasting *Viatcheslav Kharin*	SCRIBE: Upcoming deployment and development *Claude Landry*
15:15	Assessment of tidal current energy in Minas Passage, Bay of Fundy *Richard Karsten*	Forecast skill of the Madden-Julian Oscillation in two Canadian atmospheric models *Hai Lin*	UMOS-AQ: Forecasting O_3 and PM_{25} three-hourly spot concentrations using an updatable MOS methodology *Stavros Antonopoulos*
15:30	*Coffee/Café*		

Tuesday / mardi, 27 May / mai		
		08:30
		09:15
		10:00
Session 2B5 **Room / salle Chilcotin**	**Session 2B7** **Room / salle Cascade / Cassiar**	
(I) Health issues of weather and climate, part 1 of 2 *Chair:* Denis A. Bourque	**(A)** Atmosphere, ocean and climate dynamics, part 2 of 4 *Chairs:* Ron McTaggart-Cowan, Adam Monahan and Marek Stastna	
Design of a tool to support heat-alert decision *Mathilde Pascal*	The dryline in Alberta: A GEM LAM 2.5 km simulation on 24 July 2007 *Garry Toth*	10:30
Pertinence and feasibility study of an alert system for cold spells *Karine Laaidi*	An observed connection between the North Atlantic Oscillation and the Madden-Julian Oscillation *Hai Lin*	10:45
Climate change and disaster management in Canada: reducing risk, saving lives *Kirsty Duncan*	MJO and its relationship to ENSO *Youmin Tang*	11:00
Canadian coastal communities adapt to climate change *Marielou Verge*	The impact of a modified convective scheme in a coupled model simulation of the MJO and ENSO during past climate regimes *Guido Vettoretti*	11:15
Human health in a changing climate: A Canadian assessment of vulnerabilities and adaptive capacity - Vulnerabilities to natural hazards and extreme weather *Kaila-Lea Clarke*	Climate change through the past 10,000 years with implications for human cultural development *Andrew Bush* (Invited)	11:30
Climate change and infectious diseases: A Canadian assessment *Manon Fleury*		11:45
Patterson–Parsons Luncheon/ Déjeuner Patterson–Parsons, Room/salle Okanagan		12:00
Session 2C5 **Room / salle Chilcotin**	**Session 2C7** **Room / salle Cascade / Cassiar**	
(I) Health issues of weather and climate, part 2 of 2 *Chair:* Denis A. Bourque	**(A)** Atmosphere, ocean and climate dynamics, part 3 of 4 *Chairs* Ron McTaggart-Cowan, Adam Monahan and Marek Stastna	
Climate and morbidity in Quebec: Assessment of the climate effect on circulatory and respiratory diseases for the period 1989-2006 *Lampouguin Bayentin*	The 20th century carbon budget simulated with the CCCma earth system model *Vivek Arora*	14:00
Results of the 1984-2005 UHI study over Montreal using Landsat imagery *Marc Beauchemin*	Averaging and stochastic mode reduction methods applied to a model of atmospheric low-frequency variability *Joel Culina*	14:15
The Air Quality Health Index: Fundamentals and future plans *Dave Henderson*	The influence of surface buoyancy fluxes on the probability distribution of sea surface winds *Adam Monahan*	14:30
The Air Quality Health Index: Creating a social dialogue about air and health *Sharon Stevens*	Snowball versus slushball Earth: Dynamic versus nondynamic sea ice? *Jeff Lewis*	14:45
Introducing the Air Quality Health Index to interior B.C. communities *Eric Taylor*	Heat transport, wind stress and the ice edge: New insights from simple models *Brian Rose*	15:00
SCRIBE: Air quality forecasting tool *Claude Landry*	Winter climate variability in the eastern Gulf of Alaska and Line P ocean temperature measurements *Badal Pal*	15:15
Coffee/Café		15:30

Tuesday / mardi, 27 May / mai				
	Session 2D1 **Room / salle Shuswap**	**Session 2D2** **Room / salle Pennask**	**Session 2D3** **Room / salle Skeena**	**Session 2D4** **Room / salle Skaha**
	(O) Coastal and inland waters in a changing climate, part 3 of 3 *Chairs:* Ram Yerubandi and Guoqi Han	**(A)** Medium term and climate forecasts, part 2 of 2 *Chair:* Viatcheslav Kharin	**(A)** Operational meteorology, part 2 of 3 *Chair:* Al Wallace	**(C)** Polar climate stability, part 2 of 4 *Chair:* Guido Vettoretti
16:00	Occurrence rates of "unexpected" waves in Canadian waters *Johannes Gemmrich*	Interdecadal variation of ENSO predictability in multiple models *Youmin Tang* (Invited)	Evaluation of GEM-LAM over southern Baffin Island *Zhuo Liu*	West Greenland Current variability *Paul Myers*
16:15	Effects of nudging schemes in a finite-element circulation model *Zhaoshi Lu*		Operational evaluation of the GEM LAM2.5 – Maritimes Region *Chris Fogarty*	The Labrador Sea records of last Interglacial AMOC properties at Orphan Knoll (IODP Site 1302/1303) and Eirik Ridge (IODP 1305/ODP 646) *Anne De Vernal*
16:30	Deriving biological parameters from Acoustic Doppler Current Profiler (ADCP) data *Kate Collins*	Impact of the combined Aqua AIRS (Infrared Hyperspectral) and GPS radio-occultation data in the new version of the Canadian global weather forecast model *Godelieve Deblonde*	On the biases in UMOS temperature guidance for Vancouver, British Columbia *Ruping Mo*	The model resolution sensitivity of a subpolar Atlantic warming response triggered by freshwater discharge along the Labrador coast *Paul Spence*
16:45	BBLT3D - Modelling suspended sediment transport in a dynamic inshore environment *Adam Drozdowski*	The EPS forecast for Friday the 13th of April, 2007 *Mark Pilon*	Experimental meteorological fields based on NWP model output for support of forecast operations *William Burrows*	The importance of dynamic forcing on sea ice in the Arctic during the early Holocene *Sarah Dyck*
17:00	The role of changing patterns of precipitation and runoff as a cause of recent increases in productivity in Lake Winnipeg *Greg McCullough*	Avalon Peninsula snowstorm: January 20, 2008 *Daniel Jubainville*	Recent changes to and further plans for the operational production system at the Canadian Meteorological Centre *Yves Pelletier*	Mega-tides in the glacial ocean and rapid climate change *Stephen Griffiths*
17:15		Reconstructing fifty-six year (1950-2005) droughts over the Canadian Prairies using the Variable Infiltration Capacity Model *Lei Wen*	Dynamical-statistical models for lightning prediction *William Burrows*	Global unstructured grid ocean modeling: Tidal test cases *Gordan Stuhne*
17:30		The assimilation of SSM/I radiance observations with interchannel error correlations *Xingxiu Deng*	Modelling in support of day-to-day operations *Bryan McEwen*	
19:00	Public Lectures/ Conférences publiques Room/salle Okanagan	Wild about BC weather: Yesterday, today and tomorrow, *David Phillips*		
		Fluvage, cats' paws and mystical spouts: Weather wonders of the Okanagan, *Mike Roberts*		

Tuesday / mardi, 27 May / mai				
Session 2D5 Room / salle Vaseaux	**Session 2D6 Room / salle Kootenay**	**Session 2D7 Room / salle Cascade / Cassiar**	**Room / salle Chilcotin**	
(H) Forest and general hydrometeorology: Advances in science and interpretations for management *Chair:* Todd Redding	**(I)** Use, application and impact of satellite-based earth observing systems over the ocean Chair: Martin L. Taillefer	**(A)** Atmosphere, ocean and climate dynamics, part 4 of 4 *Chairs* Ron McTaggart-Cowan, Adam Monahan and Marek Stastna		
Solar radiation transmittances through lodgepole pine canopies at different stages of growth and deterioration *Pat Teti*	A new satellite capability for mapping surface blooms and marine vegetation *Jim Gower*	Double diffusive turbulence in sheared flow *William Smyth* (Invited)		16:00
Inter-annual variability in interception, evaporation and drainage from high elevation forests, clearcuts and regenerating stands in the interior of British Columbia *David Spittlehouse*	Inverse correlation between MODIS and MERIS fluorescence line height and algal biomass in a cyanobacteria-dominated lake, Lake Winnipeg, Manitoba, Canada *Greg McCullough*			16:15
Evapotranspiration in Pacific Northwest Douglas-fir stands of different age following clearcut harvesting *T. Andy Black*	Utilization of SAR-derived winds by the Meteorological Service of Canada: Present status *Laurie Neil*	Effects of near-inertial motion on midlatitude ocean gyres *David Straub*		16:30
Future changes in soil temperature and soil moisture as simulated by the Canadian Regional Climate Model (CRCM 4.1.1) *Travis Logan*	Dependence on environmental and imaging conditions of wind information derived from the Radarsat-1 synthetic aperture radar *C. Harold Ritchie*	Mean current generation by eddy-topographic interaction in a very high resolution, primitive equation ocean basin model *William Merryfield*		16:45
Using the Canadian precipitation analysis (CaPA) for land-surface and hydrological modelling at the regional scale *Vincent Fortin*	Sea level variations in the tropical Pacific Ocean associated with intra-seasonal Kelvin waves *Xu Zhang*	An explanation of fast Rossby wave speeds in the ocean *Francis Poulin*		17:00
Assessing streamflow sensitivity to crop changes *Aaron Berg*	Comparison of C-NOOFS with remote sensed and in-situ data *Andry William Ratsimandresy*	The barotropic ocean response to fast moving tropical cyclones affecting Atlantic Canada *Jennifer Mecking*		17:15
A comparative evaluation of GLUE and NSGA-II to calibrating streamflow *Gift Dumedah*	IOS-RADS mirror site and its potential for operational oceanography in Canada *Josef Cherniawsky*	On density profiles with identical internal wave spectra *Marek Stastna*	Canadian Argo Users Group meeting	17:30
				19:00

Wednesday / mercredi, 28 May / mai			
	Session 3A, Room / salle Okanagan		
08:30	Plenary Session 5, *Chair:* Diane Masson	Observing and forecasting the ocean: 10 years of achievements, *Pierre-Yves Le Traon*	
09:15	Plenary Session 6, *Chair:* Diane Masson	The energy sustainability dilemma: Powering the future in a finite world, *David Hughes*	
10:00	*Coffee/Café*		
	Session 3B1 **Room / salle Shuswap**	**Session 3B2** **Room / salle Pennask**	**Session 3B3** **Room / salle Skeena**
	(C) Dynamical and statistical downscaling, part 1 of 2 *Chairs:* William Hsieh and Philippe Gachon	**(O)** Operational oceanography, part 1 of 2 *Chair:* Guoqi Han	**(I)** Avalanche science and forecasting *Chair:* Pascal Haegeli
10:30	Arctic blizzard prediction by nonlinear statistical downscaling of GEM model outputs *Zhen Zeng*	Argo – current status and prospects for the near future *Howard Freeland* (Invited)	Weather forecasting applied to avalanche safety: Overview of winter 2007-8 *Melinda Brugman*
10:45	New multi-site generation approach of climate data for efficient assessment of climate change impacts on hydrology regime of medium and large size river basins *Malika Khalili*		Science and avalanche forecasting - A complicated dance *John Kelly*
11:00	On stochastic modeling of daily rainfall processes in consideration of climate change and variability *Van-Thanh-Van Nguyen*	Canada's contributions to Argo in observing the ocean in real-time *Anh Tran*	Snowpack evolution modeling for avalanche forecasting in areas of sparse observations *Michael Smith*
11:15	High resolution climate change scenarios from Downscaling Methods: Mean and extremes information over a river basin in southern Québec *Philippe Gachon*	Ocean observing with marine mammals: 4 years of in-situ water profiling from the Gulf of St. Lawrence to Baffin Bay *Fraser Davidson*	Numerical avalanche predictions using ensemble weather forecasts *Ted Weick*
11:30	A spatial-temporal downscaling approach to the construction of intensity-duration-frequency relations in consideration of climate change *Tan-Danh Nguyen*	Apparent supercooled water in univariate optimal interpolation of real time oceanographic data *Mathieu Ouellet*	A comprehensive framework for avalanche hazard assessment and avalanche danger ratings based on risk *Grant Statham*
11:45	Impact of climate change on France watersheds in 2050: A comparison of dynamical and multivariate statistical methodologies *Christian Pagé*	ROSE - Reflection Ocean Seismic Experiment *Blair Greenan*	The challenge of promoting better decision-making – perspectives from the field of avalanche awareness education *Pascal Haegeli*
12:00	*Lunch/Déjeuner*		

Wednesday / mercredi, 28 May / mai			
			08:30
			09:15
			10:00
Session 3B4 **Room / salle Skaha**	**Session 3B5** **Room / salle Vaseaux**	**Session 3B6** **Room salle Kootenay**	
(C) Polar climate stability, part 3 of 4 *Chair:* Guido Vettoretti	**(C)** Global coupled atmosphere–ocean modelling and assimilation, part 1 of 3 *Chair:* C. Harold Ritchie	**(I)** Water, weather, and climate: Serving decision makers in the energy sector Chair: Anne-Marie Valton	
Neural networks applied to estimating subglacial topography and glacier volume *Garry Clarke*	Assimilation of data into ocean models: On-line estimation of background error covariance parameters *Yimin Liu*	Environmental predictions and the energy sector: A Canadian perspective *Ozgur Gurtuna* (Invited)	10:30
Reconstructing past climate for glacier mass balance modeling using empirical orthogonal functions and Bayesian model averaging *Christian Reuten*	Data assimilation in a regional ocean model of the Labrador Sea *Entcho Demirov*		10:45
High-resolution regional glacier modelling driven by NARR data *Faron Anslow*	Initialization of coupled seasonal forecasts by assimilation of an ensemble of ocean reanalyses *Woo-sung Lee*	Needs analysis on the wind energy sector made by Environment Canada *Serge Besner*	11:00
Controls on the stable water isotope composition of precipitation in the southwestern Yukon *Robert Field*	The inverse modeling of the seasonal variation of the Eastern North Pacific Ocean circulation *Tsuyoshi Wakamatsu*	Wind forecasting system for application in wind power management Part A: Development and calibration *Wei Yu*	11:15
Tropical - North Pacific teleconnections: Geochemical evidence from coastal British Columbia and the western Arabian Sea *Tara Ivanochko*	Advanced data assimilation in strongly nonlinear systems via Sigma-point Kalman filters *Jaison Thomas Ambadan*	Wind forecasting system for application in wind power management Part B: Real-time test and validation *Anna Glazer*	11:30
	Connections between the Madden Julian Oscillation and extratropical regions of the global ocean and atmosphere *Eric Oliver*	Solar radiation data and information sources at Environment Canada *Katrina Tiongson*	11:45
Lunch/Déjeuner			12:00

Wednesday / mercredi, 28 May / mai			
	Session 3C1 **Room / salle Shuswap**	**Session 3C2** **Room / salle Pennask**	**Session 3C3** **Room / salle Skeena**
	(I) International Polar Year: Atmosphere, part 4 of 4 *Chair:* Michel Béland	**(O)** Operational oceanography, part 2 of 2 *Chair:* Guoqi Han	**(I)** Scientists' involvement in decision-making processes, part 1 of 2 *Chair:* Miguel Tremblay
13:30	The Polar Environment Atmospheric Research Laboratory (PEARL) in International Polar Year (IPY) *James Drummond*	The philosophy of operational oceanography *Martin Taillefer*	Knowledge management: A tool for improved knowledge communication and decision-making *Jacques Descurieux*
13:45		Forecasting extreme water levels for British Columbia coastal waters *Scott Tinis*	Intégrité et conflit d'intérêts: Perspectives éthiques sur la responsabilité du chercheur *Michel Bergeron*
14:00	Thorpex Arctic Weather and Environmental Prediction Initiative (TAWEPI): First year of modelling and data assimilation activities *Ayrton Zadra*	An Atlantic Canadian Coastal Water Level Neural Network Model (ACCSLENNT) *Guoqi Han*	S'adapter aux changements climatiques globaux selon une approche régionale. Partie I - Le consortium Ouranos *Alain Bourque* (Invité)
14:15	Modelling the Arctic boundary layer over the Eastern Beaufort Sea and Banks Island with GEM-LAM-2.5 *Daniel Deacu*	Development of a five-level nested-grid coastal circulation prediction system for the inner Scotian Shelf *Bo Yang*	Community-level assessments of climate change and variability *Arelia Werner*
14:30	Transport of long range pollutants to the Arctic by aerosols: First surface measurements using aerosol mass spectrometer *Asan Bacak*	C-NOOFS: Present status and future improvement *Fraser Davidson*	S'adapter aux changements climatiques globaux selon une approche régionale. Partie II - Vulnérabilité des communautés côtières de l'Est du Québec aux impacts des changements climatiques *Jean-Pierre Savard* (Invité)
14:45	The structure and evolution of the polar stratosphere and mesosphere and links to the troposphere during IPY - SPARC-IPY data assimilation component *Elham Farahan*	Canadian Ensemble Wave Forecast System *Syd Peel*	A modest attempt to take the "I" out of the "Hydro-Illogical" Cycle *Harvey Hill*
15:00	On the role of acidic aerosols in the formation of thin ice clouds over the Arctic during winter *Jean-Pierre Blanchet*		The need for more detailed precipitation forecasts in order to support decision making *Gabor Fricska*
15:15	A study of polar winter thin ice clouds and aerosols using CALIPSO and CloudSat datasets *Patrick Grenier*		Le portail de Données : Accès et intégration (DAI) – une mise à jour *Louis Lefaivre* (Invité)
15:30	*Coffee/Café*		

Wednesday / mercredi, 28 May / mai				
Session 3C4 **Room / salle Skaha**	**Session 3C5** **Room / salle Vaseaux**	**Session 3C6** **Room / salle Kootenay**	**Session 3C7** **Room / salle Okanagan**	
(C) Polar climate stability, part 4 of 4 *Chair:* Guido Vettoretti	**(C)** Global coupled atmosphere–ocean modelling and assimilation, part 2 of 3 *Chair:* Keith R. Thompson	**(A)** Atmosphere – general *Chair:* Kevin Strawbridge	**(A)** Operational meteorology, part 3 of 3 *Chair:* Al Wallace	
Modelling ice sheet response to climate change: Sensitivity of subgrid parameterization of margin dynamics *Shawn Marshall*	Changes in the decadal-scale potential predictability of the coupled system with global warming *G.J. Boer*	Improved radar products for Environment Canada radars *David Patrick*	Transforming university students into professional weather forecasters – the ab initio training of Meteorologists in Environment Canada *Paul Yang*	13:30
Atmospheric conditions associated with a significant Greenland melting event *Shunli Zhang*	Improving seasonal forecast skill in Canada using a post-processing method *Xiaojing Jia*	Applications of a dual polarization C-band radar to operational weather forecasting *David Hudak*	COMET Web-based multimedia training in the atmospheric and related sciences, part 1 *Greg Byrd*	13:45
CO_2 threshold for millennial-scale oscillations in the climate system: implications for global warming scenarios *Katrin Meissner*	North Pacific sea surface temperature climatology and variability in the World's Global Climate Models *Fabian Lienert*	An operational approach of blending hurricane-type wind forcing with CMC forecast wind field lacking hurricane characteristics *Serge Desjardins*	COMET Web-based multimedia training in the atmospheric and related sciences, part 2 *Greg Byrd*	14:00
Variability in the North Atlantic and North Pacific basins in CCSM3: Implications of both statistical equilibrium and global warming simulations *Marc d'Orgeville*	Decadal/Interdecadal variations in ENSO predictability in a hybrid coupled model from 1881-2000 *Ziwang Deng*	On horizontal wind gradient variability from the stratosphere to the surface over Arctic sea ice *Jennifer Verlaine Lukovich*	Towards a comprehensive training program for forecasters at Vancouver 2010 Olympic and Paralympic Winter Games *Brad Snyder*	14:15
Negative feedback of poleward intensifying Southern Hemisphere winds on atmospheric CO_2 in the 21st century *Kirsten Zickfeld*	The singular vector (SV) analysis of an ENSO prediction model for the period from 1856-2003 *Yanjie Cheng*	Retrievals of atmospheric winds measured by the Atmospheric Chemistry Experiment Fourier Transform Spectrometer *Dejian Fu*	Improved performance measurement for public forecasts in Atlantic Canada *Timothy Bullock*	14:30
Polar climate instability and climate teleconnections from the Arctic to the mid-latitudes and tropics *Guido Vettoretti*	Regional and global scale redundancy analyses of the coupled atmosphere-ocean system *Faez Bakalian*	The Canadian Operational Research Aerosol Lidar Network (CORALNet) as a tool to measure aerosol transport *Kevin Strawbridge*	Practical performance measurement using remote sensing *Phil Chadwick*	14:45
	Regional influences of ocean-atmosphere interaction on climate variability assessed using partial coupling *Ajayamohan Ravindran*	Measurements Of Pollution In The Troposphere (MOPITT) instrument – Eight years of tropospheric measurements *James Drummond*		15:00
				15:15
Coffee/Café				15:30

Poster Session / La session des affiches

Wednesday / mercredi, 28 May / mai				
Poster Session **Terrace 16:00-17:30**				
	3D-A1	**3D-A2**	**3D-A3**	**3D-A4**
	(A) Atmosphere - general *Chair:* Kevin Strawbridge	**(C)** Atmospheric modelling for research *Chair:* Xin Qiu	**(I)** Aviation weather science and service for decision makers *Chair:* Rob Honch	**(A)** Medium term and climate forecasts *Chair:* Hai Lin
1	Biogenic aerosol sulphate in the Arctic, 1993-2003 and its relationship to sea ice *Ann-Lise Norman*	Hurricane Juan – a study of impacts of surface ocean fluxes *Will Perrie*	Weather Wiki: Collecting and sharing meteorological knowledge and experience *Christina Van Eaton*	Ensemble forecast of a Canadian prairie winter snowstorm *Steve Knott*
2	DMS and aerosol sulphate in the Arctic atmosphere *Ann-Lise Norman*	Evaluation of the internal variability in the Canadian Regional Climate Model over the Arctic domain using the Approach Big-Brother *Maja Rapaic*	CMAC - Staff learning and development site: Our learning management system *James Wegner*	Subjective evaluation of the Canadian GEM Global forecast system with supplemental observations *Victor Thomas*
3	Interhemispheric differences in the structure of the polar summer mesopause using ACE-FTS measurements *Zeyu Fan*	Sea Salt Flux Parameterization Sensitivity in the Chemical Transport Model AURAMS: The contribution of naturally occurring sea salt aerosol to fine particulate mass in Atlantic Canada *T. Colleen Farrell*	Examination of 2007 verification data for 4 Canadian HUB airports, CYUL, CYYZ, CYYC, CYVR *TBD*	Development of an automated verification system for meteorological measurements *Ai Qing Li*
4	Low level wind measurements from a VHF Wind profiler and a Doppler Sodar at Harrow, Ontario *Shama Sharma Kalia*	Box modeling of biogenic and anthropogenic sulphur dioxide transport over the North Atlantic *Anne-Lise Norman*	A review of aviation winter snowstorm forecasts for terminal aerodromes *Anthony Liu*	
5	Significance of observation height in determination of wind chill index *Marque Jones*		A review of the fog and stratus episode during 16-18 October 2007 over Yellowknife Airport *Yongmei Zhou*	
6	Diurnal and seasonal variation in net ecosystem methane flux in a moderately-rich fen in northern Alberta *Kevin Long*		Vertically propagating mountain wave forecast using GEM-15km outgoing flux *Sébastien Chouinard*	
7			The process of how the aviation hazard of volcanic ash is handled in Canada and what effect it has on the aviation industry *Carmen Snyder*	
8			Volcanic hazards at Nazko Cone, British Columbia *Catherine J. Hickson*	
CMOS Awards Banquet/ Banquet des prix et honneurs de la SCMO, Room/salle Okanagan, 18:30				

Wednesday / mercredi, 28 May / mai			
Poster Session **Terrace 16:00-17:30**			
3D-A5	**3D-A7**	**3D-A8**	
(A) Extremes in weather, water and climate *Chairs:* Barrie Bonsal and Richard Lawford	**(A)** Air quality in valleys *Chair:* Douw G. Steyn	**(A)** Operational meteorology *Chair:* Al Wallace	
Extratropical cyclones responsible for storm surge events and coastal erosion processes in the Gulf of St. Lawrence (Québec, Canada): an assessment over the present and future periods *Philippe Gachon*	The Skeena-Bulkley Valley Lakes District Woodstove Exchange STudy (WEST): Mapping the spatial variability of residential woodsmoke *Gail Millar*	Vérification d'une nouvelle technique de prévision des vents dans le fjord du Saguenay/Verification of a new technique to forecast winds in the Saguenay fjord *Mélanie Boudreault*	1
Storm studies in the Arctic (STAR): Preliminary results *John Hanesiak*	Source apportionment of fine and coarse fraction particulate matter in Kelowna, British Columbia *Peter Jackson*		2
Effect of vegetation cover on soil moisture retrieval from passive microwave observations over Canadian Prairies *Alexander Komarov*			3
Satellite-derived analysis of cloud and precipitation features over Iqaluit *Alex Laplante*			4
CMOS Awards Banquet/ Banquet des prix et honneurs de la SCMO, Room/salle Okanagan, 18:30			

Wednesday / mercredi, 28 May / mai			
Poster Session **Terrace 16:00-17:30**			
	3D-C1	**3D-C2**	**3D-C3**
	(C) Climate – general *Chair:* William Hsieh	**(A)** Global coupled atmosphere–ocean modelling and assimilation *Chair:* C. Harold Ritchie	**(C)** Polar climate stability *Chair:* Guido Vettoretti
1	Eastern Equatorial Pacific forcing of ENSO sea surface temperature anomalies *Michael McPhaden*	Towards sea ice assimilation in NEMO: Background Error Covariances *Paul Myers*	Investigating deepwater oxygen isotope variability in an earth system climate model *Catherine Brennan*
2		Simulating the Northeast Pacific Ocean using OPA *Yunfeng Shao*	Une comparaison des différentes versions du modèle canadien GEM avec les données d'observations dans l'Arctique *Pascal Dehasse*
3		Comparison of precipitation fields over Canada estimated from reanalysis products *Gordon Drewitt*	
CMOS Awards Banquet/ Banquet des prix et honneurs de la SCMO, Room/salle Okanagan, 18:30			

	Wednesday / mercredi, 28 May / mai			
Poster Session **Terrace 16:00-17:30**				
	3D-O1	**3D-O2**	**3D-O3**	**3D-O4**
	(O) Oceanography – general *Chair:* Howard J. Freeland	**(O)** Coastal and inland waters in a changing climate *Chairs:* Jinyu Sheng	**(O)** Impact of climate change on biogeochemical cycles in the coastal oceans *Chairs:* William R. Crawford and Angelica Peña	**(O)** Operational oceanography *Chair:* Guoqi Han
1	Reynolds stress and eddy viscosity in sheared 2D turbulence *Patrick Cummins*	MERIS observations of blooms and vegetation in the world's oceans *Jim Gower*	Historic modeling of the timing of the spring bloom in the Strait of Georgia *Megan Wolfe*	Assessment of real-time wave model forecasts during Hurricane Noel *Bechara Toulany*
2		Modelling Lake Ontario with FVCOM *Jennifer A. Shore*		On the influence of wind stress curl errors on the four dimensional, mid-latitude ocean inverse problem *Tsuyoshi Wakamatsu*
CMOS Awards Banquet/ Banquet des prix et honneurs de la SCMO, Room/salle Okanagan, 18:30				

Wednesday / mercredi, 28 May / mai				
Poster Session Terrace 16:00-17:30				
3D-C4	**3D-C5**	**3D-H3**	**3D-I3**	
(C) Dynamical and statistical downscaling *Chairs:* William Hsieh and Philippe Gachon	**(I)** Water, weather, and climate: Serving decision makers in the energy sector Chair: Anne-Marie Valton	**(H)** Water resources and climate change *Chair:* Stephen J. Dery	**(I)** Scientists' involvement in decision-making processes *Chair:* Miguel Tremblay	
Development of high resolution climatological temperature and precipitation fields over B.C. for use in statistical downscaling and glacier mass balance studies *Bruce Ainslie*	Renewable energy forecasts for solar powered application *Wei Yu*	Detection of runoff timing changes in pluvial, nival and glacial rivers of Western Canada *Stephen Dery*	Data and metadata in science informing decision *Anna Deptuch-Stapf*	1
Multivariate ridge regression for multi-site downscaling *Alex Cannon*	Needs analysis of the Canadian hydropower generation sector *Thomas Shalansky*			2
Comparison of two regional climate modelling approaches using the GEM model: Global variable-resolution versus one-way nested limited-area *Marc Verville*				3
CMOS Awards Banquet/ Banquet des prix et honneurs de la SCMO, Room/salle Okanagan, 18:30				

Wednesday / mercredi, 28 May / mai			
Poster Session Terrace 16:00-17:30			
3D-I4	**3D-I5**	**3D-I6**	
(A) Atmosphere, ocean and climate dynamics *Chairs* Ron McTaggart-Cowan, Adam Monahan and Marek Stastna	**(I)** International Polar Year *Chair:* Barry E. Goodison	**(I)** Avalanche science and forecasting Pascal Haegeli	
How surface latent heat flux and marine low clouds are related to lower-tropospheric stability in subtropical marine stratus and stratocumulus regions *Yanping He*	How well do current GCMs simulate the influence of snow cover variations on the atmosphere under climate change? *Christopher Fletcher*	Forecasting snowpack troublemakers *Matt MacDonald*	1
Ceilometer observations of Vancouver's urban boundary layer: Validation and initial results *Derek Van Der Kamp*	Evolution of an Arctic "bomb": Impacts of surface fluxes from ocean and ice *(Presented by* Bechara Toulany)		2
Isotopic fractionation in non-steady state soil-atmosphere environments *Nick Nickerson*	Use of molecular genetics to trace zooplankton transport through Bering Strait into the Arctic Ocean *R. John Nelson*		3
	Interannual variability of the polar front in the Gulf of Alaska via high resolution temperature sections taken along the great circle route from Victoria to Dutch Harbor *Bill Williams*		4
	Sensitivity of weather forecasts over the arctic due to analysis errors in the extra-tropics and vice-versa *Ahmed Mahidjiba*		5
	A round-trip tour of Canada's Three Oceans (C3O): A Canadian contribution to the International Polar Year *Svein Vagle*		6
	Modelling Mixed-Phase Arctic Clouds using the Polar-GEM *Frédérick Chosson*		7
	The structure and evolution of the polar stratosphere and mesosphere and links to the troposphere during IPY – Overview of the SPARC-IPY *Elham Farahani*		8
	Evaluation of a coupled snowpack / sea ice model using SHEBA observations *Ayrton Zadra*		9
	Operational application of a variational data assimilation system for coupled ice-ocean models and sea ice analysis *Paul Pestieau*		10
CMOS Awards Banquet/ Banquet des prix et honneurs de la SCMO, Room/salle Okanagan, 18:30			

Thursday / jeudi, 29 May / mai			
	Session 4A, Room / salle Okanagan		
08:30	Plenary Session 7, *Chair:* Peter L. Jackson	Tricks and traps on using fine-scale numerical weather forecasts for western Canada, *Roland Stull*	
09:15	Plenary Session 8, *Chair:* Peter L. Jackson	The NASA Phoenix Mars mission, *Peter Taylor*	
10:00	*Coffee/Café*		
	Session 4B1 Room / salle Shuswap	**Session 4B2 Room / salle Pennask**	**Session 4B3 Room / salle Skeena**
	(C) Dynamical and statistical downscaling, part 2 of 2 *Chairs:* Van-Thanh-Van Nguyen and Philippe Gachon	**(H)** Water resources and climate change *Chair:* Stephen J. Dery	**(I)** Scientists' involvement in decision-making processes, part 2 of 2 *Chair:* Miguel Tremblay
10:30	The development of spatially coherent multisite, multivariate statistical downscaling models for Canada *Andrew Harding*	Dynamics and thermodynamics of seasonal convective overturn in a very deep lake (Quesnel Lake, British Columbia) and links to productivity and climate change *Eddy Carmack*	Qualitative quality: Social science benefits service development efforts at Environment Canada *Lisa Vitols*
10:45	Constraining future projections for temperature extremes at local scale *Xuebin Zhang*	Relationships between snow cover extent, topography, and streamflow in the Quesnel River Basin of British Columbia *Jinjun Tong*	Science informing decisions: the Pacific Northwest Climate Impacts Group *Philip Mote*
11:00	Influence of large-scale nudging on CRCM's ensemble simulations *Adelina Alexandru*	Responses of streamflow in British Columbia to climate trends and variability *Arelia Werner*	IPCC: Past, present and future *Charles Lin* (Invited)
11:15	Effects of large-scale nudging on fine-scale variability in a regional climate model *Leo Separovic*	Future climate changes in the Rocky Mountains *Ted Pollock*	
11:30	Land surface wind probability distributions in North American regions: Observations and Regional Climate Model evaluations *Yanping He*	Modelling vapour trajectory-stable isotope relationships in western Canadian precipitation *Kate Sinclair*	From Trout Creek to the IPCC: Linking climate change scenarios, adaptation, and sustainable development *Stewart Cohen* (Invited)
11:45	Regional climate change projections: a multi-model, multi-regional approach *Dominique Paquin*	Snowfall estimation using automated in-situ measurements and GEM model output statistics *Alexandre Fischer*	The socioeconomic and environmental benefits of a revolution in weather, climate and earth-system prediction - A Weather, Climate and Earth-System Prediction Project for the 21st Century *Michel Béland* (Invited)
12:00	Regional climate projections for British Columbia *Trevor Murdock*	Multi-year landscape-scale assessment of hydrological conditions in the Slave River Delta, NWT, using water isotope tracers *Bronwyn Brock*	
12:15	Improving regional climate change projections of temperature for Halifax, Nova Scotia by statistically downscaling the CGCM3 via principal components *Matthew Lee Titus*	Climate change and heavy rainfall-related water damage insurance claims in Ontario, Canada *Chad Shouquan Cheng*	
12:30	Using daily precipitation distributions to assess added value in the Canadian Regional Climate Model *Alejandro Di Luca*	Moisture flux convergence over the Mackenzie River Basin and Pakistan *Khalid M. Malik*	
13:00–15:00			

Thursday / jeudi, 29 May / mai		
Session 4A, Room / salle Okanagan		
		08:30
		09:30
Coffee/Café		10:00
Session 4B4 **Room / salle Skaha**	**Session 4B5** **Room / salle Vaseaux**	
(A) Fire weather and forecasting *Chair:* Brian Amiro	**(C)** Global coupled atmosphere–ocean modelling and assimilation, part 3 of 3 *Chair:* G.J. Boer	
The Kelowna wildfire of August 2003: Meteorology and impacts *Kent Johnson* (Invited)	Recent developments for an operational Canadian global assimilation and prediction capability for the coupled atmosphere-ocean-ice system *C. Harold Ritchie*	10:30
The southern BC wildfires of 2003: Operational response *Eric Meyer* (Invited)	Initial assessment of the CONCEPTS global 1/4-deg ocean and sea-ice model *Youyu Lu*	10:45
Predicting fire weather severity using seasonal forecasts *Kerry Anderson*	Progress in modelling Gulf Stream separation with an eddy admitting model *D.G. Wright*	11:00
Modeling weather associated with forest fire "spread events" using MODIS satellite data *Justin Podur*	The effects of eddy parameterization in a coarse-resolution global ocean and sea-ice model *Zeliang Wang*	11:15
Operational forest fire-growth predictions for Canada *Kerry Anderson*	Sensitivity study of the North Atlantic circulation. What are the optimal parameters or parametrizations in NEMO? *Frederic Dupont*	11:30
Forest fire greenhouse gas emissions in future climates *Brian Amiro*	Rossby waves and the North Pacific Current *Shawn M. Donohue*	11:45
		12:00
		12:15
		12:30
	CFCAS: Communications Boot Camp – Getting the message out *Kelly Crowe*	13:00–15:00
End of Congress / Fin de Congrès		

Author Index / Index des auteurs

For session code ID explanation, refer to shaded Session Time Code in Week at a Glance/ Aperçu de la semaine. Number to the right of decimal indicates paper sequence in a session. Bolded code denotes presenting author.

Pour comprendre la signification du code de la session, veuillez vous référer à la partie ombrée, sur le côté gauche, de "Week at a Glance / Aperçu de la semaine". La partie décimale indique le rang de la présentation dans la session. L'utilisation de caractères gras identifie l'auteur, par opposition aux co-auteurs.

Abstracts can be found in the Book of Abstracts or on-line at / On peut retrouver les résumés dans le Programme du Congrès ou, en ligne, à l'adresse : www1.cmos.ca/abstracts/congress_schedule.asp


CMOS Congress
Congrès SCMO
2009
Halifax, Nova Scotia / Nouvelle-Écosse
31 May / mai – 4 June / juin
www.cmos.ca/Congress2009
Sea and Sky Come to Life
Mer et ciel s'animent
CMOS
SCMO

Congress Abstracts pdf Documents

Please use the Find Command to search this document by author or any word in the text.

In the index located at the end of some documents, the name of each author is followed by the ID number of all the corresponding abstracts and their presentation sequence number.

Résumés du congrès documents pdf

Veuillez utiliser la commande Find/Trouver pour chercher un auteur ou tout autre séquence de mots dans ce document.

Dans l'index situé à la fin de quelques documents, le nom des auteurs est suivi des numéros d'identification et de présentation de tous les résumés correspondants.

1A1.1 ID:2602 INVITED/INVITÉ 09:00

Climate, Water and Weather Affairs: “Selling” Science to Society

Michael Glantz
National Center for Atmospheric Research
Contact: glantz@ucar.edu

People are intrigued by scientific findings and enthralled by engineering feats. Science museums overflow worldwide with visitors, especially families and groups of school kids. People seem to trust science and engineering; they will somehow rise to the occasion to ‘save us’ from natural and manmade disasters as well as from creeping (slow onset but cumulative) and quick onset disasters. If they cannot save us today, there is the perennial hope that they will be able to do so in the future through scientific or engineering discovery.

So, here we are in 2008. Glaciers are melting everywhere, sea ice is disappearing in the polar regions, vector-borne diseases are shifting poleward, and inland seas are drying out, as the air around us heats up. Yet, it seems, most people are either ignorant of the many ways in which climate, water and weather influence human activities or they are “ignore-ant” of it, i.e., they choose to not pay attention to such influences.

One way to address the innocent ignorance as well as those who are ignore-ant is to demonstrate the “value-added” nature of using climate water and weather information (as well as the downside of not using such existing information) through the development of education and training programs like “Climate, Water and Weather Affairs”, and a reliance on “teachable moments”.

1A1.2 ID:2608 INVITED/INVITÉ 09:45

An Observer’s View of a Changing Marine Arctic

Humfrey Melling
Institute of Ocean Sciences
Contact: mellingh@dfo-mpo.gc.ca

Perspectives on the Arctic have changed significantly over the past half century. The concept of an ocean that is variable in the short term – season-to-season and perhaps year-to-year – but stable over decades is no longer considered valid. Within our new paradigm, oscillations of inter-decadal and longer periods, with various spatial footprints, interact with each other and with “trends” to create complex patterns of variability and change in both space and in time. Change in the Arctic environment and its impacts on ecology and human society over broad ranges of parameter, of scale and of time are sources of much anxiety. Although we know quite a bit about the Arctic Ocean from a short-term perspective, we lack the historical perspective that would permit a reliable discernment of the abnormal from the normal and a confident comprehension of progressive change. Sea ice provides the backdrop to this discussion of Arctic change by a scientist with a long interest in making, and in making sense of, field observations. The data readily reveal an Arctic Ocean more complex in its interactions than commonly

thought. Change in the marine Arctic is actually enigmatic at our present level of understanding and prone to conundrum. This uncertainty will likely be integral to our picture of the future Arctic for many years to come.

1B1.1 ID:2516 **11:00**

Recent observations from the Canada Basin: 2002-2007

Fiona Mclaughlin [1], *Michiyo Yamamoto-Kawai* [1], *Eddy Carmack* [1], *Sarah Zimmermann* [1], *Koij Shimada* [2], *Motoyo Itoh* [2]
[1] Fisheries and Oceans Canada
[2] JAMSTEC
Contact: mclaughlinf@pac.dfo-mpo.gc.ca

Large-scale physical and geochemical surveys of the southern Canada Basin conducted in the 2000's show that changes observed during the 1990s have progressed further into the basin. In the last two years ice extent has decreased dramatically and in 2007 reached a historical low. The temperature of the Bering Sea summer water has increased, the volume of Bering Sea Winter Water has decreased and temperatures of the Fram Strait Branch have increased. Distributions of increased ventilation together with the above data are used to infer circulation and show that the boundary current is not the sole mechanism for the delivery of change in the southern Canada Basin.

1B1.2 ID:2425 **11:15**

Seasonal variations of flow and hydrography in Barrow Strait in the Canadian Arctic Archipelago

Youyu Lu [1], *Jie Su* [2], *Simon Prinsenberg* [2], *Zeliang Wang* [2], *Roger Pettipas* [2]
[1] Environment Canada
[2] Fisheries and Oceans Canada
Contact: Youyu.Lu@ec.gc.ca

Continuous monitoring of flow and hydrography in Barrow Strait in the Canadian Arctic Archipelago (CAA) started in 1998 by the Department of Fisheries and Oceans of Canada. The eight-year measurements reveal robust seasonal variations of flow and hydrographic conditions in the Strait. The maximum volume transport occurs in summer (June-August) and minimum in late fall (November-December). A fine-resolution global ocean and sea-ice model, forced by climatological surface forcing, reasonably reproduces the observed seasonal variations in Barrow Strait. Then model solutions are further analyzed to explore the links of the Barrow Strait variations to large-scale forcing in particular in the Beaufort Sea, and the relative importance of the barotropic and baroclinic processes in controlling the water transport through the CAA channels.

1B1.3 ID:2520 **11:30**

Spatial variability in surface oxygen and nitrogen concentrations between the subarctic Pacific and into the Arctic

Philippe Benoit [1], *Svein Vagle* [1], *Eddy Carmack* [2]

[1] University of Victoria & Institute of Ocean Sciences, Sidney, BC
[2] Institute of Ocean Sciences, Sidney, BC
Contact: pb@uvic.ca

Using an underway gas tension device (GTD) combined with an oxygen sensor on the icebreaker CCGS Sir Wilfrid Laurier traveling from Victoria BC to Barrow Alaska in July 2007 as part of the Canada's 3 Oceans (C3O) IPY project provided real-time measurements of dissolved oxygen and nitrogen concentrations in the near surface ocean along a several thousand km stretch of the NE Pacific Ocean, the Bering Strait and into the Beaufort Sea from Victoria, BC to Barrow, Alaska. Simultaneous measurements of the concentrations of these gases can be used to separate the effects of physical and biological processes, and give substantial information on the rates of warming and cooling of the subsurface waters. After correcting for effects due to the setup on the ship we are left with a dataset that reveals large variability in the subsurface dissolved oxygen concentrations at higher latitudes, without similar variability in the dissolved nitrogen concentrations. We hypothesize that subsurface currents rich in decomposing organic materials coupled with very low winds and therefore limited mixing during this period could have caused the areas of low oxygen waters observed.

1B1.4 ID:2545 11:45

The organic carbon flux to the margin sediments of Canada's three oceans; redox tracers, stable isotopes and biomarkers as proxies for change

Robie W. Macdonald [1], *Charles Gobeil* [2], *Danielle Dubien* [2]
[1] Department of Fisheries and Oceans
[2] INRS-ETE, Université du Québec
Contact: charles.gobeil@ete.inrs.ca

The intent of this research is to develop a coherent baseline for organic carbon inputs and processes in continental shelf and slope sediments that include all three of Canada's oceans—from subarctic Pacific to Arctic to subarctic Atlantic. Sediment cores are collected and analyzed to quantify the burial rates of many important elements in the sediments. Organic C is central to this proposal with interrelated elements supporting our understanding of the carbon cycle. These include manganese, iron, sulphur and a number of redox sensitive trace elements (i.e. Cd, Mo, Re, U). Profiles of natural and artificial radionuclides (e.g. 210Pb, 137Cs) and stable isotopes are also used to measure the geochemical setting (sedimentation rate, depth of surface mixed layer, surface-layer mixing rate) and to distinguish sources of the material that accumulate in sediments. Finally, organic biomarkers including alkanes, PAHs, sterols, steranes, and lignins are applied to determining sources of organic carbon and processes producing them by using methods already developed. Sediment box-cores were successfully collected, while aboard the CCGS Sir Wilfrid Laurier in July 2007, along the continental shelf and slope at depths varying from 100 to 2000 m in the Bering Sea, Chukchi Sea, Barrow Canyon and the Mackenzie Shelf. The cores were horizontally sectioned in 0.5 cm thick slices from the sediment surface to 2 cm depth, and then in progressively thicker slices of 1, 2 and 3 cm down to 10, 20 and 35 cm depth, respectively. Here we will report initial results that reveal clear regional differences in the organic carbon forcing which have direct

implications on present organic supply (allochthonous vs authochthonous) and will also yield information on past organic carbon loading.

1B1.5 ID:2535 **12:00**

Phytoplankton Productivity in Surface Waters of the Canadian Arctic During the Summer of 2007

Ian Wrohan , *Diana Varela*
University of Victoria
Contact: wrohani@uvic.ca

Phytoplankton play an important role in the cycling of nutrients in the oceans and in the export of organic matter to deeper water. As part of the "Canada's Three Oceans" IPY project, we investigated the magnitude of total, new, and regenerated primary production, and the structure of the phytoplankton community in the Arctic Archipelago and the Canada Basin during July and August of 2007. In the Arctic Archipelago, chlorophyll *a* concentrations were mostly below 1 mg m^{-3}, and results from size-fractionated chlorophyll *a* indicated that larger (>5 µm) cells (most likely diatoms) dominated phytoplankton assemblages throughout most of the region. These results indicate that this system may exhibit high carbon export to deeper waters and an efficient transfer of energy to higher trophic levels. In contrast, the Canada Basin was characterized by a higher proportion of <5 µm cells and even lower total chlorophyll *a* concentrations, potentially indicating low carbon export to deeper water and a system supported largely by recycled nutrients. We will present results from nutrient uptake rate experiments, which will contribute to the interpretation of these preliminary findings. This study represents the first thorough description of total, new and regenerated primary productivity of a large Arctic region, from the Labrador Sea to the Canada Basin.

1B1.6 ID:2524 **12:15**

Investigating the distribution of dissolved aluminum in the Beaufort Sea: a useful geochemical tracer of the supply of bio-essential trace metals to the Arctic Ocean

Tim Giesbrecht [1], *Jay Cullen* [2]
[1] Department of Chemistry and School of Earth and Ocean Sciences, University of Victoria
[2] School of Earth and Ocean Sciences, University of Victoria
Contact: jcullen@uvic.ca

Modeling studies and observations suggest that the Arctic Ocean will experience the acute impacts of global climate change yet our ability to predict ecosystem level effects of these changes are limited given that high latitude oceans are significantly under sampled. One potential consequence of regional warming in the Arctic is reduced seasonal ice cover with likely, but poorly constrained consequences for marine primary productivity and ecosystem structure. Iron (Fe) plays a predominant role in high-latitude oceans as a potentially bio-limiting nutrient and previous work in the Arctic suggests that sea-ice may be an important vector delivering coastally sourced terrigenous matter to surface waters of the deep basins. Improved understanding of the predominant sources and sinks of Fe in the Arctic Ocean is required to improve our ability to predict the

consequences of climate change for the productivity and community structure of the marine environment. To characterize Fe cycling in seawater, geochemical tracers such as aluminum (Al) and manganese (Mn) can be employed with the former indicative of lithogenic sources such as aeolian deposition and ice-rafted particulates and the latter suggesting a source through diagenetic remobilization of the sediments. Here we report dissolved (<0.2 µm) Al profiles for six stations along an onshore-offshore transect from the Mackenzie Shelf into the Canada Basin of the Beaufort Sea. Maximum dissolved Al concentrations (> 10 nmol/L) were detected in shelf waters proximate to riverine and sedimentary metal sources or subsurface waters likely influence by cross-shelf transport. Concentrations in the upper water column generally decreased with distance offshore displaying surface maxima (5-8 nmol/L) consistent with input from summer melting of sea-ice.

1B2.1 ID:2550 INVITED/INVITÉ 11:00

Advances in middle atmosphere modelling

Theodore Shepherd
University of Toronto
Contact: tgs@atmosp.physics.utoronto.ca

Over the past 25 years, comprehensive 3-D modelling of the middle atmosphere has advanced from exploratory investigations of fundamental processes to quantitative simulation of climate change and chemistry-climate coupling. At the same time, the lids of both climate models and weather forecast models are being systematically raised into the mesosphere. The middle atmosphere is increasingly seen as the natural extension of the troposphere, whose representation is required in order to provide a correct upper boundary condition for the atmosphere below. This development will be described, including what the principal challenges are in modelling this region of the atmosphere and how they are being dealt with.

1B2.2 ID:2251 11:30

Canadian Coupled Atmosphere - Ocean - Ice Forecast System for the Gulf of St. Lawrence

Manon Faucher [1], *Pierre Pellerin* [2], *Michel Desgagné* [2], *François Roy* [1], *Hal Ritchie* [3], *Serge Desjardins* [3], *Denis Lefaivre* [4], *François J. Saucier* [5], *Sophie Valcke* [6], *Tom Carrières* [7]
[1] Canadian Meteorological Centre
[2] Recherche en Prévision Numérique
[3] National Lab for Marine & Coastal Meteorology
[4] Maurice-Lamontagne Institute
[5] Institut des Sciences de la Mer à Rimouski
[6] Centre Europeen de Recherche et de Formation Avancée en Calculs Scientifiques
[7] Canadian Ice Service
Contact: manon.faucher@ec.gc.ca

A fully interactive coupled atmosphere-ocean-ice forecasting system for the Gulf of St. Lawrence (GSL) has been installed in experimental mode at the Canadian Meteorological

Centre (CMC). The system was initially developed from a research collaboration between EC's Recherche en prevision numerique (RPN), the Department of Fisheries and Ocean (DFO)'s Institut Maurice Lamontagne (IML), the Institut des Sciences de la Mer (ISMER) from Université du Québec à Rimouski (UQAR) and the European Centre for Research and Advanced Training in Scientific Computation (CERFACS, France).

This project follows a study by Pellerin et al. (2004) showing more accurate weather forecasts over the GSL and adjacent coastal areas resulting from the coupled system in a case study involving rapid ice motion. More extensive testing and preparations for operational use were carried out in a collaboration amongst several research centers: RPN, IML, CMC, EC National Laboratory for Marine and Coastal Meteorology (NLMCM), and the Canadian Ice Service (CIS).

Results during the past year have demonstrated that the coupled system produces improved forecasts in and around the GSL during all seasons, proving that atmosphere-ocean-ice interactions are indeed important even for short-term Canadian weather forecasts. This has important implications for other coupled modeling and data assimilation partnerships that are in progress involving EC, DFO and the National Defense (DND). Following this experimental phase, it is anticipated that this GSL system will be the first fully interactive coupled system to be implemented at CMC.

1B2.3 ID:2333 11:45

Canadian Coupled Atmosphere - Ocean - Ice Forecast System for the Gulf of St. Lawrence : Operational Validation for ice season 2008

Serge Desjardins [1], *Chris Fogarty* [2], *Dermott Kearney* [3], *Garry Pearson* [1], *Hal Ritchie* [4], *Manon Faucher* [5], *Pierre Pellerin* [6]

[1] National Lab for Marine and Coastal Meteorology, EC, Dartmouth
[2] Atlantic Storm Prediction Centre,,EC, Dartmouth
[3] National Lab for Marine and Coastal Meteorology, EC,Gander
[4] Meteorological Research Division, EC,Dartmouth
[5] Centre Météorologique Canadien, EC, Dorval
[6] Meteorological Research Division, EC,Dorval
Contact: serge.desjardins@ec.gc.ca

Following the successful implementation of the Gulf of St. Lawrence coupled atmosphere-ocean-ice system in an experimental mode at CMC this winter (refer to Faucher et al.), an operational validation is simultaneously under way at the Atlantic Strom Prediction Centre, the Newfoundland and Labrador Weather Office and the Quebec Storm Prediction Centre. With the help of various image sets showing the various fields from the regional model, from the coupled run and the difference between the two runs, operational forecasters can identify very quickly the impact of such coupling. Time series showing online observations and model outputs allow the forecaster on duty to rapidly compare the numerical outputs with reality. Preliminary results indicate that the coupling is correcting a cold bias in the surface temperature in the regional GEM caused by the overestimation of the ice thickness coming from climatology. Furthermore, they show that the location of the ice and its thickness might influence the formation, location and intensity of snow streamers. An overview of the validation will be presented as well as more detailed studies of a few cases during the last ice season in the Gulf of St. Lawrence.

1B2.4 ID:2285 12:00

Evaluating the Radiative Forcing of 3-D Aerosol Climatology in GEM-Strato Model

Irena Paunova [1], *Paul Vaillancourt* [2], *Louis Garand* [1], *Knut Von Salzen* [3]
[1] Data Assimilation and Satellite Meteorology, Meteorological Research Division, Environment Canada
[2] Numerical Weather Prediction Research, Meteorological Research Division, Environment Canada
[3] Canadian Center for Climate Modeling and Analysis, Environment Canada
Contact: irena.paunova@ec.gc.ca

The aerosol radiative forcing of a comprehensive 3-D multicomponent aerosol climatology is evaluated using the new GEM-strato model that includes the newly implemented narrow-band radiative parameterization of the Canadian Center for Climate Modeling and Analysis and a higher model top of 0.1 hPa. The validation component involves the use of global remotely-sensed datasets of aerosol and radiation budget, such as CERES and MODIS, as well as the use of established aerosol climatologies, such as the AVHRR GISS Global Aerosol Climatology Project (GACP).

The results show a more realistic distribution of aerosol optical thickness and aerosol radiative forcing for the climatological aerosol when compared to the old zonal mean aerosol. The contribution of the individual aerosol components is examined and compared to that of other model-derived climatologies, such as the ones from the AeroCom (Aerosol Comparison between Observations and Models) mean model project.

1B2.5 ID:2292 12:15

Large Amplitude Internal Wavepacket Propagation

Bruce Sutherland [1], *Geoff Brown* [1], *John Scinocca* [2]
[1] University of Alberta
[2] CCCma
Contact: bruce.sutherland@ualberta.ca

Horizontally periodic, vertically localized internal gravity wavepackets induce a horizontal mean flow in a manner analogous to the Stokes drift for surface waves. Unlike the the Stokes drift, however, the wave-induced mean flow of nonhydrostatic internal waves non-negligibly interacts with the waves themselves if they are moderately large amplitude: that is, if their maximum vertical displacement is larger than approximately one percent of the horizontal wavelength. Their consequent evolution, at least over few buoyancy periods, is well described by a nonlinear Schroedinger equation. The results are used to interpret the results of fully nonlinear simulations that examine the partial transmission of waves across weakly stratified regions in the Boussinesq approximation and extensions to anelastically growing waves are discussed. The salient results have recently been incorporated as an internal wave parameterization scheme in the CCCma GCM. The results show significant improvement in reproducing observed zonal wind

speeds and temperatures.

1B3.1 ID:2453 **11:00**

EXTREMES AND GEWEX

Ronald Stewart
McGill University
Contact: ronald.stewart@mcgill.ca

The Global Energy and Water Cycle Experiment (GEWEX) is one of the largest components of the World Climate Research Programme. GEWEX has long examined global features of the water cycle, it undertakes regional climate efforts, and it examines many aspects of the fast climate system including clouds and surface processes.

One of the emerging issues within GEWEX is extremes. The components of GEWEX are coming together to address the factors leading to, sustaining and ending extremes, particularly hyrometeorological ones. Such extremes include drought, heaving precipitation and flooding. From the point of view of the cycling of water, such phenomena, although quite distinct, share many features. They are formed thorough a combination of large scale processes (circulations, storm tracks), atmospheric processes over particular regions (water vapour, clouds, precipitation), and surface processes over such regions (evaporation, sublimation, soil moisture, vegetation, and terrain). Key scientific issues are concerned with how these processes sometimes produce extremes, with the possible paths through which extremes can be produced and sustained, and with the means by which they can end. A related issue is better understanding whether extremes such as drought are interwoven with major precipitation events. To address such extremes, research activities are being undertaken globally and regionally. The regional efforts include activities over Europe, Asia, South America, Australia, and North America. The major effort within Canada is DRI, the Drought Research Initiative, focused on drought over the Canadian Prairies. Collectively, better determining and understanding the physical mechanisms of extreme event generation and evolution is a major issue that is expected to lead to better prediction and improved adaptation in the present and future climate. To a considerable degree, this interdisciplinary research is also a good example of earth system science for society.

1B3.2 ID:2532 **11:15**

The Drought Research Initiative (DRI): An integrated approach to addressing Canadian drought problems

Richard Lawford [1], *Ronald Stewart* [2], *John Pomeroy* [3]
[1] University of Manitoba
[2] McGill University
[3] University of Saskatchewan
Contact: lawfordr@cc.umanitoba.ca

Frequently, climate problems are addressed with individual investigator studies that focus on a specific aspect of an overall problem. Through its networks initiative, the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) has provided the climate community with opportunities to address climate problems in a more integrated way. For example, CFCAS has provided funding for drought research through the Drought Research Initiative (DRI) to address a critical high-impact extreme phenomenon based on a detailed case study of a multi-year drought that occurred between 1999 and 2004/05.

In addition to providing a programmatic overview of DRI, this presentation reviews the experiences of DRI in striving for comprehensive understanding and problem solution through an integrated study. Since its inception, DRI has been integrating across disciplines, across scales, across functions, across data and modelling paradigms, and across research and operations. As will be evident in the results presented in this talk, integration across disciplines is well developed in the DRI research program, especially between the atmospheric and hydrologic sciences. In other areas, such as the research-user interface, integration is only now maturing. This presentation will conclude with some observations on the benefits and challenges of research and program integration that will be important to consider when addressing broad "Extremes issues" in the future.

1B3.3 ID:2370 **11:30**

Large-Scale Characteristics Associated with the 1999 to 2005 Canadian Prairie Drought

Barrie Bonsal
Environment Canada
Contact: barrie.bonsal@ec.gc.ca

Large-area, prolonged droughts are among Canada's costliest natural disasters having major impacts on a wide range of sectors including agriculture, forestry, industry, municipalities, recreation, health and society, and aquatic ecosystems. Although most regions of Canada have been affected by droughts, southern regions of the Canadian Prairies are more susceptible mainly due to their high variability of precipitation in time and space. However, rarely has Prairie drought been as serious or extensive as the recent 1999-2005 episode. Several studies have determined significant relationships between hemispheric to global-scale atmospheric and oceanic oscillations and climate anomalies over the Canadian Prairies. The main teleconnections that have been shown to affect Prairie climate include El Niño/Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), and the Pacific North American (PNA) pattern. Strongest links occur during the cold season and are generally less robust during summer. However, some analyses have indicated that persistence of a North Pacific sea-surface temperature (SST) pattern consisting of anomalously cold water in the east-central North Pacific and anomalously warm water along the west coast of North America often leads to extended summer dry spells on the Canadian Prairies. This SST pattern is consistent with the PDO-related inter-decadal mode of variability. In addition, a significant lagged relationship between winter ENSO and the Atlantic Multi-decadal Oscillation (AMO) and summer PDSI values over the Prairies has been determined. This presentation summarizes current knowledge regarding relationships between teleconnections and drought-related climate on the Prairies. Large-scale characteristics associated with the 1999-2005 Canadian Prairie drought including global SST anomalies, North American soil moisture anomalies, and major teleconnection indices (ENSO, PDO, PNA, NAO, AO, AMO) are then presented. The talk concludes with comparisons with how these identified large-scale characteristics compare to those associated with other major drought episodes on the Prairies.

1B3.4 ID:2300 11:45

The Association between Extreme Canadian Temperature and Precipitation and Interannual and Interdecadal Oscillations

Amir Shabbar , *Bin Yu*
Environment Canada
Contact: amir.shabbar@ec.gc.ca

This study examines the individual and combined effects of El Nino-Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO) and the Atlantic Multidecadal Oscillation (AMO) on a number of extreme temperature indices over Canada. These indices include the number of days with extreme warm and cold temperatures and frequency of warm and cold spells. Both linear regression and composite analyses are used to isolate in-phase and out-of-phase impact of these interannual and decadal-interdecadal phenomena on the temperature indices. The intraseasonal variability in the temperature indices is also examined. By the use of the standardized precipitation index (SPI), the impact of the interannual and interdecadal oscillations on the accumulated precipitation is also investigated. Circulation patterns leading to significant patterns in temperature and precipitation indices will be discussed. The presentation will show that there is a discernable and significant impact of these teleconnections on the extreme climate indices over Canada.

1B3.5 ID:2514 12:00

Analysis of intense sub-tropical moisture transports into high latitudes of western North America

Alain Roberge , *John Gyakum* , *Eyad Atallah*
McGill University
Contact: alain.roberge@mail.mcgill.ca

There can often be significant interactions between the high and tropical latitudes during the Northern Hemisphere's cool season. In periods of highly amplified atmospheric flow, these interactions can lead to the poleward transport of significant tropical moisture into portions of northwestern North America. These events, often referred to as Pineapple Express (PE) events, are characterized by large plumes of warm, moist air coming from near Hawaii, and reaching the west coast of North America. Also called "atmospheric rivers", these phenomena are responsible for numerous storms and floods. As such, this study documents the synoptic-scale signatures associated with the PE. Since the extent of a PE can reach as far south as California and as far north as the coast of Alaska, this study will focus on events that attain latitudes of 45° N and greater.

A trajectory analysis was used to partition the events into three different synoptic types according to the origin of their trajectories. Results indicate that this large scale moisture transport is often associated with the sub-tropical jet stream, which is curved due to a full-latitude ridge of high pressure located just offshore of the west coast of North America concomitant with a low-pressure system located in the Gulf of Alaska. Additionally, similar moisture transport values may be observed in absence of the full-latitude ridge with a stronger low-pressure system in the Gulf of Alaska. This particular configuration leads to a stronger zonal flow that curves poleward cyclonically within the warm conveyor belt of the same low pressure system, converging moisture into the area.

Furthermore, thickness anomalies after the events revealed a significant warming over North America lasting for at least three days. In fact, this downstream development seems to be similar with the ones associated with droughts in the Canadian Prairies.

1B3.6 ID:2356 **12:15**

A series of unfortunate events: Synoptic modulation of the drought

Eyad Atallah , *John Gyakum*
McGill University
Contact: eyad.atallah@mail.mcgill.ca

While it is understood the feedback mechanisms such as evapotranspiration (or, in the case of drought, the lack thereof) can have a significant impact on the presence and/or severity of drought, synoptic-scale forcing, if of sufficient magnitude, can over-ride these feedback mechanisms and either instigate or alleviate drought conditions. Therefore, the primary focus of this work is to understand the relative importance of the synoptic-scale on the modulation of the drought. Towards this end, the large-scale moisture transport and synoptic-scale flow patterns are examined. Preliminary results indicate that this drought can not be characterized by a single pattern. At least three disparate flow regimes appear to contribute significantly to the most recent Prairies drought.

Perhaps counter-intuitively, one such flow regime involves the significant transport of moisture from tropical to high latitudes along the North American West Coast, often referred to as Pineapple Express (PE) events. These events can often be accompanied by very warm and dry conditions in the Canadian Prairies as moisture is condensed over the Canadian Rockies due to adiabatic cooling resulting from the forced ascent of air. The resulting latent heat release acts to warm the air which subsequently descends onto the Canadian Prairies in a significantly warmer and drier condition then during its initial encounter with topography. Other patterns accompanied by severe moisture deficits included flow regimes where the mean storm track was displaced both to the north and south of the Prairies region. This resulted in temperatures that, for the entirety of the drought, averaged near normal. Consequently traditional concepts of drought in western Canada being related to a positive phase of the Pacific North American pattern are only partially applicable.

1B4.1 ID:2205 INVITED/INVITÉ 11:00

Review of the Lower Fraser Valley Air pollution monitoring network

Douw Steyn [1], *Bruce Ainslie* [1], *Christian Reuten* [1], *Geoff Doerksen* [2], *Hilary Hafner* [3], *Nhu Le* [1], *Kathy Preston* [2], *James Zidek* [1]
[1] The University of British Columbia
[2] RWDI AIR Inc.
[3] Sonoma Technology Inc.
Contact: dsteyn@eos.ubc.ca

The air pollution monitoring network operated by Metro Vancouver, in collaboration with the Fraser Valley Regional district is arguably the most developed such network in Canada. This network was recently subjected to a comprehensive, and wide-ranging review that took a strategic approach to addressing the air quality monitoring network, its objectives, operating framework, operation and data record. The review was deemed necessary to develop a strategy that was consistent with Metro Vancouver's and FVRD's Air Quality Management Plans (AQMP) and to ensures network met community, provincial and federal goals to maintain and improve air quality in the region. We will present the network, its history, a history of previous network reviews, and provide a complete overview of the context, results and recommendations of the latest review.

1B4.2 ID:2241 11:30

An Analysis of Air Quality at Osoyoos, British Columbia in the Okanagan Valley.

Stephanie Meyn , *Jennifer Hay* , *Roxanne Vingarzan* , *Selena Farris*
Environment Canada
Contact: Stephanie.Meyn@ec.gc.ca

An air pollution monitoring station was established near the British Columbia-Washington State border in Osoyoos, B.C. in the Okanagan Valley in 2004 as part of the Border Air Quality Study under the U.S.-Canada International Airshed Strategy. Continuous measurements of PM2.5, O3, NO, NO2, and SO2 were obtained at this site between 2004 and 2006.

Surface wind direction analysis suggests that the trans-boundary transport of PM2.5 is dominated by seasonal meteorological regimes. In general, for PM2.5 and NOx, the highest concentrations occurred under low wind (< 2 m/s) conditions. For winds ≥ 2 m/s, directional analysis shows predominant transport from the U.S. into Canada in the fall and winter months, advecting higher PM2.5 concentrations across the border. In summer, flow directions between Canada and the US are balanced, leading to relatively equal concentrations of PM2.5 transported in both directions, except in the case of summer forest fires.

Data from 2005 and 2006 suggest that Osoyoos ozone concentrations (53 to 55 ppb) are below the Canada-Wide Standard of 65 ppb. Seasonal analysis suggests that during spring (Mar,Apr,May), O3 concentrations associated with winds blowing from Canada

into the U.S. are higher, but that the opposite is true in summer (July and August). Despite the location of emission sources and larger population centers to the north of Osoyoos, concentrations associated with winds from the south (U.S.) are on average ~ 4 pbb higher than Canadian concentrations in July and August.

1B4.3 ID:2230 **11:45**

Ozone Air pollution on the Okanagan Valley.

Johnson Zhong [1], *Douw Steyn* [2]
[1] EC & UBC
[2] UBC
Contact: johnson.zhong@ec.gc.ca

Ground-level ozone is an important component of smog that is formed from reactions involving nitrogen oxides (NOx) and volatile organic compounds (VOCs) in the presence of sunlight. Motor vehicle emissions are a major source of both NOx and VOCs. To a lesser extent, Ground level ozone can also result from the down-mixing of ozone from the stratosphere (stratospheric intrusions). The correlation between long term ozone changes in the lower stratosphere and in tropospheric ozone is very significant leading to the conclusion that at least a portion of the ozone concentration changes in troposphere results from the changes in the lower stratosphere. We consider the portion of the ozone concentration that is not formed locally with photochemical process as background ozone. An ozone observations station had been operating at Kelowna College, KLO Rd, Kelowna, British Columbia since August 1983, which gives good representative ozone values for the City and its immediate environs. A statistical analysis over the observed ozone concentrations shows a rising trend over the past decade or so. Since all the Canadian ozonesonde stations show the same rising trend in the past decade, changes in background ozone concentration could be a driving force of the annual trend observed in Kelowna. On the other hand, Kelowna is a rapidly growing city, and the increasing local precursor emissions associated with the growing population and local traffic could lead to an increase in the production of photochemically generated ozone. The Air Pollution Model (TAPM) is a 3D meteorological and chemical model for air pollution studies, developed by Australian CSIRO Atmospheric Research Division. This model was designed to be run in a nestable way so that the spatial resolution can be as fine as ~100 m. TAPM was run for typical summer time ozone episodes for the central Okanagan region. By adjusting the background ozone concentration and the local emission inventory, we plan to distinguish the influence of either of these processes on the total ozone concentrations during these episodes. Ultimately, plan to analyze the effect on ozone concentration caused by the background ozone or local photochemically generation and their impact to the air quality conditions in the future with the rapid growth of population and economy (and hence the local emissions) in Kelowna.

1B4.4 ID:2408 **12:00**

Simulation of Particulate Matter in Switzerland using CMAQ-MADRID and CAMx Regional Chemical Transport Models

James Sloan [1], *Suran Nikzad* [1], *Sebnem Andreani-Aksoyoglu* [2], *Johannes Keller* [2], *Rami*

Alfarra [2], *André Prévôt* [2]
[1] University of Waterloo, Canada
[2] Paul Scherrer Institute, Switzerland
Contact: sloanj@uwaterloo.ca

We will report a comparison of the results from two large scale simulations of air quality in Switzerland during the winter of 2006, using the CMAQ-MADRID and CAMx regional atmospheric chemical transport models. The simulations are carried out in three nested domains with resolutions of 27 km (Europe), 9 km (Switzerland and neighbouring countries) and 3 km (Switzerland). In order to make a direct comparison of the performance of the two models, the same meteorology fields (created by the MM5 meteorology model) and emissions data were used for both models. The results include temporal and spatial concentration fields for a range of gas phase pollutants in the valleys and populated areas of Switzerland, but the focus of the work is on the effects of the complex and mountainous terrain on the formation and transport of particulate matter (PM) for particle sizes smaller than 2.5 µm. The ability of the models to reproduce the aerosol concentrations is investigated by comparing the simulated results with speciated aerosol measurements performed during the same period using an aerosol mass spectrometer (AMS). The measurements indicate that the aerosol composition is dominated by organics and nitrates. Secondary organics are the major components of the organic fraction and biogenic sources contribute significantly to their precursors. There is some indirect indication that wood-burning also contributes to the measured PM, but the lack of detailed emission data for this source is an impediment to the interpretation of the modelling.

1B4.5 ID:2496 12:15

A comparison of Bayesian and conditional density models in probabilistic ozone forecasting

Song Cai [1], *William Hsieh* [1], *Alex Cannon* [2]
[1] Dept. of Earth and Ocean Sciences, University of British Columbia
[2] Meteorological Service of Canada, EC, Vancouver, BC
Contact: whsieh@eos.ubc.ca

Probabilistic models were developed to provide predictive distributions of daily maximum surface level ozone concentrations. Five forecast models were compared at two stations (Chilliwack and Surrey) in the Lower Fraser Valley of British Columbia, Canada, with local meteorological variables used as predictors. The models were of two types, conditional density models and Bayesian models. The Bayesian models (especially the Gaussian Processes) gave better forecasts for extreme events, namely poor air quality events defined as having ozone concentration ≥ 82 ppb.

1B5.1 ID:2582 11:00

Prototyping new products for the Canadian Air Navigation System: 'TAFPlus' and 'V-CMAC'

Steven Laroche [1], *Rob Honch* [1], *Bruno Larochelle* [1], *Martin Kothbauer* [2]

[1] Environment Canada
[2] Air Canada Jazz
Contact: bruno.larochelle@ec.gc.ca

The Canadian Meteorological Aviation Centre (CMAC) has prototyped two new aviation weather products for evaluation by the various members of the Canadian Air Navigation System (ANS). The first product, called 'TAFPlus', is an enhanced version of the regulatory 'TAF' (aerodrome forecast). TAFPlus adds a site-specific forecaster discussion as well as a simplified NWP-based meteogram. TAFPlus has been issued regularly for Toronto, Vancouver, Calgary, Montréal and Yellowknife since February 01, 2007. NAV CANADA, the Canadian civil air navigation services provider, is currently evaluating the potential of this web-distributed product. The goal of TAFPlus is to provide enhanced aviation weather information to ANS users to enable more effective decision making than that possible by using the TAF alone. The second product, which is currently in beta testing, is called 'V-CMAC' (Virtual CMAC). The V-CMAC software is a hybrid of an integrated weather display and a contextual multi-user communication mechanism. Various users, such as major airline dispatchers, NAV CANADA Air Traffic Control and Flight Information Centres, are able to view real-time weather information (satellite imagery, surface observations, aerodrome forecasts, aviation warnings) on an integrated platform; they are also able to conduct conversations (“one on one” or “one to many”) with other Canadian ANS on-line users of this system. V-CMAC provides a virtual environment intended to help counter the physical barriers which separate the various users of the ANS. The goal of V-CMAC is to provide the ANS users with enhanced communication and common situational awareness. Both products will be demonstrated and discussed.

