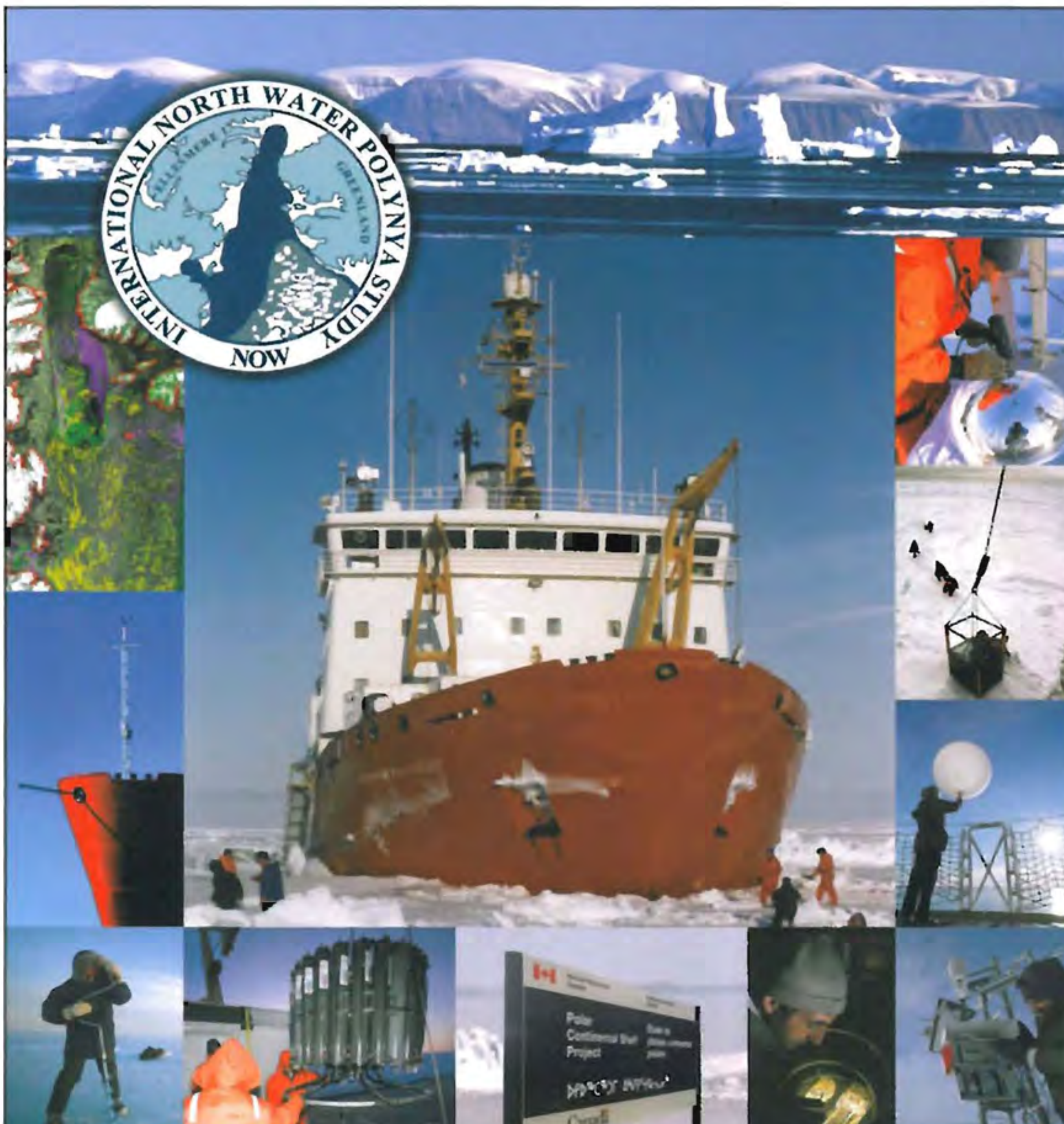
ISSN 1195-8898

Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

CMOS BULLETIN SCMO

October / octobre 2001 Vol. 29 No. 5



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

Editor / Rédacteur: Paul-André Bolduc
Marine Environmental Data Service
Department of Fisheries and Oceans
12082 - 200 Kent Street
Ottawa, Ontario, K1A 0E6, Canada
☎ (613) 990-0300; Fax (613) 993-4658
E-Mail: paulandre.bolduc@sympatico.ca
Canadian Publications Product Sales Agreement #0869228
Envois de publications canadiennes Numéro de convention #0869228

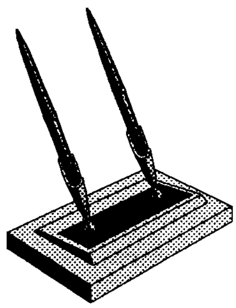
Cover page: Cover of the special issue of ATMOSPHERE-OCEAN (39-3) devoted to the International Study of the North Water (NOW) Polynya.

To learn more, read the article on page **137**.

Page couverture: Couverture du numéro spécial de ATMOSPHERE-OCEAN (39-3) dédié à l'étude de la polynie des eaux du Nord (NOW).

Pour en savoir plus, lire l'article en page **132**.

....from the President's Desk



CMOS Friends:

Well, here it is early October. My term as President seems to be flying by, and there's so much to be done.

There is no lack of incentive to continue working for CMOS. Hardly a day goes by that we aren't reminded of the importance of our fields. For example, Newfoundland recently had to endure a pounding from the remnants of a tropical storm. A group recently suggested that Manitoba could raise about $4B per year if it decided to ship water south. As well, there have been several reports on the fragile Great Lakes ecosystem and the implications of this on society. Such events, suggestions and assessments are all linked with our fields to a considerable degree.

CMOS contributes to addressing such issues through our science but we go further. For example, we interact directly with decision-makers, and we belong to umbrella or lobby groups concerned with Canadian science. In particular, CMOS is currently a member of two organizations that are, in broad terms, all acting to increase science activities within Canada:

▪ Partnership Group for Science and Engineering: PAGSE includes physical and natural science societies, engineering societies, and industrial representatives. It raises the profile of these sciences and their contributions to Canadian society mainly through large meetings and presentations by scientists who can impart to a general audience their enthusiasm, their scientific progress, and the importance of their work.

▪ Canadian Consortium for Research: CCR includes many of the same societies and groups associated with PAGSE, and it also covers the biological, medical, social and economic sciences. Its focus is on R&D and government support for it by arranging one-on-one meetings with key individuals in government, as well as preparing position papers and presenting them to government.

To be sure that we are efficiently addressing science issues with government and outside groups, we are forming a new committee, the External Relations Committee. Its aim will be to consistently handle the interests of CMOS with umbrella groups or lobby groups to which CMOS belongs, and to act as an advisory group to the Executive and Council in discussions between CMOS and others on matters linked with Canadian research.

- Continued next page - Suite à la page suivante -

Volume 29 No. **5**
October 2001 - octobre 2001

Inside / En Bref

Articles

Our regular sections / Nos chroniques régulières

Printed in Kanata, Ontario, by Gilmore Printing Services Inc.
Imprimé sous les presses de Gilmore Printing Services Inc., Kanata, Ontario.

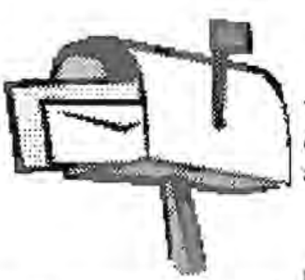
With regard to a PAGSE activity in particular, I may add that CMOS has again been successful in proposing a presentation to parliamentarians and senior government officials at an upcoming "Bacon and Eggheads" breakfast on Parliament Hill. In late November, Prof. Woo of McMaster University will make a presentation on cold climate water issues. This presentation is our third one (out of a total of 22); previous speakers have been Andrew Weaver (climate) and Diane Michelangeli (air quality). Special thanks should go to Bill Pugsley who has been a key member of the organizing committee for this event. Please give us suggestions for future talks.

These interactions beyond our immediate community of colleagues leads us to think about our future scope. In this ever-changing world with its technological breakthroughs and growing susceptibility to environmental issues, we need to ensure that we maintain a strong voice within and for Canada. I note that the American Meteorological Society has recently developed a 10-year vision of its future. It intends to become increasingly more multidisciplinary, more inclusive of other groups using science to produce or use products, and more involved in outreach to decision-makers and the public, and it intends to remain up-to-date in regard to communication technology. It is not clear whether we should completely follow such a strategy, but we need to start discussing our future and how best to get there. We expect to begin this process soon and it will probably require several to many months to resolve. We will certainly be updating you and asking for your advice.

And, to put us back into the very-near future, it is hard to believe but our 2002 Congress is fast approaching. At our last Council meeting, Gilles Simard informed us of all the progress being made by the group in Rimouski in preparation for the Congress. C'est un beau coin de pays à visiter et j'espère très sincèrement vous y rencontrer l'an prochain.

Till the next Bulletin.

Ronald Stewart, President / Président



Letter to the Editor

To all my Met Colleagues (specifically, MKT, LKM, AFV and MJN)

Tornado Tango

I've been 40 years a professionnal weatherman and twice that, subprofessionally.

Yet it was not until a few days ago, (Tuesday, July 4, 2001) that I ran into my first tornado, or rather, it ran into me, or rather, we ran into each other, actually.

Audrey and I were on the 401 returning from a funeral in Guelph. As we headed east at a high rate of knots, there were angry clouds all around, when lo! And behold! there on the far horizon loomed a peculiar cloud the like of which I had never seen, a funnel cloud, whirling like a dervish.

I bumbled along, heedless, sure we would miss it, when suddenly there it was crossing 401and we were smack-dab in the middle of it, with swirling debris rattling our cage, the wind buffeting the carso that I had to white knuckle my way through.

I could just picture the headlines: "Weatherman hoist by his own petard, Twisted by a twister, Pretzel Percy died with his boots off. Like Casey Jones he died with his hands on the throttle."

Other motorists had wisely stopped on both sides of 401, well clear of the funnel, but good old wiseacre weather guy barrelled on, oblivious to life and limb, while Audrey huddled beside me screaming her head off, her talons tearing huge chunks of bloody flesh out of the near side of her sould mate. "Get the bloody hell out of here, you blithering idiot," she murmured lovingly in my ear.

Most distressing, but then she has always been supersensitive to my putting her in harm's way (her favourite phrase). She thinks I'm the world's worst driver (with hardly any justification, I may say).

In any event, we arrived safe and sound, albeit badly battered and bruised beyond belie (mostly psychically). She took the her bed and I took to mine (now you know the state of our union).

All of which reminds me of Sir Robert Watson-Watt, caught in a radar trap, the news rocketing around the world, "Radar Inventor Trapped by Radar. The bugger got what he deserved."

Or of Cleopatra bitten by her own asp.

All of which reminds me how important it is for every doctor to suffer every illness, every general to take a bullet in his own gut, every judge to be clapped into his own can, every weather man the slings and arrows of every slug of lousy weather (as FDR said, "the only fear we have to fear is the atmosphere").

Myself, I went throug hell with Hazel with 18" of water in my cellar. I saw ball lightning rattle down my windowpane not five inches from my nose. I gathered great pails of prairie hail to make the sweetest ice cream this side of Cuba. I saw CB with great mammaries bulging down a few feet overhead right at Met HQ, 315 Bloor West. I saw a short sharp winter cold front snap through St.Hubert SFTS, taking us from blue sky to snow squalls to blue sky in a matter of minutes (made me a believer out of me in those thin blue lines on the synoptic charts, I can tell you). I've sweated all right in the buff of Toronto parks during those awful heat waves of the dirties thirties. I've had my tongue stuck frozen solid to the cold stell of CPR rolling stock in a prairie winter. I've shivered at 40 below at Fort Churchill where the piss froze in a crystalline arc in the winter wind. I've flown over acres of Arctic ice where bitter blizzards of BS veiled the sun. In short, I've been blooded and bloodied and bandied about all in the call of duty. And now a baby tornado!

So, short of landslides, mudslides, lightning strikes, tsunamis, earthquakes, volcanic blasts and tidal waves, I've drained the meteorological dregs to the full.

But has it made a better weatherman of me? Faugh!

Nonetheless, I shall always cherish the moment when I breached a funnel cloud, reached out and touched the face of God.

I, too, have clasped the asp to my bosom. Move over, Cleo!

But enough of me. What about you?

Percy Saltzman, Toronto, Ontario.

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

The Earth's Plasmasphere, by J.F. Lemaire and K.I. Gringauz, January 1998, Cambridge University Press, Hardback Cover, 0-521-43091-7, 350 pages, $90.00US.

Tsunami: The Underrated Hazard, by Edward Bryant, Cambridge University Press, Hardback Cover, 0-521-77799-X, July 2001, $74.95US.

Emissions Scenarios, Intergovernmental Panel on Climate Change, Cambridge University Press, Paper Cover, 0-521-80493-0, 2000, $44.95.

Methodological and Technological Issues in Technology Transfer, Intergovernmental Panel on Climate Change, Cambridge University Press, Paper Cover, 0-521-80494-9, 2000, $35.95.

Introduction to Atmospheric Chemistry, by Peter V. Hobbs, Cambridge University Press, Paperback, 0-521-77800-X, 2000, $24.95.

Basic Physical Chemistry for Atmospheric Sciences, by Peter V. Hobbs, Cambridge University Press, Paperback, 0-521-78567-7, 2000, $24.95.

Ionospheres, Physics, Plasma Physics, and Chemistry, by Robert W. Schunk and Andrew F. Nagy, Cambridge University Press, Hardback, 0-521-63237-4, 2000, $100.00.

If you are interested in reviewing one of these books for the *CMOS Bulletin SCMO*, please contact the Editor at the e-mail address provided below. Of course, when completed, the book is yours. The instructions to be followed when reviewing a book for the *CMOS Bulletin SCMO* will be provided with the book. Thank you for your collaboration.

