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CMOS BULLETIN SCMO

Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

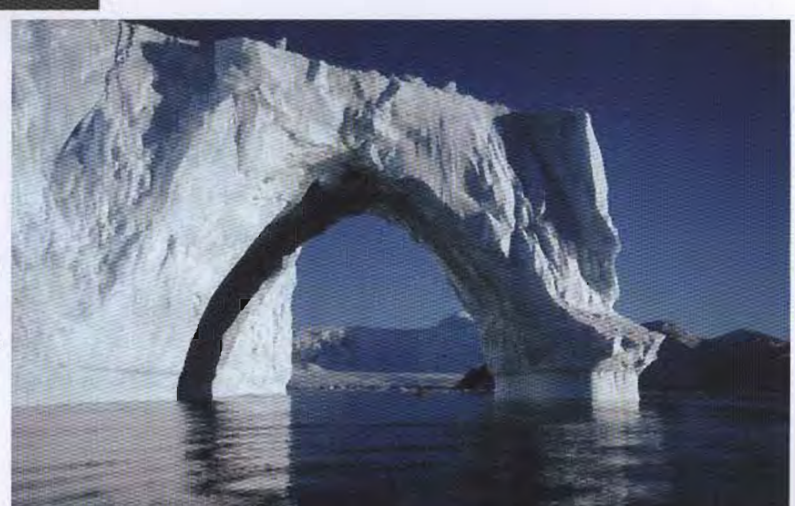
April / avril 2007 Vol.35 No.2

INTERNATIONAL POLAR YEAR / ANNÉE POLAIRE INTERNATIONALE

2007 - 2008

Elephant Foot Glacier

Glacier pied d'éléphant



Ice Arch

Arche de glace

Canadian Oceanographic Historical Photos
Photos historiques de l'océanographie canadienne

Baffin Cruise to the Gulf Stream Extension Region East of the Grand Banks of Newfoundland - 1964

Back row (left to right): Allyn Clarke, Gerry MacDonald, David Fisher, Iver Pagden.
Middle row: Charlie Ross, Wilf Young, Ed Batoosingh, Ray Hiltz, Al Grant, Elmer Lewis, W. Pearce?
Front Row: Larry Murdoch, Ship's Doctor, Ced Mann, Capt. Brick, Tom Foote

---

Pacific Oceanographic Group - 1950s

Back row (l to r): Bert Bennett, Harry Hollister, Terry Terhune.
Third row: Margaret Smith, Dick Herlinveaux, Bev Berisford.
Second row: Laurie McCracken, Al Stickland, Fred Barber.
Front row: John P. Tully, Al Dodimead, Art Groll, Sus Tabata.

....from the President's Desk

Friends and colleagues:

Geoff Strong
CMOS President
Président de la SCMO

Interdisciplinary Activities

At this writing, most Canadians continue to struggle through our usual long winter; long indeed, but noticeably less cold than we experienced in previous decades in most regions of the country. Most of us are looking forward to spring, and with it, our 41st Congress in late-May, to be co-sponsored with the Canadian Geophysical Union (CGU) and the American Meteorological Society (AMS) in St. John's. This will be the first time that CMOS and CGU have held a joint congress, perhaps long overdue (although we did collaborate with AGU at the 1980 Congress). One of the big advantages of this joint congress is that it formally brings together Canada's meteorologists, oceanographers and hydrologists for the first time at a national meeting. Together with combined meetings of the AMS and the Eastern Snow Conference, this promises to be our largest-ever congress, possibly even exceeding 1000 participants, one indication being the record number of abstracts that have been received. With the goodwill generated from this, CGU and CMOS Executives have already taken this opportunity to discuss other areas of cooperation, and we are planning to formalize a Canadian umbrella committee of CMOS, CGU and related societies to discuss collaborative science on a regular basis. A 'terms-of-reference' for this national committee is forthcoming.

Funding issues

We forewarn our membership of three important funding requests that you will be asked to approve at our Annual General Meeting (AGM) at Congress this May. *First*, our *membership fees* (e.g., $60 for regular members) have remained constant since 2002, and no longer cover minimal expenses of the Society. We have remained afloat thanks to surpluses generated by congresses in recent years. Our fees, therefore, need to be brought into line with those of other societies - for example, AMS dues are approximately $95 Canadian with similar privileges, Royal Meteorological Society $133. Council is recommending a modest increase in regular fees to $80 commencing in 2008 (an average increase of about 5% per year since 2002), with similar increases to other member categories.

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CMOS Bulletin SCMO
"at the service of its members / au service de ses membres"

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Cover page : The International Polar Year (IPY) was officially launched in Paris March 1st. Being a major international scientific project, IPY will undertake more than 220 projects from more than sixty countries. This new polar year will concentrate its efforts on social sciences about societies living in polar regions and their adaptation to global climate change. In effect, the IPY will last two years, until March 2009. To learn more about IPY, please read the article on **page 52**.

Page couverture: L'Année polaire internationale (API) a été ouverte officiellement le 1er mars à Paris. Projet scientifique international de grande envergure, l'API va mobiliser plus de 220 projets scientifiques de plus de soixante pays. La nouvelle année polaire se concentrera sur les sciences sociales à propos des sociétés vivant dans les régions polaires et leur adaptation au changement climatique planétaire. L'Année polaire durera en fait deux ans, soit jusqu'en mars de l'an 2009. Pour en savoir plus sur l'API, prière de lire l'article en **page 55.**

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Second, our Ottawa staff carry out most of the on-going day-to-day activities of CMOS, including maintenance of our web site, the huge task of putting together our publications (ATMOSPHERE-OCEAN, CMOS Bulletin SCMO), correspondence, and now a major role in the organizing and functioning of our annual congresses (registration, abstract receipts, etc.). While our Executive Director, Office Manager, Director of Publications and Bulletin Editor each receive some remuneration, none of these come even close to professional compensation for their actual expertise and time, not to mention their dedication. These remunerations therefore amount to essentially honoraria and have not been revised for several years, so that Council is now recommending increases to each of these.

And *third*, Council has now approved in principle the new position of *Communications Officer* for CMOS. This position in the Society is very much needed, and requires a dedicated professional with expertise in that area. The job would include raising the profile of CMOS, handling media communications, attracting new members, and improved communication with and assistance to our Centres and Congress organizing committees. It remains to be seen how we eventually fund this position, but initially it would be filled by a volunteer with an honorarium, and this preliminary level of funding has been included in the proposed 2008 budget being submitted to the Congress AGM in May.

Climate Change

During February, CMOS approved the release of an updated position and statement on climate change. Our science is very focussed on climate change at present and will continue to be so, but it is an area very much complicated by the political winds of change, climate change skeptics, and some resulting confusion in the media, so that this field is changing more rapidly than the climate itself. CMOS therefore feels that periodic updates to our statements are necessary, keeping strictly to the science and its defence, while refraining from political statements. Our latest statement happens to coincide with the release of the Working Group I summary of the IPCC 4^{th} Climate Change Assessment report (http://www.ipcc.ch/). The updated CMOS position and statement should appear shortly in the Bulletin and on our web site (at http://www.cmos.ca/policies.html). Continued inputs from our membership are welcomed on this.

Somewhat surprisingly, my invitation in the last issue to respond to my answers to three questions typically raised regarding climate warming generated zero - zilch replies to date! I'm confident that this does not reflect any lack of controversy, and some may still submit comments, whether in agreement or disagreement. We welcome such comments, particularly those based on refereed science.

Research Funding

Finally, for those interested in the research side of things, you may be wondering what is happening to the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS). Virtually all CFCAS research funds have now been allocated to projects and networks ranging between three and five years' duration (http://www.cfcas.org/funded_projects_e.html), as the Foundation's present mandate runs out in March of 2011. Be assured that the Foundation is very active in seeking renewed funding from the federal government with an expanded mandate to include related areas of research, and that CMOS supports this effort.

That's it for this issue. I hope I will see most of you at the St. John's Congress, and if you do attend, please consider participating in some of the business meetings of the Society. Get involved and volunteer!

Cheers,

Geoff Strong
President / Président

Highlights of Recent CMOS Meetings

January - February 2007

The following is a list of CMOS meetings during this period, including some abbreviated points on issues covered.

Jan. 15 – President participated in *CFCAS* teleconference; discussed external evaluation of CFCAS activities to date; discussed strategies regarding proposal to federal government for extended funding to CFCAS beyond 2010.

Jan. 23 – Held second teleconference with CGU executive; preliminary discussions on the need for an umbrella committee for collaboration between CGU, CMOS and related scientific societies and groups.

Jan. 25 – CMOS '*Virtual Fellows*' teleconference to discuss potential activities for CMOS Fellows, and how to encourage nominations for Fellows, particularly among the oceanographic community.

Jan. 31 – 5^{th} CMOS Executive meeting – delegated by Council, directed Executive Director to designate funding in the 2008 budget for salary and associated operating funds for the Communications Officer; approved with minor revision the updated policy statements on climate change for publication in the *CMOS Bulletin SCMO* and on the web site; approved funding support to several centres for science fairs and workshops; reviewed plans for and gave enthusiastic support to 2007 (St. John's) and 2008 (Kelowna) congress organizing committees.

Feb. 26 – Third teleconference with CGU Executive; confirmed intentions to form a Canadian umbrella committee for collaborative science among CMOS, CGU and related Canadian societies.

Feb. 26 – 6th CMOS Executive meeting – routine CMOS business.

Feb. 27 – CMOS Finance and Investment Committee (FIC) teleconference – draft 2008 budget was reviewed; discussed overdue increases in remunerations to Ottawa CMOS staff and budget implications; reviewed and approved 2007 Congress budget.

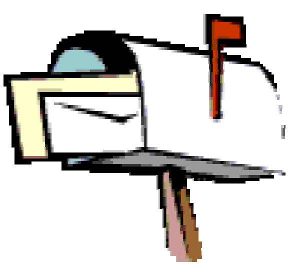
Upcoming CMOS meetings:

- CFCAS Board meeting to discuss interim evaluation, funding proposal, 08 March;
- *ad hoc* Strategic Planning Committee, March, TBA;
- Council, 28 March;
- 7th Executive Meeting, 01 May;
- CMOS/CGU combined Executives meeting at Congress, 27 May;
- CMOS and CGU Business/Committee meetings at Congress, 28 May;
- CMOS Annual General Meeting at Congress, 30 May.

Letter to the Editor

Date: 1 February 2007

Subject: Saros Cycle



It seems logical to me that, in early human communities, solar and lunar periodicity would have been observed, discussed and recorded in stone. The perigeal eclipse with its associated warmer weather and higher tides would have been worthy of being treated in this manner and appears to have been so installed by some circles in Celtic coastal societies, over 2000 years ago.

The recent discovery of what is believed to be a more sophisticated tidal recorder emphasizes how important natural environmental variation has exercised intelligent beings since the last Ice Age. Is the "tunnel vision" approach to GHG warming losing sight of examining the natural variation integers in climate change with equal diligence?

I felt it might be appropriate, as we will be getting the IPCC 2007 Report this week, to write a few lines on the Saros cycle, one of the natural variables which affects sea temperature and probably ice cover inter-decadally, but is unlikely to be mentioned in that report.

M.R. Morgan
Dartmouth, NS

The Saros Cycle

The effect of cyclical solar variability in climate change has never been thoroughly assessed, by the IPCC, despite the fact that palaeo-climatologists have provided ample proxy evidence of its contribution to the climate during the pre-industrial era of the last millennium.

On the other hand, oceanographers involved in tidal predictions have so precisely analysed past trends in the luni-solar precession that future tidal conditions can be confidently issued. Moreover, there is evidence to suggest that luni-solar eclipses were monitored and recorded closely during the Stone Age. Specifically, the perigean eclipse of 18.6 years periodicity, now referred to as the Saros Cycle, appears to have been presaged by vertical stone marker arrays, devised by Celtic peoples, over 2,500 years ago.

Interest in this hypothesis has recently been accentuated by the recovery of a bronze mechanical device, from a wreck in the Ægean Sea, which could have been used for the prediction of solar, lunar and planetary precession. It comprises relics of a machine having precision-cut bronze gears with partial instructions for its use in ancient Greek of the BC 100-200 period. It could possibly have been devised by Hipparcus, the renowned astronomer who was alive at that time. In the UK, Saros Circles comprising 18 stones, with two remote indicators, have been found in Scotland, Cornwall and also in Brittany, France. It would appear that the sea was closer to their locations in those days and shell-fish was the most prolific food source - middens in the nearby remains of villages comprise mainly mounds of shells.

The Saros Cycle has been found to be associated with warmer sea surface temperature and coastal climate change (Loder and Garrett, 1978). It is interesting that during the last two Saros Cycles (in 1980-81 and 1998-99) anomalous summer melts in sea ice occurred in the Canadian Arctic. Higher tidal ranges and stronger tidal streams would have been present during these Saros periods. Consequently, it is feasible that in the narrow channels of fjord coastline of the Canadian Arctic and west Greenland, tidal erosion could have been a contributory cause of the more rapid disintegration and widespread melting which occurred at those times.

Canadian Oceanographic Historical Photos

In 2005, the Canadian National Committee for SCOR www.cncscor.ca initiated a project to establish an on-line archive of Canadian oceanographic photographs. There are presently 47 photos in the archive. In the main, submissions have been scanned photos sent by email. In a few instances some providers did not have such capabilities; in these cases arrangements were made with a third party for scanning and submission to the archive. The host site has been established through the efforts of CMOS at :

http://www.cmos.ca/Oceanphotos/photoindex.html

A dedicated search engine is on the site to enable readers to locate individuals in the archive. A parallel effort for Canadian meteorological photos may be found at :

http://cmos.ca/Metphotos/photoindex.html

Photos are meant be reasonably clear to be able to identify individuals in the photo, and have a caption that would explain the event (a cruise, conference, university faculty, etc.), a date (year) of the event, and an organized list of (many) of those in the photo. Obviously we are looking for Canadian content, but international content would also be useful if there were several Canadian oceanographic participants. Realizing the significance of "ships" to oceanographic effort we have also tried to obtain photos of Canadian oceanographic vessels as well as photos of people. The principal criteria is have a good clear input photo. JPEG is the preferred format.

If you are able to help out, it would be appreciated if you could send a few scanned photos to **Dick Stoddart** (dick.stoddart@sympatico.ca) at your convenience. If you have better quality (clearer) photos that could replace some of the more blurry photos in the existing archive that would help the archive greatly. Check your shoeboxes and see if you could supply one or more. To spur your appetite to supply some photos, we have shown on the inside cover page (Page ii) two representative photos from the current archive.

Photos historiques de l'océanographie canadienne

En l'année 2005, le Comité national canadien pour SCOR www.cncscor.ca a amorcé le projet d'instaurer sur internet des archives de photographies de l'océanographie canadienne. On y trouve présentement 47 photos archivées. En général, on nous a envoyé par courriel des photos numérisées. Toutefois, dans quelques cas, comme plusieurs personnes ne pouvaient pas utiliser cette façon de faire, on a dû recourir à une tierce personne pour la numérisation des photos afin de les soumettre pour les archives. Grâce aux efforts de la SCMO, on utilise le site web suivant :

http://www.cmos.ca/Oceanphotos/photoindex.html

Afin de donner l'opportunité aux lecteurs de localiser certains individus, on a installé un moteur de recherche. Un effort semblable a été fait pour trouver les photos de la météorologie canadienne :

http://cmos.ca/Metphotos/photoindex.html.

On désire que les photos soient claires afin d'identifier les individus sur celles-ci. On demande aussi que chaque photo ait : une légende qui expliquerait l'événement (comme une croisière, une conférence, une rencontre universitaire, etc.), une date (année) de l'événement et une liste identifiant les noms des individus qui se trouvent sur la photo. Évidemment, on recherche principalement un contenu canadien, toutefois on accepterait un contenu international dans le cas où une photo montrerait plusieurs participants de l'océanographie canadienne. Comme on réalise l'importance des "navires" à l'effort océanographique, nous avons aussi essayé d'obtenir autant des photos de vaisseaux de l'océanographie canadienne que des photos d'individus. En ce qui nous concerne, le critère principal pour accepter une photo, c'est qu'elle soit de bonne clarté. Le format JPEG est préférable.

Si vous possédez quelques photos, nous vous serions reconnaissant d'en faire parvenir quelques-unes numérisées à **Dick Stoddart** (dick.stoddart@sympatico.ca). Dans le cas où vous posséderiez des photos de meilleures qualités (plus claires) que celles qui existent dans les archives, nous apprécierions de les recevoir. Vérifiez vos boîtes de rangement et albums de photos pour voir si vous n'en posséderiez pas quelques-unes. Pour vous donner une bonne idée à nous fournir quelques photos, regardez sur la page couverture intérieure (page ii) deux photos représentatives des photos que l'on retrouve présentement dans nos archives.

Fisheries and Oceans Canada

Centre for Ocean Model Development and Application (COMDA)

A Virtual Centre of Expertise

By Marty Taillefer[1]

The oceans are changing, in some cases rapidly compared to past historical variations. Surface waters are warming, sea-levels are expected to rise and the oceans are becoming increasingly acidic due to increased CO^2 levels being absorbed by the oceans, jeopardizing many marine eco-systems.

Interestingly, human population growth along the East, West and Arctic ocean coasts of Canada are continuing to grow at an increasing rate. The threats posed to coastal populations and infrastructure by rising sea levels, storm surges, and waves and erosion will mount in coming decades. In addition to climate change and acidification, over-fishing, invasive marine species and toxic blooms will stress the ocean as a food source, as never before.

With these changes in the ocean it is important to understand and predict global and most importantly local oceanic events up to a few days to weeks in advance. To confront this challenge, DFO has established a national Centre of Expertise for Ocean Model Development and Applications (COMDA). COMDA's goals are simple: *to improve DFO's capabilities for ocean and marine eco-system forecasting and analysis*. However, the process is complex: *to coordinate the modeling and technical development of ocean prediction systems and the implementation of ocean forecasting systems nation wide.*

Ocean Modeling Challenges (Figure 1)

Ocean models can assimilate observational information with ocean and eco-system dynamics and provide "state-of-the-ocean" nowcasts and hindcast evaluations of past changes including anthropogenic perturbations, and forecasts of future states on various space and time scales. This is contributing to a revolution in the application of ocean sciences. Many DFO Science programs currently have modelling components; however these activities are not coordinated to their full potential. Shared goals and common outcomes are necessary in ocean forecasting since development costs for operational oceanography are high. COMDA will need to foster team work among scientists. This mutual cooperation will ensure maximum effectiveness from contributing parties such as universities, government departments and other countries.