1B5.2 ID:2583 INVITED/INVITÉ 11:15

Use of new prototype products from the Canadian Air Navigation System: 'TAFPlus' and 'V-CMAC' : the dispatch perspective.

Martin Kothbauer [1], *Steven Laroche* [2], *Rob Honch* [2], *Bruno Larochelle* [2]
[1] Air Canada Jazz
[2] Environment Canada
Contact: bruno.larochelle@ec.gc.ca

The Canadian Meteorological Aviation Centre (CMAC) has prototyped two new aviation weather products for evaluation by the various members of the Canadian Air Navigation System (ANS). The first product, called 'TAFPlus', is an enhanced version of the regulatory 'TAF' (aerodrome forecast). TAFPlus adds a site-specific forecaster discussion as well as a simplified NWP-based meteogram. TAFPlus has been issued regularly for Toronto, Vancouver, Calgary, Montréal and Yellowknife since February 01, 2007. NAV CANADA, the Canadian civil air navigation services provider, is currently evaluating the potential of this web-distributed product. The goal of TAFPlus is to provide enhanced aviation weather information to ANS users to enable more effective decision making than that possible by using the TAF alone. The second product, which is currently in beta testing, is called 'V-CMAC' (Virtual CMAC). The V-CMAC software is a hybrid of an integrated weather display and a contextual multi-user communication mechanism.

Various users, such as major airline dispatchers, NAV CANADA Air Traffic Control and Flight Information Centres, are able to view real-time weather information (satellite imagery, surface observations, aerodrome forecasts, aviation warnings) on an integrated platform; they are also able to conduct conversations ("one on one" or "one to many") with other Canadian ANS on-line users of this system. V-CMAC provides a virtual environment intended to help counter the physical barriers which separate the various users of the ANS. The goal of V-CMAC is to provide the ANS users with enhanced communication and common situational awareness. Both products will be demonstrated and discussed from the perspective of airline dispatch office.

1B5.3 ID:2212 INVITED/INVITÉ 11:45

The case for automated, probabilistic TAFs

Ross Keith
None
Contact: keiths14@bigpond.net.au

The traditional, categorical TAF has continued almost unchanged for several decades. Various studies have shown that the skill of these forecasts has not changed over many years, and in fact cannot improve on persistence in the first few hours.

Material will be presented from trials on groups of forecasters in Australia which demonstrates the impact of individual forecaster's aversion to risk on financial outcomes to airlines. Results of these trials validate the use of signal detection theory to derive an optimal decision probability of the weather being below the alternate minimum.

Further material will be presented from an experiment with American Airlines which demonstrates the savings in operating costs which would have been extracted by using crude, automated probabilistic forecasts for flight planning compared to TAFs.

1B5.4 ID:2313 12:15

Improving Guidance for Aerodrome Forecasts: Aviation National Lab products and direction

Alister Ling
Meteorological Service of Canada
Contact: Alister.Ling@ec.gc.ca

In response to the needs of NAV CANADA, major air carriers, and aviation forecasters, the National Laboratory for Aviation Meteorology has initiated a project to produce a variety of decision aids in the short term, improve the accuracy of and accessibility to aviation guidance, and chart the strategic direction for iterative improvements to these and the development of new products. As a result, clients can expect to gain further efficiency and cost savings through tailored products and better consultation from a more effective forecast operations. Conditions such as NAIFR, below alternate, below approach minima, and fog probability at terminals and across the domain will also include reliability/confidence indicators. A tactical fusion approach, including efficient human intervention, will be used as a "blender-integrator" to fuse or select forecast methodologies based on past performance of the anticipated conditions in each future part period. The system will also introduce an autoTAF but only where it has a high degree of confidence. The data voids and comparatively data sparse regions of Canada limit the value of autoTAF systems developed for data dense regions. This project collaborates with and leverages the CAN-now and CMC nowcasting efforts, as well as Canadian and US ceiling/visibility probabilistic guidance programs.

1B6.1 ID:2462 11:00

Recent changes of bottom water oxygenation and temperature in the Gulf of St. Lawrence: micropaleontological and geochemical evidences.

Linda Genovesi , *Benoit Thibodeau* , *Anne De Vernal* , *Claude Hillaire-Marcel*
GEOTOP-UQAM
Contact: lindagenovesi@yahoo.ca

The deep waters of the Lower St. Lawrence Estuary (LSLE) and Gulf show a recent decrease in dissolved oxygen concentrations, which may be due to eutrophication and/or to a warming of incoming waters. In order to reconstruct variations in pelagic productivity and benthic conditions at centennial scale, we analyzed the micropaleontological and geochemical content of a sediment core (COR37BC) collected in the Laurentian trough of the Gulf of St. Lawrence (GSL). In this core, dinocyst assemblages and geochemical data (organic C, C/N, δ13Corg, δ15N) suggest uniform pelagic production and organic fluxes during the last centuries. However, significant changes are recorded in the benthic foraminiferal assemblages and isotopic composition of their shells. The decrease in abundance of Nonionellina labradorica concomitant with the increase of Oridorsalis umbonatus as well as the decrease of δ18O in the shells of Bulimina exilis indicate a warming of at least 1.5ºC of bottom waters in the past decades. Moreover, the occurrence of Brizalina subaenariensis and Cassidulina laevigata in the upper 10 cm of the core mark the recent decrease in dissolved oxygen concentrations. These results show that the recent oxygen depletion of bottom waters in the GSL is not directly related to an increase in primary productivity, as it was hypothesized in the LSLE. It rather seems to be the consequence of a warming in the bottom water layer which represents a mix of North Atlantic intermediate water and Labrador Current water. An enhanced relative contribution of the North Atlantic intermediate water and/or recent warming of sub-surface waters in the Labrador Sea and North Atlantic can be invoked.

1B6.2 ID:2380 11:15

Statistical Characteristics of the Interannual and Decadal Variability of the Water Masses in the Labrador Sea

Jennifer Mclarty , *Brad De Young* , *Entcho Demirov*
Department of Physics and Physical Oceanography, Memorial University of Newfoundland
Contact: entcho@physics.mun.ca

The thermohaline structure of the Labrador Sea (LS) has seen a distinct shift from the mean state over the last two decades. Decadal and interannual variability are not uniform

throughout the LS and define the variability of the entire LS water column. Using data comprising the entire hydrographic record of the LS from 1938-2006, we divide the LS into 22 separate regions and attempt to characterize the variability in the water masses using higher order moments calculated from the temperature and salinity fields. The skewness and kurtosis of the water mass anomalies exhibit non-gaussian characteristics both spatially and temporally. In addition to regionally quantifying the interannual and decadal variability, we examine the skewness and kurtosis of the hydrographic data to reveal physical processes influencing the hydrography of the Labrador Sea.

1B6.3 ID:2237 **11:30**

Dramatic changes in the dissolved 230Th water column profiles in Canada Basin between 1995 and 2007: a circulation signal?

Roger Francois , *Maureen Soon*
UBC
Contact: rfrancois@eos.ubc.ca

Earlier measurements of dissolved 230Th and 231Pa profiles in the Arctic Ocean, conducted in 1983 over the Alpha Ridge (85°50’N, 108°50’W), documented concentrations substantially higher than in any other ocean basins, reflecting very low particle flux and scavenging intensity under permanent ice cover (Bacon et al., 1989). In contrast, similar measurements conducted in 1995 in Canada Basin (72°32’N, 143°50’W, 3500 m) indicated much lower concentrations, reflecting higher rates of particle flux and particle scavenging (Edmonds et al, 1998). In November 2007, we measured dissolved 230Th and 231Pa at two stations off the eastern shelf of the Beaufort Sea (KC2000; 71°44’N, 135°30’W, 1925m; KC2700; 72°28’N, 136°56’W, 2490m) and compared these profiles to that obtained in 1995. While the earlier 230Th profile displayed a linear increase in concentration with depth, as predicted by a simple reversible absorption model which neglects water mass transport, the new profile obtained farthest offshore (KC2700) documents very large deviations from linearity, with a prominent maximum centered around 700m. The profile taken closer to the shelf (KC2000) does not show this feature. We suggest that the prominent maximum in 230Th concentration at KC2700 reflects recent changes in deep water circulation and the entrainment of older water from the permanently ice-covered Arctic interior into the warm Atlantic Water which is slowly penetrating into the eastern sector of Canada Basin. The contrasting 230Th profiles between KC2000 and KC2700 may provide additional information on the path of Atlantic water intrusion.

1B6.4 ID:2293 **11:45**

Dynamics of the Antarctic Circumpolar Current

Louis-Philippe Nadeau , *David Straub*
McGill University
Contact: louis-philippe.nadeau@mail.mcgill.ca

After flowing eastward through Drake Passage, the Antarctic Circumpolar Current (ACC) makes a sharp turn to the north, essentially becoming a western boundary current.

Early theories (Stommel, 1957) in fact appealed to basin-like Sverdrup dynamics and had the wind stress curl just north of Drake Passage determining the transport. This predicts a linear relationship between transport and the strength of the forcing. Numerical simulations, however, do not bear out such a relationship and basin-like theories have been called into question. Our study revisits the idea that basin-like dynamics are key to determining the transport. We carry out many simulations at eddy-permitting resolution in large domains over a range of forcing strengths. Results show three regimes. A non-zero minimum is found at very low wind stress. This is followed by two distinct dynamical regimes for stronger forcing: a Stommel phase and a saturation phase where the transport levels off. We find that the baroclinic structure of the Sverdrup flux into Drake Passage latitude band is key to explaining the observed results. This baroclinic structure is significantly modified by turbulence associated with zonal jet patterns. Characteristics, or geostrophic contours are used to predict the zonal extent of the jets as a function of latitude and their geometry allow to delimit the different dynamical regimes.

1B6.5 ID:2503 **12:00**

High resolution numerical model of canyon upwelling and comparison to laboratory experiments

Jordan Dawe , *Susan Allen*
Earth and Ocean Sciences, University of British Columbia
Contact: sallen@eos.ubc.ca

Numerical modelling of stratified flow over steep variable topography is of primary importance in coastal ocean modelling, particularly of the B.C. Coast. However, accurate modelling of such flows has proved difficult. Here we present a series of high resolution numerical models based on the MIT-gcm for flow over a submarine canyon. We will show that the velocity fields, both horizontal and vertical have converged, the bottom boundary layer has been resolved and that the flux in this boundary layer has converged. The maximum depth from which water upwells through the canyon and the volume flux of water upwelled through the canyon has converged. However, comparison with laboratory experimental results show significant differences in flow pattern, especially near the upstream rim of the canyon. We will discuss the reasons behind these differences.

1B6.6 ID:2272 **12:15**

Transport variability through the Yucatan Channel: the influence of the Florida Current and flow compensation around Cuba

Yuehua Lin [1], *Jinyu Sheng* [1], *Richard Greatbatch* [2]
[1] Dalhousie University
[2] The Leibniz Institute of Marine Sciences
Contact: Yuehua.Lin@phys.ocean.dal.ca

Water enters and leaves the Gulf of Mexico via the Yucatan Channel and the part of the Florida Current that flows between Cuba and Florida. Both observation and model results suggest that the transport through the Yucatan Channel on time scales of a month and

longer is influenced by both the upstream Florida Current and the intrusion of the Loop Current into the Gulf of Mexico in association with ring shedding. Model studies show that the transport variability associated with intrusion of the Loop Current is compensated by flow passing through the Windward Passage (enhanced transport through the Yucatan Channel) and between Cuba and the Bahamas (reduced transport through the Yucatan Channel) with relatively little affect on the variability of the Florida Current transport, a view that is consistent with the available observational data. Numerical experiments also show that the compensation effect results from the interaction between the density anomalies associated with Loop Current intrusion and the variable bottom topography.

1C1.1 ID:2374 14:00

Human-Induced Arctic Moistening

Seung-ki Min , Xuebin Zhang , Francis Zwiers
Climate Research Division, Environment Canada
Contact: xuebin.zhang@ec.gc.ca

The Arctic and the northern sub-polar regions are critical for climate change. Ice-albedo feedback amplifies warming in the Arctic, and fluctuations of regional fresh water inflow to the Arctic Ocean modulate the deep ocean circulation and thus exert a strong global influence. By comparing observations to simulations from 22 coupled climate models, we find anthropogenic influence in the space-time pattern of precipitation change over the northern high-latitude (north of 55ºN) land area during the second half of the 20th century. The human-induced Arctic moistening is consistent with observed increases in Arctic river discharge and freshening of Arctic water masses. This result, which is insensitive to the influence of the Arctic Oscillation, provides new evidence that human activity has contributed to Arctic hydrological change.

1C1.2 ID:2269 14:15

Coupled hydrologic-land-surface-atmospheric modelling for predicting freshwater flux to the arctic ocean.

Bruce Davison [1], Vincent Fortin [2], Al Pietroniro [2], Diane Holman [2], Dan Princz [2], Chris Spence [2]
[1] Environment Canada, Hydrometeorology and Arctic Lab
[2] Environment Canada
Contact: bruce.davison@ec.gc.ca

The Hydrometeorology and Arctic Laboratory (HAL) of Environment Canada in Saskatoon is a research and development lab dedicated to the improvement of water cycle prediction models and the appropriate use of their simulations. We work in collaboration with environmental scientists, project managers and computer specialists to develop and test experimental versions of numerical weather prediction, land-surface and hydrologic models. We also work with a variety of hydrologists and others interested in our model output to improve access to the information derived from the models. The presentation will introduce the work done at HAL and emphasize how our work will be applied within the context of the International Polar Year.

1C1.3 ID:2353 **14:30**

Recent trends in the timing and variability of river discharge in northern Canada

Jason Burford , *Stephen Dery*
University of Northern British Columbia
Contact: jasonburford@rogers.com

This talk will focus on recent trends in the timing and variability of observed river discharge in northern Canada. From a database of over 60 rivers from the Reference Hydrometric Basin Network (RHBN), the Mann-Kendall test is applied to assess trends on the annual and seasonal scales using 5-day (pentad) discharge for the latter half of the century onward. The study first focuses on changes in the timing of the spring snowmelt pulse and its spatial variation. Trends in the temporal variability of discharge are then discussed using moving averages of the annual and seasonal scale standard deviations in river discharge. Observed changes are placed in context of the different phases of large-scale teleconnections such as the PDO, ENSO and AO.

1C1.4 ID:2267 **14:45**

Quantifying the Fundamental Physical Responses of Great Bear Lake to Climate Variability and Change: Measurement and Modelling of Temperature and Fluxes

William Schertzer [1], *Wayne Rouse* [2], *Peter Blanken* [3], *David Lam* [1], *Ram Rao Yerubandi* [1], *David Swayne* [4], *Eddy Carmack* [5], *John Gyakum* [6]
[1] WS&TD, Environment Canada
[2] McMaster University
[3] University of Colorado (Boulder)
[4] University of Guelph
[5] Institute of Ocean Sciences
[6] McGill University
Contact: william.schertzer@ec.gc.ca

This multi-year IPY investigation is focused on: (a) understanding the current conditions on Great Bear Lake (GBL), (b) quantifying the response to climatic variability and, (c) projecting potential impacts of climate change. In an earlier study, Meyer et al. (1994) applied a 1-D temperature model with a GFDL climate scenario to GBL. They suggested that under climate warming, ice cover would be reduced from 82% to 65% of the year. Increased convective mixing in the lake during spring and autumn could alter its monomictic state to become dimictic with hydrophysical features similar to temperate lakes. The major limitation of the Meyer et al. (1994) analysis was the necessity to use climate data from Aklavik - nearly 650 km from GBL. The study drew attention to the paucity of data and knowledge on the fundamental physical responses of this northern lake to climate variability and change. In 2004-05, Rouse et al. conducted observations within the Keith Arm of GBL as a contribution to GEWEX-MAGS. The investigation quantified the magnitude and inter-annual variability of the surface heat flux, mass exchange and lake temperature adding knowledge to the baseline conditions. The study suggested that Great Bear Lake is very responsive to climatic variability, being influenced by the length of the ice-free season and absorbed solar radiation. The current

IPY study is an extension of the previous research. It will employ direct in situ intensive time-series of meteorological, radiation and limnological observations to provide the necessary spatial representation to describe the baseline physical conditions and for development and verification of thermal/hydrodynamic models to be applied to understand the impact of climate on this resource. This talk presents important results from past research and describes the multi-year field program, the challenging field deployments and modelling to be applied during the IPY investigation.

1C1.5 ID:2452 **15:00**

A study of the meteorological conditions associated with anomalously early and anomalously late openings of a Northwest Territories winter road

Katherine Emma Knowland , *John Gyakum* , *Charles Lin*
McGill University
Contact: katherine.knowland@mail.mcgill.ca

In the Canadian arctic, winter roads are engineered over the frozen land, rivers, and lakes. The strength and longevity of these roads depends on particular weather conditions. Our research focuses on the winter road between Tulita and Norman Wells, Northwest Territories, in existence since 1982. The opening dates for the winter road are statistically analyzed. Five extreme early-opening years and five extreme late-opening years are determined and subsequently compared to both surface weather observations and large-scale synoptic structures prior to the opening dates for these years. Results show extreme late years are strong El Niño seasons, and extreme early years are colder and have more precipitation during November, than the 1971-2000 climatology. The analysis of meteorological conditions near Norman Wells, associated with the extreme opening dates for this winter road, provides planners with more precise information germane to this road construction.

1C1.6 ID:2354 **15:15**

Using Water Isotope Tracers to Assess Hydrological Controls on the Water Balance of Lakes Across the Old Crow Flats, Yukon Territory

Kevin Turner [1], *Brent Wolfe* [2]
[1] PhD. Candidate, Geography and Environmental Studies, Wilfrid Laurier University
[2] NSERC Northern Research Chair, Geography and Environmental Studies, Wilfrid Laurier University
Contact: turner.kw@gmail.com

The Old Crow Flats (OCF) ecosystem, partially located within the southern region of Vuntut National Park in the northern Yukon Territory, contains over 2000 shallow thermokarst lakes and is a Wetland of International Significance (Ramsar Convention on Wetlands). For generations, traditional lifestyles of the Vuntut Gwitchin First Nation (VGFN) have been supported by the rich abundance of wildlife in the Flats, including moose, caribou, muskrat, and many species of waterfowl. However, reduced lake and river water levels over the past few decades have restricted access to traditional land and may have adverse effects on the ecosystem.

As part of a Government of Canada International Polar Year multidisciplinary research project examining the role of climate variability on the OCF ecosystem, water isotope tracers are being used to determine the relative importance of hydrological processes that govern present-day lake water balances. In 2007, 56 lakes were sampled during the spring-summer-fall seasons and analyzed for oxygen and hydrogen isotope composition. Preliminary results indicate that the water balances of lakes span a broad hydrological spectrum but can largely be classified into two groups: snowmelt-dominated and evaporation-dominated. Highlighted among our observations was the rapid drainage of a large (12 km2), evaporation-dominated lake of significant cultural importance to the local VGFN community of Old Crow. Based on climate and isotope data, substantial rainfall during spring 2007 may have increased the lake level, ultimately triggering rapid erosion of an outlet leading to the channel network that exports water from the Flats. Results from isotopic monitoring of OCF lake water balances over the next several years will be used to examine inter-annual hydrological variability. Paleohydrological reconstructions spanning decades to centuries will be derived from multi-proxy analyses of lake sediment cores from select basins. Ultimately, findings will contribute to ecosystem management and community adaptation plans to ongoing environmental change.

1C2.1 ID:2424 14:00

Development, evaluation and validation of a new Operational Air Quality Forecast Model: GEM-MACH 15

Louis-Philippe Crevier , *Sylvain Menard* , *Mike Moran* , *Donald Talbot*
(Presented by *Véronique Bouchet*)
Environnement Canada
Contact: louis-philippe.crevier@ec.gc.ca

Development and implementation of the next generation of Canada's operational Air Quality Forecast Model is underway at Environment Canada (EC). The goal of this project is the replacement in late 2008 of the current operational off-line air quality forecast model, CHRONOS, by a regional configuration of GEM-MACH, an on-line chemical transport model.

To construct GEM-MACH, chemistry modules are being implemented directly inside GEM, EC's operational multi-scale meteorological forecast model. The development of this model has lead to the creation of a chemical library along with a module to read and process atmospheric emissions. This new on-line air quality forecast model will be able to exploit EC's massively parallel supercomputer via the parallelism options (MPI) already implemented in GEM. Physical and chemical processes related to air quality will also be solved on GEM's native grid, thus reducing the number of spatial and temporal interpolations required compared to CHRONOS.

The current GEM-MACH chemistry uses the ADOM-II gas phase chemical mechanism for the processes involved in ozone formation. The physical and chemical treatment of the formation and evolution of aerosols, including those composing PM2.5 (breathable particulate material smaller than 2.5 microns) and PM10, will be improved over the basic bulk treatment used in CHRONOS : in the sectional approach, the particle size distribution is approximated by a discrete number of size sections in which the properties of all particles are assumed to be uniform.

Initial results of model testing and evaluation of the GEM-MACH 15 configuration expected to become operational during the fall of 2008 will be presented.

1C2.2 ID:2497 14:15

GEM LAM Modelling for Coastal British Columbia Air Quality Issues

Robert Nissen [1], *Colin Di Cenzo* [1], *Neil Mclennan* [1], *Hugo Landry* [1], *Donald Talbot* [1], *Xin Qiu* [2]
[1] Meteorological Service of Canada
[2] RWDI, Inc.
Contact: robert.nissen@ec.gc.ca

British Columbia's west coast has traditionally been perceived as having excellent air quality. Increases in marine transportation and the subsequent upward trend in sulphur emissions are causing concerns regarding air quality for major west coast ports. The Sulphur Emissions Control Area (SECA) Project is studying several sulphur reduction strategies, and air quality models are being employed to estimate the net effect of different scenarios. Due to the complex topography of the study area, high resolution meteorological inputs are required to realistically drive the air quality models. Actual observations of the area are limited, thus the Global Environmental Multiscale Limited Area Model (GEM LAM) is used to generate an approximate representation of the meteorology. This presentation describes various aspects of modelling using GEM LAM for this initiative. Commencing in January 2007, an archive is being populated using select outputs from the GEM LAM operational runs for southern British Columbia and Alberta. This archive will support future air quality and other atmospheric research projects.

1C2.3 ID:2493 14:30

CMAQ Modelling in Coastal Pacific Northwest with GEM-LAM Data

Xin Qiu [1], *Pierre-Olivier Dallaire* [1], *Martin Gauthier* [1], *Jeff Lundgren* [1], *Mike Lepage* [1], *Wayne Boulton* [1], *Colin Di Cenzo* [2], *Robert Nissen* [2]
[1] RWDI AIR Inc.
[2] Enviornment Canada, Pacific and Yukon Region
Contact: xin.qiu@rwdi.com

The Sulphur Emissions Control Area (SECA) air quality modelling project is focused on assessing the impacts of several sulphur reduction strategies for marine vessels. A comprehensive modelling study was undertaken over the BC coast to quantify impacts on air quality and acid deposition that would result from using different levels of sulphur content in marine diesel fuels. Crucial to this determination was the successful integration of highly resolved simulations of meteorological data from GEM-LAM over areas of complex mountainous terrain and marine environments, into a regional air quality modelling system (GEM-MCIP / SMOKE / CMAQ). A number of challenges in developing an interface between GEMLAM and CMAQ, including file formats, domain projections, variable mapping, recompilation, etc., were overcome.

Having undertaken a significant amount of effort to develop a GIS database of hourly emissions from marine vessels, CMAQ modelling was performed using the SAPRC-99 chemical mechanism and sea salt emission module. Results from a number of emission change scenarios were evaluated, both for the present and for the year 2020. Impacts on visibility, ambient levels of PM2.5, ozone, and ammonia, and on sulphur and nitrogen acid deposition will be presented.

1C2.4 ID:2224 **14:45**

High Resolution Wind Forecasting along the Coast of Nova Scotia

Matthew Corkum [1], *Hal Ritchie* [2], *Serge Desjardins* [3]
[1] Department of Oceanography, Dalhousie University, Halifax, Nova Scotia
[2] Environment Canada, Meteorological Research Division, Dartmouth, Nova Scotia
[3] Environment Canada, Meteorological Service of Canada, Dartmouth, Nova Scotia
Contact: matthew.corkum@phys.ocean.dal.ca

Currently, the Canadian Meteorological Center (CMC) runs the Global Environmental Multiscale (GEM) model with horizontal resolution of 15 km over North America. This model does a reasonable job at resolving large scale wind and other meteorological features; however the model with 15 km horizontal resolution does not resolve wind features well over sharp topography and steep coastlines. A Limited Area Model (LAM) version of the GEM 15 km is currently run over the Eastern Canada area and used to initiate and provide boundary conditions for an experimental GEM-LAM 2.5 km. The output of the newly implemented GEM-LAM 2.5 km is used to drive a microscale model which downscales the coarser model and combines high resolution topography and roughness (as high as 20 m resolution) to produce surface wind forecasts with horizontal resolution of about 200 m. The region where this model is being tested is a central region of Nova Scotia on the east coast of Canada. Validation of this Meso/Microscale Coupler (MMC) model will be presented using idealized winds, real data from buoys and weather stations located within the domain, as well as radarsat images of the area.

1C2.5 ID:2398 **15:00**

Application of high resolution GEM-LAM in marine fog prediction: diagnosis

Duo Yang [1], *Hal Ritchie* [2], *Serge Desjardins* [3], *Garry Pearson* [3], *Allan Macafee* [3]
[1] Dalhousie University
[2] Meteorological Research Division, Environment Canada
[3] National Lab for Marine and Coastal Meteorology, Meteorological Service of Canada
Contact: duo.yang@phys.ocean.dal.ca

Last year we presented a preliminary evaluation of real-time fog prediction using a high resolution GEM-LAM configuration (a limited area version of the Global Environmental Multiscale Model with a resolution of 2.5 km). As a component of the Lunenburg Bay Multidisciplinary Modeling System, this high resolution model was implemented for real-time fog prediction in cooperation with the FRAM (Fog Remote Sensing and Modeling) field experiment and is now running daily and being evaluated by the Atlantic Storm Prediction Centre. In this study our objective is to examine this model's marine fog prediction capabilities, and particularly the sensitivity to new physical parameterizations for high resolution modeling. Several more case studies have been performed and carefully examined. The condensation scheme that directly generates the cloud liquid water content (or fog) and boundary layer processes (such as MoisTKE) that lead to the vertical redistribution of the cloud liquid water content are important factors that influence marine fog prediction. We also found that there is a significant contribution from their interactions with the radiation scheme that interacts fully with clouds. As well, there is a non-negligible impact from input fields including sea surface temperature, the pilot fields (initial and boundary conditions) and geophysical fields. Some aspects of the diagnosis will be presented. The implication of the work for the two-way coupling between GEM-LAM and an ocean model will also be briefly mentioned.

1C2.6 ID:2561 15:15

Comparison of Precipitation from Weather Prediction Models and Radars Using a Multicategory Approach

Slavko Vasic , *Charles Lin* , *Isztar Zawadzki*
McGill University
Contact: slavko.vasic@mcgill.ca

In this study, we performed a further comparison of the model and radar hourly accumulated precipitation fields over the central and eastern United States. The main aim was acquiring additional and more precise information on the predicting performance of the GEM and Eta weather prediction models, especially those not offered by some statistical methods earlier applied in our studies. Hence, we examined the same set of precipitation fields that is considered in our recent studies.

This study reports the results of a multicategory forecast approach used in comparison of the model and radar fields. The joint, conditional and marginal probabilities of the predicted and observed precipitation fields are in the focus. Reported probabilities are the result of the carefully balanced compromise made between the reduced dimensionality and the completeness of the verification problem. Thus, the results obtained on the chosen number of the forecast and observation precipitation categories offer good information of the model predicting performance. Considerable differences between results of the present approach and earlier used conventional approaches are revealed; here we mention skill measure of model forecasts, and frequency distributions of the observed and the model predicted precipitation. As defined for each precipitation category, the results of the present approach are more rigorous than results from conventional approaches. Overall, the results of the present study emerged to be reliable, i.e., a multicategory approach enables very precise comparison of model forecasts with observations.

1C3.1 ID:2342 INVITED/INVITÉ 14:00

Major Drought from a Hydropower Perspective

Bill Girling
Manitoba Hydro
Contact: wcgirling@hydro.mb.ca

Large-scale, persistent drought events have a significant impact on hydropower systems and in fact form some of the fundamental planning and operating criteria for most of the major hydro-based utilities in Canada and abroad.

This presentation will focus on the impact of basin-wide drought on Manitoba Hydro's system, the importance of research in understanding the major climate drivers that produce these extreme events, and the potential impact of climate change on future drought events.

1C3.2 ID:2385 **14:15**

Comparing future/historical GCM climate moisture variability simulations to observed and dendroclimatic records

Suzan Lapp , Elaine Barrow , Dave Sauchyn
PARC
Contact: lapp200s@uregina.ca

Climate change will have a significant impact on regional water balances, but there is a relatively large range of precipitation projections from Global Climate Models (GCMs). Variability in future climate will include natural climate cycles and modulation of these cycles by the effects of global warming. Proxy hydroclimate records derived from tree-rings provide information on decadal and multidecadal hydroclimatic variability for the past millennium, providing a unique opportunity to validate the climate variability simulated by GCMs. Reconstructions of annual and seasonal climate moisture from tree rings for the past 500 years for sites in Montana, Alberta, Saskatchewan and NWT show previous centuries with drought events more extreme in magnitude, frequency and duration than recorded during the instrumental period. These drought events likely are associated with various natural climate forcings, specifically changes in sea surface temperature (SST) and different phases of Pacific Decadal Oscillation (PDO) or Atlantic Multidecadal Oscillation (AMO). The dominant atmospheric circulation patterns that govern the annual/seasonal climatic conditions in western North America have been linked to specific SST anomalies. Previous studies (e.g. Byrne et al., 1999; Lapp et al., 2002) have documented variability in these atmospheric circulation patterns over space and time, and have shown the linkages between the variations in synoptic pattern frequency/duration and precipitation. The key objectives of this work are to: 1) develop links between modes of climate variability and periodicities in moisture reconstructions derived from tree-ring data from southwestern Alberta; 2) compare climate variability modes identified in GCM control runs to observed and proxy climate variability; 3) identify the dominant seasonal circulation patterns using NCEP/NCAR reanalysis data and reconstruct using proxy data; 4) compare observed and reconstructed circulation patterns to GCM control and 20th Century experiments; and, 5) derive a composite time

series of future climate moisture natural variability for the study area.

1C3.3 ID:2334 **14:30**

A tale of two extremes: An extreme rain event that occurred during an extreme drought episode over the Canadian Prairies

Kit Szeto [1], *William Henson* [2], *Ronald Stewart* [2], *Gabrielle Gascon* [2], *Billy Szeto* [3]
[1] Climate Research Division, Environment Canada, Downsview ON
[2] Department of Atmospheric and Oceanic Sciences, McGill University, Montréal, Québec
[3] Department of Physics, U. Waterloo
Contact: kit.szeto@ec.gc.ca

A catastrophic rain storm struck the Prairies of Canada in June 2002. The return period of a rain event of the extent of the June 2002 rainstorm was found to be 258 or 1,486 years depending whether the event is included or not. This rainstorm brought a several month long break to the southern part of the Canadian Prairies from a multi-year drought that had begun in 1999. The extremeness of the event was diagnosed to be the result of the complex interplay between the unique combination of background synoptic features and the topographic setting of the region. The uniqueness and rarity of the synoptic settings that gave rise to the extremeness of the system will also be examined in the context of warm-season storm climatology and precipitation dynamics for the Canadian Prairies. In addition, prediction issues related to such an extreme rain event and the potential impacts of the event on the evolution of the background widespread severe Prairie drought will also be discussed.

1C3.4 ID:2477 **14:45**

Analysis of Cloud Fields During the Recent Prairie Drought

Heather Greene , *Henry Leighton* , *Ronald Stewart*
McGill University
Contact: heathergreene62@gmail.com

Little is known about clouds during drought and recently the Canadian Prairies experienced one of the most severe and prolonged droughts in its climatological record. Through focusing on this recent 1999-2004 drought, the objective of this study is to characterize and better understand clouds and their associated radiative properties during drought.

Information on clouds is now readily available from satellite data as far back as the early 1980's. Cloud properties available from NASA/GEWEX's Surface Radiation Budget (SRB) were used to examine overall cloud amount at various levels in the atmosphere. In addition, optical thickness, cloud base pressure and top-of-the-atmosphere albedo were investigated over the region. Drought severity was determined using the Standardized Precipitation Index (SPI) and it was developed using Environment Canada's gridded precipitation dataset, CANGRID.

Preliminary analyses of cloud cover throughout the Canadian Prairies have shown that,

although cloud amounts differ slightly from dry to wet conditions (approximately a 10% increase in cloud cover fraction from 63% when severely dry to 73% when severely wet), they are only weakly correlated with the amount of precipitation. The occurrence of thin clouds was shown to increase as drought severity increased, whereas the occurrence of medium thickness clouds as well as thick clouds was shown to decrease. Similar trends were found when investigating particular case studies, including the areas surrounding Fort McMurray, Regina, and Medicine Hat. These locations endured exceptionally severe and prolonged drought over the 1999-2004 period.

Overall, clouds are a critical, yet under-studied, aspect of the drought environment and this study is contributing to rectifying this situation.

1C3.5 ID:2562 **15:00**

Thunderstorm-Drought Links

Geoff Strong
Adjunct Prof., Earth & Atmospheric Sciences, University of Alberta
Contact: geoff.strong@shaw.ca

Short-term trends in surface moisture cycling are linked to convective outbreak periods, emphasizing the importance of local evapotranspiration in convective storm processes. During drought conditions, when soil moisture drops below the wilting point and plants can draw little water from the soil, the diurnal evapotranspiration cycle is interrupted so that moisture cycling, as well as convective storm processes are curtailed or terminated. Storms that do form during drought conditions tend to remain just outside the region of most severe drought.

Analogous to this, many Alberta severe thunderstorms form over the foothills in conjunction with a dryline, which is essentially a summer Chinook effect. Drylines transfer momentum and dry air down onto the foothills through orographic subsidence in a southwest flow aloft, when surface cyclogenesis is also taking place over south-central Alberta. The dryline interacts with moist air converging over the foothills due to the cyclogenesis, helping to initiate the storm.

These two dry processes, acting at different time and space scales, appear to be related in terms of dynamics, and may provide mutual clues to both drought initiation/cessation and thunderstorm genesis. Results from several different field data sets will be discussed.

1C3.6 ID:2270 **15:15**

Verification of the prairie agro-meteorological model against in-situ soil moisture and eddy-covariance data: Model sensitivity to soil hydraulic parameters and minimum stomatal resistance

Julian Charles Brimelow [1], *John Hanesiak* [1], *Richard Raddatz* [1], *Masaki Hayashi* [2]
[1] Centre for Earth Observation Science, University of Manitoba
[2] Department of Geoscience, University of Calgary

Contact: umbrimel@cc.umanitoba.ca

Crops on the prairies exert an important control on the seasonal variability of regional moisture fluxes, which in turn can affect the timing, location and intensity of thunderstorms. Thus, soil moisture needs to be simulated correctly to produce accurate predictions of thunderstorm formation. A useful tool for modeling soil moisture is the prairie agro-meteorological model (PAM-II). The objective of this study was to establish the model's ability to reproduce soil moisture below native grasses and a barley field at five sites in Alberta for contrasting years between 1999 and 2005. In addition, at the barley site and one grassland site (Lethbridge), model predicted daily ET was verified against daily ET estimates from eddy- covariance systems. The model was found to perform well, although sensitivity tests indicated that the model performance was strongly modulated by the specified soil hydraulic properties and minimum stomatal resistance. Further, a literature review indicated that there is a wide range of water retention characteristics for each soil textural class depending which pedo-transfer function (PTF) one uses. We hypothesized that this model sensitivity to the hydraulic parameters could, in part, be addressed by adopting a multi-model ensemble approach. In all, 20 PTFs were identified for the purpose of specifying the water retention characteristics. It was found that while no single PTF consistently produced superior results, when PAM-II was run using the mean water retention characteristics of the 20 PTFs it consistently produced superior results than the control. Following model sensitivity tests, new reference values for minimum stomatal resistance for grassland and cereal crops were proposed. Using these new reference values markedly improved the model's performance at both the grassland and cereal sites. For the first time, the multi-model ensemble approach and minimum stomatal resistance sensitivity tests allowed us to quantify the uncertainty associated with the model's output.

1C4.1 ID:2247 14:00

Quantifying the spatial and temporal variation of ground-level ozone in the Annapolis Valley, Nova Scotia, Canada using nitrite-impregnated passive samplers

Mark Gibson [1], *Judy Guernsey* [1], *Jeffrey Brook* [2], *Stephen Beauchamp* [2], *David Waugh* [2], *Robert Maher* [3], *Johnny Mcpherson* [4], *Barb Bryden* [4], *Richard Gould* [5], *Graham Gagnon* [1], *Mikiko Terashima* [1]

[1] Dalhousie University
[2] Environment Canada
[3] Centre of Geographic Sciences
[4] Nova Scotia Department of Environment and Labour
[5] Annapolis Valley Health Authority
Contact: mark.gibson@dal.ca

The aims of the research were to determine the spatiotemporal variability and to examine the factors controlling ground-level ozone (GLO) in the Annapolis Valley, Nova Scotia. Measurements were made using nitrite impregnated passive diffusion samplers (PS) from 29 August 2006 to 28 September 2007. 353 passive sampler measurements were taken at 17 ambient sites and 1 indoor location over 18 sampling sessions (3 x 14 days, 11 x 21

days and 4 x 28 days). The mean ambient annual GLO concentration observed was 34.3 ± 10.1 (σ) ppbv. The maximum and minimum GLO concentrations observed were 72.1 and 7.7 ppbv respectfully. There was a significant difference (p=0.032) observed between three Valley floor sites and three elevated sites, having higher concentrations. The mean indoor GLO concentration was 5.4 ± 3.3 ppbv. There was good agreement between three sets of paired samples (R2 = 0.88, 0.95 and 0.96 respectfully). The PS imprecision was 5.4% with a detection limit of 0.8 ± 0.02 ppbv over a 14 day sampling period. Comparison between PS and automated continuous ozone analyzers at three sites returned R2's of 0.82, 0.95 and 0.95. A simple model was developed to predict annual GLO in the region over 5 significantly different (p<0.000) time scales: GLO = 1.25x2 + 1.47x +17.78, R2 = 0.985. There was good agreement between observed GLO concentration and elevation (R2 = 0.82). The following multivariate model was used to parameterize the observed GLO concentrations in the region in terms of meteorology: GLO [ppbv] = 287 – 6.05α – 1.75 δ + 2.74 μ + 0.642ε – 1.97θ where α = visibility, δ = wind direction, μ = wind speed, ε = temperature and θ = relative humidity. The relationship between ambient and indoor GLO concentrations can be described by the following equation: indoor = 0.338xambient – 5.074

1C4.2 ID:2248 **14:15**

Toward a Wildfire Smoke Forecasting System in Canada: The Bluesky Western Canada Pilot Project

Steve Sakiyama
British Columbia Ministry of Environment
Contact: Steve.Sakiyama@gov.bc.ca

Smoke from wild fires can have significant air quality impacts over huge areas. This can have major implications on transportation, tourism and human health for example. The Edmonton Smoke Forecasting Workshop (2007) clearly indicated that the public, operational meteorologists, transportation operators and the medical community are just a few of the sectors that need to know current and forecast smoke-impacted areas along with their corresponding air pollution concentrations.

This paper presents an overview of the progress to date on the development of a Smoke Forecasting System (SFS) for British Columbia and Alberta. Co-ordinated partnerships were established between Canadian agencies, the University of British Columbia (UBC) and the US Forest Service as the development of such a system requires a wide range of data, tools and expertise. The US Forest Service has provided a computer loaded with their "Bluesky-RAINS" SFS software. High resolution, MM5 model output currently operational at UBC provides the forecast meteorology for B.C. and Alberta. The source emissions module involves satellite derived information combined with forest inventory data to estimate fuel consumption. The Bluesky computer, residing at UBC, will process the source and meteorological data and output forecasted smoke plume trajectories and PM2.5 concentrations to a GIS-based graphical display. More details will follow in a Smoke Forecasting workshop Monday evening.

1C4.3 ID:2240 **14:30**

The Impact of Agricultural Burning on Air Contaminant Concentrations in the Creston Valley of British Columbia.

Stephanie Meyn , *Selena Farris* , *Roxanne Vingarzan*
Environment Canada
Contact: Stephanie.Meyn@ec.gc.ca

An air pollution monitoring station was established near the Idaho-British Columbia border in the Creston Valley of B.C. in 2005 as part of the Border Air Quality Study under the U.S.-Canada International Airshed Strategy. Continuous measurements of PM2.5, O3, NO, NO2, and SO2 were obtained at this site between 2005 and 2007.

This paper will present the findings from air pollution monitoring conducted since 2005, with an emphasis on the agricultural burning seasons. Results will show that pollutants are re-circulated in the valley across the Canada-US border on a near-daily basis during the burning season based on local surface wind data. Results also show that while average PM2.5 concentrations are low (4.6 ug/m3), they are above background levels at this location, and subject to frequent "spikes" during burning events. The impact of local- to regional-scale burning, as well as wildfires on all contaminant concentrations is also presented. The impact of the 2007 agricultural burn ban in the State of Idaho on air quality and trans-boundary impacts will be highlighted.

1C4.4 ID:2277 **14:45**

Cold Temperature Ozone Production in a Mountain Basin

Russ Schnell [1], *Ryan Neely* [2], *Samuel Oltmans* [2]
[1] NOAA ESRL GMD, Boulder, CO USA 80303
[2] NOAA ESRL GMD, Boulder, CO 80303
Contact: russell.c.schnell@noaa.gov

Rapid, diurnal, wintertime, cold temperature photochemical ozone production at temperatures as low as -15C has been observed to occur regularly in the rural Upper Green River Basin, Wyoming, USA during sharp temperature inversion events. In these events, hourly average ozone concentrations rise from 10-20 ppb at sunrise to 120 ppb shortly after solar noon across 100s of km2 in and near the Jonah-Pinedale Anticline gas field. The ozone concentrations rapidly decrease as the sun sets. These daily photolytic ozone concentrations approach the U.S. Environmental Protection Agency (USEPA) 8-hour average concentration exceedance level of 84 ppb. Violations may result in regulatory curtailment of wintertime production in the gas field that produces at least 17 million m3 yr-1 (600 mfc) of natural gas, enough to supply the energy needs of 3 million US homes and valued at about U$ 3 billion/yr. Surprisingly, these very high ozone concentrations occur well outside the April to October time of the year for which USEPA ozone regulatory measurements are required. Similar geographic and meteorological conditions exist in Canadian and Russian gas and oil fields.

1C4.5 ID:2401 **15:00**

Comparison of WRF and MM5 simulations for Air Quality Applications in Alberta Valleys

Yan Shen
Air Quality Scientist, Air Quality Group, Jacques Whitford AXYS, Calgary AB
Contact: yshen@jacqueswhitford.com

Valleys in Alberta oil sands area presents challenges for air quality modeling: complex terrain and a great variety of oil sands industrial emissions sources. Producing better meteorological model forecasts is useful for improving the prediction of air pollutants over this region. In this study, the CALMET/CALPUFF meteorological and air quality modeling system is used along with the WRF version 2.2 and MM5 version 3.7 to study the importance of using very high resolution meteorological model to provide the necessary data for dispersion modeling work. Also, regarding the eventual replacement of MM5 by the WRF model, we have started the effort to compare WRF and MM5 simulations for air quality applications. Results of selected scenarios will be presented

1C5.1 ID:2436 **14:00**

Canadian Airport Nowcasting (CAN-Now)project: First results and plans for future

George Isaac , *Monika Bailey* , *Faisal Boudala* , *Stewart Cober* , *Norman Donaldson* , *Sylvie Gravel* , *Ismail Gultepe* , *David Hudak* , *Alister Ling* , *Paul Joe* , *Janti Reid* , *Gilles Simard*
(Presented by *G.a. Isaac*)
Environment Canada
Contact: george.isaac@ec.gc.ca

The Canadian Airport Nowcasting Project (CAN-Now) is developing an advanced prototype all-season weather forecasting and nowcasting system that can be used at major airports. This system uses numerical model data, pilot reports, ground sensor observations (precipitation, ceiling, visibility, winds, etc) as well as remote sensing (satellite, radar, radiometer) information to provide detailed nowcasts out to approximately 6 hours. The nowcasts, or short term weather forecasts, should allow decision makers at airports such as pilots, dispatchers, de-icing crews, ground personnel or air traffic controllers to make plans with increased margins of safety and improved efficiency. The system is being developed and tested at Toronto Pearson International Airport (CYYZ) with plans to extend the project to include Vancouver International Airport (CYVR) and ultimately other HUBs such as Calgary and Montreal. The Nowcasting concepts will also be applied in a research mode during the Vancouver 2010 Olympic and Paralympic Winter Games. The preliminary displays being tested will be discussed along with initial evaluations. Plans for future work will also be described including the difficulties associated with designing the system products, testing, validating, and implementing them operationally.

1C5.2 ID:2484 **14:15**

Adjusting Numerical Model Point Forecasts for Nowcasting at Pearson Airport

Monika Bailey , *George Isaac* , *Janti Reid* , *William Burrows*
Environment Canada
Contact: monika.bailey@ec.gc.ca

The Canadian Airport Nowcasting Project (CAN-Now) is a prototype nowcasting system for forecasting all-season weather at major airports. It is being tested at Toronto Pearson International Airport (CYYZ). The system focuses on forecasting aviation related parameters out to 6 hours at short time intervals. Data from multiple sources are used: hourly meteorological observations, model data (at 30 min and less resolution), radar, satellite, and measurements from a large suite of on-site instruments measuring visibility, precipitation, ceiling, and winds every minute. UMOS corrected model data are not currently available for the required variables at the time resolution desired. This paper focuses on methods for improving model-based short term forecasts at a single location. The forecast variables tested were temperature, humidity, winds and ceiling. The model data available were GEM Regional Model Output Location Time Series (MOLTS) data at 30 minute intervals and GEM LAM MOLTS data at 5 minute intervals, for Pearson and 16 surrounding alternate airports. Model errors (that is, model value minus observation value) are seen to be persistent for several hours. A simple error persistence adjustment to the model improves the mean absolute error of forecasting for up to 4 hour lead times. Simple persistence appears to show improvements over model predictions for about 2 hours. Further adjustments for the bias, and model error trend predictions using least squares predictors are described. The results are compared with both the raw model forecasts and standard observation persistence forecasts. The performance is examined on both a seasonal basis and for individual events. Also discussed is the possible use of the model error and its trend as part of a decision tool to decide when the model is no longer reliable for short term forecasts.

1C5.3 ID:2451 **14:45**

A short-term verification of GEM and RUC model parameters for the Canadian Airport Nowcasting (CAN-Now) Project

Janti Reid , *George Isaac* , *Monika Bailey* , *Lawrence Wilson*
Environment Canada
Contact: Janti.Reid@ec.gc.ca

The primary objective of the Canadian Airport Nowcasting Project (CAN-Now) is to develop an advanced four-season forecasting system which should assist airport decision makers to make decisions that have increased margins of safety and/or improve efficiency at the airport. For this project, Toronto Pearson International Airport (CYYZ) has been chosen to demonstrate such a system. Key inputs into this system are data from the GEM Regional (GEM REG), the GEM Limited Area Model (GEM LAM) and the NOAA Rapid Update Cycle (RUC) model. Hourly surface observations from CYYZ and 16 surrounding airports from July 2007 to March 2008 are compared against output from the three models. Verification of weather parameters corresponding to temperature, relative humidity, wind speed, wind direction, ceiling, cloud and precipitation occurrence is performed. For temperature, RH and winds, model errors are tabulated and organized in the following way: differences between the models and observations are calculated at

each hour and then grouped by time of day. The data are then averaged to produce a mean absolute and mean error per hour. Presenting the results in this manner has several advantages. First, it allows potential users such as aviation forecasters to more easily assess the relative performance of each model at different points throughout the day. Secondly, it may expose any diurnal trends or biasing that might exist in the models. Finally, a comparison of RUC model errors grouped by forecast hour may provide evidence to the benefits of rapidly updated models. In addition to these errors, confidence limits for the temperature, RH and wind errors are calculated using a standard non-block bootstrapping technique. For ceiling, cloud and precipitation occurrence variables, a set of categorical verification statistics are employed. Based on 9 months of data, the results of this short-term verification, including preliminary conclusions and limitations, are presented.

1C5.4 ID:2575 15:00

Explicit Forecasting of Icing Conditions with the GEM Model

André Plante [1], *Jason Milbrandt* [2]
[1] Centre météorologique canadien, Environment Canada
[2] Recherche en Prévision Numérique, Environment Canada
Contact: andre.plante@ec.gc.ca

The presence of supercooled liquid water (SLW), which freezes immediately upon contact with solid objects, is a constant concern for aviation due to the danger of aircraft icing. Numerical model guidance for the prediction of the location and timing of the occurrence of SLW in the atmosphere is therefore of great importance. The various configurations of the Canadian GEM forecast model are capable of forecasting the potential for SLW.

In the regional configuration of the model, the GEM employs the Sundqvist cloud scheme, which has a single prognostic variable for non-precipitating condensed water (liquid or solid). The regional GEM also applies an extension of the Bourgouin method to produce 3-D diagnostic output fields for the following precipitation types: rain, freezing rain, snow, and ice pellets. This diagnostic method can be used to infer SLW. In the high-resolution (LAM) configuration, the GEM uses the recently implemented Milbrandt-Yau microphysics scheme to treat grid-scale clouds. In this scheme, there are separate prognostic variables for two liquid-phase and four ice-phase hydrometeor categories. The prediction of SLW is thus more explicit in the LAM configuration of the GEM.

Details will be provided and examples will be presented on how both the regional and LAM configurations of the GEM model can provide forecasts for the 3-D SLW fields and how these forecast fields can be used as numerical guidance for regions with potential danger for aircraft icing.

1C5.5 ID:2332 15:15

Monitoring and data assimilation of moisture from aircrafts

Iriola Mati , *Real Sarrazin* , *Gilles Verner* , *Yulia Zaitseva* , *Jose Garcia*

Environment Canada
Contact: iriola.mati@ec.gc.ca

Moisture data from upper-air is important information for weather forecasting and warnings of high impact events for human activities. This work is carry out under Search and Rescue NEW Initiative Fund (SAR NIF). The purpose of this study is to examine the impact of moisture data from aircrafts into the Numerical Weather Prediction system at Canadian Meteorological Centre (CMC). The data are collected from aircrafts participating in the Great Lakes Fleet Experiment (GLFE), equipped with Tropospheric Airborne Meteorological Data Report (TAMDAR) instruments measuring relative humidity, and from the UPS AMDAR and 3 European Lufthansa aircrafts, equipped with the second generation water vapor sensing system (WVSSII) measuring the mixing ratio. The variables we use are the dew point depression and the logarithm of the specific humidity. The last one is the control variable in the CMC analysis program. The monitoring procedure consists on the statistics of observation minus first guess for moisture observations. For assimilation experiments, we run regional assimilation cycles that are initialized from the global GEM analysis with a 33km resolution. Then, the regional analysis is used to start a 48 hours forecast of the regional GEM model with 15km resolution. Here we provide the results of data quality monitoring and data assimilation for moisture from aircrafts.

1C6.1 ID:2264 **14:15**

Examining the Effect of Stratification on Tidal Circulation over the Scotian Shelf using a Three-dimensional Coastal Circulation Model

Kyoko Ohashi [1], *Jinyu Sheng* [1], *Keith Thompson* [1], *Charles Hannah* [2], *Hal Ritchie* [3]
[1] Department of Oceanography, Dalhousie University
[2] Bedford Institute of Oceanography, Fisheries and Oceans Canada
[3] Meteorological Research Division, Environment Canada
Contact: kyokoohashi@gmail.com

A three-dimensional coastal circulation model of the Scotian Shelf and the Gulf of St. Lawrence, known as DalCoast3, is used to examine the effect of the seasonal change in water column stratification on the M2 and K1 tidal circulation. The model is forced at its lateral open boundaries by tidal elevations and depth-averaged currents from a barotropic tidal prediction model developed at the Bedford Institute of Oceanography (BIO). The tidal currents simulated by DalCoast3 are similar to those predicted by the BIO tidal model over the DalCoast3 model grid, and are also consistent with observations. We examine two mechanisms by which stratification affects tidal circulation: the horizontal pressure gradient and vertical mixing. For the M2 constituent, variation of the horizontal pressure gradient due to the development of stratification affects the tidal circulation along the shelf break and over deep waters, while in other locations (e.g. Northumberland Strait, Bay of Fundy), the variation in vertical mixing due to seasonal stratification plays an important role. For the K1 constituent, both mechanisms are important near Sable Island and the Magdalen Islands, while the effect of stratification on vertical mixing appears to affect the same areas as for the M2 constituent (except for the Bay of Fundy).

1C6.2 ID:2390 **14:30**

Numerical Study of Circulation and Hydrodynamic Connectivity on the Mesoamerican Barrier Reef System using a Nested-Grid Ocean Circulation Model

Jinyu Sheng
Department of Oceanography, Dalhousie University
Contact: jinyu.sheng@dal.ca

A nested-grid ocean circulation modelling system was used to examine the impact of category-5 Hurricane Mitch on the upper ocean of the Mesoamerican Barrier Reef System (MBRS) in October 1998. The nested-grid system uses the two-way nesting technique based on the semi-prognostic method and has a coarse-resolution (~19 km) outer sub-model covering the western Caribbean Sea (WCS), an intermediate-resolution (~6 km) middle sub-model covering the MBRS, and a fine-resolution (~2 km) inner sub-model covering the northern coast of Honduras and the Bay Islands. The nested-grid system was forced by 6 hourly NCEP/NCAR winds for the first 294 days prior to the arrival of the hurricane in the MBRS, and then by the combination of the NCEP/NCAR wind forcing and an idealized vortex representative of Mitch for the following 20 days. The system was also forced by the monthly mean sea surface heat and freshwater fluxes and buoyancy forcing associated with major river discharges and storm-induced precipitation in the WCS. The simulated upper-ocean circulation during Mitch is characterized by strong and divergent currents under the storm and intense near-inertial currents and sea surface temperature cooling behind the storm. The nested-grid system also reproduced the buoyant estuarine plumes extending from the coast off Honduras as inferred from SeaWiFS satellite data. The model-calculated currents were used to the trajectories of near-surface particles that are carried passively by the ocean currents. The model results demonstrate that larger-than-normal dispersion and hydrodynamic connectivity in the MBRS during Mitch.

1C6.3 ID:2346 **14:45**

Extracting both water and fish velocity from Doppler profiler data

Len Zedel [1], *Francis-Yan Cyr-Racine* [2]
[1] Memorial University of Newfoundland
[2] McGill University
Contact: zedel@physics.mun.ca

Under certain circumstances, the movement of fish through the water can bias Doppler velocity profiles. Algorithms exist in Doppler profiler firmware that allow detection (and rejection) of such data. We take a different perspective on this problem and recover both fish and water velocities. Such data separation has been demonstrated in the past but only where the Doppler profiler detected fish simultaneously in all of the acoustic beams: water speeds could not be extracted at the same time. We present a new approach where data from individual depth bins and beams are sorted based on calibrated backscatter strength as being either characteristic of fish or of water. A least squares algorithm is then used to reconstruct velocity profiles from both fish and water components for the same time interval. The method will work even with low occurrences of data (fish or water)

and it explicitly provides an uncertainty in the final velocity estimates. The abilities of the method are demonstrated using observations of over-wintering Atlantic Cod in Smith Sound, Newfoundland.

1C6.4 ID:2348 **15:00**

Can rates of snowfall be estimated by measuring ocean noise levels?

Tahani Alsarayreh , *Len Zedel*
Memorial University of Newfoundland
Contact: zedel@physics.mun.ca

It has been established that ocean rainfall rates can be measured by recording underwater sound levels. The method has the advantage that no surface instrumentation is required and the sampled area is large with a footprint dimension comparable to the instrument deployment depth. Snow also has been observed to generate sound when it falls on water but there has been no systematic study of sound level dependence on snow type or snowfall rate. We report on a series of laboratory experiments that record sound levels for snowfall in a 0.6 x 0.6 x 0.8 m tank. The results indicate that snow types with a three-dimensional structure make sound while planar crystalline varieties do not. For those snow types that do make sound, there is a characteristic peak at a frequency of 12 kHz (similar to the peak made by some rain types). In the data presented, the snow types that do not make sound are not associated with high snowfall rates and overall sound levels do correlate with snowfall rate. These preliminary results suggest that ocean noise levels may provide a means of measuring snowfall rates in the ocean.

1C6.5 ID:2611 **15:15**

The Influence of Climate Changes on the Adriatic Sea along the Albanian Coast

Bruno Lumaj
University of Tirana
Contact: lumaj.bruno@gmail.com

Results from the simulations with the regional climate atmosphere model were used to force two versions of process oriented models for the Albanian Adriatic Sea – one time dependent, the other considering the mean state. The purpose was primarily to obtain a first scenario of the future state of the sea. In addition, we looked at this research as a method to evaluate the consistency of the water cycle and the heat balance produced by atmosphere climate models on the Adriatic Region. The regional climate atmosphere model is a high resolution model which is forced with lateral conditions from a global model. A large scale Adriatic drainage basin hydrological model, forced by regional climate atmosphere model, was used to simulate river run off. Using climate model data from the control run we found that the temperature and climatic conditions in the sea were reasonably realistic while salinity field was poorly reproduced. We conclude that the modeling of the water cycle in the Albanian Adriatic Sea needs further improvement. We also conclude that the time for the Adriatic Sea to respond to the water cycle is longer than the integration period so far used with the regional climate atmosphere model. Forcing the ocean models with climate model data from a future scenario with an

enhanced greenhouse effect gives an increased sea surface temperature due to climate warming. Also the salinity is reduced, which implies possible serious effects on the future marine life in the Adriatic Sea. Based on an overview of the coastal waters of Albania, their peculiarities and unique management problems under expected change of socio-natural systems, the management strategy would aim to adopt an improved multi-criteria approach. The strategy would discuss the advantage of implementing the most efficient methods for data capture, integration, analysis and modelling for the assessment of impacts deriving from climate changes and development scenarios.

1D1.1 ID:2369 **16:00**

Variability and Change in the Canadian Cryosphere: Early Results from a Canadian Science Contribution to International Polar Year

Anne Walker
Climate Research Division, Environment Canada
Contact: anne.walker@ec.gc.ca

The cryosphere (snow, permafrost and seasonally frozen ground, ice caps and glaciers, sea-, river-, and lake ice) represents a significant feature of the Canadian landscape that impacts climate, hydrology, the economy and the daily lives of all Canadians, especially those living in northern communities. Over the past few decades significant changes have been observed in cryospheric elements (e.g. decreases in snow cover, glacier extent, sea ice cover) that have been attributed to a warming climate. This presentation will provide an overview of initial results from the approved Canadian IPY project “Variability and Change in the Canadian Cryosphere” that is being led by Environment Canada and involves 33 co-investigators from government, academia and the private sector and links with international collaborators. This project builds on Canadian strengths in remote sensing, climate analysis and modeling with the overall objective to observe and understand the current state of the cryosphere in Canada and determine how fast it is changing and why. Research activities are focused on: (1) developing new satellite-based capabilities to provide information on the current state of the Canadian cryosphere during the IPY period; (2) placing current cryospheric conditions in the context of the historical record to document the magnitude of changes over the 50 years since the last International Polar Year (IGY 1957-1958); (3) characterizing and explaining the observed variability and changes in the context of the coupled climate cryosphere system; and (4) improving the representation of the cryosphere in Canadian land surface and climate models to provide current and future climate simulations of the cryosphere for climate impact studies. The project also includes several outreach activities to engage northern communities in cryospheric monitoring and incorporate traditional knowledge with remotely-sensed information to generate new maps on local river ice and sea ice conditions to assist residents in planning safe navigation routes.

1D1.2 ID:2339 **16:30**

Simulating the Terrestrial Cryosphere in a Regional Climate Model

Qiaobin Teng , *Murray Mackay* , *Ed Chan*
Climate Processes Section, Climate Research Division, STB, Environment Canada, Toronto

Contact: Qiaobin.Teng@ec.gc.ca

The Canadian Regional Climate Model (CRCM) has been coupled with version 3 of the Canadian Land Surface Scheme. The new scheme includes a number of improvements relevant to the terrestrial cryosphere, affecting the treatment of snow density, snow interception and unloading, and turbulent exchange with the atmosphere. The impact of these improvements on the regional climate is evaluated in a 10-year simulation over western Canada. The modeled precipitation and surface air temperature were evaluated against a station based gridded observed monthly surface climate dataset (CANGRID) produced by Environment Canada. In addition, the simulated snow water equivalent and snow cover fraction are compared with their counterparts derived from both Special Sensor Microwave/Imager and Canadian Meteorological Centre objective analysis over two contrasting surface types (boreal forest and cropland).

The CRCM not only can well reproduce the dominant atmospheric circulation patterns over the region but also can capture the observed link between the Pacific-North American (PNA) teleconnection pattern and the variation of snow depth over western Canada. In addition, our analysis also suggests a relationship between an atmospheric pattern reminiscent of Tropical/Northern Hemisphere teleconnection and snow depth variation over western Canada. The regional processes associated with these relationships will also be discussed.

1D1.3 ID:2228 **16:45**

Estimating sea-ice exchange between the Canadian archipelago and the Arctic ocean and Baffin Bay using enhanced AMSR-E

Tom Agnew [1], *Andrew Lambe* [2], *Paul Long* [3]
[1] Environment Canada
[2] University of Toronto
[3] Brigham-Young University
Contact: tom.agnew@ec.gc.ca

Enhanced Advanced Microwave Scanning Radiometer (AMSR-E) data is used to estimate sea ice exchange between the Canadian Archipelago and the Arctic Ocean and Baffin Bay for the period September 2002 to June 2007. This enhanced imagery increases the spatial resolution of the 89 GHz AMSR-E data by 25 to 50% which allows sea ice motion estimates through the main channels of the Archipelago. Results indicate that the Archipelago is a net source of sea ice production, exporting about 43 x 10^3 km2 or 49 km3 /yr into the Arctic Ocean each year and about 71 x 10^3 km2 or 75 km3/ yr into Baffin Bay. Most of this sea ice is produced in the many stationary and transient leads and polynyas which form during winter. There is considerable month-to-month variability in sea ice transport which is determined to some extent on the strength and location of the Beaufort Sea gyre and the strength and location of the atmospheric trough over Baffin Bay. For the channels facing Baffin Bay, most is newly formed ice exported through Lancaster Sound.

This work is part of the International Polar Year activity #105, the Canadian Contribution

to the State and Fate of the Cryosphere project.

1D1.4 ID:2294 **17:00**

Development of a variational data assimilation system for coupled ice-ocean models and sea ice analysis.

Alain Caya , *Mark Buehner* , *Tom Carrières*
Environnement Canada
Contact: alain.caya@ec.gc.ca

In preparation for data assimilation in coupled atmosphere-ice-ocean models, a three-dimensional variational (3D-Var) data assimilation system is developed. A first application of the system is for assimilation of sea ice concentrations into a coupled ice-ocean model on the Canadian East coast. Specification of the background-error covariance between the sea ice and ocean variables is particularly important because of the lack of direct measurements of the three-dimensional ocean state under sea ice. The assimilation system is also applied over the Canadian Arctic Archipelago to support other IPY related projects. A diffusion operator for modeling the background-error horizontal correlations in the 3D-Var is well suited for that region with complex lateral boundary conditions. Initial testing of the Canadian Arctic Archipelago implementation is done using persistence between assimilation cycles, i.e. no model is used. Results from assimilating sea-ice concentrations derived from satellite data for both systems are shown.

1D1.5 ID:2302 **17:15**

A Radiative Transfer Model for Sea Ice Data Assimilation of Satellite Passive Microwave Observations

Mingrui Dai [1], *Tom Carrières* [1], *Alain Caya* [2], *Mark Buehner* [2]
[1] Marine and Ice Service, Meteorological Service, Environment Canada
[2] Atmospheric Science and Technology, Environment Canada
Contact: Mingrui.Dai@ec.gc.ca

A vertically integrated radiative transfer model (RTM) and its adjoint have been adapted for assimilation of satellite based passive microwave observations into a sea ice analysis and forecasting system. The RTM is used to map a background state coming from a numerical ice-ocean model to observation space and the adjoint is used in the minimization process. These are two key processes in the variational data assimilation system employed here. The RTM is designed for ice covered seas and includes surface emissivities for three surfaces types, namely open water, first year ice and multi-year ice. Surface emissivity variations in open water caused by near surface wind and absorption due to atmospheric water content are considered in the RTM. A tangent linear model of the forward RTM is also estimated, utilizing finite differences, for the computation of the adjoint model. Results from a full season run of the system assimilating AMSR-E data in the Canadian east coast region will be presented.

1D1.6 ID:2506 **17:30**

The Circumpolar Flaw Lead (CFL) System Study

Dan Leitch , *David Barber*
University of Manitoba
Contact: leitch@cc.umanitoba.ca

The circumpolar flaw lead (CFL) is a perennial characteristic of the central Arctic. The CFL system is formed when the central pack ice (which is mobile) moves away from coastal fast ice, opening a flaw lead which occurs throughout the winter season, forming first in the fall, and continuing as thin ice areas during the winter season. The flaw lead is circumpolar, with recurrent and interconnected polynyas occurring throughout the Arctic. The CFL study is a major international effort that involves 15 countries and over 200 researchers. The project focuses on the Canadian component near Banks Island, NT and is designed to examine the importance of climate processes in changing the nature of a flaw lead system, and the effect these changes will have on the marine ecosystem, contaminant transport, carbon fluxes, and greenhouse gases. We will measure all aspects of the marine ecosystem and the physical system. There is a strong emphasis on the integration of traditional knowledge with western science. The project involves the over-wintering of the Canadian Research Icebreaker CCGS Amundsen within the Cape Bathurst polynya in the Southern Beaufort Sea. This represents the first time ever that a research icebreaker has studied the annual cycling of physical and biological processes in the Circumpolar Flaw Lead (CFL) system. We present information on the design of the CFL field program and highlight the scientific programs being conducted, preliminary results obtained and aspects of outreach of this International Polar Year (IPY) project.

1D2.1 ID:2543 **16:00**

Environmental Prediction in Canadian Cities (EPiCC) Network

Tim Oke [1], *James Voogt* [2], *Stéphane Bélair* [3], *Mario Benjamin* [4], *Andreas Christen* [5], *Nicholas Coops* [5], *Sue Grimmond* [6], *Valery Masson* [7], *Aude Lemonsu* [7], *Jocelyn Mailhot* [3], *Ian Mckendry* [5], *Ian Strachan* [8]
[1] University of British Columbia (UBC)
[2] University of Western Ontario (UWO)
[3] RPN, MSC
[4] Québec Region, MSC
[5] UBC
[6] King's College London, UK
[7] CNRM, Méteo France, France
[8] McGill University
Contact: toke@geog.ubc.ca

The EPiCC network (2006-2010) project in urban meteorology and remote sensing is funded by CFCAS. A central aim is to develop an urban energy balance model (TEB-ISBA; Masson, 2000) verified and optimized for conditions in Canadian cities and ready to implement in the CMC MSC numerical prediction system. The project has three components. First, an observational component measuring the radiation and energy balances also CO2 concentrations and fluxes and mixed layer depth in Montréal and Vancouver and their rural surroundings for a period of two years. Attention is given to

aspects of Canadian cities for which TEB-ISBA has not been tested extensively. The Montréal studies focus especially on winter conditions when snowfall is often large and energy demand for space heating is intense. In Vancouver the focus is summer water use for garden irrigation. The climate forcing produced by releases of anthropogenic heat, water and CO2 can be substantial and the need to work on conservation measures is central to moving towards more sustainable cities. Second, remote sensing is allowing land cover to be classified for many Canadian cities. It will be a key input to TEB-ISBA stressing as it does properties of climatic significance. Airborne LiDAR is used to help parameterize the urban structure including both built and vegetated elements. Surface and space-based techniques are also used to assess surface properties, especially temperature and snow cover. Third, modeling includes both meso- and urban boundary layer scales ultimately down to ~250 m grids which will mesh with other models to meet needs to respond to accidental or other threats to urban health and safety. This will also provide Canadians with urban weather forecasts in previously unattainable detail. All components of the project are underway and progress on the project will be illustrated and discussed.

1D2.2 ID:2572 16:15

Improvement of the Vertical Discretization in GEM

André Plante [1], *Claude Girard* [2], *Sylvie Gravel* [3]
[1] Centre météorologique canadien, Environment Canada
[2] Recherche en Prévision Numérique, Environment Canada
[3] Air Quality Research Division, Environment Canada
Contact: andre.plante@ec.gc.ca

The Canadian Global Environmental Multiscale (GEM) model is currently discretized in the vertical using a regular grid. With such a grid all variables appear on the same levels. Second order accuracy is maintained on the grid by the use of the pseudo-staggering technique which enables the evaluation of finite differences over two grid points only. The use of such a grid, however, allows for the presence in the solution of numerical modes which may lead to noise problems. Such problems can be observed in the GEM model, and examples will be presented. An potential solution is to use for the vertical discretization a Charney-Phillips grid in order to eliminate these troublesome modes. We will show that indeed much less noise develops with the new grid, and notable improvements are seen in upper air scores.

1D2.3 ID:2433 16:30

Sea fog modelling over the Nova Scotia coast using the GEM-LAM15: Impact of microphysics parameterizations

Junfeng Miao [1], *Hal Ritchie* [2]
[1] Department of Oceanography, Dalhousie University, 1355 Oxford Street, Halifax, NS B3H 4J1
[2] Meteorological Research Division, Environment Canada, 45 Alderney Drive, Dartmouth, NS B2Y 2N6
[3] E-mail: Hal.Ritchie@ec.gc.ca
Contact: Junfeng.Miao@phys.ocean.dal.ca

In this study, the Limited-Area Model (LAM) version of Environment Canada's Global

Environmental Multiscale (GEM) model with a horizontal resolution of approximately 15 km (GEM-LAM15) is applied to simulate sea fog events along the Nova Scotia coast during the period of 27-29 June 2006. The focus is on investigating the sensitivity of simulated sea fog to three microphysics parameterizations (Sundqvist scheme, Mixed-Phase scheme, and Kong-Yau Explicit Scheme) that are readily available in the model for use. Except for the microphysics schemes examined and the LAM setups, the model configurations are similar to the 15-km version of the Canadian regional forecast system. The spatial and temporal variations of cloud variables are analyzed in detail for the different microphysics schemes, and visibility is diagnosed (calculated) using the parameterizations based on cloud liquid water content. Also, the radiation variables and the surface fluxes such as sensible heat, latent heat and momentum are compared for the different schemes. The observational data (temperature, dew point temperature, specific humidity, wind, surface pressure and/or visibility) from 20 routine meteorological (climate) stations chosen over Nova Scotia, including two RAOB sites and one field site for Fog Remote Sensing and Modeling (FRAM) measurement at Lunenburg (FRAM-L), are used in this study to evaluate the model performance. In short, the study examines two lines of questions: (1) Can GEM-LAM15 simulate sea fog? If yes, to what extent? If not, what are the possible reasons? (2) How sensitive are the overall performance of the model and its applications to sea fog simulations to the choice of the microphysics parameterization schemes? The overall objectives of the study are to evaluate the model performance in predicting sea fog and suggest some improvements to be pursued in future work.

1D2.4 ID:2376 16:45

Cloud-radiation interaction as simulated by the Canadian GEM model compared to ARM observations

Danahé Paquin-Ricard [1], *Colin Jones* [1], *Paul Vaillancourt* [2]
[1] CRCMD, Université du Québec à Montréal
[2] Environnement Canada
Contact: danahe@sca.uqam.ca

Clouds are one of the dominant sources of uncertainty in climate models. A large part of this uncertainty arises from the numerous scale interactions, both in space and time, controlling cloud formation and the interaction of clouds with radiation and dynamical processes. Microphysical processes play a key role in controlling the liquid and ice water content of simulated clouds and, as a result, are important controls on the interaction of clouds with both solar and terrestrial radiation. Due to their extreme complexity, processes controlling the cloud-radiation interaction are highly parameterised in present-day climate models.