Si vous êtes intéressés à faire la critique d'un de ces livres pour le *CMOS Bulletin SCMO*, prière de contacter le rédacteur-en-chef à l'adresse électronique mentionnée ci-bas. Bien entendu, le livre 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.

Paul-André Bolduc, Editor / Rédacteur-en-chef
CMOS Bulletin SCMO; paulandre.bolduc@sympatico.ca

Books now being Reviewed
Livres présentement en révision

Scattering of Waves from Large Spheres by Walter T. Granby, Jr., Cambridge University Press, Hardback cover, 0-521-66126-9, $95.00US. Reviewer: Diane Masson, Institute of Ocean Sciences.

Climate Change Impacts on the United States, National Assessment Synthesis Team, US Global Change Program, First published in 2001, Cambridge University Press, Paperback, 0-521-00075-0, 612 pages, $39.95US. Reviewer: William A. Gough, University of Toronto at Scarborough.

Air-Sea Interaction, by G.T. Csanady, Cambridge University Press, Paperback Cover, 0-521-79680-6, 2001, Price unknown. Reviewer: Paul Myers, University of Alberta.

Land Use, Land-Use Change and Forestry, Intergovernmental Panel on Climate Change, Cambridge University Press, Paper Cover, 0-521-80495-7, 2000, $29.95. Reviewer: Ted Munn, University of Toronto.

Nonlinear and Nonstationary Signal Processing, by W.J. Fitzgerald, R.L. Smith, A.T. Walden and P.C. Young, Cambridge University Press, Hardback Cover, 0-521-80044-7, March 2001, $95.00US. Reviewer: Brenda Topliss, Bedford Institute of Oceanography.

El Niño and The Southern Oscillation, Multiscale Variability and Global and Regional Impacts, Edited by Henry F. Diaz and Vera Markgraf, Cambridge University Press, Hardback Cover, 0-521-62138-0, 2000, $90.00. Reviewer: William Hsieh, University of British Columbia.

Processus physiques dans la polynie des eaux du Nord

par D. Barber[1]*, R. Marsden[2], P. Minnett[3], G. Ingram[4] et L. Fortier[5]

[1] CEOS, Department of Geography, University of Manitoba, Winnipeg MB
[2] Collège militaire royal, Kingston ON
[3] Rosentiel School of Marine and Atmospheric Science, University of Miami, Miami FL
[4] Department of Earth and Ocean Sciences, University of British Columbia, Vancouver BC
[5] GIROQ, Université Laval, Québec QC
Première publication dans ATMOSPHERE-OCEAN 39 (3) 2001, 167–171

1 Introduction

Les polynies sont de vastes zones (10 – 90 000 km^2) d'eau libre ou dont la couverture de glace est réduite, au coeur de la banquise épaisse qui couvre les océans polaires durant la plus grande partie de l'année. En demeurant libre durant l'hiver ou en le devenant tôt au printemps, les polynies fournissent un lieu pour l'alimentation, l'accouplement, le frai et l'hivernage d'une population vaste et diversifiée d'oiseaux et de mammifères. C'est pourquoi on a comparé les polynies aux oasis des déserts terrestres. La polynie des eaux du Nord, dans la partie nord de la baie de Baffin, est parmi les régions maritimes les plus productives au nord du cercle arctique. Elle est située à des latitudes où la tendance actuelle dans la variabilité et le changement climatiques se feront sentir tôt et de façon particulièrement marquée. La polynie des eaux du Nord est active durant la majeure partie du cycle annuel et il semble qu'elle se forme et se maintienne sous l'effet d'une combinaison de mécanismes de chaleur latente et de chaleur sensible.

Sur le plan physique, les polynies réagissent à des contraintes océaniques et atmosphériques. Les processus de croissance de la glace ont aussi une «rétroaction» dans l'atmosphère et dans l'océan du fait des changements de phases liés à la couverture glacielle dans la polynie. Sur le plan climatologique, ces processus dynamiques sont des facteurs importants dans le bilan énergétique de surface à l'échelle locale et peuvent aussi réagir aux téléconnexions atmosphériques (Oscillation méridionale El Niño, Oscillation atlantique et Oscillation de l'Atlantique nord) d'échelle planétaire. Du point de vue de la physique océanique, ces processus modifient la convection verticale dans les océans en augmentant les concentrations de salinité près de la limite d'accrétion de glace dans les zones où la glace de mer croît rapidement. Sur le plan biologique, on croit que les polynies sont des foyers d'intense production d'herbivores qui assurent le transfert de l'énergie solaire fixée par les algues planctoniques et épontiques vers les morues arctiques, les phoques, les ours polaires et les humains. Dans les mers qui connaissent un englacement saisonnier, la couverture de glace qui se forme tôt à l'automne empêche le CO_2 dissout dans la couche d'eau superficielle et assimilé durant l'été par les algues marines de retourner à l'atmosphère en hiver. Par conséquent, les régions où se forment une couverture de glace saisonnière (et plus particulièrement les polynies hautement productives) pourraient contribuer de façon disproportionnée à la séquestration du CO_2 atmosphérique et au ralentissement du réchauffement global. Au point de vue physique, ce mécanisme peut être équilibré par une rétroaction glace-albédo positive qui est favorisée par un retrait hâtif de la glace de mer. Tant sur les plans physique que biologique, on peut considérer les polynies comme des systèmes modèles pouvant aider les scientifiques à prévoir la réponse du système arctique à la variabilité et au changement climatiques.

2 L'étude internationale de la polynie des eaux du Nord

Le Conseil de recherches en sciences naturelles et en génie (CRSNG) a financé une étude échelonnée sur quatre ans et consacrée à l'examen de la nature du couplage physique et biologique dans la polynie des eaux du Nord. Le projet s'est articulé autour d'une étude de terrain intensive menée de mars à juillet 1998. Le mouillage et la récupération d'instruments océanographiques, accompagnés d'un échantillonnage plus limité des paramètres physiques et biologiques, furent aussi conduits en août–septembre 1997 et 1999. L'équipe de chercheurs a été recrutée dans divers laboratoires universitaires et gouvernementaux à travers le Canada. Une importante

L'article présenté ici sert d'introduction au numéro le plus récent de **ATMOSPHERE-OCEAN**, volume 39 No. 3, septembre 2001; il est reproduit avec la permission des auteurs. Le texte intégral des articles cités se trouve sur le site de la SCMO: www.SCMO.ca, en suivant les liens à ATMOSPHERE-OCEAN et autres publications.

* courriel de l'auteur correspondant : dbarber@ms.umanitoba.ca

équipe internationale a collaboré avec l'équipe canadienne. Elle comptait parmi ses membres des représentants de la Pologne, du Danemark, de l'Allemagne, du Japon, du Royaume-Uni et des États-Unis. L'objectif premier du réseau de recherche sur la polynie des eaux du Nord était d'examiner la nature, dans le temps et dans l'espace, du couplage entre les processus biologiques et les mécanismes physiques responsables de l'apparition et du maintien de la polynie des eaux du Nord.

Des travaux précédents ont indiqué que la polynie des eaux du Nord se maintient grâce à des mécanismes de chaleur latente ainsi que de chaleur sensible. Les polynies de chaleur latente apparaissent là où la glace est retirée de sa région d'origine dès qu'elle se forme. Dans ces régions, la glace se forme continuellement à la surface de la polynie mais est exportée par les vents ou les courants océaniques. Dans ces polynies, il y a une perte continue et importante de chaleur de l'océan au profit de l'atmosphère. La chaleur requise pour équilibrer la perte vers l'atmosphère, et pour garder la polynie libre, provient de la chaleur latente de fusion résultant de la formation continuelle de la glace. La production de nouvelle glace dans une polynie contribue aussi, de façon importante, à la formation d'eau profonde par des processus thermohalins en plus de contribuer à l'advection de chaleur latente dans la région aval de la polynie. Les polynies de chaleur sensible se forment quand des remontées d'eau apportent de la chaleur océanique à la surface et empêchent la glace de se former. Ce processus est nécessaire pour satisfaire au bilan énergétique de la surface. La transmission de chaleur vers le haut peut se faire par le mélange vertical de la chaleur provenant d'eau plus profonde ou par une advection de chaleur vers le haut par des mécanismes comme les remontées d'eau causées par le vent, qui amènent suffisamment de chaleur océanique disponible pour éroder la surface inférieure de la couverture glacielle (Smith *et al.*, 1990; Dunbar, 1981). Une fois libre, la polynie perdra rapidement de la chaleur au profit de l'atmosphère mais la source d'eau plus chaude peut être suffisante pour empêcher la congélation. Sinon, les courants d'advection originaux peuvent emporter les cristaux de glace nouvellement formés avant qu'ils produisent une couverture de glace continue.

Les conditions météorologiques associées à une polynie peuvent être vues comme une contrainte (c.-à-d. les effets de la chaleur sensible et latente sur la formation et le maintien de la polynie) ou comme un effet du flux de chaleur de l'océan vers l'atmosphère qu'engendre la polynie. Ce phénomène cause/effet apparaît dans la structure de la théorie de rétroaction comme le mécanisme de rétroaction glace/nuage/albédo. L'idée est que le régime de rayonnement engendré par la prévalence des conditions nuageuses produit un flux de rayonnement de l'atmosphère vers la surface; ce flux dégrade la glace de mer et il en résulte un flux de vapeur et une formation de nuages accrus, ce qui entretien le mécanisme de rétroaction. Cette structure de rétroaction est manifeste tant dans les données d'observations que dans les études de modélisation des polynies, mais n'a pas été adéquatement caractérisée pour expliquer toutes les conséquences de ces mécanismes sur la formation et le maintien de la polynie des eaux du Nord. Dans le cas des polynies côtières dans l'Arctique ou l'Antarctique, on a trouvé que les processus météorologiques synoptiques jouent un rôle très important dans leur apparition et leur évolution. Par contre, l'effet des polynies sur l'atmosphère et le climat local a aussi été documenté. Comme le flux de chaleur de l'océan vers l'atmosphère est plus grand à travers une polynie qu'à travers la banquise environnante par plusieurs ordres de grandeur durant l'hiver, les polynies dominent le bilan de chaleur régional durant l'hiver et influencent la circulation atmosphérique en altitude. Par conséquent, les variations d'année en année dans les caractéristiques des polynies peuvent contribuer à la variabilité interannuelle du climat des hautes latitudes ou, réciproquement, la variabilité dans la taille des polynies peut être indicative de changements climatiques à grande échelle dans la région polaire.

3 Résultats dans ce numéro spécial de Atmosphere-Ocean

Le groupe responsable des processus physiques dans le réseau de la polynie des eaux du Nord a collaboré à la production de ce numéro spécial de Atmosphere-Ocean. Les résultats présentés sont les premiers d'une série d'articles qui seront produit par le sous-groupe de physique de l'Étude internationale de la polynie des eaux du Nord. Les objectifs de notre sous-groupe contribuent directement aux objectifs primordiaux du réseau de la polynie des eaux du Nord en examinant les mécanismes physiques ayant une influence sur les productivités et variabilités biologiques observées, dans le temps et dans l'espace. Dans ce numéro spécial, nous regroupons les résultats selon trois thèmes de recherches généralement inter-dépendants : 1) les études qui portent sur des propriétés reliées à la physique ou des processus physiques reliés; 2) les études qui traitent de questions particulières concernant le couplage entre l'atmosphère et la surface; et 3) des articles de synthèse plus généraux qui s'intéressent aux processus à des échelles spatiales et temporelles plus grandes. Des recoupements entre certains articles parmi les thèmes illustrent l'approche multidisciplinaire typique de l'étude Internationale de la polynie des eaux du Nord.

a *Caractérisation des propriétés et des processus physiques*

L'une des caractéristiques particulières d'une polynie est que toutes les formes de glace de mer peuvent y être présentes presque n'importe quand durant le cycle annuel. On peut voir des types de glace jeune entremêlés avec des formes de glace beaucoup plus vieille pendant les mois où la glace se consolide ou se désintègre. Le forçage thermique sur cette glace de mer est un aspect déterminant de l'évolution saisonnière de la surface de la glace de mer. Kawamura *et al.* présentent des résultats sur les propriétés physiques de la glace de mer dans les parties adjacentes aux bords de la polynie des eaux du Nord. Leurs résultats montrent comment les fractions partielles de saumure, de glace et d'air sont orientées dans la colonne de la glace de mer de première année. Les auteurs étudient l'orientation isotopique de ces constituants et fournissent des renseignements détaillés sur l'évolution de ces structures à mesure que la glace évolue pendant la saison. Ce travail contribue à la description des relations entre les propriétés physiques de la glace de mer et sa réaction au forçage thermique océanique et atmosphérique.