Given the distributed expertise and requirements for model applications across DFO and Canada, the initial impetus of

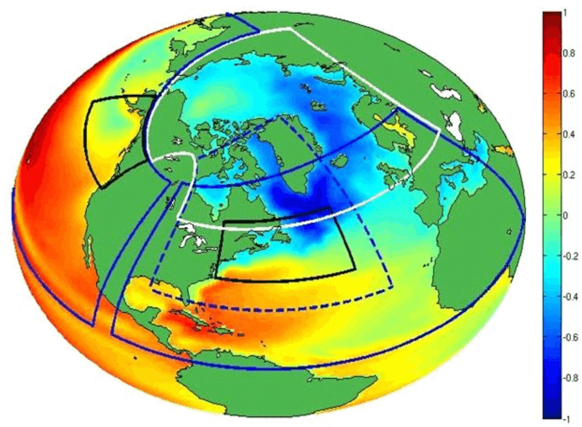


Figure 1: *COMDA modelling areas of interest. Regional and global areas extends over a broad range of space and time scales. Modelling resolution efforts: Global (1º); North-Atlantic (1/4º); North-West Atlantic (1/4º); EAST (1/12º); North-Pacific (1º, 1/4º); Norht-East Pacific (1/4º, 1/12º); Arctic (1º, 1/4º).*

COMDA's coordination effort is to establish a national and inter-agency collaborative team while setting up a modern high-speed electronic communication network to assist with the coordination and cross-pollination of the modeling efforts.

COMDA and CONCEPTS (Figure 2)

COMDA is a virtual Centre of Expertise (COE) hosted by the Bedford Institute of Oceanography in Dartmouth, Nova Scotia and is responsible to DFO's National Science Directors Committee (NSDC). COMDA's Director is Dr. John Loder and is supported by a scientific steering committee with representatives from various DFO labs and regions.

A primary focus of COMDA has been its participation in the interagency initiative CONCEPTS (Canadian Operational Network for Coupled Environmental PredicTion Systems), led by Environment Canada. The set of core projects in CONCEPTS are intended to develop an operational global coupled atmosphere-ice-ocean assimilative and prediction system for Canada. CONCEPTS is a shared and equal partnership with EC, DFO and the Department of National Defence (DND) and internationally, this Canadian modeling

[1] Senior Science Advisor, Operational Oceanography, DFO

consortium, also includes the French Mercator Ocean Operational Oceanography Centre whose ocean model is being adapted for implementation at the Canadian Meteorological Centre (CMC) in Montréal.

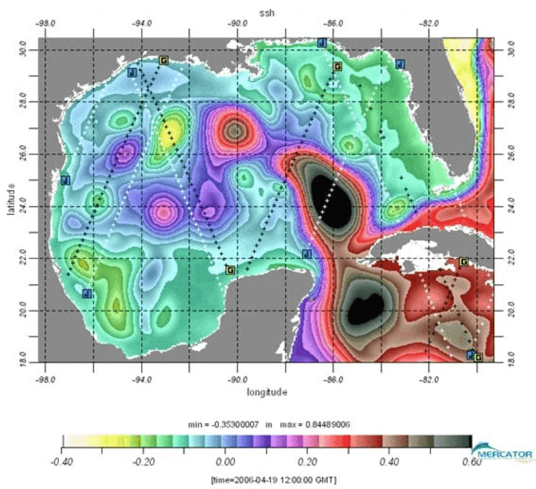


Figure 2: *Mercator Ocean Product: Gulf of Mexico, assimilated tracks at nowcast analysis 19 april 2006.*

COMDA's contributions to CONCEPTS include test and enhancements of the Mercator Ocean model OPA (Ocean Parallise) on domains ranging from global to basin (i.e. Arctic and North Atlantic) to regional scales (nested Atlantic Canadian Shelf). The initiative will build on MSC's existing meteorological and ice forecasting capabilities and infrastructure.

Ultimately, the coupled modelling project is expected to provide an excellent inter-agency framework for DFO and to expand Canadian capabilities in Operational Oceanography. This effort will help ensure the sustained and systematic application of science to provide timely and accurate oceanographic products and services that affect Canadians.

COMDA and CANOOS (Figure 3)

An example of regional operational oceanography efforts is the Canadian Network of Operational Ocean Systems (CANOOS) which builds on existing capabilities and new initiatives within DFO and EC and is an important contributor to the COMDA family. Currently, under CANOOS, is the Observatoire-du-St. Laurent and the East Coast Forecast system.

There are already several operational ocean modeling systems for the East coast of Canada. A successful R&D approach and initiative has been to focus on specific geographic and product development areas. To add to this approach is a new operational forecasting system for the Canadian East coast that is currently under development, involving, participation from the Northwest Atlantic Fisheries Centre (NAFC), the Bedford Institute of Oceanography (BIO), the Gulf Fisheries Center (GFC) and the Institut Maurice-Lamontagne (IML).

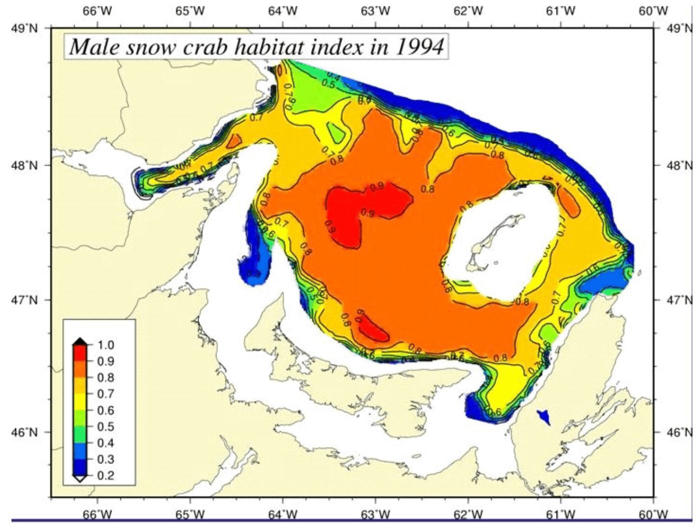


Figure 3: *Understanding ecosystems. A model developed at DFO's Gulf Fisheries Center in Moncton is providing annual predictions of ideal habitat for snow crab in the southern Gulf of St. Lawrence.*

Canada-Newfoundland 0perational Ocean Forecasting System

The first near-operational version of the east coast forecasting system is being developed as an element of the Canada-Newfoundland Operational Ocean Forecast System (C-NOOFS) in St. John's with input from all four regions. It became functional in the summer of 2006, with ongoing system evolution and enhancement. Once the C-NOOFS modeling system entered its operational phase, it has been data-fed by organisations such as the Atlantic Zone Monitoring Program (AZMP) that make major contributions through the timely and routine supply of ocean data.

This North Atlantic system, C-NOOFS is a COMDA pilot project, led by Dr. Fraser Davidson, who is developing a regional ocean forecasting system for the northwest Atlantic, with special emphasis on eastern Canadian waters.

This work is being done in collaboration with the French ocean forecasting service (MERCATOR), the European ocean forecasting consortium (MERSEA), Environment Canada, and Canadian universities.

COMDA Scientists Develop Ocean and Ice Forecast Tools (Figure 4)

Another example of the evolving forecasting tools are those efforts of l'Institut Maurice-Lamontagne (IML), a DFO laboratory in Mont-Joli, Québec. During winter, the presence of ice in the Gulf of St. Lawrence impedes maritime transportation. IML estimates time-of-arrival and safe winter routes for ships. Their initial ice distribution estimates are obtained from Canadian Space Agency satellite images. Ocean models for the Canadian Atlantic coast, developed at IML and DFO's Bedford Institute of Oceanography, are also used by Environment Canada for sea ice forecasting.

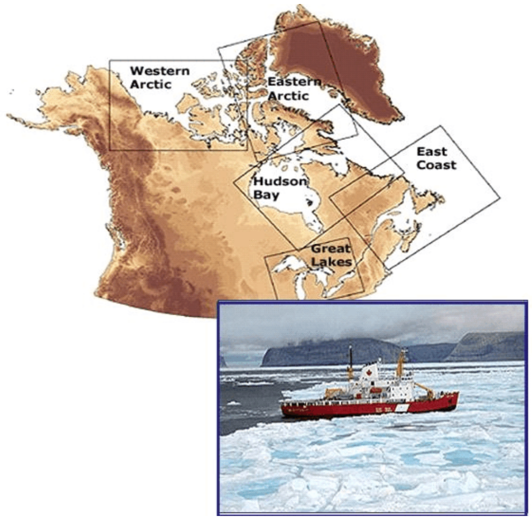


Figure 4: *Ice Forecasting Areas. The Canadian Ice Service needs ocean forecasting to support ship routing, icebreaking operations and to support the Canadian Coast Guard mandate for marine safety in Canadian waters. As the Arctic ice shelf thins and melts, shipping routes across the Arctic seas are increasing in traffic.*

COMDA scientists continue to enhance models to improve the availability of ocean current and surface temperature information to users such as the Canadian Coast Guard (CCG). For example, the CCG must accurately estimate the at-sea location of drifting life raft and other search targets. Improved ocean models will include wave information to provide the best available estimate of surface currents allowing the CCG to effectively search for survivors. These same models concurrently produce wave height and water level predictions for specific near - and offshore sites.

One of the additional developments of C-NOOFS is a scientific version of the Coast Guard's Canadian Search and Rescue Planning Program (CANSARP) software, which uses the latest wind and ocean current forecast to estimate target location of a person fallen overboard or adrift at sea (Figure 5).

Understanding Ecosystems & the Future
Through the efforts of COMDA's national leadership, coordination and advice in areas of ocean model development and the core projects of CONCEPTS, CANOOS and C-NOOFS, operational global and regional ocean monitoring and forecasting systems are and will be important efforts to measure and predict the anticipated adverse effects of climate change upon Canada's ocean eco-systems.

Recent research is making it increasingly clear that climate variability will change and damage the marine environment and the coasts. There is a need to act promptly. These efforts, led by DFO research scientists, allow Canadians to understand the changes and mitigate against adverse effects that will surely cause irreversible damage to nature and human society.

A growing ocean modelling and predictive capability is vitally important in order to help steer a sustainable course in the future.

Figure 5: *CANadian Search And Rescue Program (CANSARP). Canada spends $5 million annually on fuel searching for lost-at-sea targets. Improved modelling will allow greater chances of survival.*

Source: Ocean Newsletter, # 27, February 2007. Reproduced here with the permission of the Editor, Dick Stoddart. The author, Marty Taillefer, made substantial modifications to the original text.

Next Issue *CMOS Bulletin SCMO*

Next issue of the *CMOS Bulletin SCMO* will be published in **June 2007.** Please send your articles, notes, workshop reports or news items before **May 4, 2007** to the address given on page ii. We have an URGENT need for your written contributions.

Prochain numéro du *CMOS Bulletin SCMO*

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en **juin 2007.** Prière de nous faire parvenir avant le **4 mai 2007** vos articles, notes, rapports d'atelier ou nouvelles à l'adresse indiquée à la page ii. Nous avons un besoin URGENT de vos contributions écrites.

The Cariboo Alpine Mesonet

by Shane MacLeod[1] and Stephen J. Déry[1]

Résumé (traduit par la direction): On prévoit que les changements climatiques auront un impact accru sur l'hydrométéorologie des régions montagneuses comme celles du Nord de la Colombie-Britannique (p. ex.., Bradley et autres, 2004). Avec l'augmentation des températures de l'air, le pergélisol va fondre, les glaciers vont reculer, l'accumulation saisonnière de la neige va s'amincir, et les précipitations vont probablement augmenter en raison de l'accroissement de la teneur de l'air plus chaud en vapeur d'eau. Le centre d'intérêt de la recherche entreprise par le Groupe hydrométéorologique du nord à l'Université du Nord de la Colombie-Britannique (UNBC) désire comprendre mieux les effets de la variabilité et du changement du climat sur le bilan hydrique des bassins comme celui du bassin de la rivière Quesnel (QRB), situé à l'intérieur septentrional de la Colombie-Britannique (BC). Le réseau à moyenne échelle de la chaîne Caribou (CAM) est développé par le Groupe hydrométéorologique du nord à l'UNBC qui collecte les données climatologiques à long terme pour la chaîne Caribou du bassin de la rivière Quesnel. Ces données seront analysées au même titre que les mesures de l'écoulement des rivières afin d'élaborer une étude approfondie du bilan hydrique pour le bassin de la rivière Quesnel, et aussi pour rendre plus facile l'analyse, à long terme, à faible intervalle, des tendances et de la variabilité. De plus, la collecte des données par le CAM est disponible sur le réseau (sur demande) de telle sorte qu'elles peuvent être aussi utilisées pour d'autres projets de recherche.

Introduction

Climate change is projected to have an amplified impact on the hydrometeorology of mountainous areas such as Northern British Columbia (BC) (e.g., Bradley et al., 2004). In response to rising air temperatures, permafrost will thaw, glaciers will recede, the seasonal snowpack will thin, and precipitation is likely to increase due to the enhanced water vapour holding capacity of warmer air. The focus of research undertaken by the Northern Hydrometeorology Group at University of Northern British Columbia (UNBC) is to better understand the effects of climate variability and change on the water budget of basins such as the Quesnel River Basin (QRB) in the northern interior of British Columbia. The Cariboo Alpine Mesonet (CAM) is being developed by the Northern Hydrometeorology Group at UNBC to gather long-term climatological data for the Cariboo Mountains within the QRB. These data will be analyzed along with river flow measurements to construct a comprehensive water budget study for the QRB, and to facilitate the analysis of long-term, low-frequency variability and trends. In addition, the data collected by CAM are available online (upon request) such that they will be used in other research projects as well.

CAM currently consists of a network of four meteorological stations positioned at strategic locations within the QRB. The Quesnel River is one of the major tributaries of the Fraser River, the largest drainage basin in BC. The QRB covers an area of about 11,500 km^2 nestled within the North Cariboo region of BC (Figure 1). The terrain varies from flat to mountainous with a mean elevation of 1375 metres above sea level (Burford et al., 2006). Glaciers, deep inland fjord lakes, and the interior temperate rainforest form a unique environment in this watershed. In addition, UNBC's Quesnel River Research Centre (QRRC; http://www.unbc.ca/qrrc/) is conveniently located within the basin. This research facility includes a large workshop, laboratory, office space, and a residence in Likely, BC. This combination of landscape and infrastructure makes the QRB an ideal location for collecting high elevation climatological data.

Instruments deployed in CAM during the summer of 2006 measure air temperature, relative humidity, atmospheric pressure, wind speed and direction, incoming and outgoing longwave and shortwave solar radiation, precipitation, soil temperature, and snow depth. These parameters are recorded by dataloggers that periodically send data to the base station located at QRRC via spread spectrum radio. This paper provides an overview of CAM including some of the considerations for site selections, preliminary findings, and intentions for future development and collaborations.

Station ID	Location	Elevation	Coordinates
Station 1	QRRC	743 m	52°37.1' N 121°35.4' W
Station 2	Spanish Mountain	1509 m	52°33.8' N 121°24.6' W
Station 3	Browntop Mountain	2030 m	52°42.5' N 121°20.0' W
Station 4	Blackbear Mountain	1590m	52°36.9' N 121°26.3' W

Table 1: Identification, location, elevation, and coordinates of CAM station sites.

[1] Environmental Science and Engineering Program, University of Northern British Columbia, Prince George, BC

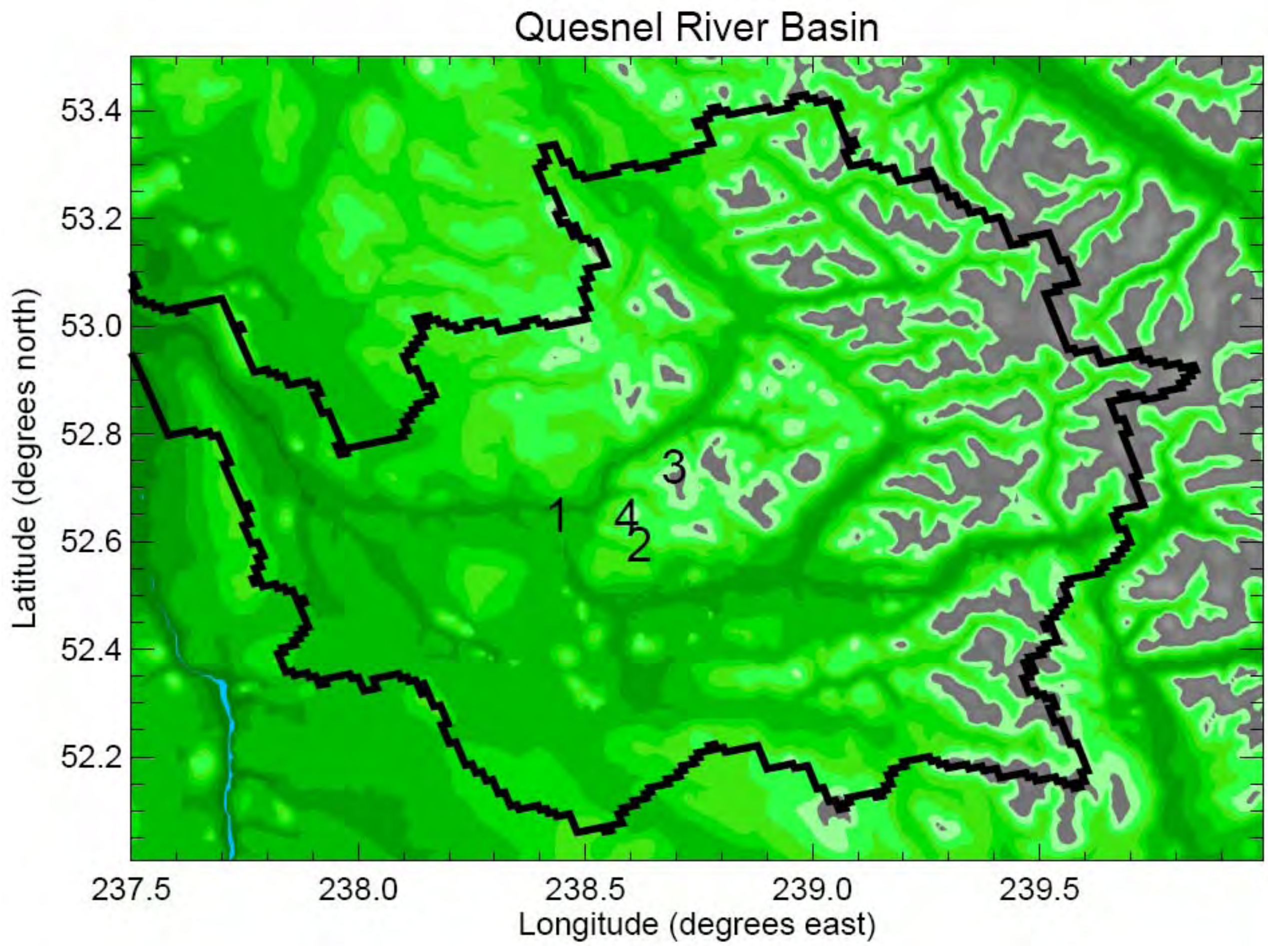


Figure 1: Topographic map of the Quesnel River Basin (bold outline), including the location of CAM meteorological stations and contours of elevation at 200 m intervals. Consult Table 1 (shown above) for station identification.