In this presentation we evaluate the cloud-radiation interaction and microphysical parameterisations in the new Canadian Regional Climate Model, based on the limited area version of GEM (Global Environmental Multiscale Model, Zadra et al. 2008). GEM-LAM was integrated for the period 1998-2004 over 2 domains, centred on the ARM Southern Great Plains site, and North Slope of Alaska site, respectively. Both integrations used ECMWF reanalysis as lateral boundary conditions, prescribed SSTs and employed a horizontal resolution of ~ 42 km.

To evaluate the models ability to reproduce the interaction between cloud-microphysics and radiation, we compare the simulated co-variability of solar and terrestrial radiation as a function of liquid water path (LWP) and integrated water vapor (IWV), with the same co-variability from observations. We compare simulated frequency distributions of LWP, IWV and precipitation rate, for different seasons, with equivalent observed distributions. We finally show the impact of these simulated interactions on the surface radiation budget. Comparison across different seasons, the diurnal cycle and at both ARM sites allows an evaluation of the microphysical processes in GEM across a wide range of meteorological conditions. It further allows us to identify climate regimes where cloud-radiation processes are simulated well and regimes that require improvement.

1D2.5 ID:2397 **17:00**

Large Eddy Simulation of dust devil formation on Mars

Babak Tavakoli Gheynani , *Peter Taylor*
Center for Research in Earth and Space Science (CRESS), York University
Contact: babak55@yorku.ca

Phoenix, NASA's first scout mission, is scheduled to arrive on Mars near 70 degrees North on 25th May 2008 and operate during the northern summer (2008). Among other experiments, the lander will make continuous meteorological measurements of pressure and temperature, plus some wind and humidity measurements. Phoenix will use a vertically pointing lidar provided by the Canadian Space Agency (CSA) to observe profiles of dust and water ice particles. Lidar data will be used to determine boundary-layer depths assuming a detectable drop in aerosol level at the top of the daytime convective boundary layer. Convective Martian boundary layers can generate a variety of dynamical structures including vertical vortices which provide a mechanism for dust lifting into the atmosphere. Dust devil tracks have been observed at the 65-72 latitude band of Mars' North Polar Region by the Mars Global Surveyor (MGS) Mars Orbiter Camera Narrow-Angle (MOC-NA). These satellite images indicate evidence of dust devils and strong winds in the Phoenix landing site environment. Our study performs Large Eddy Simulations (LES) of planetary boundary layers to compare the physical characteristics of simulated vertical vortices to those of observed dust devils. Our LES model is based on the NCAR LES adapted and developed for Martian applications. To analyze the upcoming data from the mission, this study examines the possible formation and maintenance mechanisms for vertical vortices in the highly convective Martian boundary layers, in situations with and without ambient wind.

1D2.6 ID:2392 **17:15**

Simulation of Concentration Fluctuations in an Idealised Canopy

John Postma [1], *John Wilson* [1], *Eugene Yee* [2]
[1] University of Alberta
[2] DRDC - Suffield

Contact: postmajv@yahoo.ca

The design of an emergency response plan for an accidental or intentional release of a chemical, biological, radiological, or nuclear agent into a densely populated area would be greatly aided by a means to predict the transport, and dispersion of the agent, as well as the subsequent deposition, contamination, and exposure. Numerical models can provide such information. Recent advances in computing power have led to the development of models capable of predicting the complete concentration probability density function (PDF), and thus all moments of the scalar concentration field. This is a significant advance given that concentration fluctuations are a ubiquitous feature of a dispersing plume. Their inclusion in numerical dispersion models has important applications in nuisance and hazard evaluation in air quality, pollution mitigation, combustion studies, as well as agricultural and forest meteorology.

The Interaction by Exchange with the Conditional Mean (IECM) micromixing model is a simple extension to a single particle Lagrangian stochastic dispersion model that incorporates the combined effects of turbulent and molecular mixing. This allows the full concentration PDF of a dispersing plume to be numerically estimated. In this talk recent results from IECM simulations of point source release of a passive scalar in an idealised canopy will be compared with water channel experiments of the same flow. The idealised canopy consisted of a staggered array of rectangular obstacles.

1D3.1 ID:2396 **16:00**

Case Study of a Greenland Tip Jet

Carling Hay , *Kent Moore*
University of Toronto
Contact: chay@atmosp.physics.utoronto.ca

Standing over 3000m tall in its most southern region, Greenland acts as a large barrier to storm systems traversing the North Atlantic. As a result of the interaction with Greenland, low-pressure systems located in the Irminger Sea between Iceland and Greenland often produce strong low-level winds. These westerly low-level winds are known as tip jets and can have magnitudes in excess of 30 m/s. On November 28, 2004, a low pressure system in the Labrador Sea experienced flow distortion due to the blocking effect of Greenland. The blocking effect resulted in the surface features of the cyclone being nearly completely diminished. Despite this surface weakening, a lee cyclone spun up in the Irminger Sea on November 29, 2004. This lee cyclone produced a tip jet that was captured by a meteorological buoy positioned off the southeast tip of Greenland. The Weather Research and Forecasting Model was used to study the system that produced the tip jet as well as the characteristics of the winds themselves. Trajectory analysis has revealed that the tip jet on November 29, 2004 resulted from the acceleration of air parcels around the southern tip of Greenland. I plan on examining the cyclone responsible for the event, as well as the characteristics of the tip jet.

1D3.2 ID:2320 **16:15**

Impact of Climate Variability and Change on extreme wind storms and sea levels in Southern BC.

Dilumie Abeysirigunawardena [1], *Eric Gilleland* [2]
[1] PhD Candidate, Department of Geography University of Victoria, Victoria BC, V8W 3P5, Canada
[2] National Center for Atmospheric Research (NCAR), Research Applications Laboratory, 3450 Mitchell Lan
Contact: dilumie@uvic.ca

Potential societal impacts due to natural climate variability and anthropogenic climate change are due largely to the changing frequency and magnitudes of extremes. In order to adapt to associated impacts, the critical first step is to determine how quickly and by how much, the threat is increasing. To that end, this study attempts to understand the effects of climate variability and change on extreme total water level (TWL) and extreme storm recurrences in the South Coast of British Columbia.

The study is primarily based on application of Extreme Value Analysis on measured wind and water-level extremes, in the presence of climate covariates. The analysis shows convincing evidence towards significant increases in the frequency of occurrence of extreme TWL events in Southern BC associated with El Niño episodes. However, more intense extreme wind storm recurrences were seen during the La Niña regime. This suggests an out of phase relationship between extreme TWLs and extreme wind storm recurrences in the study region. Long term sea level rise was also found to significantly increase the frequency of extreme TWL events.

1D3.3 ID:2405 **16:30**

Noel - A Canadian perspective on the impacts and the successes

Carolyne Marshall
Environment Canada
Contact:

Noel was a very powerful storm to hit Atlantic Canada in 2007. It wreaked havoc on the Dominican Republic, Haiti, Cuba and the Bahamas, killing more than 147 people before heading north. In Canadian waters, Noel was transitioned into a large, vigorous post-tropical storm referred to by Canadian meteorologists as dangerous. The storm centre moved into Canada near Yarmouth, NS, crossing southeastern NB, the Gulf of St. Lawrence and finally moving through central Labrador. Noel caused a lot of damage and inconvenienced thousands of people as powerful winds took thousands of trees down, scattered fences and downed power lines across Atlantic Canada. The greatest impact from Noel was the coastal damage done by huge powerful waves along the entire western half of Nova Scotia’s Atlantic coast. Wind and wave action destroyed several beaches, hurled rocks and obliterated or severely damaged countless wharves, docks and fishing sheds. This presentation will take a look at Noel, the successes associated with forecasting, communications and public preparedness, and its impacts.

1D3.4 ID:2557 **16:45**

An Oklahoma supercell in Ontario

Mitchell Meredith
Environment Canada
Contact: mitch.meredith@ec.gc.ca

On 8 July 2007 an isolated cyclical supercell thunderstorm developed over northern Lake Huron and tracked almost due southward along the eastern shore of the lake and into Southwestern Ontario. The storm spawned a total of 5 tornadoes and produced large hail during its 4 hour lifespan. It is typically very difficult to observe the visual characteristics of most Ontario supercells, but this storm was very photogenic and we use photographs and videos to illustrate its structure. Storm initiation, radar analysis, storm damage investigations and forecasting challenges will be reviewed in this case study. In addition we will examine the performance of the GEM-LAM (2.5 km resolution) in forecasting this event.

1D3.5 ID:2413 **17:00**

Canada's First Confirmed F5: The Elie Tornado

Jim Slipec , *Dave Carlsen* , *Patrick Mccarthy*
(Presented by *Steve Knott*)
Prairie and Arctic Storm Prediction Centre, Winnipeg MB.
Contact: jim.slipec@ec.gc.ca

On June 22, 2007 dynamic and thermodynamic conditions were favourable for the development of severe thunderstorm across southern Manitoba. At approximately 6:30 pm CDT a tornado touched down north of the Trans-Canada Highway about 40 km west of Winnipeg. The tornado initially overturned a tractor trailer, crossed the highway and produced over $1 million in damage at a near by flour mill. The tornado then tracked southeast towards the town of Elie where it lingered over the same area for approximately 4 minutes. During this time it destroyed four houses, overturned numerous vehicles, and ripped the bark off many trees. Thankfully there were no fatalities with this storm. Initially assessed as F4 damage on the Fujita scale by the Storm Damage Team of the Prairie and Arctic Storm Prediction Centre, the storm was upgraded to an F5 upon further investigation. After pouring over all available photographic evidence and damage assessment information and by extensive video analysis, the tornado was reassessed and on September 18, 2007, the Elie tornado was upgraded making it Canada's first official F5. This presentation will touch briefly on the synoptic set up of the day then focus on the devastation of the storm with photographs and video and extent of the damage which led to the rating.

1D3.6 ID:2556 **17:15**

A Great Lakes sting jet

Bryan Tugwood
Environment Canada

Contact: bryan.tugwood@ec.gc.ca

Bryan Tugwood, Severe Weather Meteorologist, Ontario Storm Prediction Centre.

During the morning of 24 September 2006 a band of strong winds swept across Georgian Bay and then eastward through the Algonquin Highlands causing considerable wind damage. Boats were torn from their moorings and 100,000 homes suffered power failures. The winds rose very suddenly and then abated over a few hours. Analysis and diagnosis of this event suggests it is likely an example of a “sting jet”, a termed first coined by Keith Browning in 1987 to describe damaging winds emanating from the evaporating tail of the hooked cloud head. In this study we use radar, satellite and model data to illustrate the characteristics of this phenomena.

1D4.1 ID:2265 **16:00**

A New Network for Monitoring the Radiative Forcing from Greenhouse Gases

Wayne Evans
York University
Contact: wayne@mesosphere.net

A new network is proposed to monitor the radiative forcing of global warming by greenhouse gases. The calibrated spectrum of greenhouse radiation at the surface has been measured for the last 10 years in Ontario. From these measurements the radiative flux from each greenhouse gas been extracted. A 10-year record exists of the radiative fluxes from carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons. The increase of these fluxes represent the forcing function of global warming, which is an experimental version of radiative forcing similar to, but different from, the radiative forcing metric used by the IPCC. It is proposed that this radiative forcing be monitored similar to the ozone layer. A world monitoring network should be set up similar to the world total ozone monitoring network. The AERI instrument already exists; 12 AERIs, manufactured by ABB BOMEM (a Canadian company), are deployed around the world. Well calibrated infrared spectral measurements of the downward infrared long-wave radiation have been made routinely by the AERI at three ARM Climate Research Facility sites for more than 7 years with a 12-year record at the Southern Great Plains site. These measurements will be processed into longwave radiation fluxes from each of the major greenhouse gases using a methodology already developed for similar measurements at 44° N. Comparisons with surface radiation fluxes calculated from GCMs will be conducted using the methodology already successfully used to compare previous 44° N data with the CCMA and NCAR GCMs. The data would be used to investigate the seasonal and climate regime variations of the surface greenhouse radiation flux, compare the measurements with climate model simulations of the surface forcing radiation fluxes for each greenhouse gas, evaluate the reduction of the surface forcing radiation by various types of clouds by measuring the reduction in surface radiation forcing under cloudy conditions, conduct complementary measurements of surface radiation forcing with radiative trapping measured from space with overpasses of satellites and monitor the increase with time of the forcing radiation from each gas. This network will provide a new experimental dataset to complement the calculated radiative forcings from climate

models currently used for policy determination of safe levels of greenhouse gases in the atmosphere. It will provide the experimental capability to conduct long-term monitoring of increases in radiative forcing from individual greenhouse gases without using an intervening climate model and add a new climate observation that could be used to compare changes in the longwave radiation balance of the atmosphere with other climate variables. The analysis of the data from ARM AERI sites, combined with the existing AERI instruments deployed around the globe, would be a big step toward building a network to monitor radiative forcing.

1D4.2 ID:2605 16:15

The high-wind climatology of Vancouver and Abbotsford: an exploration of contrasts over a small spatial scale, and some possible regional trends in windstorm frequency

Wolf Read
University of British Columbia, Department of Forest Sciences
Contact: wolfread@interchg.ubc.ca

The minimum value for high-winds by the US National Weather Service is a 64 km/h 1-minute wind and/or a 93 km/h gust. Gusts of 74 km/h, often associated with 46 km/h or higher 1-minute winds, fall within the definition of wind-advisory criteria. These minimum values were used to filter the 1955-2007 wind data collected at the Vancouver International and Abbotsford airports to identify all significant events. Over this 52-year period, the annual frequency of high-wind events at Vancouver has ranged from zero to four, with at least 59% of years having at least one high-wind storm. Assuming possible instrument changes have not been a factor, the frequency of high-wind events appears to have undergone marked shifts on multi-decadal scales, with a value of 1.6 per year from 1955-1974, 0.2 per year 1975-1996 and 1.8 per year 1997-2007. The period-of-record average is 1.1 per year. The dearth of high-wind events from 1975-1996 corresponds well with a well-documented warm phase of the Pacific Decadal Oscillation (PDO). At Abbotsford, high-wind-storm frequency drops from 2.3 per year from 1955-1974 to 0.5 per year in 1975-1996. However, the strong recovery in frequency that appears in the Vancouver record from 1997-2007 doesn't show in the last eleven years at Abbotsford, with an average of 0.8 per year. Close study of strong (gust >73 km/h) Frasier outflow events at Abbotsford reveals a sharp change in annual frequency in the middle of the 1970s. From about 1957-1973, the number of days between strong Frasier outflow events averaged 281, or about one significant event per year. From approximately 1974-2007, this average jumped to about 941 days, or about one significant event every three years. The change in frequency, if it is real, appears associated with the great climate transition of 1976-77, and may be related to the PDO.

1D4.3 ID:2281 16:30

Observations of northern latitude ground-surface and surface-air temperatures

Al Woodbury [1], *Hassan Bhuiyan* [1], *John Hanesiak* [1], *Grant Ferguson* [2]
[1] University of Manitoba
[2] St Francis Xavier University

Contact: woodbur@cc.umanitoba.ca

Since Lachenbruch and Marshall's classic study of subsurface temperatures in Alaska, there has been a great deal of interest in studying climate change through reconstructing ground surface temperatures (GST) from borehole measurements(BHT). Note that the magnitude of temperature increases reconstructed from BHT records seems to contrast however, with some proxy based reconstructions of surface air temperature (SAT) that indicate lower amounts of warming over the same period. We present data suggesting that seasonal snow cover may bias climate reconstructions based on BHT in portions of the Canadian northwest. Eight sites west of the Canadian cordillera, were examined for long-term SAT and GST changes. At seven of these sites precise borehole temperature profiles are used for the first time since the 1960s, thereby exploring the linkage between GST and SAT. New readings were made at four of these locations. All sites showed significant increasing SAT trends, in terms of annual mean minimum and maximum temperatures. Over a 54 year period, the minimum temperatures increased between 1.1 C and 1.5 C while the maximum increased between 0.8 C and 1.5 C, among those eight stations. Observations of GST at those sites, however, showed no obvious climate induced perturbations. We believe this disconnect between SAT and GST is attributable to an increase in snow cover in early winter, followed by an increasing trend toward earlier snow melt in the region. Such seasonal bias has important implications for GST reconstructions based on borehole temperatures. These results support Mann and Schmidt's conjecture about a seasonal bias in the GST reconstructions from borehole surveys and counter assertions of lower historic earth temperatures.

1D4.4 ID:2289 **16:45**

Changes in the Lifetimes of Northern Hemisphere Mid-latitude Cyclones (1948-2003)

Steven Lambert
CCCma, Meteorological Service of Canada
Contact: steve.lambert@ec.gc.ca

Over 50 years of northern hemisphere cyclone statistics have been extracted from the four times daily NCEP/NCAR Reanalyses. The analyses were interpolated to a 250 km equal area (EASE) grid and a wealth of cyclone statistics were extracted using a cyclone tracking algorithm. These data provide the opportunity, not only to comment on the procedures used to identify cyclones, but also to examine changes in the lifetimes of cyclone over several decades. The results indicate that the number of cyclones with lifetimes between one and four days have decreased while the number of cyclones with lifetimes of five days or more have increased.

1D4.5 ID:2364 **17:00**

Homogeneity test and measured trends of monthly surface wind speed in Canada

Hui Wan , *Xiaolan L. Wang* , *Val R. Swail*
Climate Research Division, Environment Canada

Contact: hui.wan@ec.gc.ca

Long-term surface wind speed observations are widely used in climate analysis and engineering applications. Wind speed data recorded at 117 stations in Canada for the period from 1953 - 2006 are analyzed in this study. Station metadata and logarithmic wind profile are used to adjust hourly wind speed to standard 10m level. Monthly means are then derived. Statistical homogeneity tests along with metadata are used to identify artificial mean-shifts (step-type changes) in the wind speed time series. Anemometer height change was found to be the main known source for discontinuities in wind speed time series. Station relocation, instrument changes, and site condition changes are other causes for wind data discontinuities.

Homogenized Canadian hourly sea level pressure data (surface station observations) are used to derive hourly geostrophic winds, which are used as reference series and compared with the homogenized wind speed in terms of long-term trends. Homogenized wind speed series and geostrophic winds show consistent trends, which are notably different from trends estimated from unhomogenized (raw) wind speed series.

1D4.6 ID:2417 **17:15**

Fractal analysis of El Niño/La Niña episodes

Zhiyong Huang , *Hiroshi Morimoto*
Graduate School of Environmental Studies, Nagoya University, Japan
Contact: huangmoonsun@yahoo.com

The fractal dimension, i.e., the Hurst coefficient “H”, is important when studying the climate. The change in fractal characteristics usually corresponds to changes to the state of the background, with “H” being dependent on time, space and frequency. An understanding of the noise characteristics of the Sea Surface Temperature (SST) is fundamental in forecasting El Niño.

El Niño Southern Oscillation (ENSO) has a period of 2-7 years. In this study, the frequencies under 2 years were called noise for ENSO, and above 7 years were called background state. We used an “H” , the frequency of which was restricted from 2-month to Quasi-Biennial (QB), as the index of the noise characteristics of Niño 3.4 SST.

We applied the discrete Daubechies wavelet transformation method to analyze 126 segments of the HadISST time series over a period from 1875 to 2005. Each segment was 64 months long, starting from January.

The results showed that the oscillation pattern of “H” mostly corresponded with the development of El Niño, particularly during 1894-1923 and 1978-1999. In these two distinct periods, there was a strong decadal/ inter-decadal variation of tropical SST background, and so the noise was more sensitive to start an El Niño.

Self-organized criticality (SOC) was one possible explanation for fractal behaviours and SOC included scale-invariance (scaling) and criticality features. There was the opinion that an El Niño event was a result of the SOC phenomena. We tried to examine the scaling and critical features of SOC for El Niño/La Niña. Strong and medium El Niño events usually showed SOC features, especially after the 1970's.

From the view of SOC, decadal/inter-decadal variations provided a basic background for El Niño. Inter-annual cycles directly affected El Niño. High frequencies played as the first chain-reaction of setting out El Niño.

1D5.1 ID:2345 16:00

DLAC2 – A Blended Training Experience On Creating Effective TAFS

Greg Byrd , Victoria Johnson , Warren Rodie
(Presented by *Warren Rodie*)
UCAR/COMET
Contact: byrd@comet.ucar.edu

The Cooperative Program for Operational Meteorology, Education and Training (COMET) has teamed up with NOAA's National Weather Service Warning Decision Training Branch (WDTB) to create and deliver blended training units as part of the second Distance Learning Aviation Course, DLAC2. Entitled "Producing Customer-Focused TAFs", DLAC 2 focuses on using special data, tools, techniques, and an understanding of customer needs to produce the best terminal aerodrome forecasts (TAFs) possible.

Traditionally, aviation forecaster training has been conducted "one-on-one" with an experienced meteorologist in a real-time, operational setting. This has been supplemented by computer-based instruction (CBI) via disk media or the Internet. However, DLAC 2 integrates Web-based modules with facilitated Warning Event Simulator (WES) exercises to allow students to apply the CBI data, tools, and techniques to a weather scenario in a simulated operational setting. This approach is similar to that of WDTB's Advanced Warning Operations Course (AWOC). The WDTB will also provide a robust library of aviation WES cases so local offices can develop their own training for aviation hazards typical in a certain area.

The DLAC 2 is composed of five self-paced Web modules. Published in the fall of 2006, Module 1, "Basic Terminal Forecast Strategies", addresses basic strategies behind producing effective TAFs and stresses the importance of understanding user needs. Module 2, "Writing TAFS for Convective Weather," challenges the student to prepare forecasts for different types of convection. Currently under development, Module 3, "Airport-Specific TAFs for Wind," introduces the concept of airport-specific criteria (ASC) and how to create value-added TAFs for wind, low-level wind shear, blowing dust, and other related hazards. Slated for delivery during next two years, Modules 4 and 5 will apply the ASC concept to forecasting winter weather and low clouds/fog, respectively. Relevant WES case scenarios will be delivered concurrently with the publication of each module. For more information on DLAC 2, see the COMET DLAC Website, http://www.meted.ucar.edu/dlac/website/index.htm.

1D5.2 ID:2610 16:30

Panel Discussion on Aviation Weather Science and Service

Rob Honch
Environment Canada
Contact: rob.honch@ec.gc.ca

This 45-minute panel discsussion will be an opportunity to address issues in Aviation Weather

1D6.1 ID:2517 16:00

The Strait of Georgia Ecosystem Research Initiative

Diane Masson [1], *Ian Perry* [2]
[1] Institute of Ocean Sciences
[2] Pacific Biological Station
Contact: massond@dfo-mpo.gc.ca

The Strait of Georgia is a coastal marine ecosystem under significant pressure from a combination of drivers of change such as global warming and increased human settlement. It is likely that these drivers will significantly affect the Strait of Georgia. The Strait of Georgia Ecosystem Research Initiative is the Pacific Region component of a newly implemented national science program of the Department of Fisheries and Oceans seeking to increase understanding of the marine environment and its resilience (and vulnerability) to environmental changes. Its main objective is to provide DFO management with tools and advice that warns and explains these changes and their causal mechanisms in an ecosystem context. A series of research projects have been initiated on a broad range of scientific issues such as: a rapid assessment of the current state of the ecosystem including chemical and physical properties, lower trophic level productivity and fish stocks; the development of statistical and mechanistic bio-physical models; the identification of critical areas or “hot spots”. A description of the program will be given, along with the scientific issues being addressed and possible future directions.

1D6.2 ID:2456 16:15

Oceanic features that might account for survival of fledgling Rhinoceros Auklets on Triangle Island, British Columbia

Gary Borstad [1], *William Crawford* [2], *Mar Martínez De Saavedra Álvarez* [1], *Peter Willis* [1]
[1] Borstad Associates
[2] Fisheries and Oceans Canada
Contact: crawfordb@pac.dfo-mpo.gc.ca

The survival rate of young Rhinoceros Auklet seabirds in their first year on Triangle Island depends on marine factors. The growth rate of these fledglings (an index of survival) varied from 10 to 120 grams per day in the past decade. Survival is greatest when April temperatures at Pine Island, 100 km away, are relatively cold in April. We extend this analysis through comparison of Auklet annual survival with chlorophyll concentrations measured from space by SeaWiFS. An analysis of chlorophyll distribution

in April 1998 to 2006 determines that the presence of a long, spatial gradient of chlorophyll near Triangle Island correlates well with fledgling survival. We propose that this gradient in chlorophyll points to an oceanic front that concentrates food for adult Auklets, and the relatively high levels of chlorophyll in this region indicate high biological productivity and plentiful feed for seabirds.

1D6.3 ID:2518 16:30

Modelling Plankton Dynamics on the British Columbia Coast: Potential impacts of changes in upwelling, stratification and temperature on biogeochemical cycles

Angelica Pena
Institute of Ocean Sciences
Contact: penaa@pac.dfo-mpo.gc.ca

To develop a quantitative understanding of the interactions between physical, chemical and biological processes is critical for predicting the marine ecosystem response to climate change. Phytoplankton production is influenced by nutrient fluxes, stratification and temperature, all of which are likely to be affected by climate change. Impacts on phytoplankton will lead to cascading effects throughout the marine ecosystem. In this study, a 3D coupled physical-biogeochemical model is used to examine the potential influence of changes in upwelling, stratification and temperature on biogeochemical cycles. The result from these simulations is towards lower productivity under several climate change scenarios. The implications of these results are discussed as well as the ability of biogeochemical models to predict future climate change.

1D6.4 ID:2290 16:45

A bio-physical model of the Pan-Arctic ocean

Frederic Dupont
Quebec-Ocean, U. Laval
Contact: frederic.dupont@dal.ca

A model of the Pan-Arctic ocean coupled to ice and a biological model will be presented. The biologcal model is a simple 4-compartment NPZD model with the addition of a module for ice algae. The goal is to study the varibility of the primary production in the last 50 years of the 20th century (1950-2000). The model is forced using monthly NCEP/NCAR reanalysis and monthly climatological boundary conditions. The primary climate change forcing comes from a warmer surface atmosphere in early 1980s and for the whole 1990s. The ice algae module formally represents the growth and aggregation of phytoplankton in the layer underneath the ice. Their importance in the Arctic Ocean stems from the fact that the bottom of the sea-ice is an unique substrate on which the phytoplanktonic cells can experience growth nearly undisturbed by surface mixed layer turbulence. In the model the ice algae contribution to primary production was found to be about 20% to 25% of the pelagic primary production. Overall for the whole Arctic Ocean, reasonable values of primary production were obtained.

1D6.5 ID:2254 **17:00**

Development of a Coupled Biological-Physical Model Appropriate for Prediction in a Coastal Inlet

Maud Guarracino , *Jinyu Sheng* , *Michael Dowd* , *John Cullen*
Dalhousie university
Contact: maud@phys.ocean.dal.ca

We describe the development of a numerical forecast system designed for real-time prediction of physical and biological dynamics of a coastal inlet. It is based on a coastal ocean observatory located at Lunenburg Bay, Nova Scotia, Canada. Biological, chemical, optical and physical measurements have been collected from instrumented moorings, weekly sampling and detailed surveys since 2002. A three-dimensional hydrodynamic model was coupled to a calibrated biological (Nutrients-Phytoplankton-Detritus) model. Here we describe a framework for development and evaluation of the ecosystem model. We present an analysis of the most appropriate version of the model, and we discuss the model skill in reproducing the observed patterns. Finally we describe the next steps toward the development of a data assimilative forecasting system for biological dynamics in the bay.

1D6.6 ID:2523 **17:15**

The estuarine nutrient trap: Evidence for increased diatom production in the Gulf of St. Lawrence

Bjorn Sundby [1], *Alfonso Mucci* [2], *Denis Gilbert* [3], *Guillaume Majeau- Bettez* [2], *Charles Gobeil* [4]
[1] ISMER, Université du Québec à Rimouski, and McGill University
[2] EPS, McGill University
[3] Institut Maurice Lamontagne, MPO
[4] INRS-ETE
Contact: sundby@eps.mcgill.ca

The estuarine circulation in the Gulf of St. Lawrence traps nutrients in general and silicate in particular. Nutrients cycle between the seaward moving surface layer, where they are incorporated into planktonic biomass, and the landward moving deeper layers, where remineralization of settling biomass returns the nutrients to solution. In general, silicate (H4SiO4) is not the most limiting nutrient in the Gulf of St. Lawrence. Therefore, an increasing supply of other nutrients, particularly nitrate, may promote diatom production, whose skeleton consists of opaline silica (SiO2). Increased production of diatoms translates into a greater flux of silica frustules to the bottom waters and sediment where they undergo partial dissolution and burial. If the estuarine trap is efficient, the net result should be to increase the inventory of silicate in the deeper layers and/or sediment. We will present evidence that the inventory of silicate in the deep waters of the St. Lawrence has indeed been increasing over the last several decades, and, using box modelling, provide first order estimates of the rate at which diatom production has been increasing.

1D6.7 ID:2531 **17:30**

Oxygen dynamics in the Slope Water and in the Gulf of St. Lawrence

Denis Gilbert
Maurice-Lamontagne Institute, Fisheries and Oceans Canada
Contact: denis.gilbert@dfo-mpo.gc.ca

Under the present climate, the best numerical models of global ocean circulation poorly represent the temperature and salinity properties and westward volume transport of the Labrador Current to the west of the tail of the Grand Banks of Newfoundland. This difficulty arises from the narrow width of the Labrador Current (20 to 30 km) and also from the proximity of the swift eastward flowing Gulf Stream near the tail of the Grand Banks. Inadequate westward volume transport of Labrador Current Water west of the tail of the Grand Banks causes large misfits between modeled and observed temperature and salinity properties in the Slope Water mass to the north of the Gulf Stream. Given these difficulties, predictions of future changes in temperature, salinity and oxygen in the Slope Water and in the deep channels of the adjacent continental shelf are tentative at best. In this context, we take a look at past ocean climate variability in the Slope Water to gain insights into plausible future scenarios of temperature, salinity, oxygen and nutrients change in the deep channels of the Gulf of St. Lawrence, Scotian Shelf and Gulf of Maine.

1D7.1 ID:2337 **INVITED/INVITÉ** **16:00**

Patterns of inter-annual climate variability and weather systems: An example of the linking dynamics.

Huw Davies , *Mischa Croci-Maspoli*
IAC ETH
Contact: huw.davies@env.ethz.ch

A two-part examination is undertaken of the linkage between patterns of climate variability and the occurrence of long lasting blocking events. First a climatological analysis is performed to examine (a) the contribution of blocks to the spatial pattern of the dominant EOF-based statistical patterns of climate variability, and (b) the impact of blocks upon the temporal evolution of the NAO and PNA indices. Second case study of the anomalously cold European winter of 2005-2006 based upon statistical, dynamical, and numerical modelling components indicates that (a) the dominant pattern of climate variability in the Euro-Atlantic sector was not a negative phase of the NAO but rather a pattern with a “block-like” centre located immediately upstream of the continent, (b) the occurrence and dynamics of the associated long-lasting blocks was influenced by upstream cloud-diabatic effects, and (c) block occurrence was sensitive to, and significantly influenced by, the warm surface temperature anomalies upstream over the western Atlantic and North America. Comments are made on the import of the foregoing results for seasonal numerical weather prediction and consideration of climate variability and change.

1D7.2 ID:2500 16:30

A Tale of Two Tip Jets: Case Studies of Two Greenland Tip Jets

Rebekah Martin , *Kent Moore*
University of Toronto
Contact: remartin@atmosp.physics.utoronto.ca

Since its discovery 10 years ago, the Greenland tip jet has been a focus of study as an orographically induced phenomenon that supports intense air sea interaction. Much of the research on this weather system has been to characterize its structure and the environmental conditions that give rise to it. As a result, its genesis mechanism has not been addressed in depth. We present here the results of mesoscale simulations of two Greenland tip jet events, and discuss some of the factors that were important to their development that should be included in a theory of tip jet formation. Both of these events were classified as strong events based on climatologies developed from reanalysis and satellite data, however their genesis was significantly different, and these cases could be considered as two end members of the spectrum of tip jet events. The first case took place from 17-19 February, 1997, and was one of the cases addressed in the first work on tip jets, while the second occurred over 22-24 January, 2001. These cases occurred under slightly different synoptic forcing conditions and had different mature configurations, however they highlight similarities between tip jet events that could be extrapolated to occur for other events.

1D7.3 ID:2432 16:45

Internal gravity waves forced by isolated topography

Lucy Campbell , *Lidia Nikitina*
Carleton University
Contact: campbell@math.carleton.ca

A multiple scaling approach is used to study the dynamics of internal gravity waves forced by an isolated mountain and propagating upwards in a density-stratified shear flow. The gravity waves take the form of a packet, localized in the horizontal direction and comprising a continuous spectrum of horizontal wavenumbers centered at zero. For horizontally-localized wave packets, there are generally two horizontal scales: the fast scale which is defined by the oscillations within the packet and the slow scale which is defined by the horizontal extent of the packet. In the case of an isolated mountain, the multiple scaling procedure is simplified by the absence of a fast spatial scale. Nonlinear interactions with the background flow are examined and the conclusions of the analysis are compared with the results of numerical simulations.

1D7.4 ID:2473 17:00

Modelling the boundary-layer flow over changes of surface Conditions: effects of thermal stratification

Wensong Weng , *Peter Taylor*
York University, 4700 Keele Street, Toronto, Ontario, Canada M3J 1P3

Contact: wweng@yorku.ca

Weng et al. (2007) have developed a numerical model to study the atmospheric boundary-layer flow over changes of surface conditions. The effects of single or multiple changes in surface roughness were investigated under neutral stratification. In reality, surface roughness changes are often accompanied with changes in thermal property. Here we shall examine the effects of surface thermal property changes on the boundary-layer flow. Model results are discussed and comparisons are made wherever are appropriate.

1D7.5 ID:2312 17:15

A Physical Scale Model to Study Urban Surface Temperatures and Radiation

Sarah Roberts [1], *James Voogt* [2], *Tim Oke* [1], *Joby Carlson* [3], *Jay Golden* [3], *Anthony Brazel* [4]

[1] Department of Geography, University of British Columbia
[2] Department of Geography, University of Western Ontario
[3] National Center of Excellence on SMART Innovations, Arizona State University
[4] School of Geogaphical Sciences, Arizona State University
Contact: sroberts@geog.ubc.ca

Much of our current understanding of the physical processes that contribute to urban climate is derived from field studies conducted in real cities using a range of ground-based and airborne measurement techniques. Much insight has also been gained from wind tunnel modeling, as this technique allows for the isolation and simplification of climatic processes by controlling the impinging flow and surface structures. Data from both types of study serve as an important input to the construction, evaluation, and validation of numerical models which further enhance our appreciation of urban processes. However, despite expanding computational abilities the inherent complexity of surface morphology and energetic exchanges of real-world urban environments still pose many numerical modeling challenges. Outdoor physical scale modeling is a potentially powerful compromise between wind tunnel modeling and full-scale observation that incorporates the experimental control possessed by both physical and numerical modeling and the real complexities associated with natural environmental forcing (atmospheric turbulence and radiation loading). Here we describe the project design and preliminary results from open-air scale model experiments intended to investigate three-dimensional surface facet temperatures and radiative exchanges within and above the urban canopy layer. The model array consists of scaled “buildings” constructed of hollow concrete masonry blocks with solid capping slabs situated on a rooftop on the campus of Arizona State University in Tempe, Arizona. Three experimental configurations (canyon aspect ratios of 1.0, 0.5, and 0.33) of the 13 m x 13 m array are tested, as is the impact of modifying the roof albedo. The measurement period (November 2006–January 2007) is characterized by clear skies, modest precipitation, low atmospheric humidity, and a large range in diurnal temperature. The performance of the scale model to achieve thermal and radiative similarity is discussed.

1E8.1 ID:2617 19:00

Discussion on possible future developments in smoke forecasting

Allen Pankratz
Environment Canada
Contact: al.pankratz@ec.gc.ca

A number of interesting developments in the area of smoke forecasting have taken place over the past year and a half. The Edmonton Smoke Forecasting Workshop was held in February 2007, the BlueSky Western Canada Extension Project began in fall of 2007 and the inaugural issue of the Canadian Smoke Newsletter was sent in March of 2008. All point to an increasing interest in making a Canadian-based smoke forecasting system work. As part of CMOS 2008, some of the main participants in the BlueSky Extension project are holding a special evening meeting on Monday, May 26th to present ongoing work and possible future developments in the smoke forecasting arena. We invite all who are interested to join us for this meeting.

2A1.1 ID:2600 INVITED/INVITÉ 08:30

Climate Change, Human Endeavor and Water Supplies in Western Canada

David W. Schindler
University of Alberta
Contact: d.schindler@ualberta.ca

Climate warming is predicted to increase the average annual temperature of the interior of western Canada by about 3 degrees C by mid-century, and 6 or more by 2100. Annual temperatures at most prairie sites have already increased by 2-4 C during the period of record, with accompanying reductions lake levels, summer river flows, snowpacks and the extent of wetland complexes. The problem will be most acute on the prairies and in the Okanagan Valley, where water is already scarce, and there is evidence of lengthy droughts in past centuries. Present climate conditions on western the prairies are already comparable to the mid-Holocene, when wetlands were almost absent and large prairie lakes were dry or reduced in area. Despite the short period of recent warming, decreases in lake levels, summer river flows and the extent of wetlands are visible. Anecdotal evidence also suggests that groundwater supplies are dwindling in many areas. Aggravating the effects of climate are human changes to the landscape, including land clearing, draining and filling of wetlands, urbanization, building of transportation corridors, reduction of beaver ponds on the prairie landscape, and modification of riparian zones. Mountain pine beetle outbreaks are increasing fuel loads, so that the area burned by forest fire will increase. These are known to increase the mercury inputs to lakes and fisheries. Aggressive wetland and land-use policies and other water conservation measures are necessary to minimize the effects of climate warming on prairie ecosystems and prairie livelihoods.

2A1.2 ID:2599 INVITED/INVITÉ 09:15

Atmosphere-Ocean Interactions in the Western North Atlantic Ocean: Weather and Climate Implications

Kathryn A. Kelly

Applied Physics Laboratory, UW
Contact: kkelly@apl.washington.edu

A strong western boundary current in the North Atlantic transports heat from the warm tropical regions to the mid-latitudes and continues on into the subpolar gyre to warm the high-latitudes in what is commonly termed the ocean's heat "conveyor belt". A convergence of oceanic heat transport in the Gulf Stream region causes large fluxes of heat to the atmosphere, which causes an increase in the atmospheric meridional heat transport. In addition, the Gulf Stream region is a local maximum in storm generation density, as well as a global maximum in storm growth rate. Thus, the ocean circulation here has important implications both for weather and for climate. Many aspects of the large-scale ocean-atmosphere interaction can be studied using the increasingly long records of satellite observations and by autonomous measurement platforms deployed in the ocean.

For changes in the large-scale ocean circulation to explain observed decadal anomalies of ocean heat and freshwater, the Atlantic Meridional Overturning Circulation (AMOC) must have a robust mechanism to move water properties across the boundaries between subtropical and subpolar ocean gyres. However, the conveyor paradigm has been challenged by recent observations showing little coherence in boundary current transport, little exchange between the subtropical and subpolar gyres, and large interannual variations in local heat storage in the subtropical gyre.

The warm waters of the Gulf Stream are known to interact with cold continental air to form strong extratropical storms (Nor'easters) along the east coast of North America. Storm intensification can be predicted knowing the intensity and location of the Gulf Stream front, so that predictability of the Gulf Stream itself has the potential to improve the forecasting of seasonal variations or future changes in storm statistics. High spatial resolution scatterometer winds are being used to study storm intensification over the Gulf Stream.

2B1.1 ID:2560 INVITED/INVITÉ 10:30

The DalCoast Coastal Prediction System: Recent Progress and Plans

Keith Thompson [1], *Yimin Liu* [1], *Chris Jones* [1], *Hal Ritchie* [2], *Darryl Williams* [3]
[1] Dalhousie University
[2] Environment Canada
[3] Department of National Defence
Contact: keith.thompson@dal.ca

A brief review will be provided of the original 2D storm surge model developed at Dalhousie (presently used for operational water level forecasting by Environment Canada, and centennial scale flood risk projections) and its evolution into a 3D baroclinic model capable of forecasting tidal currents, water temperature and salinity (presently under evaluation by the Department of National Defence for operational use). Particular attention will be paid to (i) use of spectral nudging to suppress systematic errors in temperature and salinity (ii) one-way coupling to a regional atmospheric forecast model

(iii) use of the Kolmorgorov forward and backward equation to predict the evolution of the probability density function (pdf) of passively advected objects (such as search and rescue targets, oil slicks) (iv) development of a flexible graphical user interface to visualize the model output, evolving pdfs of particle position, and observations (e.g. satellite images, in situ data) for model validation. Plans for two-way coupling of the coastal model to regional atmospheric model and a North Atlantic model will be discussed.

2B1.2 ID:2271 10:45

A modelling framework for environmental prediction in the Great Lakes

Ram Rao Yerubandi [1], *David Lam* [2], *William Schertzer* [2], *Luis Leon* [3], *Jun Zhao* [2], *Aaron Thompson* [4]
[1] Environment Canada
[2] EC
[3] EC/U.Waterloo
[4] EC/MSC
Contact: ram.yerubandi@ec.gc.ca

The Laurentian Great Lakes have horizontal scales of hundreds of kilometers and depth scales of hundreds of meters. In terms of coastal dynamics, they behave much like inland seas and exhibit physical processes characteristic of the coastal oceans. The lakes are dynamically similar to the coastal ocean in that their horizontal dimensions are larger than the vertical dimensions, and the principal source of mechanical energy is the wind. These are vulnerable to water quality problems resulting from pollutant loads from rivers and direct discharges to the lakes. An integrated lake-river model framework for the Great Lakes and interconnecting channels is required to develop a science based integrated management of these water resources. Recognizing these needs Environment Canada in collaboration with academics started developing a framework for coupling of weather prediction models with hydrological and lake models. A demonstration project has been initiated in Lake Ontario focusing on integrated lake and river models for physical and chemical transports using observed and predicted meteorological data. In this paper, we describe the preliminary results of temperature, water levels and circulation obtained from two hydrodynamic models, namely Princeton Ocean Model and Estuary Lake Coastal Ocean Model in Lake Ontario.

2B1.3 ID:2539 11:00

Investigation of Circulation and Hydrography in Stratified Coastal Waters of Nova Scotia Based on Observations and Numerical Model Results

Li Zhai , *Jinyu Sheng*
Dalhousie University
Contact:

Circulation and water mass distributions in stratified coastal waters of Nova Scotia were examined using observations and numerical model results in Lunenburg Bay. Flow and hydrographic observations made in the bay in the summer and fall of 2003 have strong

temporal and spatial variations. Heat budget analysis of observations demonstrates that the circulation associated with the first empirical orthogonal function (EOF) mode and the net surface heat flux play an important role in the local heat content in the bay. A nested-grid coastal circulation model was used in investigating the variability of the general circulation and temperature and salinity distributions. The model is able to reproduce the important physical processes such as storm and upwelling/downwelling events. Model results reveal that the baroclinicity significantly affects the currents in the bay. The baroclinic dynamics of wind- driven circulation was further examined with a linear multi-mode model based on the normal mode approach. Numerical experiments demonstrate that the isotherm movement in Lunenburg Bay is influenced by the propagation of baroclinic Kelvin waves from neighbouring Mahone Bay. To improve the model performance, a new data assimilation scheme based on the pressure correction and semi-prognostic method was developed. The performance of this new data assimilation scheme was assessed using the nested-grid circulation model. Our model results demonstrate that this new scheme improves significantly the performance of the coastal circulation model in simulating the water mass distribution and circulation over the stratified coastal waters.

2B1.4 ID:2309 **11:15**

Moored Observations of the 2007 Spring Bloom on the Scotian Shelf

Elizabeth Shadwick [1], *Blair Greenan* [2], *Helmuth Thomas* [1], *Friederike Prowe* [1]
[1] Dalhousie University
[2] Bedford Institute of Oceanography
Contact: greenanb@mar.dfo-mpo.gc.ca

The decline of a spring bloom on the Scotian Shelf is examined using an array of autonomous instruments deployed at a mooring site. A SeaHorse profiler and a CARIOCA buoy provide physical, biological and chemical measurements with very high temporal resolution. The profiler makes highly vertically resolved measurements of water temperature, salinity, fluorescence while the CARIOCA buoy makes hourly measurements of surface water pCO2, near-surface water temperature, salinity, pressure, air temperature and wind speed, as well as fluorescence. The measurements are complemented by frequent shipboard sampling at the mooring station (HL2) as part of the Atlantic Zone Monitoring Program (AZMP). Measurements obtained at HL2 from early April to early July of 2007 are presented.

Surface water pCO2 increases from a minimum of ~210 ppm during the bloom period and is highly correlated with the rise in near-surface water temperature. The temperature control on pCO2 is examined by normalizing all pCO2 values to a constant temperature. Measurements of pCO2 from the buoy are found to be in good agreement with shipboard measurements taken at station HL2 using an underway pCO2 system. Observations of chlorophyll concentration are corrected for day-time photochemical quenching; the expected inverse relationship between chlorophyll concentration and surface water pCO2 is observed throughout the measurement period.

2B1.5 ID:2527 **11:30**

Tsunami modelling for the West Coast of Canada: Recent progress and applications

Josef Cherniawsky [1], *Isaac Fine* [1], *Alexander Rabinovich* [2]
[1] Fisheries & Oceans Canada
[2] Shirshov Institute of Oceanology
Contact: cherniawskyj@pac.dfo-mpo.gc.ca

Past and potential future coastal inundation due to local (e.g., from a Cascadia Subduction Zone, CSZ), or remote (such at the 1964 Alaska earthquake) tsunami waves on British Columbia coast are examined based on available observations and numerical models. Two contrasting examples are presented: (1) a model of potential inundation from a CSZ megathrust tsunami in Sooke Harbour and Basin (southwestern Vancouver Island); and (2) tsunami wave characteristics and amplification in Alberni Inlet, as was evidenced during the 1964 Alaska event. In the first case, natural defences from narrow and shallow entrance into Sooke Basin considerably reduce tsunami amplitudes and currents inside Sooke Harbour to less than dangerous levels, while the long and narrow Alberni Inlet resonates and amplifies tsunami waves, significantly increasing the risk of damage. The results of numerical modelling are compared with the available observations of background and tsunamis recorded in this region and were found to be in good agreement.

2B1.6 ID:2441 **11:45**

A hydrodynamics study of Lake Ontario and the upper St Lawrence River

Erin Hall [1], *Shastri Paturi* [1], *Leon Boegman* [1], *Ram Rao Yerubandi* [2], *Kevin Hall* [1]
[1] Queen's University
[2] Environment Canada
Contact: erin.hall@ce.queensu.ca

Eastern Lake Ontario and the St Lawrence River are essential sources of drinking water. Under the Clean Water Act, the Ontario Ministry of the Environment required Conservation Authorities to delineate intake protection zones (IPZ) to protect drinking water from potential contamination. In order to delineate IPZs and properly assess threats to and the vulnerability of source water within an IPZ, it is essential to have an in depth understanding of the hydrodynamics of the water body in question. The three-dimensional Estuary and Lake Computer Model (ELCOM), is being applied to simulate the surface water dynamics within the Cataraqui Region Conservation Authority jurisdiction (the Napanee to Brockville corridor of the St. Lawrence River and the eastern end of Lake Ontario). To model only the eastern portion of Lake Ontario and the upper St. Lawrence River on a high-resolution computational grid (~ 100 m x 100 m horizontal), sufficient to resolve the flow field surrounding intake structures, it is necessary to specify the hydrodynamics at the open boundary with the main body of Lake Ontario. Therefore, a coarse-grid (2km x 2km horizontal) model of Lake Ontario has been developed. The resulting modeled water levels and temperature profiles will then be used to drive the finer grid model of the eastern portion of Lake Ontario and the upper St. Lawrence River. The models are forced at the free surface using meteorological data obtained from moored surface buoys and hydrodynamic results compare well with field

data from acoustic Doppler current profilers, current meters, thermistor chains and water level gauges. This presentation will discuss the results from the coarse-grid model and how these are being used to drive the fine-grid model of the eastern part of Lake Ontario and the upper St. Lawrence. Results to date from the fine-grid ELCOM model will also be discussed.

2B2.1 ID:2325 **10:30**

Polar climate variability during the last glacial cycle – new insights from Southern Ocean sediment cores

Michael Weber [1], *Gerhard Kuhn* [2], *Werner Ricken* [1], *Rainer Gersonde* [2], *Miriam Pfeiffer* [1], *Lucia Reichelt* [1]
[1] Institute for Geology and Mineralogy, University of Cologne
[2] Alfred-Wegener-Institute for Polar and Marine Research, Bremerhaven
Contact: michael.weber@uni-koeln.de

The Southern Ocean is a key area for Earth's climate variability because it influences the global thermohaline circulation as a major site of bottom and intermediate water formation. With respect to suborbital climate change, Antarctica is becoming increasingly interesting, because the Southern Ocean may have acted as a major supplier of deep water (Antarctic Bottom Water, AABW) during stadials, when production of North Atlantic Deep Water (NADW) was sluggish or even terminated. Since 2007, the German Science Foundation is funding the project "SUBCLIMATE" to study suborbital climate cycles as part of the Southern Ocean Initiative of the International Marine Past Global Change Study (IMAGES) program. We use six cores retrieved in the 90s with RV Polarstern from the continental slope in the southeastern Weddell Sea, and two cores retrieved in 2007 with RV Marion Dufresne in the Scotia Sea during cruise MD160. Scientific goals of our study are (i) a ultrahigh-resolution (millennial-to-annual) insight into ice-sheet dynamics. Through a combination of bottom water and surface water climate signals, we will investigate (ii) Antarctic Bottom Water production and the associated development of the Southern Ocean and the global thermohaline circulation. In addition, our aim is to date the retreat of the Antarctic ice masses (iii) at the end of the last glacial, and to conduct (iiii) a bi-polar comparison of suborbital climate change. To achieve these goals, we are currently generating ultrahigh-resolution paleoclimate proxy records, primarily from non-destructive core logging techniques (Multi-Sensor Core Logger, Line Scanner Camera, Spectrophotometer, XRF-scanner, x-radiographs). These proxy records will be dated by geomagnetic paleointensity, AMS14C, and δ18O, and compared to geochemical and biological proxies. We will then implement spectral and cross-spectral analyses, to provide clues about underlying forcing mechanisms and phase shifts of suborbital climate change in high southern latitudes.

2B2.2 ID:2431 **10:45**

Revisiting implicit relationships between ocean salinity, mass and volume vs. oxygen isotope composition in foraminifers

Claude Hillaire-Marcel , *Anne De Vernal*
GEOTOP-UQAM

Contact: devernal.anne@uqam.ca

Since the reassessment of oxygen paleotemperatures in the ocean by N. Shackleton, in the late 60s, most papers using isotopic records in planktic or benthic foraminifers implied some direct relationship between oxygen isotopes in seawater and the ice/ocean volume, thus some linkage with salinity, sea level, etc. Such assumptions are also made when incorporating "isotopic modules" in coupled models. Here, we intend to examine deeper, linkages between salinity and oxygen isotope ratios in sea-water, their change through time, as well as the recording of water isotopic composition by foraminifers and its potential variability. Changes in isotopic composition of precipitations and of ice meltwaters, in time and space, tune the isotopic properties of the fresh water end-member diluting the ocean. In addition, rates of sea-ice formation and evaporative conditions in the ocean play a further role on the salt and oxygen isotope contents of water masses. Thus, the oxygen 18-salinity relationship should carry a specific signature for any given water mass. At the ocean scale, residence time and mixing of these water masses, as well as the time dependent-achievement of proxy-tracer equilibrium, will also result in variable recordings of mass transfers into the hydrosphere, notable between ice-sheets and ocean, both in amplitude and time, thus making direct correlations of isotopic records potentially misleading.

2B2.3 ID:2454 11:00

Late Holocene sea-surface conditions in the Fram Strait

Sophie Bonnet , *Anne De Vernal* , *Claude Hillaire-Marcel* , *Bassam Ghaleb*
GEOTOP-UQAM
Contact: s.bonnet@wanadoo.fr

The Fram Strait, which is the principal gateway between the Arctic and the North Atlantic oceans, is a key area with respect to poleward heat transport through the North Atlantic Current and freshwater fluxes from the Arctic to the Atlantic. In order to document hydroclimatic variations during the last two thousand years, one sediment core collected off Spitzbergen (78,92°N 06,77°E, water depth: 1497 m) was analyzed for palynological and geochemical content. The chronology was established from 210Pb and 137Cs and 14C measurements, which indicate a mixing depth of 5 cm and a mean sedimentation rate of about 19 cm/kyrs. The studied sequence spans approximately 2400 yrs BP thus yielding a centennial resolution. The analyses of dinocysts permit the reconstruction of sea-surface conditions including summer and winter temperatures, salinity and sea-ice cover extent. These reconstructions point out to a general cooling trend (>4°C) with a clear transition at about 640 yrs BP (i.e. 1310 AD). This transition is characterized by the disappearance of the thermophilic taxa Spiniferites mirabilis-hypercanthus, Selenopemphix quanta and Impagidinium sphaericum, and the increase of the polar taxon Impagidinium pallidum. This change corresponds to the transition from the Medieval Warm Period to the Little Ice Age. On the average, sea-surface temperatures were higher than the moderns (> 2°C) until 640 yrs BP, despite three cooling pulses around 1900, 1550 and 900 yrs BP (i.e. 50, 400 and 1050 AD, respectively). From 640 to 80 yrs BP (i.e. 1310 to 1870 AD), the cooling trend is marked by a decrease of summer temperatures from 7°C to 2°C and the spreading of sea-ice

cover up to 7 months/year. In the Fram Strait, the recent warming conditions of the last decades have no analogue in the last 2000 yrs except a warm optimum at about 1350 BP (i.e. 600 AD).

2B2.4 ID:2419 **11:15**

Holocene terrestrial climate variability in the Canadian North.

Andre Viau , *Konrad Gajewski* , *Matthew Peros* , *Joan Bunbury*
Department of Geography, University of Ottawa
Contact: aviau@uottawa.ca

Northern Canada shows higher sensitivity to recent climate change as a result of strong amplification processes in response to greenhouse gas forcing. In this context, we review climate variability of this region at orbital and millennial scales during the Holocene. New paleoclimate data from the SW Yukon and a continental-scale reconstruction based on a novel methodology illustrate the large impact of the Younger Dryas across North America. In the high Arctic millennial-scale variability throughout the Holocene is coherent with results found in ice cores. Holocene climate variability across the Canadian Boreal region reveals time-transgressive phenomena associated with the remnants of the Laurentide Ice Sheet in the east. Millennial scale climate variability, such as the Medieval Warm Period and Little Ice Age impacted the vegetation across the continent. Lastly, we present mapped patterns and time series of plant-functional type vegetation reconstructions in an effort to better enable data-model comparisons.

2B2.5 ID:2511 **11:30**

Net carbon drawdown of realizable afforestation from satellite data

Alvaro Montenegro , *Michael Eby* , *Andrew Weaver*
University of Victoria
Contact: alvaro@uvic.ca

Afforestation, the conversion of farm and marginal lands to forests, is among the climate change mitigation strategies available to society. Recent modelling studies have evaluated the climate impacts of afforestation after the albedo effects caused by this process are taken into consideration. Some of these studies suggest that the extra shortwave absorption from the lowering of the albedo caused by afforestation would overcome the cooling caused by the carbon drawdown and result in net planetary warming, particularly for afforestation at higher latitudes. Here we use global, satellite-derived land cover, albedo and shortwave flux data to investigate the effects of realizable afforestation, operationally defined as afforestation of areas currently occupied by farmland that would be occupied by forests according to a present day potential vegetation data set. The adopted data sets allow analysis at 0.05˚x 0.05˚ resolution, much finer than those of the previous model-based studies (~2.5˚x 2.5˚). Preliminary results indicate that the net carbon drawdown can be significantly smaller than the increase in

land carbon stock and that in, some areas, afforestation causes warming. The analysis of this high-resolution satellite data set makes it clear that albedo effects must be accounted for if afforestation is to be properly used as a climate mitigating tool.

2B2.6 ID:2288 **11:45**

Balancing oceans and emissions: a tolerable windows analysis

Karin Kvale , *Kirsten Zickfeld* , *Andrew Weaver*
University of Victoria
Contact: kkvale@uvic.ca

Radiative forcing by increased atmospheric levels of greenhouse gases (GHGs) produced by human activities could lead to strongly undesirable effects on oceans and their dependent human systems in the coming centuries. Such dangerous anthropogenic interference with the climate system is a possibility the UN Framework Convention on Climate Change (UNFCCC) calls on nations to avoid. Unacceptable consequences of such interference could include inundation of coastal areas and low-lying islands by rising sea level, the rate of which could exceed natural and human ability to adapt, and ocean acidification contributing to widespread disruption of marine and human food systems. Such consequences pose daunting socioeconomic costs, for developing nations in particular. Following the tolerable windows approach (TWA) we define levels of acceptable global marine change in terms of sea level rise and ocean acidification. A global-mean climate model (ACC2), is implemented in an optimizing environment, GAMS, and coupled to an economic model (DICE). This approach allows for the computation of a range of CO_2 emissions (the so-called "emissions corridor") which respect the predetermined ceilings and take into account the socio-economically acceptable pace of emissions reductions.

2B3.1 ID:2564 **10:30**

Atmospheric Hazards: Ice Storms in Atlantic Canada

William Richards [1], *Allison Dawe* [1], *Dermott Kearney* [2], *Bruce Whiffen* [2]
[1] Environment Canada, Adaptation and Impacts Research Division
[2] Environment Canada, Meteorological Service of Canada, Atlantic Region Operations
Contact: william.richards@ec.gc.ca

Ice storms resulting from freezing precipitation are hazardous weather events which have an impact on human safety, ground and air transportation, electrical transmission lines, telecommunication infrastructure and forests. At up to 160 hours per year, parts of Atlantic Canada have the highest incidence of freezing precipitation in North America. We researched and ranked significant ice storms by radial equivalent thickness (REQ) and by socio-economic impact. An impact rating scale was devised to classify ice storms from notable to extreme. The relationship between REQ and impact was weak due to variable vulnerability. We compiled storm tracks for significant events and displayed them as a function of location, REQ and impact. Storms which affect Newfoundland follow a decidedly more southerly track over the western Atlantic than storms which affect the Maritimes. Some prolonged events are attributed to quasi-stationary lows over the Atlantic.

2B3.2 ID:2297 **10:45**

Major cold-season precipitation events at Iqaluit, Nunavut

Gabrielle Gascon , *Ronald Stewart* , *William Henson*
McGill University
Contact: gabrielle.gascon@mail.mcgill.ca

Despite their importance, storms producing snow and mixed phase precipitation with significant accumulation have received little attention in the Arctic, especially over southern Baffin Island. This study focuses on cold-season (October-April) precipitation events at Iqaluit, Nunavut that exceed the 95th percentile of daily corrected precipitation accumulation. The distribution, wind patterns and precipitation types of 194 major precipitation events are described for the 1955-1996 period. Based on NCEP-NCAR and NARR reanalysis data, the low pressure systems that led to these events came from the Atlantic Ocean (40%), the South (29%) and the West (23%), or were triggered by short-wave troughs (8%). No significant trend in the frequency of major precipitation events has been identified, but an inverse relationship between major precipitation events anomaly and the NAO index was observed. The analysis and comparison of one typical case study per origin group revealed several similarities and differences. For example, a surface warm front and a mid-level inversion were observed in all instances, but the type of precipitation varied. The Atlantic- and South-originating storms only produced snow; snow grains were observed during the short-wave trough event and are believed to be generated by riming of supercooled droplets; and freezing rain was produced during the west-originating case. This presentation will illustrate the climatological and variable internal features of these major precipitation events.

2B3.3 ID:2365 **11:00**

On the Formation of Winter Precipitation Types

Julie Theriault , *Ronald Stewart* , *William Henson*
McGill University
Contact: julie.theriault@mcgill.ca

Winter storms are often associated with a wide variety of precipitation types. At temperatures near 0ºC, particles composed of both ice and water, called mixed-phase precipitation, can be formed as well as pure liquid and pure ice particles. Many of these types of precipitation, such as wet snow and freezing rain, may cause major problems to society. The objective of this study is to better understand the formation of these many winter precipitation types and to study their sensitivity to the temperature profile through which they fall. To address this issue, a microphysics scheme was developed that accounts for the hydrometeor categories observed during winter storms. The scheme includes detailed calculations of the melting of snowflakes, the occurrence of mixed-phase precipitation, and the freezing or partial freezing of the mixed-phase precipitation. This new parameterization, when utilized within vertical atmospheric profiles, can lead to the production of a wide range of precipitation types, and its compatibility was validated

using in-flight observations during the 1998 Ice Storm. Sensitivity experiments of the precipitation types to the vertical temperature profile were also conducted. The data used for these tests were the North American Regional Reanalysis during the 1998 Ice Storm in the Montreal area as well as surface observations of precipitation types. The results also show that very small changes in the temperature profile (<0.75ºC) significantly affect the precipitation types at the surface. This implies that one needs to accurately forecast the vertical temperature profile if one hopes to correctly simulate the impacts of such icing events.

2B3.4 ID:2263 **11:15**

The 1998 Ice Storm Flow Fields and their Relation to Precipitation

William Henson [1], *Ronald Stewart* [2], *Bohdan Kochtubajda* [3]
[1] Dept. of Atmospheric Sciences, McGill University
[2] McGill University
[3] Environment Canada
Contact: william.henson@gmail.com

The 1998 Ice Storm causing catastrophic losses occurred in early January 1998 over eastern Canada and the northeastern United States. The various types of precipitation and associated precipitation structures of this storm are discussed with a particular emphasis on the storm's wind fields in the Montréal area. Hourly surface observations, Doppler radar data, in-situ aircraft observations and reanalysis information are used to describe the hydrometeor phase and production. This hydrometeor development was linked in part to the flow fields in the St. Lawrence River Valley and its topographic features. The two periods of significant freezing accumulation were characterized by more organized precipitation than at other times but there were also distinct differences between the two periods in terms of wind fields. The two periods also exhibited similarities to major icing storms in the past, and this implies comparable organizational processes within major icing events that occur in this region.

2B3.5 ID:2465 **11:30**

GEM-LAM Convective Forecasts: How Can they be used in an Operational Forecast Environment?

Steve Knott [1], *David Schmidt* [1], *Garry Toth* [2]
[1] Prairie and Arctic Storm Prediction Centre, Environment Canada
[2] Hydrometeorology and Arctic Lab, Environment Canada
Contact: steve.knott2@ec.gc.ca

The summer of 2007 was a very active convective season across the Canadian prairies, particularly over Alberta during the latter half of July. The Canadian GEM-LAM is a nested local area model with a horizontal resolution of 2.5 km. The GEM-LAM window for western Canada covers southern BC and southern Alberta. During the summers of 2006 and 2007, a systematic evaluation of the GEM-LAM forecasts of convection over Alberta was carried out in Edmonton. In addition, several of the July 2007 convective days were recently examined in greater detail. These evaluations and case studies have

provided some insight into the utility of summer convective forecasts from the GEM-LAM model in an operational forecast environment. This presentation will evaluate the potential benefits of utilizing the GEM-LAM on the forecast desk in convective situations. Various aspects of convection, including convective initiation, convective evolution, convergence zones and dewpoint temperatures, will be examined.

2B3.6 ID:2231 11:45

Real-time forecast of the 2005 and 2007 summer severe floods in the Huaihe River Basin of China

Lei Wen [1], *Charles Lin* [2], *Guihua Lu* [3], *Zhiyong Wu* [3], *Jianyun Zhang* [4], *Yang Yang* [4], *Yufei Zhu* [5], *Lingying Tong* [5]
[1] McGill University
[2] Environment Canada/McGill University
[3] Hohai University
[4] Chinese Ministry of Water Resources
[5] Environment Canada
Contact: lei.wen@mcgill.ca

We have developed a one-way coupled hydro-meteorological modeling system consisting of the mesoscale atmospheric model MC2 (Canadian Mesoscale Compressible Community), the Chinese Xinanjiang hydrological model for runoff generation, a flow routing model, and a module for acquiring real-time gauge precipitation. The system had been successfully tested in a hindcast mode using a total of 18 meteorological cases from 1998 and 2003 in the Huaihe River Basin (HRB; 270,000 km2) of China, and has been used to generate daily precipitation and flood forecasts in real-time for the 2005, 2006 and 2007 flooding season over the Wangjiaba sub-basin (30,500 km2), part of the HRB. We run MC2 daily to produce a 96-h precipitation forecast, and then use the combined gauge-model precipitation to drive the hydrological model off-line to forecast the hydrograph at the Wangjiaba Station that is at the outlet of the Wangjiaba sub-basin. We examine the daily forecasts for the two most severe flood events encountered in the past three flooding seasons. The two events occurred in July 4-15, 2005 and June 30-July 25, 2007, which necessitated the use of several flood spillway and flood detention areas along the mainstream of the Huaihe River. A total of 19 daily 96-h precipitation forecasts from the two events are examined. The 19 daily forecasts with different lead times compare reasonably well with observations, although the skill as measured by the MC2 relative error and the MC2 forecast success rate is uneven over a 4-day forecast period. MC2 can better forecast the 96-h accumulation compared to 24-h amounts. We also analyze 10 daily hydrograph forecasts from the two events. The flood peak of the two events at the Wangjiaba Station is predicted well in both timing and intensity with a lead time beyond four days, although the quality of our daily hydrograph forecasts as measured by the relative percentage error of the forecast peak discharge and the Nash-Sutcliffe coefficient is not uniform over different forecast days. It is clear that the skill of the MC2 precipitation has the largest effect on the predicted hydrographs, and the accuracy of daily hydrograph forecasts can be improved substantially using the up-to-date gauge precipitation to complement the MC2 precipitation for driving the hydrological model in real-time flood forecast. Our results demonstrate the applicability

and the value of using mesoscale model precipitation for real-time flood forecast, which can provide a long lead time of heavy precipitation and subsequent flooding for authorities in operational flood management decision making.

2B7.1 ID:2468 10:30

The Dryline in Alberta: A GEM LAM 2.5 km Simulation on 24 July 2007

Neil Taylor , *Garry Toth*
Hydrometeorology and Arctic National Lab (HAL), MSC, Edmonton
Contact: garrym.toth@ec.gc.ca

The Rocky Mountain foothills in Alberta are a preferred region for convective initiation (CI) and the development of severe thunderstorms. Past studies of storm initiation in this region have examined the role of the mountain-plain circulation. Recently, the dryline has been investigated as a mechanism for CI and severe storm development over this region. Conceptual models for dryline genesis and morphology and a preliminary dryline climatology have been developed by the lead author. The present study investigates the simulation of an Alberta dryline by Environment Canada's GEM LAM 2.5 km model.

On 24 July 2007 a mini-supercell storm was initiated within ~25 km of a dryline. The storm caused widespread severe hail and damaging winds. The GEM LAM simulated dryline is characterized by a strong gradient in atmospheric boundary layer (ABL) moisture coincident with a line of convergence in the near-surface winds. On the moist side of the dryline the ABL is shallow and capped by an over-running elevated mixed layer. On the dry side the ABL is significantly drier and deeply mixed. Air on the dry side of the dryline is mainly subsident while at the dryline interface strong ascent is evident through the depth of the ABL. Deep-layer shear is maximized on the moist side of the dryline. In the dry air horizontal rolls are generated along the direction of ABL flow. Surface winds are convergent (divergent) beneath ascending (descending) branches of the rolls. The low-level mixing ratio is maximized along the convergent axes. The dryline exhibits along-line variability in wind, vertical velocity, and moisture fields with the presence of small-scale vortices. These results are broadly consistent with other dryline simulations and observations but there are indications that the dryline in Alberta may differ in origin and evolution from its US counterpart, responding mainly to subsidence and vertical momentum transport in the dry air. Characterization of the dryline in Alberta is a central goal of the Understanding Severe Thunderstorms and Alberta Boundary Layers Experiment (UNSTABLE). A pilot UNSTABLE field study will take place in summer 2008.

2B7.2 ID:2467 10:45

An observed connection between the North Atlantic Oscillation and the Madden-Julian Oscillation

Hai Lin [1], *Gilbert Brunet* [1], *Jacques Derome* [2]
[1] MRD, Environment Canada
[2] McGill University

Contact: hai.lin@ec.gc.ca

Based on a bivariate Madden-Julian Oscillation (MJO) index and 25 years (1979-2004) of pentad data, the association between the North Atlantic Oscillation (NAO) and the MJO on the intraseasonal time scale during the Northern Hemisphere winter season is analyzed. Time-lagged composites of the NAO index for different phases of the MJO reveal statistically significant connections between the NAO and the tropical convection of the MJO. A significant increase of the NAO amplitude happens about 5 to 15 days after the MJO-related convection anomaly reaches the tropical central Pacific region. The development of the positive NAO is associated with a Rossby wave train in the upstream Pacific and North American region, whereas for the negative NAO it is more likely that its northern center develops through advection and a merging of two anomaly centers from two different directions. In the Atlantic and African sector, there is an indication of an extratropical influence on the tropical intraseasonal variability. The occurrence of a strong NAO is followed by a significant change of tropical upper zonal wind in about 10 days, leading to significant changes in upper divergence and tropical convection from eastern Brazil to tropical Africa. This upper zonal wind change is likely to be caused by a modulated transient westerly momentum flux convergence associated with the NAO. The resulting change of convective activity in the tropical Atlantic-Africa region possibly serves as a trigger and precursor for the MJO as the anomalous convection develops rapidly after moving into the Indian Ocean.

2B7.3 ID:2322 **11:00**

MJO and its relationship to ENSO

Youmin Tang [1], *Bin Yu* [2]
[1] UNBC
[2] Environment Canada
Contact: ytang@unbc.ca

In this study, we detected the spatial and temporal characteristics of Madden-Julian Oscillation (MJO) using surface zonal wind and outgoing long-wave radiation (OLR) from the NCEP-NCAR (U.S. National Center of Environmental Prediction-National Center for Atmospheric Research) reanalysis product from 1981-2003. The results show that MJO activity in zonal winds at the surface and OLR has large variances both in the region off the equator around 10 degree and in the near-equatorial western Pacific.

One central issue addressed in this study is MJO-ENSO (El Ni~no and Southern Oscillation) relationship. It has been found that there exists a statistically significant relationship between MJO in spring-summer and ENSO in autumn-winter. The relationship of MJO-ENSO is nonlinear in nature and has a decadal variation. A much stronger statistical relationship of MJO-ENSO was found in the 1990s than in the 1980s. These findings were further verified using ECMWF (European Center for Medium-Range Weather Forecasts)reanalysis product. The potential mechanisms responsible for MJO-ENSO relationship are also discussed.

2B7.4 ID:2386 **11:15**

The impact of a modified convective scheme in a coupled model simulation of the MJO and ENSO during past climate regimes

Guido Vettoretti [1], *W. Richard Peltier* [1], *Xiaoqing Wu* [2]
[1] University of Toronto
[2] Iowa State University
Contact: g.vettoretti@utoronto.ca

Modifications to the representation of subgrid-scale cloud systems and convection in a version of the NCAR coupled atmosphere-ocean model (CSM1.4) have been implemented to improve modeling both interannual El Nino-Southern Oscillation (ENSO) and intraseasonal Madden-Julian (MJO) variability in closer accord with observations. We will present results from this modified version of CSM1.4 and discuss the factors leading to improvements in the simulated Tropical Pacific climate variability. The modified model is also used to conduct experiments investigating the response of ENSO variability during an idealized freshwater forcing (FWF) event and in a simulation of Last Glacial Maximum (LGM) climate.

2B7.5 ID:2486 **INVITED/INVITÉ** **11:30**

Climate change through the past 10,000 years with implications for human cultural development

Andrew Bush
University of Alberta
Contact: andrew.bush@ualberta.ca

Despite being considered a relatively stable climatic period, the past 10,000 years (the Holocene) have in fact exhibited distinct regional shifts in climate, particularly in central Asia. Holocene climate was influenced by a number of external factors. Atmospheric carbon dioxide gradually increased through the Holocene. The Earth's orbital parameters of obliquity, eccentricity, and longitude of perihelion were changing such that the amplitude of the seasonal cycle (defined by the difference between summer and winter temperatures) was much larger in the early Holocene than today. Remnants of continental ice sheets from the Last Glacial Maximum persisted into the early-mid Holocene.