Comme dans plusieurs études sur les polynies arctiques, la télédétection a joué un rôle important dans l'étude de la polynie des eaux du Nord. Le travail de Clausi montre comment on peut utiliser différents algorithmes de traitement d'image pour estimer le type de glace de mer présent à l'intérieur et autour de la polynie des eaux du Nord. L'estimation de toute la gamme des types de glace présents est un défi permanent tant pour les études sur les processus géophysiques que pour la navigation maritime. Les techniques de traitement d'image s'avèrent prometteuses en tant que moyen d'obtenir des estimés non ambiguës de la gamme de types de glace typiques d'une polynie arctique. Yackel *et al.* utilisent aussi des données de RADARSAT pour estimer l'état thermodynamique de la glace de première année d'après l'évolution saisonnière du coefficient de diffusion des hyperfréquences. Ils montrent comment on peut utiliser des données de télédétection satellitaire en hyperfréquences pour estimer l'évolution de la fonte et le taux de fonte de la neige sur de la glace épaisse de première année plane. La configuration spatiale de cette fonte conditionne la région de la polynie des eaux du Nord à la fonte de la glace et on croit qu'elle est liée à la configuration spatiale de la formation du phytoplancton au printemps. Dans une étude connexe, Vincent et Marsden ont aussi montré comment on peut utiliser les données du capteur AVHRR pour comprendre l'évolution de la dissolution du pont de glace dans le détroit de Nares. Étant donné l'importance du pont de glace dans la formation et le maintien de la polynie, cette approche est perçue comme un outil important pour la surveillance future de la région de la polynie de eaux du Nord.

b *Couplage entre la surface et l'atmosphère*

À cause du temps de réponse plus court de l'atmosphère (par rapport à l'océan), on a fait un effort particulier pour essayer de comprendre le couplage atmosphère–surface. Grâce à un programme d'échantillonnage par navire et à une série de camps d'observation des glaces entourant la région de la polynie des eaux du Nord, nous avons été en mesure d'étudier le couplage à la surface sous les zones de banquise côtière et les zones de glace marginales, sous les mêmes conditions synoptiques dans les deux cas. Dans leurs travaux, Hanesiak *et al.* comparent différents schémas de paramétrisation des échanges d'ondes courtes au-dessus de la région de la polynie des eaux du Nord. Les auteurs comparent aussi plusieurs approches de paramétrisation avec l'observation directe des flux pertinents. La sélection de schémas optimaux devrait contribuer à la future modélisation thermodynamique de la glace de mer et aux études de modélisation atmosphérique à l'échelle régionale. Dans une étude connexe, Hanafin et Minnett ont examiné le rôle des nuages dans le forçage à la surface dans la région de la polynie des eaux du Nord. En raison de la prédominance d'une couverture nuageuse durant une grande partie du cycle annuel, ce travail est jugé essentiel à notre compréhension du couplage entre la surface et l'atmosphère. Ils ont comparé les schémas de paramétrisation avec les observations directes des flux d'ondes courtes et des flux d'ondes longues. Leurs résultats fournissent un ensemble de données expérimentales sur une importante période du cycle annuel et mènent à des recommandations sur les approches à adopter pour la paramétrisation de ces processus reliés aux nuages. Comme une grande partie de la région de la polynie des eaux du Nord est constituée de zones de marge des glaces, la dynamique et la cinématique des glaces ont été des points centraux de l'examen de la circulation à la surface et de la circulation atmosphérique. Une étude détaillée par Wilson *et al.* fournit les premières estimations à haute résolution dans le temps et dans l'espace du mouvement des glaces au cours d'un cycle annuel dans la polynie des eaux du Nord. Leurs résultats sont basés sur une série chronologique de paires de données de RADARSAT-1, où le déplacement dans les paires d'images donne les vecteurs de déplacement des types de glace. Ils ont ensuite comparé la dynamique du mouvement des glaces avec des données de bouées. Les résultats montrent des configurations spatiales et temporelles distinctes dans le mouvement de la glace à travers la polynie des eaux du Nord. Dans une étude connexe, Vincent *et al.* montrent comment les données de télédétection optique du capteur AVHRR peuvent aussi servir à estimer le mouvement des glaces dans la région de la polynie des eaux du Nord. Bien que les observations dans cette étude aient été faites sur une période beaucoup plus courte, elles se comparent assez favorablement à celles de Wilson *et al.*

Le couplage direct entre l'atmosphère et la surface est manifeste dans le comportement des séries chronologiques des données de diffusion des hyperfréquences actives et passives. Les travaux de Steffen et Heinrichs montrent comment les propriétés de la glace de mer détectées par le radar à ouverture synthétique (ROS) réagissent au forçage par l'atmosphère dans une zone typique de la région visée par l'étude de la polynie des eaux du Nord. Leurs résultats décrivent comment les émissions d'hyperfréquences de la glace de mer et de la glace de glacier réagissent au forçage atmosphérique. Ils montrent aussi comment on peut utiliser ces données pour estimer l'état thermodynamique de la cryosphère par rapport à divers processus qui entrent en jeu entre l'atmosphère et la surface. Les résultats de ces travaux et ceux de Yackel *et al.* montrent l'importance de ces approches pour l'étude du couplage entre l'atmosphère et les différentes surfaces que l'on trouve dans la région de la polynie des eaux du Nord.

c *Dynamique de la polynie*

Les articles précédents contribuent tous à améliorer notre compréhension du fonctionnement de la région de la polynie des eaux du Nord, y compris, mais sans s'y limiter, la formation et le maintien de la polynie. Malgré qu'il y ait plusieurs discussions de processus importants dans les articles précédents, nous concluons ce numéro spécial avec trois articles qui cherchent à établir le contexte pour l'intégration de ces processus dans la région de la polynie des eaux du Nord à des échelles de temps annuelle ou inter-annuelle.

Du point de vue de l'océanographie physique, l'étude de Melling *et al.* montre que la région de la polynie des eaux du Nord est dominée par une forte circulation vers le sud d'eau froide et de glace en provenance de l'océan Arctique. Une branche du courant groenlandais de l'ouest produit un modeste courant d'eau chaude vers le nord du côté est de la baie de Baffin. Le courant chaud vers le nord est dévié par la topographie complexe du fond près des îles Carey, où il perd la plus grande partie de sa chaleur par recirculation et mélange isopycnique dans l'écoulement arctique. Une remontée d'eau près de la côte du Groenland, sous l'effet du transport d'Ekman, amène l'eau chaude jusqu'à la base de la couche turbulente de surface, dans laquelle elle est entraînée.

En ce qui concerne la glace de mer, Mundy et Barber montrent qu'il existe un "paysage de glace" distinctif dans la région de la polynie de eaux du Nord. Ce "paysage de glace" (par analogie avec un paysage terrestre) résulte des processus dominants qui ont cours dans la région de la polynie des eaux du Nord à diverses échelles spatiales et temporelles. L'agrégation statistique des types de glace a montré qu'il se crée des agrégats de mélanges de types de glace typiques à la région et à la saison, qui dépendent de la prédominance du réchauffement par chaleur sensible ou latente dans la formation et le maintien de la polynie. On pense que la configuration de ces agrégats, dans le temps et dans l'espace, est le résultat du couplage entre l'océan, la glace de mer et l'atmosphère et peut fournir un moyen de surveiller les répercussions de la variabilité et du changement climatiques futurs sur la glace de mer.

Le dernier article de ce numéro présente un contexte historique pour l'examen du couplage entre la glace de mer et l'atmosphère. L'article de Barber *et al.* utilise des données SMMR et SSM/I historiques à une résolution temporelle hebdomadaire sur la période de 1978 à 1996. Les auteurs se basent sur ces concentrations de glace et ces écarts par rapport aux concentrations hebdomadaires pour déterminer les conditions glacielles "moyennes" dans la région de la polynie des eaux du Nord sur une période de 18 ans. En les combinant aux données atmosphériques modélisées, les auteurs ont trouvé des modes atmosphériques et des modes de glace de mer qui semblent cohérents dans le temps et dans l'espace. Plusieurs de ces modes correspondent aux observations détaillées de l'étude sur le terrain de 1998 et fournissent un contexte historique pour les études détaillées de géophysique et sur les processus présentées dans ce numéro spécial de Atmosphere-Ocean sur la polynie des eaux du Nord.

Conclusion

Les articles présentés dans ce numéro spécial sont les premiers d'une série d'articles produits dans le cadre de l'étude internationale de la polynie des eaux du Nord. En ce moment, on en est à la révision de documents traitant des aspects biologiques du projet pour un numéro spécial de la revue "Deap Sea Research". En combinant ces deux numéros, les articles constitueront l'étude la plus détaillée jamais faite sur la polynie de eaux du Nord. Nous possédons maintenant une compréhension rudimentaire de la structure et du fonctionnement de base de la polynie et nous pouvons raisonnablement prévoir comment cette polynie pourrait réagir à la variabilité et au changement climatiques. Nous procédons à des analyses plus globales (couplage physique/ biologique) dans le réseau de recherche sur la polynie des eaux du Nord et nous avons l'intention d'étendre les études des données d'observations de la polynie de eaux du Nord (typiques de ce numéro spécial) à des études de modélisation.

Remerciements

Nous tenons tous à remercier les officiers et l'équipage du NGCC *Pierre Radisson* pour leur assistance enthousiaste durant l'étude internationale de la polynie des eaux du Nord. Nous voulons également souligner l'appui que nous avons reçu de l'Étude du plateau continental polaire (EPCP) du Service canadien des glaces (SCG) ainsi que du National Ice Service (NIC) pour ce travail. L'appui financier pour la publication de ce numéro spécial est venu du Service météorologique du Canada (SMC), de Canadian Cryospheric System (CRYSIS; B. Goodison, chercheur principal) et du Conseil de recherches en sciences naturelles et en génie du Canada (CRSNG). Enfin, nous remercions Mme S. Bourque pour sa révision technique attentive de ce numéro spécial. Des remerciements détaillés figurent avec chaque contribution de ce numéro.

Documentation

BARBER, D.G.; J.M. HANESIAK, W. CHAN and J. PIWOWAR. 2001. Sea-Ice and Meteorological Conditions in Northern Baffin Bay and the North Water Polynya between 1979 and 1996. ATMOSPHERE-OCEAN, **39**: 343-359

CLAUSI, DAVID A. 2001. Comparison and Fusion of Co-occurrence, Gabor and MRF Texture Features for Classification of SAR Sea-Ice Imagery. ATMOSPHERE-OCEAN, **39**: 183-194

DUNBAR, M.J. 1981. Physical causes and biological significance of polynyas and other open water in sea ice. *In*: Polynyas in the Canadian Arctic, I. Stirling and H. Cleator, (Eds), Can. Wildlife Service, Occasional Paper **45**, pp. 29–43.

HANAFIN, J. A. and P.J. MINNETT. 2001. Cloud Forcing of Surface Radiation in the North Water Polynya during NOW '98. ATMOSPHERE-OCEAN, **39**: 239-255

HANESIAK, J.M.; D.G. BARBER, T.N. PAPAKYRIAKOU and P.J. MINNETT. 2001. Parametrization Schemes of Incident Radiation in the North Water Polynya. ATMOSPHERE-OCEAN, **39**: 223-238

KAWAMURA, TOSHIYUKI; KUNIO SHIRASAWA and KUNIO KOBINATA. 2001. Physcial Properties and Isotopic Characteristics of Landfast Sea Ice around the North Water (NOW) Polynya Region. ATMOSPHERE-OCEAN, **39**: 173-182.

MELLING, HUMFREY; YVES GRATTON and GRANT INGRAM. 2001. Ocean Circulation within the North Water Polynya of Baffin Bay. ATMOSPHERE-OCEAN, **39**: 301-325

MUNDY, C.J. and D.G. BARBER. 2001. On the Relationship between Spatial Patterns of Sea-Ice Type and the Mechanisms which Create and Maintain the North Water (NOW) Polynya. ATMOSPHERE-OCEAN, **39: 327**-341

SMITH. S.D.; R.D. MUENCH, and C.H. PEASE. 1990. Polynyas and Leads: An Overview of Physical Processes and Environment. J. Geophys. Res. **95(C6)**:9461–9479.

STEFFEN, KONRAD and JOHN HEINRICHS. 2001. C-band SAR Backscatter Characteristics of Arctic Sea and Land Ice during Winter. ATMOSPHERE-OCEAN, **39**: 289-299

VINCENT, R.F. and R.F. MARSDEN. 2001. An Analysis of the Dissolution of Ice in Nares Strait using AVHRR Imagery. ATMOSPHERE-OCEAN, **39**: 209-222

———; R.F. MARSDEN and A. MCDONALD. 2001. Short Time-Span Ice Tracking using Sequential AVHRR Imagery. ATMOSPHERE-OCEAN, **39**: 279-288.

WILSON, K.J.; D.G. BARBER and D.J. KING. 2001. Validation and Production of RADARSAT-1 Derived Ice Motion Maps in the North Water (NOW) Polynya, January – December 1998. ATMOSPHERE-OCEAN, **39**: 257-278.

YACKEL, J.; D.G. BARBER and T.N. PAPAKYRIAKOU. 2001. On the Estimation of Spring Melt in the North Water Polynya using RADARSAT-1. ATMOSPHERE-OCEAN, **39**: 195-208.

Atmosphere-Ocean Vol. 39-3 (NOW) Paper Order

Introduction

Physical Processes within the North Water (NOW) /Polynya, D. BARBER, R. MARSDEN, P. MINNETT, G. INGRAM and L. FORTIER.

Processus physiques dans la polynie des eaux du Nord, D. BARBER, R. MARSDEN, P. MINNETT, G. INGRAM and L. FORTIER.

OC-203

Physical Properties and Isotopic Characteristics of Landfast Sea Ice around the North Water (NOW) Polynya Region, TOSHIYUKI KAWAMURA, KUNIO SHIRASAWA and KUNIO KOBINATA.

OC-214

Comparison and Fusion of Co-occurrence, Gabor and MRF Texture Features for Classification of SAR Sea-Ice Imagery, DAVID A. CLAUSI.

OC-217

On the Estimation of Spring Melt in the North Water Polynya using RADARSAT-1, J. YACKEL, D. G. BARBER and T. N. PAPAKYRIAKOU.

OC-204a

An Analysis of the Dissolution of Ice in Nares Strait using AVHRR Imagery, R. F. VINCENT and R. F. MARSDEN.

OC-208

Parametrization Schemes of Incident Radiation in the North Water Polynya, J. M. HANESIAK, D.G. BARBER, T. N. PAPAKYRIAKOU and P.J. MINNETT.

OC-213

Cloud Forcing of Surface Radiation in the North Water Polynya during NOW '98, J. A. HANAFIN and P.J. MINNETT.

OC-221

Validation and Production of RADARSAT-1 Derived Ice-Motion Maps in the North Water (NOW) Polynya, January – December 1998, K. J. WILSON, D. G. BARBER AND D. J. KING.

OC-204b

Short Time-Span Ice Tracking using Sequential AVHRR Imagery, R. F. VINCENT, R. F. MARSDEN and A. MCDONALD.