Site selection

There were a number of qualifications that a site needed to meet prior to the installation of a meteorological station, most notably its elevation. Preferential elevations in range of QRRC for three remote stations were 1500 m, 1750 m, and 2000 m. Each location needed to have line-of-sight, and be within a 30 km radius of QRRC or the repeater station to enable communications with the base station. In addition, each site needed to be appropriate for a meteorological station: a large portion of the sky (preferably greater than 80%) needed to be visible, there would be no large obstructions such as trees, large rocks or bluffs nearby that may create an eddying effect, a level area with minimum 5 m radius was required to allow sufficient space for the tripod and rain gauge to be installed, and it was desirable for the site to be as natural as possible. Accessibility was also a factor since the stations require periodic maintenance; however, it was also important to keep them out of high traffic areas. Ideally the stations would be accessible by a four-wheel drive vehicle and a short hike in summer and by snowmobile or quad in winter. Site selection began in the first week of June 2006 and was completed during the last week of July 2006. Station identification and site information is listed in Table 1, and the following paragraphs provide further details on each meteorological station.

Figure 2: View (facing east) of the Quesnel River Research Centre station.

Station 1: QRRC

The QRRC station was installed at an elevation of 743 m, on a 10-m tower approximately 100 m south of the Quesnel River (Figure 2). Concrete foundations for the tower footing and guy wire anchors were required, making this a permanent structure. This site is not ideal for a meteorological station since QRRC is located within a valley adjacent to the Quesnel River. About 50% of the sky is visible, the clearing is about 60 m in diameter, and the surrounding forest is taller than the tower. Vegetation at the site consists mostly of grasses, and the surrounding forest contains Engelmann spruce, subalpine fir, hemlock and cedar.

At the heart of this station is a Campbell Scientific® CR23x datalogger that was selected owing to its capacity to run a CNR1 net radiometer with heater, and an eddy covariance system in addition to a suite of instruments deployed at the other stations (see Table 2). Data are periodically sent to the base station (also located at QRRC) via spread spectrum radio. The tower can be taken down for service by removing some bolts at the footing and enabling a hinge feature that allows the tower to be tipped over. This made the instrument installation relatively easy; however some of the configuration such as instrument leveling was a bit tricky. The QRRC station began operation on 11 August 2006.

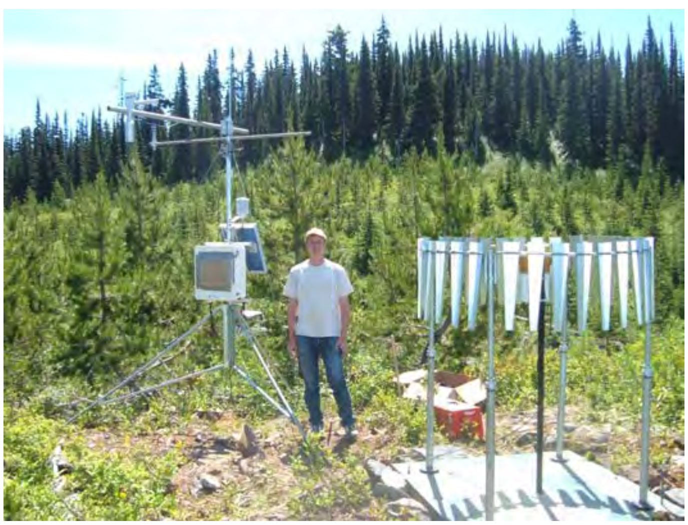


Figure 3: View (facing southeast) of the Spanish Mountain station.

Station 2: Spanish Mountain

Spanish Mountain was chosen as the site of our first remote meteorological station. On 29 June 2006 a site was selected in an old cut block near the summit of Spanish Mountain. Station assembly commenced on the same day, and it became operational on 30 June 2006. The Spanish Mountain site is located at an elevation of 1509 m, on a small rise that extends above a slope near the summit of the mountain (Figure 3). The slope faces northwest, and rises to the southeast of the site at about a 5% gradient. The site is located within a large cut block that is 15-20 years old. The edge of the block closest to the site is located approximately 150 m to the southeast. The trees at the site are young (less than 20 years), well spaced, and have an estimated average height of 3-4 m. Ground cover consists of small shrubs such as blueberry, fireweed and grasses. The site is open, with 75-80% of the sky visible, making this an ideal location for a meteorological station. The Spanish Mountain station is located about 25 m off a logging road, making it the easiest of the remote stations to access with travel time to the site from QRRC at approximately 30 minutes.

Figure 4a)

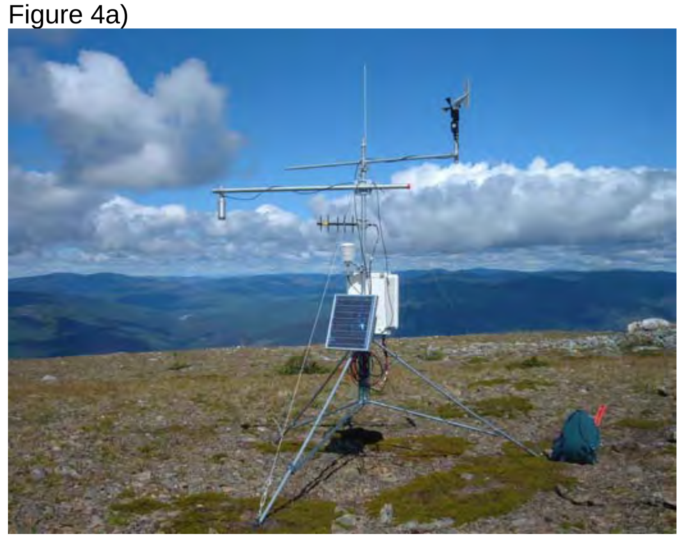


Figure 4b)

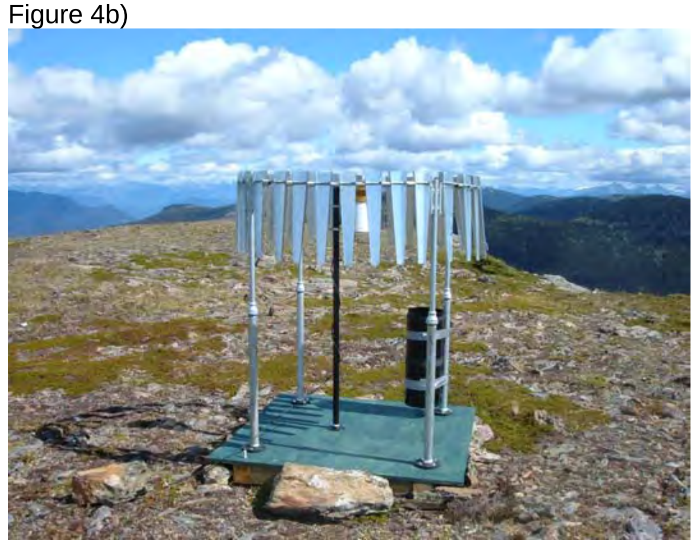


Figure 4: View **a)** facing northwest and **b)** facing east of the Browntop Mountain station.

Station 3: Browntop Mountain

Browntop Mountain was selected because it was the highest elevation site we found that was accessible within a reasonable amount of time and effort. Access time from QRRC is about 2 hours, with half the travel time by four-wheel drive vehicle followed by a steep hike toward the summit. This site was selected in the last week of June, and the station was installed and became operational on 2 August 2006 following the transport of equipment by helicopter to the site earlier that day. The station was installed at the summit of Browntop Mountain where the elevation is 2030 m (Figure 4). The site is ideal for a meteorological station since 100% of the sky is visible, and there are no obstructions nearby. It is located above the tree line such that vegetation remains sparse, and consists of a few small shrubs, grasses and lichens. The ground is mostly rock with some patches of thin soil. There is line-of-sight with Blackbear Mountain and Spanish Mountain, but none with QRRC.

Figure 5: View (facing north) of the Blackbear Mountain station.

Station 4: Blackbear Mountain

The Blackbear Mountain site was selected in July, and the station was installed during the second week of August. The access road to the site has been deactivated such that it is only passable with a large 4x4 truck, or by quad, and travel time to the site is about 1.5 hours from QRRC. The station site is located in a large cut block that crests Blackbear Mountain at an elevation of 1590 m (Figure 5). The cut block is 7 years old and has been planted with pines that have an average height of 1 m. Other vegetation at the site consists of shrubs and grasses. Nearly 80% of the sky is visible at the site, and it has line-of-sight with both Spanish and Browntop Mountains, and QRRC making it an ideal site for a repeater station and meteorological station. The elevation difference between Blackbear Mountain and Spanish Mountain is only 80 m; we wanted the elevation to be 250 m higher than the site at Spanish Mountain, but a suitable site was not found.

The equipment was transported to the top of Blackbear Mountain by helicopter on 2 August 2006, and the station was assembled and became operational one week later on 9 August 2006. Assembly of this station was slightly more complex because we needed to install the repeater station on the same tripod as the meteorological equipment, and ensure there was no conflict with the sensors. The repeater station enables communications among the three remote stations and the base station at QRRC.

Station equipment and functioning

The meteorological equipment was purchased from Campbell Scientific Canada Corporation®; however it should be noted that this report is not an endorsement of their products and services. The remote stations were assembled on CM10 tripods which have a total height of approximately 3 m. The stations are anchored to the ground to preserve the appropriate orientation, and keep sensors stationary. They are also grounded to prevent electronics damage due to lightning strikes. Table 2 below shows a list of sensors used in CAM, along with the parameters they measure, and the stations in which they are deployed. Scan intervals are 60 seconds apart and the data are sampled or averaged and recorded every 15 minutes at all stations.

Most of the sensors were installed and configured as recommended in the manuals. However, the rain gauges were an exception since the construction of concrete footings was not feasible at the remote sites. Instead, the rain gauges were installed on 1.2 m x 1.2 m platforms anchored to the ground with rebar. The platforms support the rain gauges, as well as Alter wind screens that reduce wind effects on precipitation measurements.

The remote stations employ CR1000 dataloggers to power and operate the sensors whereas the QRRC station employs a CR23x datalogger to operate the instruments. This datalogger was selected for the 10-m tower station because it provides the additional power required to operate the heater included with the CNR1 net radiometer, and is capable of running an eddy covariance system and performing the necessary covariance calculations. Dataloggers were programmed using SCWin, CRBasic, and Edlog software packages included with Loggernet.

A base station computer was installed at QRRC to program and update the dataloggers, as well as to receive and store data. This station acts as a gateway to online data retrieval, as soon as broadband Internet access becomes available at QRRC. Communications between the meteorological stations and the base station is accomplished using spread spectrum radio frequency (RF) radios. RF radios have a range of approximately 30 km within line-of-sight; however, the radio signals are significantly reduced when there are obstructions such as hills or vegetation as well as icing. In addition, the type of antenna used also significantly influences signal strength. These factors were taken into consideration to estimate the effective range of the radios; this range turned out to be approximately 13 km, which influenced the site selection process for the remote stations. After installing the station at Spanish Mountain, it was found that direct radio communication with the base station was impossible due to terrain. This issue was corrected with the installation of a repeater station at the Blackbear Mountain site. Radio communications for the Spanish Mountain and Browntop Mountain stations are thus routed through the repeater station at Blackbear Mountain, to the base station at QRRC. The Blackbear Mountain and QRRC tower stations communicate directly with the base station.

		Sensor	Model #	Measurements	Units	Sensitivity	Accuracy
QRRC TOWER STATIONS	REMOTE STATIONS	RM Young wind monitor	5103	Wind speed / Wind direction	$m\ s^{-1}$ / degrees	information not provided	± 0.3 $m\ s^{-1}$ / ± 3°
		Barometric pressure sensor	61205v	Pressure	hPa	0.1 hPa	± 0.5 hPa
		Tipping bucket rain gauge	TE525	Precipitation	mm	0.254 mm per tip	± 1% (precipitation rate up to 1 in/hr)
		Temperature and RH probe	HMP45C212	Air temperature / Relative humidity	°C / %	information not provided	± 0.1 °C / ± 2% (0-90% RH) / ± 3% (90-100% RH) at 20 °C
		Temperature probe	107B	Soil temperature	°C	information not provided	± 0.9 °C
		Sonic ranging sensor	SR50	Snow depth	cm	0.1 mm	± 0.4% of distance to target
		Net Radiometer	CNR1	Shortwave up/down / Longwave up/down	W^{m-2} / W^{m-2}	6.18 μ V/W^{m-2}	± 10% for daily totals
		Sonic Anemometer	CSAT3 (see note below)	Wind speed / Wind direction	$cm\ s^{-1}$ / degrees	1 $mm\ s^{-1}$ / 1 $mm\ s^{-1}$	± 4.0 cm^{-1} / ± 6% of reading
		Krypton Hygrometer	KH20	water vapour density	$g\ m^{-3}$	1.78 - 18.97 $g\ m^{-3}$ full vapour range	information not provided

Table 2: Meteorological station equipment configurations

Note: The CSAT3 measures wind speed in three different axis: Ux, Uy and Uz. Based on these measurements, a calculation is performed to convert the result to an orthogonal propeller output (m/s and degrees). The sensitivity indicated in the above table for this instrument represents the wind speed sensitivity in the three axis Ux, Uy, Uz, (mm/s).

Preliminary findings

The Quesnel River drainage basin was under the influence of a strong ridge of high pressure during the first week of data collection at Spanish Mountain. These conditions contributed to an active forest fire regime in the region. Even at 1509 m elevation, daily maximum temperatures during this period were around 25°C and the relative humidity averaged 15% to 40% (Figure 6a). Soil temperature closely followed air temperature with a range between 15°C and 25°C, and a time lag of about 6 hours (Figure 6b).

A correlation analysis was performed on temperature and precipitation data collected by the remote stations for the period of 11 August to 19 October 2006. The analysis shows a strong correlation between temperature data from all the remote stations with $r > 0.97$ ($p < 0.001$) for all stations (Figure 5c). The strongest temperature correlation was found between Spanish Mtn and Blackbear Mtn stations as expected since these stations are only a few kilometres apart and located at similar elevations. Correlation analysis of daily precipitation totals revealed a strong correlation between Spanish and Blackbear stations; however, there is little correlation between Blackbear/Browntop and Spanish/Browntop.

Future developments and collaborations

i) Eddy covariance system

An eddy covariance system, composed of a CSAT3 sonic anemometer and KH20 Hygrometer, will also be deployed at QRRC to measure high frequency momentum and water vapour fluxes. These measurements will be the result of covariance calculations performed by the datalogger on the following variables: wind and temperature (CSAT3), and water vapour density (KH20) (Campbell Scientific 2006). The data will be used to gain insight on evapotranspiration rates in the area. This is a joint effort between the Northern Hydrometeorology Group with research groups led by Art Fredeen and Peter Jackson at UNBC.

ii) Blackbear Mountain station

The elevation difference between the Blackbear and Spanish Mountains stations is merely 80 m, and they are a distance of 5 km apart. Since these stations are located relatively close together and at similar elevations, they tend to experience the same climatic conditions. As noted earlier, it is desirable to have a minimum elevation difference of 200 m between stations, and we want to gather data for as much of the study area as possible. For these reasons the Blackbear Mountain station will be relocated to a more appropriate site in summer 2007. Relocating the Blackbear Mountain station will most likely improve communications by eliminating the direct link with the base station, and routing all communications through the repeater station.

Figure 6a)

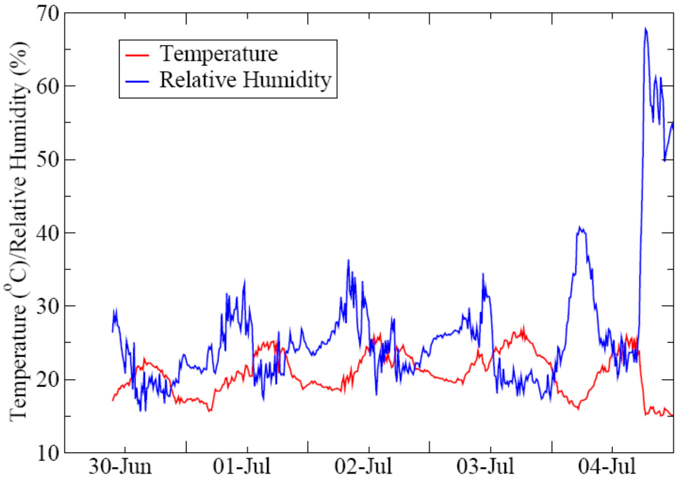


Figure 6b)

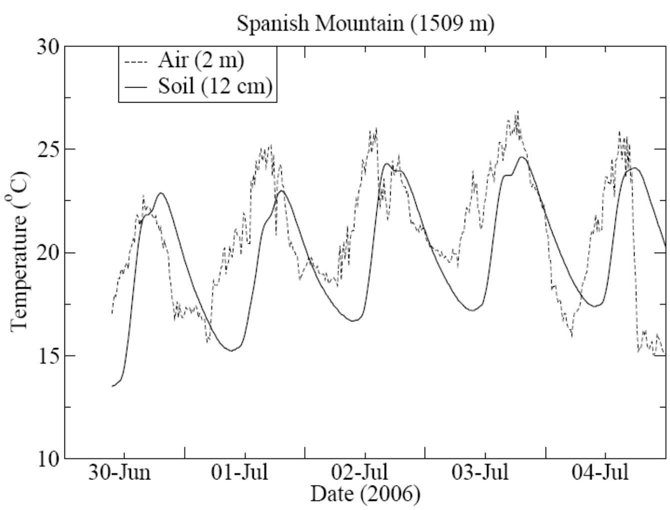


Figure 6: Temporal evolution of **a)** air temperature and relative humidity, and **b)** air and soil temperature for the 5 days following start of data collection at the Spanish Mountain station.

iii) Potential expansion and inclusion of data from outside CAM

The QRB covers complex terrain and multiple biogeoclimatic zones over an area of about 11,500 km^2 (Burford et al., 2006). Thus a network of 4 meteorological stations is not sufficient to properly represent the climate for the entire region. Therefore it is desirable to expand CAM, especially to the higher elevations within the QRB. In addition to relocating the Blackbear Mountain station, we are looking at the feasibility of installing a station on or near a glacier within the study area during the summer of 2007 since 2% of the basin is glacierized (Figure 8). This will provide critical information on the mass balance of glaciers in the Cariboo Mountains, one of seven regions identified for intensive research within the Western Canadian Cryospheric Network (WC^2N). The possibility of expanding CAM by one station per year during the study period is also being considered.