Results from numerical general circulation model experiments that include all of these factors indicate that environmental conditions over central Asia through the Holocene evolved from cold and wet to warm and dry, with the transition occurring relatively rapidly at 6,500 years ago. Regional model results using NCAR/PSU's MM5, in conjunction with environmental reconstructions from pollen and lake diatom data, also show a distinct mid-Holocene shift in central Asian climate.

Coeval with this climate change there was a distinct shift in culture in the region of Lake Baikal (southern Siberia), where past human populations have been studied extensively. Evidence from mortuary practices, dietary reconstructions, and mitochondrial DNA suggest a cultural replacement in the region around 6,500 years ago.

This talk will explore the possibility that climate change was a driving force in this cultural evolution and/or migration.

2B5.1 ID:2327 10:30

Design of a tool to support heat-alert decision

Mathilde Pascal [1], *Karine Laaidi* [1], *Françoise Bénichou* [2], *Vincent Cassé* [2]
[1] Institut de Veille Sanitaire
[2] Météo-France
Contact: m.pascal@invs.sante.fr

Following the 2003-heatwave, France developed a plan to prevent heat-related health impacts during heat -waves. It includes a heat-warning system designed to identify adverse weather situations and to trigger heat-alerts. The system is mainly based on the monitoring of three-day average of the minimal and maximal temperatures. A heat-alert is issued when these averages are above defined thresholds. The heat-warning system is operated by the French Institute for Public Health Surveillance since summer 2004. Feedback from its yearly evaluation showed the interest of taking into account additional qualitative criteria such as humidity, air pollution, social background and possible health impact. It also revealed that the analysis of these criteria could substantially differ depending on the person operating the system. A tool was thus developed to improve the reproducibility of the analysis of the criteria to support decision making. Two dimensions were taken into account: the probability of being above the thresholds, which remains the basis of the system, and several risks factors, either meteorological or social. Real time surveillance of sanitary data was also considered to maintain or not an alert. Risks factors were selected through expertise and through a review of the literature. The tool will be blind-tested by different decision-makers on former situations. At the time of abstract submission, the test has not been done. Results are expected on the added-value of the tool in terms of decision-support and time. The tool will be used from 1st June to 31st August 2008. It will be evaluated at the end of the summer 2008.

2B5.2 ID:2326 10:45

Pertinence and feasibility study of an alert system for cold spells

Karine Laaidi , *Assimoula Economopoulou* , *Vérène Wagner* , *Pascal Empereur-Bissonnet*
institut de veille sanitaire
Contact: ka.laaidi@invs.sante.fr

Context. The French Institute for Public Health Surveillance has set up since winter 2004 a surveillance of temperatures and health indicators. But this surveillance is not based on scientifically defined indictors. Objectives. The objective of this study was to define if setting up an alert system, making possible to prevent excess mortality due to cold in France, is pertinent and feasible. Method. We defined pertinence and feasibility criteria, such as: showing a relation between cold and excess mortality, having a management plan, defining meteorological indicators and thresholds on the basis of sensibility and

Positive Predictive Value (PPV)... Daily meteorological and mortality data were integrated in a time-series analysis on a 20-year period to identify the best indicator and the best-fitted alert thresholds for two pilot cities, Paris and Marseille, which experience different climatic conditions. We used Poisson regression model to predict mortality from meteorological parameters, adjusted on confounding factors. Results: A relationship between cold and excess mortality has been showed, and we determined an indicator and alert thresholds for Paris and Marseille, which are near to the second percentile of the minimal temperature distribution (-5°C in Paris, -3°C in Marseille). It corresponds to an increasing mortality of 10% or more two days after the cold peak. But it generates more false alerts than real ones. Moreover, most of the measures that could help to reduce cold related mortality don't need an alert system, like improving isolation in hold houses or giving grants for heating. Alerts could be justified for emergency units or for informing the population, even if, in that last case, a simple system mediated by meteorology information could be enough. Conclusions: Not all criteria are present to build an alert system for cold, and further studies should be done, in relation with the management authorities.

2B5.3 ID:2209 **11:00**

Climate change and disaster management in Canada: reducing risk, saving lives

Kirsty Duncan
University of Toronto
Contact: kirsty.duncan@utoronto.ca

Recently, there has been a disturbing increase in the number of natural disasters: for example, in 1998, flooding in China affected 180 million people, destroyed nearly seven million homes, and killed close to 4,000 people. In 1999, a cyclone in India affected 10 to15 million people and killed 10,000; and in 2000, floods in Mozambique left 330,000 homeless, and killed 500 people. Natural disasters of medium size and stronger caused at least 25,000 deaths around the world in 2001, more than double the number the previous year, and economic losses of US $36 billion. More recently, human-made and natural disasters in 2004 claimed more than 21,000 lives worldwide and economic losses of US$105 billion. The year 2005 further tested the international relief community with ‘unparalleled frequency and scale of natural disaster’; Hurricane Katrina alone destroyed 300,000 homes, displaced 770,000 people, and cost US$ 200 billion. Canada is not immune to severe weather: for example, heavy rains in August, 2005, beat the 100-year event level, damaged cars, flooded basements, and washed away infrastructure in the Greater Toronto Area. Two tornadoes touched down in the Fergus/Salem, Ontario area, and the combined event cost more than Cdn $500 million in insured losses. In the future, climate change is likely to mean higher maximum temperatures and more intense precipitation (with concomitant increased avalanches, floods, mudslides, etc.) in Canada. Because disaster response professionals and emergency managers from all levels of government, the military, the private sector, and volunteer organizations are often the first people ‘on the ground’ during/following an extreme weather event, this paper will explore what climate change may mean for disaster managers in Canada, how climate change may affect the environments in which they work, and how best to reduce risks, and save lives.

2B5.4 ID:2206 **11:15**

Canadian coastal communities adapt to climate change

Marielou Verge
Health Canada
Contact: marielou_verge@hc-sc.gc.ca

Recent research has demonstrated that Canada's coastal zones are vulnerable to climate change, primarily through sea level rise, storm activity and sea ice changes. It is predicted that storms will occur more frequently, and that intense storms combined with high tides may result in extreme water levels and flooding. Stormsurges impact both the biophysical and socio-economic environment of coastal communities, having consequences on sectors such as fisheries, transportation, tourism and recreation, public health services and community life. In order to better understand this vulnerability and best manage impacts to coastal communities, it is important to assess the capacity of communities to cope with extreme weather events. In this perspective, Health Canada led field studies, partly funded by the Climate Change Impacts and Adaptation Program of Natural Resources Canada.

The research project aimed at evaluating the adaptive capacity of two atlantic coastal communities (Cap-Pelé, New-Brunswick and Port-aux-Basques, Newfoundland) to respond to a storm surge. To evaluate the adaptive capacity of coastal communities to extreme events, we applied principles used during simulation exercises. In participating in a simulation exercise, decision-makers from all sectors (government, business, non-governmental organisations, etc.) were presented the impacts and consequences of a storm surge in their community and made decisions related to emergency response plans, emergency management, communication and coordination, and public health.

The results of the project helped identify and assess the response capacity of emergency and long-term support systems, as well as the capacity of stakeholders to deliver an effective, coordinated response. More specifically, best practices and strategies for improved community health, protection and recovery were highlighted in hopes of reducing social and environmental costs. Lessons learned and the final analysis provided a better understanding of the key factors regarding adaptive capacity to climate change that could be shared with other coastal communities across Canada.

2B5.5 ID:2347 **11:30**

Human health in a changing climate: A Canadian assessment of vulnerabilities and adaptive capacity - Vulnerabilities to natural hazards and extreme weather

Peter Berry , *Kaila-Lea Clarke*
Health Canada Climate Change and Health Office
Contact: peter_berry@hc-sc.gc.ca

With its widespread environmental and human health impacts, climate change has become a major global health issue. Climate change and increasing climate variability already affect the health of populations worldwide both directly and indirectly, causing physical and mental illnesses, injury and, in extreme cases death—Canada is no exception. In June 2003, the Climate Change and Health Office at Health Canada launched Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity. Using a broad range of health data and analytical methods this assessment reports on the scope and magnitude of current and anticipated health impacts of climate change in Canada related to air quality, natural hazards, infectious diseases and a range of health impacts in Quebec and the North. It also gauges the capacity of governments and communities to respond to climate-related health risks. This assessment integrates information from a variety of perspectives including those of public health, the voluntary sector, emergency preparedness, meteorological services, air quality, and academia. The full assessment document will be available Spring 2008. Events in recent years have demonstrated the impacts on Canadians from climate-related natural hazards, including extreme temperatures, floods, droughts, storms, avalanches and mudslides. The evidence and implications of climate change for natural hazards in Canada and the impacts of these events on health are reviewed in one chapter of this Assessment. The health vulnerabilities of individuals and communities are assessed and ways of managing risks and reducing vulnerability through adaptation are explored.

2C1.1 ID:2505 INVITED/INVITÉ 14:00

Upwelling Flow Dynamics of Slow Flow in Long Canyons

Amy Waterhouse , *Susan Allen* , *Alexander Bowie*
Earth and Ocean Sciences, University of British Columbia
Contact: sallen@eos.ubc.ca

Submarine canyons, topographic features incising the continental slope, are responsible for increased upwelling along coastal margins. Canyons vary in both shape and size. The dynamics of short canyons have been observed and described in the field, laboratory and with numerical simulations. Long canyons, such as the Juan de Fuca canyon, located between Vancouver Island and Washington State in the Pacific Northwest, have been associated with seasonal upwelling onto the nearby shelf. Flow within these canyons is less well understood. Physical models of both long and short canyons have been constructed to understand the upwelling dynamics in long canyons and how upwelling changes with flow speed (Rossby number). Stratification and rotation, both important parameters in determining the dynamics in canyons, can be controlled and scaled accordingly for replication of oceanic conditions. Flow visualization is used to determine the strength and location of upwelling, the strength and mechanisms generating vorticity, as well as the differences between the flow within the long and short canyons. At high Rossby number, upwelling occurs in the short canyon over a period of time due to advective processes. As Rossby number decreases, upwelling strongly decreases in the short canyon. At high Rossby number, the flow in the long canyon is comparable to that in a short canyon but as Rossby number decreases, upwelling continues and blocking occurs upstream of the canyon. These characteristics are indicative of upwelling due to isobath convergence.

2C1.2 ID:2530 **14:15**

Grand Banks White Hake Recruitment in Relation to the Labrador Current and Spring Bloom

Guoqi Han , *David Kulka*
Fisheries and Oceans Canada
Contact: hang@dfo-mpo.gc.ca

White hake (Urophycis tenuis) is a temperate bottom dwelling fish with the northern extent of its distribution on the Grand Banks. They are found at bottom depths from 50-800 m on the Grand Banks and are mostly concentrated over a narrow band along the southwest edge where local bottom temperatures are warmest. Survey data indicated exceptionally good abundance of the 1999 year class from 1970s to 2004. Here we investigated potential dispersion patterns of eggs, larvae and juveniles under the reconstructed circulation fields based on a 3-D ocean model and satellite altimetry. We also examined the abundance of the spawning females from the survey data and the evolution of spring phytoplankton blooms from the SeaWiFs data. The abundance of the 1999 year class seems to be related to a weaker Labrador Current and an early spring bloom in 1999.

2C1.3 ID:2363 **14:30**

A Three-Level Nested-Grid Coastal Circulation Model for the Pearl River Estuary of the South China Sea

Jinyu Sheng [1], *Xiaomei Ji* [2], *Liqun Tang* [3]
[1] Department of Oceanography, Dalhousie University
[2] Oceanography, Dalhousie University and School of Grographic and Oceanogr. School, Nanjing University
[3] Institute of Hydropower and Water resources of China, China
Contact: jinyu.sheng@dal.ca

The Pearl River is the largest river system in Southern China. The mean annual discharge of the Pearl River is ~330 km^3, which is slightly smaller than the St. Lawrence River discharge of ~450 km^3, but larger than the Frazer River discharge of ~113 km^3. The Pearl River Delta, which occupies the low-lying areas alongside the Pearl River Estuary with a population of ~50 million people, has been the fastest growing portion of the fastest growing province in the fastest growing large economy in the world. The Pearl River Delta is also notoriously polluted, with sewage and industrial waste treatment facilities failing to keep pace with the growth in population and industry in the area. Circulation in the Pearl River Estuary is dynamically complicated due to several forcing mechanisms including tides, wind, freshwater runoff and highly variable topography in the region. A nested-grid ocean circulation modelling system was recently developed based the POM with three sub-components. The outer sub-component of the system is a two-dimensional tidal and storm-surge sub-model covering the Yellow Sea, East China Sea and northern South China Sea, with a horizontal resolution of ~7 km. The middle sub-component is a three-dimensional (3D) baroclinic sub-model, covering the inner shelf of the northern South China Sea with a horizontal resolution of ~3 km. The inner sub-component is also a 3D baroclinic sub-model, covering the Pearl River Estuary with

a horizontal resolution of ~1.2 km. Our ultimate goal is to develop an operational nested-grid coastal circulation prediction system for providing nowcasts and short-term forecasts of physical conditions including storm surges, 3D currents and water mass distributions in the estuary. In this study the nested-grid modelling system was used in examining the dynamic response of the Pearl River Estuary to tides, wind forcing and freshwater runoff.

2C1.4 ID:2244 **14:45**

Modelling for Tidal Power Energy and Impacts

David A. Greenberg , *Peter C. Smith* , *Charles Hannah*
Bedford Institute of Oceanography
Contact: greenbergd@mar.dfo-mpo.gc.ca

Nova Scotia is proceeding with prototype in-stream tidal power installations in the Upper Bay of Fundy. The tidal power studies in the 1970s to 1980s concentrated on a possible barrage across the head of Minas Basin between Economy Point and Cape Tenny. The present work is proceeding at demonstration sites further up the Bay in Minas Passage, a very dynamic narrow channel that opens into Minas Basin, with the hope of expansion to make a major contribution to energy supplies. As in the earlier studies, we are interested in possible near and far field environmental effects throughout the Bay of Fundy and Gulf of Maine, as well as near field flow characteristics that would affect energy generation. This talk will review what the earlier tidal power modelling work can tell us about the present plans, give updates using more recent model results, and describe future plans.

2C1.5 ID:2245 **15:00**

Tidal Power from Minas Passage, NS: Prospects and Potential Impacts

Peter C. Smith , *David A. Greenberg* , *Charles Hannah*
(Presented by *Peter Smith*)
Bedford Institute of Oceanography
Contact: smithpc@mar.dfo-mpo.gc.ca

A recent report (Hagerman et al., 2005) evaluates eight potential sites in the Bay of Fundy for Tidal In-Stream Energy Conversion (TISEC). Of these sites, the Minas Passage excels in all categories, including energy resource potential, seabed conditions, onshore facilities and proximity to the power grid. However, quantitative understanding of both the generation potential and important environmental impacts in the region is presently lacking (e.g. estimates of the total available tidal stream resource differ by at least a factor of 2). In an effort to remedy this situation, critical observations of seabed conditions (high-resolution multibeam) and current structures (ADCP moorings/transects) have been made in the Minas Passage in anticipation of an ambitious TISEC demonstration project scheduled commence in 2009. This presentation will review the recent, as well as historical, data from Minas Passage and their implications for TISEC and related model development.

Hagerman, G., G. Fader, G. Carlin, and R. Bedard. 2005. Nova Scotia Tidal In-Stream Energy Conversion (TISEC): Survey and Characterization of Potential Project Sites. Draft EPRI Report-TP-003 NS Rev 1, 98pp.

2C1.6 ID:2287 **15:15**

Assessment of Tidal Current Energy in Minas Passage, Bay of Fundy

Richard Karsten , *Justine Mcmillan* , *Megan Lickley* , *Ronald Haynes*
Acadia University
Contact: RKARSTEN@ACADIAU.CA

The Bay of Fundy has the world's highest tides. In particular, the Minas Basin has tides with a range of over 12m. The Minas Passage, which connects Minas Basin to the Bay of Fundy, has mean tidal currents of over 3m/s making it a promising location for tidal turbines. In this talk we examine the potential power that could be extracted from Minas Passage and the effect that extracting the power would have on the surrounding tides. A mathematical model is used to predict the effect of turbine drag on the flow through the Minas Passage and the tidal amplitude in the Minas Basin. The theory is compared to two-dimensional, finite-element numerical simulations of the Bay of Fundy-Gulf of Maine system. Together, they suggest that a maximum of 7 GW of power can be extracted by turbines. The simulations also show that any power extraction in Minas Passage pushes the Gulf of Maine-Bay of Fundy system closer to resonance with the forcing tides resulting in increased tidal amplitudes throughout the Gulf of Maine. While extraction of the maximum power will result in significant changes, over 2.5 GW of power can be extracted with less than a 5% change in the tidal amplitude at any location. Finally, we examine how isolated turbines and turbine fences might be best located in the Minas Passage by examining the fluid dynamics of flow past a turbine.

2C2.1 ID:2485 **INVITED/INVITÉ** **14:00**

The Coupled Historical Forecast Project, version 1: Formulation, results, and progress towards CHFP2

William Merryfield , *G.j. Boer* , *Greg Flato* , *Viatcheslav Kharin* , *Woo-sung Lee* , *Badal Pal* , *John Scinocca*
Canadian Centre for Climate Modelling and Analysis
Contact: bill.merryfield@ec.gc.ca

The Coupled Historical Forecast Project (CHFP) uses coupled climate models developed at CCCma to perform retrospective one-tier seasonal/interannual forecasts. The motivation is to extend the range of the current AGCM-based operational CMC seasonal forecast methods beyond the first season. An initial set of retrospective forecasts for the 30-year period from 1972 to 2002 have been performed (CHFP1) with CanCM3, a version of the coupled model used also to produce scenarios for the IPCC Fourth Assessment Report. A simple procedure consisting of nudging to observed SST is used to initialize all components of the model. Ensembles of 10 12-month forecasts are produced commencing in September, December, March and June of each year.

This talk (i) describes the effectiveness of the SST nudging procedure in initializing the surface and subsurface ocean, particularly in the equatorial Pacific, (ii) assesses the skill of the model in forecasting SST anomalies, and (iii) provides a comparison between CHFP1 forecast skill and that of the two-tier, four-model hindcast experiment, HFP2, which underpins Environment Canada's current operational seasonal forecasts.

CHFP1 also provides a baseline against which to judge the utility and applicability of new approaches and methodologies when developing improved versions of the coupled forecast system. Progress toward a successor system that will serve as the basis for CHFP2 is briefly described.

2C2.2 ID:2305 14:30

Climate trends in seasonal forecasts

G.j. Boer
Canadian Centre for Climate Modelling and Analysis
Contact: george.boer@ec.gc.ca

Deterministic forecasts produced with the HFP2 multi-model two-tier seasonal forecast system are analyzed in order to assess the presence and importance of long term trends on seasonal forecast skill. The results show that the trends in land surface temperature, 700hPa temperature and 500hPa geopotential height in the NCEP reanalysis data, with which the forecasts are initialized and verified, are much stronger than those in the forecasts. Since biases are removed from the forecast variables, this lack of trend is unlikely to be a consequence of model climate drift.

Although the atmospheric initial conditions and oceanic boundary conditions for the forecasts contain greenhouse gas and aerosol forcing information, these forcing mechanisms are not explicitly represented in the atmospheric general circulation models with which the forecasts are made. It is possible, therefore, that long term externally forced trends are weak or absent in the forecasts, especially over land, for this reason. The largest (missing) trends are in the DJF season over land and their lack in the forecasts can be at least partially overcome, and cross-validated forecast skill increased in some regions, by correcting the forecast trends a posteriori.

2C2.3 ID:2214 14:45

Seasonal forecasts at the Canadian Meteorological Centre

Juan Sebastian Fontecilla
CMC (Centre météorologique canadien)
Contact: juan-sebastian.fontecilla@ec.gc.ca

Since 1995, the Canadian Meteorological Centre has been producing seasonal temperature and precipitation anomaly forecasts using objective and statistical methods. Until recently, forecasts for season 1 were generated by numerical models GEM and GCM2, but since 1st December, two other models have been added. This new ensemble system generates deterministic and probabilistic products. This implementation has required 35 years of seasonal hindcasts which has been conducted with four different models: the CCCma models AGCM3 and AGCM2, and the RPN models GEM and SEF. This ensemble of hindcasts constitutes the second Historical Forecast Project (HFP2) which follows the protocol established by the PCMDI for the SMIP2/HFP. The protocol consists in 4-month forecasts for the period 1969 to 2003 for 12 rolling seasons (January-February-March-April, February-March-April-May, etc.) and 10 different realisations for each season. Climatic sea ice extent were prescribed for subsequent months and the sea surface temperatures (SST) were forecast using persistence of the anomalies calculated for the month preceding the integrations.

In this presentation we will describe the operational system of seasonal forecasts and the main deterministic and probabilistic products generated by this system. We also will show the main scores used to determine the skill of this system and the pertinence to replace the old system.

2C2.4 ID:2249 15:00

Benefits of multimodel ensembles in seasonal forecasting

Viatcheslav Kharin
CCCma, MSC, Victoria, B.C.
Contact: slava.kharin@ec.gc.ca

Skill levels of seasonal hindcasts produced in the second phase of the Canadian Historical Forecast Project (HFP2) tend to increase both with the overall ensemble size and with the number of models. An analysis of skill obtainable with different number of models and of different ensemble sizes indicates that there are genuine advantages in the multimodel ensemble approach. Using simple analytical skill-versus-size relationships in an idealized analog of the HFP2 seasonal forecasting system, it is demonstrated that the four model HFP2 ensemble with ten ensemble members per model is a reasonable multimodel configuration. The addition of a new model to the four-model ensemble would result in comparatively modest skill increase that could be perhaps more easily achieved by increasing the ensemble sizes in the existing ensemble. On the other hand, compensating for lost skill from eliminating a model from a four-model ensemble by increasing ensemble size would be more difficult.

2C2.5 ID:2466 15:15

Forecast skill of the Madden-Julian Oscillation in two Canadian atmospheric models

Hai Lin [1], *Gilbert Brunet* [1], *Jacques Derome* [2]
[1] MRD, Environment Canada
[2] McGill University
Contact: hai.lin@ec.gc.ca

The output of two global atmospheric models participating in the second phase of the Canadian Historical Forecasting Project (HFP2) is utilized to assess the forecast skill of the Madden-Julian Oscillation (MJO). The two models are the third generation of general circulation model (GCM3) of the Canadian Centre for Climate Modelling and Analysis (CCCma) and the Global Environmental Multiscale (GEM) model of Recherche en Prevision Numerique (RPN). Space-time spectral analysis of the daily precipitation in near-equilibrium integrations reveals that GEM has a better representation of the convectively coupled equatorial waves including the MJO, Kelvin, equatorial Rossby (ER) and mixed Rossby-gravity (MRG) waves. An objective of this study is to examine how the MJO forecast skill is influenced by the model's ability to represent the convectively coupled equatorial waves. The result shows that the GEM model produces a significantly better forecasts of the MJO in the first two weeks. The difference is larger in winter than in summer. In winter the correlation skill score drops below 0.50 at a lead time of 10 days for GEM whereas at 6 days for GCM3. At lead times longer than about 15 days, GCM3 performs slightly better. There are some features that are common for the two models. The forecast skill is better in winter than in summer. Forecasts initialized with a large amplitude of the MJO are found to be more skillful than those with a weak MJO signal in the initial conditions. The forecast skill is dependent on the phase of the MJO in the initial conditions. Forecasts initialized with an MJO that has an active convection in tropical Africa - Indian ocean sector have a better forecast skill than those initialized with a different phase of the MJO.

2C3.1 ID:2222 14:00

The complexities of establishing a network of automatic weather stations and associated systems in support of the 2010 Vancouver Winter Olympics

Bill Scott
Environment Canada,
Contact: bill.scott@ec.gc.ca

Since the bid was awarded in 2004 to Vancouver/Whistler for the 2010 Winter Olympics, the Meteorological Service of Canada has been involved with setting up a network of automated data monitoring and collection systems. The entire area surrounding the Whistler and Callaghan Valley venues and the areas meteorologically upstream were very data sparse. To complicate matters, much of the area is inaccessible, thickly treed, steeply sloped and exposed to extreme winter weather conditions. Although a primary focus was to install systems within the venues, it became clear that additional automated systems were required along the Sunshine Coast and along the eastern side of Vancouver Island. Although approximately 35 new or upgraded automated systems have now been installed such that the 'core' Olympic Autostation Network' is now functional, by the time of the events of 2010 there may be 50 - 60. Although most are new systems, wherever possible exisiting systems were upgraded and cooperatives with other government agencies have been established to utilize their systems for Olympic forecasting purposes. To maintain these systems in the extremely harsh climate of the Coast Mountains so that the winter data collection continues as accurately as possible has proven to be very complex and high maintenance. The intent of installing this network as much in advance of the Olympics as possible and to gather data over several prior winters has proven to be extremely important. Although the primary client for these new systems is the weather forecast operations of MSC, other clients include weather modelling, climatological studies, public weather information and the specific requirements of the Olympic sport events. System installation locations and sensor siting had to be optimized to meet these client requirements.

2C3.2 ID:2227 **14:15**

Economic and operational aspects of weather forecast information to the 2010 Olympic Winter Games

Chris Doyle
Environment Canada
Contact: chris.doyle@ec.gc.ca

The Olympic Winter Games will be held in Vancouver, BC during February 12-28, 2010. Given the climatology of the region, it is likely that adverse weather will, in some manner, affect the conduct of the event. The Vancouver Olympic Organizing Committee (VANOC) has contracted with Environment Canada (EC) to provide weather services for the benefit of planning and operations. Severe winter weather and other forms of adverse weather will affect the scheduling and operation of individual sporting events, and may create difficult and possibly hazardous conditions for athletes, spectators, and the games workforce.

Simulating the operations of the Games during the Olympic period in years prior to the event is now standard operating procedure for Games' organizers who want to avoid potential catastrophes. Given the high potential impact of weather during the Winter Olympics, the aim of this study is to determine, during Olympic practice and training periods in 2008 and 2009, how forecasts are used by Operational Olympic decision makers to mitigate the effects of adverse weather conditions, and to demonstrate the economic and social-safety value of those forecasts.

Two kinds of forecasts will be evaluated: • Short–term (0-48h) subjective (forecaster-produced) forecasts based on guidance from the Canadian GEM, derivative LAM models, and other sources where appropriate, and • Longer term (48h-96h) forecasts produced from model data provided by the Thorpex Interactive Grand Global Ensemble (TIGGE) and through global model data informed by T-PARC (Thorpex Pacific-Asia Regional Campaign) winter-phase additional data sets and model output.

Emerging from the assessment of research results will be in indication of how additional T-PARC winter phase data sets have contributed to an increase in the accuracy of forecasts, with linkages to their potential economic benefit.

2C3.3 ID:2234 **14:30**

The Vancouver 2010 Olympic Forecasting Science Plan

Paul Joe , Chris Doyle , George Isaac , Jocelyn Mailhot , Stephane Belair , Faisal Boudala , Edwin Campos
Environment Canada

Contact: paul.joe@ec.gc.ca

In Feb 2010, the Winter Olympics will be held in Vancouver, Cypres, Whistler and Blackcomb Mountains and in the Callaghan Valley. Forecasts are needed at all time and space scales and in particular on the nowcast scale. The average temperature in the Whistler valley are -2.3 o and -0.6o C with a mix of rain and snow. Typically on Whistler Mountain, high winds can be expected at the top, fog and low cloud at mid-levels and snow-rain at lower levels. Combined with coastal aspects, winter weather and complex terrain issues, the nowcast problems are novel requiring the development of a monitoring approach where a unique suite of in-situ sensors capable of collecting heavy wet snow and measuring wind in icing conditions, a valley radar is sited to produce vertical-section products and high temporal snowfall measurements are installed. Development of high resolution models require improvements in microphysics scheme and initialization approaches. These model outputs are used to drive a very high resolution surface scheme to forecast relevant weather elements at each of the venues. A aviaton nowcast system, CAN-NOW, is adapted to produce nowcasts of many weather elements including temperature, visibility, wind, etc besides the usual precipitaton intensity. In addition, a World Meteorological Organization Research Development Project is proposed to accelerate the development of winter complex terrain nowcasts, to provide real-time verification and to develop end-user specific products.

2C3.4 ID:2549 14:45

SCRIBE: Upcoming deployment and development.

Claude Landry , *Richard Verret* , *Denis Vigneux* , *Michel Nadeau* , *Jacques Marcoux* , *Jamie Mclean* , *Louise Faust* , *Reine Parent* , *Jean-François Deschênes* , *Matthew Holly* , *Jean-Pierre Talbot*
MSC-CMC Environment Canada
Contact: claude.landry@ec.gc.ca

Since 2005 the SCRIBE Interactive Expert System is used as the main forecast production tool in all Storm Prediction Centers of Canada. It supports the National Weather Forecast Programs of the Meteorological Service of Canada (MSC). This relatively recent implementation has showed its efficiency to support the dissemination of a wider collection of meteorological products in both official languages and in different useful format.

The new Scribe versions that will be implemented soon, will support the new Marine Forecast Program and the Air Quality Forecast Program. Furthermore, other projects on Scribe are currently under development. The Canadian Ensemble Forecast System will be used as input to Scribe to generate the long term forecast. The current matrices will migrate to a BUFR format. The GEM Regional intermediate runs (06-18Z) will be integrated in Scribe. And, special features will be added to Scribe to fulfill some requirement for the Olympic 2010. A description of these new versions and projects will be presented.

2C3.5 ID:2307 **15:00**

Improving SCRIBE public weather forecasts by using a background field to interpolate point forecasts

Vincent Fortin [1], *Matthew Holly* [2], *Stéphane Beauregard* [2], *Marcel Vallée* [1], *Gérard Croteau* [2], *Pierre Bourgouin* [2]
[1] Meteorological Research Division, Environment Canada
[2] Meteorological Service of Canada, Environment Canada
Contact: vincent.fortin@ec.gc.ca

Forecasters from the Meteorological Service of Canada (MSC) use SCRIBE to generate public and marine forecasts. SCRIBE ingests several types of data including forecasts generated by the updateable model output statistics (UMOS) system. This statistical package generates forecasts by combining the observations at a weather station with numerical weather predictions at the same location using stepwise regression, and thus requires real-time weather observations as well as a record of past observations at the location of interest. At some locations where a public forecast is required, UMOS may not have enough information to issue a reliable forecast. This could be due to a lack of real-time observations, insufficient past forecast records, or poor correlation between the numerical weather predictions and observational data. In such cases, UMOS forecasts valid at neighbouring locations are interpolated to the location of interest and provided to SCRIBE instead. We show that temperature forecasts are significantly improved if a background field provided by the numerical weather prediction system is used during the interpolation process. Major improvements are seen not only for isolated locations, but also for stations located near the Canada-US border.

2C3.6 ID:2210 **15:15**

UMOS-AQ: Forecasting O_3 and PM_{25} three-hourly spot concentrations using an updatable MOS methodology

Stavros Antonopoulos , *Pierre Bourgouin* , *Jacques Montpetit* , *Marcel Vallée* , *Gérard Croteau*
CMC, MSC
Contact: stavros.antonopoulos@ec.gc.ca

The steps taken to expand for the first time the updatable MOS (UMOS) methodology to air-quality forecasting will be presented. This methodology has shown great ability to improve direct model output with weather elements.

Air-quality data (observational and numerical) were sufficient to produce 3-hourly spot concentration forecasts of ozone (O_3) and particulate matter 2.5μm (PM_{25}), up to 48 hours. Numerical data originating from two sources; an air-quality model (CHRONOS) and a meteorological model (regional GEM) were used to produce a set of 71 direct and calculated predictors.

The UMOS-AQ system produces one equation per station, per predictand, per model run and per forecast hour. Forecast equations were produced with 250+ dependent sample

days, for a set of about 100 sites. Verifications on a 25-day independent sample show encouraging results with a significant improvement over the model's direct forecast. The UMOS-AQ system effectively reduces the model's bias and error while increasing its variance.

Important conclusions can be derived from the order of the chosen predictors that can lead to a better understanding of site-specific conditions. This information can also act as an additional verification step to the air quality model.

An overall description of the UMOS-AQ system will be highlighted. Verification results suggest that UMOS may become an important tool for air-quality forecasting.

2C7.1 ID:2314 14:00

The 20th century carbon budget simulated with the CCCma earth system model

Vivek Arora , G.j. Boer , Charles Curry , Jim Christian , Kos Zahariev , Kenneth Denman , Greg Flato , John Scinocca
Canadian Centre for Climate Modelling and Analysis, Meteorological Service of Canada
Contact: vivek.arora@ec.gc.ca

The atmosphere-land-ocean CO2 exchange for the 1850-2000 period simulated with the Canadian Centre for Climate Modelling and Analysis Earth System Model (CanESM1) is assessed. In the absence of nutrient limitation the overactive terrestrial component leads to higher land carbon uptake and lower atmospheric CO2 concentration than observed for the period. This result is consistent with studies of the down-regulation of terrestrial photosynthesis as CO2 concentration increases. The rate of down-regulation inferred from experimental studies of plant growth under conditions of increased CO2 is used to implement an empirical down-regulation mechanism in the model. The result is better comparison with observation-based land and ocean carbon uptake and atmospheric CO2 concentration. The annual cycle of simulated global averaged CO2, dominated by the northern hemisphere terrestrial photosynthesis and respiration cycles, is simulated reasonably well as is the simulated latitudinal distribution of CO2. The empirical down-regulation approach used here offers a reasonable mechanism suitable for coupled carbon-climate simulations in the absence of an explicit biogeochemical-based representation in models.

2C7.2 ID:2378 14:15

Averaging and stochastic mode reduction methods applied to a model of atmospheric low-frequency variability

Joel Culina , Adam Monahan
University of Victoria
Contact: culinaj@uvic.ca

Low-dimensional (planetary scale) models of extratropical atmospheric low-frequency variability (LFV) are derived from a nearly 10000-dimensional (planetary and synoptic scale) model through averaging and stochastic representation of the fast processes. The

bottom drag parameter is a bifurcation parameter of the unreduced model, controlling the transition from a stationary jet to aperiodic, low-frequency meridional shifts of the jet. At realistic bottom drag, for which there are meridional shifts, the statistics of the greatest variance, low-frequency modes is captured by three-dimensional ordinary and stochastic differential equations (ODEs and SDEs). Two primary strategies are applied to achieve this reduction to a closed system of low-frequency modes, each strategy based on mathematically rigorous theory in the limit of infinite timescale separation. One strategy is suitable for an explicit stochastic parametrisation scheme, as it yields explicitly the coefficients of the reduced SDE. The other strategy is flexible, as the parameters can be adjusted according to the desired balance between cost and error tolerance, and it is easily implemented. The reduced models shed light on the physics of LFV, including different interpretations from previous studies of the dynamics of the shifting jet.

2C7.3 ID:2383 **14:30**

The Influence of Surface Buoyancy Fluxes on the Probability Distribution of Sea Surface Winds

Adam Monahan
School of Earth and Ocean Sciences, University of Victoria
Contact: monahana@uvic.ca

Fluxes of mass, energy, and material substances at the interface between the atmosphere and the land or ocean surface mediate interactions between these fundamental components of the climate system. It is therefore important that these fluxes be accurately simulated in climate models. Because these fluxes are nonlinear functions of the surface winds, fluctuations in the wind around its mean value will influence the space- or time-averaged surface fluxes. This talk will present an idealised stochastic boundary-layer model which can be used to investigate the roles of large-scale forcing and local surface buoyancy fluxes in determining the character of the probability density function (pdf) of surface winds.

2C7.4 ID:2239 **14:45**

Snowball versus slushball Earth: Dynamic versus nondynamic sea ice?

Jeff Lewis [1], *Andrew Weaver* [2], *Michael Eby* [2]
[1] Malaspina University-College
[2] University of Victoria
Contact: lewisj@mala.ca

Modeling studies of the Neoproterozoic snowball Earth offer two variations for snowball conditions, the original ‘‘hard’’ snowball Earth where the ocean is completely covered by sea ice, and an alternate slushball Earth or ‘‘soft’’ snowball, where there is an equatorial oasis of open water. We use the University of Victoria Earth System Climate Model to show that the soft snowball result is only possible when dynamics are excluded from the sea ice component of the model. Using a purely thermodynamic sea ice component the soft snowball condition is stable, whereas with a dynamic and thermodynamic sea ice component it is not. As the behavior of dynamic sea ice largely depends on wind stress, we compare simulations using two different wind fields: a zonally averaged present-day wind field and a wind field derived by a general circulation model, the Fast Ocean Atmosphere Model, using Neoproterozoic conditions. Another consequence of using dynamic sea ice is that the sea ice does not become sufficiently thick to flow under its own weight when there is open water; this suggests that sea glacier dynamics are not important for snowball inception.

2C7.5 ID:2410 15:00

Heat transport, wind stress and the ice edge: new insights from simple models

Brian Rose
Massachusetts Institute of Technology
Contact: brose@mit.edu

Sea ice is an active player in the climate system: ice extent is both shaped by, and helps to shape, the coupled atmosphere-ocean circulation. I will present a hierarchy of simple models that illustrate some fundamental thermodynamic and dynamic constraints on the atmosphere-ocean-ice system, with a particular focus on how the partition of heat transport between atmosphere and ocean affects the ice edge. I will discuss a feedback between the ice edge, the surface wind stress, and the wind-driven ocean heat transport, that gives rise to multiple steady states in a simple model. These results suggest interesting new mechanisms for glacial climate variability, and argue for a more careful consideration of the role of the wind stress in climate dynamics.

2C7.6 ID:2382 15:15

Winter climate variability in the eastern Gulf of Alaska and Line P ocean temperature measurements

Badal Pal [1], *William Merryfield* [1], *William Crawford* [2]
[1] Canadian Centre for Climate Modelling and Analysis
[2] Institute of Ocean Sciences
Contact: badal.pal@ec.gc.ca

This study examines the winter climate variability associated with warm and cold winter temperatures along Line P in the eastern Gulf of Alaska by analyzing data from the NCEP/NCAR reanalysis for the period 1956-2005. Based on the Line P temperature anomalies, indices of warm and cold ocean temperatures are created for inshore (stations 1-5), offshore (stations 13-27) and all Line P stations (1-27). Composite patterns of sea level pressure, 10-m winds, storm tracks, sea surface temperature and surface heat fluxes associated with 10 warmest and coldest Line P index years are compared with those of years having the 10 highest and lowest values of the North Pacific Index (NPI), an inverse measure of strength of the Aleutian Low. Warm Line P temperatures are usually associated with a strong Aleutian Low and stronger winds from the southwest and often accompany El Niño winters. Cold temperatures correspond to weak Aleutian Lows and stronger westerly winds, often found in La Niña winters. The cold (warm) ocean regime is associated with downwelling (upwelling) favourable wind anomalies in the central North Pacific and upwelling (downwelling) favourable wind anomalies along the British

Columbia coast. When the Aleutian Low is strong, storms crossing Line P are relatively intense, approach western Canada almost exclusively from the southwest and often remain in the Gulf of Alaska, whereas when the Aleutian Low is weak the storms are less intense, approach more frequently from the northwest and are more likely to track over land. Anomalous latent and sensible heat fluxes have substantial roles in driving SST anomalies along Line P, and throughout much of the northeast and central North Pacific.

2C5.1 ID:2421 14:00

Climate and morbidity in Quebec: assessment of the climate effect on circulatory and respiratory diseases for the period 1989-2006

Lampouguin Bayentin [1], *Salaheddine El Adlouni* [1], *Taha B.m.j. Ouarda* [1], *Pierre Gosselin* [2]

[1] INRS-ETE
[2] INSPQ
Contact: Lampouguin_Bayentin@ete.inrs.ca

Extreme climate events are projected to increase in severity and frequency with increasing global mean temperatures and changing precipitation regimes. Climate change is thus likely to have wide-ranging and mostly adverse impacts on human health. Several studies have explored this relationship, especially for mortality. However, few studies have focused so far on the analysis of climate variability and warming and its impacts on morbidity. This study examines the relationship between meteorological variables and the frequency of hospitalisations in the province of Quebec, Canada. Among the various causes of hospitalisation, particular interest will be given to ischemic heart disease (ICD9 410-414), cerebro-vascular disease (ICD9 430-438) and pneumonia and influenza ((ICD9 480-487). Through a two-step modelling process, we use at first the Bayesian P-spline and Generalized Additive Models (GAM) to estimate the relationship between each covariate and the response variable on a historical basis (1989-2006), followed by the Generalized Cross-Validation (GCV) for model selection. The data used for the study are the Hospital Medical Discharge Records from the Health and Social Services Ministry of Quebec, and corresponding observed and simulated climatic variables, provided by the Canadian Regional Climate Model (CRCM), for socio-health regions and major cities of Quebec. The characteristics of model biases provided by the CRCM are investigated and the method for bias correction is developed. Methodological aspects and illustrative results will be presented, along with a discussion on limitations of such analyses of hospital discharge data.

2C5.2 ID:2459 14:15

Results of the 1984-2005 UHI study over Montreal using Landsat imagery

Marc Beauchemin [1], *Philippe Martin* [2]
[1] Environment Canada, MSC-Quebec, Atmospheric sciences and environmental issues
[2] MSC-Quebec
Contact: marc.beauchemin@ec.gc.ca

Urban Heat Islands (UHI) are a concern because they exacerbate heat related health

problems. In the context of increasingly intense and/or frequent heat waves, added to increasing urbanization, the impacts of UHIs could increase. Moreover, UHIs contribute to high ozone formation and pollen emissions, which amplify heat stresses. Montreal health authorities are interested in pinpointing and quantifying the cities' UHIs in order to target areas of intervention. We present here an estimate of the contribution of the UHI phenomenon to the heating occurred in Montreal, through the use of ten 30m-resolution Landsat thermal images over the period 1984-2005. The results show that while Montreal has undergone an absolute heating of 3.6C over the period, the "regional" UHI (mean urban temperature minus rural tremperature) has increased by 1.6C, meaning that almost 50% of the temperature increase is due to the UHI phenomenon. Area wise, the intra-urban heat islands (IUHIs), defined as temperatures in excess of 5 degrees of spatial mean, have increased by 6 km2 out of a total of 17 km2, or 33%. The increase in IUHIs is mainly due to expanding, already existing, heat islands rather than newly created heat islands, although "permanent" IUHIs constitute only half of total. The trend in the city-wide UHI is correlated (-0.53) with mean areal NDVI, which shows that vegetation, to a certain degree, controls surface temperature. Data spectrum analysis shows that the increase in average temperature was mainly due to diminishing cold temperatures, or "cool islands", rather than increasing warm temperatures (compression of the negative tail of the spectrum). In conclusion, while satellite-based temperatures are not directly linked to surface-based temperatures, the increases in UHI and IUHIs shown here can still serve as indications of the magnitude of true urban heat islands, and of city districts where UHI-control measures should be planned.

2C5.3 ID:2232 **14:30**

The Air Quality Health Index: Fundamentals and Future Plans

Dave Henderson [1], *Kelly Lehman* [2]
[1] Meteorological Service of Canada, EC
[2] Health Canada
Contact: dave.henderson@ec.gc.ca

The Air Quality Health Index (AQHI) was developed by Health Canada and Environment Canada, in collaboration with governments and health and environment organizations, to empower Canadians to plan, on a daily basis, to modify their behaviour and reduce the personal risk associated with air pollution. The development of the AQHI reflectsthe results of Canadian and international research linking daily air pollution levels to acute health impacts associated with local air quality in urban communities. The index was developed to capture the mortality health risk associated with three criteria pollutants (particles, ground level ozone and nitrogen dioxide) that are indicative of the risk to health posed by the air pollution (smog) mixture.

In 2007, the federal Ministers of Health and Environment committed $30M over four years to transition the existing MSC Air Quality Forecast Program towards providing AQHI forecasts and to support, through provincial and local partnerships, the adoption of the index nationally. In recognition of the regional differences and existing infrastructure, the AQHI is being implemented in phases with regions/municipalities contributing to pieces that are of particular relevance to that area of the country.

This presentation will outline the fundamentals of the AQHI, the current state of activities across Canada and the future plans for national implementation of the index.

2C5.4 ID:2233 **14:45**

The Air Quality Health Index: Creating A Social Dialogue about Air and Health

Sharon Stevens
Communication Solutions Inc
Contact: sharon@communicationsolutions.ca

The Air Quality Health Index (AQHI) developed by Health Canada and Environment Canada, in collaboration with multiple government, health and environment organizations, provides an impetus for increased social dialogue regarding the quality of outdoor air and its affects on health.

In 2006, the new AQHI was made available to 14 communities in BC through a web-based presentation of the Index and associated health messaging. While communicating this new service focused on engaging health professionals to spread the message to those most at-risk from the effects of poor air quality, multiple other communication and outreach tools were used to promote the web-based Index and, eventually, present the daily Index values and associated health messages through mass media.

This year, Toronto will join British Columbia in implementing a social marketing campaign aimed at increasing awareness of the effects of air pollution on health and the new AQHI. Through multiple advertising, outreach and education programs, numerous government and NGO agencies will be engaged and supported in creating a social dialogue about air and health so that in the future, people will understand the AQHI and what it means to them just as they do other environmental measurements such as the UV Index.

This presentation will outline the lessons learned through past efforts to increase awareness of outdoor air quality and its affects on health.

2C5.5 ID:2258 **15:00**

Introducing the Air Quality Health Index to Interior B.C. Communities

Eric Taylor
British Columbia Ministry of Environment
Contact: Eric.Taylor@gov.bc.ca

The new Air Quality Health Index (AQHI) is currently being provided on a trial basis to six interior BC communities. Air Quality Advisories are generally issued in these communities when PM2.5 concentrations exceed, or are expected to exceed, the B.C. PM2.5 objective. However, there has been some confusion when Air Quality Advisories are issued while the AQHI values are indicating a "Low Health Risk".

There are at least three significant differences between the Air Quality Health Index and the PM2.5 trigger for Air Quality Advisories. Firstly, the Air Quality Health Index is based on a three hour average of air pollutant concentrations while Air Quality Advisories are based on a twenty-four hour average. Secondly, the Air Quality Health Index algorithm is based on a basket of pollutants, while the trigger for Air Quality Advisories in the interior of BC is almost always based only on the PM2.5 objective. Finally, the Air Quality Health Index was designed as a tool to provide individuals with advice related to health risk from air pollutants. Conversely, Air Quality Advisories are mainly used as a tool to manage PM2.5 emissions, though they do contain rudimentary information on the health impacts of poor air quality. However, this health information sometimes conflicts with the health advice of the AQHI.

This presentation will show that, in general, the 24 hour average PM2.5 concentrations and the values of the AQHI differ somewhat, but are not incompatible with each other. It will also show how the Air Quality Health Index depends on concentrations of several pollutants in a different way in each of the interior BC communities. It will also briefly outline plans to design and implement an AQHI Communications program in order to raise awareness of air quality and health issues and to highlight the usefulness of the AQHI in reducing health risks.

2C5.6 ID:2574 **15:15**

SCRIBE: Air Quality Forecasting Tool

Claude Landry , *Guy Roy* , *Denis Vigneux* , *Michel Nadeau* , *Reine Parent* , *Louise Faust* , *Jean-Pierre Talbot* , *Gérard Croteau*
MSC-CMC Environment Canada
Contact: claude.landry@ec.gc.ca

The Air Quality Forecast Program in gradually been implemented. The Scribe forecast production tool has been selected to support the program. The Scribe matrices, the weather elements generator, the text generator and the interface have been upgraded to support the processing of 6 pollutants. The Scribe system will compute the AQHI (Air Quality Health Index) and generate the Air quality text bulletin based on the standards established in the AirPro manual. Phase I of the project has been completed and phase II will be completed next year. Description of this new Air Quality Scribe System will be presented.

2D1.1 ID:2259 **16:00**

Occurrence rates of “unexpected” waves in Canadian waters

Johannes Gemmrich
University of Victoria
Contact: gemmrich@uvic.ca

Rogue waves have received considerable scientific attention in recent years. They are commonly defined as waves with height $H > 2.2H_s$, where H_s is the significant wave height (typically the average height of the highest one third of the waves). We suggest that the “unexpectedness” of large waves is also of great concern to ships and beachcombers. Linear simulations suggest that a wave being twice as large as any of the preceding 25 dominant waves might be as common as a rogue wave occurring within a longer wave group. We examine historical wave records from the Pacific and Atlantic and compare the observed occurrence rates of unexpected waves with our simulations with the goal of providing probabilistic predictions of these hazardous waves.

2D1.2 ID:2375 16:15

EFFECTS OF NUDGING SCHEMES IN A FINITE-ELEMENT CIRCULATION MODEL

Zhoashi Lu [1], *Guoqi Han* [2], *Brad Deyoung* [1]
[1] Memorial University of Newfoundland, St. John’s, NL, Canada
[2] Fisheries and Oceans Canada, St. John’s, NL
Contact: zhaoshi@mun.ca

In this study, we examine effects of two different nudging schemes on circulation, temperature and salinity solutions of a three-dimensional finite element model over the Newfoundland and Labrador Shelf. One approach is to nudge temperature and salinity allowing them to evolve on the tidal-time scale. The other approach is to fix the density fixed but allow dynamical evolution of temperature and salinity. We compare the evolution patterns of the model temperature, salinity and currents from the two approaches. The model circulation results are evaluated against moored measurements.

2D1.3 ID:2280 16:30

Deriving biological parameters from Acoustic Doppler Current Profiler (ADCP) data

Kate Collins , *Jim Hamilton* , *Simon Prinsenberg*
Department of Fisheries and Oceans
Contact: collinsak@mar.dfo-mpo.gc.ca

An innovative technique described by Deines (1999) is used to obtain zooplankton information from data collected by a 300kHz Broadband ADCP moored in Barrow Strait, in the Canadian Arctic Archipelago in 2003-04. Backscatter strength from suspended matter is calculated using calibrated ADCP echo intensity data and density profiles measured by the nearby under-ice profiler, ICYLCER. The resulting year-long time series of absolute backscatter coefficient, Sv, shows patterns of vertical zooplankton abundance and movement on daily and seasonal timescales. The effects of large and small-scale meteorological forcing, ice cover several meters thick, and periods of both 24-hour darkness and 24-hour daylight on zooplankton behaviour and distribution are evident in the data. Fluorescence measurements provided by ICYCLER help to verify the scatterers as zooplankton. This technique reveals the biological potential of previously recorded physical data, increasing the value of deployed ADCPs by expanding the useful output at no additional cost.

2D1.4 ID:2295 16:45

BBLT3D - Modelling Suspended Sediment Transport in a Dynamic Inshore Environment

Adam Drozdowski
Bedford Institute of Oceanography
Contact: drozdowskia@mar.dfo-mpo.gc.ca

BBLT is a numerical modeling tool developed to study the fate of suspended particulate drilling waste. The initial development focused on near field (1-20 km) and short term (5-30 day) descriptions of the offshore environment where the assumption of horizontal uniformity in the currents was both practical and suitable. However as interest in the potential environmental impacts related to suspended particulate matter (SPM) moves closer to the shore and into more horizontally variable environments this assumption becomes questionable. Migrating the BBLT module to a 3D circulation ocean model is the next logical step in the series of improvements that the model has undergone in the last decade. The talk will cover technical aspects of the coupling of BBLT v7.0 with a 3D circulation model of the Gulf of St. Lawrence (GSS4) and present preliminary applications at potential drilling sites.

2D1.5 ID:2444 17:00

The role of changing patterns of precipitation and runoff as a cause of recent increases in productivity in Lake Winnipeg

Greg Mccullough [1], *Michael Stainton* [2], *Ray Hesslein* [2], *Stephen Page* [2]
[1] Centre for Earth Observations Science, Department of Geography, University of Manitoba
[2] Canada Department of Fisheries and Oceans
Contact: gmccullo@cc.umanitoba.ca

By analysis of AVHRR satellite imagery we have determined that in the mid-1990s there was a sudden and dramatic increase in the frequency and extent of cyanophyte blooms in Lake Winnipeg. These blooms have been associated with widespread mid-summer bottom hypoxia, production of algal toxins, fowled beaches and general changes in the food web. While developing eutrophication of the lake has for the most part been attributed to increased anthropogenic phosphorus (P) and nitrogen (N) loading from municipal and agricultural sources, the documented changes in P and N concentrations in tributary rivers have been gradual over the 40 years of record. Changing precipitation and runoff patterns better explain the dramatic recent response in the lake. In this presentation we report on observed and modeled major nutrient concentrations in the lake and relate them back through changing relative runoff in major tributary rivers to changes in precipitation patterns in the watershed. The nutrient loading model used to estimate in lake concentrations is also used to demonstrate the effectiveness of various initiated and proposed nutrient management strategies. While there are doubtless anthropogenic impacts driving eutrophication of Lake Winnipeg, we conclude that the dominant event driving recent changes in the water quality of Lake Winnipeg has been a recent increase in precipitation in the Red River basin and the consequent disproportionate contribution of the P rich waters of the Red River to the lake. Current nutrient management strategies

are brought into question.

2D2.1 ID:2278 INVITED/INVITÉ 16:00

Interdecadal Variation of ENSO Predictability in Multiple Models

Youmin Tang [1], *Ziwang Deng* [1], *Xiaobing Zhou* [1], *Yanjie Cheng* [1], *Dake Chen* [2]
[1] UNBC
[2] Lamont, Columbia University
Contact: ytang@unbc.ca

In this study, we performed ENSO (El Ni\~{n}o and the Southern Oscillation) retrospective forecasts for the 120 years from 1881-2000 using three realistic models that assimilate historic dataset of sea surface temperature (SST). By examining these retrospective forecasts and corresponding observations, as well as the oceanic analyses from which forecasts were initialized, we have explored several important issues related to ENSO predictability including its interdecadal variability and the dominant factors that control the interdecadal variability.

The prediction skill of the three models showed a very consistent interdecadal variation, with high skill in the late 19th century and in the middle-late 20th century, and low skill during the period from 1900-1960. The interdecadal variation in ENSO predictability is in good agreement with that in the signal of interannual variability and in the degree of asymmetry, a basic nature of nonlinearity, of ENSO system. A good relationship was also identified between the degree of asymmetry and the signal of interannual variability, and the former is highly related to the latter. Generally the high predictability is attained when ENSO signal strength and the degree of asymmetry are enhanced, and vice versa. The atmospheric noise generally degrades overall prediction skill, especially for the skill of mean square error, but is able to favor some individual prediction cases. The possible reasons why these factors control ENSO predictability were also discussed.

2D2.2 ID:2352 16:30

Impact of the combined Aqua AIRS (Infrared Hyperspectral) and GPS radio-occultation data in the new version of the Canadian global weather forecast model

Louis Garand , *Josep Aparicio* , *Mark Buehner* , *Godelieve Deblonde* , *Michel Roch* , *Cecilien Charette* , *Alain Beaulne* , *Stephen Macpherson*
(Presented by *Godelieve Deblonde*)
Environment Canada
Contact: godelieve.deblonde@ec.gc.ca

GEM-Strato (Global Environmental Multiscale) is a new version of the global Canadian weather forecast model with model top raised from 10 hPa (30 km) to 0.1 hPa (65 km). This allows to assimilate 35 additional AIRS channels on top of the currently used 87 channels. As well, GPS radio-occultation refractivities are assimilated up to 3 hPa (40 km). Background error statistics were revised, with added localization of the vertical correlations. The separate and combined impacts on short to medium range forecasts are evaluated in 3DVar-FGAT (First Guess at Appropriate Time) assimilation cycles.

2D2.3 ID:2316 **16:45**

The EPS Forecast for Friday the 13th of April, 2007

Mark Pilon
Environment Canada
Contact: mark.pilon@ec.gc.ca

The public extended day 5 forecast for Halifax, Nova Scotia, issued on Monday April 9 for Friday April 13th 2007 by MSC, which was based on the 00 UTC Monday GEM Global NWP model run, called for sunny skies with a high of plus 6. However, an examination of the Canadian EPS forecasts issued during the same production run showed that the operational GEM Global model was the outlier among the various EPS members with several members indicating threatening weather for the Maritimes on Friday. The EPS output is examined to highlight the high spread and thus low skill of the early Monday operational run. Some of the limitations of incorporating information gleaned from ensemble forecasts into Environment Canada's current deterministic long range public forecasts and some possible work-arounds are discussed. This particular case was recently presented during a regional staff EPS workshop in Atlantic Canada. It is believed that using a specific case, such as this one, to consider practical ways to integrate useful EPS output into specific forecasts that are provided to various users would be of benefit to the meteorological community at large.

2D2.4 ID:2409 **17:00**

Avalon Peninsula Snowstorm: January 20, 2008

Daniel Jubainville
Environment Canada
Contact: daniel.jubainville@ec.gc.ca

Each winter, eastern Newfoundland is usually impacted by a number of major snowstorms associated with rapidly developing low pressure systems that approach from the south. Often, numerical guidance will incorrectly forecast the track and intensity of these systems, with precipitation-maximums too weak and too far offshore. A number of studies have identified certain signals which can aid forecasters in recognizing potential important model errors affecting the forecast at 24 to 48 hours lead time. This case illustrates how forecasters at the Newfoundland and Labrador Weather Office were able to use such signals to correctly forecast the heavy snowfall amounts associated with one of these storms and to issue warnings more than 30 hours in advance, when all operational numerical models were forecasting only a minor or marginal event.

2D2.5 ID:2229 **17:15**

Reconstructing fifty-six year (1950-2005) droughts over the Canadian Prairies using the Variable Infiltration Capacity model

Lei Wen [1], *Charles Lin* [2], *Zhiyong Wu* [3], *Guihua Lu* [3], *John Pomeroy* [4]
[1] McGill University

[2] Environment Canada/McGill University
[3] Hohai University
[4] University of Saskatchewan
Contact: lei.wen@mcgill.ca

Severe droughts are extreme events, which can have devastating impacts on almost all sectors in the society. Droughts are responsible for four of the six most costly natural disasters in the Canadian history; and more staggeringly, all four droughts took place within the last 25 years (Environment Canada, 2003). Recent observations and climate modeling studies have shown that the impact of climate change could be greatest at middle to high latitudes according to the newly released Fourth Assessment Report of the Unite Nations Intergovernmental Panel on Climate Change (IPCC, 2007). Drought is therefore a major concern in Canada. The Canadian Prairies are part of the Great Plains of North American, which occupy approximately 20% of Canada's territory and contain more than 85% of the Country's farming land forming one of the world largest agricultural areas. However, the Prairies are particularly susceptible to drought, causing enormous economic, environmental and societal impacts to the region. One recent example is the severe drought of 1999-2005. As the result, the Drought Research Initiative (DRI) was established in 2005, and one of the major objectives is to assess and reduce uncertainties in the prediction of drought over the Prairies. A drought monitoring and seasonal prediction system is being developed for the Prairies. Presently, the system uses the Variable Infiltration Capacity (VIC) land surface macroscale hydrology model driven by observed and forecast maximum and minimum air temperatures and precipitation to simulate daily soil moisture values starting from 1 January, 1950 up to the present. The simulated soil moisture values are used to calculate a soil moisture index for measuring the severity of agricultural and hydrological droughts. The drought monitoring component of the system comprises two modules: a 56-yr retrospective soil moisture climatology in the top 1-m layer from VIC, and a real time drought monitoring module using the operational Canadian GEM (Global Environmental Multiscale) model daily output for driving the VIC model. We also plan to develop a seasonal drought prediction scheme for Canada with a focus on the Prairie regions, in collaboration with the seasonal Historical Forecast Project team. The VIC model is applied over a Prairies domain consisting of 4393 grid points with a resolution of 0.25 degree × 0.25 degree. Using the observed maximum and minimum air temperatures and precipitation, the VIC model is first calibrated and validated with daily hydrographs from 11 Prairies' catchments for the period 1 January, 1975 to December 31, 2001. The calibrated VIC is then used to reconstruct Prairies' daily soil moistures for the period 1 January, 1950 to 31 December, 2005. VIC performs well over both calibration and validation periods. The calculated soil moisture index explains well most documented drought events in the Prairies over the past 56 years. The real time drought monitoring is achieved by updating the soil moisture index fields every 24 hours with the lead time up to 10 days.

2D2.6 ID:2362 17:30

The assimilation of SSM/I radiance observations with interchannel error correlations

Xingxiu Deng , *Peter Houtekamer* , *Herschel Mitchell*

Meteorological Service of Canada
Contact: xingxiu.deng@ec.gc.ca

The impact of observations in data assimilation systems is crucially dependent on the specified observation-error statistics. For convenience, satellite radiances are usually assimilated using the questionable assumption that the interchannel correlations are negligible. In preparation for a recent parallel run with a new global ensemble prediction system, we have tested the addition of several new observation types in the ensemble Kalman filter (EnKF) data-assimilation component. The addition of quickscat data and wind profiler observations yielded positive impacts, but the addition of SSM/I data led to disappointing results in the EnKF system. This might be due to the assumption that the interchannel correlations are negligible for the SSM/I data. To test this hypothesis, the interchannel correlations were estimated from observed-minus-modeled radiance statistics, computed for a 9-day period using quality controlled but unthinned SSM/I data and 6-h model forecast. Subsequently, the EnKF system has been run using full covariance matrices for the SSM/I observational error.

2D3.1 ID:2213 16:00

Evaluation of GEM-LAM over Southern Baffin Island

Zhuo Liu [1], *John Hanesiak* [1], *Ron Goodson* [2], *Ronald Stewart* [3]
[1] Centre for Earth Observation Science(CEOS), University of Manitoba
[2] Hydrometeorology and Arctic Lab Environment Canada, Edmonton, Alberta
[3] Department of Atmospheric and Oceanic Sciences, McGill University
Contact: zhuo_liu@umanitoba.ca

Storms in the Arctic region have strong impacts on climatic, human life, the landscape (terrestrial, sea ice and ocean), economy, the environment, as well as on social society. In order to better understand the severe weather systems in the Arctic area, we focus on these hazardous Arctic storms that occur in the southern Baffin Island region. We carried out a modeling study as well as observations over this region. The model we're using is GEM-LAM, which is a general environmental multi-level model. With different configurations, the model is able to run over various regions and variable resolutions. The model domain covers southern Baffin Island and surrounding areas; the horizontal resolution is 2.5km and vertical level contains 58 sigma-pressure hybrid coordinate levels up to 10 hPa. The model was applied to study the November 6-9, 2006 storm event. As observed, around 2100Z, Nov. 7, 2006, a cyclone propagated from southwest to northeast, with warm air advection ahead of the system and a sudden wind shift as the system moved through Iqaluit. Temperatures rose 4-5 °C and surface pressure declined from 1007hPa to 993 hPa, the wind direction at Iqaluit changed from easterly to northwesterly. The model run began Nov.7, 1300Z, and was integrated 18 hours ahead. The vertical profile of the simulated fields was compared to radiosonde observations every 3 hours at Iqaluit and time series surface fields were also compared with hourly METARs. The temperature and dew point temperature were simulated well both for time series surface data and vertical profiles. For wind speed, the simulated surface wind is always weaker than the observation; while at 925hPa, the simulated wind has a strong jet and is much stronger than the observations. Modeled wind direction near the surface was

reasonably close to observations except for the timing of the wind shift, which was 2 hours earlier compared to observations.

2D3.2 ID:2257 **16:15**

Operational Evaluation of the GEM LAM2.5 – Maritimes Region

Chris Fogarty
(Presented by *Timothy Bullock*)
Canadian Hurricane Centre / National Lab for Marine and Coastal Meteorology
Contact: chris.fogarty@ec.gc.ca

During the summer of 2007, the National Lab for Marine and Coastal Meteorology in conjunction with the Atlantic Storm Prediction Centre began evaluation of the GEM LAM2.5 model over Nova Scotia and Prince Edward Island. A model output display site was created by the National Lab to assist forecasters in their evaluation of the model. Various model output and diagnostic fields are generated and displayed daily for use by forecasters, including pre-set geographical zooms over Nova Scotia so that details from the high resolution model could be clearly seen. Difference fields between the GEM REG and GEM LAM are also automatically generated, assisting in the identification of features resolved in the LAM, but not necessarily by the REG model.

Many interesting meteorological features have been identified in the LAM grid over the Maritimes, including realistic depiction of Les Suetes lee winds over the Cape Breton Highlands. The model has also helped identify more uncommon “reverse Suetes” winds to the east of the Highlands. Other topographically-forced and geographically-influenced weather features have been successfully depicted in the LAM, including sea breezes, wind channelling in bays and sea-effect snow squalls.

Based on discussions with the Ontario region, output of 900-mb vertical velocity and relative humidity were later added to the model display site as a proxy for snow streamer/snow squall identification. Some tailored output for the Ontario Region was also prepared by the Atlantic Region Lab with emphasis on the Great Lakes. The 900-mb proxy fields for snow squalls have been helpful in predicting the location of Lake-effect snow squalls during the past winter. Output is currently displayed in a way such that the detail provided by the model is appreciated using large, screen-scale display windows.

2D3.3 ID:2349 **16:30**

On the Biases in UMOS Temperature Guidance for Vancouver, British Columbia

Ruping Mo
Pacific Storm Prediction Centre, MSC-EC, Vancouver, BC V6C 3S5
Contact: Ruping.Mo@ec.gc.ca

The Updateable Model Output Statistics (UMOS) is a post-processing calibration method known to remove the bias from direct model output. It is shown in this study that the UMOS statistical guidance for Metro Vancouver, based on the Canadian GEM Regional Model, has a noticeable warm bias in the low temperatures forecast for the night-time period. All monthly warm biases in 2007, ranging from 0.5°C in August to 1.4°C in December, are statistically significant at the .05 level of significance. Their magnitudes are reduced to some extent in the official forecast issued by the Pacific Storm Prediction Centre (PSPC). It is argued that this UMOS warm bias is due to the underestimate of the outflow effect by the GEM model. A typical scenario is given as a Pacific low pressure system approaching from the west. Ahead of the system easterly outflow winds will develop in Fraser Valley, drying out and cooling off the boundary layer of Metro Vancouver. Because of the smoother topography in the model, the outflow winds are underestimated, and the associated cold air at low levels is eroded too quickly by the warm advection. The moister south to southeast flow brought in by the model also leads to cloudier conditions, which enhances the warm bias at night and, on the contrary, has a cooling effect in the daytime period. On the other hand, the westerly inflow winds behind the low across Metro Vancouver are well handled by the model.

Several case studies are performed to shore up support for the above arguments and to highlight the impact of the problem on the operational forecast. It is shown that the UMOS warm bias has resulted in misleading forecast guidance for several major snow events over Metro Vancouver in the last winter. In these cases the UMOS guidance either mentioned rain only or changed rain to snow too early in the forecast, and it was the critical judgment of human forecasters in PSPC that had led to some improvement in the official forecast.

2D3.4 ID:2509 16:45

Experimental Meteorological Fields Based on NWP Model Output for Support of Forecast Operations

William Burrows [1], *Neil Taylor* [2], *Garry Toth* [2], *Andrew Giles* [2], *Ron Goodson* [2]
[1] Environment Canada, Science and Technology Branch, ARMP & HAL
[2] Environment Canada, Hydrometeorology and Arctic Lab
Contact: william.burrows@ec.gc.ca

The Hydrometeorology and Arctic Lab (HAL), is one of the national labs created by the Meteorological Service of Canada for conducting applied science in support of forecast operations. The HAL group in Edmonton is co-located with the Prairie and Arctic Storm Prediction Center and the western Canadian Meteorological Aviation Center. In direct consultation with operational forecasters there has been considerable effort by HAL staff on research and development of hourly experimental forecast fields and new ways of visualizing GEM0 regional model output. Results are communicated in real-time to forecasters on five animated websites covering convective initiation and severe weather, lightning, fog and stratus, wind, and winter weather. Forecasts are national in scope and available throughout MSC. Three-hourly lightning forecasts out to 48 hours are available on a website developed by the lead author. These products are widely used to develop convective forecasts in both public and aviation Canadian weather centres. The Summer Season Research Support Desk website displays 48 forecast fields divided into 4 general themes: convective initiation, combined instability/shear fields, wind and wind shear fields, and convective mode and storm motion fields. Several of these fields are already providing valuable insight into selection of new predictors for statistical lightning forecasts and for better rules for forecasting convective initiation and severe weather. The Winter Weather Experimental Model Fields website displays 30 forecast fields divided into 3 general themes: blowing snow/blizzard fields, precipitation typing/aviation icing fields, and traditional fields. The Statistical Wind Guidance website displays wind forecasts by new statistical methods for Arctic locations in complex terrain. The Experimental Fog Forecasting Products website displays fog and stratus forecasts by new rule-based methods developed in the HAL, and will eventually include forecasts by statistical methods as well. The websites include real-time weather element observations for verification. Several of the fields on these websites, such as Mixed Moist Layer Depth and Blizzard Potential, are newly conceived forecast fields that have already proven their utility in forecast operations. The work will be described and case studies shown.

2D3.5 ID:2250 **17:00**

Recent changes to and further plans for the operational production system at the Canadian Meteorological Centre

Yves Pelletier
Meteorological Service of Canada
Contact: yves.pelletier@ec.gc.ca

The Canadian Meteorological Center (CMC) runs, in a fully operational production environment, the models and data assimilation systems that have been developed by its Development Division along with EC's Atmospheric Research groups. The current status of the operational forecasting suite will be reviewed. Significant innovations were introduced in the past year. They include:

* Major improvements to the Ensemble Prediction System (July 2007)

* Several new data types added to the operational data assimilation system (April 2008)

* The CAPA precipitation analysis

* An experimental implementation, in the operational suite, of a coupled ice-ocean-atmosphere prediction system

Improvements to the operational system planned for the upcoming 12 months will be presented. The two main planned changes are an increase in regional model forecast run frequency to four per day (from two)and a major new global model upgrade. Further planned changes or additions to the operational production suite will also be discussed.

Finally we will also touch on NWP data availability.

2D3.6 ID:2507 **17:15**

Dynamical-Statistical Models for Lightning Prediction

William Burrows
Environment Canada, Sci. & Tech. Branch, ARMP & HAL

Contact: william.burrows@ec.gc.ca

Dynamic-statistical models giving three-hourly lightning probability prediction to 48 hours in the warm months have run at the Canadian Meteorological Center (CMC) since 2003 (Burrows et al., WAF, 2005). Since the original model development it became possible to include important predictors not previously available and to make significant modeling improvements. New models were developed and have run daily at CMC year-round since April 2006, making predictions for all Canada and the United States. Use of the forecasts by Canadian forecasters is widespread for thunderstorm prediction in public forecasts and for specifying areas of expected convection in aviation area forecasts. Use of the forecasts in a 1-2 day forest fire likelihood prediction research model is underway in the Canadian Forestry Service. Model resolution is 15 km. The training data domain covers the northern half of the United States and all southern Canada. Only seven days in 2005 were needed for training because of the large variety of synoptic situations found each day over this large area. Two three-hourly predictands were derived from observations by the North American Lightning Detection Network: (1) time-area coverage (similar to probability), and (2) number of flashes. Several predictors derived from Kain-Fritsch convection parameterization in CMC's GEM regional model are included, plus environment predictors. Calculations are on a moveable 9*9 grid centered on each grid point at four times in each three-hour period (t, t+1, t+2, t+3 hours), and derived predictors are computed as statistics from the 324-point data cloud, e.g. the minimum Showalter index; the mean convective rain rate at points where convection is triggered. Data reduction keeps the number of predictors to less than 50. Tree-structured regression is used to build models. Cross-validation shows the trees will fit 80-90% of the variance expected in independent data. Trees have 300-700 nodes, allowing for quasi-continuous predictions across the whole domain. Eight models were derived, one for each 3-hour diurnal period, and each model spans the entire domain.

2D3.7 ID:2266 **17:30**

Modelling in Support of Day-to-Day Operations

Jim Young , *Bryan Mcewen* , *Dan Hrebenyk*
SENES Consultants Limited
Contact: jyoung@senes.ca

The key to good decision making is the quality of the information on which decisions are based. This paper will present six case studies of modelling in support of operational decision making around the world.

The common element is the FReSH Forecasting System developed by SENES Consultants Limited which uses as its driver, the Non-hydrostatic Mesoscale Model (NMM) which is the current operational forecast weather model at NCEP.

The six decision making support modelling case studies to be presented are (1) protecting a town from adverse air quality from a smelter in Manitoba; (2) weather, air quality and Saharan sand transport in Macedonia (a country with significant topography); (3) sailing, car rallies and on water transportation across Europe (ProGRIB); (4) effective herbicide

application to wheat crops in Southern Ontario; (5) personal decision making through days 3-9 weather forecasting though a weekly newspaper; and (6) forest-fire decision making in Southern British Columbia.