OC-212

C-band SAR Backscatter Characteristics of Arctic Sea and Land Ice during Winter, KONRAD STEFFEN and JOHN HEINRICHS.

OC-219

Ocean Circulation within the North Water Polynya of Baffin Bay, HUMFREY MELLING, YVES GRATTON and GRANT INGRAM.

OC-218

On the Relationship between Spatial Patterns of Sea-Ice Type and the Mechanisms which Create and Maintain the North Water (NOW) Polynya, C. J. MUNDY and D. G. BARBER.

OC-209/223

Sea-Ice and Meteorological Conditions in Northern Baffin Bay and the North Water Polynya between 1979 and 1996, D. G. BARBER, J. M. HANESIAK, W. CHAN and J. PIWOWAR.

Physical Processes within the North Water (NOW) Polynya

by D. Barber[1], R. Marsden[2], P. Minnett[3], G. Ingram[4] and L. Fortier[5]

[1] CEOS, Department of Geography, University of Manitoba, Winnipeg MB (dbarber@ms.umanitoba.ca)
[2] Royal Military College, Kingston ON
[3] Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami FL
[4] Department of Earth and Ocean Sciences, University of British Columbia, Vancouver BC
[5] GIROQ, Université Laval, Québec QC

First publication in ATMOSPHERE-OCEAN 39 (3) 2001, 163–166

1 Introduction

Polynyas are large areas (10–90 000 km^2) of open water or reduced ice cover in the midst of the thick ice pack that cover polar oceans during much of the year. By remaining open in winter or becoming ice-free early in spring, polynyas serve as feeding, mating, spawning and over-wintering grounds for a diverse and populous bird and mammal community. Accordingly, polynyas have been compared to oases in terrestrial deserts. The North Water (NOW) Polynya in northern Baffin Bay is amongst the most productive marine areas north of the Arctic circle. It is located within latitudes that will be impacted early and most strongly by the present trend in climate variability and change. The NOW Polynya is active throughout most of the annual cycle and is likely created and maintained through a combination of latent and sensible heat mechanisms.

Physically, polynyas respond to both forcing from the ocean and the atmosphere. Processes of ice growth also 'feedback' into the atmosphere and the ocean through the phase changes associated with the ice cover within the polynya. Climatologically, these dynamics impart a significant control over the surface energy balance at the local scale and may also respond to planetary scale atmospheric tele-connections (e.g., El Niño Southern Oscillation, Atlantic Oscillation and North Atlantic Oscillation). In terms of ocean physics, these processes affect vertical convection within the ocean as a result of increasing salinity concentrations next to the ice accretion boundary of rapidly growing sea ice. Biologically, polynyas are thought to be focal points for the intense production of herbivores that ensure the transfer of the solar energy fixed by planktonic and epontic algae to Arctic cod, seals, polar bear and humans. In seasonally frozen seas, the ice cover forming in early autumn prevents the atmospheric CO_2, dissolved in the surface waters and assimilated in summer by marine algae, to return to the atmosphere in winter. Therefore, seasonally ice-covered areas (in particular highly productive polynyas) could contribute disproportionately to the sequestration of atmospheric CO_2 and the slowing down of global warming. Physically, this may be counterbalanced by a positive ice-albedo feed-back which is promoted by the early removal of sea ice. Both physically and biologically, polynyas can be considered as model systems to help scientists forecast the response of the Arctic system to climate variability and change.

2 The International North Water (NOW) Polynya study

The Natural Sciences and Engineering Research Council funded a four-year study, dedicated to examining the nature of the physical and biological coupling in the NOW Polynya. The project was structured around a dedicated field study, conducted between March and July 1998. Mooring and recovery of oceanographic instruments, coupled to limited physical/biological sampling, were also conducted in August–September 1997 and 1999. The research team was drawn from various university and government laboratories from across Canada. A large international team complemented the Canadian core, with representation from Poland, Denmark, Germany, Japan, the United Kingdom and the USA. The overarching hypothesis of the NOW research network was to examine the nature, in both space and time, of the coupling between the biological processes and the physical mechanisms which create and maintain the NOW Polynya.

Previous work has indicated that the NOW Polynya is maintained by both latent and sensible heat mechanisms. Latent heat polynyas form in areas in which ice is removed from the region of origin as quickly as it is formed. In these areas, ice continually forms within the polynya but is exported by winds and/or ocean currents. In these polynyas there is a continual and significant loss of heat from the ocean to the atmosphere. The heat required to balance loss to the atmosphere, and hence to maintain the open water, is provided by the latent heat of fusion of the ice which continually forms. Production of new ice within a polynya is also a significant contributor to the formation of deep water through thermo-haline processes and a contributor to the advection of latent heat within the

The article presented here is the introduction to the most recent special issue of **ATMOSPHERE-OCEAN**, volume 39 No. 3, September 2001, reprinted with permission of the authors. The complete text of each of the papers cited can be found on the CMOS web site: www.CMOS.ca, by following the links to **ATMOSPHERE-OCEAN** and other Publications.

downstream area of the polynya. Sensible heat polynyas form when the upwelling of oceanic heat is made available to the surface waters, preventing ice from forming. This process is required in order to satisfy the energy balance at the surface. The upward heat transfer can occur through vertical mixing of heat from deeper water or through upward advection of heat by such mechanisms as wind-driven upwelling, making sufficient oceanic heat available to erode the underside of the ice cover (Smith et al., 1990; Dunbar, 1981). Once open, the polynya will rapidly lose heat to the atmosphere but the source of warmer water may be sufficient to prevent freezing. If not, the original advection currents may carry away newly formed ice crystals before they can form a continuous ice cover.

The meteorological conditions associated with a polynya can be conceptualized either as a forcing phenomenon (i.e., sensible and latent heat effects on the formation and maintenance of the polynya) or as a consequence of the ocean to atmosphere heat flux that is created by the polynya. This cause/effect phenomenon is embodied in the framework of feedback theory as the sea-ice/cloud/albedo feedback mechanism. The concept is that the radiative regime which is created by the prevalence of cloudy conditions imparts an atmosphere-to-surface radiative flux which ablates the sea ice, creating an enhanced vapour flux and cloud formation, thereby supporting the feedback mechanism. This feedback structure is evident both in observational and modelling studies of polynyas, but has not been adequately characterized to understand the full consequence of these mechanisms on the formation and maintenance of the NOW Polynya. In cases involving coastal polynyas in the Arctic and Antarctic, the synoptic meteorological processes have been found to be very important in their production and evolution. In contrast, the impacts of polynyas on the local atmosphere and climate have also been documented. Since the ocean-to-atmosphere heat flux through a polynya is several orders of magnitude greater than that through the surrounding ice pack in winter, the polynyas dominate the regional heat budget during the winter and influence the atmospheric circulation aloft. Consequently, the year-to-year changes in polynya characteristics may contribute to the interannual variability in the high latitude climate — or conversely, the variability in the polynya's size may be indicative of large-scale climate changes in the polar region.

3 Results in this special issue of Atmosphere-Ocean

The physical processes group within the NOW network collaborated to produce this special issue of Atmosphere-Ocean. The results presented are the first of a series of papers which will be produced by the physical subgroup of the International North Water Polynya Study. The objectives of our subgroup contribute directly to the overarching objectives of the NOW network by examining the physical controls on the observed biological productivity and variability in both space and time. In this special issue we present results within three broadly interrelated research themes: 1) studies which examine physically related properties and/or related processes; 2) studies which specifically address issues of the coupling between the atmosphere and the surface; and 3) broader integrative papers which examine processes at larger spatial and temporal scales. Overlap within particular papers amongst themes illustrates the multidisciplinary approach typical of the NOW study.

a *Characterization of Physical Properties and Processes*

The unique characteristics of a polynya include the fact that all forms of sea ice can be present at almost any period during the annual cycle. Young ice types can be found in close association with much older forms within particular months of consolidation and/or decay. The thermal forcing on this sea ice is a critical part of the seasonal evolution of the sea ice surface. Kawamura et al. present results on the physical properties of sea ice within the landfast areas surrounding the NOW region. Their results show how the partial fractions of brine, ice and air are oriented within the column of first-year sea ice. The authors explore the isotopic orientation of these constituents and provide detailed information on the evolution of these structures as the sea ice evolves seasonally. This work contributes to the relationship between physical properties of sea ice and how it responds to oceanic and atmospheric thermal forcing.

As with many Arctic polynya studies, remote sensing played a significant role in the NOW study. Work by Clausi shows how various image-processing algorithms can be used to estimate the type of sea ice occurring within and around the NOW Polynya region. The estimation of the full range of ice types is an ongoing challenge both for geo-physical process studies and ship navigation. These image-processing techniques show promise as a means of obtaining unambiguous estimates of the range of ice types typical of an arctic polynya. Yackel et al. also use RADARSAT data to estimate the thermodynamic state of first-year sea ice based on the seasonal evolution of the microwave scattering coefficient. They show how spaceborne microwave remote sensing data can be used to estimate the timing and rate of snowmelt over smooth thick first-year sea ice. The spatial pattern of this melt preconditions the NOW region for ice melt and is seen to be associated with the spatial pattern in phyto-plankton development in the spring. In a related study Vincent and Marsden showed how data from the AVHRR sensor can also be used to understand the timing of the dissolution of the ice bridge in Nares Strait. Given the importance of the ice bridge in the formation and maintenance of the polynya this approach is seen as an important contribution to the future monitoring of the NOW region.

b *Coupling Between the Surface and Atmosphere*

Because of the quicker response times of the atmosphere, relative to the ocean, a significant effort was directed towards understanding atmosphere-surface coupling. With both a ship-based sampling program and a series of ice camps surrounding the NOW region we were able to investigate surface coupling over both landfast and marginal ice zones; both within the same synoptic setting.

Work by Hanesiak et al. compared various parametrization schemes for shortwave exchange over the NOW region. The authors also compared several parametrization approaches with direct observations of the pertinent fluxes. Selection of the optimal schemes is seen as a contribution to future thermodynamic sea-ice modelling and regional scale atmospheric modelling studies. In a related study, Hanafin and Minnett looked at the role of clouds in the surface forcing within the NOW region. Due to a predominance of cloud cover throughout a large portion of the annual cycle, this work is deemed essential to our understanding of the coupling between the surface and atmosphere. Parametrization schemes were compared with direct observations of both the short and longwave fluxes. Their results provide an experimental dataset for an important period of the annual cycle and provide recommendations on the most appropriate approach to parametrization of these cloud-related processes. Since much of the NOW region consists of marginal ice zone ice, ice dynamics and kinematics were focal points for examination of the surface and atmospheric circulation. A detailed study by Wilson et al. provides the first high resolution estimates in time and space of ice motion over an annual cycle in the NOW Polynya. Their results are based on time series pairs of RADARSAT-1 data, where displacement in the image pairs provides ice-type displacement vectors. The dynamics of ice motion were then statistically compared with buoy data. The results show distinct spatial and temporal patterns in ice motion over the NOW region. In a related study, Vincent et al. show how optical remote sensing data from the AVHRR sensor can also be used to estimate ice motion in the NOW region. Although observations in this study were taken over a much shorter temporal period, they compare quite favourably with those of Wilson et al.

The direct coupling between the atmosphere and surface is evident in the time series of scattering behaviour in both active and passive microwave remote sensing data. Work by Steffen and Heinrichs shows how Synthetic Aperture Radar (SAR) sea-ice signatures respond to forcing from the atmosphere over a region typical of the NOW study site. Their results show how the microwave response of both sea ice and glacial ice responds to atmospheric forcing. They also show how these data can be used to estimate the thermo-dynamic state of the cryosphere relative to various processes operating between the atmosphere and surface. The results from this work and that of Yackel et al. show the importance of these approaches to monitoring the coupling between the atmosphere and the various surfaces found within the NOW region.

c *Polynya Dynamics*

The preceding papers all contribute towards an improved understanding of how the NOW region operates, including, but not limited to, the formation and maintenance of the NOW Polynya. Although there are many discussions of important processes in the preceding papers, we conclude this focus issue with three papers which attempt to set the context for the integration of these processes within the NOW region over timescales from annual to inter-annual.

From the physical oceanographic perspective, the study by Melling et al. shows that the NOW region is dominated by a strong southward flow of cold water and ice from the Arctic Ocean. A branch of the West Greenland Current provides a modest northward flow of warm water up the eastern side of Baffin Bay. The warm northward flow is diverted by the complex bottom topography near the Carey Islands, where it loses much of its heat through re-circulation and isopycnal mixing with the Arctic outflow. Upwelling near the Greenland coast, forced by Ekman transport, brings the warm water to the base of the turbulent surface layer where it is entrained.

From the perspective of sea ice, Mundy and Barber (this issue) show that a distinct 'icescape' exists for the NOW region. This 'icescape' (analogous to landscape) is created by the dominant processes operating within the NOW region over a variety of time and space scales. Statistical clustering of ice types showed that regionally and seasonally specific clusters of a mixture of ice types are created depending on the dominance of latent and/or sensible heating in the creation and maintenance of the NOW Polynya. The pattern of these clusters in both space and time is seen as a consequence of the coupling between the ocean, sea ice and atmosphere and may provide a means of monitoring the response of the sea ice to future climate variability and change.

The final paper of this issue presents a historical context which examines the coupling between the sea ice and the atmosphere. The paper by Barber et al. uses historical Scanning Multichannel Microwave Radiometer (SMMR) and Special Sensor Microwave/Imager (SSM/I) data at a weekly temporal resolution during the period 1978 to 1996. These ice concentrations and deviations from weekly concentrations are used to determine the 'average' sea-ice conditions within the NOW region over 18 years. By combining these with modelled atmospheric data, the authors found both atmospheric and sea-ice modes which appear to be consistent, both spatially and temporally. Many of these modes are related to detailed observations from the 1998 field study and provide a historical context for the detailed geo-physical and process studies presented in this NOW focus issue of Atmosphere-Ocean.