Figure 7a)

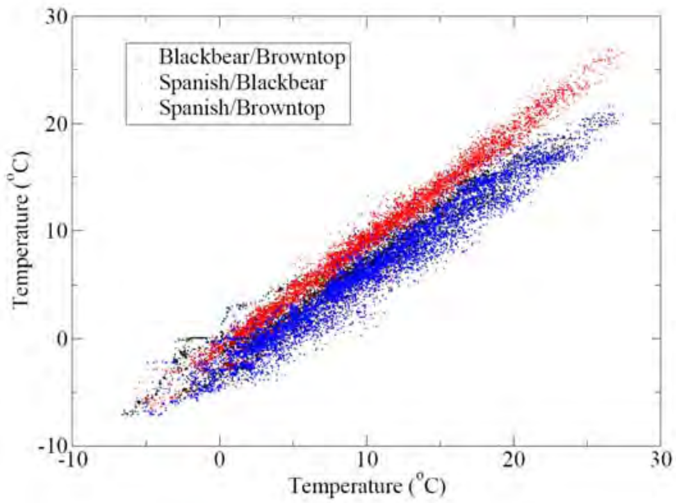


Figure 7b)

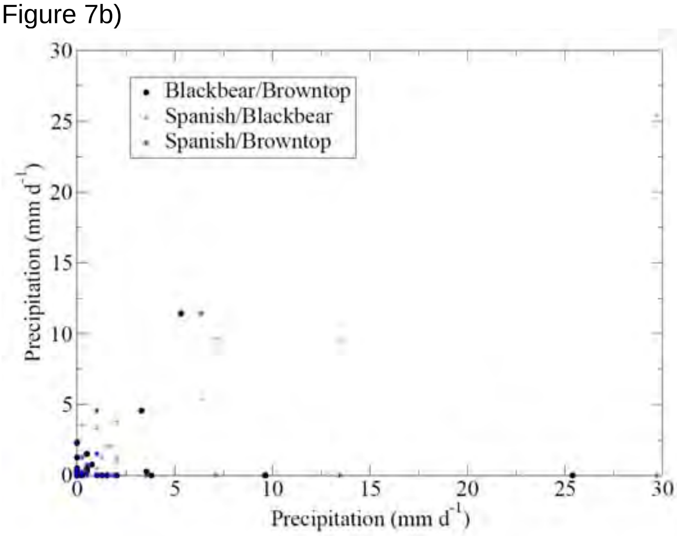


Figure 7: Correlation analysis of **a)** 15-min. temperature and **b)** daily precipitation data between CAM remote stations for the period of 11 August to 19 October 2006.

As in many alpine regions such as the North American Cordillera (Bradley et al., 2004), relatively little meteorological data existed for the QRB until the deployment of CAM in summer 2006. Since work in the Northern Hydrometeorology Group requires long-term, historical climate records, it is desirable to find other records that may fill this gap. There are a few meteorological stations in the vicinity of the QRB that may be able to provide additional data to complete this record. Specifically, stations maintained by the BC Ministry of Forests (Likely Airport, el. 983 m), BC Ministry of Environment (Yanks Peak East, el. 1670 m), and Environment Canada (Barkerville, el.

1265 m) provide crucial hydrometeorological information for the area. Data from Likely Airport and Yanks Peak East are suitable for this work; however, it is unknown how complete these records are, and how far they date back. On the other hand, the Barkerville record dates back to 1888 and provides the third longest continuous climate record in BC. However, it is unknown how representative this climate record is since Barkerville is located 50 km to the north of Likely, BC.

Figure 8: Typical view of the glacier-clad Cariboo Mountains in the eastern part of the QRB.

iv) Collaborations with other users

Apart from ongoing partnerships with other UNBC faculty members, we are seeking collaboration with others to further enhance CAM as well as to offset some of the costs associated with its operation. The data collected by CAM can be invaluable to many fields of study, and is suitable for use with short-and long-term research interests. In addition, QRRC also provides excellent infrastructure to facilitate research activity in the QRB.

v) Website and community outreach

A website is being developed to report our CAM activities as well as to provide online access to meteorological data. The website can be accessed from: http://cam.unbc.ca. Please contact Stephen Déry to obtain the appropriate account information to gain access to the data. Files will be periodically updated with quality-controlled data.

Community outreach is an important component of the CAM project. An article describing the mesonet was published on 3 November 2006 in a local newspaper (http://www.pgfreepress.com/). In addition, Stephen Déry gave a talk to UNBC's Natural Resources and Environmental Studies Institute (NRESi) on 20 October 2006, focussing on the deployment of CAM. Other outreach activities, such as a possible open house at the QRRC, will be conducted to broaden the impacts of this project to the general community.

Acknowledgements:

We thank Rick Holmes, Bill Best, Gordon Schill, RoRy Allen, and Peter Jackson for their assistance in the development of CAM. Funding for CAM has been provided by the Canada Foundation for Innovation, the British Columbia Knowledge Development Fund, the Natural Sciences and Engineering Research Council of Canada, the Canada Research Chair Program of the Government of Canada, and UNBC.

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REMINDER - REMINDER - REMINDER

CMOS has negotiated great membership deals for its members. CMOS members are eligible for a 25% discount off membership fees for the Royal Meteorological Society (RMetS) and the Canadian Geophysical Union (CGU) as associate members. Members of both these societies are also eligible for associate membership in CMOS; so please encourage your colleagues in those societies to join CMOS too.

RAPPEL - RAPPEL - RAPPEL

La SCMO a négocié des tarifs intéressants pour ses membres qui désirent devenir membre de la Société royale de météorologie (RMetS) et de l'Union géophysique canadienne (CGU). Un rabais de 25% est appliqué lorsque vous devenez membre associé de ces deux sociétés savantes. Les membres de ces deux sociétés ont également le privilège de devenir membre associé de la SCMO; dites-le à vos collègues et encouragez-les à joindre la SCMO.

ICSU and WMO launch the largest Polar Research Programme in 50 years

International Polar Year (IPY) 2007-2008 officially got underway on 1 March, 2007. IPY, which is a programme of the International Council for Science (ICSU) and the World Meteorological Organization (WMO), will be the largest internationally coordinated scientific research effort in 50 years.

During the course of IPY, thousands of scientists, from over sixty countries and a wide range of research disciplines, will carry out 220 science and outreach projects under six major themes:

- Status: to determine the present environmental status of the polar regions

- Change: to quantify and understand past and present environmental and social change in the polar regions, and to improve projections of future change;

- Global linkage: to advance our understanding, on all scales, of the links and interactions between polar regions and the rest of the globe, and of the processes controlling these links;

- New frontiers: to investigate the frontiers of science in the polar regions;

- Vantage point: to use the unique vantage point of the polar regions and develop and enhance observatories from the interior of the Earth to the Sun and the cosmos beyond;

- Human dimension: to investigate the cultural, historical, and social processes that shape the sustainability of circumpolar human societies and to identify their unique contributions to global cultural diversity and citizenship.

The campaign also aims to educate and involve the public while helping to train the next generation of engineers, scientists and leaders. Secretary-General of the World Meteorological Organization, Mr Michel Jarraud, says: "IPY comes at a crossroads for the planet's future; February's first phase of the Fourth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC) has shown that these regions are highly vulnerable to rising temperatures."

"However, meteorological and other regular environmental in-situ observation facilities at the poles are few and it is essential to install more and increase satellite coverage to gain a better overall picture of how rapidly these areas are changing, and of the global impact of these changes."

Dr David Carlson, Director of the IPY International Programme Office, says: "We face many challenges as we start: funding, data sharing, and, most importantly, the surprising and rapidly changing nature of the polar regions."

"But we have an enormous strength: international enthusiasm and cooperation, at a higher level and across a wider range of science than most of us will see at any other time in our careers. IPY will succeed because of this scientific urgency and energy."

Previous International Polar Years of 1882-83, 1932-33, and 1957-58 (also known as the International Geophysical Year), each produced major increases in our understanding of the Earth system.

IPY 2007-2008 will initiate a new era in polar science with a stronger emphasis on interdisciplinary research including physical, ecological and social sciences, and strong partnerships with indigenous communities and educators.

Prof. Thomas Rosswall, Executive Director of the International Council for Science, explains: "In comparison with previous Polar Years, we have planned a broader programme involving all the relevant disciplines from both natural and social sciences. The IPY is an excellent example of strengthening international science for the benefit of society – the mission of ICSU."

In order to ensure full and equal coverage of both the Arctic and the Antarctic, IPY will span two full annual cycles, from March 2007 to March 2009.

Many national and regional IPY launch events are being organized over the next few weeks. The official international launch ceremony took place at 11:00am, 1 March, 2007 at the Palais de la Découverte, Paris, France. Media representatives were invited at this special event.

The Canadian launch took place at the Canadian Museun of Civilization, Gatineau, Québec, on March 1, 2007 and also the Yukon ceremony took place at the Elijah Smith Building, Whitehorse, Yukon, on the same day.

IPY History

On three occasions over the past 125 years scientists from around the world banded together to organize concentrated scientific and exploration programs in the polar regions. In each major thrust, or "year," scientific knowledge and geographical exploration were advanced, thereby extending understanding of many geophysical phenomena that influence nature's global systems. Each polar year was a hallmark of international cooperation in science. The experience gained by scientists and governments in international cooperation set the stage for other international scientific collaboration. International scientific cooperation also paved the way for several political accords that gained their momentum from the polar years. IPY 2007-2008 will expand upon this legacy of scientific achievement and societal benefits.

First International Polar Year (1882-1883): The idea of International Polar Years was the inspiration of the Austrian explorer and naval officer Lt. Karl Weyprecht who was a scientist and co-commander of the Austro-Hungarian Polar Expedition of 1872-74. From his experiences in the polar regions Weyprecht became aware that solutions to the fundamental problems of meteorology and geophysics were most likely to be found near the Earth's poles. The key concept of the first IPY was that geophysical phenomena could not be surveyed by one nation alone; rather, an undertaking of this magnitude would require a coordinated international effort. Twelve countries participated and fifteen expeditions to the poles were completed (thirteen to the Arctic, and two to the Antarctic). Beyond the advances to science and geographical exploration, a principal legacy of the First IPY was setting a precedent for international science cooperation. Unfortunately Weyprecht did not live to see his idea come to fruition.

Second International Polar Year (1932-1933): The International Meteorological Organization proposed and promoted the Second IPY (1932–1933) as an effort to investigate the global implications of the newly discovered "Jet Stream". Forty nations participated in the Second IPY, and it heralded advances in meteorology, magnetism, atmospheric science, and in the "mapping" of ionospheric phenomena that advanced radioscience and technology. Forty permanent observation stations were established in the Arctic, creating a step-function expansion in ongoing scientific Arctic research. In Antarctica, the U.S. contribution was the second Byrd Antarctic expedition, which established a winter-long meteorological station approximately 125 miles south of Little America Station on the Ross Ice Shelf at the southern end of Roosevelt Island. This was the first research station inland from Antarctica's coast.

The International Geophysical Year (1957-58): The International Geophysical Year (IGY), 1 July 1957 to 31 December 1958, celebrated the 75th and 25th anniversaries of the First and Second IPYs. The IGY was conceived by a number of post-WWII eminent physicists, including Sydney Chapman, James Van Allen, and Lloyd Berkner, at an informal gathering in Washington, DC in 1950. These individuals realized the potential of the technology developed during WWII (for example, rockets and radar), and they hoped to redirect the technology and scientific momentum towards advances in research, particularly in the upper atmosphere. The IGY's research, discoveries, and vast array of synoptic observations revised or "rewrote" many notions about the Earth's geophysics. One long disputed theory, continental drift, was confirmed. A U.S. satellite discovered the Van Allen Radiation Belt encircling the Earth. Geophysical traverses over the Antarctic icecap yielded the first informed estimates of the total size of Antarctica's ice mass. For many disciplines, the IGY led to an increased level of research that continues to the present. The world's first satellites were launched. A notable political result founded on the IGY was ratification of the Antarctic Treaty in 1961. The success of the IGY also fostered an additional year of research through the International Geophysical Cooperation. The Special Committee for the IGY became the model on which three post-IGY Scientific Committees developed, for Antarctic, Oceanic, and Space Research, and several focussed research efforts including the International Year of the Quiet Sun. The scientific, institutional, and political legacies of the IGY endured for decades, many to the present day.

2007-2008 IPY

In short, the 207-2008 IPY's goal is to study the atmosphere, oceans, ice, land, people and space in Arctic and Antarctic regions:

i) Atmosphere

Large-scale atmospheric circulations produce polar weather systems that result in spring thaws, sea ice movement, and severe winter storms. Changes in storm frequency and intensity accelerate erosion of polar coastlines. Long-range atmospheric transport processes deliver pollutants to Arctic and Antarctic environments. Transport of remote aerosols and local emissions from open ocean leads play major roles in polar cloud formation and in polar precipitation. Peak atmospheric concentrations of man-made ozone-depleting substances will occur approximately during the IPY time span, and because changes in stratospheric temperature, moisture, or circulation might develop during that same period, IPY researchers will give careful attention to polar stratospheric clouds, to ozone loss, and to damaging UV-B radiation penetrating the polar atmosphere.

ii) Oceans

Cooling and freezing processes in key polar regions produce dense cold ocean water. These cold bottom waters flowing from the poles, coupled with warm equatorial surface waters flowing toward the poles, regulate the overall climate of our planet. At the same time, marine ecosystems in polar regions, often dependent on atmospheric transport of trace nutrients from temperate latitudes, play key roles as downward 'biological pumps' in the global carbon cycle. Warmer waters, loss of sea ice, invading species, and contaminants delivered from lower latitudes will affect polar marine ecosystems, particularly top polar predators such as bears, seals and whales. Integration of physical, ecological and economic models will allow development of new strategies for sustainable use of polar marine resources. Marine geologists will establish histories of strategic oceanic gateways to understand past polar ocean current systems.

iii) Ice
IPY occurs amidst abundant evidence of changes in snow and ice, including reductions in extent and mass of glaciers and ice sheets, reductions in area, timing, and duration of snow cover, and reductions in extent and thickness of sea ice. Some changes show clear downward or decreasing trends over recent years and decades. Other changes, for example net mass changes of the massive Greenland and Antarctic ice sheets, remain uncertain in magnitude and direction. Changes in snow cover and sea ice have immediate consequences for land and ocean heating, and for terrestrial and marine ecosystems. Investigators will seek to understand origins of, and connections among, Antarctic sub-glacial lakes and recent evidence of sub-glacial flood-like outflows. The observations and modelling of IPY will document and quantify the extent, rate and impact of snow and ice changes and their integrated impact on global sea level.

iv) Land
Permafrost, a form of ice that influences nearly twenty-five percent (25%) of the northern hemisphere landmass, shows substantial change, mostly in the form of thermal decomposition due to warming air temperatures. Permafrost degradation affects local ecology and hydrology as well as coastal and soil stability. Decomposition of permafrost will mobilize reserves of frozen carbon, some of which, as methane, will increase the global greenhouse effect. Researchers will focus on changes in hydrological systems, on vegetation changes, on wildlife populations and on the overall habitability of the Arctic, and will use integrated geophysical, ecological and economic models to determine thresholds of critical change in, for example, human-Rangifer (caribou) systems. Geologists and geophysicists will work to understand factors that initiated and guided formation of Antarctic ice sheets, particularly in the region of the ice-covered Gamburtsev Mountains.

v) People
IPY promotes constructive and respectful engagement with northern people, through community monitoring, through acknowledgement and protection of traditional knowledge, and through inclusion of northern people as valued partners in planning and conducting IPY and in evaluating and assessing IPY results and legacies. IPY researchers will focus on northern human health, particularly on impacts of pollution, contaminants and parasites in traditional foods, existing and emerging infectious diseases, chronic diseases, and unhealthy behaviours. Researchers will explore many facets of Arctic social systems, to determine resiliency to internal and external change and to develop adaptation and mitigation strategies. IPY investigations will include studies of unique uses of language, such as for intergenerational understanding of sea ice, studies of how legal systems protect the value and integrity of traditional knowledge, and economic and social assessments of the impacts and opportunities related to natural resource management and energy and transportation developments.

vi) Space
Space research during IPY focusses on space itself, particularly solar processes that impact earth's outer atmosphere, on making measurements of distant space from polar regions, and on the use of satellite sensors in space to monitor polar conditions and processes. In partnership with the International Heliophysical Year, IPY scientists will explore global geoelectric circuits and the auroras, and relationships of those systems with meteorological and solar variations. Researchers will evaluate Antarctic sites for suitability as locations of future astronomical facilities to determine, for example, polarization of the cosmic microwave radiation. Other researchers will make new polar geomagnetic measurements to help quantify a rapid field decrease that may signal a reversal of the Earth's field and drift of the magnetic poles. Satellite sensors will provide large-scale views of snow and ice properties and dynamics, of ocean colour and roughness, of terrestrial geography and vegetation, and of atmospheric processes and properties.

Note from the Editor: Prepared and presented by Paul-André Bolduc, *CMOS Bulletin SCMO* Editor, based on information found on IPY web site at http://www.ipy.org early March 2007.

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L'Année polaire internationale ouverte officiellement à Paris

sur fond de réchauffement climatique

L'Année polaire internationale a été ouverte officiellement le 1er mars à Paris, sur fond de réchauffement climatique. Projet scientifique international sans précédent depuis un demi-siècle, elle va mobiliser 220 projets scientifiques de plus de soixante pays. Ces projets concernent la physique, la biologie ou les sociétés des régions polaires. La nouvelle année polaire se concentrera sur les sciences sociales à propos des sociétés vivant dans les régions polaires et leur adaptation au changement climatique planétaire. L'Année polaire durera en fait deux ans, soit jusqu'en mars de l'an 2009.

Au Canada, le lancement s'est tenu au Musée canadien des civilisations situé à Gatineau, Québec, le 1er mars dernier. Une cérémonie similaire s'est tenue dans l'édifice Elijah Smith, Whitehorse, Yukon, le même jour.

En 1882-1883 eut lieu la première année polaire internationale (API). A l'origine de cet événement, la constatation que les phénomènes géophysiques ne pouvaient pas être appréhendés de manière unilatérale, par les nations. Douze pays rassemblèrent donc leurs forces pour organiser cette année là treize expéditions en Arctique et deux en Antarctique. C'est à cette occasion, par exemple, que les américains établirent leur base à Barrow, le long de la côte nord de l'Alaska.

La deuxième API fut initiée par l'Organisation Mondiale de la Météorologie en 1932-1933 pour étudier spécifiquement les implications, au niveau mondial, du "Jet Stream", récemment découvert. Des avancées significatives furent alors obtenues dans les domaines de la météorologie, le magnétisme, les sciences atmosphériques et ionosphériques.