A brief overview of each forecast approach will be presented along with validation statistics where they are available.

2D4.1 ID:2565 **16:00**

West Greenland Current Variability

Paul Myers [1], *Mads Ribergaard* [2], *Chris Donnelly* [3]
[1] Department of Earth and Atmospheric Sciences, University of Alberta
[2] Danish Meteorological Institute
[3] University of Calgary
Contact: pmyers@ualberta.ca

Six historical sections across the West Greenland Current are examined. Three sections have been regularly occupied since the late 1950s, while the three southern ones have been taken since 1984. Significant variability in hydrography is observed at all sections, both for the freshwater core of the coastal current on the shelf, and for the warm and saltier Irminger Water offshore. Maximum mean transport of 9.3 $\pm$ 2.3 Sv, relative to 700 db, for 1984-2005, are observed at the Cape Desolation section. Transports decrease to the north, with the majority of the exchange with the interior of the Labrador Sea occurring between Cape Desolation and Fylla Bank. Mean Summer northward transport into Baffin Bay on the shelf is 0.4 $\pm$ 0.2 Sv at Sisimiut. Freshwater transport is largest at Cape Desolation, with a mean summer transport of 87.4 $\pm$ 10.4 mSv. Approximately 75.2 mSv of this freshwater is fluxed into the Labrador Sea south of Davis Strait. Volume transports show little interannual variability at Cape Desolation but significant variability exists in freshwater transport. A significant enhancement of freshwater carried by the coastal component of the current is seen after the mid-1990s south of Fylla Bank.

2D4.2 ID:2429 **16:15**

The Labrador Sea records of last Interglacial AMOC properties at Orphan Knoll (IODP Site 1302/1303) and Eirik Ridge (IODP 1305/ODP 646)

Anne De Vernal , *Claude Hillaire-Marcel* , *Jennifer Mckay* , *Sergio Mayor*
GEOTOP-UQAM
Contact: devernal.anne@uqam.ca

Sheltered from direct influence of the western boundary undercurrent (WBUC), the IODP Site 1302/1303 provides a uniform and continuous record of linkages between the northeastern Laurentide Ice Sheet surge area (cf. Heinrich events) and the North Atlantic spanning the last 700 ka. The site also provides critical information on the Atlantic Meridional Overturning Circulation (AMOC) since all water masses contributing to the modern North Atlantic Deep Water still preserve their identity in the overlying water column. At this site oxygen and carbon isotope record in N. pachyderma carry a typical

North Atlantic signature, notably with regard to well developed stratigraphies of the OISs 5e to 5a interval. A most interesting feature during termination II (end of OIS 6) is seen in the recording of a major surge event not unlike the H1 event of the last termination. Isotopic measurements in G. bulloides suggest a warming trend in surface water toward the end of OIS 5e, in contrast to the present interglacial that shows an early thermal optimum. Isotopic data in benthic, mesopelagic and epipelagic foraminifers (Cibicides wuellerstorfi, N. pachyderma and G. bulloides) suggest the presence of stratified intermediate vs. bottom water masses. Dinocyst data indicate much higher than present sea-surface temperatures (+3°C in winter and +5°C in summer), which were probably too high for convection to occur in the Labrador Sea. In comparison, sites 1305 and 646 from the southern Greenland rise illustrate conditions in the inner NW Labrador Sea gyre, which differed from those of sites 1302/03 above. They indicate the existence of distinct water masses in the inner basin, with a uniform subsurface water column and the absence of the bottom water mass illustrated at site 1302/03 by different isotopic compositions in benthic foraminifers.

2D4.3 ID:2216 16:30

The model resolution sensitivity of a subpolar Atlantic warming response triggered by freshwater discharge along the Labrador coast.

Paul Spence , *Andrew Weaver*
University of Victoria
Contact: jspence@uvic.ca

A wide range of modeling studies have demonstrated a weakened Atlantic Meridional Overturning Circulation (AMOC) in response to surface freshening at North Atlantic Deep Water formation sites. The traditional view is that an increased freshwater flux creates more stably stratified surface water, which reduces deep water formation and its concomitant meridional heat transport, producing a widespread cooling of northern hemisphere climate. However a recent study (Saenko et al., GRL vol 34, 2007) explored a feedback mechanism that led to an extensive area of the subpolar west Atlantic actually warming when freshwater is discharged along the Labrador coast in cold climates, despite a substantial weakening of the AMOC. It seems likely the strength of the feedback will amplify with increasing model resolution, because the increased strength of the coastal boundary current should make it more difficult for the freshwater anomaly to penetrate inside the subpolar gyre. In this project we explore the sensitivity of this feed back mechanism to increasing horizontal resolution. We use versions of a global climate model with horizontal resolutions ranging from 1.8 (degrees latitude) x 3.6 (degrees longitude) to 0.2 x 0.4 to evaluate the North Atlantic climate response to boundary layer freshwater forcing in cold climates. Our results reveal a monotonic increase in the strength of the feedback with increasing model resolution; the high resolution models produce substantially more warming of the western North Atlantic despite a significant weakening of the AMOC.

2D4.4 ID:2455 16:45

The importance of dynamic forcing on sea ice in the Arctic during the early

Holocene

Sarah Dyck [1], *Bruno Tremblay* [1], *Anne De Vernal* [2]
[1] McGill University
[2] Universite de Quebec a Montreal, GEOTOP
Contact: sarah.dyck@mail.mcgill.ca

Sea ice in the eastern Arctic was reduced during the early Holocene (9.5 kaBp) as shown by sediment cores taken from the North Atlantic Ocean. Despite elevated solar insolation sediment cores from the Chukchi Sea suggest that in the western Arctic sea ice extent was similar to that of the present day. It has thus been suggested that atmospheric conditions reminiscent of the positive phase of the the NAO may have prevailed throughout the early Holocene. We examined the effects of a positive NAO regime on early Holocene Arctic sea ice using a coupled slab ocean – ice model. The results of our model show that changes in sea ice due to the changes in prescribed dynamic forcing of the model are dominant over the changes due to radiation alone. With the increased summer insolation and the decreased long wave radiation of the early Holocene the model shows a retreated sea ice edge along the peripheral seas. When the model is also forced with prescribed winds and ocean currents derived from years of positive NAO – believed to be representative of the early Holocene – we observe similarities between the reconstructed sea ice extent and the ice extent suggested from the paleorecord. These observations includes a reduction in summer sea ice extent in the eastern Arctic and relatively no change the western Arctic compared to present day conditions.

2D4.5 ID:2338 17:00

Mega-tides in the glacial ocean and rapid climate change

Stephen Griffiths , *W. Richard Peltier*
University of Toronto
Contact: sdg@atmosp.physics.utoronto.ca

Over the history of the Earth, changes in ocean depth and coastal configuration have led to considerable variations in the pattern and amplitude of ocean tides. Such variations are of interest because tides influence the Earth's rotation and climate in several ways. Of particular interest are tidal amplitudes under glacial conditions, as such conditions have occurred quasi-periodically and accounted for the most extreme topographic changes over the Late Pleistocene epoch. Here we perform global simulations of ocean tides for the Last Glacial Maximum, using new datasets for both ocean depth and density stratification. We show how the configuration of the Arctic Ocean, which was almost entirely enclosed by continents at that time, leads to the near-resonant excitation of large semi-diurnal tides. Under certain conditions, this previously unidentified Arctic tide is massively amplified in the Canadian Archipelago. Such tides may have played a role in destabilizing the coastal margins of North American ice-sheets, with implications for rapid changes in the Earth's climate and ocean circulation. Globally, the picture is one of energized semi-diurnal tides at the Last Glacial Maximum, with an increase in tidal dissipation from its present-day value, the dominant energy sink being conversion to the internal tide.

2D4.6 ID:2422 17:15

Global Unstructured Grid Ocean Modeling: Tidal Test Cases

Gordan Stuhne , *W. Richard Peltier*
University of Toronto
Contact: gordan@atmosp.physics.utoronto.ca

We report on progress in the development of a new unstructured grid global climate modeling framework. Employing unstructured grids, as opposed to structured Cartesian grids, should, in principle, make it easier to simulate multi-scale phenomena through local grid refinement in regions of interest. For instance, it would be desirable to enhance mesh resolution around Western ocean boundary currents, as well as in the Arctic archipelago, where sea-ice dynamics in narrow channels might interact strongly with the global climate system.

As reported previously, we have developed a body of numerical methodology for unstructured grid ocean modeling on the sphere. The scheme is based on the Arakawa C-grid approximation and offers a good balance in terms of conservation properties and efficiency. We have discovered, however, that there are a number of issues relating to accuracy and parameterization that must be addressed before the numerical framework could be useful for full-fledged climate modeling applications. At present, a set of cases pertaining to the simulation of the global tides is enabling us to investigate these issues in a relatively simple physical system whose dynamical time scales are much shorter than those of the climate system. It would be an important advance, simply to be able to resolve the local generation of baroclinic waves by the barotropic tide in a global, variable resolution unstructured grid model.

In results thus far, the barotropic tidal mode has been robustly and accurately resolved in shallow-water and 3-D free-surface discretizations, but the resolution of the baroclinic wave mechanism remains an elusive goal. We will discuss our latest efforts in this direction, and how these relate to the global climate problem.

2D5.1 ID:2393 16:00

Solar radiation transmittances through lodgepole pine canopies at different stages of growth and deterioration

Pat Teti
B.C. Ministry of Forests and Range
Contact: pat.teti@gov.bc.ca

Early spring transmitted solar radiation was estimated in 35 Lodgepole pine stands on the Interior Plateau of British Columbia to support the parameterization of distributed watershed runoff models. Sixteen plots were in cutblocks up to 34 years old and 20 were in natural stands up to 216 years old. Plots in recovering cutblocks and in naturally regenerated wildfires up to 75 years old represented changes in radiation transmittances over time during early stand development. Plots in natural stands over 100 years old represented a range of structures and transmittances associated with small to large levels of disturbance by Mountain Pine Beetles.

Transmittances were calculated from hemispherical canopy photographs and were reported as a portion of above canopy radiation. These were greater than 95 percent in cut blocks that had been logged up to ten years earlier. Transmittances decreased with stand age in immature stands, dropping to 17 percent 30 years after logging in a managed stand having hundreds of stems per hectare and 18 percent after 75 years in a naturally recovering burn with thousands of stems per hectare. Transmittances in older natural stands ranged from 14 to 57 percent but were not correlated with age. In those stands, lower transmittances were found in mature, green stands of mixed-species while higher transmittances occurred in stands where many of the original stems had died and fallen due to a beetle infestation approximately 25 years earlier.

Confidence limits calculated as functions of sample size, indicated that in all plots, a sample size of 22 would be sufficient to estimate mean transmittances to within 10% of the true value at alpha = 0.05. The largest samples sizes were needed in young stands where tree crowns had not yet merged and in the highly disturbed old stands.

2D5.2 ID:2499 **16:15**

Inter-annual variability in interception, evaporation and drainage from high elevation forests, clearcuts and regenerating stands in the interior of British Columbia

David Spittlehouse
Research Branch, BC Ministry of Forests and Range
Contact: dave.spittlehouse@gov.bc.ca

Ten years of weather data and precipitation interception and soil moisture measurements at the Upper Penticton Creek Watershed were combined with a physically based water balance model in determining the effect of forest cover on the annual site water balance. The model was used to extend the analysis for 6 more years when only daily weather data were available. Over this 16-year period evaporation from the forest averaged 400 (±1sd=45) mm/y, of which 43% was from intercepted rain and snow. Forest transpiration plus soil evaporation was only slightly higher than the amount lost by soil evaporation from the clearcut where there was no interception. 16 years after harvest, evaporation from the regenerating stand was about halfway between that of the forest and clearcut. Drainage from the site followed a reverse pattern with the clearcut averaging 510 (±1sd=87) mm/y and the forests 290 (±1sd=70) mm/y. The increase in the clearcut is mainly a result of the reduction in interception loss. Inter-annual variability of evaporation was mainly a function of variation in summer precipitation, while drainage depended on winter precipitation. Transpiration plus soil evaporation from the forest or clearcut was relatively constant. Only two years with low summer rainfall were substantially below the average. In these dry summers, evaporation from the clearcut was substantially less than that of the forest and the regenerating stand. Within 6 years after harvest, transpiration plus soil evaporation from the regenerating stand approximated that from the forests.

2D5.3 ID:2538 16:30

Evaporation in Pacific Northwest Douglas-fir stands of different age following clearcut harvesting

T. Andy Black [1], *Paul Jassal* [1], *David Spittlehouse* [2], *Zoran Nesic* [1]
[1] University of BC
[2] BCMoFR
Contact: andrew.black@ubc.ca

We have used the eddy covariance technique to measure evapotranspiration (Et) and gross primary production (GPP) in a chronosequence of three coastal Douglas-fir stands (7, 19 and 58 years old, hereafter referred to as HDF00, HDF88 and DF49, respectively) since 1998. Here, we focus on the controls on canopy conductance (gc), Et, GPP and water use efficiency (WUE) and the effect of interannual climate variability. We also address the effects of stand age following clearcut harvesting. Daytime dry-foliage Priestley-Taylor a and gc was 0.4-0.8, and 2-6 mm s-1, respectively, and were linearly correlated (R2 = 0.65). These low values suggest stomatal limitation to transpiration. Monthly Et showed a strong positive correlation to monthly net radiation (R2 = 0.94), air temperature (R2 = 0.77), and D (R2 = 0.76). During Jul-Sep, Et was significantly influenced by soil water content (Et = 453q - 21, R2 = 0.69), and GPP was similarly affected. Annual Et and GPP of DF49 for the period 1998-2007 varied from 370 mm to 430 mm and from 1950 g C m-2 to 2390 g C m-2 , respectively. After clearcut harvesting, Et dropped but still was as high as 60% of that for the mature stand with the ecosystem hydrological cycle fully recovered when stand age was 15 years. This contrasted to GPP and NEP, which varied hyperbolically with stand age. Monthly GPP showed a strong positive linear relationship with Et irrespective of the stand age. While annual WUE of HDF00 and HDF88 varied with age from 0.5 g C m-2 kg-1 to 4.1 g C m-2 kg-1 and from 2.8 g C m-2 kg-1 to 4.4 g C m-2 kg-1, respectively, it was quite conservative at 5.3 g C m-2 kg-1 for DF49. These results will be important in modeling water vapour and CO2 fluxes in Douglas-fir forests.

2D5.4 ID:2428 16:45

Future changes in soil temperature and soil moisture as simulated by the Canadian Regional Climate Model (CRCM 4.1.1).

Travis Logan [1], *Daniel Houle* [2], *Daniel Caya* [1]
[1] Ouranos
[2] MRNFP - Quebec; Ouranos
Contact: logan.travis@ouranos.ca

Soil temperature (ST) and soil moisture (SM) are fundamental variables that affect key processes of forest soils. Soil moisture is essential for plant water uptake and along with ST is also important for seed germination and adequate root development of many vascular plants. Both variables also affect soil nutrient cycling and the rate of soil organic matter decomposition thus having indirect effects on forest nutrition. For this reason, future scenarios of ST and SM at a regional scale are essential in order to predict the

response of forest ecosystems to global warming. The most recent version of the Canadian Regional Climate Model (CRCM 4.1.1) has been coupled with the Canadian Land Surface Scheme (CLASS 2.7), increasing realism for describing thermodynamic exchanges between the soil-vegetation component and the atmosphere. As a result, in addition to widely used climatic variables or indices, CRCM outputs now include variables such as ST and SM for multiple soil layers. Although there is a considerable amount of climatic scenarios that have been published in the last decade, future scenarios of ST and SM are scarce. In this study, we present future scenarios of climatic variables and of ST and SM, projected by the CRCM 4.1.1. RCM outputs are also compared with "off line" models specifically built for the prediction of forest ST (FORSTEM) and SM (FORHYM). Climate change scenarios for other variables of interest such as changes in the date of snow appearance / disappearance, snow accumulation and growing-degree days will also be presented.

2D5.5 ID:2308 17:00

Using the Canadian precipitation analysis (CaPA) for land-surface and hydrological modelling at the regional scale

Vincent Fortin [1], *Marco Carrera* [2], *Jacques Marcoux* [2], *Isabelle Doré* [1], *Stéphane Bélair* [1], *Pierre Bourgouin* [2]
[1] Meteorological Research Division, Environment Canada
[2] Meteorological Service of Canada, Environment Canada
Contact: vincent.fortin@ec.gc.ca

The Meteorological Research Division of Environment Canada and the Meteorological Service of Canada have developed jointly an analysis of 6h precipitation accumulation for use in land-surface and hydrological modelling over Canada. The approach taken consists in combining a numerical weather prediction of precipitation with ground observations of precipitation accumulation from synoptic and coop stations accross Canada. The density of the ground precipitation network being relatively low in most of Canada has motivated us to improve upon this technique by adding ground observations of precipitation type from synoptic stations, observations of clear sky from GOES imagery, lightning strikes observations as well as ground radar observations where available. We describe the data fusion process and show how the product can be used for land-surface and hydrological modelling at the regional scale.

2D5.6 ID:2478 17:15

Assessing streamflow sensitivity to crop changes

Aaron Berg , *Adam Bonneycastle* , *Wanhong Yang*
University of Guelph
Contact: aberg@uoguelph.ca

This research assesses the link between crop cover changes and hydrological responses in a medium sized agricultural watershed in southwestern Ontario. Using object-oriented classifications of annual 30-m Landsat 5 imagery as inputs for the Soil and Water Assessment Tool (SWAT), we compare both observed and simulated streamflow to crop

cover during the growing season. Results show that statistically significant correlations between differences in observed streamflow sensitivity and changes in crop cover are most evident in May and the late fall. However, relationships between simulated streamflow and these crop cover changes, while statistically significant, were very low. Further, using annual landcover change as model inputs did not improve model efficiency. As we demonstrate, the streamflow elasticity parameter proves useful for measuring this sensitivity, and may serve as a basis for examining simulated against observed streamflow when incorporating observed annual landuse/landcover changes into the modeling regime.

2D5.7 ID:2482 17:30

A comparative evaluation of GLUE and NSGA-II to calibrating streamflow

Gift Dumedah , *Aaron Berg*
University of Guelph
Contact: aberg@uoguelph.ca

As part of the mathematical approximation of hydrologic processes, extensive model calibration is necessary. During calibration, the model parameters are adjusted to best approximate known conditions in the watershed, and to improve the performance of the model by matching simulated process to observations. However, given the numerous model parameter sets, their interrelationships, varying degrees of parameter sensitivity and different objective functions during model calibration, the hydrologist is faced with the problem of deciding between several possible combinations for parameter values. This problem has led hydrologists to identify numerous model calibration methods. In this study we evaluate the performance of two calibration approaches for Soil and Water Assessment Tool (SWAT); the Generalized Likelihood Uncertainty Estimation (GLUE), and Non-dominated Sorting Genetic Algorithm II (NSGA-II). The GLUE methodology is based in Bayesian statistics in which a measure of belief is associated with each model prediction based on a likelihood measure. The NSGA-II technique, in contrast, is a multi-objective optimization method based on genetic algorithms. The GLUE methodology and the NSGA-II framework have been successfully applied to calibrate SWAT for streamflow in an agricultural watershed in southern Ontario. A comparison between results for both frameworks illustrates the capability of NSGA-II to provide unique information about model sensitivity and confidence regions of model parameters.

2D6.1 ID:2391 16:00

A new satellite capability for mapping surface blooms and marine vegetation

Jim Gower , *Stephanie King*
Institute of Ocean Sciences, DFO/FOC, Sidney, BC, Canada
Contact: gowerj@pac.dfo-mpo.gc.ca

The MERIS optical imager on the European satellite Envisat provides a band at 709 nm which we are finding to have a wide range of applications for ocean and coastal remote sensing. It allows a new and powerful capability to detect intense surface phytoplankton

blooms and has also detected a previously reported type of super-bloom in Antarctic ice. We have used it to detect and map pelagic Sargassum for the first time, and to show the seasonal and interannual variations in its concentration. We are now exploring its capability to measure aquatic vegetation on the BC coast, to detect blooms in high-sediment river plumes, and to assist in the global monitoring of coral reefs. Inclusion of the 709 nm band on MERIS provides a significant new window on the marine environment. It is not included on the present US SeaWiFS and MODIS instruments and is not planned for the future US VIIRS instrument. It will be included in ESA's future replacement for MERIS.

2D6.2 ID:2434 **16:15**

Inverse correlation between MODIS and MERIS fluorescence line height and algal biomass in a cyanobacteria-dominated lake, Lake Winnipeg, Manitoba, Canada.

Greg Mccullough [1], *Hedy Kling* [2], *Michael Stainton* [3], *David Barber* [1]
[1] Centre for Earth Observations Science, Department of Geography, University of Manitoba
[2] Algal Taonomy and Ecology Inc.
[3] Canadian Department of Fisheries and Oceans
Contact: gmccullo@cc.umanitoba.ca

Algal blooms have become of increasing concern to both users and managers of Lake Winnipeg. Chlorophyll concentrations frequently range up to 70 mg m-3 and are occasionally much higher in surface blooms. Remote sensing offers one means of mapping algae to monitor lake-wide response to planned watershed management action. For mapping chlorophyll, fluorescence line height (FLH) measured using radiometric data from either MODIS and MERIS is expected to outperform older blue/green band ratio algorithms in CDOM-coloured, turbid waters like those in Lake Winnipeg. Using a large set of ship-borne remote sensing reflectance spectra paired with water quality data, we show that FLH is, indeed, a strong predictor of chlorophyll (r2=0.84) but not due to the expected fluorescence peak at 685. Rather, over cyanobacteria-dominated phytoplankton communities, FLH records a local minimum in the reflectance spectrum determined by phycoeritherin absorption near 675 nm and increasing "red edge" reflectance beginning near 700 nm. FLH varies inversely with chlorophyll concentration. On the other hand, for observations over bacillariophyte and cryptophyte-dominated algal assemblages, FLH increases with increasing chlorophyll as expected. We are currently investigating the power of this difference to distinguish cyanobacteria from other phytoplankton communities in the lake.

2D6.3 ID:2492 **16:30**

Utilization of SAR-Derived Winds by the Meteorological Service of Canada: Present Status

Laurie Neil
Meteorological Service of Canada
Contact: laurie.neil@ec.gc.ca

This presentation will give an update on the status of efforts to utilize synthetic aperture radar derived wind data within the Meteorological Service of Canada. A brief review of SAR-wind product generation will be provided, and strengths and limitations of the dataset will be discussed using examples from recent retrievals. The outcomes of the MENTOR (Marine ENvironmental moniTORing) project will be discussed, along with opportunities for future work.

2D6.4 ID:2317 16:45

Dependence on environmental and imaging conditions of wind information derived from the Radarsat-1 synthetic aperture radar

Hal Ritchie [1], *Rick Danielson* [2], *Michael Dowd* [2]
(Presented by *C. Harold Ritchie*)
[1] Meteorological Research Division, EC, Dartmouth NS
[2] Dalhousie University
Contact: harold.ritchie@ec.gc.ca

A nonlinear regression approach has been shown to improve upon the marine surface winds of operational forecasts, when synthetic aperture radar (SAR) measurements are also available. This has permitted distinctions to be made regarding the environmental and imaging conditions that are most suitable for the use of SAR wind information. With the caveat that forecast errors also depend on environmental conditions, the dependence of improvements on factors such as wind speed, low-level static stability, and incidence angle (of the SAR beam) are considered. The dependence on functions that define the relationship between SAR backscatter and its wind information are also explored.

2D6.5 ID:2426 17:00

Sea level variations in the tropical Pacific Ocean associated with intra-seasonal Kelvin Waves

Xu Zhang [1], *Youyu Lu* [2], *Keith Thompson* [1]
[1] Dalhousie University
[2] Environment Canada
Contact: zhangx@phys.ocean.dal.ca

Intra-seasonal variability of the sea surface height (SSH) in the central tropical Pacific Ocean, and its relationship to westerly wind bursts are studied using 8-years (1999-2007) of satellite altimeter and scatterometer measurements. The 40-120 day band-passed SSH anomalies show an elevated level of variability confined in a narrow strip within 2º of the equator, and extending zonally from the dateline to 120ºW. Adjacent to this narrow strip, elevated SSH variability is also observed near 6ºN, presumably due to tropical instability waves and Rossby waves. The narrow strip of high SSH variations on the equator is associated with intra-seasonal Kelvin Waves, propagating eastward with phase speeds of about 2.5 m/s. A significant coherence is found between intra-seasonal SSH (180-120ºW) and zonal wind stress from 120-180ºE in specific frequency bands, with the wind variations in the west leading the SSH changes in the east. The physical connections between intra-seasonal Kelvin wave activity, the Madden-Julian Oscillation and ENSO

will be discussed.

2D6.6 ID:2412 17:15

Comparison of C-NOOFS with remote sensed and in-situ data

Andry William Ratsimandresy , *Fraser Davidson* , *Dan Wright* , *Frederic Dupont* , *Zeliang Wang*
Fisheries and Oceans Canada
Contact: ratsimandresya@dfo-mpo.gc.ca

In order to provide a reliable and accurate ocean forecast information, we carry out comparison of our model result with data from different sources. The data can be from other forecast systems, from in-situ measurement, as well as from remote sensing.

The comparison is done synoptically and/or on weekly basis depending on the availability of information.

Definition of metrics, considered as common quantities and diagnostics with a given mathematical definition, is a necessity for performing such comparison of our system with other international ocean forecast systems. All the comparisons were then performed on the metrics. Of particular interest is the verification of the model result in the forecast mode.

This presentation focuses mainly on surface distribution (of temperature, salinity, sea surface height, currents), on distribution along specific transects, and on possible comparison of remote sensed ocean color with ocean mixing depth. In-situ data considered in this study include seal based CTD observations as well as the systematic observations obtained from AZMP cruises. For the remote sensed data, we will use ocean color, altimetry as well as SST.

Such exercise will help assess the performance of the forecast system and will also allow its calibration to better reproduce the ocean.

2D6.7 ID:2512 17:30

IOS-RADS mirror site and its potential for operational oceanography in Canada

Josef Cherniawsky [1], *Jane Eert* [1], *Remko Scharroo* [2], *Michael Foreman* [1]
[1] Fisheries & Oceans Canada
[2] Altimetrics LLC / NOAA
Contact: cherniawskyj@pac.dfo-mpo.gc.ca

Altimeter data from current and historical satellite altimeters are now available at IOS-RADS, a mirror site of the Delft University and NOAA RADS (Radar Altimeter Data System) web site. The development of the mirror site has been accomplished using sporadic funding from several sources. Access to data is via networked workstations and a graphical user interface (GUI), which mimics the parameter selection and numerous options given in the parent RADS site (http://rads.tudelft.nl/rads/data/authentication.shtml). The data in the mirror site are updated nightly, thus lagging the parent site by up to one day. As in the parent web site, the IOS GUI allows to select data from ERS-1 and 2, Envisat, Geosat, Geosat Follow-On, Jason-1, Topex and Poseidon altimeters and their associated data fields. However, unlike the parent site, the GUI at the mirror site allows to select and output in a single data set all of the available pass/cycle combinations for a particular altimeter. In addition, work is proceeding on customized post processing, such as alongtrack collocation and tidal analysis, thus increasing the versatility and potential usefulness of these data for historical re-analyses and for near-real-time operational applications and data-assimilating ocean models.

2D7.1 ID:2400 **INVITED/INVITÉ 16:00**

Double diffusive turbulence in sheared flow

William Smyth , *Satoshi Kimura*
College of Oceanic and Atmospheric Sciences, Oregon State University
Contact: smyth@coas.oregonstate.edu

This talk describes numerical simulations of double diffusion in a sheared ocean flow. This mixing process depends on the vast difference between the molecular diffusivities of heat and salt in water, which renders the simulation a computational grand challenge. These simulations are the first to take full account of that difference in diffusivities and to evolve to a fully turbulent state.

Double diffusive instability results when the different molecular diffusivities of heat and salt generate regions of anomalously high and low density. Shear-driven turbulence and double diffusive convection have been studied individually and are relatively well understood, but their interactions are not, despite the fact that the two mechanisms act in concert in about one half of the ocean interior.

When ambient horizontal currents vary in the vertical, the salt fingering instability is supplanted by salt sheets, alternating planar regions of rising and sinking fluid which contain within them opposed horizontal flow patterns parallel to the sheets. Our simulations show that, as the salt sheets attain large amplitude, three-dimensionality is introduced via two distinct secondary instabilities. The first causes the sheets to buckle into nearly-horizontal strips. The second induces billowing motions at the upper and lower tips of the sheets. Shortly after the appearance of these secondary instabilities, a complex and poorly-understood sequence of events leads the flow to a fully turbulent state which has properties of both shear-driven turbulence and double diffusion.

The vertical momentum transport in sheared double diffusion turns out to be much lower than anticipated. This has important implications for the theory of thermohaline interleaving, where momentum transport sets the vertical scale of the layers.

2D7.2 ID:2268 **16:30**

Effects of near-inertial motion on midlatitude ocean gyres

David Straub [1], *Aaron Gertz* [2]
[1] McGill
[2] formerly at McGill
Contact: david.straub@mcgill.ca

The classic midlatitude wind driven gyre problem is revisited to examen effects of near inertial modes on the geostrophic flow. To simplify, we consider unstratified hydrostatic dynamics, but allowing for the velocity field to vary with the vertical coordinate. In the absence of such depth dependence, the system is identical to the barotropic QG system. Depth dependent modes are forced at near-inertial frequencies and the resulting motion feeds back on to the depth averaged flow. We show that i) the level of 3d motion is directly related to the level of near-inertial forcing and ii) the 3d modes exert a net drag on the 2d gyres. Specifically, we show that a transfer of energy from 2d-to-3d modes, coupled with a forward energy cascade of 3d energy can play an order one role in gyre energetics. The stronger the background 3d motion, the larger the effect. As an extreme example, we show solutions to the double gyre problem run at high (hyper-viscosity) Reynolds number and no bottom drag parameterisation. Without 3d forcing, the solution is highly unrealistic. With 3d forcing, realistic-looking solutions (e.g., with a Sverdrup interior and western boundary intensification, etc.) are readily obtained. Relevance of these results to the stratified problem are discussed.

2D7.3 ID:2489 16:45

Mean current generation by eddy-topographic interaction in a very high resolution, primitive equation ocean basin model

William Merryfield [1], *Robert Scott* [2]
[1] Canadian Centre for Climate Modelling and Analysis
[2] University of Texas at Austin
Contact: bill.merryfield@ec.gc.ca

It is well established theoretically and in idealized (e.g. quasi-geostrophic) numerical models that fluctuating currents over a sloping bottom tend to drive deep along-slope currents in the direction of topographic Rossby wave propagation, i.e. with shallower water to the right of the current vector in the Northern Hemisphere. Evidence that this process is significant in the oceans is provided by the far greater prevalence of such currents in high-resolution, vigorously eddying global ocean models than in coarser models. Available observations, while relatively sparse, are consistent with this view.

The present study uses a primitive-equation ocean model, MOM4, to represent circulation in a fictitious basin featuring a variety of bathymetric features. Horizontal resolutions ranging from O(1 degree) to 1/48 degree are considered. Questions addressed include (i) how do the strength and direction of abyssal mean flows depend on model resolution and eddy intensity, and (ii) at what resolution (in any) do eddy intensity and

the mean flow field become insensitive to further refinements. A prescription for adjusting viscous dissipation coefficients under changes in model resolution is also described.

2D7.4 ID:2472 **17:00**

An explanation of fast Rossby wave speeds in the Ocean

Francis Poulin , *Marek Stastna*
University of Waterloo
Contact: fpoulin@uwaterloo.ca

Atmospheric Rossby waves have been well studied for decades since they are easily observed. In contrast, oceanic Rossby waves have only become apparent in the last decade thanks to the accuracy of the Ocean Topography Experiment (TOPEX)/Poseidon data. The data reveals that the observed first baroclinic Rossby waves travel faster than what quasi-geostrophic theory predicts. In particular, at mid-latitudes they can be twice as fast. There has been much speculation as to the source of this discrepancy. In this work we explain how the inclusion of inertial effects produces faster Rossby waves and yields a closer agreement than with the quasi-geostrophic theory.

2D7.5 ID:2252 **17:15**

The barotropic ocean response to fast moving tropical cyclones affecting Atlantic Canada

Jennifer Mecking [1], *Richard Greatbatch* [2], *Chris Fogarty* [3], *Jinyu Sheng* [1]
[1] Dalhousie University
[2] Leibniz-Institut für Meereswissenschaften, IFM-GEOMAR
[3] Canadian Hurricane Center, MSC
Contact: meckingj@phys.ocean.dal.ca

Atlantic Canadian coastal waters are occasionally affected by tropical cyclones (TC) which can have devastating effects in the form of a storm surge and/or meteorological tsunami. The current operational storm surge model run at the Meteorological Service of Canada (MSC) has reasonable skill in forecasting the storm surge induced by storms with translational speeds much less than the shallow water wave speed. In cases that the translational speeds of the storms are near or greater than the shallow water wave speed, the non-isostatic response of the sea level becomes important and the performance of the storm surge model is hindered. Previous work on the ocean response to TC affecting Atlantic Canada used idealized atmospheric pressure and wind forcing to represent the tropical cyclone. In this study we examined the dynamic response of the eastern Canadian seaboard to the Hurricane Juan (2003) and Tropical Storm Helene (2000) using a shallow water equation model forced by atmospheric pressure and surface winds based on the Mesoscale Compressible Community (MC2) model. Preliminary model results demonstrate that atmospheric pressure forcing plays a dominant role in driving the sea level elevation in Helene while in the combination of wind and pressure forcing is responsible for the sea level elevation in Juan. Model sensitivity studies show that having a small time-step (on the order of minutes) in the atmospheric forcing is needed to obtaining a realistic sea level response produced by the ocean model during the two storms. Our studies also indicate that the horizontal model resolution should be fine enough to resolve the structure of the storm's sea level response. Reasonable representation of the storm structure in the model is also important for forecasting the maximum sea level elevation due to the storm.

2D7.6 ID:2286 17:30

On Density Profiles with Identical Internal Wave Spectra

Marek Stastna
University of Waterloo
Contact: mmstastn@uwaterloo.ca

The linear theory of vertically trapped internal waves has been known for well over 50 years. It is used for a variety of back of the envelope estimates and forms the basis for wide variety of weakly nonlinear extensions such as the KdV family, Boussinesq equations, Cammassa-Holm equations etc. While it is quite easy to show that different stratifications can have the same mode-1 propagation speed, it is quite surprising that it is possible to construct non-trivial stratification profiles that are different, yet yield an essentially identical set of wave speeds. In this talk I will provide an example of such a situation and discuss what this isospectral nature of the stratification means for the generation of finite amplitude internal waves by tidal flow over topography.

2E8.1 ID:2615 17:30

Canadian Argo Users Group meeting

Howard Freeland
Institute of Ocean Sciences
Contact: howard.freeland@dfo-mpo.gc.ca

Anyone at the CMOS-2008 congress with an interest in the Argo project of drifting-profiling floats in the world ocean is invited to attend a meeting of the "Canadian Argo Users Group". This meeting will be hosted by the group of people responsible for supplying the Canadian contribution to the international Argo program. At the meeting those who supply the program will present their plans and invite comments, feedback, complaints etc about the program and its delivery.

Réunion du groupe canadien des utilisateurs d'Argo Tous les participants au congrès SCMO-2008 intéressés par le projet Argo de flotteur-profileurs dans l'océan mondial sont invités à assister à la réunion du "groupe canadien des utilisateurs d'Argo". Cette réunion sera dirigée par le groupe de personnes responsables de fournir la contribution canadienne au programme international Argo. Pendant la réunion, ces personnes présenteront leurs plans futurs et inviteront l'audience à leur fournir des commentaires, questions, plaintes, etc. au sujet du programme et de sa livraison.

3A1.1 ID:2601 INVITED/INVITÉ 08:30

Observing and forecasting the ocean: 10 years of achievements

Pierre-Yves Le Traon
IFREMER
Contact: Pierre.Yves.Le.Traon@ifremer.fr

The development of global operational oceanography has been a major breakthrough in oceanography over the past 10 years. In-situ and remote sensing data are now routinely assimilated in global and regional ocean models to provide an integrated description of the ocean state. Observation and forecast products are readily accessible through major data and product servers and serve a wide range of applications covering both climate and mesoscale aspects. Main achievements in global operational oceanography will be reviewed. We will first discuss the status of the global ocean observing system (in-situ and remote sensing). The system has been primarily designed to serve climate applications but is also used as a backbone for most operational oceanography applications. A review of the development and achievements of the Global Ocean Data Assimilation Experiment (GODAE) international program will then be given. GODAE was set up in 1997 with the aim of demonstrating the feasibility and utility of global ocean monitoring and forecasting and so to assist in building the infrastructure for global operational oceanography. GODAE has had a major impact on the development of global operational oceanography capability. Global modelling and data assimilation systems have been progressively developed, implemented and inter-compared. There has been increased attention to development of applications and demonstration of their utility. Presentation will also include an overview of Europe operational oceanography activities and of the new GMES Marine Core Service programme of the European Union. An overview of France involvement in operational oceanography (open ocean and coastal) will also be given.

3A1.2 ID:2576 INVITED/INVITÉ 09:15

The Energy Sustainability Dilemma: Powering the Future in a Finite World

David Hughes
National Coal Resource Inventory, NRCan
Contact: davehughes@xplornet.com

Global energy consumption has nearly tripled in the past four decades. The developed world, 18% of population, consumes 54% of the world’s energy. Canadians consume five times more energy per capita than the world average and more than nine times that of developing countries such as China. Energy demand in the developing world, however, is forecast by the Energy Information Administration to grow by 95% through 2030, when this region will account for 58% of a global energy demand that is also forecast to grow by 50% over this period.

In 1850, 90% of the world’s energy was provided from renewable biomass (the balance from coal), whereas in 2006, 89% of the world’s energy was provided from non-renewable energy resources – coal, oil, gas and uranium. Since 1850 the world’s population has increased five-fold, the per capita consumption of energy has increased

eight-fold, and the total energy consumption has increased by 43 times. The fact that only 11% of 2006 energy consumption came from renewable sources (biomass, hydro, wind, solar etc) underscores the dilemma facing our modern society.

The limits to our ability to ever grow energy supply from non-renewable resources are now becoming evident. More than half of the world's oil production comes from countries that are past peak production. Estimates of the timing of the peak of global oil production range from now to as late as 2040, with a mean estimate in the 2012-2014 timeframe. Peak oil production in North America has already happened - the U.S. peaked in 1970, Mexico in 2004 and only Canada is now able to grow oil production thanks to the tar sands. Peak North American natural gas production happened in the early part of this decade and a global peak of gas production is forecast to occur before 2050. Natural gas is not expected to be able replace the energy lost from the depletion of oil supply after the peak in global oil production. Other forecasts suggest that global peak coal production, once considered an energy resource for "hundreds of years", could occur as early as 2025. Although there is a debate in the timing of peak production of oil, gas and coal among energy experts, there is a general consensus that peak production will happen. Given the sheer magnitude of the contribution of non-renewable hydrocarbons to our energy consumption, the peaking of production of these fuels has tremendous implications for our modern way of life, unless we begin to move toward more sustainable levels of consumption. Increasing global conflicts related to energy, Iraq and Nigeria come to mind, are yet another consequence of an unsustainable energy future.

The issue of climate change has achieved large scale penetration of the collective consciousness of the general public. The Energy Sustainability Dilemma is much less understood. Solutions to both issues will be hugely challenging and have much in common, however, the energy sustainability issue is likely to present the most imminent socio-economic threat to our current way of life and thus warrants a clear, objective and non-emotional assessment of our options. Some of the proposed "solutions" to climate change exacerbate the energy sustainability issue and have to be objectively reassessed in terms of the looming energy challenge.

This presentation focuses on the "Big Picture" and how Canada fits into it, as well as what must be considered going forward to assure a sustainable energy future.

3B1.1 ID:2501 **10:30**

Arctic blizzard prediction by nonlinear statistical downscaling of GEM model outputs

Zhen Zeng [1], *William Hsieh* [1], *William Burrows* [2], *Andrew Giles* [2]
[1] Dept. of Earth and Ocean Sciences, University of British Columbia
[2] Hydrometeorology and Arctic Lab, EC, Edmonton, AB
Contact: whsieh@eos.ubc.ca

Blizzards have been identified as hazardous weather events with the greatest impact on human activity in the Arctic, and as the greatest forecast problem there. For the purpose

of improving Arctic blizzard forecasts, three nonlinear statistical forecast models, Classification and Regression Tree (CART), Bayesian Neural Network (BNN) and Support Vector Machine (SVM), in addition to linear regression, were developed to forecast wind speed using hourly predictors derived from the Global Environmental Multiscale (GEM) model forecasts at two stations (Clyde River and Paulatuk) in the Northwest Territories and Nunavut regions during the winter of 2005. CART was also used to select a smaller subset of predictors to be used by the BNN and SVM models. The SVM model was found to give the best cross-validated forecasts.

3B1.2 ID:2418 **10:45**

New Multi-Site Generation Approach of Climate Data for Efficient Assessment of Climate Change Impacts on Hydrology Regime of Medium and Large Size River Basins.

Malika Khalili [1], *Robert Leconte* [2], *François Brissette* [2]
[1] McGill University, Department of Civil Engineering and Applied Mechanics
[2] École de Technologie Supérieure, Département de Génie de la Construction
Contact: malika.khalili@mail.mcgill.ca

Weather generators are increasingly being used in hydrology, agriculture, environment and climate change studies to simulate series of weather data for any length of time with similar statistics as observations. Climate change projections from global circulation models (GCM) can be used to modify the weather generator parameters, in order to provide future climate time series. Because of the low spatial resolution of GCMs, weather generators can also be used as statistical downscaling tools to create local scale climate scenarios.

Most of the existing weather generators operates at a single site independently of the others, while the extension of the weather event over the watershed implies that the weather data at a given weather station are likely to be correlated with those in the surrounding area. Multi-site weather generators are thus required to take into account the spatial dependence exhibited by the observed data.

A multi-site generation approach based on the spatial autocorrelation concept is developed. It is firstly implemented for the multi-site generation of daily occurrence and amount precipitation data, and then extended to the multi-site generation of daily maximum temperature, minimum temperature, and solar radiation data. The proposed approach allowed the reproduction, in a single step, of the observed daily spatial autocorrelations and the observed monthly interstation correlations. A hydrological modeling study showed that the multi-site weather generator, coupled with distributed hydrological model, highly improves the frequencies and magnitudes of summer, autumn and spring floods.

3B1.3 ID:2591 **11:00**

On Stochastic Modeling of Daily Rainfall Processes in Consideration of Climate Change and Variability

Van-Thanh-Van Nguyen , *Arshad Hussain*
(Presented by *Van-thanh-van Nguyen*)
McGill University
Contact: van.tv.nguyen@mcgill.ca

Rainfall records contain a finite amount of information regarding the historical rainfall pattern. A stochastic simulation of the rainfall process is thus needed to generate many sequences of synthetic rainfall time series that could have similar properties as those of the observed rainfall data. A large number of generated rainfall sequences could provide more adequate information to assess the response and reliability of a water resource system.

The present study is concerned with the development of a stochastic rainfall model to provide reliable synthetic daily rainfall series for practical applications. The proposed MCME model requires a combination of two components that describes, respectively, the persistence of daily precipitation occurrences based on the first-order Markov Chain (MC) and the distribution of rainfall amounts on wet days using the mixed exponential (ME) probability distribution. The performance of the proposed model was assessed in terms of its accuracy in describing various properties of the underlying daily precipitation process using daily rainfall data available from three stations located in regions with completely different climatic conditions: Dorval Airport in Quebec (Canada), Sooke Reservoir in Victoria (Canada), and Roxas City in Philippines. Further, to account for the seasonal variability of the rainfall process, the parameters of the MCME model were allowed to vary with the monthly periods by fitting a truncated polar Fourier series to the estimated parameters. Results of this assessment have indicated that the proposed MCME model was able to reproduce accurately many characteristics of the daily precipitation series. In addition, an innovative approach was proposed to combine the estimation of daily annual maximum precipitations (AMPs) by the MCME model with those by the downscaled Global Circulation Models (GCMs). The combined model was found to be able to provide AMP estimates that were comparable to the observed values at a local site.

3B1.4 ID:2578 **11:15**

High resolution climate change scenarios from Downscaling Methods: Mean and extremes information over a river basin in southern Québec

Philippe Gachon [1], *Dimitri Parishkura* [2], *Milka Radojevic* [3], *Andrew Harding* [3], *Yonas Dibike* [4]
[1] Environnement Canada
[2] UQÀM/Environnement Canada
[3] GEC3-McGill/Environnement Canada
[4] NWRI/Environment Canada
Contact: philippe.gachon@ec.gc.ca

Downscaling approaches, namely statistical and dynamical downscaling techniques, have emerged as useful tools to develop high resolution climate change information instead of the use of coarse resolution information provided by global climate models (GCMs). In order to analyze the added values with respect to GCMs, statistical and dynamical downscaling outputs are evaluated and compared over the current period as well as for future time windows. For validation and reference from baseline climate, comparison is made using kriging observed daily precipitation and temperature data over southern Quebec (i.e. a river basin scale of around 270 km2). All simulated values are downscaled data from two GCMs (CGCM2/3 and HadCM3) with the use of a multiple regression based statistical approach and the corresponding values from the two versions of the Canadian Regional Climate Model (CRCM 3.7.1 and 4.1.1, all over a 45-km grid). The downscaled results are validated over the 1961-1990 baseline period, and evaluated over the 2041-2070 period (with the SRES A2 emission scenario). Results, with particular emphasis to the statistical distribution and climate extremes, suggest that the downscaling performance over the baseline period significantly varies between the two downscaling techniques and over various seasons, while both approaches produced quite similar temperature changes in the future from median values and less systematic for extremes. For precipitation, more differences and/or less convergence are present between the two methods with higher uncertainties in the downscaled results in that case.

3B1.5 ID:2592 **11:30**

A spatial-temporal downscaling approach to the construction of intensity-duration-frequency relations in consideration of climate change

Tan-Danh Nguyen , *Van-Thanh-Van Nguyen*
McGill University
Contact: van.tv.nguyen@mcgill.ca

Intensity-Duration-Frequency (IDF) relations for annual maximum precipitation (AMP) for future periods in consideration of climate change has become critical for the assessment of climate change impacts on the design of various hydraulic structures. This paper presents therefore a spatial-temporal downscaling approach to the construction of the IDF relations that could take into account the climate change factor. More specifically, the proposed approach is based on a combination of a spatial downscaling method to link large-scale climate variables as provided by General Circulation Model (GCM) simulations with daily extreme precipitations at a local site and a temporal downscaling procedure to describe the relationships between daily extreme precipitations with sub-daily extreme precipitations using the scaling General Extreme Value (GEV) distribution. The feasibility of the proposed downscaling method has been tested based on climate simulation outputs from two GCMs under the A2 scenario (HadCM3A2 and CGCM2A2) and using available AM precipitation data for durations ranging from 5 minutes to 1 day at 15 raingage stations in Quebec (Canada) for the 1961-1990 period. Results of this numerical application has indicated that it is feasible to link large-scale climate predictors for daily scale given by GCM simulation outputs with daily and sub-daily AM precipitations at a local site. Furthermore, it was found that AM precipitations at a local site downscaled from the HadCM3A2 displayed a small change in the future, while those values estimated from the CGCM2A2 indicated a large increasing trend for future periods.

3B1.6 ID:2279 **11:45**

Impact of climate change on France watersheds in 2050: a comparison of dynamical and multivariate statistical methodologies

Christian Pagé [1], *Julien Boé* [1], *Laurent Terray* [1], *Florence Habets* [2], *Eric Martin* [3]
(Presented by *Christian Page*)
[1] CERFACS, Toulouse, France
[2] UMR Sisyphe 7619-ENSMP, Paris, France
[3] CNRM, Météo-France, Toulouse, France
Contact: page@sca.uqam.ca

A multivariate statistical downscaling methodology is implemented to generate local time series of precipitation, temperature, and other variables at different sites based on large-scale circulation predictors such as the mean sea-level pressure or 500 hPa geopotential. It starts from regional climate properties to establish discriminating weather types for the chosen local variable. Intra-type variations of the relevant forcing parameters are then taken into account by multivariate regression using the distances of a given day to the different weather types as predictors. The final step consists of conditional resampling.

The methodology is evaluated over France. Using NCEP reanalysis fields as predictors, satisfying results are obtained at daily timescale and concerning low-frequency variations, for both temperature and precipitation. Similarly, the use of general circulation model results as predictors gives a realistic representation of regional climate properties demonstrating the reliability of the methodology for future climate projections at local scales. Finally, the underlying stationarity hypothesis of the statistical relationship between the predictors and the regional climate is evaluated using the perfect model framework.

A practical application of this methodology will be presented: the impact of climate change scenarios performed in the context of the IPCC AR4 (the CMIP3 exercise) on river flows over several hydrological basins in France. An assessment of the different sources of uncertainties will also be presented regarding streamflow changes in 2050 for various France watersheds. This new methodology will be compared against a dynamical downscaling methodology with a quantile-quantile bias correction and a perturbation method based on direct model output.

3B2.1 ID:2223 **INVITED/INVITÉ 10:30**

Argo – current status and prospects for the near future

Howard Freeland [1], *Anh Tran* [2]
[1] DFO Science-Pacific Region
[2] DFO-Science-National Capital Region
Contact: howard.freeland@dfo-mpo.gc.ca

Late in 2007 the target array of 3000 floats was achieved with the vast majority of these floats reporting data in real time to the two Global Argo Data servers. New sensors are being considered with plans for a Carbon-Argo (CARGO?) program. Dissolved oxygen was looking very promising a few years ago, then problems were detected leading to few

deployments of floats carrying oxygen sensors in the last 12 months. The problems appear to have been corrected and oxygen measurements appear likely to return.

At the time of writing 24 nations are deploying floats, all following the same data policy and all agreeing to the same rules for access. In December 2007 the Argo array reported a total of 9200 CTD profiles, which is equivalent to 109,000 profiles per year. All participating countries follow the same protocols for data management and quality control and deliver the data to the global data servers. We also have established a system of Argo Regional Centres charged with maintaining data consistency throughout ocean basins.

Some problems appeared in the last year, for example:- 1) Some floats were determined to have a significant pressure offset problem. 2) Though 3000 floats is sufficient for a global ocean-mapping array, the northern hemisphere is slightly over-sampled and the southern hemisphere under-sampled. 3) Argo is an international program, but some elements have long-term financial security and some do not. 4) The coordinating office is only marginally funded and was almost lost early in 2007. 5) A continuing problem is a persistent threat from concerns about the way we keep ourselves in compliance with the Law of the Sea.

Of these problems, 2) seems the most difficult one to correct. However, the US program is secure for about another 3½ years at which time a decision will be taken whether or not to continue the program delivery through the Universities or fully operationalise the US Argo program which is about 50% of the total fleet presently in the water. A Euro-Argo program is under development that might see the European contribution move from 18%, at present, to 25% of the total array. Thus it seems likely that though a 3000-float array may be hard to maintain in the very long term, a very large fraction of the array will remain in place for many years to come.

3B2.2 ID:2461 11:00

Canada's contributions to Argo in observing the ocean in real-time

Anh Tran
Integrated Science Data Management (ISDM) - Fisheries and Oceans Canada
Contact: Anh.Tran@dfo-mpo.gc.ca

Prediction of climate variability depends on our ability to observe ocean variability. Argo is an international program with its goal is to deploy 3000 profiling floats that collect temperature and salinity in the world ocean, and transmit data in real-time to all users without any restriction. The program of float deployment began in 2000 and achieved its goals in late 2007.

Argo will provide a quantitative description of the evolving state of the upper ocean and the patterns of ocean climate variability. Data provided by Argo and other observation programs will feed in to the Global Ocean Data Assimilation Experiment (GODAE) which will supply the first forecasting tools for the ocean climate. Argo supports the concept of Operational Oceanography.

Canada joined Argo in its early state. Canada made its first deployment on June 9, 2001 and to date we deployed 219 floats and currently we had 99 floats actively collect T and S in the ocean of interested to Canada. Since 2001, Canadian Argo program collected 16542 profiles. All of the data are quality control and available to users within 24 hours of the float surfacing. The majority Canadian floats measured T and S, some measured oxygen data. The floats were built by Webb Research and METOCEAN. The float lifetime is about 5 years.

The objective of our talk is to show Canada's contribution to the Argo program. The Canadian Argo data system will be described showing the various stages that the raw data goes through to become completed T, S and oxygen profiles. Comparisons between data collected from Argo floats and other instruments will be discussed, as well as some products available to users.

3B2.3 ID:2585 11:15

Ocean observing with Marine Mammals: 4 years of in-situ water profiling from the Gulf of St. Lawrence to Baffin Bay.

Fraser Davidson [1], *Garry Stenson* [2], *Mike Hammil* [2], *Paul Stead* [2]
[1] Fisheries and OCeans Canada
[2] Fisheries and Oceans Canada
Contact: davidsonf@dfo-mpo.gc.ca

The Fisheries and Oceans Centre of Expertise for Marine Mammalogy has deployed in-situ temperature profiling tags since 2004 in Eastern Canada. This talk presents the physical oceanographic observation results from 4 years of seal tagging deployments by DFO biologists. Data is transmitted every 2-3 hours by the seal tag providing a detailed description of the upper ocean water colum from ranging from 50 m on the shelf to 1600 m in the Labrador sea. Sensor validation from 3 research cruises is presented along with interesting observed features. This includes seal based CTD profiles in ice covered waters.

3B2.4 ID:2475 11:30

Apparent supercooled water in univariate optimal interpolation of real time oceanographic data

Mathieu Ouellet
Gestion des données scientifiques intégrées - Ministère des Pêches et Océans
Contact: mathieu.ouellet@dfo-mpo.gc.ca

Optimal interpolation is a method frequently used to transform data gathered from punctual observations into continuous fields that can in turn be used for data assimilation or model initialization. Such fields are produced on a real-time and operational basis, given actual technologies.

We examine the case where a combination of separate, univariate 2D optimal interpolation of ocean temperature and salinity, might produce fields in which the estimated temperature is below the freezing point of water calculated from the estimated salinity field. Such results are unlikely to correspond to a real physical phenomenon and thus undesirable.

Some of the responsible factors are examined and quantified : data coverage, climatology used in the removal of the variance, instrument accuracy, a priori specification of the scales of covariance, etc. Special attention is brought to a case involving a sub area of the Eastern Canadian coast, where the southern Labrador Shelf and northern Newfoundland Shelf meet and with summer conditions.

3B2.5 ID:2311 11:45

ROSE - Reflection Ocean Seismic Experiment

Blair Greenan [1], *Ramzi Mirshak* [2], *Mladen Nedimovic* [2], *Barry Ruddick* [2]
[1] Bedford Institute of Oceanography
[2] Dalhousie University
Contact: greenanb@mar.dfo-mpo.gc.ca

In the summer of 2007, the Government of Canada contracted a 6900 km multi-channel seismic (MCS) survey over the Sohm Abyssal Plain, south of Nova Scotia, with the intent to define Canadian jurisdiction of the seabed and its natural resources under Article 76 of the United Nations Convention on the Law of the Sea (UNCLOS). The survey lines crossed a major oceanographic boundary between the Gulf Stream and the slope waters. Capitalizing on this opportunity, the research vessel R/V Endeavor was used to collect an oceanographic dataset coincident with a part of the UNCLOS MCS survey. Approximately 350 km of high spatial density data (500-1500 m) was collected using shipboard XBTs and CTDs. The combined MCS and oceanographic data provide the basis for the Reflection Ocean Seismic Experiment – ROSE. This composite data set will enable quantitative analysis of the gathered water column information to produce corresponding synthetic and field reflection sections and to study the spatial resolution limits of seismic oceanography. It will also provide ground-truth for the MCS structures and improve understanding of the linkages between the physical structures and the seismic reflections.

3B3.1 ID:2403 10:30

Weather Forecasting Applied to Avalanche Safety: Overview of Winter 2007-8

Melinda Brugman , *Matt Macdonald* , *Allan Coldwells*
(Presented by *Mindy Brugman*)
Pacific Storm Prediction Centre, Meteorological Service of Canada, Environment Canada
Contact: mindy.brugman@ec.gc.ca

In this paper we review the winter of 2007-8 in terms of the weather impacting mountain snow packs over BC and resulting avalanche sensitivity. The winter season 2007-8 was cooler and moister than normal across most of BC as typically occurs during La Nina – or Cool Phase events of ENSO. By mid-winter 2007-8 mountain snow packs across BC had grown deeper and weaker than normal, and the avalanche conditions were treacherous. Notable weak layers from special weather events contributed to weaknesses in the snowpack which persisted well into midwinter. Forecasting of avalanche related weather was carried out at PSPC using a variety of models, and communicated to through public forecasts and warnings, mountain highway forecasts and using a special product prepared for the CAC called the CPCN63. Verification of these forecast are examined with emphasis on events and long term patterns which had the potential to affect the snow pack stability. The critical variables affecting avalanches are surface loading, energy budget, snowpack layering and metamorphism. These are expressed by forecast precipitation (amount, phase, density), freezing level, air temperature, wind (speed and direction) and cloud cover (including cirrus and valley cloud). In this paper verification of typecasting and meteorological variables for 2007-8 avalanche weather forecasts are evaluated and compared to past years when dangerous avalanche conditions developed. The goal of this paper is to provide a better understanding on how we may improve weather forecasting for applied avalanche safety in the region – both short and long term.

3B3.2 ID:2597 10:45

Science and Avalanche Forecasting - A Complicated Dance

John Kelly
Canadian Avalanche Centre
Contact: pascal@avisualanche.ca

Patterns of avalanche activity can be predicted with a high degree of certainty; however predicting individual avalanches remains an elusive goal. In the absence being able to point out which slopes will avalanche on a given day, avalanche forecasters need to apply research from the social as well as the physical sciences in order to supply backcountry recreationists with information that will help them make appropriate decisions of where to go. The Canadian Avalanche Centre programs are conceived to supply a comprehensive suite of tools to support safe amateur recreation. These tools range from awareness and education, to information on conditions and public warnings. Our programs are based on a variety of scientific research initiatives that inform our decisions on a daily basis. This presentation will review some of these research results and our incorporation of them into our activities.

3B3.3 ID:2225 11:00

Snowpack evolution modeling for avalanche forecasting in areas of sparse observations

Michael Smith
Applied Snow and Avalanche Research at University of Calgary (ASARC)
Contact: masmith@ucalgary.ca

Snow avalanches in Canada are responsible for an average of 13 deaths per year and numerous road closures with estimated costs of $25,000 to $100,000 per hour, not including the consequences of delayed just-in-time deliveries. Avalanche bulletins prepared by the Canadian Avalanche Centre (CAC) were initially for forecast areas for which commercial and governmental operations provided daily avalanche, weather and snowpack data. Recently, the CAC has begun producing bulletins for at least two areas with limited weather data and manual snowpack observations. As the popularity of winter backcountry recreation continues to grow more such avalanche forecast areas are likely..

The Applied Snow and Avalanche Research group at the University of Calgary (ASARC), in partnership with Alberta Environment and the CAC has embarked on a pilot study of the applicability of the Swiss SNOWPACK model to data-sparse regions of Canada. This model has the ability to simulate evolving snow stratigraphy when provided with appropriate meteorological input. A remote weather station in the Crowsnest Pass of Southern Alberta has been outfitted with additional instrumentation including an acoustic snow depth sensor and short and longwave radiometers. Continuous weather data from this station will be used to drive SNOWPACK throughout the 2007-2008 winter season. Manual snow profiles are recorded approximately twice each month and are compared with model output. CAC forecasters will assess the merit of the SNOWPACK simulations compared to forecasting with weather data and limited snowpack observations. Results will be used to evaluate model performance and recommend changes to parameterizations to better suit the North American terrain and winter climate.

3B3.4 ID:2221 11:15

Numerical Avalanche Predictions using Ensemble Weather Forecasts

Ted Weick [1], *Paul Cordy* [2], *Stull Roland* [2]
[1] BC Ministry of Transportation
[2] UBC Earth and Ocean Sciences
Contact: ted.weick@gov.bc.ca

The Ministry of Transportation operates eight avalanche programs province wide to monitor avalanche conditions and maintain safe highways for the traveling public. A numerical model to predict avalanche cycles was created (McClung and Tweedy, 1996) and operationally utilized using historical data and local information through the late 1990s. This work was extended during the winter of 2006/2007 to use more recent technology and data (Cordy, P, Master's thesis, Cordy et al, in progress) and then further enhanced for operational use during the winter of 2007/08. The enhancements implemented include incorporation of ensemble mesoscale forecast information that projects avalanche forecasts further into the future (Roeger et al. 2001) and gives technicians further information for near future decision making. In addition, the avalanche forecast models were run against datasets that varied both in duration and avalanche frequency. Avalanche forecast predictions were utilized and compared for several avalanche areas in the BC Coast (Duffy Lake, Coquihalla, Fraser Canyon, Bear Pass) and Selkirk Mountains (Kootenay Pass, Three Valley Gap). This paper provides information on Ministry systems, data utilized by the application and some preliminary results.

References

Roeger, C., D. McClung, R. Stull, J Hacker, H. Modzelewski (2001) A verification of numerical weather forecasts for avalanche prediction. Cold Regions Science and Technology 33:189-205

Cordy, P., (2007), Applied Automated Numerical Avalanche Forecasting Using Electronic Weather Sensor Data. Masters Thesis, Department of Geography, University of British Columbia

Cordy, P., D.M. McClung, C.J. Hawkins, J. Tweedy, T. Weick (in progress), Computer assisted avalanche forecasting using electronic weather sensor data.

3B3.5 ID:2513 11:30

A Comprehensive Framework for Avalanche Hazard Assessment and Avalanche Danger Ratings Based on Risk

Grant Statham [1], *Pascal Haegeli* [2]
[1] Parks Canada Agency
[2] Simon Fraser University
Contact: grant.statham@pc.gc.ca

Effective communication of avalanche hazard plays a crucial role in avalanche safety initiatives. While technical information exchanges have become an integral part of professional avalanche risk control, more general avalanche bulletins are used to communicate avalanche conditions to the public. With the recent development of rule-based decision tools, such as the Avaluator, there has been an increased demand for avalanche danger ratings, which condense all of the relevant information into a single value on a five-point scale. However, the existing definition of the danger scale is incomplete and provides only limited guidance about how danger levels are assigned. This deficiency promotes inconsistencies in the application of the scale, considerably limits its educational value and ultimately inhibits its use as an effective communication tool.

In this presentation, we provide a new perspective on avalanche hazard assessment and avalanche danger levels based on a comprehensive, risk-based analysis of the physical avalanche system. In this analysis, we deconstruct avalanche hazard in detail and reassemble its components in a probability-consequence framework. The resulting framework supplies a process-oriented model for assessing avalanche hazard that allows a more explicit integration of scale and uncertainty. In comparison to similar models in the geotechnical realm, the avalanche model is characterised by a particularly complex consequence component. The new framework represents a unifying platform for avalanche hazard assessments that promotes consistency, has a much higher educational value because of its transparency, and provides more useful information about travel and risk mitigation choices.

3B3.6 ID:2547 11:45

The challenge of promoting better decision-making – perspectives from the field of

avalanche awareness education

Pascal Haegeli
REM Simon Fraser University
Contact: pascal@avisualanche.ca

The combination of challenging terrain, fast changing environmental conditions and remoteness makes the winter backcountry a hazardous place where even minor mistakes can lead to injury or death. Over the last 35 years, approximately 400 people have been killed in avalanches in Canada, most of them while engaged in unguided recreational activities in British Columbia and Alberta.

Traditionally, avalanche awareness education was based on the assumption that backcountry users are rational decision-makers and that better subject knowledge would automatically lead to better decisions and fewer accidents. However, while the model of the rational decision-maker is well established in our society, research in the fields of cognitive science and decision-making has shown that this approach is actually used very rarely. Instead, we use simpler methods, such as heuristics and intuition, for the majority of our decision-making. While these approaches work reliably most of the time, they can become deadly traps when applied in avalanche terrain. The complexity of the avalanche system, the generally high level of uncertainty and the often exhilarating benefits of the pursuit make avalanche terrain a challenging environment to properly develop these decision methods.

To address this challenge, a change of perspective is needed. Instead of the knowledge-based approach that relies on the existing decision-making skills of backcountry users, a more comprehensive approach is required that also provides guidance for the decision-making process itself. This presentation will provide an overview of the recent social science studies and decision support tool developments in avalanche awareness education.

While the short-term effects of unwise decisions related to meteorology or climatology might not be as dramatic as in avalanche terrain, the points raised in this presentation might also help these fields to better connect with their target audiences.

3B4.1 ID:2226 10:30

Neural networks applied to estimating subglacial topography and glacier volume

Garry Clarke
Earth & Ocean Sciences, University of British Columbia
Contact: clarke@eos.ubc.ca

Most of Earth's mountain glaciers and ice caps are shrinking rapidly. To predict the rate and consequences of these rapid changes, we need improved regional-scale models of mountain glaciation and better knowledge of the subglacial topography upon which these models must operate. Because geophysical ice thickness mapping of more than 100,000 glaciers is unfeasible, we have developed a neural network approach to estimating glacier thickness that uses calculations performed on a digital elevation model (DEM) and on a mask of the present-day ice cover. To apply the method, we classify ice-covered DEM cells as either gently-sloping, for which the neural net approach is appropriate, and steeply-sloping, for which a simple algebraic estimator is employed. The depth predictions are validated by using a numerical ice dynamics model to reglaciate regions that are currently ice-free, with the aim of generating DEM datasets for which the subglacial topography is perfectly known. In this manner, predictions of ice thickness based on the neural network can be compared to the known ice thickness and the performance of the neural network can be evaluated and improved. From our results, thus far, we find that the neural net depth estimates yield plausible, smoothly varying subglacial topography with a typical r.m.s. elevation error of 50 m.

3B4.2 ID:2377 10:45

Reconstructing Past Climate for Glacier Mass Balance Modeling using Empirical Orthogonal Functions and Bayesian Model Averaging

Christian Reuten , *Tanya Stickford* , *Garry Clarke*
The University of British Columbia
Contact: creuten@eos.ubc.ca

When modeling past glacier mass balances based on station temperatures and precipitation one faces the problem that weather stations are usually far from glaciers and at lower elevations and data are often incomplete. By comparison, National Center for Environmental Prediction North American Regional Reanalysis (NARR) data provide a vertically and dynamically consistent representation of the atmosphere at a spatial resolution of 32 km at 45 levels in 3-hour time steps since 1979. Because of problems with the surface scheme, NARR's 2-m temperatures are in bad agreement with station observations. Elsewhere a method was developed to adjust CRU TS 2.1 gridded station temperatures to approximate NARR pressure-level temperatures at station elevation. Principle component (PC) analysis on NARR's 1979-2006 monthly mean pressure-level temperature fields yields a set of 28 3D empirical orthogonal functions (EOFs). For each year in this 28-year period, NARR temperature fields can be exactly reconstructed as a linear combination of the 28 EOFs, with the PCs as the coefficients. For years before 1979, the linear combinations of these EOFs become models to approximate pre-1979 temperature fields based on adjusted CRU temperatures. The total model space comprises 2^28 models. Models with insignificant probability are filtered out using a Markov chain Monte Carlo algorithm. For all significantly probable models, the sum of their posterior predictive distributions weighted by model probability are a good approximation of the full Bayesian model average. This constitutes a mixture model beyond the original model space and allows us to estimate pre-1979 temperature fields more closely and with more reliable posterior distributions than the one model with the greatest model probability without over fitting the data. This approach can be extended to other observational quantities, climate model output, and proxy data.

3B4.3 ID:2504 11:00

High-resolution regional glacier modelling driven by NARR data

Faron Anslow [1], *Alexander Jarosch* [1], *Gwenn Flowers* [2], *Brett Wheler* [2], *Garry Clarke* [1]

[1] University of British Columbia
[2] Simon Fraser University
Contact: anslowf@geo.oregonstate.edu

As a testing ground for large-scale modelling of polar glaciers we apply a coupled mass balance/ice dynamics model to an area surrounding two small valley glaciers in the St. Elias Mountains, Yukon. Our overall modelling aim is to generate topographically detailed (200 m grid spacing) glacier mass balance to drive a regional ice dynamics model for simulations of the regional response of glaciers to changing climate. Glacier mass balance is computed from a temperature/radiation based ablation model while accumulation is determined from fields derived from a linear model of orographic precipitation. Input data for these models is derived from the North American Regional Reanalysis. We compare modelled ablation with stake-based ablation measurements and with acoustic range sensor data from two adjacent glaciers during summer, 2007. Model accumulation is compared with accumulation measurements. We also test the feasibility of validating the model with high resolution snow cover maps derived from satellite imagery and present first results of a regional ice dynamics model forced by the high resolution mass balance.

3B4.4 ID:2447 **11:15**

Controls on the stable water isotope composition of precipitation in the southwestern Yukon

Robert Field , *Kent Moore*
Dept. Physics, University of Toronto
Contact: robert.field@utoronto.ca

The goal of our work is to better understand controls on the stable water isotope (SWI) composition of precipitation in the southwestern Yukon, and in particular, to better-interpret the SWI signal from the Mount Logan ice core.

One feature of interest in the Mt. Logan ice core record is a significant drop in d18O in the 1850’s towards more depleted values, which is thought to have resulted from a shift in North Pacific circulation towards a deeper Aleutian Low and moisture from more southerly sources. Because of their greater arrival times, these air masses would have undergone a greater isotopic depletion than moisture from closer, colder sources under a more zonal flow regime. Although physically plausible, it is possible that the d18O drop caused by this proposed shift might be offset by warmer source evaporation conditions and warmer air mass trajectories.

To test the plausibility of the meridional hypothesis, we conducted numerical experiments with the NASA GISS ModelE isotopically-equipped general circulation model. We found that positive d18O anomalies in the SW Yukon were in fact associated with a deeper Aleutian Low and stronger meridional transport. It would appear as though the effect of a longer transit is offset by a warmer moisture transport pathway, in disagreement with the current moisture shift explanation. Our results are in agreement with recent tree-ring reconstructions of the North Pacific Index, which suggest an 1850’s

shift towards a weaker Aleutian Low.

We also found that the degree of control on the SW Yukon isotope signal is highly dependent on seasonality. During the summer months, the underlying circulation controls on d18O are largely absent,whereas during the winter months, the circulation features become much more enhanced. This suggests that much information can be gained by separating the winter from summer signals in the Mt. Logan ice core record.

3B4.5 ID:2616 11:30

Tropical - North Pacific teleconnections: Geochemical evidence from coastal British Columbia and the western Arabian Sea

Tara Ivanochko [1], *Stephen Calvert* [1], *Thomas Pedersen* [2]
[1] University of British Columbia
[2] University of Victoria
Contact: tivanoch@eos.ubc.ca

Present day fluctuations in the intensity of the Indian monsoon (IM), El Niño/ Southern Oscillation (ENSO) events, and the strength of the Aleutian Low pressure system result in extreme weather events, large scale ecosystem shifts, and impact human life and livelihood. An understanding of the teleconnections linking these systems is necessary in order to predict how they will interact as climate changes occur. Two new geochemical proxy records of Holocene climate variability improve our understanding of past tropical – North Pacific teleconnections. The first, from the western Arabian Sea, demonstrates significant variability in soil moisture on the Horn of Africa, driven by the changing position of the Intertropical Convergence Zone (ITCZ) and the IM, over the last 10 kyrs. The second, from Effingham Inlet (Vancouver Island), tracks changes in the strength of the California Undercurrent and NE Pacific coastal upwelling over the same timescale and allows our understanding of climate change in the Pacific region to be expanded northward to include the Aleutian Low pressure system. Here we show that over the last 10 kyrs variations in the position of the ITCZ, the strength of the IM and coastal upwelling in the NE Pacific are coherent and vary inversely with the frequency of ENSO events. These two new records indicate that ocean/atmosphere processes in the tropics are a critical driving force of centennial scale climate variability.