Conclusions

The papers presented within this special issue represent the first of a series resulting from the International North Water (NOW) Polynya Study. At this time, manuscripts for a special issue focusing more on the biological aspects of the project are being reviewed for the journal 'Deep Sea Research'. When these two issues are combined, the papers will represent the most detailed study yet completed of the NOW region. We now have a rudimentary understanding of the fundamental structure and functioning of the polynya and can make reasonable predictions about how this polynya may respond to climate variability and change. We are currently working on more integrative types of analysis (physical/biological coupling) within the NOW research network and intend to extend the observational studies (typical of this special issue) to model-based studies of the NOW region.

Acknowledgements

We all wish to thank the officers and crew of the CCGS *Pierre Radisson* for their enthusiastic assistance throughout the NOW study. In addition we wish to acknowledge the support of the Polar Continental Shelf Project (PCSP), the Canadian Ice Service (CIS) and the National Ice Service (NIC) for this work. Financial support for the publication of this special issue was provided by the Meteorological Service of Canada (MSC), Canadian Cryospheric System (CRYSYS; B. Goodison, Principal Investigator) and the Natural Science and Engineering Research Council (NSERC). Thanks also to Ms. S. Bourque for her professional technical editing of this special issue. Detailed acknowledgements are provided with each of the contributions in this issue.

References

BARBER, D.G.; J.M. HANESIAK, W. CHAN and J. PIWOWAR. 2001. Sea-Ice and Meteorological Conditions in Northern Baffin Bay and the North Water Polynya between 1979 and 1996. ATMOSPHERE-OCEAN, **39:** 343–359.

CLAUSI, DAVID A. 2001. Comparison and Fusion of Co-occurrence, Gabor and MRF Texture Features for Classification of SAR Sea-Ice Imagery. ATMOSPHERE-OCEAN, **39:** 183–194.

DUNBAR, M.J. 1981. Physical causes and biological significance of polynyas and other open water in sea ice. *In:* Polynyas in the Canadian Arctic, I. Stirling and H. Cleator, (Eds), Can. Wildlife Service, Occasional Paper **45**, pp. 29–43.

HANAFIN, J.A. and P.J. MINNETT. 2001. Cloud Forcing of Surface Radiation in the North Water Polynya during NOW '98. ATMOSPHERE-OCEAN, **39:** 239–255.

HANESIAK, J.M.; D.G. BARBER, T.N. PAPAKYRIAKOU and P.J. MINNETT. 2001. Parametrization Schemes of Incident Radiation in the North Water Polynya. ATMOSPHERE-OCEAN, **39:** 223–238.

KAWAMURA, TOSHIYUKI; KUNIO SHIRASAWA and KUNIO KOBINATA. 2001. Physcial Properties and Isotopic Characteristics of Landfast Sea Ice around the North Water (NOW) Polynya Region. ATMOSPHERE-OCEAN, **39:** 173–182.

MELLING, HUMFREY; YVES GRATTON and GRANT INGRAM. 2001. Ocean Circulation within the North Water Polynya of Baffin Bay. ATMOSPHERE-OCEAN, **39:** 301–325.

MUNDY, C.J. and D.G. BARBER. 2001. On the Relationship between Spatial Patterns of Sea-Ice Type and the Mechanisms which Create and Maintain the North Water (NOW) Polynya. ATMOSPHERE-OCEAN, **39:** 327–341.

SMITH. S.D.; R.D. MUENCH, and C.H. PEASE. 1990. Polynyas and Leads: An Overview of Physical Processes and Environment. *J. Geophys. Res.* **95(C6)**: 9461–9479.

STEFFEN, KONRAD and JOHN HEINRICHS. 2001. C-band SAR Backscatter Characteristics of Arctic Sea and Land Ice during Winter. ATMOSPHERE-OCEAN, **39:** 289–299.

VINCENT, R.F. and R.F. MARSDEN. 2001. An Analysis of the Dissolution of Ice in Nares Strait using AVHRR Imagery. ATMOSPHERE-OCEAN, **39:** 209–222.

———; R.F. MARSDEN and A. MCDONALD. 2001. Short Time-Span Ice Tracking using Sequential AVHRR Imagery. ATMOSPHERE-OCEAN, **39:** 279–288.

WILSON, K.J.; D.G. BARBER and D.J. KING. 2001. Validation and Production of RADARSAT-1 Derived Ice-Motion Maps in the North Water (NOW) Polynya, January – December 1998. ATMOSPHERE-OCEAN, **39:** 257–278.

YACKEL, J.; D.G. BARBER and T.N. PAPAKYRIAKOU. 2001. On the Estimation of Spring Melt in the North Water Polynya using RADARSAT-1. ATMOSPHERE-OCEAN, **39:** 195–208.

Note from the EDITOR

Please note that the paper order of the **Atmosphere-Ocean** Vol. 39-3 (NOW) special issue is shown on page 136 of this CMOS Bulletin SCMO.

Radarsat-2 Launch on Schedule

November 2001 will be the 6th anniversary of the launch of RADARSAT-1, the Canadian Space Agency's first Earth Observation Satellite. Equipped with a powerful Synthetic Aperture Radar (SAR), the RADARSAT-1 satellite acquires images of the earth day or night and in all weather. The launch of RADARSAT 2 is scheduled for 2003.

For more information, please access http://www.space.gc.ca/csa_sectors/earth_environment/

Top Climate Scientists Advise the U.S. President on Global Warming

Responding to a request from the Bush administration, a new report from the National Academies sums up science's current understanding of global climate change. The report characterizes warming trends over the last 100 years, examines what may be in store for the 21st century and comments on the extent to which warming may be attributable to human activity. The report is available at http://www.nationalacademies.org/topnews/#0606

The wind they call Maria
and bhoot, bull's-eye, cockeyed bob, burster, warm braw, williwaw

by Dave Phillips

More than any weather element, wind has fascinated people throughout the ages. Our ancestors were all too familiar with wind's unpleasant effects - hot droughty air, driving rain, drifting soil, blowing snow, chilling air, destructive gales. However, they were also well aware of winds that brought pleasure and comfort, pushed away ice, dissipated fog, helped move ships, and generated power.

In ancient times, winds were thought to be controlled by magic or by gods and goddesses. Wind gods were revered by the Chinese, Egyptians and other older cultures. In Ancient Greece, the Tower of the Winds was erected to immortalize various characteristics of the winds. In many cultures the early folklore was resplendent with imaginative references to wind. According to North American Indian legends, the North Wind was a cruel and demanding monster, who had to be humoured. Another tradition says that an Indian hero hunted the great bird whose beating wings caused the wind, and broke its wing. When the bird healed, its wing was smaller and could only produce a lighter wind.

Our ancestors soon learned that changes in the wind often brought changes in the weather. It was said, *"To read the wind correctly is to read the weather"*. From this understanding came countless sayings to forecast the weather.

- The Devil is busy in a high wind.
- No weather is ill,
  If the wind be still.
- Wind in the west,
  Weather at its best.
- A southerly wind with showers of rain,
  Will bring the wind from the west again.
- When wind comes before rain,
  Soon you may make sail again.
- The sharper the blast,
  The sooner it's past.
- If wind rises at night,
  It will fall at daylight.

So important were the winds to early civilizations in different parts of the world, that they were give names. Winds such as the chilling bise of Switzerland and northern France, the scorching out-of-Africa simoon of the middle and southern Mediterranean regions, the dreaded buran of central Asia, the oppressive berg of coastal South Africa, the fierce mistral of France's lower Rhone Valley, the fickle foehn of the Alps, and the migraine-inducing sharev of Israel are fairly well known. Others, such as Hawaii's kohilo and the West African cacimbo, are enjoyed as refreshing pleasant breezes.

Canada is home to the chinook (also called rancher's friend and snow-eater) and to several other winds with special names, at least 70 by my reckoning. An inordinate number are from marine-conscious Newfoundland, such as the lun, dwye, strife, stun breeze and sheelagh (but not the twister, which is a rolled cigarette in Newfoundland). Several others have an Indian origin, such as keewatin and siwash.

Some Canadian-named winds reveal the origin of blow (in-wind, suete, nordet), some describe the coldness of the air (cold maker woolly whipper), or the gentleness or fury of the blow (airsome, dally). Other names mimic wind sounds (faffering, shuff, screecher), suggest its effects on the land or people (lambkiller, cow storm, wreckhouse) or its geographic origin (Yoho blow, Taku, Squamish). Others are just exotic (haboob, Sheila's brush), descriptive (hog's nose, black blizzard, meringue storm) or beautiful (cat's paw).

The names of Canadian winds are not all well known and may not be unique to Canada. While some wind names have endured and are used in daily conversation, others have been dropped, forgotten or changed. The following listing, by no means complete, is a sampling:

barber	a strong wind carrying precipitation that freezes up on contact, especially on the face and hair
black blizzard	a dust storm of black, prairie soil
breakup wind	a spring wind that hastens the breakup of ice in northern rivers and lakes
cold maker	a cold north wind
cow storm	a gale on Ellesmere Island so strong that "it blows the horns off the cows"

dally	a sudden slackening, shifting of the wind
dwigh (dwey, dwoy)	a sudden shower or snowstorm in Newfoundland, accompanied by strong winds
fairy	a strong, sudden gust of wind on an otherwise calm day
flaw	a sudden gust or squall
ground-drifter	a cold north wind that creates ground snowdrifts
haboob (Arabic origin)	a prairie duststorm characterized by rounded projections along the front edge of the advancing wall of dust
lambkiller	a severe sudden storm in March just after lambs are born
liner	a strong wind or gale at the time of the fall equinox
out-wind	a wind blowing seaward off the land
plow wind	strong downdraught associated with squall lines and thunderstorms and with the force of a tornado
scud	a sudden gust of wind
Sheila's brush	a fierce wind and heavy snowstorm around St. Patrick's Day
snow devil	a whirling column of snow sucked up in a vortex by the wind
Squamish	a violent outflow from Squamish, B.C., along Howe Sound and through the channels around Bowen Island
Wreckhouse	an extremely fierce wind in western Newfoundland noted for blowing trains off tracks and trailer trucks off roads
Yoho blow	a strong, cold wind in the Yoho Valley in the Rocky Mountains

TENURE-TRACK POSITION IN PHYSICAL OCEANOGRAPHIC MODELING

The Department of Physics and Physical Oceanography at Memorial University of Newfoundland invites applications for a tenure-track faculty position from individuals working in numerical modeling of climate and ocean/atmospheric interactions. The appointment will be made at the Assistant Professor level. The anticipated starting date is September 1, 2002. The successful applicant will be expected to develop an active research program and to teach at the graduate and undergraduate levels. Many members of the Department participate in interdisciplinary degree programs in Computational Science and Environmental Science and the successful applicant will also be expected to participate in and contribute to interdisciplinary activities in such areas.

The Department has strong externally funded research programs in several areas including ocean modeling, ocean circulation, ocean acoustics, coastal oceanography, laboratory fluids, atomic and molecular collisions, optical and vibrational spectroscopy, magnetism, polymer physics, membrane biophysics, and non-linear dynamics (for more details, see the Department's web site: www.physics.mun.ca

Applications, including a C.V., the names of three references and a statement of research interests, should be submitted to: **Dr. J.P. Whitehead, Head, Department of Physics and Physical Oceanography, Memorial University of Newfoundland, St. John's, NF, A1B 3X7.** Consideration of applications will begin January 1, 2002.

Memorial University is committed to employment equity and encourages applications from qualified men and women, visible minorities, aboriginal people and persons with disabilities. In accordance with Canadian Immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada.

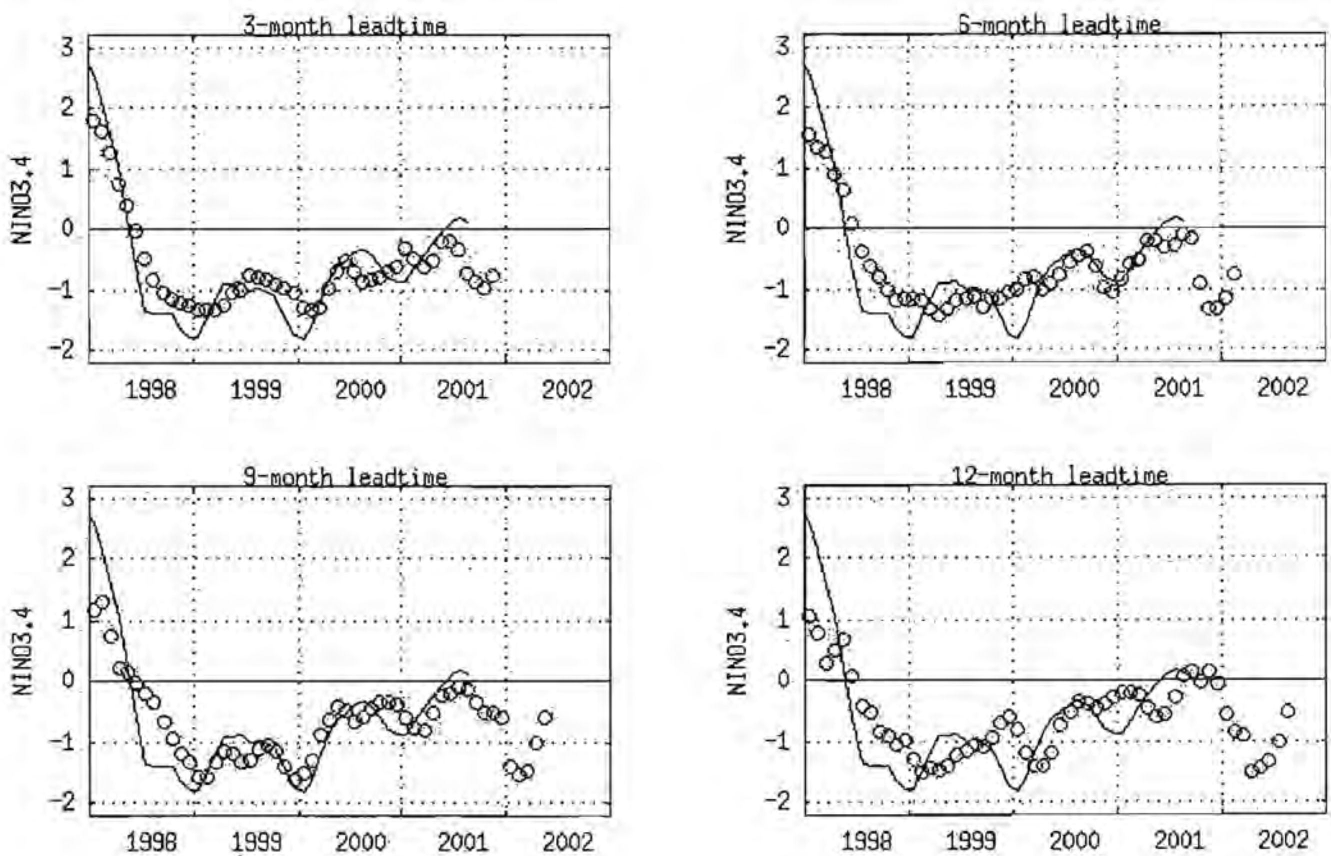
Memorial University is the largest university in Atlantic Canada. As the Province's only university, Memorial plays an integral role in the educational and cultural life of Newfoundland and Labrador. Offering diverse undergraduate and graduate programs to almost 16,000 students, Memorial provides a distinctive and stimulating environment for learning in St. John's, a very safe, friendly city with great historic charm, a vibrant cultural life, and easy access to a wide range of outdoor activities.