Enfin, en 1957-1958, la troisième API se fit dans le cadre de l'Année Géophysique Internationale (AGI). Au lendemain de la seconde guerre mondiale, les scientifiques souhaitaient appliquer les avancées technologiques récentes (fusées, radars, etc.) à des fins plus pacifiques, notamment dans des recherches sur la haute atmosphère. En fait, l'AGI fut l'occasion d'un effort sans précédent à l'échelon mondial pour l'étude de notre planète. Les décennies de recherche qui ont suivi reposent à l'évidence sur la dynamique initiée au cours de cette année. Ce fut par exemple la confirmation de la théorie très discutée de la dérive des continents, le début des mesures de CO_2 à l'observatoire de Mauna Loa, ou encore le début de la conquête spatiale avec le lancement du premier Spoutnik. Plus spécifiquement, la recherche polaire a véritablement pris son essor à partir de cette époque : douze nations ont établi plus de cinquante observatoires sur le continent antarctique dont Amundsen-Scott (USA), Vostok (URSS) et Dumont d'Urville (France). Cet effort a été à l'origine de la signature du Traité de l'Antarctique en 1961, puis de l'adhésion au Protocole de Madrid pour la protection de cet environnement exceptionnel en 1991.

125 ans après la première API et 50 ans après l'AGI, la communauté scientifique internationale s'apprête à organiser la 4ème Année Polaire Internationale en 2007-2008. Le but de ce grand projet international est d'étudier l'atmosphère, les océans, la glace, la terre, les personnes et l'espace dans les régions arctique et antarctique.

Cette nouvelle API sera l'occasion d'organiser des campagnes internationales de grande envergure, capables de faire franchir de nouvelles étapes à la recherche polaire. Ces campagnes se dérouleront tant dans l'hémisphère nord que dans l'hémisphère sud et participeront à démontrer le rôle moteur que jouent les régions polaires vis-à-vis du reste de la planète. Toutes les disciplines seront concernées, incluant les sciences humaines et sociales, mais les projets devront présenter une approche interdisciplinaire et impliquer des acteurs internationaux.

Avis du Rédacteur: Préparé et présenté par Paul-André Bolduc, Rédacteur, *CMOS Bulletin SCMO*, à partir de l'information publiée sur le site web de Ifremer, France à http://www.ifremer.fr/ifrtp au début de mars 2007.

Early History of The Central Analysis Office (CAO) in Ottawa

by George W. Robertson[1]

As I recall…..

I received notice early in 1950 that I had been successful in a competition for Central Analysis Office (CAO) staff. We sold our home in Edmonton and traveled by car to Ottawa in late October. On the way east we met Hugh Cameron and his family in a motel in Sault-Saint Marie. He was on his way east from Winnipeg also to join the CAO Staff. When we arrived at the CAO we found that the Officer-in-Charge, Jim Leaver, had already established a small office in a temporary building along Wellington Street and acquired a small staff consisting of Ralph Anderson from Winnipeg and Don McClellan. All original staff members were former wartime MetMen (1) (2).

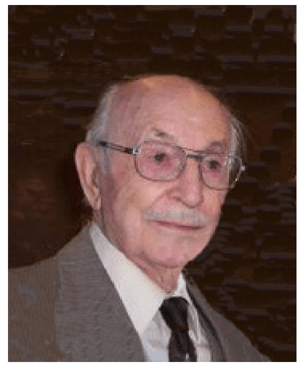
Prior to his appointment in May 1950 as OIC of the CAO, Jim was OIC of the District Aviation Forecast Office (DAFO) at Rockcliffe Airport. It appears that he may have established a temporary quarters for the CAO at the Rockcliffe Airport before moving to the Wellington Street site. The office at this site was in a temporary wartime building on the right-hand side of the U-drive around the quadrangle upon leaving the Supreme Court Building to enter Wellington Street.

A small unit of technical support staff and map plotters was recruited in 1950 and early in 1951. Sometime in 1951 Barney Boville (1) (2) joined the professional staff.

During the time that the CAO was in Ottawa it did not become an operational unit. We were mainly concerned with consolidating analytical and prognostic techniques and exploring new ideas. Our equipment was meagre: a teletype terminal for receiving weather reports, an electric-mechanical calculator, and other routine office equipment available at that time. Computers and other digital equipment were unheard of.

The most sophisticated piece of technical apparatus was the "wiggle-wagon" for studying waves in the westerlies. This machine was constructed from parts of my son's Meccano Set. Jim made a request to MSC HQ in Toronto to build a more sturdy instrument with more sophisticated mathematically-adjustable parameters but at the same time he made the prediction that when the mathematical and engineering geniuses at HQ became involved they would never produce a practical workable model. His prediction proved correct.

The main technical concern of the Centre at this formative stage was the development of waves in the easterly flow of the upper air and their propagation rate. In this connection the first scientific reports issued by the CAO were prepared at the Ottawa Centre (3) (4) (5).



George W. Robertson in 2005

Although we were not operational we did keep abreast of current synoptic weather conditions across the country and often received queries from the field concerning problem situations. Also, since we were the only MSC office in Ottawa, local radio and television stations and newspapers took advantage of our availability. Jim looked after most of the requests from the media and often was pitted against Ottawa's famous and long-time weather expert, Bill Baker, an employee of the Central Experimental Farm who kept climatic records from Agricultural Experimental Stations across Canada. For all Jim's efforts, some of which were not too successful, one local news paper dubbed him "Pluvious Leaver".

During the winter of 1950-51 news leaked out that the CAO was scheduled to be moved out of Ottawa. It appeared that Dr. Andrew Thomson (2), then Controller of the MSC, favoured a move to Toronto, but Air Vice Marshall A. de Niverville (2), the Director General of Air Services Branch, vetoed this move on the basis that Toronto already had the Headquarters for the MSC and opted for a move to Montréal (Dorval).

This caused some consternation amongst certain staff members. I for one was not happy with the idea of making another move so soon. We had just purchased a new home in a developing area of Ottawa and the family was well adjusted to the new school and church in the area. Hugh Cameron was of the same mind. Nevertheless we made several trips to Montreal to look at prospective residential areas and houses. At the same time we scouted around for other applications for our meteorological training and experience. Hugh found a requirement for his services in the Department of Forestry and I found one in the Department of Agriculture at the Central Experimental Farm. At this time secondment was one of the options offered by the MSC and Hugh and I were both kept on as employees of the MSC but seconded respectively to Forestry (February 1951) and Agriculture (December 1951).

[1] CMOS Member, Ottawa Centre

Our vacancies on the CAO staff were not filled until the Centre was moved to Montréal (Dorval) in 1952.

The relocation of the CAO appears to have taken place during the summer of 1952. I checked Ottawa Telephone Directories for the period 1951 to 1953. Jim Leaver's name disappeared from the Directory published in February 1952 so it is assumed he moved to Dorval late in 1951, possibly to prepare accommodation and facilities for staff arriving later. The names of Ralph Anderson, Don McClellan, and Barney Boville were still in the February 1952 Directory but were missing in the Directory issued December 1952. It appears that they all moved sometime during the summer of 1952 and the CAO in Ottawa closed. The temporary building was demolished shortly afterwards and the area was landscaped with lawn and trees.

Acknowledgement
At this point I wish to acknowledge Morley Thomas's encouragement regarding the preparation of this brief report and thank him for providing information on staff and related administration matters.

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Central Analysis Office (CAO) Montréal Staff. Photo taken in September 1953 to commemorate the inauguration of the national facsimile circuit. The outside temperature was 93^{o} F.

<u>Top row</u> (left to right, 7 persons): Art Duffy, Don McClellan, Ralph Anderson, Romeo Richard (technician), Paul Dennison, Doug Page, Bob Dodds.

<u>Third row</u> (7 persons): female technician, Beth ? a female technician, Barney Boville, Mike Kwizak, a male technician, Charlie James, a male technician.

<u>Second row</u> (6 persons): Madam Arbuckle (secretary), Agnes (Aggie) Smith, Jim Leaver, Celia Primeau (teletype), ?.

<u>Front row</u> (4 persons): all unknown technicians.

Photograph taken from the *Canadian Meteorological Historical Photos Archive* found at : http://www.cmos.ca/Metphotos/photoindex.html and supplied, with thanks, by Bob Jones, CMOS Webmaster.

This photograph was recently discovered by Morley Thomas, CMOS and MSC Archivist. During the process of trying to identify people, we discovered that the photo was taken not long after the CAO had moved from Ottawa (Rockcliffe Air Base) to Montréal, where it remains to this day. We are hopeful that readers of the *CMOS Bulletin SCMO* might be able to complete the identifications. Please send any findings to the Editor of the Bulletin (bulletin@cmos.ca) or to the CMOS Webmaster (webmaster@cmos.ca).

Canadian National Committee for SCOR
Comité national canadien pour SCOR
Scientific Committee on Oceanic Research

28th SCOR General Assembly

Report submitted by Allyn Clarke[1]

The 28th SCOR General Assembly was attended by representatives of 23 of its 33 member nations. Observers also attended from Columbia, Cuba, Kuwait and Venezuela. Given the South American location (and the accompanying workshop on Oxygen Minimum Systems in the Ocean), all of the Latin American members of SCOR were represented at the meeting. The meeting and its workshop were attended by three Canadians: Bjorn Sundby (McGill University), the current and ongoing President of SCOR, Denis Gilbert (Institut Maurice-Lamontagne), the co-chair of SCOR WG 128 and co-organizer of the scientific workshop, and Allyn Clarke (Bedford Institute of Oceanography), Canadian nominated member for SCOR.

As is the custom, the meeting was opened with a few moments of remembrance and respect to those ocean scientists who had contributed to SCOR and who had died during the previous year. This year we remembered, Agustin Ayala-Castañares (Mexico), Sayed El-Sayed (USA), Sergey Sergeevich Lappo (Russia), Henk Postma (Netherlands), Robert Stewart (Canada), and Ümit Ünlüata (Turkey).

The new elected SCOR executive consists of:

- President (2004 – 2008) Bjorn Sundby Canada
- Past-President (2004 – 2008) Robert Duce USA
- Secretary (2006 – 2010) Jorma Kuparinen Finland
- Vice-President (2006 – 2008) Peter Burkill UK
- (2004 – 2008) Victor Akulichev Russia
- (2006 – 2008) Huasheng Hong China-Beijing

The President discussed his efforts during the past year in strengthening SCOR's links with its international sponsors and partners. His discussions with ICSU have led to an understanding that SCOR will play a stronger role as ICSU's voice on the oceans. This means SCOR needs to be proactive with respect to working groups co-sponsored by ICSU with ocean components.

SCOPE is an example of a committee where SCOR can explore common interests, for example the proposed SCOPE WG on Enclosed Basins. Capacity building should also be a strong focus for SCOR in partnership with the IOC and ICSU.

The SCOR Executive Director pointed out that the SCOR budgetary reserve has allowed it to cosponsor several important meetings and workshops during the past year, including the very important workshop on the impacts of high CO_2 on the oceans. The Executive Director asked member nations to develop more flow-through funding from their national funding agencies to help fund specific SCOR activities. Presently much of SCOR's funding, exclusive of membership fees, comes through USA funding agencies. A more diverse funding would provide SCOR's finances with greater stability.

A few selected highlights of the SCOR meeting follow.

WG 78 – Determination of Photosynthetic Pigments in Seawater. The original WG had produced a monograph on the analytical methods of determining these pigments. This was published by UNESCO in 1997 and is currently out of print. Analytical methods and techniques have also evolved since the mid 1990's. SCOR sponsored a meeting in April 2006 to scope out a revised monograph on this subject. Authors are presently writing chapters for the new volume; Suzanne Roy of the University of Quebec is a member of the 4 person editorial board for the new volume.

WG 111 – Coupling Winds, Waves and Currents in Coastal Models, WG 115 – Standards for the Survey and Analysis of Plankton, WG 116 – Sediment Traps and $_{234}$Th Methods for Carbon Export Flux Determination, WG 120 – Marine Phytoplankton and Global Climate Regulation, and SCOR/Images, WG 123 – Reconstruction of Past Ocean Circulation (PACE) have all held their final meetings and have their final publications in press, submitted for publication or in the final stages of preparation. All of these WG's will produce significant publications reviewing their specific areas of concern.

SCOR / IOC WG 119 – Qualitative Ecosystems Indicators for Fisheries Management is holding its final workshop in November. This will be followed by a final publication. Villy Christensen (UBC) is the WG Chair, and Daniel Pauly (UBC) Tony Pitcher (UBC), Jake Rice (DFO/HQ) and Kees Zwanenburg (BIO) are Associate Members.

SCOR/IAPSO WG 121 – Ocean Mixing has published a special issue of Deep-Sea Research II in 2006. They are planning to sponsor a Gordon Research Conference on ocean mixing before holding their final meeting at the 2007 IUGG General Assembly. Chris Garrett (UVic) is a WG Member and Barry Ruddick (Dalhousie) is a WG Associate Member.

SCOR/LOICZ/IAPSO WG 122 – Estuarine Sediment Dynamics. The meeting decided to suspend funding to this WG until they present a credible work plan.

[1] Bedford Institute of Oceanography, Dartmouth, NS.

SCOR/IMAGES WG 124 – Analyzing the Links Between Present Oceanic Processes and Paleo-records (LINKS) will hold their final meeting in November, 2006. This is expected to lead to their final publication in 2007. Roger François (UBC) is a WG Member.

WG 125 – Global Comparisons of Zooplankton Time Series is planning its second meeting in late November 2006. On the recommendation of WG 115, the meeting added a TOR giving this group the responsibility to evaluate the global monitoring of zooplankton. This WG is cochaired by Dave Mackas (IOS). The WG has good co-funding from national agencies and is making good progress.

WG 126 – Role of Viruses in Marine Ecosystems held its first meeting and workshop in Victoria in June 2006. They have established the outline of their final publication, a textbook on Methods in Aquatic Virus Ecology. It is intended to have this document available as an electronic publication. They are seeking co-funding to deal with the publication costs. Curtis Suttle (UBC) is a member of the WG and organized the Victoria meeting and workshop.

SCOR/IAPSO WG 127 – Thermodynamics and Equation of State of Seawater has held its first meeting and has established a detailed work plan that will allow it to accomplish the exacting task of redefining the standards for salinity and the equation of state of seawater. The Secretary General of IOC asked if IOC might co-sponsor this WG and this was agreed. IOC and the SCOR Executive are to determine if additional members should be added to the group. The final recommendations of this WG will be presented to the general assemblies of each of its sponsors for final approval before these new formulations become the new standard. Dan Wright (BIO) is a member of the WG.

SCOR WG 128 on Natural and Human-Induced Hypoxia has held its first meeting and organized a scientific workshop in association with this SCOR Assembly. They have a work plan towards their ultimate publication. There appears to be great scientific interest and excitement with respect to this WG. Denis Gilbert (IML) co-chairs this WG. After considerable discussion, the meeting supported two new working groups, namely: a **Working Group on Deep Ocean Exchanges with the Shelf**, and a **Working Group on Automatic Plankton Visual Identification**. All members agreed that both were worthy proposals. There was considerable discussion on whether the Deep Ocean Exchanges proposal should have more inclusion of chemical and biological processes but the eventual consensus was that the focus on physical processes was necessary to allow the working group to accomplish its objectives. Members were concerned that the Automatic Plankton Visual Identification was too narrowly focussed on a particular instrument and its associated software. The terms of reference will be broadened somewhat to allow a more generic approach although many of the members supporting this proposal have purchased (or are considering purchasing) this instrument and do look to this WG to improve the available procedures and software.

GLOBEC. This project has largely completed its field studies and is in its integration / analysis / modelling phase. Its final Open Science Meeting is planned for 2009. Over the past year, this project has sponsored 7 scientific workshops in addition to various working and task group meetings. The project has generated more than 1600 publications including a number of special volumes of various scientific journals. NERC UK has renewed their funding for the International Project Office. Rosemary Ommer (UVic) and Ian Perry (PBS) are SSC Members.

GEOHAB. GEOHAB has conducted open Science meetings to formulate Implementation plans for its four Core Research Programs called for in its 2003 Science Plan. GEOHAB is making slow but steady progress. It has been a challenge as its community of scientists learn to work collaboratively together regionally and internationally. The present challenge is to standardize on protocols and data standards. The lack of an International Project Office also makes coordination and organization difficult. Administrative assistance is presently provided by SCOR and the IOC on a part time basis. Canada has no GEOHAB program nor any members on the SSC.

SCOR/IGBP Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project. IMBER has published its Science Plan and Implementation Strategy and is working on its Implementation plan through Task Groups and Working Groups. It has created a Task Team on Capacity Building. Its Data Management Committee is developing its data-sharing policy and guidelines. The present plan is for the project office to store the metadata with the data itself to be stored in a number of national and regional centres. No formal Canadian IMBER projects and no Canadian on the SSC.

GEOTRACES Planning Committee. GEOTRACES has published its Science Plan and its new SSC will hold their initial meeting in December. Canada has one full member and one associate member on the SSC. GEOTRACES is a strongly coordinated program that aims for a new global survey of the distribution of geochemical tracers in the ocean. SCOR is the sole sponsor of GEOTRACES. Kristian Orians (UBC) and Roger François (UBC) are both Associate members of the GEOTRACES Planning Group.

SCOR / IGBP / WCRP / CACGP Surface Ocean-Lower Atmosphere Study (SOLAS). SOLAS has completed detailed research plans for its focus areas and is planning its second Open Science Meeting in 2007. 2007 will see the end of the SSC terms for the final original SSC members, including that of the chair. This represents a major change in leadership of this program. Ken Denman will rotate off the SSC at the end of 2006. This will leave Canada without an SSC member, perhaps appropriate given the failure of Canada SOLAS to get funding renewal from NSERC.

Land Interactions in the Coastal Zone (LOICZ) Project. While SCOR had agreed to cosponsor those parts of LOICZ related to Coastal Ocean Science it does not co-sponsor the program as a whole. There was no written report from either the LOICZ Project Office or the SSC. Julie Hall, the SCOR Executive Officer responsible for LOICZ, reported that its Project Office has relocated to Germany and there has been considerable turnover in members of the SSC. There is no Canadian LOICZ project and no Canadian members of the SSC. SCOR will support LOICZ through travel grants to their workshops and summer schools.

IOC / IGBP International Ocean Carbon Coordination Project (IOCCP). IOCCP has been greatly revitalized (replacing the old SCOR / IOC Panel on Ocean CO_2) and has an active program integrating the various ocean carbon observation programs. This is a very necessary support to GOOS. There are discussions to include this activity under an overall Carbon Theme Office in UNESCO; this office would deal with carbon in earth, air and water. Helmut Thomas (UBC) is a Canadian member of the committee.

SCOR / IOC International Symposium on "The Ocean in a High CO_2 World". A special issue of JGR-Oceans was published containing the papers from the first symposium. A second symposium is being planned for 2008, likely in Monaco. SCOR and IOC are seeking financial support for this meeting. Likely support from US NSF and Monaco.

SCOR Summit of International Marine Research Projects. A meeting of the leaders of the major international marine research projects will be held in December chaired by the President of SCOR. Some of the funding will be provided by the Sloan Foundation. Plan to hold such meetings every two years . Focus will be on data policy and co-ordination among programs.

Panel on New Technologies for Observing Marine Life. This panel has held its second meeting. It is funded by the Sloan Foundation and focuses on the observational needs of the Census of Marine Life project. There is no Canadian member on the panel. The acoustic tag technology for fish tracking developed by a Canadian company would seem to fall under the interest of this panel.