3B5.1 ID:2548 10:30

Assimilation of Data Into Ocean Models: On-Line Estimation of Background Error Covariance Parameters

Keith Thompson , *Yimin Liu*
Dalhousie University
Contact: keith.thompson@dal.ca

One of the main problems with the assimilation of ocean observations into eddy resolving models is the specification of the background error covariance i.e., the degree to which the model forecast is believed. We will present a computationally efficient method for simultaneously estimating both the ocean state and background error covariance

parameters in a sequential (on-line) manner. The method has a straightforward interpretation in terms of hierarchical Bayesian modelling and can accommodate prior information on the covariance parameters. There are similarities between the present approach and that proposed by Dee (1995). The main difference is that the present approach maximizes the joint probability density function (pdf) of state and covariance parameters (rather than the marginal pdf of the parameters); this difference leads to significant computational savings. The new method will be illustrated using results from the assimilation of sea levels (observed by altimeters) and vertical profiles of temperature and salinity (from Argo floats) into a basin scale, eddy permitting model of the North Atlantic. It will be shown that the parameter estimates have reasonable magnitudes and also change with season. The application of the method to the assimilation of ocean data into coupled atmosphere and ocean models will be discussed.

3B5.2 ID:2483 **10:45**

Data assimilation in a regional ocean model of the Labrador Sea

Entcho Demirov , *Jieshun Zhu* , *Madlena Hakobyan*
Department of Physics and Physical Oceanography, Memorial University of Newfoundland
Contact: entcho@physics.mun.ca

In this talk we present results from model simulations of interannual variability in the Labrador Sea with an eddy permitting ocean model. The ocean model is NEMO with ¼ degree horizontal resolution, which is driven with NCEP atmospheric reanalysis. The model solution is spectrally nudged to climatology. Two model experiments are performed. The first one is a free run with no data assimilation. A reduced order Kalman Filter is used in the second run to assimilate satellite altimetry and ARGO (temperature and salinity) data. The predictive skills of the model and data assimilation scheme are assessed.

3B5.3 ID:2361 **11:00**

Initialization of Coupled Seasonal Forecasts by Assimilation of an Ensemble of Ocean Reanalyses

Woo-sung Lee [1], *William Merryfield* [1], *Youmin Tang* [2]
[1] Canadian Centre for Climate Modelling and Analysis
[2] University of Northern BC
Contact: WooSung.Lee@ec.gc.ca

Because the prediction skill of seasonal forecasts strongly depends on information contained in the initial state of the ocean, it is very important to incorporate observational knowledge together with uncertainty in that knowledge in the oceanic initial condition. To obtain realistic initial conditions, a variety of ocean assimilation algorithms have been developed. Here we use an off-line variational assimilation scheme which initializes ocean temperatures using existing reanalysis data instead of raw in situ observations. Although this is a relatively simple scheme, it is known to be effective, convenient to apply and computationally efficient.

Moreover, there are several ocean reanalyses available today that can be used as a basis for generating an ensemble of initial conditions using this scheme. These products will, of course, differ from each other due to the use of different models and methods in their construction. Such differences potentially provide diversity in ocean initial conditions that could enhance ensemble spread taking into account observational uncertainties. For this purpose, seasonal forecasts using different reanalyses as input for ocean data assimilation were carried out for the 22 years from 1980 to 2001. Each forecast consists of a 12-month integration commencing September 1 and using an updated version of the CCCma coupled model. The reanalysis products considered include global monthly ocean temperature data obtained from GODAS, SODA, GFDL, CERFACS, INGV, ECMWF and METUK. In this talk, we will discuss (1) the differences between ocean reanalysis products, (2) the impact of variational data assimilation on forecast skill as compared to simple initialization by SST nudging and (3) the influence of the multi-reanalysis initialization procedure on ensemble spread.

3B5.4 ID:2481 11:15

The inverse modeling of the seasonal variation of the Eastern North Pacific Ocean circulation

Tsuyoshi Wakamatsu [1], *Michael Foreman* [1], *Keith Thompson* [2]
[1] Institute of Ocean Sciences
[2] Dalhousie University
Contact: wakamatsut@pac.dfo-mpo.gc.ca

The seasonal variation of the Eastern North Pacific Ocean circulation is reconstructed from climatological hydrographic data and sea level anomaly data based on the variational data assimilation method. The dynamics of the ocean model is a reduced version of OPA ocean model in which the momentum equation is replaced by the geostrophic balance and only the sea surface height and tracer equations evolve. Sensitivity of the estimated circulation to errors in a momentum/buoyancy flux and in a geoid model will be discussed.

3B5.5 ID:2298 11:30

Advanced Data Assimilation in Strongly Nonlinear Systems via Sigma-point Kalman Filters.

Jaison Thomas Ambadan , *Youmin Tang*
University of Northern British Columbia
Contact: ambadan@unbc.ca

In this study, we investigated the performance and capabilities of Sigma-point Kalman filter (SPKF) data assimilation schemes in strongly nonlinear dynamical systems. The SPKF data assimilation scheme is compared against existing Kalman filter based data assimilation schemes. Three particular cases, namely the state, parameter, and joint estimation of states and parameters from a set of discontinuous noisy observations are studied. The problems associated with the use of tangent linear model (TLM) or Jacobian when using standard Kalman filters, are eliminated when using SPKF data assimilation algorithms. After describing the properties and advantages of SPKF data assimilation scheme, the constraints and issues of SPKF data assimilation in real ocean/ atmosphere models are emphasized. A reduced sigma-point subspace model is proposed and investigated its viability in higher dimensional models. A low dimensional Lorenz ‘63 model and a higher dimensional Lorenz ‘95 model are used as the test-bed for data assimilation experiments. The results of SPKF data assimilation schemes are compared with existing Kalman filter data assimilation schemes where a highly nonlinear chaotic case is studied. Numerical experiments showed that in all cases, the SPKF can give consistent results with better assimilation skills than existing Kalman filter data assimilation schemes, and can overcome the drawbacks associated with the same.

3B5.6 ID:2446 11:45

Connections Between the Madden Julian Oscillation and Extratropical Regions of the Global Ocean and Atmosphere

Eric Oliver , *Keith Thompson*
Department of Oceanography, Dalhousie University
Contact: eric.oliver@dal.ca

The Madden Julian Oscillation (MJO) is an important mode of atmospheric variability on intraseasonal timescales and has been clearly observed in outgoing longwave radiation and precipitation in the tropical oceans. Vecchi and Bond (2004 GRL, henceforth VB2004) recently found a statistical connection between the MJO and high-latitude surface air temperature and air pressure. This study points to the possibility of using the MJO to extend the range of extratropical atmospheric forecasts. We extend the analysis of VB2004 and search for an extratropical expression of the MJO in the global ocean. Using a number of statistical techniques (e.g. Hilbert transforms, conditional expectations, bandpass filtering, cross spectral analysis) we first show that the assumption of linearity is reasonable and that coherency spectra conditioned on season can recover the results found earlier in VB2004. We next search for a component of the MJO in global fields of sea surface temperature (SST), sea level anomaly (SLA) and sea level pressure (SLP). In addition to statistically significant relationships between the MJO and variability in the Indian and Pacific Oceans, we also identify significant, but weaker, seasonally dependent variations in mid- and high-latitude regions that are coherent with the MJO. The physical cause of the teleconnections is presently under investigation but preliminary evidence suggests important roles for (i) coastal ocean responses which are coherent with the MJO, and (ii) basin-scale air-sea fluxes driven by the extratopical atmospheric expression of the MJO. Plans to use a global ocean model (NEMO) and a global atmospheric model (GEM) to explore MJO related predictability in the ocean, and eventually the coupled atmosphere-ocean system, will be described.

3B6.1 ID:2595 INVITED/INVITÉ 10:30

Environmental Predictions and the Energy Sector: A Canadian Perspective

Ozgur Gurtuna [1], *Matt Davison* [1], *Claude Masse* [2]
[1] Turquoise Technology Solutions Inc.

[2] Environment Canada
Contact: anne-marie.valton@ec.gc.ca

This paper will summarize the findings of a study conducted for Environment Canada, focusing on the economic benefits of applying Environmental Prediction (EP) for the planning and management of the energy system. In the first phase of the study, through a comprehensive literature review, the economic benefits of EP across the energy value chain in Canada were investigated. In the second phase, four case studies were examined and valuation frameworks were developed for each case study.

The economic benefits studied are those applying to well defined classes of energy sector participants who use certain types of EP in their business, active in a variety of areas such as offshore oil and gas, hydroelectricity and wind energy.

One of the most fundamental insights identified in this report relates to the use of the forecast information. For there to be any value, the information has to be "actionable". If the information cannot be used to take action, or the marginal impact of the decision is negligible, then no matter how accurate or long-term the forecast might be, the economic value is minimal. On the other hand, if the forecast provides exclusive, timely or actionable information, then, in most cases, it has a positive value.

The study findings indicate that EP has a rich set of applications in the energy sector. This significant potential creates more responsibilities for both policy makers and the industry itself. Given the limited resources in both public and private sectors, the real challenge will be determining the optimal subset of EP applications to invest in.

3B6.2 ID:2593 11:00

Needs analysis on the wind energy sector made by Environment Canada

Serge Besner
environment canada
Contact: serge.besner@ec.gc.ca

A needs analysis of the wind energy sector in Canada was undertaken in 2006-2007 by Environment Canada as a first milestone in order to better answer the needs of the industry in this sector in Canada. A sample of wind energy companies was carefully chosen and we initiated a dialogue on the topic of wind energy sectors' weather-sensitive operations and decision-making processes. The results of this need analysis will be communicated in this presentation. We will see why wind forecasting is so important and why this sub sector has a significant need for Meteorological expertise for now and in the future, we will see also what we need to improve Environmental Prediction to satisfy the need of this industry and how wind and hydro energy are a win-win combination.

3B6.3 ID:2587 11:15

Wind Forecasting System for Application in Wind Power Management Part A:

Development and Calibration

Wei Yu [1], *Anna Glazer* [1], *Robert Benoit* [1], *André Plante* [2], *Laurent Chardon* [1], *Alain Forcione* [3], *Gaétan Roberge* [3]
[1] Numerical Prediction Research Section, Science and Technology Branch, Environment Canada
[2] Canadian Meteorological Center, CMC, Environnement Canada
[3] Institut de recherche d'Hydro-Québec, I.R.E.Q., Hydro-Québec
Contact: Wei.Yu@ec.gc.ca

Accurate wind prediction is of critical importance for grid integration of wind power and daily management of wind farms. Environment Canada initiated a research project in collaboration with Hydro-Québec on the development of a high resolution wind forecast system. This system consists of three components: a Limited Area Model (LAM), a microscale model, and a Local Error Handler (LEH). The LAM, at a resolution of 2.5 km, is nested in the Canadian Meteorological Centre's (CMC) regional operational model which is run twice a day (00 and 12 UTC) for a forecast horizon of 48 hours at a resolution of 15 km. The output of the LAM is used as input to the microscale model for further downscaling of winds and temperature at a resolution of about 200 m. LEH will be applied to remove model error by using real-time on site observations. This forecasting system is being under real-test for a period of one year (May 2007 – August 2008).

This talk will give an overview of the prediction system and some calibration results. The validation of real-time forecasts will be presented in another presentation.

3B6.4 ID:2589 11:30

Wind Forecasting System for Application in Wind Power Management Part B: Real-time Test and Validation

Anna Glazer [1], *Wei Yu* [1], *Robert Benoit* [1], *André Plante* [2], *Laurent Chardon* [1], *Alain Forcione* [3], *Gaétan Roberge* [3]
[1] RPN, Environment Canada
[2] CMC, Environment Canada
[3] I.R.E.Q. Hydro-Québec
Contact: anna.glazer@ec.gc.ca

The wind forecasting system, developed by Environment Canada in collaboration with Hydro-Québec, is under real-time test for wind farms in Gaspésie, Québec, over a period of one year (May 2007 – August 2008). The daily forecasts are evaluated by meteorologists of Hydro-Québec and systematically validated against weather stations of Environment Canada and masts observations. Preliminary validation showed a systematic improvement of the predicted winds compared with the CMC's GEM-Regional model.

This talk will present a detail set-up of real-time test and preliminary validation results: model's performance and limitations. Research needs for further improvement of this forecasting system will be also discussed.

3B6.5 ID:2580 11:45

Solar Radiation Data and Information Sources at Environment Canada

Katrina Tiongson
Environment Canada - MSC
Contact: katrina.tiongson@ec.gc.ca

Solar radiation is an important component of climate and weather for a variety of sectors such as forestry, agriculture and energy. Importance for energy especially is increasing with the growing attention to solar energy collection systems and energy efficiency measures of buildings and more sophisticated design of their energy systems.

Solar radiation observations are a part of both regular network and special research monitoring programs at Environment Canada. Recent developments in the network and processing of solar radiation data will be described. In addition, access to the data and a variety of information products will be presented, with some examples of how the information is used for solar and building applications. Finally, a brief description of Environment Canada research activities involving specialized solar observations will be described.

3C7.1 ID:2443 13:30

Transforming University Students into Professional Weather Forecasters – the ab initio Training of Meteorologists in Environment Canada

Paul Yang , Curtis Mooney , Lisa Torneby , Kitty Wilkes
Prediction and Training Division, MSC-PNR, Environment Canada
Contact: Paul.Yang@ec.gc.ca

Since 1999, Environment Canada has annually hired about 30 new meteorologist interns to participate in the Meteorologist Operational Internship Program (MOIP). In this program, the interns go through seven months of in-classroom training. They are then posted to the weather centres where they receive an additional three months of on-the-job training which includes “double-banking” with a supervising Meteorologist. The interns are then promoted to Developmental Meteorologists, which completes their MOIP training. After another 18 months (based on performance) they become full-fledged operational Meteorologists.

The English in-classroom training is conducted in Halifax and Edmonton, respectively, whereas the French training is conducted in Montreal. This in-classroom training focuses on three categories, namely, meteorological theory and its applications, practical skills, and personal suitability. This presentation will use the experience of the Edmonton Training Centre as an example to briefly discuss the objectives, content, methods and emphases of the MOIP training.

3C7.2 ID:2343 13:45

COMET Web-based multimedia training in the atmospheric and related sciences, part 1

Greg Byrd [1], *James Cummine* [2], *Phil Chadwick* [2]

[1] UCAR/COMET
[2] Meteorological Service of Canada
Contact: byrd@comet.ucar.edu

This presentation will provide an overview and brief demonstrations of COMET training on warm season weather phenomena. A companion presentation highlights COMET winter weather training offerings. While some residence courses such as the Flash Flood Hydrology and QPE Workshop have some emphasis on warm season phenomena, the primary training delivery mode is a variety web-based distance learning ranging from highly-interactive multimedia modules to webcasts of expert lectures. Convective weather topics include mesoscale convective systems, flash flooding, storm structure and evolution, buoyancy and CAPE, and supercell motion. Tropical meteorology topics include extratropical transition, hurricane preparedness, and satellite estimation of tropical rainfall. There are also numerous warm season topics covered in our NWP and aviation-related training including writing TAFs for convective weather. Some of these materials have been organized in to a Summer Severe Weather Distance Learning Course available at http://www.meted.ucar.edu/dl_courses/svrconvection/index.htm.

The COMET program is actively involved in converting residence courses on fire weather to distance learning. We recently completed development of a 12-hour online version of the National Weather Service's S-591 Advanced Fire Weather Forecasters Course that was formerly a 24-hour residence offering. The NWS and Interagency fire groups are funding a similar effort to convert the 32-hour S-290 Intermediate Wildland Fire Behavior residence course to a web-based format. The web version of the S-290 course is expected to be available in late 2009.

In addition to the S-290 course conversion efforts, we have other warm-season training efforts in development, most notably an online textbook on tropical meteorology. Warm-season weather training is available via a variety of topic and distance learning courses via the MetEd website at http://www.meted.ucar.edu.

3C7.3 ID:2344 **14:00**

COMET Web-based multimedia training in the atmospheric and related sciences, part 2

Greg Byrd [1], *Phil Chadwick* [2], *James Cummine* [2]
[1] UCAR/COMET
[2] Meteorological Service of Canada
Contact: byrd@comet.ucar.edu

For nearly two decades, the COMET Program has been developing and delivering forecaster training on a variety of topics. Our partnership with the Meteorological Service of Canada (MSC) has resulted in a significant set of science-based training related to forecasting winter weather.

This presentation will provide an overview of the suite of COMET winter weather training, including residence and distance learning offerings. The cornerstone offering is the two-week MSC/COMET Winter Weather residence course taught in Boulder, Colorado. Offered annually since 2001, this course has been attended by nearly 150 forecasters from MSC, NOAA's National Weather Service, European weather agencies, and the private sector. The course entails conceptual lectures on critical winter topics, including Q-G and isentropic analysis and diagnosis, jet streaks, explosive cyclogenesis, mesoscale precipitation features, precipitation type, lake-ocean effect, blowing snow, satellite applications, and societal impacts. The lectures are complemented with hands-on computer-based laboratory exercises designed to reinforce conceptual material. More recently COMET and MSC worked to develop and produce a similarly structured one-week residence course on mountain meteorology, targeted at forecasters supporting the 2010 Winter Olympics.

Winter Weather distance learning offerings include several different formats, ranging from highly mediated, Web-based, multimedia modules to webcast lectures from subject matter experts. Topics include cold air damming, precipitation type, heavy banded snow, barrier jets, jet streak circulations, mesoscale banded precipitation, frontogenesis, conditional symmetric instability, lake-effect snow, cool season orographic storms, polar lows, satellite detection of clouds, snow and ice, and aircraft icing. We also have winter weather topics treated in our NWP and hydrology training materials. We recently combined several of these topics into an on-line Winter Weather Distance Learning Course targeted to MSC forecasters and consisting of core and advanced topics. The seven hours of core topics include orographic storms, freezing and melting, precipitation type and NWP, mesoscale banded precipitation, and heavy banded snow. The 9-10 hours of advanced topics include inverted troughs, isentropic analysis, ensemble forecasting and associated case study exercises.

We have several Web-based training efforts in development, including material on forecasting Alberta Clippers, satellite feature identification, and mountain meteorology, to be posted to the MetEd website in the near future. Web-based winter weather training is available via the MetEd website at http://www.meted.ucar.edu/topics_winterwx.php.

3C7.4 ID:2603 14:15

Towards a Comprehensive Training Program for Forecasters at Vancouver 2010 Olympic and Paralympic Winter Games

Brad Snyder , *Trevor Smith* , *Chris Doyle*
Meteorological Service of Canada
Contact: brad.snyder@ec.gc.ca

The Meteorological Service of Canada (MSC) has been tasked with the provision of forecasts in support of the Vancouver 2010 Olympic and Paralympic Winter Games. Provision of high spatial and temporal resolution forecasts for these games poses a significant training challenge for the MSC. The Olympic forecast team comprises meteorologists from across Canada as well as from two National Weather Services (USA) offices. Many of these forecasters have little local weather knowledge. Moreover, virtually all meteorologists lack a solid grounding in the theoretical fundamentals of mountain meteorology.

Traditional approaches to training new meteorologists in MSC have included classroom teaching of theoretical meteorology followed by on the job training. Indeed, a 2006 survey of operational meteorologists across MSC and parts of the NWS revealed that "Double-banking with experts" (i.e., working alongside an experienced forecaster) was considered the most effective mode of training.

In order to put the forecasters in the best position to succeed in 2010, a multi-pronged training approach was devised to train the team. This has included both theoretical training and practical training at the Olympic venues. Specifically:

Theoretical Foundation - In addition, a series of Mountain Weather Workshops have been delivered in Boulder, CO in conjunction with the Cooperative Program for Operational Meteorology, Education and Training (COMET). Experts in the field of mountain meteorology presented lectures to the forecast team and afternoon lab sessions were given to allow students to apply some of the new-found knowledge.

Practical Training - To date, there have been two seasons of practicum training at Olympic venues. These have been accompanied by simulators and double banking.

The investment in this training will continue up until 2010 with more classroom course and practicum sessions. The end result shall be a group of highly qualified meteorologists and a legacy of training material and methods for future applications.

3C7.5 ID:2508 **14:30**

Improved Performance Measurement for Public Forecasts in Atlantic Canada

Timothy Bullock
Prediction and Training Section, MSC Operations - Atlantic, Meteorological Service of Canada
Contact: Timothy.Bullock@ec.gc.ca

With adoption of the ISO 9001:2000 Quality Management System (QMS), performance measurement (PM) has been elevated to a more prominent profile in the Meteorological Service of Canada (MSC). Existing performance measures are inadequate to support the decision-making process of the MSC QMS, particularly in Atlantic Canada. In this paper, some of the inadequacies in the current PM system are examined, and improvements are proposed that will address these shortcomings to some extent. The impacts of these changes on MSC initiatives such as Phoenix will be discussed.

3C7.6 ID:2236 **14:45**

Practical Performance Measurement using Remote Sensing

Phil Chadwick
Environment Canada

Contact: phil.chadwick@ec.gc.ca

The detection of severe events in Canada is insufficient to meet the needs of performance measurement. Low infrastructure and population densities virtually guarantee that no one hears the trees that fall in the forest. Remote sensing data can fill this data void and provide justifiable, reproducible and meaningful performance measurement quantities.

The radar identification of convective cells is used to illustrate these concepts in the performance measurement of the Severe Convection Program. The relative severity of the convective cells can be estimated from the radar signature. Although the radar severity algorithms have not been calibrated this approach will illustrate how the relative severity of signatures may be used to estimate performance measurement.

This approach calculates performance measurement scores first for the severe events that were detected, investigated and vetted by MSC. Performance measurement scores are then calculated for a data set consisting of these vetted events and then the most severe convective cells detected by radar. Performance measurement scores are then calculated for a series of event databases that progressively include radar convective cells of less severity until the final calculation includes all vetted events and all radar detected convective cells. The graph of the performance scores versus the various event databases reveals much about the Severe Weather Program.

This paper will illustrate some of the performance measurement characteristics that can be gleaned from this approach. These characteristics aid in the evaluation of the services and feedback into the design of that service. It will briefly suggest how lightning and satellite data might also aid in the performance measurement of the Severe Convection Program.

3C1.1 ID:2324 **13:30**

The Polar Environment Atmospheric Research Laboratory (PEARL) in International Polar Year (IPY)

James Drummond , And The Pearl Science Team
Dalhousie University and the University of Toronto
Contact: james.drummond@dal.ca

The PEARL laboratory is situated at Eureka, Nunavut at 80N, 86W. It is operated by the Canadian Network for the Detection of Atmospheric Change (CANDAC). Instrumentation at the laboratory spans a large range of atmospheric measurements from surface to about 100km altitude using lidars, radars, spectrometers, radiometers, imagers and other methodologies. Data from the laboratory is processed and supplied to several international databases.

As part of IPY a number of projects have been initiated at PEARL and its auxiliary laboratories. These are designed to address specific issues of radiation balance, precipitation, long-range transport and the like. In addition, the measurements at PEARL have been intensified.

Since the regeneration of PEARL is only just now being completed, this has produced an intense flurry of activity and many new measurements beginning in a very short time. In addition, linkages are being made to other observatories in the “Arctic ring” which are also contributing to IPY.

Thus Canada is providing a high-level research activity in the High Arctic which is attracting a growing interest in the community. This talk will provide a general overview of activities at PEARL and how they fit with each other and the broader activities of IPY. Other talks and posters in this conference will provide more detail on individual projects.

PEARL is supported by the Canadian Foundation for Innovation (CFI); Canadian Foundation for Climate and Atmospheric Science (CFCAS); Canadian Space Agency (CSA); Environment Canada (EC); Government of Canada IPY funding; Ontario Innovation Trust (OIT); Natural Sciences and Engineering Research Council (NSERC); Nova Scotia Research Innovation Trust (NSRIT); Ontario Research Fund (ORF); and the Polar Continental Shelf Program (PCSP).

3C1.2 ID:2276 14:00

Thorpex Arctic Weather and Environmental Prediction Initiative (TAWEPI): first year of modelling and data assimilation activities

Ayrton Zadra
RPN/MRD, Environment Canada
Contact: ayrton.zadra@ec.gc.ca

TAWEPI is a science and research project partly funded by the Government of Canada Program of the International Polar Year (IPY). The primary objective of TAWEPI is to develop and validate a regional Numerical Weather Prediction (NWP) model over the Arctic during the IPY observational period. The proposed experimental model, called Polar-GEM, will be a twin of the Environment Canada (EC) operational regional GEM (Global Environmental Multiscale) model, used for one- to two-day weather forecasts. This initiative includes modelling and data assimilation studies taking place in various research divisions of EC, in collaboration with the Canadian Meteorological Centre, the Canadian Ice Service, the Department of Fisheries and Oceans, various Canadian universities and other IPY projects.

TAWEPI’s research activities started in April 2007 and the first steps in the development of the Polar-GEM model have been taken. A research version of the model, covering the Arctic basin and surrounding regions has been proposed. A state-of-the-science sea-ice model is being adjusted to improve the sea-ice representation in the domain of the Polar-GEM. High-resolution sea-ice concentration analyses have recently become available and are being tested in the framework of the Polar-GEM system. A multi-layer snow model, describing processes over the various types of surfaces of the Arctic environment, such as sea-ice, tundra, glaciers and ice caps, is currently being implemented in Polar-GEM. Using a stratospheric extension of the GEM model, preliminary analyses of the stratosphere are being generated for the IPY period, including estimates of the ozone field, which will lead to an improved understanding of polar processes in the atmosphere. A brief account of these activities, the challenges encountered so far, and plans for the future will be presented.

3C1.3 ID:2315 **14:15**

Modelling the Arctic boundary layer over the Eastern Beaufort Sea and Banks Island with GEM-LAM-2.5

Daniel Deacu [1], *Ayrton Zadra* [2], *John Hanesiak* [3], *Alain Caya* [4]
[1] RPN/MRD Environment Canada and University of Manitoba
[2] RPN/MRD, Environment Canada
[3] University of Manitoba
[4] MDAS/MRD, Environment Canada
Contact: daniel.deacu@ec.gc.ca

We present preliminary results from a comprehensive modelling study of the boundary layer over the Eastern Beaufort Sea and Banks Island. The main focus is on the momentum, heat and moisture transfer between the atmosphere and the surface, as well as on the ability of the model (2.5-km GEM-LAM) to represent the long-lived stable boundary layer typical for the winter season. Also investigated are the changes in the surface fluxes and boundary layer structure in the region of transition from pack ice to land along the western coast of Banks Island. The sensitivity of the model to sea ice analysis, similarity functions, and near-surface resolution is addressed as well.

3C1.4 ID:2388 **14:45**

The Structure and Evolution of the Polar Stratosphere and Mesosphere and Links to the Troposphere during IPY - SPARC-IPY Data Assimilation Component

Elham Farahani
University of Toronto
Contact: elham@atmosp.physics.utoronto.ca

To achieve a detailed picture of the polar middle atmosphere, where key processes associated with ozone depletion and its eventual recovery occur, the IPY has provided a unique opportunity for SPARC. The SPARC-IPY project is facilitating analysis of available research and operational satellite data while encouraging work on data assimilation and inter-comparison of assimilated data sets. One of the key outcomes of the SPARC-IPY project will be a collection of analysis products from several operational and research centers, which will be archived at the SPARC Data Center. The analysis products will cover the period of IPY (March 2007 to March 2009) and will represent the best available self-consistent representations of the state of the atmosphere during this period.

The SPARC-IPY data assimilation component is focusing on studying the large-scale circulation associated with the polar vortex during IPY and associated physical and chemical features. Here we present an analysis of the dynamics and chemistry associated

with Stratospheric Sudden Warmings (SSWs) in the Arctic Polar atmosphere. In this study, the Canadian Middle Atmosphere Model, which extends from the ground to above the mesopause and includes comprehensive and coupled chemistry, radiation and dynamics, is used together with a 3D-Var data assimilation scheme. Also the links of the SPARC-IPY project with other closely related IPY activities both in the Arctic and Antarctica will be furthered discussed in this presentation.

3C1.5 ID:2528 **15:00**

On the Role of Acidic Aerosols in the Formation of Thin Ice Clouds over the Arctic during Winter

Jean-Pierre Blanchet [1], *Tarek Ayash* [1], *Jonathan Jiang* [2], *Colin Jones* [1], *Eric Girard* [1], *Patrick Grenier* [1], *Rodrigo Munoz-Alpizar* [1], *Graeme Stephen* [3]

[1] Université du Québec à Montréal

[2] Jet Propulsion Laboratory

[3] Colorado State University

Contact: blanchet.jean-pierre@uqam.ca

Recent findings from CloudSat – CALIPSO satellites and from the ground based observatory at PEARL, Eureka NU, together with concurring model simulations over the Arctic are leading us into a new perspective on the formation of cold air anomalies in the High Arctic through the dehydration-greenhouse feedback process. Our results show that vast regions of thin ice cloud formations (1000 to 4000 km wide and 5 to 10 km deep) are modified by anthropogenic aerosols reaching deeply in the Arctic troposphere during the cold season (November to March). The cold core from synoptic winter storms in their final life phase are often drifting into the Arctic, carrying their remaining angular momentum. In the cold Arctic, the otherwise dominant stratified air is forced to mix deeply in the troposphere. The low level convergence in cold low systems result in a slow lifting of cold and moist air, enriched by anthropogenic aerosols and dominated by sulphuric acid. Observations and model simulations agree that the maximum aerosol concentration in the upper troposphere (4 to 8 km) occurs during winter above the Arctic. The forces cold air accent in decaying lows requires the perturbation to do work against its environment. In turn, it allows a slow diabatic and IR cooling rate which favours the interaction between aerosol, originating for arctic haze, and clouds. The resulting thin ice cloud formations are associated to acid coating on most aerosol particles, deactivating IFN and leading to fewer but larger ice crystals. The process effectively dehydrates the air deeply into the troposphere and produces very distinct cloud types from those dominating in more pristine regions, like Greenland and Antarctica. Statistics on aerosol and thin ice clouds found in both polar regions are compared. Microphysical processes in thin ice clouds and light precipitation occurring in these regions are enhancing the lost of energy in the far IR region and can be responsible for profound alteration of the production rate of cold anomalies which eventually feeds into midlatitudes synoptic storms. This study of aerosols, thin ice clouds, radiation, light precipitation and atmospheric dehydration in cold conditions is part of the Canadian research activities during the International Polar Year.

3C1.6 ID:2449 15:15

A study of polar winter thin ice clouds and aerosols using CALIPSO and CloudSat datasets

Patrick Grenier , *Jean-Pierre Blanchet*
Université du Québec à Montréal
Contact: grenier@sca.uqam.ca

Datasets from the CALIPSO lidar backscattering and the CloudSat radar reflectivity measurements provide a new regard on Arctic and Antarctic winter cloud systems, as well as on the way aerosols influence their formation and evolution. Especially, the links between the cloud ice crystal size and the surrounding aerosol field may be further investigated, in an attempt to find a signature of the Arctic haze effect on the dehydration efficiency of air masses. In this study, the satellite observations are used to heuristically separate polar thin ice clouds into two crystal size categories (radar/lidar versus lidar-only), and an aerosol index based on the backscattering and the color ratio of sampled volumes is used for identifying haze in cloud-free regions. Statistics from about 6 million profiles over the Arctic during January 2007 and from a similar number over Antarctica during July 2007 reveal differences in cloud cover and haze occurrence between the poles, and among sub-regions of a same pole. Several correlations are also explored for determining if polluted clouds tend to consist of different ice crystal populations than pristine clouds. Finally, the statistical significance of the results and their dependency on the algorithm parameters and assumptions are discussed.

3C2.1 ID:2590 13:30

The Philosophy of Operational Oceanography

Martin Taillefer [1], *Fraser Davidson* [2]
[1] Fisheries and Oceans Canada, Ottawa
[2] Northwest Atlantic Fisheries Centre
Contact: marty.taillefer@dfo-mpo.gc.ca

As each year passes, we are confronted with increasing evidence of climate and oceanic changes. Surface waters are warming, the arctic is melting, sea-levels are expected to rise and the oceans are becoming increasingly acidic due to increased CO2 levels being absorbed by the oceans, jeopardizing many marine eco-systems. With these changes in the ocean over the years and decades to come, it is important to understand and predict local, regional and global oceanic events, from a few days in advance to weeks, months and years. Most importantly, it is the direct application of oceanographic sciences that allow decision makers to adapt and/or mitigate environmental changes that may affect our socio-economic fabric. Over the past fifty years oceanographic sciences matured. We have become adept at merging scientific understanding of the oceans with the technologies and tools for routinely making, disseminating and interpreting ocean observations and measurements. However the application or operationalisation of oceanographic data for practical use is only in it's infancy, particularly when compared to Atmospheric Sciences. The identity threshold between oceanography and operational oceanography is not always well defined. This paper and presentation will attempt to investigate the delivery in Canada of oceanographic data and information that is critical

to decision making, safety, commerce and environmental protection.

3C2.2 ID:2306 13:45

Forecasting Extreme Water Levels for British Columbia Coastal Waters

Scott Tinis [1], *Richard Thomson* [2], *Ben Kangasniemi* [3]
[1] Institute of Ocean Sciences
[2] Department of Fisheries and Oceans
[3] British Columbia Ministry of Environment
Contact: tiniss@dfo-mpo.gc.ca

Low-lying areas of coastal British Columbia are vulnerable to flooding by high sea levels due to a combination of high tides and storm surge during the Pacific storm season from October to March. Extreme high water levels can occur when a large storm surge coincides with the spring high tides which peak in December and January. Interannual variations in coastal sea level can also contribute to extreme sea levels, particularly during El Niño when coastal sea levels can be 0.20-0.30 m higher than normal. Ongoing sea level rise due to anthropogenic climate change further increases the risk of flooding during extreme events. During the 1982 El Niño, a series of December storms combined with high tides to cause record high sea levels at Vancouver and widespread flooding in the dyke-protected Lower Mainland communities of Richmond and Delta. An intense storm on January 1, 2003, resulted the highest sea levels recorded at Victoria in the last 94 years. In order to predict marine water levels during the winter storm season, a storm surge forecasting numerical modeling system has been developed for British Columbia coastal waters at the Institute of Ocean Sciences (DFO) in cooperation with the British Columbia Ministry of Environment (BCMOE). The system is based on the Princeton Ocean Model forced with forecast winds and sea-level pressure from the US Navy COAMPS model and the Environment Canada 15-km regional GEM model. Daily water level forecasts out to 48-hours are provided to the BCMOE, the Provincial Emergency Program and regional municipal managers of extreme high water events with the potential for flooding. Forecasts are compared with tide gauge records in an effort to understand the limitations in the present numerical simulations and to assist in the improvement of future storm surge model predictability.

3C2.3 ID:2525 14:00

An Atlantic Canadian Coastal Water Level Neural Network Model (ACCSLENNT)

Guoqi Han , *Yu Shi*
Fisheries and Oceans Canada
Contact: hang@dfo-mpo.gc.ca

Coastal sea level information is essential for coastal zone management, navigation and oceanographic research. However, long-term sea level observations are usually available at a limited number of locations only. This study discusses a method based on Neural Networks (NN) to predict sea levels at a specified coastal site from the data gathered at other nearby or remote permanent stations. A simple 3-layered feed-forward back-propagation network and a neural network ensemble, named ACCSLENNT, were

developed to establish the nonlinear relationship of sea level data among stations by learning historical characteristics between them. Hourly sea level observations at five stations along the coast of Atlantic Canada, St. John's, Argentia, North Sydney, Belledune and Halifax, are used to formulate and validate the ACCSLENNT model. Qualitative and quantitative comparisons of the network output with target observations showed that appropriately trained NN models are able to provide robust long-term predictions of both tidal and non-tidal sea levels when only short-term sea level data are available. The results indicate that the NN models in conjunction with limited permanent stations are able to supplement long-term historical sea level data along the Atlantic Canadian coast. The approach can be readily applied to other coastal regions.

3C2.4 ID:2331 14:15

Development of a Five-Level Nested-Grid Coastal Circulation Prediction System for the Inner Scotian Shelf

Bo Yang , *Jinyu Sheng*
Dalhousie University
Contact: Bo.Yang@phys.ocean.dal.ca

A five-level nested-grid ocean coastal circulation prediction system known as NCOPS-LB was developed for predicting three-dimensional (3D) circulations and hydrographic distributions over the inner Scotian Shelf as part of CMEP (Center for Marine Environmental Prediction). The system is the integration of a shelf circulation forecast system known as Dalcoast3 (Thompson et al., 2007) and a high-resolution coastal circulation model for Lunenburg Bay (LB) (Zhai et al., 2008). The NCOPS-LB is forced by astronomical forcing based on WebTide developed by scientists at Bedford Institute of Oceanography and meteorological forcing based on 3-hourly weather forecast fields provided by the Meteorological Service of Canada. The nested-grid prediction system is used to study the dynamic response of the inner Scotian Shelf to tropical storm Alberto in June 2006. A comparison of model results with the observations made in LB demonstrates that the NCOPS-LB has reasonable skills in predicting surface elevations, 3D currents, and hydrographic distributions associated with coastal upwelling/downwelling over the inner Scotian Shelf. Model results are also used to identify the major physical processes in LB during the storm period. The EOF analysis of the model currents demonstrate that the throughflow in the deep waters to the southeast of LB is mainly driven by the remote wind forcing outside LB and circulation in LB is affected by wind and baroclinicity associated with local upwelling/downwelling in the bay.

3C2.5 ID:2411 14:30

C-NOOFS: present status and future improvement

Andry William Ratsimandresy , *Fraser Davidson* , *Adam Lundrigan* , *Debbie Power*
Fisheries and Oceans Canada
Contact: ratsimandresya@dfo-mpo.gc.ca

C-NOOFS is the Canada-Newfoundland Operational Ocean Forecasting System pilot

project for developping a quasi operational ocean forecast for eastern Canada. The ocean model is european community model NEMO and the domain covers the northwestern part of the North Atlantic. The model is forced by daily sea surface wind from the CMC weather forecast system, the lateral boundaries are prescribed to Meractor-Ocean daily output.

C-NOOFS has been providing experimental daily 6-day forecast of 3-dimensional temperature, salinity, and ocean currents on an operational basis for the last 6 months. Works are carried out to also provide other prognostic parameters such as sea surface height and heat exchange.

Both the system and the numerical model in particular are under continued development. We describe the status of the system in term of numerical model, forcing, forecast configuration and its dissemination to users. Also presented is the quantitative and qualitative limitation of the result as of the present status.

Suggestions for further development of the system include various improvements such as increase of resolution around the Scotian and Newfoundland Shelves as well as in the Gulf of St. Lawrence and implementation of data assimilation. Further collaboration with other research centers is also sought with the idea of implementing a coupled ocean-atmosphere-ice system.

3C2.6 ID:2367 **14:45**

Canadian Ensemble Wave Forecast System

Syd Peel
Meteorological Research Division/Environment Canada
Contact: syd.peel@ec.gc.ca

The Canadian atmospheric ensemble prediction system (EPS), which has evolved dramatically over the last few years, currently produces 21-member forecast samples of meteorological variables such as precipitation amount, temperature, and surface wind. These forecast samples are intended to represent the likely range of the pertinent predictand, affording a statistically grounded objective measure of the predictability of the forecast element, and facilitating the generation of probabilistic weather forecasts. Adaptation of the atmospheric EPS to the marine forecast problem can be achieved by supplying the surface wind fields forecast by each member of the atmospheric EPS as inputs to the WAM4.5 wave model, in an attempt to realistically portray the uncertainty in the winds forcing the wave model. Uncertainty in the winds input to the wave model is thus translated into uncertainty in the wave forecasts through the generation of an ensemble of 21 forecasts sampling the anticipated range of wave predictands such as the significant wave height and peak period. These samples can be used to construct distribution functions modelling the uncertainty in the wave forecasts, and from these distributions can be calculated the probabilities of events such as the exceedance of significant thresholds - for example the probability that the significant wave height will exceed 5 metres. Improvement over deterministic forecasts can also be achieved by the ensemble mean, which tends to filter out some of the noise in the model solutions, while dispersion (as given by the standard deviation, for example) in the ensemble sample affords an objective measure of the magnitude of the uncertainty which might be expected in the corresponding deterministic forecast. Configurations of the ensemble wave forecast system currently under development will be described, along with techniques used to produce continuous models from the empirical cumulative distribution functions obtained directly from the raw output of the ensembles. Some of the products available from this system will be presented, along with preliminary results on its performance. Finally, future work planned for the project will be outlined. ~

3C3.1 ID:2414 **13:30**

Knowledge management: a tool for improved knowledge communication and decision-making.

Jacques Descurieux
Enviroment Canada /Meteorological Service of canada
Contact: jacques.descurieux@ec.gc.ca

Knowledge management is now an accepted concept that is often confused with information management. Therein lies the likely root cause for the knowledge communication problems between experts and decision makers. This paper differentiates the two concepts. It describes the interaction between tacit and explicit knowledge. It explains how the capabilities to acquire, transfer, and exchange knowledge leads to knowledge conversion. Finally, it shows how, when combined with the ability to transcend ones own limited perspective or corporate boundaries, knowledge management leads to the co-production of new knowledge and to improved decision-making.

3C3.2 ID:2510 **13:45**

Intégrité et conflit d'intérêts: perspectives éthiques sur la responsabilité du chercheur

Michel Bergeron
Université de Montréal
Contact: m.bergeron@umontreal.ca

Soumise dans le cadre de la session spéciale intitulée «Implication des scientifiques dans la prise de décision», cette présentation abordera certaines questions éthiques concernant l'intégrité et les conflits d'intérêts liés au «métier de chercheur» et à l'utilisation des résultats de recherche dans la prise de décision. Pour ce faire, nous nous appuierons sur les travaux en éthique de la valorisation effectués à l'Université de Montréal, au cours des trois dernières années, dans le cadre du Programme de Valorisation de l'Innovation et du Capital intellectuel (VINCI).

3C3.3 ID:2540 **14:00**

Community-level assessments of climate change and variability

Arelia Werner , *Trevor Murdock*
University of Victoria, Pacific Climate Impacts Consortium

Contact: dhuis@uvic.ca

After completing an overview of hydro-climatology in British Columbia, several communities requested that the Pacific Climate Impacts Consortium (PCIC) complete assessments of climate change at their local level. These assessments contain attractive graphics and maps, which convey pertinent information to community members and decision makers. Although materials were targeted to the small-scale, the ability of the community to assimilate this information was uncertain.

Communities that PCIC staff have worked with to date include: Whitehorse; Atlin; Dawson City; the Cariboo-Chilcotin and the South Coast. Information was tailored to suit the needs of communities after discussion with local technical staff and representatives, such as staff of the Northern Climate Exchange, the City of Whitehorse or the Integrated Land Management Bureau at the Ministry of Agriculture and Lands. The number of people involved in crafting these assessments was highly variable, and interaction took place remotely via phone conversations or through hands-on involvement in processes, such as Charrettes. Thereby, the needs of communities were explored through engagement with local representatives coming from different backgrounds and responsibility levels, who participate in decision-making.

The results show a strong desire by community-level decision-makers to understand the consequences of global climate change and regional impacts that can be applied to their community. However, there is frequently confusion between the consequences of climate change as compared to climate variability. Although technical information is needed, the methodology is often not appreciated. Furthermore, there is a need for a broad explanation of climate mechanics in Pacific North America. These limitations demand additional time for personal interaction, repetition of concepts, and concrete examples or demonstrations of the issues. Ultimately, the driving theme of these interactions was the need for community members to address the question, “What does this mean for us?” in terms of water supply, energy requirements and infrastructure.

3C3.4 ID:2552 INVITED/INVITÉ 14:15

S’adapter aux changements climatiques globaux selon une approche régionale. Partie I - Le consortium Ouranos -

Alain Bourque
(Presented by *Jean-Pierre Savard*)
Ouranos Inc.
Contact: louis.lefaivre@ec.gc.ca

Créé en 2001 par le gouvernement du Québec, Hydro-Québec et le Service météorologique du Canada, Ouranos est un regroupement de scientifiques et d’experts réunis pour étudier des changements climatiques de plus en plus apparents. La mission d’ouranos est le développement de connaissances sur les changements climatiques, les vulnérabilités et les impacts, afin d’informer les décideurs sur l’évolution du climat et les conseiller sur des stratégies d’adaptation. Afin d’accomplir sa mission, il est indispensable de se baser sur des outils pertinents de modélisation climatique, de créer des projets multidisciplinaires pour évaluer les impacts à la fois sociaux, environnementaux et économiques puis de former des partenariats avec les acteurs de l'adaptation afin d'optimiser l'utilité de la science des changements climatiques avec les décideurs. Dès sa création, Ouranos a été pensé comme un organisme permettant d'intégrer l'ensemble des disciplines pour aider les décideurs dans leurs choix stratégiques et leur permettre de mieux planifier dans un contexte de changements climatiques. Ouranos rassemble aujourd'hui une centaine de scientifiques et spécialistes auxquels s'ajoutent plus de 150 experts provenant de différentes disciplines scientifiques et issus de plusieurs dizaines d'organismes afin de travailler sur une programmation scientifique de plus de 45 projets. La présentation mettra l'accent sur les différents outils d'aide à la décision développés par Ouranos afin de favoriser le développement de stratégies d'adaptation aux changements climatiques

3C3.5 ID:2553 INVITED/INVITÉ 14:30

S'adapter aux changements climatiques globaux selon une approche régionale. Partie II - Vulnérabilité des communautés côtières de l'Est du Québec aux impacts des changements climatiques

Jean-Pierre Savard [1], *François Morneau* [2], *Alain Bourque* [3]
[1] Ouranos Inc.
[2] Ministère de la sécurité publique, Gouvernement du Québec
[3] Ouranos Inc
Contact: louis.lefaivre@ec.gc.ca

La région maritime du Québec abrite une population de 400 000 habitants sur un vaste territoire. La plupart des villes et villages ont été implantés le long des côtes dont 65% sont en érosion. Ces communautés présentent donc une vulnérabilité importante face aux changements climatiques, c'est pourquoi Ouranos a cofinancé et piloté une étude sur la vulnérabilité des populations côtières de l'est du Québec aux impacts des changements climatiques. Cette étude est basée sur une méthodologie novatrice qui a permis, grâce à une approche holistique, d'intégrer l'ensemble des processus reliant le climat à l'érosion des berges. Ainsi, une équipe de spécialistes du climat et hydrodynamique maritime a mené des études intégrées sur la modélisation climatique, les trajectoires de tempêtes, processus océaniques et conditions de gel dégel. Une seconde équipe de spécialistes en géomorphologie et sédimentologie côtière a analysé l'évolution de l'état du littoral au cours des 6 ou 7 décennies passées et produit des scénarios d'érosion (horizon 2050) qui ont été soumis à des comités de décideurs et d'usagers pour analyser les options d'adaptation. Cette approche multidisciplinaire et participative, impliquant une cinquantaine de chercheurs, usagers et décideurs en constante interaction pendant 2 ans, a permis de couvrir plusieurs problématiques et de développer des outils d'aide à la décision afin de proposer des solutions d'adaptation originales et consensuelles touchant le zonage du territoire, les méthodes de protection, les axes de développement et la gestion environnementale des zones côtières.

3C3.6 ID:2427 14:45

A Modest Attempt to Take the "I" out of the "Hydro-Illogical" Cycle

Harvey Hill [1], *Terry Rolfe* [2], *Elaine Wheaton* [3], *Richard Lawford* [4], *John Pomeroy* [5], *Ronald Stewart* [6], *Nancy Lee* [7]
[1] Agriculture and Agri-Food Canada
[2] Consultant
[3] Saskatchewan Research Council
[4] Drought Research Iniatitive
[5] University of Saskatchewan
[6] Mcgill University
[7] Agrculture and Agri-Food Canada
Contact: hillh@agr.gc.ca

A great deal has been written regarding the inefficiencies of current approaches to preparing for and responding to droughts. Normally politicians, scientists, public servants, institutions, and private sector decision makers expend an intense amount of activity during a drought or extreme event only to stop almost all activities when the drought ends. Consequently knowledge is lost, opportunities for advanced preparation are squandered, and resources are needlessly wasted. This process has been facetiously described as the hydro-illogical cycle. Scientists involved in the CFCAS funded Drought Research Initiative are exploring ways to link their research results to the decision-making processes of their operational partners. Ideally this will help identify ways to facilitate enhanced drought preparation and response both physically and socio-economically. This presentation will describe how this effort builds on work done in Canada, the United States, and Australia and extend it. The presentation will also discuss how these activities could become part of the operational risk management and warning system of Agriculture Canada's climate unit and its Federal and Provincial partners. Furthermore, the presentation will consider how this approach could potentially support efforts to proactively address and enhance drought responses under current and projected future conditions, both domestically and with U.S. and Mexican partners.

3C3.7 ID:2573 **15:00**

The need for more detailed precipitation forecasts in order to support decision making

Gabor Fricska , *Lisa Vitols* , *Kent Johnson*
Meteorological Service of Canada
Contact: gabor.fricska@ec.gc.ca

During the past two years members of the Meteorological Service of Canada (MSC) national service office have met with a variety of users to learn more about how they make critical weather related decisions. The users include officials from emergency management teams, public utilities, municipalities and aviation groups. The stories and discussions during these visits highlighted the universal need for more detailed precipitation forecasts. Current meteorological forecasts of precipitation were deemed too general by many of these decision makers. Participants have asked for more detail in the timing of the onset and duration of precipitation along with more detailed information on precipitation rate and precipitation amount. Of these factors, precipitation rate was identified as being particularly important because of its link with local flooding, municipal engineering design standards and public safety.

3C3.8 ID:2555 INVITED/INVITÉ 15:15

Le portail de Données : accès et intégration (DAI) –une mise à jour

Louis Lefaivre [1], *Patrice Constanza* [2], *Khanh- Hung Lam* [3], *Philippe Poudret* [4], *Milka Radojevic* [2], *Philippe Gachon* [4], *Stéphane Gagnon* [3], *Charles Lin* [5]
[1] Environnement Canada et Ouranos Inc.
[2] Centre sur les changements climatiques et l'environnement global, Université McGill
[3] Services scientifiques, Région du Québec, Environnement Canada
[4] Adaptation and Impact Research Division, Environment Canada
[5] Atmospheric Science and Technology Directorate, Environment Canada
Contact: louis.lefaivre@ec.gc.ca

Le portail DAI (Données accès et intégration) a été proposé en 2005 à Ouranos et Environnement Canada (EC) par le Centre sur les changements climatiques et l'environnement global (C3EG) de l'Université McGill pour permettre à ses membres universitaires d'accéder aux données quotidiennes et horaires du Modèle régional canadien du climat (MRCC) en provenance d'Ouranos et aux données de réanalyses régionales provenant de la NOAA. L'intérêt pour EC était de permettre un accès commun à tous les chercheurs disséminés à travers le pays. Pour Ouranos, cela lui permettait de s'assurer de la visibilité de ses produits, tout en respectant sa politique d'accès aux données. Le mandat de DAI s'est élargi avec le temps avec l'ajout d'autres bases de données et d'autres produits. De plus, toutes les requêtes en provenance des membres G3EG , Ouranos et DRI (Drought Research Initiative) pour accéder aux observations météorologiques des archives nationales d'EC passent par l'interface DAI.

On fera le point sur les dernières améliorations à l'interface et on montrera des exemples d'applications d'aide à la décision dans le contexte des changements climatiques.

3C4.1 ID:2536 13:30

Modelling ice sheet response to climate change: Sensitivity of subgrid parameterization of margin dynamics

Shawn Marshall
University of Calgary
Contact: shawn.marshall@ucalgary.ca

Arctic icefields and the Greenland ice sheet are currently losing mass, with the potential to induce several decimetres of sea level rise in the coming decades. Ice sheet models capture many of the large-scale processes involved in glacier dynamics and ice sheet response to climate change, but have been unable to simulate the rapid changes in several major outlets of the ice sheets in Greenland and Arctic Canada. Part of the challenge is resolution of outlet glaciers that occupy narrow fjords, but it is also evident that ice sheet models are not sufficiently sensitive to changing ocean conditions, ice front variations, and the input of surface meltwater to the basal water system. I examine several of these processes in simple parameterizations of outlet glacier dynamics in the Greenland Ice Sheet. Most of these 'unseen processes' give the current generation of ice sheet models a systematically conservative bias, such that sensitivity to climate change is underestimated

in the models.

3C4.2 ID:2399 13:45

Atmospheric Conditions Associated with a Significant Greenland Melting Event

Shunli Zhang , *Kent Moore*
Department of Physics, University of Toronto
Contact: shunli@atmosp.physics.utoronto.ca

The Greenland melt event in late June 2002 is widely identified as being the most significant melt event, in terms of area extent, that has occurred on the Greenland ice sheet over the period 1979-2003. A mesoscale forecast model (Polar MM5) is used to document the large and regional scale circulations that gave rise to the melting event. Model hourly forecasts of downward short wave radiation, 2-m temperature, 10-m wind speed, wind direction, are compared to observations of seventeen Greenland Automatic weather stations (AWS). The modeled vertical structures of temperature, wind speed and wind direction are verified as well with the sounding data at Aasiaat, Narsarsuaq and Tasiilaq. The model simulation shows a high degree of skill for the basic meteorology variables. Temperature advection and adiabatic heating are shown to play different roles in southern and northern Greenland. In southern Greenland, the warming temperature advection resulted from the high pressure ridge over Greenland was responsible for the higher temperature that lead to melting in the region. In contrast, the adiabatic heating resulted from the lee side substance leads to the abrupt temperature rise and melting over northeastern Greenland. The results provide insight into the atmospheric conditions that result in melting over Greenland.

3C4.3 ID:2217 14:00

CO2 threshold for millennial-scale oscillations in the climate system: implications for global warming scenarios

Katrin Meissner [1], *Michael Eby* [1], *Andrew Weaver* [1], *Oleg Saenko* [2]
[1] University of Victoria
[2] Canadian Centre for Climate Modelling and Analysis
Contact: katrin@ocean.seos.uvic.ca

We present several equilibrium runs under varying atmospheric CO2 concentrations using the University of Victoria Earth System Climate Model (UVic ESCM). The model shows two very different responses: for CO2 concentrations of 400 ppm or lower, the system evolves into an equilibrium state. For CO2 concentrations of 440 ppm or higher, the system starts oscillating between a state with vigorous deep water formation in the Southern Ocean and a state with no deep water formation in the Southern Ocean. The flushing events result in a rapid increase in atmospheric temperatures, degassing of CO2 and therefore an increase in atmospheric CO2 concentrations, and a reduction of sea ice cover in the Southern Ocean. They also cool the deep ocean worldwide. After the flush, the deep ocean warms slowly again and CO2 is taken up by the ocean until the stratification becomes unstable again at high latitudes thousands of years later. The existence of a threshold in CO2 concentration which places the UVic ESCM in either an

oscillating or non-oscillating state makes our results intriguing. If the UVic ESCM captures a mechanism that is present and important in the real climate system, the consequences would comprise a rapid increase in atmospheric carbon dioxide concentrations of several tens of ppm, an increase in global surface temperature of the order of 1-2C, local temperature changes of the order of 6C and a profound change in ocean stratification, deep water temperature and sea ice cover.

3C4.4 ID:2420 **14:15**

Variability in the North Atlantic and North Pacific basins in CCSM3: Implications of both statistical equilibrium and global warming simulations

Marc d'Orgeville , *W. Richard Peltier*
University of Toronto
Contact: marcdo@atmosp.physics.utoronto.ca

The nature of the variability in the northern ocean basins is investigated through detailed analysis of multi-century integrations performed using a modern atmosphere-ocean coupled general circulation model. Specifically, the results of simulations under both pre-industrial and present-day perpetual seasonal cycle conditions are compared to each other and also to the results of five simulations characterized by different increasing CO2 scenarios.

The modeled North Pacific decadal variability is demonstrated to be independent of the different perpetual seasonal cycle simulations and global warming scenarios that we have investigated. It is shown to be dominated by a mode of variability, which is in close accord with the observed Pacific Decadal Oscillation (PDO). A detailed analysis of the statistical equilibrium runs, confirms that the underlying mechanism of the PDO is a basin wide mode of ocean adjustment to changes of the atmospheric forcing associated with the Aleutian low pressure system.

The modeled Atlantic Multidecadal Oscillation (AMO), on the other hand, appears to depend strongly upon the epoch selected for the perpetual seasonal cycle simulation. Simulations initialized from the cold/pre-industrial statistical equilibrium run are dominated by a strong coupling between the subpolar gyre and the overturning circulation. The resulting quasi-periodic multidecadal mode of variability (with a well defined timescale of 40-50 years) is characteristic of the cold/pre-industrial statistical equilibrium run. The differences between the two statistical equilibrium cases are shown to be due to salinity and sea-ice effects which are intensified under colder climate conditions.

Finally, depending on our ongoing examination of this simulation ensemble, we shall present the influence of the different increasing CO2 scenarios on the melting rate of the Arctic sea-ice and its subsequent effect on the modelled Arctic Oscillation.

3C4.5 ID:2430 14:30

Negative feedback of poleward intensifying Southern Hemisphere winds on atmospheric CO_2 in the 21st century

Kirsten Zickfeld [1], *John C. Fyfe* [2], *Michael Eby* [1], *Andrew Weaver* [1]
[1] University of Victoria
[2] Canadian Centre for Climate Modelling and Analysis
Contact: zickfeld@ocean.seos.uvic.ca

An Earth System model is used to explore the response of the oceanic and terrestrial carbon sinks to strengthening and poleward shifting of the extratropical Southern Hemisphere winds, which is a robust feature of climate models' response to greenhouse gas forcing through the 20th and 21st centuries. We find that poleward intensifying Southern Hemisphere winds have an opposite effect on the uptake of natural and anthropogenic CO_2 in the Southern Ocean (90^{o}S - 40^{o}S): altered winds lead to anomalous outgassing of natural CO_2 and anomalous uptake of anthropogenic CO_2. As a result, uptake of total CO_2 (natural + anthropogenic) initially decreases and, from the end of the 20th century on, increases relative to the pre-industrial flux. On land, changing winds also lead to an enhanced efficacy of the CO_2 sink. We therefore suggest that poleward intensification of the Southern Hemisphere winds will likely provide for a negative feedback on atmospheric CO_2 in the 21st century. This feedback is found to be on the order of a few percent in 2100.

3C4.6 ID:2384 14:45

Polar climate instability and climate teleconnections from the Arctic to the mid-latitudes and tropics

Guido Vettoretti [1], *Marc d'Orgeville* [1], *Marek Stastna* [2], *W. Richard Peltier* [1]
[1] University of Toronto
[2] University of Waterloo
Contact: g.vettoretti@utoronto.ca

It is generally accepted that the ocean thermohaline circulation plays a key role in polar climate stability and rapid climate change. Here we consider both the impact of substantial slowing of the Atlantic thermohaline circulation due to fresh water forcing (FWF) of the North Atlantic, as well as its recovery after the anomalous forcing has ceased. We will present results from coupled atmosphere-ocean model simulations that describe the pathways along which a high latitude climate signal propagates into both the mid-latitudes and the tropics. We will also describe the effect such teleconnections have on the tropical ocean-atmosphere system and, in particular, on tropical climate variability through shifts of both the typical timescale and intensity of ENSO events in the model.

3C5.1 ID:2304 13:30

Changes in the decadal-scale potential predictability of the coupled system with global warming

G.j. Boer
Canadian Centre for Climate Modelling and Analysis
Contact: george.boer@ec.gc.ca

Potential predictability measures the component of long timescale natural variability that rises above the unforcastable natural variability "noise" and hence could potentially be predicted with enough knowledge. The CMIP4 collection of coupled model results for the IPCC AR4 provides the data for a statistically stable multi-model estimate of decadal potential predictability of both temperature and precipitation (Boer and Lambert, 2008). Decadal potential predictability of temperature is found primarily over mid- to high-latitude oceans, with modest incursions into land areas, and the potential predictability of precipitation is a rather pale shadow of that of temperature.

As the climate evolves under increasing greenhouse gas and aerosol forcing both a forced component and an internally generated natural variability component will exist and the predictability of the natural variability component may well change as climate changes. This is estimated from the CMIP4 data and connected to other features of the changed climate in so far as possible. Preliminary results suggest that the decadal predictability of the natural variability generally decreases as climate changes.

3C5.2 ID:2442 13:45

Improving seasonal forecast skill in Canada using a post-processing method

Xiaojing Jia [1], *Hai Lin* [2], *Jacques Derome* [1]
[1] McGill University,Montreal, Quebec, Canada
[2] Environment Canada, Dorval, Quebec, Canada
Contact: jiaxj@zephyr.meteo.mcgill.ca

The statistical post-processing approach proposed in Lin et al. (2005) is applied to seasonal forecasts of surface air temperature (SAT) and precipitation in four seasons (DJF, MAM, JJA and SON), based on the ensemble forecasts of the four global atmospheric general circulation models (GCMs) in the Canadian Historical Forecasting Project (HFP2). It is known that large-scale atmospheric circulation patterns, such as the Pacific/North American (PNA) and the North Atlantic Oscillation (NAO) can significantly influence the seasonal SAT and the precipitation over Canada. The time series associated with these large-scale patterns can be reasonably well predicted by the GCMs, but their forecast spatial structures are biased and model dependent. This statistical post-processing uses the forecast time series and the observed relationship between the tropical sea surface temperature and the mid-latitude flow to adjust the forecasts. The results show that this post-processing approach significantly improves the predictive skill of the SAT in autumn and precipitation in autumn and winter.

3C5.3 ID:2439 14:00

North Pacific Sea Surface Temperature Climatology and Variability in the World's Global Climate Models

Fabian Lienert , *John C. Fyfe*

Canadian Centre for Climate Modelling and Analysis
Contact: cccma-student-003@ec.gc.ca

For much of Canada predictive skill at seasonal, interannual and longer time-scales is substantially controlled by processes residing in the Pacific Ocean. Here we focus on processes in the extratropical North Pacific Ocean, and in particular on an evaluation of sea surface temperature (SST) climatology and variability in an ensemble of sixteen state-of-the-art Global Climate Models (GCMs). Our overall objective is to provide a regional North Pacific benchmark against which the Canadian Coupled Data Assimilation and Prediction System can be usefully compared.

Measured against the latest long-term observational SST dataset we find that the World's GCMs reproduce the overall spatial pattern of climatological monthly-mean SST, however the simulated SSTs are systematically too cold in the central North Pacific (e.g., by as much as 4 degrees C during the summer months). The World's GCMs also reproduce the overall spatial pattern of SST variance, however they significantly and systematically overestimate the magnitude of SST variability in the Kurishio Currrent and Bering Sea regions (e.g. by at least 60%). We also report on the fidelity of the GCM simulated leading mode of North Pacific SST variability known as the Pacific Decadal Oscillation (PDO), computed as the leading Empirical Orthogonal Function (EOF) of monthly-mean SST. The PDO is reasonably well simulated by the World's GCMs, however there are some important biases in both the spatial and temporal dimensions which we will highlight in the presentation. Finally, we report on the ability of the World's GCMs to reproduce the observed coupling between SST and sea level pressure (SLP) fluctuations.

3C5.4 ID:2360 14:15

Decadal/Interdecadal variations in ENSO predictability in a hybrid coupled model from 1881-2000

Ziwang Deng , *Youmin Tang*
Environmental Science and Engineering,UNBC
Contact: ldxd101@yahoo.com

The retrospective predictions of ENSO were performed for the period from 1881-2000 using a hybrid coupled model, an ocean general circulation model coupled to a linear statistical atmospheric model, and using a newly-developed initialization scheme of SST assimilation by Ensemble Kalman Filter (EnKF). With the retrospective predictions of the past 120 years, some important issues of ENSO predictability (measured by correlation and RMSE skills of NINO3 sea surface temperature anomaly index) were studied including decadal/interdecadal variations in ENSO predictability and the mechanisms responsible for these variations. Emphasis was placed on investigating the relationship between ENSO predictability and various characteristics of ENSO system such as the signal strength, the irregularity of periodicity, the noise and the nonlinearity. Further, fifteen bred vectors (BVs) were generated for each initial condition and the relationship between prediction skill and the bred vector growth rate was also investigated. It is found that there are significant decadal/interdecadal variations in the prediction skills of ENSO during the past 120 years. The ENSO events were more predictable during the late 19th and the late 20th century. The decadal/interdecadal variations of prediction skills are closely related to the strength of sea-surface temperature anomaly (SSTA) signals, especially to the strength of SSTA signals at the frequencies of 2-4yr period. The SSTA persistence, dominated by the SSTA signals at the frequencies over 4 yr period, also has a positive relationship to prediction skills. The high-frequency noise, on the other hand, has a strong inverse relationship to prediction skills, suggesting that it also probably play an important role in ENSO predictability. The BV's growth rate, which associates with initial condition, is positively correlated with RMSE skill. All results suggest that the decadal/interdecadal variation of the strength of ENSO signals is a critical factor of decadal/interdecadal variation of ENSO predictability.

3C5.5 ID:2359 **14:30**

The Singular Vector (SV) Analysis of An ENSO Prediction Model For The Period From 1856-2003

Yanjie Cheng , *Youmin Tang* , *Xiaobing Zhou*
University of Northern British Columbia
Contact: chengy@unbc.ca

A tangent linear model is constructed for the latest Zebiak-Cane (ZC) model LDEO5 version to study the error growth and ENSO predictability for the past 148 years from 1856-2003. Singular vector (SV), the optimal perturbation growth pattern, is obtained by two methods; one is from the perturbation of original model and the other from the tangent linear model. Both methods generate similar results. The variations of SV/Singular value with initial time, with seasons, and with the optimal period are investigated. Also the model actual error growth and its relationship to SV are examined.

The results show that the first SV is dominated by a west-east dipole spanned in the equatorial Pacific with one center located in the east and the other in the dateline. SVs are less sensitive while there is a strong sensitivity of singular values to initial conditions. The model output statistics (MOS) error correction scheme used in the LDEO5 has a large impact on the SVs.

3C5.6 ID:2319 **14:45**

Regional and Global Scale Redundancy Analyses of the Coupled Atmosphere-Ocean System

Faez Bakalian [1], *Hal Ritchie* [1], *Keith Thompson* [1], *William Merryfield* [2]
[1] Dept. of Oceanography, Dalhousie University, Halifax, NS
[2] Canadian Centre for Climate Modelling and Analysis, Victoria, BC
Contact: bakalian@phys.ocean.dal.ca

An exploratory statistical analysis of the covariance structure of joint atmosphere-ocean variables is performed on global scales in preparation for a coupled atmosphere-ocean model assimilation scheme for long-range forecasting. The ultimate goal is to better describe the background error covariance structure needed for the joint assimilation of

atmosphere and ocean observations into the coupled system. The data sets used in this study are the global fields of Sea Surface Temperature (SST) and Sea Level Pressure (SLP) from (i) an NCEP reanalysis and (ii) output from the Canadian Centre for Climate Modelling and Analysis coupled model. Time-lagged Redundancy analyses are carried out on global scales for: 1) SST forcing SLP and 2) SLP forcing SST. In all case studies, SLP is found to be the principal forcing agent leading the SST by about 1 month. Propagating components of the ENSO SST signal from the Pacific to the Atlantic ocean were also identified in the global redundancy analyses of observations and model output. Several regional Redundancy Analyses were undertaken to explore the effect of SLP on SST for the North Atlantic region on monthly to seasonal time scales. A tripole SST anomaly is identified in the 1st mode of the North Atlantic Redundancy Analyses and is found to be associated with the strengthening and weakening of the Azores and Icelandic pressure systems. The implications of these statistical relationships for modeling the background error covariance, and ultimately prediction of the coupled atmosphere-ocean system using a data assimilative model, are discussed.

3C5.7 ID:2458 15:00

Regional influences of ocean-atmosphere interaction on climate variability assessed using partial coupling

Ajayamohan Ravindran , *William Merryfield*
Center for Climate Modelling and Analysis
Contact: Ajaya.Mohan@ec.gc.ca

Sources of seasonal to decadal variations in climate potentially include (i) intrinsic atmospheric variability, (ii) atmospheric responses to intrinsic ocean variability, and (iii) coupled ocean-atmosphere interactions. Whereas the first of these processes likely contributes little to predictability on timescales longer than a season, the second and third can by virtue of the relatively long intrinsic timescales of the ocean. As a first step toward assessing regional influences of ocean variability and air-sea coupling on climate predictability, coupled climate simulations are examined in which the atmosphere responds to specified rather than interactive sea surface temperatures in certain regions, whereas the ocean continues to receive the modeled atmospheric forcing. Regions in which this partial coupling is implemented include the tropical Pacific and Indian Oceans. Resulting impacts on modeled climate variability, including that of North America, the North Pacific, and Asian monsoon regions, are described.

3C6.1 ID:2437 13:30

Biogenic aerosol sulphate in the Arctic, 1993-2003 and its relationship to sea ice

Ann-Lise Norman [1], *Sunling Gong* [2], *Desiree Toom-Sauntry* [2], *Steve Howell* [3], *John Yackel* [3], *Len Barrie* [4]
[1] The University of Calgary
[2] Science & Technology Branch
[3] University of Calgary
[4] World Meteorlogical Association
Contact: annlisen@phas.ucalgary.ca

Isotope apportionment techniques were used to derive the amount of aerosol sulphate from dimethylsulphide (DMS) oxidation in aerosol samples from Alert, Nunavut, Canada. A significant increase in DMS sulphate is seen for the period 1993 to 2003 for weekly high volume filter samples. Changes in DMS sulphate aerosol concentrations are most apparent in the fall and winter months; October, November and December. The relationship between aerosol sulphate and methanesulphonic acid (MSA), a second product of DMS oxidation, has been explored with respect to sea ice coverage from Special Sensor Microwave Imager (SSM/I) passive microwave satellite data for the same period. A significant relationship between yearly average DMS sulphate at Alert and Arctic sea ice extent ($P = 0.01$) is observed when the year 2001 is treated as an outlier. A significant increase in MSA with time is not observed for the same time period, but a trend is apparent when a longer-term record is considered. MSA in aerosols at Alert, Nunavut are correlated with NOW polyna ice cover rather than Arctic ice cover and this difference is likely related to seasonal differences in the SO4/MSA branching ratio. These results are important to the global radiation budget and may provide constraints for Arctic DMS aerosol feedbacks in future aerosol coupled climate models.

3C6.2 ID:2371 **13:45**

Applications of a Dual Polarization C-band Radar to Operational Weather Forecasting

David Hudak , *John Scott* , *Sudesh Boodoo* , *Jim Young* , *Norman Donaldson* , *Michael Leduc*
Environment Canada
Contact: david.hudak@ec.gc.ca

As part of the evolution and future enhancement of the Environment Canada (EC) weather radar network, the EC King City radar in southern Ontario has been recently upgraded to include dual polarimetric capabilities. The motivation for this project is to test the engineering design and data quality of the C-band polarimetric radar and to demonstrate the utility of the new radar data to operational users. Data has been collected on a wide variety of meteorological situations over the past three years. In order to evaluate the information, processing algorithms have been developed to characterize the nature of the echoes, either meteorological, biological or clutter. If the target is meteorological, then it is further subdivided into hydrometeor class. In summer severe weather, the algorithms have proven to be very effective in the identification of hail and in the characterization of heavy rain events. Examples that include the tornado outbreak and flooding in southern Ontario on August 19, 2005, will be shown to highlight the benefits of dual polarization technology over the standard radar products in an operational forecast setting. The ability of the new measurements to correct for heavy attenuation of the radar beam is major factor in the improvement. In winter applications, the differential reflectivity and the correlation coefficient parameters are shown to provide insight into the detection of the 0°C level and the rain-snow transition line as well as into the nature of snow particles. The results confirm the soundness of the engineering design of the King City radar. The potential advantages of the addition of dual polarization technology to other radars in the EC network will be discussed.

3C6.3 ID:2336 **14:00**

An operational approach of blending hurricane-type wind forcing with CMC forecast wind field lacking hurricane characteristics

Serge Desjardins [1], *Roop Lalbeharry* [2], *Allan Macafee* [1], *Garry Pearson* [1], *Hal Ritchie* [3]
[1] National Lab for Marine and Coastal Meteorology,Dartmouth, EC
[2] Science and Technology Branch, EC, Downsview
[3] Meteorological Research Division, EC, Dartmouth
Contact: serge.desjardins@ec.gc.ca

An operational blending process between the Regional GEM forecast surface field and parametric hurricane wind and pressure fields is in continuous development. The blending is done through a system called SWIM (Surface Wind Interpolator and Modifier). In the near future, SWIM will be connected through a coupled system to a wave or a surge model which will receive the modified wind and pressure fields when the hurricane blending process is activated. Until this connection, SWIM currently prepares modified wind fields for wave or storm surge models.

In cases when the atmospheric model already simulates a significant surface vortex as its representation of the hurricane, two questions arise: how to blend, and to what extent. In this paper an environmental weight based on the surface geostrophic vorticity is applied to take into consideration the current representation of the hurricane by the atmospheric model. The methodology leads to an automated decision maker on the degree of blending. The use of the surface geostrophic vorticity as a predictor of the extent of the blending zone is also presented.

Some results of past cases will be presented at this conference.