Memorial University is part of a lively, local scientific and engineering community which maintains an inventory of available positions for qualified partners. Partners of candidates for positions are invited to include their resume for possible matching with other job opportunities.

Cool tropical Pacific sea surface temperatures forecasted for this winter

by William Hsieh and the UBC Climate Prediction Group

Starting in September, 2001, the UBC Climate Prediction Group has three independent operational models for forecasting the tropical Pacific sea surface temperature anomalies (SSTA). In addition to the original neural network model and the hybrid neural-dynamical coupled model, we have added a nonlinear canonical correlation analysis (NLCCA) model, which uses the tropical Pacific sea level pressure anomaly field to forecast the tropical Pacific SSTA field. All three models unanimously predict weak cooling in the equatorial Pacific till at least the beginning of 2002.The two more mature models (the hybrid model and the neural network model) predict a full La Niña cold episode in 2002, whereas the new (and still being improved) NLCCA model predicts some warming by spring 2002.The forecasts by the neural network model for the SSTA in the Nino3.4 region in the equatorial Pacific are shown below. For the other model forecasts, see our web site http://www.ocgy.ubc.ca/projects/clim.pred



Latest forecast using a neural network model trained with data up to the end of August 2001. The four panels are for the 3-, 6-, 9- and 12-month leadtime forecasts, respectively. The solid curve is the observed Nino3.4 SSTA (in degree Celsius), and the circles are the forecasts.

The Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)

La Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA)

Canadian Role in Climate Science: CFCAS Funds University and Government Collaboration in Network and Research Projects

MONTRÉAL, May 2, 2001. Announcements made today by the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) will help move Canada back toward the forefront of global climate science. The announcements were made at the Université du Québec à Montréal in presence of the Honourable Gilbert Normand, Secretary of State for Science, Research and Development.

"These network projects involve university and government researchers from all over Canada", said Professor Gordon McBean, Chair of the Board of Trustees of CFCAS. "The best and the brightest of Canadian expertise in climate and atmospheric sciences are working collaboratively. The result will be a vast increase in what we know about climate variability, our oceans and how they interact with the atmosphere, the impact of clouds on climate, the interaction of smog-causing air pollutants in our atmosphere and the chemistry of climate."

A total of $5.1 million dollars will be invested over a three-year period in four research projects. The final selections were made on the basis of collaboration and the contribution the project will make to the overall body of knowledge on climate and atmospheric sciences.

"This significant contribution in Canada's research capacity is also an investment in its future and in the quality of life of all Canadians", said Secretary of State Normand. On behalf of the Government of Canada, I congratulate all the research teams for their vision and success in developing innovative programs."

"Many of these research projects relate to similar work going on elsewhere in the world", said Dr. McBean. "Canada will be able to continue making a contribution to the international scientific community. This, of course, is the ultimate collaboration. The knowledge we can gain about the planet as an entire climatic and atmospheric system will allow us to reinforce informed policy about protecting that system."

The CFCAS funds research in the areas of:

- climate system science;
- climate change;
- extreme weather;
- air quality; and
- marine environmental prediction.

The selected four network projects are:

1) Modelling of Clouds and Climate Network (MOC2)

Network Leader: Philip Austin, Earth and Ocean Sciences/Geography, University of British Columbia.
Total: $403,000/3 years.

Clouds are one of the major influences on global climate. Heat released by condensation drives the global atmospheric circulation, while rain and snowfall distribute the world's supply of fresh water. More subtly, clouds have what is called a radiative impact: they cool the planet by reflecting shortwave radiation into space, and warm the planet through the emission of thermal radiation to the surface.

Present or projected global warming caused by human activities is expected to affect the radiative character of clouds. For instance, while the net effect of clouds on the current climate is to cool the planet, relatively minor changes in cloud properties could modify this balance and have a significant impact on future climate. These changes could affect total cloud coverage, thickness or even the size of cloud droplets and ice crystals. The complex, variable nature of ice and water in the clouds makes the task of predicting their properties in global climate models extremely difficult.

Computer models will be developed of important cloud types and integrated into the Canadian Global Climate model. The work will include new ways to predict cloud extent; the ice and liquid water content of clouds; the number of droplets and crystals; and the effect of clouds on the transfer of long and shortwave radiation, heat and moisture in the climate model.

The research network will pool the resources of university and government scientists who measure and model clouds, who will in turn compile and make available a unique data set of aircraft, surface and satellite observations of cloud properties. It will also join a major international effort studying the same areas.

Network Leader: Philip Austin, Earth and Ocean Sciences/Geography, University of British Columbia
Tel.: (604) 822-2175; Email: paustin@eos.ubc.ca

MOC2 Network members:
1. P.H. Austin, Associate Professor, University of British Columbia, Principal Investigator.
2. H.W. Barker, Meteorological Service of Canada and Adjunct Professor, Dalhousie University.
3. J-P. Blanchet, Professor, Université du Québec à Montréal.
4. G.A. Isaac, Meteorological Service of Canada and Adjunct Professor, Dalhousie University.
5. U. Lohmann, Assistant Professor, Dalhousie University
6. N.A. McFarlane, Meteorological Service of Canada and Adjunct Professor, University of Victoria.
7. R.E. Stewart, Meteorological Service of Canada and Adjunct Professor, York University.
8. R.B. Stull, Professor, University of British Columbia.
9. M.K. Yau, Associate Professor, McGill University.

2) Modelling of Global Chemistry for Climate

Principal Investigator: Theodore Shepherd, Professor of Physics, University of Toronto.
Total: $1,028,855/3 years.

Predicting the impact of emissions of greenhouse gas and their chemical precursors on climate is an important element of Canada's response to the challenges of climate change. This project will develop a capability for modelling the global chemical climate of the atmosphere based on fundamental physical principles. It will also assist in monitoring changes in the atmosphere.

The project will enhance the current coupled climate system prediction model used by the Meteorological Service of Canada (MSC) with an interactive representation of the global chemical climate. During the project, climate sensitivity experiments will be performed to address such questions as the recovery of the stratospheric ozone layer and changes in the oxidizing capacity of the atmosphere.

The project will also contribute to the development of a new chemical climate data assimilation facility for MSC, in partnership with the Canadian Space Agency (CSA). The Space Agency will be able to use this facility for interpreting measurements and designing new measurement systems that focus on global chemistry and climate.

Principal Investigator: Theodore Shepherd, Professor of Physics, University of Toronto.
Tel.: (416) 978-6824;
Email: tgs@atmosp.physics.utoronto.ca

Modelling of Global Chemistry for Climate Network Members:
1. J.P.D. Abbatt, Professor, University of Toronto.
2. P.A. Ariya, Assistant Professor, McGill University.
3. I.A. Folkins, Associate Professor, Dalhousie University.
4. U. Lohmann, Assistant Professor, Dalhousie University.
5. J.C. McConnell, Professor, York University.
6. R. Ménard, Meteorological Service of Canada.
7. D.V. Michelangeli, Associate Professor, York University.
8. J.F. Scinocca, Meteorological Service of Canada and Adjunct Professor, University of Victoria.
9. N.A. McFarlane, Meteorological Service of Canada and Adjunct Professor, University of Victoria.
10. J.Li, Meteorological Service of Canada.
11. S.M. Polavarapu, Meteorological Service of Canada and Adjunct Professor, Univeristy of Toronto.
12. T.G. Shepherd, Professor, University of Toronto, Principal Investigator.
13. W.E. Ward, Associate Professor, University of New Brunswick.

3) Climate Variability: Its Causes and Predictability (CLIVAR)

Network leader: Jacques Derome, Atmospheric and Oceanic Sciences, McGill University.
Total: $3 million/3 years ($1.3 million from each CFCAS and NSERC, and $400,000 from MSC/3 years).

Scientists have long known that oceans influence the atmosphere. Further research will help improve the understanding of this influence, and help improve seasonal and possibly longer-term forecasting. While there is increasing confidence that the observed global warming is related to the rising atmospheric concentration of greenhouse gases, there also remain some important uncertainties.

The research will clarify the relative importance of the greenhouse gases and natural variability in explaining the observed global warming. It will examine the different ways in which global warming manifests itself over North America, for example, in terms of cloudiness and precipitation.

With a total of $3.0 million over three years, a team of seventeen specialists from seven universities and four federal government research laboratories will work together in a network and ensure that Canada continues to play a leading international research role.

The goals of the research are to clarify the physical mechanisms for the natural climate variability on timescales that range from a season to a century; to determine the extent to which this variability is predictable; and develop the tools to predict that variability. The project will produce state-of-the art seasonal forecasting tools that will be transferred to the Canadian Meteorological Centre (MSC) for operational forecasting purposes as they become available during the course of the project. A new high-resolution ocean model will be developed to clarify how the oceans and the atmosphere influence each other over periods of tens-to-hundreds of years. The model will be used to test the extent to which the ocean-related climate variability is predictable over these periods, while new analysis tools will help separate natural variability from the human causes in current global warming observations and those predicted for the future.

Network leader: Professor Jacques Derome, Atmospheric and Oceanic Sciences, McGill University.
Tel.: (514) 398-5350; E-mail: jacques.derome@mcgill.ca

CLIVAR Network members:
1. G.J. Boer, Adjunct Professor, University of Victoria.
2. G.J. Brunet, Adjunct Professor, McGill University.
3. D. Caya, Adjunct Professor, Université du Québec à Montréal.
4. J.F. Derome, Professor, McGill University, Principal Investigator.
5. G.M. Flato, Adjunct Professor, University of Victoria.
6. J.C. Fyfe, Adjunct Professor, University of Victoria.
7. R.J. Greatbatch, Professor, Dalhousie University.
8. K.G. Lamb, Associate Professor, University of Waterloo.
9. R.J. Laprise, Professor, Université du Québec à Montréal.
10. N.A. McFarlane, Adjunct Professor, University of Victoria.
11. L.A. Mysak, Professor, McGill University.
12. L.L. Pandolfo, Assistant Professor, University of British Columbia.
13. C.H. Ritchie, Adjunct Professor, Dalhousie University.
14. F.J. Saucier, Adjunct Professor, Université du Québec à Rimouski.
15. D.N. Straub, Associate Professor, McGill University.
16. A.J. Weaver, Professor, University of Victoria.
17. F.W. Zwiers, Adjunct Professor, University of Victoria.

4) Pacific 2001

Project Leader: Geoffrey Harris, Professor of Chemistry, York University.
Total: $677,502/2 years

Particulate matter and ozone are the two major components of smog. Air quality is an issue of concern in a number of areas around Canada, including the Lower Fraser Valley of British Columbia.

The Pacific 2001 project will help provide a better understanding of the interactions of particulate matter (PM) and ozone in the area. It will also help pinpoint more accurately its sources, formation and distribution.

The research activities will include studying the horizontal and vertical distribution of fine particulates and ozone in the Lower Fraser Valley airshed, particularly the relationship from the emissions to the actual formation of PM and ozone.

Research will also help determine the actual physical and chemical characteristics of fine particulates in the airshed and look at any changes in those characteristics. Work will involve identifying the major physical and chemical processes in the formation of secondary aerosols and ozone, and determine the role of natural and human-induced emissions, such as those from the transportation sector. A major result will be an integrated database for evaluating regional PM and ozone computer models.

The network involves researchers from a number of Canadian universities who will work toward providing a sound scientific basis for government and industry policy relative to air quality.

Project Leader: Geoffrey Harris, Professor of Chemistry, York University.
Tel: (416) 736-5992; Email: gharris@yorku.ca

Pacific 2001 Team Members:
1. G.W. Harris, Professor, York University, Principal Investigator.
2. D.R. Hastie, Professor, York University.
3. R. McLaren, Assistant Professor, York University.
4. M. Mozurkewich, Associate Professor, York University.
5. J. Rudolph, Professor, York University.
6. A-L. Norman, Assistant Professor, University of Calgary.
7. D.G. Steyn, Professor, University of British Columbia.
8. I.G. McKendry, Associate Professor, University of British Columbia.
9. R.B. Stull, Professor, University of British Columbia.
10. W. F.J. Evans, Professor, Trent University.
11. J.J. Sloan, Professor, University of Waterloo.
12. S.A. Mabury, Associate Professor, University of Toronto.
13. B.E. McCarry, Professor, McMaster University.
14. M.J. Whiticar, Professor, University of Victoria.

The Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)

La Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA)

Le Canada et les sciences du climat : la FCSCA subventionne des réseaux et projets de recherche unissant universités et gouvernement

MONTRÉAL, le 2 mai 2001 - La Fondation canadienne pour les sciences du climat et de l'atmosphÞre (FCSCA) a annoncé aujourd'hui quatre projets de recherche qui aideront le Canada à se replacer à l'avant-scène des sciences du climat de la planète. L'annonce a été faite à l'"Université du Québec à Montréal en présence de l'honorable Gilbert Normand, secrétaire d'état à la science, la recherche et le développement.

"Ces recherches effectuées en réseau réunissent des chercheurs des universités et du gouvernement partout au Canada, a déclaré M. McBean, président du Conseil d'administration de la FCSCA. Les meilleurs et plus brillants experts canadiens en sciences du climat et de l'"atmosphère travaillent ensemble. Le résultat sera une avancée considérable dans notre compréhension de la variabilité du climat, des océans et de leur interaction avec l'atmosphère, du rôle des nuages dans le climat, de l'interaction de polluants causant le smog dans notre atmosphère et de la chimie climatologique".

Une somme totale de 5,1 millions de dollars sera investie dans quatre projets de recherche au cours des trois prochaines années. La sélection finale a été basée sur la collaboration et la contribution éventuelle du projet à la base générale de connaissances en sciences du climat et de l'atmosphère.

"Cette importante contribution aux capacités de recherche canadiennes est également un investissement dans l'avenir de notre pays et dans la qualité de vie de la population canadienne", a dit le secrétaire d'état Normand. "Au nom du gouvernement du Canada, je félicite les équipes de recherche pour leur vision et les programmes novateurs qu'elles ont conçus".

"Plusieurs de ces projets de recherche s'alignent avec des travaux similaires effectués ailleurs dans le monde, a expliqué M. McBean. Le Canada pourra maintenir sa contribution à la communauté scientifique internationale et il s'agit là, bien sûr, de l'ultime collaboration. Une meilleure compréhension du vaste système climatique et atmosphérique que constitue la planète nous permettra de consolider des politiques éclairées sur la protection de ce système".

La FCSCA subventionne la recherche dans les domaines suivants:

- science du systÞme climatique;
- changements climatiques;
- temps violent;
- qualité de l'air; et
- prévisions touchant l'environnement marin.

Les quatre projets réseaux choisis sont:

1) Modélisation des nuages et du réseau climatologique (MOC2)

Chef du réseau: Philip Austin, Sciences de la Terre et des océans/géographie, Université de Colombie-Britannique. Total: 403 000 $ sur trois ans.

Les nuages comptent parmi les plus importantes influences sur le climat planétaire. La chaleur issue de la condensation détermine la circulation atmosphérique globale, tandis que la pluie et les chutes de neige distribuent l'eau douce sur la planète. De façon plus subtile, les nuages ont ce que l'on appelle un effet radiatif: ils refroidissent la planète en réfléchissant les courtes longueurs d'ondes dans l'espace, et réchauffent la planète par l'émission d'un rayonnement thermique (grandes longueurs d'ondes) à la surface.

Le réchauffement planétaire actuel ou anticipé résultant de l'activité humaine devrait modifier les caractéristiques radiatives des nuages. Par exemple, l'effet net des nuages sur le climat est actuellement de refroidir la planète, mais des modifications relativement mineures dans les propriétés des nuages pourraient changer cet équilibre et avoir d'importantes répercussions sur le climat. Elles pourraient modifier la couverture nuageuse totale, l'épaisseur ou même la taille des gouttelettes et cristaux de glace des nuages. La nature complexe et variable de la glace et de l'eau dans les nuages rend extrêmement difficile la tâche de prédire leurs propriétés dans les modèles de circulation générale.

Des modèles informatiques seront mis au point pour les principaux types de nuages et intégrés au modèle canadien de circulation générale. Le travail portera sur de nouvelles façons de prédire l'étendue des nuages; le contenu en eau et en glace des nuages; le nombre de gouttelettes et de cristaux; et l'effet des nuages sur le transfert des courtes et grandes longueurs d'ondes, de la chaleur et de l'humidité dans le modèle de circulation.

Le réseau de recherche mettra en commun les ressources des scientifiques universitaires et gouvernementaux mesurant et modélisant les nuages. On compilera ensuite des données d'observation des propriétés des nuages recueillies à partir d'aéronefs, de la surface et de satellites, lesquelles seront rendues disponibles. Ce projet s'insérera également dans un effort international d'étude des mêmes questions.

Directeur des recherches: Philip Austin, Sciences de la Terre et des océans/géographie.
Universit. de la Colombie-Britannique
Tél.: (604) 822-2175; courriel: paustin@eos.ubc.ca

Membres du réseau MOC2:

1. P.H. Austin, professeur agrégé, Université de la Colombie-Britannique, directeur des recherches.
2. H.W. Barker, Service météorologique du Canada et professeur auxiliaire, Université Dalhousie.
3. J.-P. Blanchet, professeur, Université du Québec à Montréal.
4. G.A. Isaac, Service météorologique du Canada et professeur auxiliaire, Université Dalhousie.
5. U. Lohmann, professeur adjoint, Université Dalhousie.
6. N.A. McFarlane, Service météorologique du Canada et professeur auxiliaire, Université de Victoria.
7. R.E. Stewart, Service météorologique du Canada et professeur auxiliaire, Université York.
8. R.B. Stull, professeur, Université de la Colombie-Britannique.
9. M.K. Yau, professeur agrégé, Université McGill.

2) Modélisation de la chimie climatologique planétaire

Chef du réseau: Theodore Shepherd, professeur de Physique, Université de Toronto.
Total: 1 028 855 $ sur trois ans.

La prévision des effets sur le climat des émissions de gaz à effet de serre et de leur précurseurs chimiques est un élément important de la réponse du Canada aux défis que posent les changements climatiques. Ce projet développera une capacité de modéliser le climat chimique général de l'atmosphÞre à partir des principes physiques fondamentaux. Il sera aussi utile pour surveiller l'évolution de l'atmosphère.

Le projet viendra améliorer le modèle de prévision couplé de circulation générale actuellement utilisé par le Service météorologique du Canada (SMC) avec une représentation interactive du climat chimique général. On mènera des expériences de sensibilité du climat afin de répondre à des questions sur le rétablissement de la couche d'ozone stratosphérique et les changements dans la capacité oxydante de l'atmosphère.

Le projet contribuera également à mettre au point un nouveau système d'assimilation des données chimiques du climat pour le SMC, en partenariat avec l'Agence spatiale canadienne (ASC). L'Agence spatiale pourra s'en servir pour interpréter les mesures et désigner de nouveaux systèmes de mesure axés sur le climat et la chimie planétaires.

Directeur des recherches : Theodore Shepherd, professeur de Physique, Université de Toronto.
Tél.: (416) 978-6824;
courriel: tgs@atmosp.physics.utoronto.ca

Membres du réseau de modélisation de la chimie climatologique planétaire:
1. J.P.D. Abbatt, professeur, Université de Toronto.
2. P.A. Ariya, professeur adjoint, Université McGill.
3. I.A. Folkins, professeur agrégé, Université Dalhousie.
4. U. Lohmann, professeur adjoint, Université Dalhousie.
5. J.C.K. McConnell, professeur, Université. York.
6. R. Ménard, Service météorologique du Canada.
7. D.V. Michelangeli, professeur agrégé, Université York.
8. J.F. Scinocca, Service météorologique du Canada et professeur auxiliare, Université de Victoria.
9. N.A. McFarlane, et professeur auxiliaire, Université de Victoria.
10. J. Li, Service météorologique du Canada.
11. S.M. Polavarapu, Service météorologique du Canada et professeur auxiliaire Université de Toronto.
12. T.G. Shepherd, professeur, Université de Toronto, directeur des recherches.
13. W.E. Ward, professeur agrégé, Université du Nouveau-Brunswick.

3) Variabilité du climat: Ses causes et sa prévisibilité (CLIVAR)

Chef du réseau: Jacques Derome, Sciences atmosphériques et océaniques, Université McGill.
Total: 3 millions de dollars sur trois ans (FCSCA et CRSNG, 1,3 million de dollars chacun, et 400 000 $ du SMC).

Les scientifiques savent depuis longtemps que les océans influencent l'atmosphère. De nouvelles recherches nous aideront à mieux comprendre cette influence et à améliorer les prévisions saisonnières et peut-être même celles à plus long terme. Bien qu'il soit de plus en plus certain que le réchauffement planétaire observé soit lié à la plus forte concentration de gaz à effet de serre dans l'atmosphère, pusieurs incertitudes notables demeurent. Ce projet clarifiera l'importance relative des gaz à effet de serre et de la variabilité naturelle dans le réchauffement planétaire observé. On examinera iverses manifestations du réchauffement planétaire en Amérique du Nord, notamment au plan de la couverture nuageuse et des précipitations.

Avec une somme totale de trois millions de dollars répartie sur trois ans, une équipe de dix-sept spécialistes, rattachés à sept universités et quatre laboratoires de recherche du gouvernement fédéral, travailleront ensemble, en réseau, et aideront le Canada à continuer à jouer un rôle important sur la scène internationale de la recherche.

Les objectifs du projet sont de clarifier les mécanismes physiques de variabilité naturelle du climat pour des périodes variant d'une saison à un siècle; de déterminer l'étendue de la prévisibilité de cette variabilité; et de mettre au point des outils pour la prévoir. Il en résultera des outils de prévision saisonnière de pointe qui seront, au fur et à mesure de leur mise au point, transférés au Service météorologique du Canada à des fins de prévisions opérationnelles. On élaborera en outre un nouveau modèle océanographique à haute résolution pour clarifier comment les océans et l'atmosphère s'influencent mutuellement sur des périodes de dizaines à centaines d'années.

Le modèle servira à tester l'étendue de la prévisibilité de la variabilité du climat reliée aux océans durant ces périodes, tandis que de nouveaux outils d'analyse aideront à distinguer la variabilité naturelle des causes humaines du réchauffement climatique actuellement observé et anticipé pour l'avenir.

Chef du réseau: professeur Jacques Derome, Sciences atmosphériques et océaniques, Université McGill.
Tél.: (514) 398-5350; Courriel : jacques.derome@mcgill.ca

Membres du réseau CLIVAR:
1. G.J. Boer, professeur auxiliaire, Université de Victoria.
2. G.J. Brunet, professeur auxiliaire, Université McGill.
3. D. Caya, professeur auxiliaire, Université du Québec à Montréal.
4. J.-F. Derome, professeur, Université McGill, directeur des recherches.
5. G.M. Flato, professeur auxiliaire, Université de Victoria.
6. J.C. Fyfe, professeur auxiliaire, Université de Victoria.
7. R.J. Greatbatch, professeur, Université Dalhousie.
8. K.G. Lamb, professeur agrégé, Université de Waterloo.
9. R.J. Laprise, professeur, Université du Québec à Montréal.
10. N.A. McFarlane, professeur auxiliaire, Université de Victoria.
11. L.A. Mysak, professeur, Université McGill.
12. L.L. Pandolfo, professeur adjoint, Université de la Colombie-Britannique.
13. C.H. Ritchie, professeur auxiliaire, Université Dalhousie.
14. F.J. Saucier, professeur auxiliaire, Université du Québec à Rimouski.
15. D.N. Straub, professeur agrégé, Université McGill.
16. A.J. Weaver, professeur, Université de Victoria.
17. F.W. Zwiers, professeur auxiliaire, Université de Victoria.

4) Pacifique 2001

Chef du projet: Geoffrey Harris, professeur de Chimie, Université York.
Total : 677 502 $ sur deux ans.

Les particules et l'ozone sont les deux principales composantes du smog. La qualité de l'air sont inquiétantes dans plusieurs régions du Canada, notamment dans la vallée du bas Fraser, en Colombie-Britannique.

Le projet Pacifique 2001 aidera à mieux comprendre les interactions des particules et de l'ozone dans cette région. Il aidera également à cerner plus précisément ses sources, son processus de formation et sa distribution.

Les activités de recherche consisteront à étudier la distribution horizontale et verticale des particules fines et de l'ozone dans l'air de la vallée du bas Fraser, en particulier la relation entre les émissions et la formation des particules et de l'ozone. La recherche contribuera également à déterminer les caractéristiques physiques et chimiques réelles des particules en suspension dans l'air et permettra d'examiner tout changement dans ces caractéristiques. Il faudra cerner les grands processus physiques et chimiques de formation d'aérosols secondaires et d'ozone et déterminer le rôle des émissions naturelles et de celles produites par l'Homme, par exemple dans le secteur du transport. Il en résultera principalement une base de données intégrée destinée à l'évaluation des modélisations informatiques régionales de particules et d'ozone.

Le réseau réunit des chercheurs de plusieurs universités canadiennes qui travailleront ensemble à fournir une solide base scientifique pour l'établissement de politiques gouvernementale et industrielle en matière de qualitéde l'air.

Chef de projet: Geoffrey Harris, professeur de Chimie Université York.
Tél.: (416) 736-5992; Courriel : gharris@yorku.ca

Membres de l'équipe Pacifique 2001:
1. G.W. Harris, professeur, Université York, directeur des recherches.
2. D.R. Hastie, professeur, Université York.
3. R. McLaren, professeur adjoint, Université York.
4. M. Mozurkewich, professeur agrégé, Université York.
5. J. Rudolph, professeur, Université York.
6. A.-L. Norman, professeur adjoint, Université de Calgary.
7. D.G. Steyn, professeur, Université de la Colombie-Britannique.
8. I.G. McKendry, professeur agrégé, Université de la Colombie-Britannique.
9. R.B. Stull, professeur, Université de la Colombie-Britannique.
10. W. F.J. Evans, professeur, Université Trent.
11. J.J. Sloan, professeur, Université de Waterloo.
12. S.A. Mabury, professeur agrégé, Université de Toronto.
13. B.E. McCarry, professeur, Université McMaster.
14. M.J. Whiticar, professeur, Université de Victoria.