SOLAS/INI Workshop on Anthropogenic Nitrogen Impacts on the Open Ocean. This activity is co-sponsored by SOLAS, SCOR and SCOPE. INI – International Nitrogen Initiative is a SCOPE project. Workshop will be held in November. Aims to produce a major synthesis paper on this issue as well as a collection of specialist papers.

Regional Graduate Schools of Oceanography and Marine Environmental Sciences. The very successful Regional school in Concepción is actively seeking funding to replace the funding that had earlier been provided by Germany. SCOR has budgeted funds for a regional meeting in Southeast Asia to advance plans for that region. SCOR will cooperate with Canadian scientists to plan a similar meeting for South Asia, in Sri Lanka, funded by the Canadian International Development Agency (CIDA). Plans are being made for this meeting, pending stabilization of the security situation there.

Disciplinary Balance among SCOR Working Groups. The disciplinary Balance Committee was charged with reviewing the disciplinary balance within SCOR working groups and other programs and to identify gaps that should be highlighted in the 2007 call for new working group proposals. Allyn Clarke (BIO) served on the Disciplinary Balance Committee. The disciplinary balance committee reported that the balance among working groups is presently good; however, several groups are expected to end during the coming year. They recommended that the 2007 call for working group proposals specifically seek proposals on issues related to benthic communities, microbial life, and the physical / chemical stability of the sediments on continental shelves and slopes. The committee also noted that in the longer term there will be need to do large scale synthesis of the accelerated research programs in the polar regions under the IPY. These recommendations were accepted by the Assembly.

The 2007 SCOR Executive meeting will take place in Bergen, Norway with probable dates of Aug 26-28, just before a Scientific Conference on Polar Dynamics. The 2008 SCOR General Meeting will take place at Woods Hole, with probable dates of Oct 20-24 and will be associated with an Open Science meeting celebrating SCOR's 50th Anniversary.

Source: Ocean Newsletter, # 26, December 2006. Reproduced here with the permission of the Editor, Dick Stoddart and the author, Allyn Clarke.

Note from the Editor: Please read on **page 70** the call for SCOR Working Group Proposals for 2007.

Windswept: The Story of Wind and Weather[1]

by Marq de Villiers

McClelland & Stewart, 388 pages, $34.99 cloth
ISBN 0-7710-2644-7

Book Reviewed by Morley Thomas[2]

Marq de Villiers has written a delightful book on wind and weather that is both informative and fascinating. The author has previously published successful books on exploration, history, politics, water and travel and in this book he demonstrates that he can persuasively write on weather and climate as well. Any meteorologist aspiring to write on the subject for the general public would be wise to acquire and closely read *Windswept* since, in this book, the author demonstrates that the wonders of wind and weather can be explained without the use of mathematical equations and professional jargon. This book is hardly a textbook on wind and weather but I certainly recommend it to anyone interested in forecasts and weather in general.

Throughout the text de Villiers effectively introduces the different chapters with recollections from relevant personal experience or from memorable weather events he has read about. Clearly, hurricanes, tornadoes and other great windstorms have fascinated him throughout his life and, perhaps because of this, he has used instalments of "Ivan's story" at the beginning of each chapter to string his chapters together. Ivan, a complex hurricane of August-September 2004, inflicted extensive property damage and loss of life in the Caribbean and the United States before weakening and causing very limited damage to de Villiers' property in Nova Scotia subsequent to moving out over the Atlantic Ocean. Ivan's story is good reading but it would have been better if it had been presented without breaks in a single chapter. I could not see any relationship between the bits of Ivan's story and the content of each chapter so I skipped them until I had finished the chapters. But, this is a small criticism of a very good book.

Beginning with ancient beliefs and the local names given to specific winds in various parts of the world, the author recounts how man's knowledge of the composition of air ("the stuff that makes wind") grew over the period of recorded history and the rather more modern realization that there are identifiable layers in the atmosphere. He then explains how Anaximander, a philosopher in the sixth century B.C., appears to have been the one who first gave us a quasi-scientific definition of wind and how the Greeks identified the cardinal wind directions and built the precisely oriented eight-sided Tower of the Winds in Athens. Of course, sailors have always used the wind and by the time of Columbus they understood the warning signs of bad weather although it would be another century before both the wind directions and some indication of their speeds were routinely recorded in meteorological logs and daybooks.

A theory of storms developed more slowly than practical knowledge about them and it was not until the early decades of the nineteenth century that their true cyclonic nature was understood by men who were called "scientists." This was a new name and replaced the earlier term "natural philosophers." One of these scientists was an American Naval officer, Matthew Fontaine Maury, who published his research on meteorology and oceanography after extended voyages around the world. He is best known in meteorological history for his development of a system for sea captains to record meteorological and oceanographic data, a system that was adopted internationally at a congress in Brussels in 1853. This was followed by another international meeting of scientists in Vienna in 1871 where methods of meteorological observing and the definitions of terms were adopted which led to the establishment of an organization that is today known as the World Meteorological Organization.

Also during the mid-1800s Sir Francis Beaufort, who was to become a Rear Admiral in the Royal Navy, developed a scale for estimating the force of the wind by observing its effect on ships' sails. The Beaufort number increased from 0 in a calm to 12 in a hurricane; its use was made mandatory in the Royal Navy by 1838 and international use soon followed. In time the scale was adapted for land use with reference to the wind effects on trees, chimneys and buildings. The Beaufort scale is still the basis for reporting wind in meteorology but the equivalent values used in weather reports are expressed in knots, imperial units, or metric units. The author mentions the gale warning service introduced in Britain in the 1859s and he might have told readers that the national meteorological services of both the United States and Canada were first federally established to issue storm warnings in the 1870s for the Great Lakes and Atlantic Coast in response to the expressed needs of shipping interests and fishermen.

Weather analysts and forecasters require representative meteorological elements from reporting stations to construct a weather map. Amongst the surface elements, the wind measurement usually presents the most problems. Ideally wind should be measured at 10 metres above a flat surface at a distance from any obstructions such as trees or buildings but until remote sensing became available these conditions were difficult to meet at airports and other

[1] Originally published in *Books in Canada* Vol.35, No.6, September 2006. Reproduced here with the permission of the author.

[2] CMOS Member, Toronto Centre.

observing stations. Further, pedestrians on downtown urban streets rarely experience a representative wind as large buildings sometimes give shelter and other times create a "canyon effect" to the discomfort of passers by. Now, when large structures are planned, building codes call for the study of the effect of wind forces on models in wind tunnels to produce design values.

Only in the last century was meteorological theory so developed that forecasters required upper air winds in their weather map analysis. At first only pilot balloon observations, made by watching and recording the altitude and azimuth of a rising balloon, were available. But the height reached was only a few kilometres before the observer lost sight of the balloon and, of course, observations were not available on cloudy days. However, in the 1930s, radiosondes, instruments carried aloft by balloons, were invented to transmit temperature, pressure and humidity data back to earth as they rise through the atmospheric layers to nearly thirty kilometres. Using radar, the position of the balloon is known at all times and so the wind speed and direction can also be continuously determined along with the other elements.

De Villiers is particularly good in reminding us of such effects of wind on nature as the distribution of plant seeds and harmful fungi and on our economic and social lives such as the transport of atmospheric pollution, the development of maritime transport over the centuries and today's air transport. He examines wind as a source of energy and notes the attention given to it in today's climate change debate as a partial substitute for the use of coal, which would slow down the increase of carbon dioxide in the atmosphere and global warming. The author does not spell out his convictions but it is evident to me that he thinks the need for wind power will soon become evident to all.

De Villiers has suffered only a little from hurricanes but they have certainly sparked his interest in wind and weather. He has written one of the best books on the subject that I have ever read.

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Interactions of the Major Biogeochemical Cycles

Edited by J. M. Mellilo, C. B. Field and B. Moldan

SCOPE 61, Island Press, 2003
Washington, DC

Book reviewed by Kaz Higuchi[3]

Since its first publication in 1971, SCOPE (Scientific Committee on Problems of the Environment) has published in timely fashion many volumes on scientific and technological issues related to environmental problems caused by human activities that have perturbed the natural processes in the biosphere. By the time I purchased a copy of SCOPE 21 *(The Major Biogeochemical Cycles and Their Interaction*, edited by Bert Bolin and Robert Cook, 1983) in 1984, I already owned a copy of SCOPE 17 *(Some Perspectives of the Major Biogeochemical Cycles*, edited by Gene Likens, 1981). As Gene Likens states in the preface of SCOPE 17, it has become increasingly apparent that a realistic understanding of individual [carbon, nitrogen, phosphorus, sulphur, water] cycles is not possible in isolation from other interacting cycles, and it is clear that attempts must be made to take a more holistic approach to global biogeochemistry. And I believe SCOPE 17 succeeded as a first attempt to examine each cycle within the context of other cycles. SCOPE 17 was followed two years later by SCOPE 21 with more comprehensive and lengthy discussions (compare 175 pages of SCOPE 17 to 525 pages of SCOPE 21) on the interactions of major biogeochemical cycles. SCOPE 61 *(Interactions of the Major Biogeochemical Cycles*, edited by J.M. Mellillo, C.B. Field and B. Moldan), published in 2003, is an update of SCOPE 21, and gives us a synthesis of major scientific advances and a greater insight into the complex nature of the workings of biogeochemical cycles and their interactions that have been made over the last 20 years.

The existence of life (including *homo sapiens*) on earth depends on major biogeochemical cycles of elements that include carbon (C), hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P) and sulphur (S), and on how they interact with each other and with other element cycles. The state of the environment through which these elements flow is the product of the dynamic and nonlinear interactions of the element cycles; it is ever changing and evolving, never at steady state. The time-scale of natural environmental change, however, has always been much longer than that

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associated with environmental impact of human actions. Not too long ago, with very limited technology and significantly smaller population size, human disturbance of the major biogeochemical cycles was confined to regional space scale and of limited magnitude. This, of course, is no longer the case.

Through major and widespread changes in the earth environment by such human activities related to food production, urbanization, industrialization, and water management (Chapter 2), human beings are perturbing the very process of distribution of the elements in the environment that has supported the life as we know it on earth. Consequences of such activities result in selective release and mobilization of elements such as C, N, S and P from their long-term stores and cause degradation of the quality of lands, air and water. (Chapter 5) Instead of allowing the volcanoes to perform their function, for example, human beings have short-circuited the global biogeochemical cycle of carbon by digging out fossil carbon (in the form of coal, oil, natural gas, etc.) from the lithosphere, burning it and releasing it directly into the atmosphere. Geological process takes millions of years to do it; human beings do it in a matter of days. Carbon in the atmosphere (in the form of carbon dioxide) does not pose a health threat directly, but it is a greenhouse gas that could cause climate warming to occur, with all its consequences for life on earth.

Another consequence of burning fossil fuels is the emission of sulphur dioxide, SO_2, which gets converted to sulphuric acid in the atmosphere. This has led to acidification of soils, rivers and lakes not only in regions of proximity to the source, but also in regions far downwind. Environmental impact of acid deposition has been large and extensive, upsetting and destroying existing aquatic and terrestrial ecosystems. As a well-known example, acidification of lakes has produced crystal clear water but devoid of life. This can result in a new stoichiometric redistribution in elements of C, O, N, S and P.

In many countries, the use of fertilisation in food production has been made necessary to feed increasing human populations. A notorious environmental consequence of such human activity has been observed even from space. Addition of nitrogen to farmlands in upstream areas of the Mississippi river basin has resulted in the transport of excessive nitrogen into the Gulf of Mexico. This has caused hypoxia along the Louisiana coast due to excessive aquatic plant growth and decay that consume oxygen in the water to the extent that most animal life becomes unsustainable. Indeed, the disruption of the fishing industry in this northern Gulf of Mexico region has been near-catastrophic. These are just a small sample of scientific and practical issues of environmental concern addressed in SCOPE 61.

SCOPE 61 is 357 pages long and is divided into five basic parts, preceded by a short overview by the editors of the book. Part I (Crosscutting Issues) attempts, successfully I believe, to highlight the interactive nature of the biogeochemical cycles and to convince the reader that the understanding of the environmental problems caused by human activities requires interactions among various scientific disciplines, and that eventual solutions to the problems will necessitate interdisciplinary and system approaches.

Part II is composed of three papers and focusses on a discussion for the need of a comprehensive theory that offers a unified perspective on element interactions in ecosystems. Trying to unify interactions on various time and space scales will continue to be a significant challenge in the development of a general conceptual framework that will successfully describe environmental patterns and interactions from global to local scales. With an overwhelming presence of broken symmetry, there are no first principles here. However, as described in Chapter 6 by Peter Viousek, the stoichiometric approach is a promising vehicle for analyses of element interactions on various scales.

Part II is followed by discussions of element cycling and interactions on land (Part III: Lithosphere), in air (Part IV: Atmosphere), and in water (Part V: Hydrosphere). In describing the role of vegetation in the cycling of such elements as carbon and nitrogen, Chapter 9 points out some of the limitations of the stoichiometric approach, stating that this approach ignores the ways in which organisms affect elemental interactions and biogeochemistry and that plants affect elemental interactions far out of proportion to the stoichiometric ratio of the particular compounds. An example of element interactions (such as C, N, P and Ca) at a particular site (Amazon) is given in Chapter 10. The main land-use change in the Amazon is the conversion of forests to agriculture. A further discussion on the elemental interaction of C, N, P, S and micronutrients in tropical agroecosystems is continued in Chapter 12.

Human activities such as industrialisation and deforestation result in net emissions of major greenhouse gases (CO_2, CH_4 and N_2O) into the atmosphere. Our present level of understanding about the radiative role of these greenhouse gases and the dynamic response of the atmospheric circulation to the radiative perturbation seems to indicate climate warming. A discussion in Chapter 13 shows that such climate warming would lead to redistribution of carbon and nitrogen cycles in ecosystems that could feed back onto the atmosphere-biosphere exchange process of these greenhouse trace gases. One example is the possibility of increased respiratory release of CO_2 from the soil due to warming soil temperature.

Acid deposition has been a major environmental problem for decades. Anthropogenic emissions of sulphur and nitrogen have resulted in acidification of soils and water. Chapter 14 describes how nitrogen and sulphur cycles disturb carbon cycling in the terrestrial ecosystem that usually results in a loss of biodiversity and living biomass. Chapter 15 picks up on this theme and examines the effect of increased net emission of nitrogen into the atmosphere. This has a cascading effect in the atmosphere that leads to significant changes in atmospheric chemistry and impacts on the elemental cycling in ecosystems through deposition of transformed nitrogen compounds. However, there are still fundamental uncertainties in understanding and estimating deposition [that] limit our ability to successfully model the interactions of terrestrial nitrogen and carbon cycles.

The last part (Part V) of the book discusses interactions of element cycles in hydrosphere and is composed of 3 chapters. Chapter 16 focusses on the relatively recent recognition by the general scientific community of the role of iron as a key nutrient limiting ocean photosynthesis, carbon storage, and glacial-interglacial variations in atmospheric carbon dioxide concentration. This is followed by a discussion of carbon-silicate interactions in Chapter 17. The discussion highlights the possibility of accelerated silicate weathering under anthropogenic-CO_2-induced global warming, thus acting as an accelerated transient terrestrial sink for CO_2. It can also promote diatom phytoplankton growth in coastal waters, producing a long-term CO_2 sink. The final chapter in Part V describes elemental interactions among carbon, sulphur and nitrogen cycles in extreme marine environments.

The book achieves its goal in showing the reader the tremendous complexity of the interaction among major biogeochemical cycles. The book identifies the various scientific advances made over the last 20 years since the publication of SCOPE 21 in the understanding of the anthropogenic perturbation of the cycles and how they can feed back to enhance the perturbation. But the reader is also left with the impression that the task of gaining enough understanding to manage element interactions without introducing new problems is daunting, partially due to the fact that there is no real generalised theoretical framework that can be applied anywhere on various time scales. There are exciting challenges ahead and the book, with contributions from respected scientists, does provide a sound scientific basis from which to meet the challenge. Graduate students in environmental sciences will be served well by the book.

Vous êtes intéressés à faire la critique d'un livre pour le *CMOS Bulletin SCMO*? C'est vraiment facile; vous n'avez qu'à contacter le rédacteur-en-chef à l'adresse électronique mentionnée ci-bas. Bien entendu, le livre choisi vous appartient lorsque vous avez terminé la critique. Les instructions qui doivent être suivies lors de la critique d'un livre dans le *CMOS Bulletin SCMO* vous parviendront avec le livre. Merci pour votre collaboration

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The Global Carbon Cycle

Edited by C.B. Field and M.R. Raupack

SCOPE 62, Island Press, 2003, Washington, DC

Book reviewed by Kaz Higuchi[4]

The first SCOPE book (SCOPE 13) on the global carbon cycle was published in 1979 (Bolin et al., 1979), just in time for me to learn about carbon cycle for my doctoral thesis at the University of Toronto. SCOPE 13 was basically my first exposure to anything related to carbon cycle and quickly became my "bible" for my research work. My first 1-dimensional global carbon cycle model (punched on cards and fed into IBM360) was based on the description by Björkström (Chapter 15, SCOPE 13). The book is now stained with coffee and falling apart at the seams. However, it is still useful and I do refer to it now and then because it still contains certain basic scientific aspects of the global carbon cycle that still hold valid today as they did over 25 years ago. In this respect, SCOPE 62 is not so much an update of SCOPE 13, but more of a "successor to the SCOPE carbon-cycle books of the 1970s and 1980s" (Chapter 1).

Although both volumes possess the same title in the same SCOPE series, I think that the focus of SCOPE 62 is quite different from SCOPE 13. There is more human dimension and the importance of human action on the global carbon cycle is highlighted. The global carbon cycle is highly interdisciplinary as a discipline, and a comprehensive understanding of the cycle requires knowledge and understanding of the interactive processes among various carbon reservoirs which now include the "human system". The editors and the authors of articles in the book attempt to portray the global carbon cycle, with some success I might add, as an integral component of a "single system" (Chapter 1) that has climate and human activities as other components. The editors of the volume use the word "synthesis" to try to bring together some detailed knowledge relevant to the understanding of the global carbon cycle from the various traditional research areas in the atmosphere, terrestrial biosphere, oceans and humanity. Over the last 20-30 years, many advances in the carbon cycle understanding have been made, but now the devil is in the detail, both in time and space. Compared to SCOPE 13, SCOPE 62 offers much more detailed quantitative coverage of carbon cycle processes (and their interactions with the climate and human systems) on regional scale where human impact is most significant and obvious. The complexity thus arising is reflected in all the chapters through words like "uncertain" and "incomplete."