3C6.4 ID:2262 **14:15**

On horizontal wind gradient variability from the stratosphere to the surface over Arctic sea ice

Jennifer Verlaine Lukovich , *David Barber*
University of Manitoba
Contact: lukovich@cc.umanitoba.ca

Previous studies have demonstrated changes in vertical wind shear in recent decades, with implications for upward-propagating planetary waves, the stratospheric polar vortex, and tracer transport. Changes in vertical wind shear combined with horizontal gradients have also been shown to contribute to an increase in vertical gradients in tracer fields, with important implications for vertical transport. In order to explore the extent to which changes in vertical wind shear are reflected in changes to horizontal stirring, we examine horizontal wind gradient fields from the stratosphere to the surface from 1979 to 2000. Studied in particular are the spatial and temporal properties and trends for relative vorticity, divergence, strain and the Weiss criterion (which monitors the competition between strain- and vorticity-dominated fields), to illustrate how horizontal wind

gradients have changed over the last several decades. The results from this investigation show increased cyclonic activity in the middle stratosphere to 1998 during winter and positive strain anomalies during spring from 1990 to 1998, in support of the now well understood phenomenon of a strengthened polar vortex associated with increased vertical shear in the 1990s. Spatial distributions for seasonal relative vorticity fields exhibit spatially coincident large- and small-scale coherent features near the surface and in the middle stratosphere during fall and winter. Trend analyses highlight statistically significant trends in strain and relative vorticity fields during fall and winter, which are reflected in coherent features in relative vorticity trends at the surface during winter months, strain trends over Fram Strait near the tropopause during summer, and in all trends in wind gradient fields in the middle stratosphere during fall. The results from this investigation suggest that despite significant variability in wind gradient fields, statistically significant trends exist from the stratosphere to the surface and exhibit spatial coincidence with sea ice concentration anomaly patterns. This coupling from the surface to the upper atmosphere is important in the development of our understanding of the response of sea ice concentrations to climate variability and change.

3C6.5 ID:2261 14:30

Retrievals of Atmospheric Winds Measured by the Atmospheric Chemistry Experiment Fourier Transform Spectrometer

Dejian Fu [1], *Chris D. Boone* [1], *Peter F. Bernath* [2], *Sean D. Mcleod* [1], *Kaley A. Walker* [3]
[1] University of Waterloo
[2] University of York
[3] University of Toronto
Contact: dfu@acebox.uwaterloo.ca

The Atmospheric Chemistry Experiment (ACE) is a Canadian-led satellite mission for remote sensing of the Earth’s atmosphere. The ACE satellite, also known as SCISAT-1, was launched on 12 August 2003 and began science operations in February 2004. The primary instrument on SCISAT-1 is a Fourier Transform Spectrometer called the ACE-FTS, featuring a high spectral resolution of 0.02 wavenumber (±25 cm maximum optical path difference) and broad spectral coverage in the mid-IR: 750 – 4400 wavenumber. An approach is being developed for the retrieval of atmospheric winds from the solar occultation spectra recorded by the ACE-FTS, employing features in the solar spectrum for frequency calibration and determining winds from the Doppler shifts of atmospheric absorption lines. The analysis will use hundreds of absorption lines from six atmospheric species: CO2, CO, NO, H2O, CH4, and N2O. The retrieval approach together with sample retrievals of atmospheric winds will be presented.

3C6.6 ID:2404 14:45

The Canadian Operational Research Aerosol Lidar Network (CORALNet) as a Tool to Measure Aerosol Transport

Kevin Strawbridge , *Michael Harwood* , *Michael Travis* , *Bernard Firanski*
Environment Canada

Contact: Kevin.Strawbridge@ec.gc.ca

The remote sensing technique of Lidar provides vertically-profiled information with high temporal resolution making it well-suited for understanding the optical characteristics of aerosol layers aloft. Lidar has the ability to detect the complex vertical structure of the atmosphere and can therefore identify the existence and extent of aerosols that have undergone long-range transport with the aid of “back-trajectory” information. Environment Canada along with other university, federal and provincial partners is beginning a new initiative to locate a network of lidars at strategic places across Canada to study and monitor the impact of aerosols on Air Quality on local, regional and national scales. The motivation in part has come from the partnership of lidars within REALM (Regional East Atmospheric Lidar Mesonet) where Environment Canada has been making routine measurements with a vertically-pointing lidar at the Centre For Atmospheric Research Experiments (CARE). CORALNet will help to address the magnitude and occurrence of long-range transported aerosols. This is becoming increasingly important as countries try to understand the relative role of anthropogenically, locally-produced aerosols versus those advected into the region via meteorological highways and their subsequent impact on air quality. It is further complicated by biogenically-produced aerosols such as desert dust and forest fire plumes that can have significant impacts on air quality from time to time and travel great distances around the globe. CORALNet and examples of such events will be presented.

3C6.7 ID:2323 15:00

Measurements Of Pollution In The Troposphere (MOPITT) instrument – Eight Years of Tropospheric Measurements

James Drummond [1], *John Gille* [2], *Merritt Deeter* [2], *David Edwards* [2], *Jay Kar* [3], *Florian Nichitiu* [3], *Jason Zou* [3]
[1] Dalhousie University & University of Toronto
[2] National Center for Atmospheric Research
[3] University of Toronto
Contact: james.drummond@dal.ca

The MOPITT instrument was launched on the Terra spacecraft on 19th December 1999 and has now completed over eight years of measurements of carbon monoxide from space and taken over two billion measurements.

During the time that the MOPITT instrument has been flying our ability to interpret measurements from such instruments has improved and our understanding of the dataset has become more mature. This has led to a number of significant improvements in the quality of the data since launch: Better understanding of the sensitivity to the boundary layer, better understanding of the influence of clouds and aerosols and better understanding of the effect of high concentrations of CO such as are produced by large biomass burning events.

The most recent MOPITT studies concern the lowest regions of the atmosphere and the extent to which local, rather than regional sources can be seen in the MOPITT data. In

addition we can begin to look at what internanual variability, e.g El Nino, can be seen in the data.

The MOPITT instrument was built by COMDEV in Cambridge, Ontario and financed by the Canadian Space Agency. The Terra mission and the US processing of MOPITT data is financed by NASA. Support for the MOPITT project has also been provided by the Canadian Foundation for Climate and Atmospheric Science and the Natural Sciences and Engineering Research Council.

3D-A2.1 ID:2544 16:00

Hurricane Juan – a study of impacts of surface ocean fluxes

Will Perrie [1], *Lujun Zhang* [2]
(Presented by *Bechara Toulany*)
[1] Bedford Institute of Oceanography
[2] Bedford Institute of Oceanography / Nanjing University
Contact: perriew@dfo-mpo.gc.ca

Hurricanes that form over the N Atlantic Ocean frequently migrate into the middle latitudes where they encounter much different oceanic and atmospheric conditions than in the tropics. Cool sea surface temperatures cause these storms to weaken and become thermodynamically decoupled from the ocean, while baroclinic atmospheric environments often cause them to transform into extratropical storms - a process known as extratropical transition (ET) and to re-intensify. Meanwhile, because surface fluxes can be strongly altered by sea-surface wave drag or by sea spray, the changing structure of these storms in the midlatitudes presents many unique forecasting challenges related to the increasing asymmetry in moisture and wind fields, and the impacts of air-sea interactions.

We investigated the physical processes and mechanisms of ocean surface wave-breaking, boundary layer turbulence structures and interactions between the atmosphere and ocean. We developed a coupled analytical and computational atmosphere-ocean-wave-sea spray model to calculate the effects of sea spray in terms of the processes of air-sea transformation and energy flux exchange during North Atlantic cyclones. We found that air-sea transfer processes over the ocean can potentially strongly affect how hurricanes develop. High winds generate large amounts of sea spray, which can modify the transfer of momentum, heat, and moisture across the air-sea interface, However, the extent to which sea spray can modify midlatitude hurricanes and intense cyclones has not been resolved, for all situations. This paper reports simulation of extratropical Hurricane Juan (2003). This storm was a category 2 hurricane when it made landfall in Nova Scotia on 29 September, 2003.

The simulations show that sea spray can significantly increase the sea surface flux, especially the latent heat flux, in a midlatitude cyclone such as Juan, and that sea spray's impact on cyclone intensity depends on the storm structure and development and is strongest for cyclones with high winds, and warm sea surface temperatures. The wave-

induced drag is important during the rapid-development phase of the storm and decreases as the storm's ocean waves reach maturity. Thus, sea spray tends to intensify storms particularly when winds are maximal, whereas wave-related momentum drag takes energy from the storm, primarily during the rapid development phase of the storm.

3D-A2.2 ID:2242 16:00

Evaluation of the Internal Variability in the Canadian Regional Climate Model over the Arctic domain using the Approach Big-Brother

Maja Rapaic , *Martin Leduc* , *René Laprise*
CRCMD-UQÀM
Contact: rapaic@sca.uqam.ca

The Arctic shows the largest vulnerability of all regions on Earth to climate changes. One of the very important characteristics of this area is the circumpolar circulation that provides a long residency time to air parcels inside the region. This has repercussions for the integration of nested regional climate models (RCM). It has been shown that the residency time is highly correlated to the internal variability (IV) for RCM simulations in mid- latitudes (Lucas-Picher et al. 2007). It is also recognized that there are large differences between models' simulated climate over the Arctic (Rinke et al. 2006). Furthermore the sensitivity of the results to the domain size is a well known phenomenon (Leduc et Laprise, 2008): the domain needs to be large enough to allow the development of added fine scales, but small enough for the integration to be constrained by the lateral boundary conditions (LBCs). To investigate the IV of RCM and the impact of the domain size over the Arctic, we chose to use the Big-Brother Experiment (BBE) approach (Denis et al. 2002). The BBE is developed to provide testing of the downscaling ability of one-way nested RCM with a special attention to small scales. By comparing the model against itself, the analysis is free from all model errors except those due to the nesting technique. BBE allows here to compare simulations performed over different domain sizes and study how this affects the result. Also, for a given domain, IV can be studied by introducing small differences in initial conditions in an ensemble of simulation. The advantage that provides from use of BBE is the possibility to study small-scale climate features that are the added value of RCM as they are not comprised in the LBCs, and to investigate the nature and magnitude of IV for an Arctic domain. An important objective in this study is to estimate the optimal size of the RCM domain that is small enough to limit model's IV but, at the same time, large enough to allow the full development of small-scale features that are not present in the LBCs.

3D-A2.3 ID:2464 16:00

Sea Salt Flux Parameterization Sensitivity in the Chemical Transport Model AURAMS: The contribution of naturally occurring sea salt aerosol to fine particulate mass in Atlantic Canada

T. Colleen Farrell [1], *Paul A. Makar* [2], *Wanmin Gong* [2], *Sunling Gong* [3]
[1] Environment Canada - Atlantic
[2] Environment Canada - AQRD

[3] Environment Canada -AQRD
Contact: colleen.farrell@ec.gc.ca

While trans-boundary transport dominates during large scale episodes of poor air quality in Atlantic Canada, it is important to quantify natural background levels during periods of elevated particulate matter (PM). Over the ocean, particles of sea salt are produced from the spray of breaking waves, generated by wind stress acting on the sea surface in high winds. The most common areas of breaking waves, and thus having the greatest density of airborne salt particles, are at the coast in the surf zone. Based on a comparison of modelled and measured fine particulate ($PM_{2.5}$) at various sites, it is suspected that the Chemical Transport Model (CTM) *A Unified Regional Air Quality Modeling System* (AURAMS) over-estimated the contribution of fine sea salt to predicted $PM_{2.5}$ mass concentrations at Atlantic coastal sites and in the surf zone under high wind conditions. It is hypothesized that one possible cause of such over-predictions is the physically derived sea salt emission function used in the CTM; the parameterizations governing the generation of sea salt aerosol over the open ocean may allow too much sea salt aerosol to build up in the model's boundary layer, which in turn leads to an over-prediction in PM mass concentration on days when the wind is strong. The model's sensitivity to various commonly used parameterizations governing sea salt generation over the open ocean as a function of wind speed was tested during select events of elevated PM in the Atlantic region. Model results were compared to $PM_{2.5}$ measurements near the coast and at Sable Island, which is assumed to represent concentrations in the surf zone. Results of attempts to better represent model sea salt generation in the surf zone will also be shown.

3D-A2.4 ID:2438 16:00

Box modeling of biogenic and anthropogenic sulphur dioxide transport over the North Atlantic

Michelle Seguin [1], *Ann-Lise Norman* [1], *Moire Wadleigh* [2]
[1] The University of Calgary
[2] Memorial University of Newfoundland and Labrador
Contact: annlisen@phas.ucalgary.ca

Dimethylsulphide (DMS) is released from the surface ocean and is oxidized in the atmosphere to produce methanesulphonic acid (MSA) and SO_2 in the atmosphere. Sulphur dioxide can further be oxidized to form new sulphate aerosols and act as cloud condensation nuclei. Elevated biogenic SO_2 was found over the North Atlantic during the summer Canadian SOLAS campaign of 2003. Biogenic SO_2 (distinguished from anthropogenic SO_2 by sulphur isotope apportionment) ranged in concentration from below detection limit up to 80 nmol/m^3, while anthropogenic SO_2 concentrations reached values of up to 105 nmol/m^3.

A simple box model is presented to describe the concentration and transportation of both anthropogenic and biogenic SO_2 over the North Atlantic. Input values from the Canadian SOLAS campaign include SO_2 concentrations, particulate sulphate concentrations, temperature, wind speed and DMS concentrations. Modeled net transportation fluxes for biogenic SO_2 ranged between +8.0 and -20 mmol/m^2/day. Removal and production mechanisms of SO_2 are examined to determine the importance of net transport of both anthropogenic and biogenic SO_2 over the North Atlantic.

3D-A3.1 ID:2476 16:00

Weather Wiki: Collecting and Sharing Meteorological Knowledge and Experience

Christina Van Eaton , *Shayne Keetley* , *Erik De Groot* , *David Whittle*
Environment Canada
Contact: graham.kerr@ec.gc.ca

The Free On-Line Dictionary of Computing defines a Wiki as “any collaborative website that users can easily modify via the web, typically without restriction. A Wiki allows anyone, using a web browser, to edit, delete or modify content that has been placed on the site, including the work of other authors.” It is derived from the Hawaiian word “wiki wiki”, which means “quick”, and articles are entered via a simple mark-up language which is then rendered as HTML. This is in contrast to static web pages, which do not allow universal user input, and need further software or HTML knowledge in order to create. Perhaps the most well known usage of a Wiki is the site Wikipedia.org, an online encyclopedia with articles that are created by web users around the world.

A large part of weather forecasting is the collection and sharing of knowledge and experience, and in order to encourage this at Canadian Meteorological Aviation Centre – West (CMAC-W), a user-friendly tool that was accessible office-wide was needed. The development of a locally based, internal Wiki (aptly named Weather Wiki) has risen to the challenge, allowing for forecaster interactivity through the addition of articles which capture collective experience and knowledge, in an online environment that is accessible anytime.

Weather Wiki accomplishes this through the following means: • Case study articles • Conference and Fam trip reports • Study group topics • Forecast verification information and statistics

With a focus on aviation weather hazards as well as the large geographical location CMAC-W MT’s cover in their forecasting, the Wiki has become a useful, easily searchable repository of forecaster knowledge and experience. Overall, the results have been positive, and to date Weather Wiki contains hundreds of articles completed or in progress, continues to grow.

3D-A3.2 ID:2479 16:00

CMAC - Staff Learning and Development Site: Our Learning Management System

James Wegner , *Erik De Groot* , *David Whittle*
Environment Canada
Contact: graham.kerr@ec.gc.ca

A learning management system (LMS) can be defined as being a computer-based, automated, software or web-based application that offers a platform for the administration and management of learning and training initiatives. These applications offer a learning environment where the student has the ability to go through a lesson, take an exam, fill out a survey, or even interact with instructors or peers. Similarly, the instructor has the ability to post and assign all this material, and interact with his/her students in the same web-based fashion.

A large amount of knowledge and information is needed to be a successful aviation forecaster. To maintain their skills and keep updated on newer techniques, Meteorologists require continual training. The Canadian Meteorological & Aviation Centre West (CMAC-West) is using its LMS to supplement in-person workshops with online resources. The LMS will contain reference material and links as well as learning opportunities such as quizzes and tests. This poster will include information related to this new learning management system that is being developed at CMAC-West. The system is set up using the Moodle application (see www.moodle.org) that is used by many online courses at universities around the world. The learning management site will serve as a tool used by trainers to distribute a variety of learning materials. The site was originally proposed as a way to quiz CMAC-West forecasters on aviation topics before and after participation in a workshop. After assessing the software and setting it up, it is apparent this site can be used, potentially, to address almost any kind of learning management needs. The software also is bilingual, making it an ideal system to be used by both CMAC-West and CMAC-East in Montreal.

3D-A3.3 ID:2460 **16:00**

Examination of 2007 verification data for 4 Canadian HUB airports, CYUL, CYYZ, CYYC, CYVR

Erik De Groot , *Jacqueline Spilak*
(Presented by *Tbd Tbd*)
Environment Canada
Contact: graham.kerr@ec.gc.ca

In October of 2006 CMAC (Canadian Meteorological Aviation Centre) made changes to their operations to place more emphasis on focusing on the 4 main Canadian HUB airports – CYUL Pierre Elliot Trudeau, Montreal, CYYZ Lester B. Pearson, Toronto, CYYC Calgary International, CYVR Vancouver International. In addition new tools and software were brought into operations to help the forecaster explain thinking and uncertainty about the forecasts to the users. These were TAFPlus – with an extended forecaster discussion and a graphical view of climatology and model guidance; and VCMAC – an interactive weather display tool with the ability for chat between the forecaster and user.

A preliminary evaluation of the 2007 TAF performance measurement data as compared with previous years (1999-2006) will be presented. The year has been divided into 4 seasons. In an attempt to make a more valid comparison, each season has been compared with the seasons with similar amounts of below alternate weather from other years. The analysis includes looking at FAR, POD, CSI, HSS for IFR and alternate limits. As well an evaluation of the number of amendments (both proactive and reactive) has been performed.

3D-A3.4 ID:2596 16:00

A Review of Aviation Winter Snowstorm Forecasts for Terminal Aerodromes

Anthony Liu , *Mary Qian* , *Ron Goodson* , *Garry Toth* , *Andrew Giles* , *Steve Knott*
Environment Canada
Contact: graham.kerr@ec.gc.ca

Strong winds, intense clouds and precipitation associated with winter snowstorm can bring low visibilities and ceilings, freezing precipitation and damaging low-level wind shear to terminal aerodromes. These weather features can significantly affect aviation operations. Through examining the observations and forecasts of about 200 terminal aerodromes over Canada from 2000 to 2007, we find that on average the below-alternate landing limit occurs most frequently in winter, with a peak of about 20% in December and January. However forecast skill scores are relatively low in winter. In this study, we review the winter snowstorm forecasts for several major Canadian airports and investigate the challenges of winter snowstorm forecast for terminal aerodromes. We address current efforts and future improvements as a result of advances in observation technology and networks, numerical weather prediction, ensemble prediction system and local climatology studies. Finally we discuss the importance of producing aviation forecasts and products more efficiently and economically with a great orientation to the customer.

3D-A3.5 ID:2246 16:00

A review of the fog and stratus episode during 16-18 October 2007 over Yellowknife Airport

Yongmei Zhou
MSC
Contact: betty.zhou@ec.gc.ca

Fog is a severe event that has the potential to cause delays and even disasters. A fog event, given the increased traffic volume and speed of traffic, has now become significantly more important. During 16-18 October 2007, over Yellowknife airport, a fog and mist episode, with visibilities less than 2SM lasted for nearly 18 consecutive hours was reported. Synoptic pattern, forecast guidance, and local geographic situations are reviewed in the paper to better understand this event. Summary points for this fog and low ceiling stratus case are examined for future referee.

3D-A3.6 ID:2274 16:00

Vertically propagating mountain wave forecast using GEM-15km outgoing flux.

Sébastien Chouinard , *Ivan Dubé*
Environnement Canada

Contact:

Forecasting turbulence is a daily challenge for aviation forecasters. Vertically propagating mountain waves are particularly difficult to forecast since they need a strong interaction between many parameters such as: static stability at precise levels, wind speed, direction and shear as well as the topography. Recent research has shown that the GEM-15km has some skill in forecasting the cloud pattern associated with vertically propagating mountain waves. A presentation showing comparisons between GEM-15km outgoing flux and satellite pictures for different cases across Canada will demonstrate that the operational model is able to forecast such waves and therefore help duty forecasters to forecast the turbulence associated with such events.

3D-A3.7 ID:2494 **16:00**

The process of how the aviation hazard of volcanic ash is handled in Canada and what effect it has on the aviation industry.

Carmen Snyder
Environment Canada
Contact: graham.kerr@ec.gc.ca

After several aircraft had encountered volcanic ash in flight with near catastrophic results, the international community realized that they had to take action. In 1987 ICAO established the International Airways Volcano Watch (IAVW) group which started the process of international arrangements. In 1990 a formal system was developed to address the roles and responsibilities of the major players in the aviation community, and the volcano observatories. The goal is to give warning about the occurrence and extent of volcanic ash as fast as possible to aircraft in flight as well as ensure that Air Traffic Control and the airlines can plan safe routes around volcanic ash clouds. The Canadian Meteorological Aviation Centre West (CMAC-W) in Edmonton plays an integral role in this system.

Also in 1990, Canada was the first country in the world to set up a notification plan called the Interagency Volcanic Event Notification Plan (IVENP) for both aviation and civilian agencies to warn of volcanic events near or within Canadian borders. This plan does not supersede the ICAO plan, but expands it to non-aviation users.

The safety of their passengers is of the highest priority to the airlines, and to date, no loss of life has occurred with encounters with volcanic ash, which is a testament to their pilots and procedures developed by the airlines. The aircraft however have incurred substantial damage even with limited exposure to volcanic ash which cost the airlines a considerable amount of money.

This presentation will show how the hazard to aviation of volcanic ash was discovered, addressed by the international community, the way Canada reacted to the hazard and some effects on the major air carriers.

3D-A3.8 ID:2381 **16:00**

Volcanic Hazards at Nazko Cone, British Columbia

Catherine J. Hickson [1], *Kazuharu Shimamura* [1], *Melanie Kelman* [1], *René Servranckx* [2], *Dov Bensimon* [2], *John Cassidy* [1]
[1] Natural Resources Canada
[2] Meteorological Service of Canada
Contact: rene.servranckx@ec.gc.ca

Between early October and late December of 2007, a series of seismic events deep in the earth's crust was recorded 20 km west of the Nazko Cone (100 km west of Quesnel, B.C.). As of late 2007 there have been over 1000 microearthquakes whose characteristics suggest magma movement deep underground (25 km). The current risk of eruption is minimal; however, if earthquake activity were to resume and lead to an eruption, the event would likely be similar to the last Nazko eruption about 7000 years ago, i.e. a small "Hawaiian style" cone building event. In response to concerns by residents living near Nazko cone and the epicentral area, a hazard map was created to communicate potential eruption hazards to the public and key decision-makers, including the aviation community. Information related to seismicity and lava flows was compiled by in-house experts in seismology, volcanology, and geographic information systems at Natural Resources Canada. Wind roses were constructed from climatological data from Environment Canada to find predominant wind patterns. The area has variable surface wind patterns, thus only moderate to high speed winds were plotted by month; these seemed to provide meaningful representations of stronger wind directions. However, winds on a specific day may be quite different from the climatological values and often change drastically over a few hours. In the event of an eruption, real-time information about weather, winds and atmospheric transport and dispersion of volcanic ash would be important. Environment Canada (Meteorological Service of Canada and Montréal Volcanic Ash Advisory Centre) are working closely with Natural Resources Canada to provide this information. Discussion within the working group centered on the height of the eruption plume and how local weather would affect ash distribution. In "Hawaiian style" eruptions the plume typically does not exceed a kilometre above the earth's surface.

3D-A3.9 ID:2619 **16:00**

DLAC2 - A Blended Training Experience On Creating Effective TAFS

Greg Byrd
UCAR/COMET
Contact: byrd@comet.ucar.edu

The Cooperative Program for Operational Meteorology, Education and Training (COMET) has teamed up with NOAA's National Weather Service Warning Decision Training Branch (WDTB) to create and deliver blended training units as part of the second Distance Learning Aviation Course, DLAC2. Entitled "Producing Customer-Focused TAFs", DLAC 2 focuses on using special data, tools, techniques, and an understanding of customer needs to produce the best terminal aerodrome forecasts (TAFs) possible.

Traditionally, aviation forecaster training has been conducted “one-on-one” with an experienced meteorologist in a real-time, operational setting. This has been supplemented by computer-based instruction (CBI) via disk media or the Internet. However, DLAC 2 integrates Web-based modules with facilitated Warning Event Simulator (WES) exercises to allow students to apply the CBI data, tools, and techniques to a weather scenario in a simulated operational setting. This approach is similar to that of WDTB’s Advanced Warning Operations Course (AWOC). The WDTB will also provide a robust library of aviation WES cases so local offices can develop their own training for aviation hazards typical in a certain area.

The DLAC 2 is composed of five self-paced Web modules. Published in the fall of 2006, Module 1, "Basic Terminal Forecast Strategies", addresses basic strategies behind producing effective TAFs and stresses the importance of understanding user needs. Module 2, “Writing TAFS for Convective Weather,” challenges the student to prepare forecasts for different types of convection. Currently under development, Module 3, “Airport-Specific TAFs for Wind,” introduces the concept of airport-specific criteria (ASC) and how to create value-added TAFs for wind, low-level wind shear, blowing dust, and other related hazards. Slated for delivery during next two years, Modules 4 and 5 will apply the ASC concept to forecasting winter weather and low clouds/fog, respectively. Relevant WES case scenarios will be delivered concurrently with the publication of each module. For more information on DLAC 2, see the COMET DLAC Website, http://www.meted.ucar.edu/dlac/website/index.htm.

3D-A4.1 ID:2471 16:00

Ensemble Forecast of a Canadian Prairie Winter Snowstorm

Steve Knott [1], *Anthony Liu* [2], *Ron Goodson* [3], *Garry Toth* [3], *Mary Qian* [2]
(Presented by *Knott Steve*)
[1] Prairie & Arctic Storm Prediction Centre, Environment Canada
[2] Canadian Meteorological Aviation Centre, Environment Canada
[3] Hydrometeorology and Arctic Lab, Environment Canada
Contact: steve.knott2@ec.gc.ca

A severe winter snowstorm on 9-11 January 2007 resulted in blizzard conditions with near-zero visibility and snowfall accumulations of up to 20 cm in many parts of the Canadian prairies. In this study, through investigating the meteorological conditions associated with this snowstorm, the favorable synoptic pattern is documented; through comparison of the forecast guidance from the Canadian deterministic operational GEM global model and the North America Ensemble Forecast System, the capability of ensemble prediction system in providing a more consistent indication of high impact weather is investigated; also through reviewing the public forecasts and warnings issued by the Meteorological Service of Canada for this high impact weather event, the advantages of employing an ensemble prediction system in an operational setting to deliver earlier warnings for high impact weather are discussed.

3D-A4.2 ID:2368 16:00

Subjective Evaluation of the Canadian GEM Global forecast system with supplemental observations

Victor Thomas , *Suzanne Roy* , *Richard Moffet*
Canadian Meteorological Centre
Contact: richard.moffet@ec.gc.ca

The latest update of the Canadian GEM Global forecasting system includes the addition of supplemental observations which come from satellite data which are: assimilation of SSM/I data (7 channels, humidity and surface wind speed information over oceans) : assimilation of QuikScat data (retrieved surface winds over oceans) : assimilation of AIRS data (87 channels, temperature and humidity information) : assimilation of additional AMW data (3.9 micron channel, lower tropospheric wind information at night) : assimilation of AMSU-A/B data near swath edges. There were also some improvements to some assimilation processes such as on-line dynamic bias estimation/correction for all satellite radiance data , an upgrade of fast radiative transfer in 4D-Var, a new vertical interpolation scheme for radiance data and new cloud filter for AMSU-B. CMC's Analysis &Prognosis division evaluated the mass field (surface pressure and 500 mb) and QPF performance of the new global forecast system subjectively and found the new system improved the forecasts in general across North America. Scores will be displayed to show the improvement along with specific cases which illustrate how the system was enhanced due to better initial conditions provided by the additional satellite data.

3D-A4.3 ID:2220 16:00

Development of an Automated Verification System for Meteorological Measurements

Ai Qing Li
Hu Nan Meteorological Bureau
Contact: longchengxuan@hotmail.com

Meteorological data collected through different Automated Meteorological Stations (AMS) usually contains biases and errors that need to be corrected and calibrated. A verification system was developed that automatically verify and calibrate different measurements according to international standards. This computer based system takes digital inputs from AMS, uses integrated system and comprehensive technology, examines and processes various elements collected with new inspection equipment, regulator and data collector, to evaluate and verify element based on national AMS evaluation and verification methodologies. It also utilizes automated regulator and data collected to analyze elements, calculate errors, measure and process results, and generate reports (certificates, verification records, etc.) for inquiring and database. It can also deliver the calibrated data to the database center through an intelligent network.

3D-A5.1 ID:2579 16:00

Extratropical cyclones responsible for storm surge events and coastal erosion processes in the Gulf of St. Lawrence (Québec, Canada): an assessment over the present and future periods

Philippe Gachon [1], *Corina Rosu* [2], *Jean Pierre Savard* [3]
[1] Environnement Canada
[2] UQÀM/Environnement Canada
[3] Ouranos consortium Inc.
Contact: philippe.gachon@ec.gc.ca

Storm surge events in the maritime sectors, with winds and pressure effects from intense extra-tropical cyclones, are of the primary importance for infrastructures, the environment and the public safety, in particular through their effects on the coastal erosion processes in the Gulf of St. Lawrence area (Québec, Canada). In order to investigate the main atmospheric forcings related to coastal erosion, a storm track algorithm based on maximum of vorticity, with the optimized combination of winds in term of direction, intensity, persistence and frequency, has been developed to assess the effect of strong large-scale cyclones over the year on high oceanic waves (i.e. more than 4 m). The assessment of cyclone activities has been done from both reanalysis products (i.e. global as well as regional, i.e. NCEP and ECMWF, and NARR, respectively) and the simulated values from global and regional climate models (i.e. the Canadian CGCM2/3 and RCM 3.7.1/4.1.1, respectively). A detailed evaluation of seasonal and interannual distributions of the storm tracks and wind/vorticity intensity is carried out, including validation using oceanic and atmospheric observed data series. Results reveal that the link between cyclone activity and the waves higher than 4 m has been identified in three different areas of Gulf (Sept-Îles, Gaspé and Madgdalen Islands). This study also investigates the basic characteristics of extratropical cyclone activities during the current period (i.e. 1961-2005) and the future period using climate change runs (over 2041-2070 using the SRES A2 emission scenario), and will conclude on potential effects of the changes in the main features of atmospheric events on coastal erosion processes.

3D-A5.2 ID:2260 **16:00**

Storm Studies in the Arctic (STAR): Preliminary Results

John Hanesiak [1], *Ronald Stewart* [2], *Kent Moore* [3], *Peter Taylor* [4], *David Barber* [1], *Gordon Mcbean* [5], *Mengistu Wolde* [6], *Walter Strapp* [7]
[1] University of Manitoba
[2] McGill University
[3] University of Toronto
[4] York University
[5] University of Western Ontario
[6] NRC/Flight Research Lab
[7] Environment Canada
Contact: john_hanesiak@umanitoba.ca

Storms and their related hazards over the Arctic can have profound effects including loss of life and impacts on all life forms, industry, transportation, hunting, recreation, as well as on the landscape (terrestrial, sea ice and ocean). The CFCAS funded Storm Studies in the Arctic (STAR) network completed its major field project between Oct 1 - Dec 2, 2007 and Feb 2008, focused in the south-east Canadian Arctic, a region that experiences intense autumn and winter storms. This project is concerned with the documentation, better understanding and prediction of meteorological and related hazards in the Arctic

including their modification by local topography and land-sea-ice- ocean transitions, and their impact on the local communities. STAR had a variety of surface-based and unique research aircraft field measurements, high-resolution modeling and remote sensing (including CloudSat) as part of its science strategy, and has the first and only Arctic CloudSat validation data set to date. A total of 14 research flights were flown between Nov 5 – Nov 29, with 8 of them coinciding with CloudSat passes. The aircraft was outfitted with many cloud microphysical measurements and three unique Doppler polarized airborne radars operating in Ka, X and W bands. The February 2008 phase focused on blizzards and blowing snow processes in association with extreme visibility reductions as well as atmosphere-fast ice linkages. STAR has also been very active in working with communities, northern stake holders, and government agencies to ensure its relevance to these sectors of society. Although the field phase of STAR is complete, the project will continue until December 2010 to meet the study's scientific and societal objectives. The poster highlights the major achievements of STAR to date and planned future work.

3D-A5.3 ID:2395 16:00

Effect of vegetation cover on soil moisture retrieval from passive microwave observations over Canadian Prairies

Alexander Komarov , *Alexander Trishchenko* , *Shusen Wang*
Canada Centre for Remote Sensing, NRCan
Contact: akomarov@nrcan.gc.ca

The modeling and analysis of polarization index and soil moisture retrievals over Canadians Prairie region from AMSR-E/AQUA satellite observations were conducted for dry and wet years over 2002-2007 period. The decrease of polarization index from AMSR-E data for wet conditions in comparison to dry ones was observed while the satellite retrieved soil moisture varied insignificantly. We attributed this to deficiencies of the algorithm in accounting for the masking effect of vegetation and the small penetration depth for X-band (10.65 GHz) and K-band (18.7 GHz) channels used in the standard AMSR-E algorithm. To examine the influence of vegetation on soil moisture retrieval in greater details the simulations of brightness temperature for soil covered by vegetation were conducted for the different frequency bands (L, C, X). The complex dielectric properties of soil were calculated using the spectroscopic refractive soil dielectric model, with the soil bound water influence being taken into account. The change from dry to wet conditions included also change in the vegetation water content. The distribution of soil moisture and vegetation properties was simulated using the Canada Centre for Remote Sensing land surface model EALCO (Ecological Assimilation of Land and Climate Observations). Modelling results showed that including vegetation water content leads to decrease of polarization index in agreement with AMSR-E observations. This effect complicates the soil moisture retrievals using the high frequency (X&K-bands) observations. The information about vegetation properties and/or additional measurements at longer wavelength (L-band) are required to improve the accuracy of soil moisture retrievals from space. We analyze the possibility to combine the normalized difference vegetation index (NDVI) with passive microwave observations and include

also AMSR-E C-band channel (6.925 GHz) to improve satellite retrievals of soil moisture over Canadian Prairie region. This work is conducted at the Canada Centre for Remote Sensing (CCRS), Earth Sciences Sector of the Department of Natural Resources Canada as part of the Project J35 of the Program “Enhancing Resilience in a Changing Climate”. It is supported by the Canadian Space Agency under the Government Related Initiative Program (GRIP). AMSR-E data were acquired from the National Snow and Ice Data Center (NSIDC).

3D-A5.4 ID:2357 **16:00**

Satellite-Derived Analysis of Cloud and Precipitation Features over Iqaluit

Alex Laplante , *Ronald Stewart* , *William Henson*
McGill University
Contact: alexander.laplante@mail.mcgill.ca

The capability of researching clouds and their associated precipitation fields varies from region to region depending on the remoteness of the area and the accessibility of various technologies. Contrary to the highly integrated weather observation networks found in the mid-latitudes, gathering observational information on weather systems is sparse or almost non-existent across the Canadian Arctic. Due to this, forecasting and modelling Arctic storms are particularly difficult problems that need to be addressed.

To begin to resolve this issue, the goal of the current research is to improve our understanding of clouds and precipitation over Iqaluit. The data used for analysis include Cloudsat (2B-GEOPROF, 2B-CWC, ECMWF-AUX) and MODIS (MYD05, MYD06, MYD07) satellite data, aircraft data collected by the NRC Convair 580 research aircraft, and surface photographs of ice crystals taken during the STAR project of Fall 2007/Winter 2008. In all, the satellite data consist of over 60 variables including radar reflectivity, ice/liquid water concentration, cloud top temperature, and cloud top pressure.

Preliminary results illustrate that a variety of conditions are associated with Arctic clouds over Iqaluit. For example, a substantial amount of liquid water is often found within the lower cloud layers of storm systems passing through the area (up to 1 g/m^3). As well, many of these storms are very inefficient at producing precipitation at the surface regardless of the water content. Ice crystals which do reach the surface tend to be much smaller ($\leq$1 mm) than those aloft. These and other results will be shown and explained.

3D-A7.1 ID:2542 **16:00**

The Skeena-Bulkley Valley Lakes District Woodstove Exchange STudy (WEST): Mapping the spatial variability of residential woodsmoke

Gail Millar [1], *Peter Jackson* [1], *Michael Brauer* [2], *Ryan Allen* [3], *Sara Leckie* [2]
[1] University of Northern British Columbia, Prince George, BC
[2] University of British Columbia, Vancouver, BC
[3] Simon Fraser University, Burnaby, BC
Contact: rothg@unbc.ca

WEST (the Skeena-Bulkley Valley Lakes District Woodstove Exchange Study) is a series of studies that aim to provide scientific evidence about air quality and health impacts due to the implementation of a woodstove exchange program and wood burning bylaws within the Skeena Region and Bulkley Valley Lakes District (BVLD) (north western British Columbia). WEST was launched in October 2007. One of its initial goals is to characterize the spatial variability of residential wood smoke and identify persistent wood smoke 'hot spots' at a neighbourhood level within five Skeena/BVLD communities (Burns Lake, Houston, Telkwa, Smithers and Terrace). This is currently being accomplished through mobile and fixed-site monitoring. Mobile monitoring consists of equipping a vehicle with an integrating nephelometer and a GPS receiver, then driving predetermined routes throughout each community on cold, calm, clear nights when pollutant levels are elevated. $PM_{2.5}$ filter samples and meteorological data are also being collected at fixed-sites in each community. In addition to mass, the $PM_{2.5}$ filter samples will be analyzed for levoglucosan, a wood smoke tracer. Levoglucosan concentrations will indicate the contribution of wood smoke to ambient $PM_{2.5}$ concentrations in each community and confirm the presence of wood smoke during the mobile sampling runs. Preliminary $PM_{2.5}$ concentration maps derived from the mobile monitoring will be presented along with an initial analysis of meteorological influences on $PM_{2.5}$ concentration and distribution within each of the communities.

3D-A7.2 ID:2571 **16:00**

Source apportionment of fine and coarse fraction particulate matter in Kelowna, British Columbia

Janice Allen [1], *<u>Peter Jackson</u>* [1], *Mark Graham* [2]
[1] University of Northern British Columbia
[2] BC Ministry of Environment
Contact: peterj@unbc.ca

This study identified the sources contributing most significantly to both the fine and coarse fraction of airborne particulate matter in the city of Kelowna, British Columbia, Canada. One hundred and six 24 hour samples were collected on a one-in-three day sampling schedule, between October, 2005 and September, 2006. Speciation of the samples was performed using X-ray fluorescence and ion chromatography, as well as a thermal/optical carbon analyzer. Source apportionment was conducted using the software package EPAPMF2. The most important sources contributing to fine fraction mass were found to be organic dust (from agricultural sources), natural dust or road traction material, residential wood smoke, secondary particles, and smoke from forest fires. Considering the coarse fraction, sources which contributed most substantially were natural dust or road traction material, road salt, secondary particulate, and organic dust. The sources identified by this analysis agree well with observed potential sources of particulate matter in this area.

3D-A1.1 ID:2440 **16:00**

DMS and aerosol sulphate in the Arctic atmosphere

Ofelia Rempillo , Michelle Seguin , <u>Ann-Lise Norman</u>

(Presented by *Ann-Lise Norman*)
The University of Calgary
Contact: annlisen@phas.ucalgary.ca

Dimethyl Sulphide (DMS), a compound released by phytoplankton, is the major source of sulphate in the remote atmosphere. Sulphate plays a key role in the earth's radiation balance by forming aerosols and cloud condensation nuclei (CCN) that increases the albedo of clouds. In 1987, Charlson et.al. hypothesized, that the formation of sulphate from the oxidation of dimethyl sulphide (DMS), could provide a biological climate feedback that could stabilize the Earth's temperature in the event of a warming episode (Charson et.al., 1987).

Leck et. al. (1996) showed that the ice edge and surrounding water could be strong sources of DMS. Increasing annual average Arctic temperature and decreasing annual mean Arctic sea ice extent could open Arctic waters providing sources of DMS. This study aims to determine how the changing Arctic environment affects the production of DMS and DMS oxidation products such as SO_2 and particulate sulphate. Measurements of DMS, SO_2 and sulphate concentrations in the atmosphere from the 2007 Fall study on board the CCGS Amundsen as part of the Arctic Surface Ocean Lower Atmosphere Study will be presented.

[1] R. Charlson, J. Lovelock, M. Andreae and S. Warren (1987). Oceanic phytoplankton, atmospheric sulphur, cloud albedo and climate. Nature, 326, 655-661. [2] Leck, C., and C. Persson, 1996b, Seasonal and shortterm variability in dimethyl sulfide, sulfur dioxide and biogenic sulfur and sea salt aerosol particles in the arctic marine boundary layer, during summer and autumn, Tellus 48B, 272-299.

3D-A1.2 ID:2569 **16:00**

Interhemispheric differences in the structure of the polar summer mesopause using ACE-FTS measurements

Zeyu Fan [1], *Kaley A. Walker* [2], *Robert J. Sica* [3]
[1] Department of Chemistry, University of Waterloo
[2] Department of Physics, University of Toronto
[3] Department of Physics and Astronomy, The University of West Ontario
Contact: z4fan@uwaterloo.ca

Temperature in the summer polar mesopause region is different from our experience on the surface, as atmospheric wave dynamics cause this region to have a seasonal temperature variation opposite to the troposphere. The Atmospheric Chemistry Experiment Fourier Transform Spectrometer (ACE-FTS) is a Canadian atmospheric sounding instrument, which is presently measuring atmospheric composition and temperature from the troposphere to the thermosphere. Retrievals of temperature and minor constituents in the mesopause region up to 70º latitude in the polar summer have been processed to search for hemispheric differences. Measurements are available for 4 Arctic summers (2004-2007) and 3 Antarctic summers (2004-2006). The averaged mesopause temperature over all year shows that Arctic summer mesopause is typically more than 2 K colder than the Antarctic summer mesopause. Yearly variations show that the 2005 and 2006 Arctic summer mesopause temperatures are 5.5 K and 2.1 K colder respectively than over Antarctica, while in 2004 the summer Arctic and Antarctic mesopause temperature are approximately the same. Mesopause temperatures below 150 K have been linked to the occurrence of polar mesospheric clouds (PMCs) and polar mesospheric summer radar echoes (PMSEs). Mesopause temperatures are below 150 K in the Arctic summer about 60% of the time. In the Antarctic, the occurrence is about the same in 2004 and 2006 as in the Arctic, but is below 150 K only 23% in 2005. The relative humidity in the Arctic summer mesopause region is typically higher compared to Antarctica and is more frequently supersaturatured in the summer. The Antarctic mesopause region is only supersaturated about 1 to 15% of the time compared to the Arctic, where supersaturation occurs about 20-40% of the time. We will discuss the relation of these results to the occurrence of both PMCs and PMSEs.

3D-A1.3 ID:2533 **16:00**

Low level wind measurements from a VHF Wind profiler and a Doppler Sodar at Harrow, Ontario.

Shama Sharma Kalia [1], *Peter Taylor* [1], *Wayne K. Hocking* [2], *John Hanesiak* [3]
(Presented by *Shama Kalia*)
[1] York University
[2] University of Western Ontario
[3] University of Manitoba
Contact: kalia_shama@yahoo.com

Radar wind profilers are instruments which measure wind speeds and related parameters within the atmosphere over a relatively deep region. Our VHF profilers (Mardoc WindTTrackers) perform consistently well in a height range from about 1.5 km up to 10 or 15 km. We are also interested in their performance at altitudes below 1.5km. The VHF wind profiler radars used in this study work in the frequency band between 40 and 55 MHz. An advantage of this frequency range is that it reduces problems related to signal contamination due to birds and insects, and also reduces the contamination which could occur due to precipitation but there are difficulties in obtaining low altitude winds below 1.5 km. The aim of this study is to compare the measurements of wind speed and wind direction from our VHF Wind profiler with data from a co-located (Remtech monostatic) Doppler Sodar at Harrow, Ontario in order to investigate the performance of Wind profilers at low altitudes. The Doppler Sodar is capable of measuring winds at heights ranging from 15m up to 1500m depending upon the atmospheric conditions. Surface (10m) wind and other meteorological measurements are also made at the same location

3D-A1.4 ID:2537 **16:00**

Significance of observation height in determination of wind chill index

Loren White , *Marque Jones*
Jackson State University
Contact: loren.d.white@jsums.edu

The 2001 Windchill Temperature index assumes a wind speed at 1.5 m of one-half of the wind speed observed at the standard level of 10 m. Using mesonet data observed at both 10 m and 2 m, we consider the significance of this assumption in calculation of wind chill. Results are analyzed separately for day and night conditions, as well as according to 10 m wind speed categories.

3D-A1.5 ID:2581 **16:00**

Diurnal and seasonal variation in net ecosystem methane flux in a moderately-rich fen in northern Alberta

Kevin Long , *Larry Flanagan* , *Tiebo Cai*
University of Lethbridge
Contact: long.long@uleth.ca

We conducted measurements of net ecosystem methane flux using the eddy covariance technique during May-October 2007. Mid-day fluxes increased from near zero in May to a peak of approximately 80 nmol m-2 s-1 in July and then declined through the rest of the growing season. There was a strong diurnal pattern in the concentration of methane (measured at the top of the canopy at 10m height) and methane net flux, with low fluxes at night and peak fluxes occurring near mid-day. The diurnal pattern in concentration and flux had two primary causes. First, consistently low winds at night resulted in a lack of turbulent exchange and a large build up in methane concentration below the eddy covariance sensors and the inlet for the methane analyzer. Second, model calculations suggested that stomatal closure at night limited methane flux through vascular plants. During the day, open stomatal pores apparently allowed some methane flux through vascular plants thereby avoiding oxidation in aerobic layers near the surface of the peatland. The model calculations suggest that in July the net methane flux was associated with a maximum methane production rate (Max Pr) of 146 nmol m-2 s-1 and a maxiumum oxidation rate (Max Ox) of 144 nmol m-2 s-1 (both rates normalized to 10ºC), with approximately 25% of the methane production passing through vascular plants and being affected by stomatal control.

3D-A8.1 ID:2256 **16:00**

Vérification d’une nouvelle technique de prévision des vents dans le fjord du Saguenay/Verification of a new technique to forecast winds in the Saguenay fjord

Mélanie Boudreault , *Ivan Dubé*
SMC-CPIQ
Contact: melanie.boudreault@ec.gc.ca

La rivière Saguenay, qui relie le lac St-Jean au fleuve St-Laurent sur près de 200km, se trouve en fait dans un fjord large de 1 à 3km et bordé par des parois rocheuses jusqu’à 500m de haut. Les vents y sont donc fortement canalisés et, en général, mal représentés dans les sorties des modèles numériques dont la résolution est insuffisante pour adéquatement simuler les caractéristiques topographiques du fjord. Une nouvelle technique a été développée afin d’assister les prévisionnistes dans la production de la prévision maritime pour ce secteur. Il s’agît d’une équation statistique de type “prévision

parfaite” dont les intrants approximent l’intensité et l’orientation du gradient de pression environnant. Les résultats obtenus suite à un processus de vérification de cette technique sont présentés. De plus, l’applicabilité de cette méthode à d’autres sites similaires est suggérée.

The Saguenay river, linking lake St-Jean to the St-Lawrence river over near 200km, is in fact located in a fjord about 1 to 3km wide bounded by rock faces up to 500m high. Winds in the fjord are strongly channelled and, in general, poorly represented in numerical model outputs with insufficient resolution to adequately simulate the actual topography. A new technique has been developed in order to assist forecasters in the production of the marine forecast. It involves a statistical equation (“perfect prog” type) where inputs approximate the intensity and orientation of the surrounding pressure gradient. Results from a verification process are presented. The applicability of this method to other similar sites is also suggested.

3D-C2.1 ID:2566 **16:00**

Towards sea ice assimilation in NEMO: Background Error Covariances

Mattea Turnbull , *Paul Myers*
Department of Earth and Atmospheric Sciences, University of Alberta
Contact: pmyers@ualberta.ca

Our long-term goal is the assimilation of sea ice into the NEMO ocean/sea-ice coupled model. We will initial use a simplified 1-D assimilation scheme developed by the Canadian Ice Service. This will require an understanding of the model background error covariances. We produce and analyze the error covariances using a Monte Carlo approach where the only difference between the ensemble members is the atmospheric forcing. The ensemble members are computed using random, but spatially and temporally correlated, fields based on EOF decomposition. We discuss the error covariances based upon ten short ensemble simulations for each season.

3D-C2.2 ID:2299 **16:00**

Simulating the Northeast Pacific Ocean using OPA

Yunfeng Shao , *Michael W. Stacey*
Royal Military College of Canada
Contact: stacey-m@rmc.ca

OPA is used to simulate the circulation of the North Pacific Ocean. The model domain extends from 3 degrees S (so the equator is included in the simulation) to about 66 degrees N (so the entire Northeast Pacific Ocean and much of the Bering Sea are also included). The horizontal spatial resolution is 0.25 degrees and there are 46 unequally spaced vertical levels. The model is forced with NCEP observed monthly winds, sea-surface heat flux and sea-surface pressure. Our specific region of interest is the Northeast Pacific Ocean. We discuss the ability of a twenty year simulation to reproduce the circulation of the Northeast Pacific Ocean, with special emphasis on the models ability to

reproduce the variability of the North Pacific Current and the Rossby Wave field.

3D-C2.3 ID:2487 16:00

Comparison of precipitation fields over Canada estimated from reanalysis products.

Gordon Drewitt , *Aaron Berg*
Department Of Geography, University of Guelph
Contact: gdrewitt@uoguelph.ca

As part of the Global Ocean-Atmosphere Prediction and Predictability (GOAPP) project, we are currently developing a continuous 50-year record of soil moisture at the global scale. This information will be used to examine aspects of land surface state initialization in order to improve model forecast skill. The soil moisture dataset will be calculated using the Canadian Land Surface Scheme driven with meteorological forcing data from National Center for Environmental Prediction - National Center for Atmospheric Research (NCEP/NCAR) reanalysis products. This driving data is provided at a resolution of 2.5 degrees and a temporal resolution of 6 hours. A large component of this research is to remove biases from reanalysis data products by comparison with observations. Newer reanalysis products covering Canada such as the Canadian Precipitation Analysis project and The National Land and Water Information Service provide much higher spatial resolution. In this poster we will present a preliminary comparison of precipitation derived from these data sources and discuss methodologies for reducing biases in order to obtain more realistic estimates of soil moisture.

3D-C3.1 ID:2488 16:00

Investigating deepwater oxygen isotope variability in an earth system climate model

Catherine Brennan , *Katrin Meissner* , *Michael Eby* , *Andrew Weaver*
University of Victoria
Contact: cbrennan@ocean.seos.uvic.ca

The distribution of oxygen isotopes in the hydrologic cycle provides important information about climate processes, yet very few coupled atmosphere-ocean general circulation models include oxygen isotopes. Delta-O18 values from oceanic sediment cores are used to estimate both water temperature and past global ice volume. Explicitly representing the fractionation and resulting distribution of oxygen isotopes in a coupled model serves to both test the model and explore the physical mechanisms that produce the observed isotopic distribution in space and time. Here we trace oxygen isotopes through the hydrosphere and analyze the distribution of delta-O18 in the University of Victoria Earth System Climate Model (version 2.8). We aim to address unresolved questions concerning the influence of variable sea ice formation rates on deepwater isotopic content.

3D-C3.2 ID:2577 **16:00**

Une comparaison des différentes versions du modèle canadien GEM avec les données d'observations dans l'Arctique

Pascal Dehasse , *Jean-Pierre Blanchet*
Département des Sciences de l'Atmosphère, Université du Québec à Montréal
Contact: boxofficielle@hotmail.com

Afin de pouvoir évaluer les impacts futurs des changements climatiques en Arctique, il faut bien simuler les tendances de ces changements, en particulier les tendances passées. La comparaison des résultats des modèles climatiques avec les observations est donc capitale pour le développement de modèles climatiques fiables et pour la compréhension de leurs limitations lors des projections futures. Le problème est que seulement quelques modèles couplés sont en mesure de reproduire les tendances majeures de température de surface du 20e siècle (3e Assessment Report of the Intergouvenmental Panel of climate Change (IPCC-2001)). En fait, alors que la majorité des modèles climatiques prédisent un maximum de réchauffement au pôle en hiver, les observations obtenues au cours de la deuxième moitié du XXe siècle montrent des tendances systématiques de refroidissement durant l'automne et l'hiver, non seulement à l'intérieur du cercle polaire arctique, mais également dans certaines régions du nord de l'Europe, de la Russie et du Canada. La comparaison des différentes versions du modèle GEM avec les ensembles d'observations ERA40, NCEP/NCAR, AVHRR et IABP/POLES dans la région arctique permet ainsi de vérifier si le traitement de la physique dans les modèles est adéquat pour représenter les principales tendances et les patrons moyens de la variabilité atmosphérique observés.

3D-C4.1 ID:2521 **16:00**

Development of high resolution climatological temperature and precipitation fields over B.C. for use in statistical downscaling and glacier mass balance studies.

Bruce Ainslie , *Peter Jackson*
The University of Northern British Columbia
Contact: ainslie@unbc.ca

Glacier melt provides an important source of water in Western Canada during the summer months. Potential changes in glacier runoff, due to climate change is of great importance to electric utilities, agriculture, fisheries, forestry and tourism. In the Pacific Northwest, glacier mass melt is largely driven by summertime temperatures and and compensated by wintertime precipitation.

In order to properly assess the sensitivity of glacier mass balance to climate change, it is necessary to know the present spatio-temporal distributions of both temperature and precipitation. Due do the region's complex topography and coastal boundaries, the climatology of both these fields show large variability which is difficult to characterize either solely from observations or via low resolution numerical weather prediction models.

In this research, we present high resolution temperature and precipitation fields over BC

developed using the RAMS meso-scale model. We compare these fields with equivalent gridded temperature and precipitation fields developed using statistical methods (PRISM and CRU) as well as by dynamical methods (NARR) using an independent observational dataset comprised of measurements from BC ministry of Highways, Ministry of Forestry and Ministry of the Environment meteorological stations. We show the value added through the dynamical development of meteorological fields in regions of complex terrain.

We then use these dynamically developed temperature and precipitation fields to develop statistical relationships with GCM model output. We compare the resulting statistically downscaled fields at the regional level with similar fields developed using other gridded temperature and precipitation products.

3D-C4.2 ID:2490 16:00

Multivariate ridge regression for multi-site downscaling

Alex Cannon
Meteorological Service of Canada
Contact: alex.cannon@ec.gc.ca

The multivariate ridge regression model is introduced as a means of improving the covariance structure of linear multi-site downscaling models. The procedure is conceptually similar to expanded downscaling in that both models constrain predicted and observed covariances to match. Unlike expanded downscaling, an explicit constraint on the covariance matrix is not added to the regression cost function. Instead, regression coefficients are estimated directly via a matrix equation, while ridge parameters, which are free to take positive or negative values, are iteratively adjusted such that the resulting discrepancy between modelled and observed covariance matrices is minimized. The multivariate ridge regression model is demonstrated on multi-site temperature and precipitation datasets from British Columbia, Canada.

3D-C4.3 ID:2310 16:00

Comparison of two regional climate modelling approaches using the GEM model: global variable-resolution versus one-way nested limited-area

Marc Verville [1], *Ayrton Zadra* [2], *René Laprise* [3], *Bernard Dugas* [2]
[1] CRCMD, Université du Québec à Montréal
[2] RPN, Environnement Canada and ESCER, Université du Québec à Montréal
[3] CRCMD and ESCER, Université du Québec à Montréal
Contact: verville@sca.uqam.ca

Variable-resolution stretched-grid general circulation models (VRGCM) and nested limited-area models (LAM) provide two alternative approaches often used in regional climate simulations. In a VRGCM, the domain of integration is global, resolution is relatively high within the regional area of interest, and gradually decreases outwards until it reaches the typical coarse resolution of global circulation models (GCM). In a LAM, the high-resolution simulation is restricted to the area of interest but lateral boundary

conditions must be provided, e.g. by GCM data, and this lateral forcing is usually one-way. While the VRGCM approach may allow a continuous two-way interaction between global and regional scales, its computational cost is higher than that of a LAM.

The Canadian Global Environmental Multiscale (GEM) supports global variable and limited-area grid configurations, with the same dynamical core and physics package, and thus provides an ideal setup to compare the relative benefits of the two approaches to regional climate modelling. The objective of this project is to develop objective diagnostic tools to allow this comparison. These tools will be applied to climatological fields generated by VRGCM and LAM simulations, and will include estimates of significant differences based on the student’s t-test, comparison of EOF (Empirical Orthogonal Function) patterns, and comparison of various spectral properties. Two pairs of regional climate simulations have been chosen as a benchmark for this comparison: one pair of LAM and VRGCM simulations over Europe, and one over North America. A description of the methodology and preliminary results will be presented.

3D-C5.1 ID:2588 16:00

Renewable Energy Forecasts for Solar Powered Application

Wei Yu [1], *Lewis Poulin* [2], *Jacques Hodgson* [3]
[1] Numerical Prediction Research Section, Science and Technology Branch, Environment Canada
[2] canadian Meteorological Center, Environment Canada
[3] Canadian Meteorological Center, Environment Canada
Contact: Wei.Yu@ec.gc.ca

Environment Canada's growing expertise in the area of environmental prediction is making available a number of publicly available datasets and products of great interest to industrial sectors including the energy industry. A few existing and emerging datasets and products are highlighted.

Ensemble models are a particularly interesting emerging product. They can be used to produce medium range (1-2 week) forecasts that include information on probablity and forecast uncertainty for a variety of pre-defined weather conditions like for example severe weather. It will be shown how this system could also be used to highlight renewable energy forecasts. Samples of probablistic renewable energy forecasts from ensemble data will be presented. Such forecasts could help solar applications maximize their harvest of solar energy.

These prototype renewable energy forecasts may be helpful to make using solar energy more practical by allowing solar users to monitor the atmosphere's daily renewable energy load and plan energy related activities accordingly. Renewable energy forecasts could also be used for educational campaigns to inform the public of the potential of solar energy applications and help grow the solar energy market. Vendors of solar technology could also use solar energy forecasts to assist clients, after the sale, in harmonizing their daily energy consumption patterns with expected solar energy forecast to arrive at their sites.

3D-C5.2 ID:2594 **16:00**

Needs Analysis of the Canadian Hydropower Generation Sector

Thomas Shalansky
Environment Canada
Contact: tom.shalansky@ec.gc.ca

A needs analysis of the hydropower generation sector in Canada was undertaken in 2006-2007 as a first step toward achieving service development goals. A nationally representative sample of contacts was assembled and meetings organized to initiate dialogue on the topic of hydro generators' weather-sensitive operations and decision-making processes. Results from the needs analysis show many common and expected themes among the target groups. For example, in terms of meteorological variables, the most important was quantitative precipitation forecast (QPF) information, especially the timing of the bulk of precipitation associated with heavy rainfall events. As for meteorological product types, most decision-makers expressed a need for improved and more accessible radar imagery. The ability to speak with local meteorologists especially during significant precipitation events was a common service need expressed. Other needs learned from the analysis were seasonal forecasts with more detail and greater skill and improved weather data archive systems.

3D-C1.1 ID:2606 **16:00**

Eastern Equatorial Pacific Forcing of ENSO Sea Surface Temperature Anomalies

Michael Mc Phaden [1], *Xuebin Zhang* [2]
(Presented by *Michael Mcphaden*)
[1] NOAA/PMEL
[2] NOAA/PMEL and JISAO/University of Washington
Contact: michael.j.mcphaden@noaa.gov

Previous studies have described the impacts of wind stress variations in the eastern Pacific on sea surface temperature (SST) anomalies associated with the El Niño/Southern Oscillation (ENSO) phenomenon. However, these studies have usually focused on individual El Niño events and typically have not considered impacts on La Niña - the cold phase of the ENSO cycle. In this paper we examine effects of wind stress and heat flux forcing on interannual SST variations in the eastern equatorial Pacific from sensitivity tests using ocean general circulation model over the period from 1980 to 2002. Results indicate that in the Niño-3 region (5°N-5°S, 90°-150°W) a zonal wind stress anomaly of 0.01 N m-2 leads to about 1°C SST anomaly and that air-sea heat fluxes tend to damp interannual SST anomalies generated by other physical processes at a rate of about 40 W m-2 per 1 °C. These results systematically quantify expectations from previous event specific numerical model studies that local forcing in the eastern Pacific can significantly affect the evolution of both warm and cold phases of the ENSO cycle. The results are also consistent with a strictly empirical analysis that indicates a wind stress anomaly of 0.01 N m-2 leads to about 1°C SST anomaly in the Nino-3 region.

3D-H3.1 ID:2358 **16:00**

Detection of runoff timing changes in pluvial, nival and glacial rivers of Western Canada

Stephen Dery [1], *Kerstin Stahl* [2], *Dan Moore* [3], *Paul Whitfield* [4], *Brian Menounos* [1], *Jason Burford* [1]
[1] UNBC
[2] University of Oslo
[3] UBC
[4] Environment Canada
Contact: sdery@unbc.ca

Changes in temperature, precipitation and, in some cases, glacial runoff affect the timing of river flow in watersheds of western Canada. This talk presents a robust method to detect streamflow phase shifts in pluvial, nival and glacial rivers. The nonparametric Mann-Kendall test yields monotonic trends in standardized pentad values of runoff in nine river basins of western Canada over the period 1955-2006. In comparison to trends in the timing of the date of annual peak flow and the center of volume, two other metrics often used to infer streamflow timing changes, our approach reveals more detailed structure on the nature of these changes. For instance, it is shown that changes toward an earlier occurrence of the centre of volume are not only sensitive to the earlier spring melt but also to higher late fall and winter flows and the seasonal snow accumulation. In contrast, the Mann-Kendall test yields evidence of an extension of the warm hydrological season in nival and glacial rivers of western Canada. This feature is marked by an earlier onset of the spring melt, statistically-significant decreases in summer streamflow, and a delay in the onset of enhanced autumn flows. This novel approach therefore provides critical information on streamflow timing changes throughout the entire hydrological year, enhancing results from previous methods to assess climate change impacts on the hydrological cycle.

3D-O2.1 ID:2529 16:00

MERIS observations of blooms and vegetation in the world's oceans

Jim Gower , *Stephanie King*
IOS DFO/FOC
Contact: gowerj@pac.dfo-mpo.gc.ca

We present examples of observations made with the optical imager MERIS on the European Envisat satellite. We show intense surface phytoplankton blooms, blooms in ice and sediment plumes, pelagic Sargassum, coral reefs and other benthic vegetation.

3D-O2.2 ID:2255 16:00

Modelling Lake Ontario with FVCOM

Jennifer A. Shore
(Presented by *Jennifer Shore*)
Royal Military College of Canada
Contact: rojo_cinco@yahoo.com

Kingston Basin, a region in the northeastern end of Lake Ontario, sits between the main body of the lake and the outflowing Saint Lawrence River. Its circulation is influenced by three large islands and other bathymetric features as well as its hydrographic location. Thus, to accurately model the flow structure in the basin, a model would necessarily include the entire lake but also have the ability to resolve the smaller scale bathymetric features and coastline within Kingston Basin. We use a finite volume numerical model (FVCOM) to simulate Lake Ontario hydrology with a focus on the Kingston Basin circulation. The model is forced with monthly climatological atmospheric forcing and has a specified inflow of 7000 m^3/s at the Niagara River location. The model mesh has 2394 nodes and 4126 triangular elements with horizontal resolution varying from about 375 m to 6 km. As this study is preliminary, sensitivity tests are conducted to measure the simulated response to variation in vertical resolution, time step, outflow boundary conditions, and wind forcing. Simulated results are compared to observations of vertical temperature profiles, current measurements and drift pathways.

3D-O3.1 ID:2498 16:00

Historic modeling of the timing of the spring bloom in the Strait of Georgia.

Megan Wolfe , *Susan Allen*
University of British Columbia, Department of Earth and Ocean Science
Contact: mwolfe@eos.ubc.ca

A coupled biophysical model of the Strait of Georgia, British Columbia was been developed to examine how natural physical mechanisms regulate biological production. The timing of the spring bloom within the Strait of Georgia (SoG) has been successfully predicted, matching observations from the field over a four year period (2002-2005). The physical model is a 1D vertical mixing model that uses a K-profile Parameterization of the boundary layer and the biological model uses one phytoplankton class (diatoms) and one nutrient source (nitrate). Recent alterations in the marine ecosystem of SoG has led to questions involving the historic timing of the spring bloom and whether these significant changes have evolved over time or developed much more recently. There is an extensive set of physical and biological data sets available for the Strait of Georgia, allowing for historical timelines to be developed using the coupled biophysical model. There is no record of the timing of the spring bloom in the Strait of Georgia, predating satellite observations. Examination of these historical time-series will help determine if climate change and shifts in the physical forcings affecting biological production have helped to cause the recent changes in the Strait of Georgia.

3D-O4.1 ID:2329 16:00

Assessment of real-time wave model forecasts during Hurricane Noel

Bechara Toulany , *Will Perrie* , *Yongcun Hu*
Bedford Institute of Oceanography
Contact: perriew@dfo-mpo.gc.ca

This presentation describes our activities at BIO in running wave forecast systems for several network projects. These include GoMOOS, the Gulf of Maine Ocean Observing

System http://www.gomoos.org, SCOOP, the Southeast University Research Association (SURA) Coastal Ocean Observing and Prediction project, http://www.openioos.org and the Dalhousie CMEP (Centre for Marine Environmental Prediction) project, on “Interdisciplinary Marine Environmental Prediction in the Atlantic Coastal Region” http://cmep-av.ocean.dal.ca.

This presentation will discuss the nested grids used in WW3 (WaveWatch3, the USA NCEP operational model http://polar.wwb.noaa.gov.waves) for each system. We will specifically look at the quality and accuracy of the real-time wave model forecasts during Hurricane Noel of November 4, 2007. We will assess the quality and usefulness of model-buoy data comparisons and site specific forecasts, which are made available online at the click of a buoy icon, at websites listed above. We present statistical results for quantitative analysis of comparisons.

We also compare results from two setups driven by two different wind fields. The model - model comparisons with observed buoy data, includes significant wave height, mean wave direction and period time series, as well as 1-D and 2-D wave spectra. Results suggest support for maintaining these forecasts and show their importance for mariners and stakeholders in the Northwest Atlantic Ocean.

3D-O4.2 ID:2495 **16:00**

On the influence of wind stress curl errors on the four dimensional, mid-latitude ocean inverse problem

Tsuyoshi Wakamatsu , *Michael Foreman* , *Patrick Cummins* , *Josef Cherniawsky*
Institute of Ocean Sciences
Contact: wakamatsut@pac.dfo-mpo.gc.ca

We examine sensitivities of the forecast error covariance of an ocean general circulation model to the wind stress error covariance. These sensitivities are diagnosed by computing the prior sea surface height (SSH) error variance and representers for the SSH measurements. The prior SSH error variance shows strong sensitivity to the rotational component of the wind stress error. The forecast error in the subtropical domain are mainly explained by baroclinic response to the wind stress curl error while both barotropic and baroclinic responses are important for the subpolar gyre.

3D-O1.1 ID:2551 **16:00**

Reynolds stress and eddy viscosity in sheared 2D turbulence

Patrick Cummins , *Greg Holloway*
Institute of Ocean Sciences
Contact: cumminsp@dfo-mpo.gc.ca

The Reynolds stress associated with the adjustment of an isotropic field of eddies subject to a large-scale shear flow is examined in a series of numerical calculations in a re-entrant channel geometry. Three stages in the temporal evolution of the Reynolds stress

can be identified. Initially there is a brief period associated with passive straining of the eddy field in which the net Reynolds stress and associated eddy viscosity are essentially zero. In spectral space this is characterized by mutual cancellation of contributions to the Reynolds stress at high and low eddy wavenumbers. Subsequently, eddy-eddy interactions produce a tendency to return to isotropy at high wavenumbers, leading an overall positive eddy viscosity associated with the dominant contribution to the Reynolds stress at low eddy wavenumbers. This persists as the scale of the eddy energy grows. Eventually, as the eddy length scale approaches the scale of the channel, the net Reynolds stress has a large variability and is of indefinite sign. The results are consistent with theoretical predictions of a positive eddy viscosity when there is a scale separation between eddies and the mean shear flow.

3D-I4.1 ID:2218 16:00

How Surface Latent Heat Flux and Marine Low Clouds are related to Lower-Tropospheric Stability in Subtropical Marine Stratus and Stratocumulus Regions

Yanping He [1], *Robert Dickinson* [2], *Adam Monahan* [1]
[1] University of Victoria
[2] Georgia Institute of Technology
Contact: yhe@uvic.ca

Surface latent heat flux and the lower-tropospheric stability (LTS) relationship and marine low cloud-surface radiation feedback are examined using ERA-40 reanalysis, NCEP reanalysis, COADS ship data, and ISCCP FD satellite data in subtropical marine stratus and stratocumulus regions during the period from 1985 to 1997. The change of surface latent heat flux with LTS is determined by a competition between the correlation of LTS with surface wind speed and with near surface humidity difference. At intermediate LTS, both surface evaporation and downward surface radiation flux amplifies small, LTS perturbations due to surface wind-LTS relationship and cloud-radiation feedback near the Peruvian and Namibian regions; at high LTS, surface latent heat flux passes its peak value and works as a regulating mechanism to keep LTS around its commonly observed monthly value in most subtropical MSC regions. ISCCP FD Surface radiation flux is observed to be decreased at a smaller rate with LTS than that of surface latent heat flux. By applying the regulating effect of daily LTS on near surface humidity difference, monthly ERA-40 surface latent heat flux can be well represented near southern subtropical MSC regions. Seasonal Changes of Surface Flux-LTS feedback and Cloud-Radiation feedback are also discussed and presented in subtropical MSC regions.

3D-I4.2 ID:2435 16:00

Ceilometer observations of Vancouver's urban boundary layer: Validation and initial results

Derek Van Der Kamp, *Ian Mckendry*
University of British Columbia
Contact: derek.vanderkamp@gmail.com

A mini-lidar system, Vaisala's CL31 ceilometer, has been running continuously within Vancouver, BC, since July 2007 in order to make detailed measurements of the the city's Urban Boundary Layer. Validation of the ceilometer as well as the initial application of a Mixing-Layer Height algorithm is presented here. Validation was undertaken in two separate instances. Firstly, in-situ vertical profiles of particulate matter concentrations and a full-suite of meteorological data were taken at the ceilometer field site and compared to the boundary layer structure suggested by the ceilometer. Strong correlation between the two datasets were found, including a significant, linear relationship (ρ = 0.72) between ceilometer backscatter intensity and particulate matter concentrations. The ceilometer data was also compared to ground-based particulate matter concentrations observed around the city. Strong correlation was found between the concentration measurements and the first 100m of ceilometer data. Additionally, a Mixing-Layer Height algorithm was applied to the ceilometer data which involves the fitting of an ideal backscatter profile to the observations. Initial results of this algorithm are presented as well.

3D-I4.3 ID:2570 **16:00**

Isotopic Fractionation in Non-Steady State Soil-Atmosphere Environments

Dave Risk , *Nick Nickerson*
Earth Sciences, St. Francis Xavier University
Contact: drisk@stfx.ca

Isotopic studies are frequently carried out in environments where diffusion is the dominant mode of transport, including the ocean, freshwaters, ice, solid earth, shallow subsurface, and within terrestrial vegetation. While researchers develop novel ways of exploiting isotopic fractionations as a way to track biochemical or physical processes, exploration of basic fractionation mechanisms associated with diffusive transport lags behind. This study examines the implications of diffusive-transport induced fractionations on the interpretation of isotopic processes in the geophysical environment using the example of gaseous δ13C-CO2 flux from soils. We use a multi layer soil-atmosphere diffusion model to simulate isotopic composition of the soil profile and the transport of δ13C-CO2 from soil into the overlying atmosphere. Preliminary results suggest that changes in the rate of production and alterations to the soil diffusive parameters, such as pore space and water content, can cause significant non-steady state (NSS) transport-related fractionation in the δ13C signature of both soil CO2 and surface CO2 flux. Without proper consideration, these NSS diffusive fractionation processes can readily lead to misinterpretations of observed isotopic data. Our results may also be extended to other NSS diffusive environments where isotopes are used to understand basic processes including molten-rock interactions, ocean carbon cycling and plant ecology.