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The basic presentation structure of the book is as follows. It starts off with a short editorial introduction (The Global Carbon Cycle: Integrating Humans, Climate, and the Natural World), highlighting the basic purpose of the volume. It is followed by Part I (Crosscutting Issues) that begins with a short overview of the natural carbon cycle processes (Chapter 2: Current Status and Past Trends of the Global Carbon Cycle) but quickly gets into the human dimension of the carbon cycle (Chapters 3 to 6). Part II (Overview of the Carbon Cycle) covers the paleoclimate connection of CO_2 with the climate change (Chapter 7), inverse estimates of regional carbon fluxes using high-precision atmospheric CO_2 measurements in 3-d atmospheric transport models to constrain the estimates (Chapter 8), the role of non-CO_2 greenhouse gases in the climate system (Chapter 9), interaction between climate and carbon cycle (Chapter 10), and various future CO_2 emission scenarios based on various socioeconomic assumptions (Chapter 11). Part III (The Carbon Cycle of the Oceans), Part IV (The Carbon Cycle of the Land), and Part V (The Carbon Cycle of Land-Ocean Margins) focus on the detailed and quantitative characterisation of carbon distribution processes in each of the major carbon reservoirs. It is interesting to note that there are relatively very little discussion related to CO_2 measurements in the atmosphere and how they can be influenced by interactive processes in these reservoirs that govern the net CO_2 flux into the atmosphere. And in the same vein, it is very unfortunate that there is practically no discussion of the details on the role of stable isotopes (and maybe even C^{14}) in the global carbon cycle. A separate chapter on the way C^{13} and O^{18} isotopes can be used to distinguish and identify how various sources and sinks of carbon could have constituted a very important part in the discussion about the global carbon cycle.

The volume wraps up with Part VI (Humans and the Carbon Cycle) and Part VII (Purposeful Carbon Management) that get into socioeconomic and physical strategies of managing the flow of carbon, from various emission control strategies such as reducing energy consumption (Chapter 20: Social Change and CO_2 Stabilization) to various removal strategies such as ocean burial (Chapter 27: Direct Injection of CO_2 in the Ocean).

The book is slightly over 500 pages in length, and almost 50% of that is devoted to human-related issues of the global carbon cycle. While my knowledge of the global carbon cycle has increased somewhat over the last 20 years or so, my pace for the appreciation of the role of human element in the cycle has lagged quite a bit. SCOPE 62 brings to the forefront the importance of human activities in the global cycling of carbon through regional manipulation of carbon storages.

The book identifies certain areas of the carbon cycle we know relatively well (i.e., with a certain amount of certainty), but it also identifies those areas in which our knowledge is uncertain, incomplete and/or insufficient. For example, we still need to know much more about the "interactions among marine biology, biogeochemistry and physics" (Chapter 12) before we can have sufficient confidence in our ability to predict future ocean uptake of CO_2 under changing climate. In a way, SCOPE 62 is a treasure house of ideas and important problems to solve for those who are venturing into carbon cycle research, either from the natural science side or from the socioeconomic side. The book is written by a group of well-known experts in the carbon cycle research community, and it is written at the level that is accessible to anyone seriously interested in the scientific complexities of understanding the global carbon cycle and the socioeconomic implication of managing it. Personally, I still like SCOPE 13 better, but I will not throw away SCOPE 62.

Books in search of a Reviewer
Livres en quête d'un critique

Flood Risk Simulation, by F.C.B. Mascarenhas, co-authored with K. Toda, M.G. Miguez and K. Inoue, WIT Press, January 2005, ISBN 1-85312-751-5, Hardback, US$258.00.

Statistical Analysis of Environmental Space-Time Processes, by Nhu D. Le and James V. Zidek, Springer Science+Business Media Inc., 2006, ISBN 0-387-26209-1, Hardback, US$79.95.

Nonlinear Dynamics and Statistical Theories for Basic Geophysical Flows, by Andrew J. Majda and Xiaoming Wang, Cambridge University Press, 2006, pp.551, ISBN 0-521-83441-4, Hardback, US$90.00, 2 copies available.

The Equations of Oceanic Motions, by Peter Müller, Cambridge University Press, ISBN # 0-521-85513-6, 2006, Hardback, US$80.

The Chronologers' Quest: The Search for the Age of the Earth, by Patrick Wyse Jackson, Cambridge University Press, ISBN # 0-521-81332-8, Hardback, pp.291, US$30, 2 copies available.

Numerical Weather Prediction: Richardson's Dream, by Peter Lynch, Cambridge University Press, ISBN # 0-521-85729-5, Hardback, pp.279, US$75.

The Gulf Stream, by Bruno Voituriez, IOC Ocean Forum Series, UNESCO publishing, ISBN# 978-92-3-103995-9, Paris, 2006, pp.223.

Le Gulf Stream, par Bruno Voituriez, Collection COI Forum Océans, Éditions UNESCO, ISBN# 978-92-3-203995-8, Paris, 2006, pp.209.

The Economics of Climate Change, The Stern Review, Nicholas Stern, Cambridge University Press, ISBN 978-0-521-70080-1, 2007, Paperback, pp.692, US$50.

Solitary Waves in Fluids, Editor: R.H.J. Grimshaw, Wessex Institute of Technology Press, ISBN 978-1-84564-157-3, pp.183, Hardback, February 2007, pp.183, US$130.

PERCY SALTZMAN

TV WEATHERMAN

1915 – 2007

Percy Saltzman was born in Winnipeg on March 11, 1915. He died at home in Toronto on January 15, 2007, of a stroke after suffering a short illness. He was 91. He is survived by his wife, Audrey, sons Earl and Paul, three grandchildren, two great-grandchildren, and his younger brother Kenneth. He was predeceased by his first wife, Rose.

Percy Saltzman was the eldest of three sons of shopkeeper Solomon and Elizabeth (née Ross) Saltzman. His father, who was born in Ukraine, came to Canada in 1911 and married four years later. The Saltzmans moved to Neudorf, Sask., with their infant son Percy, and operated a general store, selling groceries, hardware, guns, bolts of material and other bulk items. His siblings Morris (1918-1988), Eva (1921-1971) and Kenneth (1924) were all born in Neudorf before the family pulled up stakes and moved to Vancouver in 1925.

An excellent student, Percy Saltzman went to Dawson Public School and King George High School, winning Governor-General Lord Willingdon's Silver Medal for coming first in the province in the final exams. After that, he enrolled in a bachelor of arts degree at the University of British Columbia, where he studied life sciences and won two scholarships. After graduating in 1934, he made his way to Montréal by working as an animal tender on a cattle train. His parents' grocery store business had foundered during the Depression and they had moved to Los Angeles with their youngest son, Ken. Mr. Saltzman, rarely - if ever - saw them again, but following his mother's wishes, he studied medicine for a year at McGill University, having overcome "McGill's anti-Semitic exclusion quota," as he later wrote on his website. He didn't like medicine, and he was broke, so he dropped out. About the same time, he met Rose Kogan, a refugee who had been born on the Russian-Romanian border and who had fled the brutal aftermath of the Russian Revolution. They married in Montréal in 1935. She worked in a dress factory, and he found a variety of jobs -- a fur operator in a clothing store, a waiter, a printer and even an envelope opener in a puzzle contest.

The Saltzmans moved to Toronto in 1937, where the ever-adept Percy learned linotyping, a trade he worked at until 1943. Their son Earl, a now-retired computer systems consultant, was born in 1942, followed by Paul, a film director and producer, a year later. After Rose died in 1988, Mr. Saltzman married Audrey (née Modeland) Ford in 1990.

Percy Saltzman found his vocational calling during the Second World War. In 1943, the federal government was searching for meteorologists to work in the British Commonwealth Air Training Plan, both as weather forecasters and as trainers to give pilots and navigators the rudiments of the atmospheric sciences. Although he had no formal training in the discipline, he had exceptional skills in mathematics and physics, which enabled him to qualify as a meteorologist after completing a concentrated course in the subject.


Percy Saltzman around 1950

He served in nine stations, eventually becoming chief of the wartime weather office at Malton (now Pearson International Airport). Having to explain the weather business, often to French - and Polish - speaking airmen, using blackboard and chalk and basic vocabulary, probably honed the presentation skills that were such a plus later on in his broadcasting career. After the war, he stayed on at the Dominion Weather Service head office in Toronto. Percy Saltzman began doing weather broadcasts on the radio for the CBC, and proposed making the switch to television at his wife's urging, according to his older son, Earl. His career before the cameras began on September 8, 1952, the day that TV officially began in Canada. Mug shots of the fugitive Boyd Gang flashed on screens in the Toronto area followed by the opening credits for Uncle Chichimus and Hollyhock, a puppet show produced by Norman Campbell. The next image was the earnest and bespectacled Percy Saltzman, wearing a sports jacket and a tie, the only human on the show, making him the first person to appear live on Canadian TV.

The idea of putting a weatherman on a puppet show came from Mr. Campbell, later known as a TV producer and one of the creators of the musical Anne of Green Gables. He was from B.C., where he had studied mathematics and physics at the University of British Columbia and then joined the Meteorological Service of Canada, which posted him to Sable Island off Nova Scotia during the war.

Shy and introverted in person, he bloomed under the spotlight, writes Sandra Martin. He always considered himself a meteorologist, first and foremost. At home, he kept a barometer in every downstairs room, except the kitchen, which had two.

Sandra Martin

Mr. Campbell abandoned the weather to join the fledgling TV network in Toronto in 1952. After meeting Percy in the cafeteria one day, Mr. Campbell invited him to do his weather gig on Uncle Chichimus and Hollyhock, according to his widow, Elaine. "Norman really appreciated Percy's sense of humour and his wonderfully genuine attitude about everything in life. He was so warm and personable." One night, Mr. Campbell had him dangling from "the lighting grid to do his weather forecast, with his famous chalk, making it look as though he was hanging from the ceiling."

He was soon lured away to do the weather on Stop, Watch and Listen and then Tabloid, a daily current-affairs interview show produced by Ross McLean. The two men had first met in 1948 when Mr. McLean, then an undergraduate at the University of Toronto, produced Focus, a weekly show on radio station CKEY. Among the (unpaid) writers for the program were Robert Weaver and Percy Saltzman.

Tabloid aired Monday to Friday across the country at 7 p.m. and made Percy Saltzman a household name in Canada, a country many feel is weather-obsessed. In a profile in Maclean's magazine in 1954, Percy Saltzman said he still thought of himself as a weatherman and considered his TV appearances as a sideline, even though that "sideline" had tripled his income. His house in the Wilson Heights area of Toronto was a testament to his calling. Every ground-floor room had a barometer, except the kitchen, which had two, according to Robert Olson in his Maclean's profile. Throughout his career, even when being notorious because of his daily appearance on TV, he never forgot his Met colleagues as it can be read when describing his first and last experience while driving into a tornado (Ref.: <u>Tornado Tango</u>, Letter to the Editor, *CMOS Bulletin SCMO*, Vol.29, No.5, pp.130-131).

At the time, Percy was head of the verification section of the federal weather service, the office where all official Canada weather forecasts were received, compared against the actual weather conditions, graded for accuracy and archived in order to compile a long-term meteorological record for the country. After a full day's work as a meteorologist, he would "hop on bike and pedal to CBLT on Jarvis Street, there to peddle my foggy, foggy dew," as he wrote on his website decades later. He resigned from the federal weather service in 1968.

His daily TV forecasts routinely began at 4 p.m. with a phone call to the meteorologist on duty at the airport. After getting a detailed report, he would spend the next hour comparing it with conditions in teletype reports from about 200 of the 1,300 weather stations that stretched across the country in the early 1950s, augmented by reports from stations in the United States. He'd digest all of this data, make himself a simplified weather map, analyze the atmospheric and climactic conditions, then check the teletype machines for updates at 5:30 p.m. Then he would grab his chalk and head for the studio to make his daily broadcast at 6.

He did interviews, too, but the weather is what most people remember about him. "Even people who don't much care what sort of weather is on the way watch Saltzman faithfully," Mr. Olson reported in Maclean's in 1954. "They like to see him point out the birthplace in the Arctic of the blizzard, which will soon be around their windows, or watch him trace the curve along which warm air is sweeping from the Gulf of Mexico. He tends to personify weather, symbolizing with a broad curve the 'high' resting serenely over the Prairies or indicating with jagged strokes the rain from a villainous warm front 'kicking up a fuss' in the southwest. And all winter, he says, there is a cold air mass which 'just sits and broods' in the Far North."

He worked for CBC-TV for 20 years before moving to the rival Canadian Television Network, where he appeared weekdays on Canada AM, its flagship morning program, from 1972 to 1974. He then moved to CITY-TV for a year before going freelance for the next five years. He ended his TV career at Global, where he appeared from 1980 to 1982.

He was an avid reader of biographies and magazines and newspapers. As recently as last month, he was blogging on a personal website that he had constructed. Just before Christmas, he suffered some soft-tissue damage in his shoulder and chest while getting out of bed one morning, according to Earl. "It took all of the strength out of him, probably because of his age."

Among other honours, he received the Order of Canada in 2003 (Ref.: <u>On Being Gonged</u>, Letter to the Editor, *CMOS Bulletin SCMO*, Vol.30, No.6, pp.166-167) and was made a member of the Canadian Broadcast Hall of Fame in 2004.

<u>Source:</u> Based on an obituary written by Sandra Martin and published in the Globe and Mail, January 18, 2007 and adapted for the *CMOS Bulletin SCMO.*

REMINDER - REMINDER - REMINDER

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CMOS-CGU-AMS 2007 / SCMO-UGC-AMS 2007

Air, Ocean, Earth and Ice on the Rock

May 28 - June 1 2007

CMOS-CGU-AMS Congress 2007
St. John's, Newfoundland, Canada
May 28 – June 1 2007

http://www.cmos2007.ca

The Canadian Meteorological and Oceanographic Society (CMOS), the Canadian Geophysical Union (CGU), the American Meteorological Society (AMS) [Polar Meteorology and Oceanography, Climate Variability, Air-Sea Interactions Committees] Congress 2007 together with the Eastern Snow Conference (ESC) will be held at the St. John's Convention Centre and Delta Hotel in Newfoundland Canada from May 28 to June 1, 2007.

The Congress theme "*Air, Ocean, Earth and Ice on the Rock*", along with the key objectives of the International Polar Year, reflect the Congress' objective to explore, link, bridge and integrate the scientific interests of the CMOS, CGU, AMS and ESC.

Scientific Program: Several invited speakers will discuss scientific issues on geophysics, atmosphere, climate, hydrology, ocean and snow. Among plenary speakers are Susan Allen, University of British Columbia, James P. Bruce, CMOS Member, Garry Clarke, University of British Columbia, Louis Fortier, Laval University, Marika Holland, National Center for Atmospheric Research (USA), Brian Hoskins, University of Reading (UK), C.K. Shum, The Ohio State University (USA) and Lonnie Thompson, Byrd Polar Research Center (USA).

Travel: Air Canada is the official airline of the Congress. Simply contact Air Canada's North America toll free number at 1-800-361-7585, or local number 514-393-9494, or your travel agent and take advantage of Special Discounted Airfares, or to book web fares, by quoting our convention number UR4A86B1. By ensuring that the CV convention number appears on your ticket, you will be supporting our organisation. For flight information, please consult www.aircanada.com.

WestJet offers 10% off their 'best air fare' at the time of conference booking (except during unadvertised seat sales). By quoting our convention number QC2432. The contact is their Specialty Sales Dept., at 1-888-493-7853 (toll free), or FAX 1-800-582-7072. Their local Calgary number is 403-444-2294. For flight schedule information , please visit www.westjet.com.

Hertz is the official car rental company for the Congress. Special discounted rates have been set up for all participants. The special rates are available for period May 21st 2007 to Jun 10 2007, so that you can take advantage of some pre and post conference sightseeing.

Registration: Early registration deadline is **April 15, 2007.** Cost of registration includes the Ice Breaker, coffee breaks, poster session receptions, lunch each day and the Gala Banquet.

For enquires on scientific sessions, please contact the co-chairs of the Scientific Program Committee Guoqi Han (CMOS) at HanG@dfo-mpo.gc.ca, Rod Blais (CGU) at blais@ucalgary.ca, or Taneil Uttal (AMS) at Taneil.Uttal@noaa.gov. For other information on the Congress visit http://www.cmos2007.ca or contact Local Arrangements Committee (LAC) Chair, Fraser Davidson at DavidsonF@dfo-mpo.gc.ca.

CMOS-CGU-AMS 2007 / SCMO-UGC-AMS 2007

Air, océan, terre et glace sur le roc

28 mai - 1 juin 2007

Congrès SCMO-UGC-AMS 2007
St-Jean, Terre-Neuve, Canada
28 mai – 1 juin 2007

http://www.cmos2007.ca

Le congrès 2007 de la Société canadienne de météorologie et d'océanographie (SCMO), de l'Union géophysique canadienne (UCG) et de l'American Meteorological Society (AMS) [comités de météorologie et d'océanographie polaire, de la variabilité du climat et des interactions air-mer], en partenariat avec le Eastern Snow Conference (ESC), sera tenu au St. John's Convention Centre et à l'hôtel Delta de Terre-Neuve, du 28 mai au 1er juin 2007.

Le thème du congrès "*Air, Océan, Terre et Glace sur le Roc*", ainsi que les objectifs de l'Année polaire internationale, reflètent l'objectif du congrès qui est d'explorer, d'échanger et d'intégrer les intérêts scientifiques de la SCMO, de l'UGC, de l'AMS et du ESC.

Programme scientifique: Plusieurs conférenciers invités discuteront des enjeux scientifiques sur la géophysique, l'atmosphère, le climat, l'hydrologie, les océans et la neige. Parmi les conférenciers des sessions plénières nous retrouvons Susan Allen, Université de la Colombie Britannique (UBC), James P. Bruce, membre de la SCMO, Garry Clarke, UBC, Louis Fortier, Université Laval, Marika Holland, Centre national pour la recherche atmosphérique (É.U.), Brian Hoskins, Université de Reading (R.U.), C.K. Shum, Université de l'État de l'Ohio (É.U.) et Lonnie Thompson, Centre de recherche polaire Byrd (É.U.).

Transport: Air Canada est la compagnie de transport aérien officielle pour le congrès. En Amérique du nord, veuillez contacter Air Canada directement au numéro sans frais 1-800-361-7585 ou au numéro local 514-393-9494 ou contactez votre agent de voyage et profitez des offres spéciales, ou réservez en ligne, en mentionant le code promotionnel pour le congrès CV 070251. En assurant que le code promotionnel pour le congrès apparait sur votre billet, vous supportez notre organisation. Pour les horaires de vol, prière de consulter www.aircanada.com.

West Jet offre aux délégués un rabais de 10% sur leur meilleur tarif régulier au moment de la réservation (sauf soldes de places) en mentionant le code promotionnel pour le congrès QC2432. Communiquez avec l'équipe de ventes spéciales (Specialty Sales Dept.) au 1-888-493-7853 (sans frais), ou par télécopieur au 1-800-582-7072. Leur numéro local à Calgary est 403-444-2294. Pour les horaires de vol, visitez www.westjet.com.