3D-I3.1 ID:2448 **16:00**

Data and Metadata in Science Informing Decision

Anna Deptuch-Stapf , *Sule Alp*
Environment Canada

Contact: anna.deptuch-Stapf@ec.gc.ca

In the new era of data and information management, the poster discusses the importance of the presence of metadata in research and scientific investigations.

Examples of data interoperability, exchange and discovery of data will be given in the context of the metadata standards. Standards such as ISO 19115NAP, FGDC, SWE-SensorML and O&M, Dublin Core are referenced.

3D-I5.1 ID:2469 16:00

How well do current GCMs simulate the influence of snow cover variations on the atmosphere under climate change?

Christopher Fletcher [1], *Paul Kushner* [1], *Alex Hall* [2], *Xin Qu* [2]
[1] Department of Physics, University of Toronto, 60 St George St, Toronto, M5S 1A7, Canada
[2] University of California, Los Angeles
Contact: cgf@atmosp.physics.utoronto.ca

Recent work has shown that climate change will likely cause reductions in the amount and spatial extent of snow cover on land. This reduction will exert an influence on the local atmospheric climatology and hydrology. A significant fraction of variability among general circulation model (GCM) predictions for future climate change is found to be related to the models' representation of the snow-albedo feedback (SAF) mechanism. We present new work investigating the robustness of snow-atmosphere interaction among GCM simulations. Our results suggest that SAF also exerts a control over the nonlocal atmospheric response to climate change. Increased surface warming in models with higher SAF is associated with boreal summer Annular Mode type variability. These results indicate that a significant fraction of the spread in GCM predictions of changes in, for example, the position and strength of the zonal jets, is controlled by SAF.

3D-I5.2 ID:2330 16:00

Evolution of an Arctic “bomb”: impacts of surface fluxes from ocean and ice

Lujun Zhang [1], *Will Perrie* [2], *Zhenxia Long* [2]
(Presented by *Bechara Toulany*)
[1] Bedford Institute of Oceanography / Nanjing University
[2] Bedford Institute of Oceanography
Contact: perriew@dfo-mpo.gc.ca

The Arctic is a significant region for because of its unique thermodynamic characteristics and its potential role in global climate change. Intense Arctic storms are examples of "extreme" weather which can has impact on coastal oceanographic processes in the southern Beaufort Sea and waters of the west Canadian Arctic. This area is important because the coastal marine environment used by Canadian Northerners is an integral part of their life style. The area is also undergoing hydrocarbon exploration with potential development within the next decade. Factors such as open water and ice, and the oceanic surface fluxes can modulate storm development and winds. Climate change in the

Beaufort-Chukchi region may endanger coastal settlements and marine environments.

In tropical and extratropical latitudes, it is well known that hurricane intensity is influenced by factors such as the storm's initial intensity, the spatial extent of the storm, the thermodynamic state of the atmosphere through which the storm moves, the storm propagation speed, and sea surface fluxes along the storm track. Although several of these factors are also known to modulate the strength of midlatitude cyclone systems, little is known about the impact of atmosphere–ocean–ice interactions on storms in the Arctic Ocean. In this study we investigate the ability of surface heat fluxes to influence Arctic storm development, including processes that control their atmosphere–ocean–ice dynamics. We use the Canadian Mesoscale Compressible Community (MC2) atmospheric model coupled to the Princeton Ocean Model (POM) and Hibler Ice Model.

As a case study we simulate an Arctic storm from late 1999. Comparing our results to NCEP reanalysis data, we demonstrate very good simulations of the storm pattern, track and intensity. This cyclone is a mesoscale Arctic storm that developed over the NE Pacific and western Bering Sea. It intensified explosively in the Gulf of Alaska, developing into a meteorological bomb on 21 September 1999. The storm made landfall with surface winds > 30 m s-1 at Cape Newenham, Alaska, on 22 September and rapidly moved north northeastward. Thereafter, it crossed the Rocky Mountains to the Yukon and Northwest Territories and re-intensified over the coastal waters of the southern Beaufort Sea, over a zone of high sea surface temperature gradients, causing extensive coastal damage to communities in that region. During with its mature stage, satellite images [what satellite ??] reveal mesoscale scale and spiral cloud bands of unusual symmetry. The track of the low pressure center passed over Anchorage, Alaska where time series show a pronounced maximum in equivalent potential temperature at the storm's core.

We show the role of sea surface fluxes on the storm's explosive development as a bomb in the NE Pacific and in its re-intensification over the Beaufort coastal waters. We compare these processes to the other factors that modify the storm's development as it passes from the generation region in the Pacific, across the Rockies, to its final decay region in the Arctic.

3D-I5.3 ID:2480 **16:00**

Use of molecular genetics to trace zooplankton transport through Bering Strait into the Arctic Ocean

R. John Nelson [1], *Eddy Carmack* [1], *Fiona Mclaughlin* [1], *Nick Vagelatos* [2], *Glenn Cooper* [2], *Amber Messmer* [2]
[1] Institute of Ocean Sciences
[2] University of Victoria
Contact: nelsonjo@pac.dfo-mpo.gc.ca

Climate change will increase opportunities for southern marine organisms to become established in the Arctic Ocean. The study of intraspecific genetic variation across oceanic transition zones holds great potential for early detection of such invasions and of ecological change. Using molecular analysis of the 16S rRNA gene, we find that Calanus

glacialis from the Bering Sea and the Arctic Ocean are genetically distinct from each other. Further, we find that C. glacialis from the Bering Sea is advected into the Arctic with the northward flow of Pacific water but is not observed outside areas of recent Pacific water influx. This suggests that Bering Sea C. glacialis is not widely reproductively established in the Arctic Ocean at present. The genetic approach we report here can be used to monitor for change in ecosystems and water circulation in the western Arctic.

3D-I5.4 ID:2515 16:00

Interannual variability of the polar front in the Gulf of Alaska via high resolution temperature sections taken along the great circle route from Victoria to Dutch Harbor.

Bill Williams [1], *Eddy Carmack* [1], *Svein Vagle* [1], *Igor Belkin* [2]
[1] Department of Fisheries and Oceans
[2] University of Rhode Island
Contact: WilliamsBi@pac.dfo-mpo.gc.ca

In July 2006 and July 2007 we made CTD/rosette casts twice daily and deployed XBTs approximately every 1.5 hours from the CCGS Sir Wilfrid Laurier during its transit across the Gulf of Alaska from Victoria in the southeast to Dutch Harbor in the northwest. The southeastern part of the section is warm (~15°C) at the surface and cools monotonically with depth. In the northwestern part of the section the temperature is warm at the surface (~10 °C), but then there is a temperature minimum near 100m, a temperature maximum near 150m and a slow drop in temperature with depth. The polar front forms the boundary between these two regions. In 2006 the temperature minimum first appeared at around 147W, in 2007 it appeared around 143W, suggesting that the front has moved southeast. Other data collected concurrently show differences in the chlorophyll fluorescence, dissolved oxygen and zooplankton communities on either side of the front and in the frontal region. These differences suggest that the polar front forms boundary between biomes in the Gulf of Alaska. The Canada's Three Oceans (C3O) aims to track the location of these biomes on annual, interannual, decadal and climate time-scales and thus understand the potential effects of a changing climate.

3D-I5.5 ID:2350 16:00

SENSITIVITY OF WEATHER FORECASTS OVER THE ARCTIC DUE TO ANALYSIS ERRORS IN THE EXTRA-TROPICS AND VICE-VERSA

Ahmed Mahidjiba , *Mark Buehner* , *Ayrton Zadra*
Meteorological Research Division, Environment Canada, Dorval, Canada
Contact: ahmed.mahidjiba@ec.gc.ca

The objective of this investigation is to study the main factors that can influence the meteorological forecast over the Polar Regions, and how the meteorological conditions over those regions can impact the quality of global forecasts on time-scales of one-day to two-weeks. Using the Global Environmental Multiscale (GEM) model and global analyses on -levels provided by the Canadian Meteorological Centre (CMC), a climatology of singulars vectors (SVs) for the Arctic of the summer 2007 are being generated and diagnosed. Once per day, 15 SVs are computed using an optimization time interval of 48h and a tangent linear model including a complete set of simplified parametrizations. At the initial time, the global total-energy norm is used. For the final time, the total energy norm over the Arctic (60ºN < lat < 85ºN) is used. The preliminary results, obtained for summer of 2007 suggest that a relatively small number (15) of SVs may capture almost 30% of the 48h forecast error energy over the Arctic in that period. This study will cover the period of the International Polar Year. The use of others norms, at initial or final time, will also be examined.

3D-I5.6 ID:2519 16:00

A Round-trip Tour of Canada's Three Oceans (C3O): A Canadian Contribution to the International Polar Year

Svein Vagle , *Fiona Mclaughlin* , *Humfrey Melling* , *Bill Williams* , *Eddy Carmack*
Institute of Ocean Sciences, Department of Fisheries and Oceans
Contact: vagles@dfo-mpo.gc.ca

Changes within the ice-cover, water column and ecosystems of Arctic Canada are inextricably linked to the global system in general and to the bordering subarctic Pacific and Atlantic in particular. It is within this high-latitude domain that the consequences of global change and climate variability are expected to be biggest and fastest. Both observational and modelling results suggest that the major impact of climate change on the marine system will be the re-distribution of oceanic boundaries and habitats/biomes; and this dictates the need to carry out times series observations over broad spatial domains. The oceans surrounding Canada are both geographically and dynamically interconnected. C3O is a multidisciplinary IPY project which aims to produce a comprehensive view of the physical, chemical and biological oceanic structure of subarctic and arctic waters around Canada and to use this information to establish a sound scientific basis for a long-term Arctic Ocean monitoring program. C3O has two focuses: "long-lines" along which hydrographic and biogeographical data are collected on sections crossing the subarctic Pacific, Arctic and subarctic Atlantic and "regional studies" that investigate specific ecodomains. Here we present data collected in 2007, along the first C3O circuit of northern North America, and discuss the observed oceanic structures with regards to the global patterns of moisture transport and ocean circulation that force a 'downhill journey' of low salinity waters from the North Pacific to the Arctic and then into the North Atlantic. Already these data are showing some intriguing results, such as a dramatic change in surface salinity right across the southern Beaufort Sea.

3D-I5.7 ID:2366 16:00

Modelling Mixed-Phase Arctic Clouds using the Polar-GEM

Frédérick Chosson , *Paul Vaillancourt* , *Jason Milbrandt* , *Jocelyn Mailhot*
RPN-SMC
Contact: paul.vaillancourt@ec.gc.ca

This research will focus on the arctic and northern parts of Canada, in support of the development of the Polar-GEM modeling system planned within TAWEPI in the context of IPY.

During summer, fall and spring cloud fractions are typically in excess of 70% over the Arctic pack ice. The predominant cloud type is mixed phase stratus clouds (Curry et al. 1996, 2000). These low-level stratiform clouds have unique features such as the fact that they often have liquid tops while they precipitate ice, and they can be quite long lived. They tend to persist locally for 5-10 days at a time. These clouds are not only important for the precipitation they produce but also for their very significant role in modulating the radiation exchange between the surface, the atmosphere and space.

The cloud scheme in the GEM 15km (Sundqvist 1989), which will be used in the initial version of Polar-GEM has a single prognostic equation for total water content. We plan to evaluate more complex cloud microphysical schemes in the Polar-GEM model. One such scheme (Milbrandt and Yau, 2005) contains up to six hydrometeor types and can be used in single, double or triple moment mode. This scheme allows a more physical discrimination between the liquid and solid phase condensates, a more realistic treatment of the sedimentation of precipitation size particles as well as a more coherent interaction with the radiation scheme. Note that this scheme is already in use for the LAM 2.5km windows.

A description of the Polar-GEM model, of the microphysical and radiative schemes to be tested will be provided at the conference.

3D-I5.8 ID:2389 **16:00**

The Structure and Evolution of the Polar Stratosphere and Mesosphere and Links to the Troposphere during IPY – Overview of the SPARC-IPY

Elham Farahani
University of Toronto
Contact: elham@atmosp.physics.utoronto.ca

The evolution of stratospheric ozone and its related atmospheric constituents in Polar Regions is tightly coupled to a number of chemical and physical processes as well as dynamical features, which couple the polar stratosphere and mesosphere to the troposphere. To study the Antarctic and Arctic polar vortices within the SPARC framework the project titled “The Structure and Evolution of the Polar Stratosphere and Mesosphere and Links to the Troposphere during IPY” (IPY Activity No. 217) was proposed and endorsed as an activity within the international IPY programme (SPARC-IPY). A key component of the SPARC-IPY project is the collection and archiving of analysis products documenting the dynamics, chemistry and microphysical processes occurring within the polar vortices. These products, now being archived at the SPARC Data Center, will provide a detailed large-scale picture of the polar middle atmosphere during IPY in addition to facilitating analysis of available observational data and work on data assimilation and inter-comparison of assimilated data sets.

In addition to the data assimilation component, SPARC-IPY also includes observational activities. The central part of SPARC-IPY Arctic measurement programme includes four lidar systems located at sites across the Arctic. The focus of this presentation will be on the understanding of the “state of the Arctic middle atmosphere” by interpreting the data from these lidars that are distributed under different regimes of the Arctic middle atmosphere. The lidar measurements provide key observations for understanding the role of tides, planetary and gravity waves in the circulation of the polar middle atmosphere. Also, data available from instruments in operation at different Antarctic sites in the southern tip of South America, where the Antarctic polar vortex/ozone hole system passes over inhabited regions, will be presented together with their interpretation on their role in evolution of ozone fields.

3D-I5.9 ID:2291 16:00

Evaluation of a coupled snowpack / sea ice model using SHEBA observations

Yi- Ching Chung , *Stéphane Bélair* , *Jocelyn Mailhot* , *Ayrton Zadra*
(Presented by *Ayrton Zadra*)
RPN/MRD, Environment Canada
Contact: ayrton.zadra@ec.gc.ca

Snow processes over sea ice are currently represented with a simple one-layer snow model in the Meteorological Service of Canada (MSC) operational forecasting systems. Although fully coupled with a multi-layer sea ice model, the snow scheme does not represent detailed processes such as snow densification, vertical profiles of density and temperature, and liquid water in the snow, among others. Previous studies have shown that the widely accepted SNTHERM snow model predicts reasonably well the behavior of snow during cold periods. To more realistically describe snowpack and sea ice dynamics, a modified version of SNTHERM has been included in MSC’s physics package and coupled with the multi-layer sea-ice model. The coupled snowpack / sea ice system has been evaluated using detailed observations from the Surface Heat Budget of the Arctic Ocean (SHEBA) field campaign from October 1997 to October 1998. The snow evolution has been found to be sensitive to surface albedo, new snow density, threshold temperature for precipitation types, and solar extinction. Results show that heat conduction through sea ice affects the thermal stratification of the snowpack more significantly in winter, especially in the lower part of the snowpack. These conductive heat fluxes do not alter the simulated snow depth but have an impact on the temperature profile in the snowpack. The model system captures accurately the start of snow melt (29 May) and intensive snow melts until snow depletion (between 24 June and 12 July) but overestimates the snow depth. This overestimation in winter may occur because the model does not include horizontal transport due to blowing snow at SHEBA sites. Another uncertainty also comes from the density of new fallen snow. This study provides an interesting framework for exploring the ice-snow interactions in the Arctic in the context of IPY (the International Polar Year).

3D-I5.10 ID:2296 16:00

Operational application of a variational data assimilation system for coupled ice-ocean models and sea ice analysis

Paul Pestieau , *Alain Caya* , *Maxime Pilon* , *Luc Desjardins*
Environment canada
Contact: paul.pestieau@ec.gc.ca

Two projects to implement prototypes of ice data assimilation into Operations at the Canadian Ice Service were initiated late in 2007. The data assimilation uses a three-dimensional variational method (3D-Var) with first guess at appropriate time (FGAT). Canadian Meteorological Centre (CMC) Operational protocols and utilities were used to facilitate support and possible production at CMC. The first project is applied to the Canadian Arctic Archipelago and is near completion. This application uses persistence to carry ice concentration from one analysis to the next in the data assimilation cycle. The second project is applied to the Labrador Sea and uses the Community Ice Ocean Model to forecast ice concentration and displacement from the analysis produced by the data assimilation cycle. A few gridded and visual products are available and a first assessment is made of their usefulness to further science informed decisions. This includes specifically a preliminary evaluation of these products as a fully automated analysis and prognosis complement to the ice analysis charts done at the Canadian Ice Service.

3D-I6.1 ID:2402 16:00

Forecasting Snowpack Troublemakers

Matt Macdonald , *Melinda Brugman*
Environment Canada - Pacific Storm Prediction Center
Contact: matt.macdonald@ec.gc.ca

To date, the 2007-2008 winter season in British Columbia (BC) has seen an abnormally large number of avalanche fatalities. An extremely high percentage of these accidents are attributable to a single “rain on snow” event from early December. The event was part of a series of severe weather systems which lashed the Canadian west coast throughout the first week of December resulting in everything from cold arctic outbreaks to freezing rain to heavy snow. This early rain on snow event created a rain crust that became deeply buried in the snowpack resulting in a persistent weak layer (PWL). The PWL remained unstable for months and created a real challenge to avalanche forecasters.

In this presentation, the meteorological setup that led to this high impact weather event is examined. Past events with similar consequences are also analyzed and compared to the early December storm. Finally, we examine long range operational forecasting tools that could help forecast such events with a lead time of two to three weeks. Topics such as the multivariate regression model for the Madden Julian Oscillation and ensemble forecasts are covered.

4A1.1 ID:2607 INVITED/INVITÉ 08:30

Tricks and Traps on Using Fine-scale Numerical Weather Forecasts for Western Canada

Roland Stull

University of British Columbia
Contact: rstull@eos.ubc.ca

Wonderful advances have been made in resolving fine-scale weather features in numerical weather prediction (NWP) models, but interpretation of the NWP forecasts is often not straight forward. I will explore some of the pitfalls (traps) in high-res NWP forecasts, and offer suggestions (tricks) on how to extract useful information.

One trap relates to grid resolution in the model, and how terrain smoothing affects point and area forecasts. Useful coarse-resolution forecasts over the oceans change to useless forecasts over the mountains. Another trap relates to modelers who revel in the realistic looking weather features in their NWP forecasts, disregarding the timing/placement errors that cause local forecast busts. Trapped by the steep learning curve in relating outdated NWP forecast variables (sea-level pressure, vorticity or 50 kPa geopotential heights) to useful surface weather variables, operational meteorologists fail to use the new high-res NWP forecasts to full advantage. Ensemble forecasts provide an illusion of capturing the spread of possible forecasts; meanwhile calibrated probabilistic forecasts fall unused on the forecast floor.

To illustrate these tricks and traps, I will show many case-study forecasts and animations. Cases include: occluding cyclones, pre-frontal jets, resolved convection, convergence and shadow zones, anabatic and katabatic winds, rainstorms and windstorms, and others. Issues affecting the future of high-res forecasts will be explored, including computing power advances, upstream data voids and bottom-boundary data gaps.

4A1.2 ID:2604 **09:15**

The NASA Phoenix Mars misson

Peter Taylor
Earth and Space Science, York University
Contact: pat@yorku.ca

The NASA Phoenix Mars lander launched Aug 4, 2007 from Cape Canaveral and should land on Mars on May 25, 2008. A Canadian lidar system and other meteorological instruments are on board to provide a unique data set on the Mars boundary-layer at about 70 degrees N. The lander is scheduled to operate for at least 90 sols during the Martian summer, providing near-continuous temperature and pressure plus some wind and humidity information. In addition this will be the first time a lidar has operated from the surface of Mars. It should provide valuable information on aeolian dust in the Mars atmosphere and also on cloud heights and ice content.

As a member of the Canadian MET team and of the Atmospheric Sciences Theme Group for Phoenix, Peter Taylor has been closely involved with the mission and will talk about Mars and its atmosphere, the Phoenix mission and instrumentation, its characterization and planned use. The first few sols of the mission will focus on establishing the health of the lander, but he may just be able to show some early data coming back from Mars. Over the years Peter has worked primarily on atmospheric boundary-layer issues on

Earth, and can now apply some of that experience to this interesting Space Science research.

4B1.1 ID:2584 **10:30**

The Development of Spatially Coherent Multisite, Multivariate Statistical Downscaling Models for Canada

Andrew Harding [1], *Philippe Gachon* [2], *Van-Thanh-Van Nguyen* [1]
[1] GEC3/McGill University
[2] Environnement Canada, GEC3/McGill
Contact: philippe.gachon@ec.gc.ca

Due to recent partnerships between Canada's Climate Analysis Group (CAG), a collaborative research group working on a common research project funded by NSERC (i.e. "Probabilistic assessment of regional changes in climate variability and extremes"), the ENSEMBLES 6th Framework EU project, and the North American Regional Climate Change Assessment Program (NARCCAP), a large volume of data have recently been made available for research. A new global set of predictors have been developed by the CAG at daily resolution, concerning the large-scale state of the atmosphere for both historical (from NCEP reanalysis and GCMs) and future (CGCM3 and others) periods, with common methods of calculation. Reanalysis and regional climate models are also available at greater spatial resolutions (~50km) over all North America (the North American Regional Reanalysis, different RCMs). Currently developed or under development, a substantial quantity of station data have been interpolated on high-resolution grids over both Quebec and other areas of Canada utilizing kriging methods. There is therefore now considerable scope for the comparison of advanced multisite, multivariate statistical downscaling methods for target regions. In this paper, the statistical downscaling methods currently in development by the CAG are focused on a consideration for the dynamic forcing that may contribute toward the considerable differences in the climate regimes across Canada, particularly factors related to the contrasting character of extreme climate events experienced in the target areas. A significant challenge when approaching such issues is that of internal spatial coherence in models. Presented here are some of the downscaling methods in current development (including a neural network approach and a multivariate linear regression), approaches to the spatial coherence problem, and preliminary results regarding the ability of downscaling tools to serve as both analytical tools, and a means for the production of high resolution climate scenarios and ensemble runs used to develop probabilistic scenarios.

4B1.2 ID:2373 **10:45**

Constraining future projections for temperature extremes at local scale

Xuebin Zhang [1], *Weijie Dong* [2], *Jiafeng Wang* [3], *Francis Zwiers* [1]
[1] Climate Research Division, Environment Canada
[2] China National Climate Center
[3] York University
Contact: xuebin.zhang@ec.gc.ca

An implicit but very important assumption for downscaling large-scale projection to regional and local scales is that the projected large-scale change represents future changes in the climate due to anthropogenic forcing. This assumption, unfortunately, has rarely been verified. Without proper verification, it is difficult to gauge our confidence on the projected future change. In this paper, we present a framework in which model projected large-scale climate changes are verified with and constrained by the observed past changes, improving our confidence in the projected future changes. Using simulations from 14 GCMs participating the IPCC 4th assessment, and observations over 700 stations over China, we found that influence from external forcing is clearly detectable in China mean temperature and external forcing influence may have also manifested at local level. We then estimated possible contributions from external forcing on the risk of the record annual mean temperatures that mostly occurred in the past two decades and found that anthropogenic forcing may have more than doubled the risk of such extreme temperatures across China. Model projected future changes in the regional mean temperature was finally used to estimate the probability of 50-yr return annual temperature in the future.

4B1.3 ID:2379 **11:00**

Influence of Large-Scale Nudging on CRCM's ensemble simulations

Adelina Alexandru [1], *Ramon De Elia* [2], *René Laprise* [3], *Sébastien Biner* [4]
[1] Département des sciences de la Terre et de l'Atmosphère, UQÀM & Ouranos Consortium
[2] Ouranos Consortium and Département des sciences de la Terre et de l'Atmosphère, UQÀM
[3] Département des sciences de la Terre et de l'Atmosphère, UQÀM
[4] Ouranos Consortium
Contact: adelina@sca.uqam.ca

Study shows that small uncertainties in the initial conditions (IC) might sometimes accumulate to significant differences among RCM simulations during the model integration (internal variability of the model). One possibility to diminish the internal variability is to control Regional Climate Model (RCM) not only at the boundaries but also inside of the domain, by forcing the model to follow the large-scale of GCM or reanalyses (large-scale nudging or, more known, spectral nudging technique). The present study is mainly focused on the impact of large-scale nudging on the CRCM's ensemble simulations and is based on a series of seasonal experiments over North America. Each experiment, consisting of four ensembles of 15 perturbed runs corresponding to four different domain sizes, is performed under a given large-scale nudging configuration. The study reveals differences in CRCM's behaviour to reproduce regional characteristics when large scale nudging has been added to the model driving. Large-scale nudging has diminished in general the model's internal variability, but a noticeable effects on statistics of extremes and estimation of simulated precipitation on large domains has been noticed.

4B1.4 ID:2502 **11:15**

Effects of large-scale nudging on fine-scale variability in a regional climate model

Leo Separovic [1], *Ramon De Elia* [2], *René Laprise* [1], *Adelina Alexandru* [1]
[1] MDCR-UQAM

[2] Ouranos
Contact: separovi@sca.uqam.ca

Internal nudging of the large-scale flow has become a popular strategy to prevent nested regional climate models (RCM) from developing large-scale deviations from the driving fields provided as lateral boundary condition (LBC). The present study is conducted within the frame of probabilistic dynamical downscaling and focuses on effects of nudging on generation of fine scales. A multiple-ensemble of high-resolution RCM simulations is conducted for one summer season over a large mid-latitude domain with LBC derived from the NCEP reanalysis. Each ensemble within the multiple-ensemble consists of identical simulations generated with perturbed initial conditions. The individual ensembles differ only in the choice of nudging parameters and they are verified against a non-nudged ensemble. Each ensemble is used to separate the downscaled information in two parts: a reproducible component exclusively dependent on the driving fields, and a stochastic component associated with perturbations in initial conditions. The results show that the application of nudging increases the relative magnitude of the reproducible part at scales smaller than a few hundred of kilometres, especially in the rotational component of the flow. This is mainly due to the fact that it eliminates the stochastic component from the large-scale variables. At the same time, there is no evidence that nudging lessens the fine-scale spatio-temporal variance generated by individual simulations, which would be problematic since RCMs are employed to provide fine-scale detail. Although internal nudging seems to succeed in diminishing internal variability without too much loss of small scales, a concern still remains regarding its effect on precipitation.

4B1.5 ID:2219 11:30

Land Surface Wind Probability Distributions in North American Regions: Observations and Regional Climate Model Evaluations

Yanping He [1], *Adam Monahan* [1], *Colin Jones* [2], *Aiguo Dai* [3], *Sebastien Biner* [4], *Daniel Caya* [4]
[1] University of Victoria
[2] Univ. of Quebec at Montreal
[3] NCAR, USA
[4] Ouranos
Contact: yhe@uvic.ca

The Weibull distribution has been used for empirical downscaling of surface wind, while regional climate models are widely used for dynamical downscaling of surface wind. The intent of this study is to investigate the observed land weather station surface wind PDF and to evaluate three regional models in North American regions during the period from 1979 to 1999. Surface wind PDF is classified based on seasons, day and night, and three land cover types (forest, open land, and open water). It is found that the observed mean and standard deviation of 10-m wind speed have their maximum during winter day-time over open-water dominated surface; while the skewness has its maximum during summer night-time. The first two moments have large seasonal variations while the skewness has large day- night variations. Weibull distribution is a good fit for both daytime and nighttime station wind PDF over open-water dominated surface; however, it underestimates nighttime skewness over forests and open land by up to 1.0. A simple stochastic model study suggests that the nonlinear dependence of surface drag on wind speed and surface buoyancy flux and the shallow of boundary layer may explain the observed large value of nighttime skewness and the observed rapid increase of skewness with mean surface buoyancy. The 10-m PDFs from ERA-40 reanalysis, NCAR-NCEP reanalysis, and three regional climate models (RCA3, GEM, and CRCM4) all show Weibull-like distributions. Compared with station data, the reanalysis and model-simulated skewness has a narrow range and is underestimated in moderate to high wind speed regimes. Among them, ERA-40 and RCA3 reproduce the observed North American wind PDF difference between day and night; and GEM and RCA3 simulate the observed North American wind PDF differences among three different land cover types.

4B1.6 ID:2303 **11:45**

Regional climate change projections: a multi-model, multi-regional approach.

Dominique Paquin , *Sébastien Biner* , *Daniel Caya*
Ouranos
Contact: paquin.dominique@ouranos.ca

While the role of Global Climate Models in climate change studies is to estimate a global trend of future changes, Regional Climate Models (RCMs) carry the responsibility of producing a more detailed representation of this signal. This expectation on the RCM's capacity to deliver is sometimes hindered by the complexity of the operation and the unavoidable cascade of uncertainty from large scales to small scales. There are two main ways to tackle these problems: i) one is to continually improve model's capacity to represent the climate system, ii) and the other is to work with an ensemble of models to create quasi-probabilistic projections. An important obstacle to any of these complementary roads is that models sometimes improve their skill scores for the 'wrong reasons', that is, climate simulations may apparently improve due to compensation of errors or excessive 'tuning'. Usual recipes to fight against this are careful analysis and the will of running models in different regions of the world, where model progress due to tuning or error compensation is usually defeated. At Ouranos, the Climate Simulations Team is involved in different projects that aim to confront both model uncertainty and the validation issues. In this presentation we will show results from our role in several ongoing multi-model projects (NARCCAP, ENSEMBLES, and our in-house production), as well as a multi-regional experiment (ICTS). In addition, preliminary results discussing the prospective gains of running at a higher resolution (10 km) will also be presented.

4B1.7 ID:2394 **12:00**

Regional climate projections for British Columbia

Trevor Murdock , *David Bronaugh*
University of Victoria, Pacific Climate Impacts Consortium
Contact: dhuis@uvic.ca

Adaptation to climate change requires planning and decision making at local and regional scales. Scenarios based on multiple projections from Global Climate Models may be used to indicate a range of future outcomes for a large region. However, demands are increasingly being placed on climate impacts scientists to produce information at higher spatial and temporal scales.

Each of three sources of information (GCMs, RCMs, and empirical downscaling) were analysed over the Province of British Columbia in order to obtain a comprehensive assessment of future projected changes to annual and seasonal temperature and precipitation for the 2050s compared with historical climate (1961-1990).

By the middle of the 21st century, BC-average anomalies from historical climate, based on an ensemble of 30 GCM projections run for the IPCC Fourth Assessment Report, are +1.7°C for annual temperature and +6% for annual precipitation. Winter and summer temperature anomalies are similar to annual. However, precipitation anomalies are +7% in winter and -3% in summer. The ensemble of projections was also used to determine a range of uncertainty surrounding these estimates, and to quantify the relative uncertainty attributable to GCM differences and to emissions scenarios.

BC is both a challenging and attractive locale for investigating high resolution projections because of the Pacific Ocean influence and effect of complex topography on regional climate. To compare with GCM results, single higher-resolution projections were obtained from the Canadian Regional Climate Model to illustrate the regional distribution of changes within the Province of BC. In addition, empirical downscaling using ClimateBC was used in order to compare to interpolated historical climatology.

4B1.8 ID:2328 12:15

Improving regional climate change projections of temperature for Halifax, Nova Scotia by statistically downscaling the CGCM3 via principal components.

Matthew Lee Titus
Environment Canada
Contact: Lee.Titus@ec.gc.ca

In order to best assess the expected climate change impacts on a species, ecosystem or natural resource in a region, climate variables and climate change scenarios must be developed on a regional or even site-specific scale (Wilby et al, 2002). To provide these values, projections of climate variables must be ‘downscaled’ from the GCM results, utilizing either dynamical or statistical methods (IPCC, 2001).

Statistical downscaling has two main parts. The first and most important part is the development of the regression between daily atmospheric predictors (from NCEP) and the predictand, which is the observed maximum or minimum daily temperature (TMAX or TMIN). In this study, observed TMAX was taken from Shearwater airport (used as proxy for Halifax). The second part of the downscaling process is using future predictors from the CGCM3 in the developed regression to make projections. The focus of this study is on the first part, i.e. the development of the regression.

The regression was developed from daily values of predictors and predictands from 1961-2000 (40 years). First the dataset was normalised via subtracting the mean and dividing by the standard deviation. A Butterworth filter was then applied to remove frequencies greater than 120 days (deseasonalize). The high frequency data was then divided into the four seasons which are; winter (JFM), spring (AMJ), summer (JAS) and fall (OND). Next, the principal components (PC) of the predictors were calculated and the ten highest correlated PC were used to make the regression. The regression was then used to predict values of high frequency TMAX from 1961-2000.

Predictability of the regression was determined using gamma squared which is the variance in the errors of prediction divided by variance in the observed TMAX. Predictability was highest in the fall and winter and dropped off for spring and summer. The PC that had the highest correlation with TMAX for each season was examined. The parts of that PC with the largest weighting (largest coefficients) are the predictors that play the largest role in governing TMAX. During fall and winter, vorticity and mean sea level pressure have the most influence on TMAX. During spring, wind direction and speed have the largest influence on TMAX. Finally in the summer mean sea level pressure and geopotential height play a dominant role.

4B1.9 ID:2470 **12:30**

Using daily precipitation distributions to assess added value in the Canadian Regional Climate Model

Alejandro Di Luca [1], *Ramon De Elia* [2], *René Laprise* [1]
[1] Université du Québec à Montréal
[2] Ouranos Consortium
Contact: diluca@sca.uqam.ca

High-resolution climate information is currently in high demand in climate-change impact studies. Regional Climate Models (RCMs) constitute one of the main sources of this kind of datasets since present-day General Circulation Models (GCMs) do not run at a resolution sufficient to satisfy these needs. RCMs were developed with the aim of: a) accounting for sub-GCM grid scale forcings (e.g., complex topographical features and land cover inhomogeneity) in a physically-based way; and b) enhance the simulation of atmospheric circulations and climatic variables at fine spatial scales. Once RCMs were shown to be technically feasible, a large effort has since ensued to assess their capability as a climate downscaling tool, mostly concentrating on time-averaged fields. This effort has not translated into unequivocal gains when compared to GCM simulations performed at much coarser resolution. The main objective of this project is to contribute to the effort of objectively and unequivocally detecting the added value generated by regional models. For this aim we will present experiments consisting on climate simulations performed with the Canadian Regional Climate Model (CRCM driven by the Canadian GCM) over North America. Daily time series of precipitation rate in the period 1961-1990 are analysed and evaluation of added value is performed by comparing intensity frequency distributions and higher-order statistics of the distribution derived from three different sources: CRCM, CGCM and climate stations. We will present results over areas

characterized by different fine-scale surface forcing and different climate regimes and we will discuss the consequences for developers as well as for users.

4B2.1 ID:2522 **10:30**

Dynamics and thermodynamics of seasonal convective overturn in a very deep lake (Quesnel Lake, British Columbia) and links to productivity and climate change

Eddy Carmack [1], *Svein Vagle* [1], *John Morrison* [2], *Fiona Mclaughlin* [1], *Bernard Laval* [3]
[1] Fisheries and Oceans Canada
[2] Vynx Design
[3] University of British Columbia
Contact: carmacke@dfo-mpo.gc.ca

Quesnel Lake is a deep (Zmax=524m) dimictic lake in British Columbia (52.5N; 121W). It is an important habitat for commercial and sport fish; and since the lake is oligotrophic, its carrying capacity is influenced by nutrient re-supply during seasonal overturn. Because of its great depth, convection is constrained by the fact that the temperature of maximum density decreases with increasing pressure, and thus both wind-forced and free convection (including the thermobaric process) affect deep water renewal. We here present profile and mooring data to document the annual convective cycle. Fall overturn follows a sequence of events: 1) progressive outcropping and deepening of isotherms; 2) abrupt warming at the bottom; 3) episodic cooling at the bottom and concurrent formation of a mid-depth temperature maximum as the lake enters inverse stratification. Surface temperatures generally remain above 0oC and ice free throughout winter, thus allowing additional mixing during winter storms. The spring period is marked by progressive restratification as the lake warms, so that fall is the primary overturn period. Comparison of annual thermal histories with other lakes in western Canada demonstrates that deep lakes offer a powerful means of observing the consequences of climate change.

4B2.2 ID:2372 **10:45**

Relationships between snow cover extent, topography, and streamflow in the Quesnel River Basin of British Columbia

Jinjun Tong , *Stephen Dery*
Environmental Science and Engineering Program, University of Northern British Columbia
Contact: jtong@unbc.ca

This presentation will focus on the relationship between remotely-sensed snow cover extent (SCE) and observed streamflow in the Quesnel River Basin (QRB) of British Columbia for the period 2000-2006. The hydrology of the QRB, one of 13 major sub-watersheds of the Fraser River Basin, is strongly influenced by snowmelt. This region is thus adopted as a test bed to evaluate the Moderate Resolution Imaging Spectroradiometer (MODIS) daily and 8-day snow cover products. MODIS snow cover extent (SCE) from February 2000 to December 2006 are compared to fixed point measurements of snow across the region. The analyses show that MODIS 8-day products perform better in the classification of snow and land than MODIS daily products, with cloud cover leading to the lower classification accuracy of the high-resolution data. The

snow cover fraction (SCF) products are then used to analyze the spatial distribution and temporal variations of snow across the QRB. In addition, the snow cover duration periods are compared to elevation data to quantify the impacts of topography on SCE. Comparisons between the evolution of SCE with observed streamflow demonstrate the strong influence of snow on the Quesnel River.

4B2.3 ID:2526 **11:00**

Responses of streamflow in British Columbia to climate trends and variability

Arelia Werner , Dave Rodenhuis , Katrina Bennett , David Bronaugh
University of Victoria, Pacific Climate Impacts Consortium
Contact: dhuis@uvic.ca

Results of a recent study of hydroclimatic trends and variability across British Columbia are presented. The spatio-temporal correspondence of change in climate variables with those of seasonal streamflow reflects causal influence and highlights the sensitivity of streamflow to climatic trends. Additionally, streamflow responses to climate variability are presented as potential analogues of future streamflow regimes.

Trends in minimum and maximum daily streamflow in BC reflect significant changes in water source variables. Larger winter peaks flows of up to 23% were found at some basins with hybrid regimes from 1976-2005. This supports findings that the percentage of winter precipitation falling as rain versus snow has increased over a similar time period. In most rainfall-dominated basins, minimum (-62% to -7%) and maximum (-37% to -1%) streamflow decreased due to reductions in precipitation and temperature increases. An average decrease of 25% in April 1st snowpack (snow water equivalent) was found for all available stations (16) over 1951-2007. In the majority of the snowmelt-dominated basins, streamflow decreased for minimum (-25% to -2%) and maximum (-28% to -18%) flows. Exceptions occurred in the Okanagan, where increases in minimum streamflow (10% to 50%) were observed, likely due to increased summer precipitation. Glaciated basins had more complex responses related to the percentage glacier cover of the basin, elevation, latitude, and proximity to the ocean.

Streamflow in BC also responded to climate variability. For example, average daily streamflow in June at the Silmilkameen River in the Okanagan decreased by 50 m3 s-1on average during El Niño compared to La Niña years. This change corresponds to a 50% reduction in April 1st snowpack, a decrease of 5% to 10% in winter precipitation, and an increase of 3oC to 4oC in winter temperature during El Niño years, as compared to average long term conditions (1935-2005).

4B2.4 ID:2491 **11:15**

Future climate changes in the Rocky mountains

Ted Pollock
University of Alberta
Contact: edwardp@ualberta.ca

Many have speculated that accelerated glacial retreat around the world is a symptom of climate changes brought on by increasing concentrations of greenhouse gases, specifically carbon dioxide. Past studies of glacier mass balance under future climate scenarios as produced by global models alone have been subject to criticism because of their relatively low resolution (90-150km) versus the small scale of most glaciers (1 - 3 km) as well as inadequate statistical downscaling methods. The following study implements the Princeton GFDL coupled GCM and the PSU/NCAR MM5 mesoscale model to acquire climate predictions out to 2100 in three domains centered over the Alberta and British Columbia Rockies ranging in resolution from ~54 km to 6 km. Carbon dioxide concentrations in the global model are set to a relatively moderate emission scenario for the 21st century as produced by the Intergovernmental Panel On Climate Change (IPCC) and results are used to force the MM5. This study focuses primarily on the impacts of climate change on the Northern Cordillera of North America but will also discuss other similar locations around the world. Such a study warrants examination of possibly evolving teleconnection patterns associated with El nino. Implications of an average warming on Northern Cordillera glacier mass balance will be discussed through an examination of the role of air temperature in controlling atmospheric water vapour content and topographically forced rainfall and snowfall.

4B2.5 ID:2563 11:30

Modelling Vapour Trajectory-Stable Isotope Relationships in Western Canadian Precipitation

Kate Sinclair , *Shawn Marshall*
University of Calgary
Contact: kate.sinclair@ucalgary.ca

The variability of synoptic circulation, and associated shifts in vapour transport pathways that bring moisture from Pacific Ocean source regions to the Canadian Rocky Mountains, is a key control on water storage in winter snowpacks. For this reason, the linkages between stable isotopes ($\delta^{18}O$ and δD) in precipitation and vapour trajectories are considered to investigate the potential to use isotopic data as a tool for water resource studies.

Meteorological and snowpit data were collected from three accumulation seasons at two alpine field sites in the Canadian Rocky Mountains; the Haig Glacier (Kananaskis Country) and the Opabin Glacier (Yoho National Park). These sites are located in an east-facing/lee-slope and west-facing/windward environment respectively. Snowpits were sampled through each accumulation season (October-April, 2004-2005, 2005-2006 and 2006-2007) for $\delta^{18}O$, δD, temperature and density. In addition, isotope data were collected along a transect through southern British Columbia from October 2006 to March 2007. Seven high schools participated in this project, which allowed the near simultaneous collection of precipitation from major storm systems that crossed this region.

73 snowfall events were identified in the accumulation records from both field sites over the three accumulation seasons. Events were fit to the snowpit isotope stratigraphies to

determine the mean isotopic characteristics of each accumulation event. A manual trajectory classification was produced for all accumulation events and each trajectory class was associated with a mean isotopic signature in winter snowpacks. Finally, a Rayleigh distillation model is used to represent the changing isotopic characteristics of precipitation across each key vapour trajectory.

4B2.6 ID:2445 **11:45**

Snowfall Estimation using Automated In-situ Measurements and GEM Model Output Statistics

Alexandre Fischer
Environment Canada
Contact: alexandre.fischer@ec.gc.ca

One of the fundamental problems in atmospheric, hydrological and cryospheric sciences today is the variety of temporal and spatial resolutions; and sampling strategies needed to accurately measure meteorological parameters such as snowfall. Every measurement technology used has limitations. In the arctic, for example, satellite microwave measurements are incapable of measuring very light precipitation from shallow arctic clouds. This has implications with regards to monitoring climate change, numerical weather prediction, and hydrology since up to 50% of the total arctic water budget comes from very light precipitation events. It is proposed that if one takes measurements of snowfall water equivalent from instruments such as total precipitation gauges, and present weather sensors and combines this information with GEM model data of snowfall density; snowfall estimation can be obtained. Preliminary results of this approach will be presented along with case studies and verification statistics from the following test sites: Egbert, ON; St. John’s, NF; and Iqaluit, Nunavut.

4B2.7 ID:2407 **12:00**

Multi-year landscape-scale assessment of hydrological conditions in the Slave River Delta, NWT, using water isotope tracers

Bronwyn Brock [1], *Brent Wolfe* [2], *Tom Edwards* [1]
[1] Department of Earth and Environmental Sciences, University of Waterloo, Waterloo, Ontario
[2] Department of Geography and Environmental Studies, Wilfrid Laurier University, Waterloo, Ontario
Contact: bronwyn@gmail.com

Located on the south shore of Great Slave Lake, NWT, the hydrology of the Slave River Delta (SRD) is affected by a complex interplay of factors, including the flow regime of the Slave River and climate. Recent concerns about the impacts of upstream water use, declining river discharge and the effects of climate variability on the hydroecology of the SRD have prompted the need to further understand the crucial role of water in the ecosystem.

Measurement of stable isotope (^{18}O, ^{2}H) and suspended sediment data from water samples collected from SRD lakes over three consecutive thaw seasons (2003-2005) provides a unique opportunity to tease apart the roles of the Slave River and climate on SRD

hydroecology. While climate conditions were remarkably similar during the study period, the spring break-up period varied significantly, with moderate spring flooding in 2003, an absence of flooding in 2004, and a significant flood in 2005. Floodwater serves as a key hydrological input to lakes in the active delta, where the spatial extent of flooding is positively correlated with discharge on the Slave River. Later in the season, evaporation becomes one of the major factors controlling SRD lakewater balances. Using a coupled isotope tracer method, incorporating admixture of local and advected vapour, end-of-thaw-season lakewater balances are quantified. Results identify that water losses by evaporation exceed input for lakes in the relict delta. Interestingly, lakes in the active delta maintained positive water balances (input > evaporation) over the three year monitoring period, even in the absence of spring flooding (i.e., 2004). This information is critical when considering the implications of naturally- and anthropogenically-induced variations in climate and river discharge, consequent impacts on the hydroecology of the SRD, and resource management decisions for the delta and the nearby community of Fort Resolution.

4B2.8 ID:2282 **12:15**

Climate Change and Heavy Rainfall-related Water Damage Insurance Claims in Ontario, Canada

Chad Shouquan Cheng , *Guilong Li* , *Qian Li*
Atmospheric Science and Applications Unit, Meteorological Service of Canada Branch, Environment Cana
Contact: shouquan.cheng@ec.gc.ca

The objective of this paper is to estimate possible impacts of climate change on heavy rainfall-related water damage insurance claims and incurred losses for four selected cites (Kitchener-Waterloo, London, Ottawa, and Toronto) located at Ontario, Canada. To achieve this goal, the future climate change scenarios and rainfall projection were needed. A statistical downscaling method was used to downscale five global climate model (GCM) scenarios to selected weather stations. The downscaled meteorological variables include surface and upper-air hourly temperature, dew point, west–east and south–north winds, air pressure, and total cloud cover. These variables are necessary to project future daily rainfall amounts using within-weather-type rainfall simulation models. A model results verification process has been built into the whole exercise, including rainfall simulation modeling and the development of downscaling transfer functions. The results of the verification, based on historical observations of the outcome variables simulated by the models, showed good agreement.

To effectively evaluate heavy rainfall-related water damage insurance claims and incurred losses, a rainfall index was developed considering rainfall intensity and duration. The index was evaluated to link with insurance data as to determination of a critical threshold of the rainfall index for triggering high numbers of rainfall-related water damage insurance claims and incurred losses. The historical relationship between rainfall index and insurance data was used with future rainfall scenarios to estimate changes in future heavy rainfall-related sewer flood risks in terms of water damage insurance claims and incurred losses. The modeled results show that, averaged over the five GCM scenarios and across the study area, both the number of claims and incurred losses could

increase by about 13%, 20% and 30% for the periods 2016–2035, 2046–2065, and 2081–2100, respectively (from the four-city seasonal average of 12 ±1.7 thousand claims and $88 ±21 million during April–November 1992–2002). Within the context of this study, increases in the number of future insurance claims and incurred losses are driven by only increases in frequency and magnitude of future heavy rainfall events. These estimates did not consider other non-environmental factors (e.g., population growth, socio-economic changes, changes in the location and value of assets, aging properties and infrastructure, land use changes and urbanization, and any substantial changes in government policy).

4B2.9 ID:2321 **12:30**

Moisture Flux Convergence over the Mackenzie River Basin and Pakistan

Khalid M. Malik , *Peter Taylor*
Earth and Space Science, York University
Contact: pat@yorku.ca

This paper presents a methodology and results computed for moisture flux convergence into a region using reanalysis data obtained from the National Centre for Environmental Prediction (NCEP) and the European Centre for Medium-Range Weather Forecasts (ERA-40) for a period of 10 years from 1992-2002. The research work has been divided into three parts. The first part concentrates on the computation of moisture flux convergence into the Mackenzie River Basin using data sets at four different times of a day (00, 06, 12 and 18z). These results were compared with those obtained in earlier studies by Schuster using two data sets per day corresponding to 00 and 12 UTC. It is expected that four data sets per day will give more accurate results than two data sets. A difference in results is expected due to the variations of moisture caused by evaporation at four different time of the day compared with the earlier study comprises of two data sets. The results indicate some differences but are generally quite compatible. A second part deals with simulation of the moisture flux convergence into MRB using two different data sets (NCEP and ERA-40) and the variation in results due to the use of two different input data sets is discussed. The vertical profile of moisture flux convergence has also been obtained and results reveal that the largest moisture flux convergence lies in the range of 700 hPa to 850 hPa. Finally the same methods are applied to the Asian region in general and to Pakistan in particular. The moisture flux convergence of Pakistan was higher than MRB due to the high ambient temperatures in this part of the globe. The maximum vertical moisture flux convergence was shifted form 700 hPa to 600 hPa in summer and at 700 hPa in rest of the year.

4B3.1 ID:2558 **10:30**

Qualitative quality: Social science benefits service development efforts at Environment Canada

Lisa Vitols
Meteorological Service of Canada
Contact: kent.johnson@ec.gc.ca

As Environment Canada endeavours to improve weather information tools to reflect the

evolving needs of Canadians, one innovative team chose a social science, qualitative approach to service development. Members of the Meteorological Service of Canada (MSC) national service office focused on a subset of the public who make critical decisions that affect the lives of many other Canadians – municipal officials. Rather than counting web hits or using numerical, computer-generated surveys to evaluate the usage of different tools, the team made informal, interactive presentations about existing weather information to small groups of municipal staff from the parks, engineering, roads and public works departments of local communities. The discussions, stories and connections that emanated from this initial interpersonal outreach led to consistent discoveries about how municipalities use weather information to improve safety for Canadians, and how MSC might improve products and services to support them. This validation of the social science approach to service development will inform future efforts targeting other Canadian decision makers.

4B3.2 ID:2215 **10:45**

Science informing decisions: the Pacific Northwest Climate Impacts Group

Philip Mote , *Lara Whitely Binder* , *Alan Hamlet*
JISAO/CSES Climate Impacts Group, University of Washington
Contact: philip@atmos.washington.edu

Since its founding in 1995, the Climate Impacts Group (CIG) at the University of Washington has achieved remarkable success at translating global- and regional-scale science into forms and products that are useful to, and used by, decision-makers. From GCM scenarios to research on the connection between global ocean variability and regional droughts or floods, to original research on connections between PNW climate and hydrology, CIG's strong physical science foundation is matched by a vigorous and successful outreach program. As a result, CIG is deeply involved in advising all levels of government on adapting to climate variability and change. This talk will showcase some of the decision support tools CIG has developed and the ways these tools are being applied.

4B3.3 ID:2559 **INVITED/INVITÉ** **11:00**

IPCC: Past, Present and Future

Charles Lin , *Brian Gray* , *Francis Zwiers* , *Patti Edwards*
Science and Technology Branch, Environment Canada
Contact: Charles.Lin@ec.gc.ca

The Intergovernmental Panel on Climate Change (IPCC) was created in 1988 with the purpose of providing objective information on the causes of climate change, its potential environmental and socio-economic consequences and the adaptation and mitigation options to respond to it. Over the past 20 years, the IPCC has provided this objective information through four major assessment reports and a series of technical and special reports that has been instrumental in shaping the international policy response to the challenge of global climate change. With the completion of the Fourth Assessment

Report in 2007, which very clearly concluded that warming of the climate system is unequivocal and very likely due to the observed increase in anthropogenic greenhouse gases, the IPCC needs to scope out future activities to remain policy relevant while remaining firmly rooted in its core function: science assessment. This talk will illustrate how the IPCC has been at the forefront of science-policy interface over the past 20 years and suggest ways in which the IPCC can keep itself policy-relevant over the next 20 years.

4B3.4 ID:2387 INVITED/INVITÉ 11:30

From Trout Creek to the IPCC: Linking Climate Change Scenarios, Adaptation, and Sustainable Development

Stewart Cohen
Adaptation & Impacts Research Division, Environment Canada
Contact: stewart.cohen@ec.gc.ca

Successful application of climate change science in decision making is about more than reducing uncertainty in climate models or in detecting precipitation trends. An important element is the translation of climate scenario information into “the damage report” accounting for both changes in the biophysical environment and changes in land use, water use, development and governance that can alter relationships between climate and society. This requires an interdisciplinary approach in which teams with various research and professional skills apply a range of analytical tools to a set of common scenarios. This is supported by dialogue with local practitioners who can offer insights into the management and planning of climate-sensitive systems. This experience can lay the foundation for assessment of effectiveness of response options for individual cases, as well as for communication of these concerns to communities and governments. Examples are offered from a case study of Okanagan water management, and participation in the IPCC Third and Fourth Assessments.

4B3.5 ID:2598 INVITED/INVITÉ 11:45

The Socioeconomic and Environmental Benefits of a Revolution in Weather, Climate and Earth-System Prediction - A Weather, Climate and Earth-System Prediction Project for the 21st Century

Michel Béland
Environment Canada
Contact: michel.beland@ec.gc.ca

This document was prepared by scientists from the World Meteorological Organisation (WMO)-World Weather Research Programme (WWRP), World Climate Research Programme (WCRP), International Geosphere-Biosphere Programme (IGBP), and the natural-hazards and socioeconomic communities. It is intended to inform policy makers, national academies of science and users of weather, climate and environmental information of the urgent necessity for establishing a /Weather, Climate and Earth-System Prediction Project/ to increase the capacity of disaster-risk reduction managers and environmental policy makers to make sound decisions to minimize and adapt to the

societal, economic and environmental vulnerabilities arising from high-impact weather and climate. This endeavor is comparable in scale to the Apollo Moon Project, International Space Station, Genome Project and Hubble Telescope, with a socioeconomic and environmental benefits-to-cost ratio that is much higher. It will provide the capacity to realize the full benefits from the observational, modeling, prediction and early-warning system components of the Global Earth Observation System of Systems (GEOSS) and to accelerate major advances in weather, climate and Earth-system prediction and the use of this information by global societies. Delivering the benefits from this ambitious endeavor will require building upon the Group on Earth Observations (GEO) as an international organizational framework to coordinate the proposed/ Project/ across the weather, climate, Earth-system, natural-hazards and socioeconomic disciplines. Moreover, it will require investments in: i) maintaining existing and developing new observational capabilities; ii) advanced high-performance computing facilities with eventual sustained speeds of more than 10,000 times that of the most advanced computers of today, linked to a network of research and operational-forecast centers and early-warning systems world wide; iii) education, science and technology transfer projects to enhance the awareness and utilization of weather, climate, environmental and socioeconomic information; iv) infrastructure to transition/ Project/ research achievements into operational products and services.

4B3.6 ID:2618 INVITED/INVITÉ 12:00

Discussion on scientists involvement in decision-making

Miguel Tremblay
Environnement Canada
Contact: miguel.tremblay@ec.gc.ca

All speakers are invited for a 30 minutes discussion, which will allow us to elaborate on points raised and respond to any questions which we did not have time to address previously. We would like to encourage you to think about these questions and, during the discussion, comment and share your ideas. All contributions are welcomed and will be compiled and will be available on this web page.

4B4.1 ID:2567 INVITED/INVITÉ 10:30

The Kelowna Wildfire of August 2003: Meteorology and Impacts

Kent Johnson
Meteorological Service of Canada
Contact: kent.johnson@ec.gc.ca

In August of 2003, a number of major wildfires burned across the southern interior regions of British Columbia. Due to the proximity to a major urban centre and the loss of hundreds of homes, the Okanagan Mountain (Kelowna) fire received the most attention. Meteorology leading up to this fire and the local weather during the fire will be discussed.

4B4.2 ID:2568 INVITED/INVITÉ 10:45

The Southern BC Wildfires of 2003: Operational Response

Eric Meyer
British Columbia Forest Service
Contact: kent.johnson@ec.gc.ca

In August of 2003, a number of major wildfires burned across the southern interior regions of British Columbia. Due to the proximity to a major urban centre and the loss of hundreds of homes, the Okanagan Mountain (Kelowna) fire received the most attention. However, there were several larger fires. The British Columbia Forest Service was forced to simultaneously action numerous large fires. Several of these were interface fires directly affecting people, homes and businesses. For one small town, the local sawmill, the sole employer, was completely destroyed. Impacts of the fires and the response of the BC Forest Service will be discussed.

4B4.3 ID:2283 11:00

Predicting fire weather severity using seasonal forecasts

Kerry Anderson , Peter Englefield , Richard Carr
Canadian Forest Service
Contact: kanderso@nrcan.gc.ca

This presentation describes a methodology to predict the fire weather severity for an upcoming fire season using Environment Canada's probabilistic seasonal forecasts, the Canadian Forest Fire Danger Rating System (CFFDRS) and historical fire weather data. Fire-weather severity is evaluated by comparing the forecasted Seasonal Severity Rating (SSR), an index within the CFFDRS, to the average SSR. Forecasted and average SSR values were calculated for a number of stations across Canada. Average SSRs are based on average weather conditions at each station from 1971 to 2000. Forecasted SSRs are based on Environment Canada's probabilistic seasonal forecast, which is a result of a 40 member ensemble based on 10 runs of four independent models. Monthly anomalies from each ensemble member are applied systematically to the daily average weather value at each station to create an ensemble of forecasted fire weather time series from which forecasted SSRs are derived. Maps showing the forecasted and average SSR as well as the ratio of the two are produced to indicate the predicted fire weather severity. A forecast of the fire severity for the 2008 fire season is presented, following this approach.

4B4.4 ID:2554 11:15

Modeling weather associated with forest fire "spread events" using MODIS satellite data

Justin Podur , Michael Wotton
York University Faculty of Environmental Studies
Contact: jpodur@yorku.ca

Although large fires can take weeks to reach their final size, most fire growth occurs on a small number of days called 'spread events'. In collaboration with BM Wotton of the

CFS, I used active fire growth data from the MODIS satellite, which provides locations and times of active forest fire growth, as well as forest fire records and fire weather data from the Ontario Ministry of Natural Resources (OMNR), to develop a model to predict spread events given weather. I found that the best predictor of a spread event was the Initial Spread Index (ISI) of the Canadian Fire Weather Index (FWI) System. A logistic regression of this weather index variable with the presence/absence of an active growth day (as detected by the MODIS satellite) in Ontario showed a strong relationship. This modeling has enhanced our understanding of fire growth and improved our fire growth modeling.

4B4.5 ID:2284 **11:30**

Operational forest fire-growth predictions for canada

Kerry Anderson , *Peter Englefield* , *John Little*
Canadian Forest Service
Contact: kanderso@nrcan.gc.ca

This presentation describes an operational model that predicts fire growth for wildland fires occurring in Canada. National fuels and elevation grids, forecasted weather, and fires detected by remote sensing are entered into a fire growth model. Predicted fire perimeters are mapped and presented to the public over the Internet through the Canadian Wildland Fire Information System (http://cwfis.cfs.nrcan.gc.ca/). Current wildland fires are detected nationally using MODIS and NOAA/AVHRR satellite-based detection systems (burning areas detected by these systems are referred to as hotspots). Regions selected for fire-growth modelling include those with hotspots occurring near a community, and clusters of hotspots in areas of high fire danger. For each selected region, a fire-growth simulation environment is assembled. Fuel type data from several fire management agencies is available in grid format at a resolution of 100 m or less; in areas where such data is not available, a national fuels map based on SPOT VGT land cover and forest inventory is used. Similarly, terrain data is available from a variety of sources. Current hotspots are used as ignition points while past hotspots are used to delineate area burned. Surface wind, temperature and dew-point values (forecasted by Environment Canada) are used to determine the fire weather conditions at the fire location. The use of this model is illustrated for a large fire in Wood Buffalo National Park, which burned nearly 200 000 ha in June 2007.

4B4.6 ID:2208 **11:45**

Forest fire greenhouse gas emissions in future climates

Brian Amiro [1], *Alan Cantin* [2], *Mike Flannigan* [2], *Bill De Groot* [2]
[1] University of Manitoba
[2] Canadian Forest Service
Contact: brian_amiro@umanitoba.ca

New estimates of greenhouse gas emissions from Canadian forest fires have been developed based on a revised model for fuel consumption, using both the fire fuel load and the Canadian fire weather drought code as inputs. The model was applied to future climate scenarios of 2xCO2 and 3xCO2 environments using the Canadian Global Climate Model. Annual total surface fuel consumption for six boreal forest ecozones were estimated at 60, 80 and 117 Tg dry biomass for the 1xCO2, 2xCO2 and 3xCO2 scenarios, respectively. Almost all of the increase in fuel consumption for future climates is caused by an increase in the area burned. The effect of more severe fuel consumption density (kg fuel consumed m-2) is relatively small, ranging from 0 to 18%, depending on ecozone. The combustion emissions of greenhouse gases from surface fuels are estimated to increase from about 118 Gg CO2-equivalent y-1 in the 1xCO2 scenario to 229 Gg CO2-equivalent y-1 in the 3xCO2 scenario, including contributions from CO2, CH4 and N2O for the six ecozones. The net fire effect on climate is uncertain, but the increase in area burned will be a concern for forest management and community protection.

4B5.1 ID:2318 **10:30**

Recent developments for an operational Canadian global assimilation and prediction capability for the coupled atmosphere-ocean-ice system

Hal Ritchie [1], *Fraser Davidson* [2], *John Loder* [3], *Youyu Lu* [4], *Pierre Pellerin* [4], *Wayne Renaud* [5], *Martin Taillefer* [6], *Keith Thompson* [7], *Dan Wright* [3]
[1] Meteorological Research Division, EC, Dartmouth NS
[2] Northwest Atlantic Fisheries Centre, DFO
[3] Bedford Institute of Oceanography, DFO
[4] Meteorological Research Division, EC
[5] Directorate of Meteorology and Oceanography, DND
[6] Operational Oceanography and Ocean Sciences, DFO
[7] Department of Oceanography, Dalhousie University
Contact: harold.ritchie@ec.gc.ca

Environment Canada (EC), Fisheries and Oceans Canada (DFO), and the Department of National Defence (DND) require environmental information products and capabilities that can be provided by an operational global coupled atmosphere-ocean-ice data assimilation and prediction system. In-situ data from Argo floats together with other observations (e.g., altimeter, remotely sensed sea surface temperature) permit effective ocean data assimilation. A new inter-agency initiative, the Canadian Operational Network of Coupled Environmental PredicTion Systems (CONCEPTS) including Mercator-Ocean participation (France), will provide a framework for research and operations on coupled atmosphere-ocean-ice prediction. CONCEPTS includes projects on: 1) development of improved data assimilation and prediction systems; 2) their validation on both global and basin scales for the North Atlantic, Arctic, and North Pacific; 3) demonstration of regional ocean prediction capabilities and applications in the context of the Canada – Newfoundland Operational Ocean Forecasting System (C-NOOFS); 4) sea ice and Arctic modelling and data assimilation and 5) improved ocean data assimilation capabilities. Initial resources have been put in place for the establishment of three major inter-related activities: 1) an operational activity based on coupling the Canadian atmospheric GEM model with the Mercator system; 2) a research and development (R&D) activity consisting of government and academic research networks to develop and maintain a system tailored to Canadian needs in the longer term; and 3) a products activity to identify, develop and disseminate relevant products and outputs. Operational activity is being built upon existing EC infrastructure with R&D activity enhanced through a Global

Ocean-Atmosphere Prediction and Predictability (GOAPP) research network funded by the Canadian Foundation for Climate and Atmospheric Sciences since October 2006. This talk will provide an overview of CONCEPTS and GOAPP, and will summarize results to date and plans for the future.

4B5.2 ID:2423 **10:45**

Initial assessment of the CONCEPTS global 1/4-deg ocean and sea-ice model

Youyu Lu [1], *Jean-marc Belanger* [1], *François Roy* [1], *Hal Ritchie* [1], *Dan Wright* [2], *Zeliang Wang* [2], *Frederic Dupont* [2], *Greg Holloway* [2], *Gilles Garric* [3]
[1] Environment Canada
[2] Fisheries and Oceans Canada
[3] Mercator-Ocean, France
Contact: Youyu.Lu@ec.gc.ca

As a contribution to the development of the Canadian Operational Network of Coupled Environmental PredicTion Systems (CONCEPTS), a fine-resolution global ocean and sea-ice model has been tested under a daily climatology of surface forcing. The model is based on the Nucleus for European Modelling of the Ocean (NEMO), and has a nominal horizontal resolution of ¼˚ in longitude with approximately square grid cells throughout the domain. The multi-year model solutions are compared with large-scale ocean observational datasets to evaluate several aspects the solution, including the development of biases in the model's hydrography, the strength and structure of the time-mean, eddy variability and tropical instability waves produced by the model, and the seasonal sea-ice variations in the polar regions. These preliminary evaluations are intended to help identify model problems that need to be corrected before coupling to the Global Environmental Multi-scale model that is used for weather forecast at the Canadian Meteorological Center. The resulting coupled model will subsequently be extended, improved and evaluated for its operational use at CMC.

4B5.3 ID:2415 **11:00**

Progress in Modelling Gulf Stream Separation with an Eddy Admitting Model

Dan Wright [1], *Zeliang Wang* [1], *Frederic Dupont* [2], *Keith Thompson* [2], *Youyu Lu* [3]
[1] Bedford Institute of Oceanography
[2] Dalhousie University
[3] Environment Canada
Contact: wrightdan@mar.dfo-mpo.gc.ca

It is well known that representing the Gulf Stream separation from the continental slope near Cape Hatteras is a major problem for ocean modellers. In eddy admitting models, the mean path typically continues along the slope past Cape Hatteras before separating from the slope and turning back to form an anomalous anticyclonic eddy to the north-east of Cape Hatteras. In previous work it has been shown that a method referred to as spectral nudging can alleviate this problem by constraining the mean path of the stream while still permitting eddy variability to be determined by the model dynamics. This has been a major advance for simulating eddy variability, but the need to constrain a major

component of the solution is undesirable. Thus an important goal is to reduce and eventually eliminate the need for this constraint. In this presentation, we very briefly review the spectral nudging technique and then discuss two model modifications that reduce the need for it. First we introduce a physically motivated modification of mixing slopes to be used with “isopycnal mixing” of tracers and show that this allows the magnitude of spectral nudging to be reduced by about a factor of 5 without significant degeneration of model results for the mean path or the eddy variability associated with the Stream. We then add biharmonic Smagorinsky mixing in the momentum equations and show that this permits us to completely eliminate spectral nudging without reintroducing the Gulf Stream overshooting problem. Eddy variability with these modifications to the tracer and momentum equations is then examined to determine the limitations of this approach and suggestions for future work are discussed.

4B5.4 ID:2335 11:15

The effects of eddy parameterization in a coarse-resolution global ocean and sea-ice model

Zeliang Wang [1], *Dan Wright* [1], *Youyu Lu* [2], *Greg Holloway* [3], *Frederic Dupont* [1]
[1] Bedford Institue of Oceanography
[2] Environment Canada
[3] Inst of Ocean Sciences
Contact:

Solutions of a coarse-resolution global ocean and sea-ice model are examined, with an emphasis on the large-scale circulation and seasonal sea-ice variations. The model is based on the Nucleus for European Modelling of the Ocean (NEMO), has a nominal horizontal resolution of 1-degree in latitude/longitude, and surface forcing is determined by daily climatological fields. The curvilinear grid has finer resolution (to ~20 km) in the Canadian Arctic. It is demonstrated that model solutions are sensitive to two schemes implemented for parameterizing the effects of un-resolved meso-scale eddies. First, the eddy topographic stress parameterization (“neptune”) provides well-defined representations of Deep Western Boundary Currents at mid-latitudes and of the Arctic “Rim Current”; both of these currents are much weaker without neptune. In the Southern Ocean, the Weddell Sea polynya appears/disappears with/without neptune. Initial indications are that the appearance of the polynya is associated with the strong interaction of local currents with topography near the Maud Rise. Second, including the Gent-McWilliam parameterization of the eddy-induced tracer transport velocity has significant influences on the circulation in the North Atlantic, including the path and intensity of the Gulf Stream, the strength of the subpolar gyre, and the pattern of the deep circulations.

4B5.5 ID:2355 11:30

Sensitivity study of the North Atlantic circulation. What are the optimal parameters or parametrizations in NEMO?

Frederic Dupont [1], *Dan Wright* [2], *Zeliang Wang* [2], *Keith Thompson* [3]
[1] GOAPP, Dalhousie U.
[2] BIO, DFO

[3] Oceanography, Dalhousie U.
Contact: frederic.dupont@dal.ca

Using altimetry product for mean sea surface topography, standard deviation and skewness of sea surface height, we characterize the effect of different parameterizations on the North Atlantic circulation. The model used is NEMO (Nucleus for European Modelling of the Ocean) run at ¼ degrees nominal resolution. The parameters include lateral mixing coefficents and the continuous varying parameter controlling the lateral slip nature of the flow between free-slip and no-slip. The parameterizations include replacing sponge boundaries by open boundaries, use of different energy and/or enstrophy conserving schemes, and use of a Smagorinsky paramatrization for momentum lateral mixing.

4B5.6 ID:2253 **11:45**

Rossby Waves and the North Pacific Current

Shawn M. Donohue , *Michael W. Stacey* , *Jennifer A. Shore*
Royal Military College of Canada
Contact: stacey-m@rmc.ca

The Parallel Ocean Program (POP) is used to produce a simulation of the circulation of the North Pacific Ocean for the time period 1960-2006. The horizontal resolution of the model is 0.25 degrees, and there are 28 unequally spaced vertical levels. The vertical spacing is as small as about 10 m in the surface layer where the spatial variability in the circulation is the greatest. Spectral nudging is used to prevent model drift from Levitus, monthly climatology. The model is forced with NCEP mean monthly winds, sea-surface heat and freshwater flux, and sea-surface pressure. Our primary region of interest is the Northeast Pacific Ocean. The influence of the ENSO and the Pacific Decadal Oscillations (PDO 1 & 2) are evident in the simulations. Wavenumber-frequency analyses show clear evidence for mode-1 Rossby waves with periods of 2-5 years, wavelengths of 350-1000 km, and phase speeds of 1-2 cm/s. A number of coastal locations are identified as source regions for these Rossby waves. The observed north-south variability in the location of the North Pacific Current is reproduced by the model and is attributed in large part to these Rossby waves. The largest current and transport anomolies occurred at Ocean Weather Station Papa when Rossby waves passed through there in 1986, 1990 and 2000. Because the model covers the time period from 1960 to 2006, it produces estimates of the location of the North Pacific Current for periods of time for which there are no observations. It can take Rossby waves as long as five years to propagate from the coast to a location where they can influence the location of the North Pacific Current, so there can be a five year lag between cause and effect, the effect being independent of the contemporaneous, local winds. This time lag suggests that there may be a degree of predictability in the location of the North Pacific Current.

4C5.1 ID:2613 **13:00**

Communications Boot Camp - Getting the message out / Atelier de communication - Faire passer le message

Dawn Conway , *Kelly Crowe*
CFCAS/FCSCA
Contact: conway@cfcas.org

Communication of results is an essential element in the research enterprise: publicly funded scientists have a responsibility to get their results known - and do, in scientific fora. Step outside that context and it can be a minefield. What if the press gets the message wrong, sceptics ridicule your work, or undermine its credibility? What if you - or your family - are attacked for your opinions? How to you respond to unanswerable questions? This special session will review effective messaging; interview techniques and presentation; dealing with bad press; preparing op-ed articles or letters to the editor; organizing public events; handling 'loose cannons'; influencing decision makers; and other 'popular' science communications. The session is organized in three parts: Who, what and how?; The interview; and the Weird and wacky.

Dans toute entreprise de recherche, la communication des résultats est un élément essentiel : les scientifiques soutenus par les fonds publics ont la responsabilité de faire connaître leurs résultats - ce qu'ils font, dans des tribunes scientifiques. Cependant, hors du milieu scientifique ils risquent de se retrouver en terrain miné. Qu'arrive-t-il si les médias saisissent mal le message, ou si des sceptiques ridiculisent votre travail ou minent votre crédibilité? Que se passe-t-il si vous-même - ou votre famille - êtes attaqués pour vos opinions? Comment répondre à des questions impossibles à répondre? Cette séance spéciale sera consacrée aux thèmes suivants : messages efficaces; techniques d'interview et présentation; comment réagir à la mauvaise presse; préparation d'articles d'opinion ou de lettres au rédacteur; organisation d'événements publics; comment faire face aux « électrons libres »; influencer les décideurs; autres communications scientifiques « populaires ». Cette séance est structurée en trois parties : Qui, quoi et comment?; L'interview; Aspects insolites.