Hertz est la compagnie de location de voiture officielle pour le congrès. Des taux de location spéciaux sont offerts aux délégués. Ces taux sont disponibles du 21 mai au 10 juin 2007 pour permettre aux participants de visiter Terre-Neuve avant ou après le congrès.

Inscription: La date limite pour le tarif préférentiel est le **15 avril 2007.** Le tarif inclut la réception d'ouverture, les pauses santé, les réceptions durant les sessions d'affiches, les dîners à chaque jour et le banquet.

Pour plus d'information sur les sessions scientifiques, contactez les co-présidents du comité du programme scientifique : Guoqi Han (SCMO) à HanG@dfo-mpo.gc.ca, Rod Blais (UGC) à blais@ucalgary.ca, ou Taneil Uttal (AMS) à Taneil.Uttal@noaa.gov. Pour d'autres informations générales à propos du congrès visitez http://www.cmos2007.ca ou contactez le président du comité des arrangements locaux Fraser Davidson au DavidsonF@dfo-mpo.gc.ca.

CMOS
SCMO

American Meteorological Society
87th Annual Meeting and Conference
San Antonio, TX, USA
January 14 - 18, 2007

Canadians were well represented in the awards that were presented at the AMS conference banquet last January in Texas:

★ **Isztar Zawadzki** (McGill University) - the Remote Sensing Prize (for pioneering contributions to the application of meteorological radar to the quantitative estimation and forecasting of precipitation);

★ **Timothy Oke** (Professor Emeritus, University of British Columbia) - the Helmute E. Landsberg Award (for visionary leadership in urban climatology and meteorology);

✦ **Barry Ruddick** (Dalhousie University) - the Editors Award, Journal of Physical Oceanography; and

✦ **Ulrike Lohmann**, currently at the Institute for Atmospheric and Climate Science in Zurich and formerly a professor at Dalhousie University, received the Henry G. Houghton Award for pioneering contributions to the representation and quantification of the effects of cloud-aerosol interactions on climate.

Congratulations to all recipients!

Atlantic Zone Monitoring Programme

The annual Atlantic Zone Monitoring Programme Bulletin presents an annual review of the general oceanographic conditions in the Northwest Atlantic region, including the Gulf of St. Lawrence, as well as AZMP-related information concerning particular events, studies, or activities that took place during the previous year. The 2006 issue of the AZMP Bulletin is available at http://www.meds-sdmm.dfo-mpo.gc.ca/zmp/main_zmp_e.html.

Second Annual CMOS Photo Contest

We are pleased to announce that CMOS Members are invited to participate in the CMOS Photo Contest. Details can be found now on the CMOS Web Page at http://www.cmos.ca/photos.html. The photos should be submitted directly to Bob Jones, webmaster@cmos.ca The deadline for submissions is **May 15, 2007.**

Call for SCOR Working Group Proposals for 2007

The 38th Executive Committee Meeting will take place in Bergen, Norway on 26 - 28 August 2007 and it will evaluate proposals for new SCOR Working Groups at that time. New Working Group proposals will be entertained until **30 April 2007**. Model proposals and other information about working groups may be found at http://www.scor-int.org/wkgrpinfo.htm

SCOR examines the disciplinary balance of its working groups annually. Comments from the 2006 evaluation recommended that "SCOR encourage multidisciplinary approaches, at the limits between existing large programs. In biology, we need some activities on the benthic boundary interface with chemistry, physics, and sedimentology, including exported fluxes from the surface ocean. [Earlier discussions at the meeting identified ecology of the mesopelagic zone as a potential area of SCOR interest.] In the area of physical oceanography, we need some integrative activities and perhaps something on sea ice. In chemistry/biogeochemistry, we need something on remote sensing and clathrate dynamics." Each proposal, whether in these areas or others, will be evaluated against each other by national SCOR committees in terms of scientific merit and quality, timeliness, and achievability of the proposed terms of reference. SCOR tentatively plans to start two new working groups in 2008, pending availability of adequate funding. National SCOR committees are an important aspect of SCOR's operation and can play a key role in reviewing working group proposals and in seeking new funds to pay for working group activities. Proponents should consider submitting their proposals through their national SCOR committees, although SCOR will also accept proposals from individuals and other organizations.

Details on the call for proposals may be found at: http://www.scor-int.org/2007EC/2007EC.htm (the second entry).

Deuxième concours annuel de photographies de la SCMO

Nous invitons les membres de la SCMO à participer au concours de photographies de la société. Les détails du concours sont présentement indiqués sur la page web de la SCMO à http://www.scmo.ca/photos.html. Les photos doivent être envoyées directement à notre webmestre Bob Jones à webmaster@scmo.ca. La date limite pour soumettre vos photos est le **15 mai 2007**.

Greenhouse Gas Bulletin

Geneva, 3 November 2006 (WMO) – In 2005, globally averaged concentrations of carbon dioxide in the atmosphere reached their highest levels ever recorded. The World Meteorological Organization's (WMO) 2005 Greenhouse Gas Bulletin says quantities of CO_2 were measured at 379.1 parts per million (ppm), up 0.53 per cent from 377.1 ppm in 2004.

After water vapour, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are the three most prevalent greenhouse gases in the Earth's atmosphere respectively. Greenhouse gases are some of the major drivers behind global warming and climate change.

Concentrations of N_2O also reached record highs in 2005, up 0.19 per cent from 318.6 parts per billion (ppb) to 319.2 ppb while methane remained stable at 1783 ppb.

The 35.4% rise in carbon dioxide since the late 1700s has largely been generated by emissions from the combustion of fossil fuels.

Around one third of N_2O discharged into the air is a result of human activities such as fuel combustion, biomass burning, fertilizer use and some industrial processes.

Human activity such as fossil fuel exploitation, rice agriculture, biomass burning, landfills and ruminant farm animals, account for some 60% of atmospheric CH_4, with natural processes including those produced by wetlands and termites responsible for the remaining 40%.

Accurate atmospheric observations from some 44 WMO Members are archived and distributed by the World Data Centre for Greenhouse Gases (WDCGG), located at the Japan Meteorological Agency.

WMO prepares the Greenhouse Gases Bulletin in cooperation with WDCGG and the Global Atmosphere Watch Scientific Advisory Group for Greenhouse Gases with the assistance of the National Oceanic and Atmospheric Administration's Earth System Research Laboratory.

WMO is the United Nations' authoritative voice on weather, climate and water

CMOS exists for the advancement of meteorology and oceanography in Canada.

Le but de la SCMO est de stimuler l'intérêt pour la météorologie et l'océanographie au Canada.

ATMOSPHERE-OCEAN 45-1 Paper Order

AO-713
A Canadian Precipitation Analysis (CaPA) Project: Description and Preliminary Results by Jean-François Mahfouf, Bruce Brasnett and Stéphane Gagnon.

AO-808
Surface Water and Energy Budgets over the Mississippi and Columbia River Basins as Simulated by Two Generations of the Canadian Regional Climate Model by Raphaël Brochu and René Laprise.

AO-716
Thirty-Five Year (1971-2005) Simulation of Daily Soil Moisture Using the Variable Infiltration Capacity Model over China by Zhiyong Wu, Guihua Lu, Lei Wen, Charles A. Lin, Jianyun Zhang and Yang Yang.

AO-803
Internal Wave Tunnelling Through Non-uniformly Stratified Shear Flow by G. L. Brown and B. R. Sutherland.

OC-280
Late-Summer Pack Ice in the Canadian Archipelago: Thickness Observations from a Ship in Transit by Jacqueline A. Dumas, Humfrey Melling and Gregory M. Flato.

Ocean Science in the US

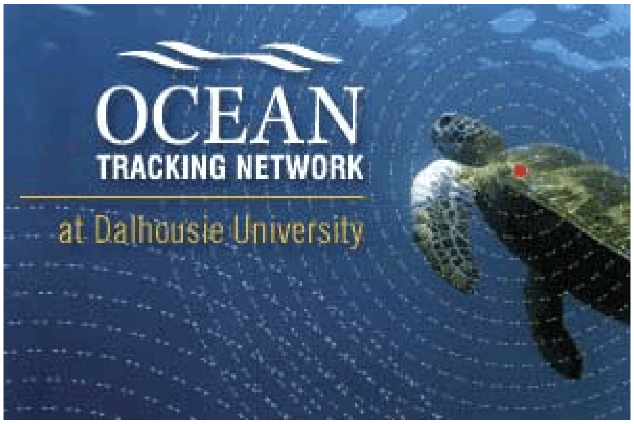
The report entitled "Charting the Course for Ocean Science in the United States for the Next Decade: An Ocean Research Priorities Plan and Implementation Strategy" outlines the national ocean research priorities for the US for the next ten years. The document represents the first national effort to identify research priorities that address key interactions between society and the ocean. The report is available at http://ocean.ceq.gov/about/sup_jsost_prioritiesplan.html.

Offshore Oil and Gas Environmental Research

The Centre for Offshore Oil and Gas Environmental Research (COOGER) was established by Fisheries and Oceans Canada to coordinate the Department's nation-wide research into the environmental and oceanographic impacts of offshore petroleum exploration, production and transportation. For information on COOGER and its research projects, access http://www.dfo-mpo.gc.ca/science/cooger-crepge/research_e.htm.

Understanding the world's oceans a benefit for future generations

Dalhousie University has become the epicentre for international oceans' research that will change how scientists and world leaders understand and manage pressing global concerns such as fisheries management in the face of climate change.



The Ocean Tracking Network (OTN), headquartered at Dalhousie University and led by Dr. Ron O'Dor, unites the finest marine scientists in the world, in the most comprehensive and revolutionary examination of marine life and ocean conditions, and how they are changing as the earth warms.

A global monitoring system will track the movement and behaviour of diverse marine species — salmon to turtles to whales. The network will establish 'listening curtains,' comprised of innovative Canadian-made tracking technology, in 14 ocean regions covering the entire planet.

The network's technological capacity will be provided by private sector companies, like AMIRIX Systems Inc., Lotek Wireless Inc., Satlantic Inc. and Kintama Research Corp. The network will enable the world's best minds in marine science and management to collaborate among research institutions located in Canada, the United States, Argentina, Bermuda, Spain, South Africa, Japan, Australia, and elsewhere.

The results will provide the most comprehensive data to inform marine management practices ever available and will determine how life-sustaining ocean properties are changing in response to climate change in a way never before possible.

This research is enabled by the largest federal government university research award in Dalhousie – and Atlantic Canadian – history: a $35-million investment by the Canada Foundation for Innovation (CFI); supplemented by an additional $10 million from the Natural Sciences and Engineering Research Council of Canada (NSERC); and $327,000 from the Social Sciences and Humanities Research Council of Canada (SSHRC). This investment will leverage in excess of $100 million of in kind and financial contributions from our OTN partners world-wide.

"This support from the federal government follows a rigorous merit review of proposals submitted by universities across Canada. For Dalhousie to have been successful is a recognition of the timeliness of this research," said Dr. Carl Breckenridge, VP (Research). "It also recognizes the international expertise of Dalhousie's scientists, particularly the leadership of marine biologist Dr. Ron O'Dor."

Dalhousie's undergraduate, graduate and professional students will benefit directly from the knowledge generated by this research initiative. Science students will have the opportunity to join research teams and to publish articles in collaboration with their internationally-recognized professors. Humanities students will focus their research on the pressing local and legal issues raised by technological advances and the consequent impact on ocean management.

"Dalhousie is committed to building capacity in the next generation of leaders who will assume responsibility for the decision-making required by an increasingly complex and changing environment," said Dr. Tom Traves, President.

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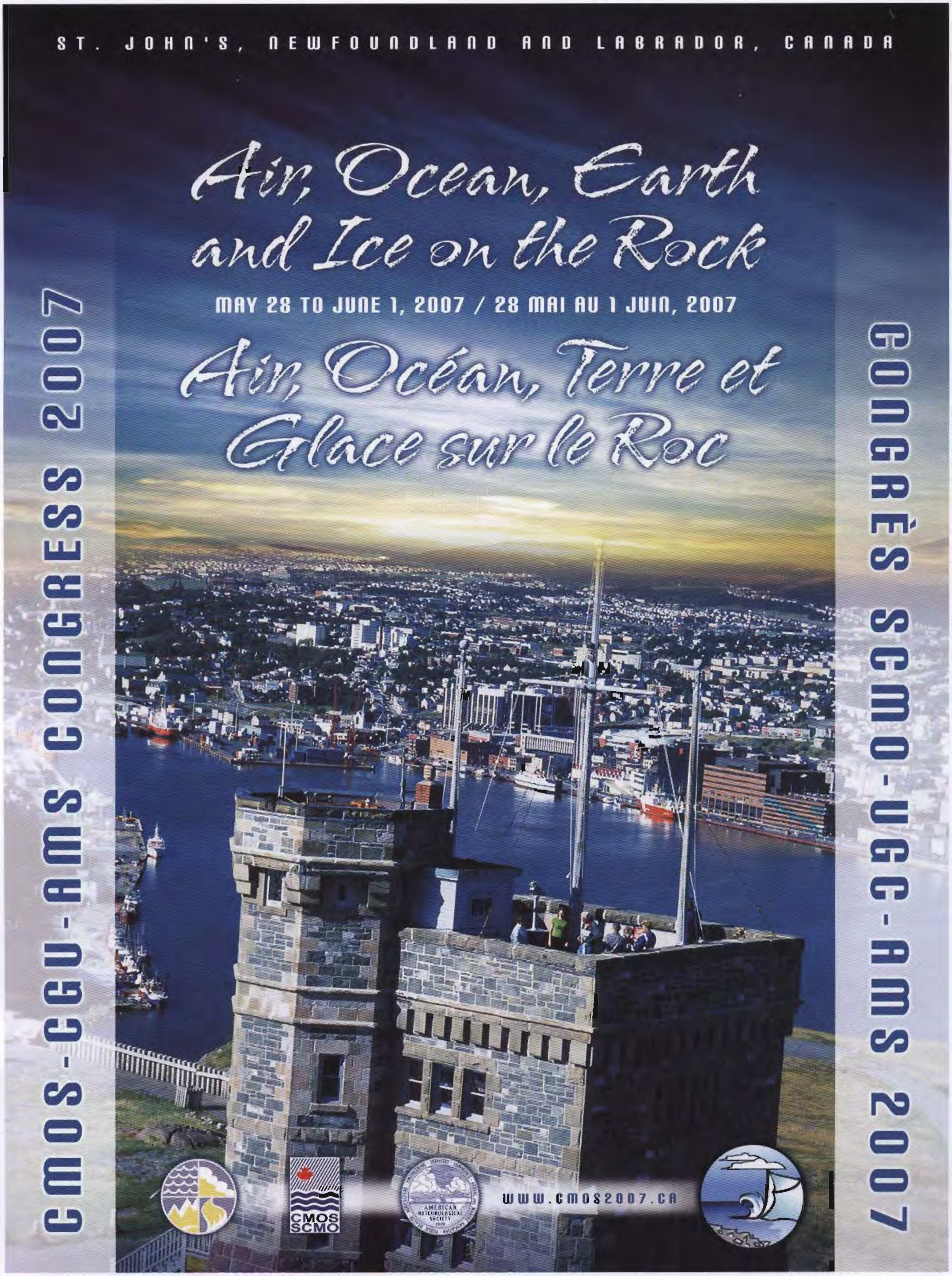
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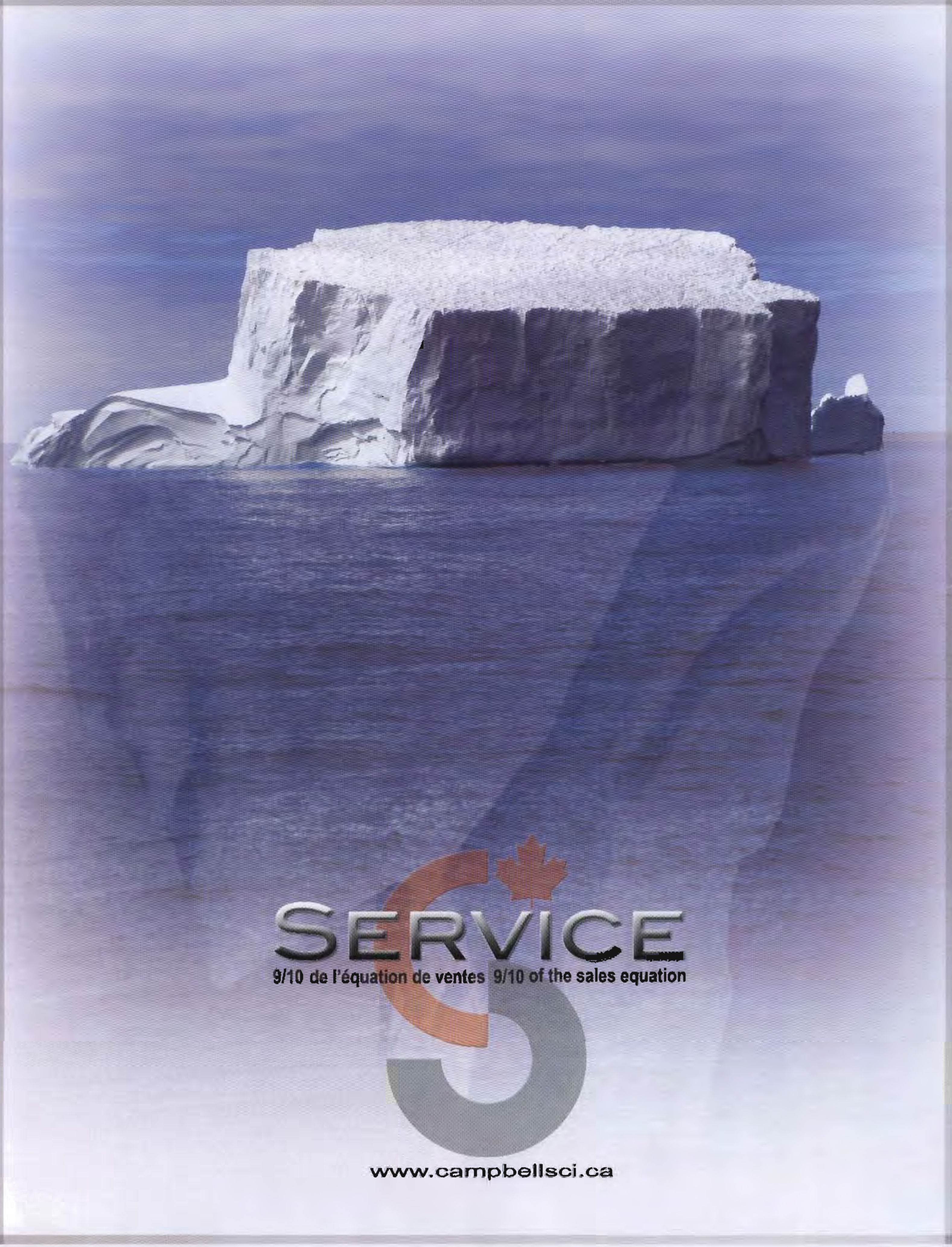
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