Pour plus de renseignements:

Linda Larocque, Communications
Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA)
Tél.: (819) 772-0925
Téléc.: (819) 772-8908
Courriel : llarocque@videotron.ca

Dawn Conway, Directrice générale
Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA)
Tél.: (613) 238-2223; Téléc.: (613) 238-2227
Courriel : conway@cfcas.org

Atmosphere, Not Oceans, Carries Most Heat To Poles

BOULDER, 27 September 2001 – According to a new data analysis, the atmosphere redistributes annually as much heat from the tropics to the poles as would be produced by five million of the world's biggest power stations, generating 1,000 megawatts each. This is far more heat than previously estimated and much more than the oceans carry poleward. Until now scientists have been unable to reconcile observations of the atmosphere and ocean with results from global climate models. The new study establishes the role of each in total heat transport poleward.

"This new analysis makes the observations more consistent with the most stable global climate models and gives us confidence that the models are on target," says Kevin Trenberth of the National Center for Atmospheric Research.

Trenberth and NCAR colleague Julie Caron performed the analysis, which was published in a recent issue of the Journal of Climate, a publication of the American Meteorological Society. It was selected this month by the journal "Science" as an Editor's Choice of important new findings.

The atmosphere and oceans help to even out the planet's temperatures by moving vast amounts of solar heat from the equator toward both poles, primarily during winter in each hemisphere. Without this leveling effect, all the high latitudes would be frozen solid while the tropics would be much warmer and wetter.

Based on a reanalysis of data gathered between February 1985 and April 1989, the study shows that the atmosphere handles 78% of the total heat transport in the Northern Hemisphere and 92% in the Southern Hemisphere at 35 degrees latitude–where the total poleward transport in each hemisphere peaks. The ocean carries more heat than the atmosphere only in the tropics between 0 and 17 degrees north, according to the study.

In the past, computer models attempting to mimic the Earth's climate have required artificial fixes to match real-world observations. Only recently have NCAR and the United Kingdom's Hadley Center developed climate models stable enough to simulate centuries of climate without these fixes.

Their results now nearly match the observations. To complete the picture, recent results from ocean measurements fit well with those deduced by Trenberth and Caron from the atmospheric component and both now add up to the already known total heat transport.

In the late 1970s the ocean and atmosphere were thought to be conveying about the same amount of heat globally. Scientists estimated that the atmosphere was hauling 57% of the heat load, with oceans bearing a hefty 43% at the 35-degree latitude. As analyses have improved, estimates have steadily increased the magnitude of poleward heat transport occurring in the atmospheres of both hemispheres.

The atmosphere's role may have been slighted in the past because of a lack of data over the oceans, where substantial atmospheric heat transport occurs. Satellites have helped fill that gap. Trenberth and Caron focused on the 1985-1989 period because it offers reliable top-of-the-atmosphere radiation data from satellite measurements taken during the Earth Radiation Budget Experiment.

The new study was based on two data reanalyses, one by the National Center for Environmental Prediction and NCAR, the other by the European Centre for Medium-Range Weather Forecasts. The study was funded by the National Oceanic and Atmospheric Administration and NASA. NCAR is managed by the University Corporation for Atmospheric Research with primary sponsorship by the National Science Foundation.

Note from the Editor: Adapted from a news release issued by the National Center for Atmospheric Research/University Corporation for Atmospheric Research. Credit is provided to the National Center for Atmospheric Research/University Corporation for Atmospheric Research as the original source. For more information, please consult:

http://www.sciencedaily.com/releases/2001/09/010927071942.htm

Scientists Suggest New Index to Capture "Flavors" of El Niño

BOULDER- 16 April 2001- Just as the Federal Reserve uses more than one index to measure the health and state of the economy, scientists at the National Center for Atmospheric Research (NCAR) believe it is essential to have at least two climate measures to capture all "flavors" of El Niño.

Climate scientists have long used changes in sea surface temperatures in specific regions of the Pacific Ocean to characterize El Niño events. But using just that one index does not give a complete picture of the climate phenomenon, according to Kevin Trenberth, head of the Climate Analysis Section at NCAR.

"El Niño comes in many different 'flavors'," said Trenberth. "Each has a different and distinct character. An index of average sea surface temperature variations in some parts of the Pacific Ocean does not allow us to differentiate between major, moderate, and minor El Niños, or between the entire nature of the event and its evolution."

Writing in the April 15 issue of the American Meteorological Society's *Journal of Climate*, Trenberth and colleague David Stepaniak, propose a second El Niño index called the "Trans-Niño Index" or TNI. The new index is a mathematical equation that calculates the difference between sea surface temperature changes in the central equatorial Pacific Ocean and those in waters along the coast of South America. This type of index, showing different developments across the Pacific, allows scientists to see how and where El Niño events have developed over the last 50 years and to detect changes that may be occurring on a decadal time scale.

In his research Trenberth found that although El Niño events tend to be locked to the annual cycle and typically peak in the northern winter, the evolution of El Niño has changed substantially. The TNI index shows that El Niño events between 1950 and 1976 tended to develop first along the coast of South America and then spread westward. More recent El Niño events developed in the central Pacific and spread eastward.

"We want to explore whether we can use the relationships of temperature variations between the different parts of the Pacific to evaluate numerical climate models on how well they simulate El Niño events," added Trenberth. "Our goal is to capture that character so we can improve confidence in future predictions."

NCAR is managed by the University Corporation for Atmospheric Research, a consortium of 66 universities offering Ph.D.s in atmospheric and related sciences. NCAR's primary sponsor is the National Science Foundation.

Founded in 1919, the AMS is the nation's leading professional society for scientists in the atmospheric and related sciences. The Society publishes well-respected scientific journals, sponsors scientific conferences, and supports public education programs across the country.

On the Web: For NCAR, visit http://www.ncar.ucar.edu. For the AMS, find more information at http://www.ametsoc.org/AMS.

Next Issue CMOS Bulletin SCMO

Next issue of the *CMOS Bulletin SCMO* will be published in December 2001. Please send your articles, notes, workshop reports or news items at the earliest to the address given on page ii. We have an **URGENT** need for your articles.

Prochain numéro CMOS Bulletin SCMO

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en décembre 2001. Prière de nous faire parvenir au plus tôt vos articles, notes, rapports d'atelier ou nouvelles à l'adresse indiquée à la page ii. Nous avons un besoin **URGENT** d'articles.

Roger Willis Daley
1943 - 2001

Roger Willis Daley, UCAR Distinguished Scientific Visitor at the Naval Research Lab in Monterey, died at his home in Carmel Valley, California, August 29, 2001. Daley was born in Purley, England on January 25, 1943. He moved with his parents at an early age to West Vancouver, British Columbia, Canada. He studied at the University of British Columbia graduating with a B.S. in mathematics and physics in 1964. He completed a M.S. in Meteorology at McGill University in 1966 with a thesis on the topic of large-scale rainfall prediction. After two years as a professional weather forecaster in Goose Bay, Labrador and Montreal, Quebec, he began PhD studies at McGill, graduating in 1971. His PhD thesis was on the simulation of convection using the spectral method.

Daley spent two years of post-doctoral studies at the Institute for Theoretical Meteorology in Copenhagen before returning to Canada to a research scientist position with the Meteorological Service of Canada (MSC) in Montréal. From 1973 to 1977, he carried out research and development on numerical weather prediction (NWP) systems that were implemented at the Canadian Meteorological Centre (CMC). He was the team leader for the world's first operational spectral forecast model, which was implemented in 1976. The spectral approach is now used in most operational global NWP centres and forms the dynamical basis for most climate models presently in use. He also was a co-developer of the variable resolution finite element model that was used for regional forecasting applications in Canada for many years.

In 1977, Daley accepted a position at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado where he carried out research on non-linear normal mode initialization and other outstanding problems in the dynamics of large-scale atmospheric flow particularly as they related to global NWP. He also became much more interested in the science of data assimilation. During this period, Daley was author or co-author on some 16 publications in the refereed literature and was honoured by receiving the NCAR outstanding publication award. Nevertheless, he did not neglect his interest in operational applications. He was involved in implementation of nonlinear normal mode initialization for baroclinic models at CMC in Canada and at Météo-France in Paris; and implemented an innovative error covariance formulation at the European Centre for Medium Range Weather Forecasts.

In 1985, Daley returned to Canada to take up the position of Chief Scientist in the Canadian Climate Centre. He was an integral part of the development of the research agenda for the Canadian Climate Program that was ultimately a major initiative of Canada's Green Plan. This program supported the development of a vigorous climate research capability in Canada that thrives to this day. His personal scientific work was consumed with the production of a book entitled "Atmospheric Data Assimilation", which was published in 1991. This book is now a classic. In writing the book, Daley encountered many vexing difficulties and inconsistencies with the approaches used in operational data assimilation. He proceeded to tackle and resolve these questions. These investigations led to an explosion of publications by Daley in the refereed literature during the period 1985 to 1995. By the time he left the MSC he was firmly established as a world leader in data assimilation through his comprehensive book, but also in terms of creative new developments in the theory and practice of data assimilation. Some scientists believe that Daley was largely responsible for elevating data assimilation to be a prestigious field of scientific enquiry.

In 1995, Daley accepted a position as a UCAR Distinguished Scientific Visitor at the Marine Meteorology Division, Naval Research Laboratory, in Monterey, California, and moved his family to the Carmel Valley. Daley took on the job of the design and construction of a new three-dimensional variational data assimilation system specifically meant to serve the needs of the US Navy. This system is now known as the NRL Atmospheric Variational Data Assimilation System, or NAVDAS. It is poised to transition to operations at Fleet Numerical Oceanography and Meteorology Center and Navy regional centres. NAVDAS is designed to meet data assimilation needs of both global models and regional nested models. Daley continued to innovate as he continued to implement. His colleagues at NRL Monterey greatly admired his ability to be equally productive in the "nitty-gritty" computer programming of components of NAVDAS as he was in the abstract matrix algebra of data assimilation theory. Daley was full of ideas and very active in research on an accelerated cycling representor method as a new approach to four-dimensional data assimilation.

Throughout his career, Daley was in demand as a consultant, as a scientific visitor and adjunct professor. He held visiting appointments at ECMWF, Météo-France;

Florida State University and The Meteorological Institute of Stockholm University. He was an adjunct professor at McGill University, Colorado State University and the Naval Postgraduate School and a Scientist Emeritus with the Meteorological Service of Canada. He also lectured extensively throughout the world including a series of lectures in Beijing, China; as a principal lecturer at the 1990 Summer Colloquium at NCAR and at the University of Toulon in France. He also gave unstintingly of his time and energy to professional activities serving on many important international scientific committees, carrying out scientific reviews and serving as member of journal editorial boards of the AMS and the Swedish Geophysical Society. He was Editor for the CMOS journal Atmosphere-Ocean from 1989-1992.

Daley received many honours during his career. From the Canadian Meteorological and Oceanographic Society (CMOS) he received the Prize in Applied Meteorology in 1975 and the President's Prize in 1982. He was elected a Fellow of the Royal Society of Canada in 1993 and a Fellow of the American Meteorological Society (AMS) in 1997. In January 2001, he was awarded the prestigious Jules Charney Medal of the AMS for a lifetime of outstanding scientific achievement.

Daley was an avid mountaineer and very interested in the history of polar exploration. He is survived by his wife of 33 years, Lucia; a daughter, Kate Daley of Victoria , B.C.; a son, Charlie Daley of Arcata, California; a brother Andrew Daley of Kelowna, B.C.; two nephews and a niece.

Philip Merilees,
Superintendent, Marine Meteorology Division
Naval Research Laboratory

Thanks to Barney Boville

It was with great sadness that I learned of Barney Boville's passing. Of his many professional colleagues and associates who benefited of his talent, interest and mentoring over the years, I suspect his gifts to me were the most. I wish to leave some record of those gifts.

I first met Barney at the new Department of Meteorology at McGill in 1962. He was an Associate Professor and I was recently hired as a meteorologist by the (then and now) Meteorological Service of Canada (MSC) and sent to McGill to study for a Master's degree. Barney was a very lively scientist, clearly loved his subject of dynamic meteorology and sought for innovative ways to teach and organize learning. He was always very open and available for discussions and advice. He certainly "turned me on" during that first year at McGill. With his guidance and financial support from his research contracts I stayed at McGill to complete a PhD degree in 1966 with Barney as my supervisor in 1966. Barney was a bit unusual as a PhD supervisor in that he expected his students to teach him new things and that was very refreshing.

A few years later, Barney was now Chairman of the Department of Meteorology at McGill and he arranged for me to join the faculty as an Assistant Professor. We enjoyed a number of years working together, conducting the Stanstead Seminars, working with students and helping to grow the Department as a place to study dynamical meteorology especially in the context of the growing field of numerical weather prediction. Barney always was on the outlook to provide me opportunities to be influential in Canadian meteorological science through his connections with the MSC and the National Research Council of Canada. This was particularly important in the context of the international program GARP (The Global Atmospheric Research Programme) of WMO. In late 1972, Barney left McGill to take on the position of Director of the Atmospheric Processes Research Branch of the MSC in Downsview.

In the spring of 1977, I was considering different employment opportunities. Once again Barney was there and made everything happen so that I could join the Atmospheric Processes Research Branch of the MSC in Downsview. He was a visionary for Climate Research and Services and started the Canadian Climate Centre in 1978. He also got the Climate Modeling group going in that time frame and they have gone on to be a very important part of the international study of climate and climate change. He put me into the position of Chief Scientist of the CCC in 1979 and that was the event that essentially entrained me into scientific research management.

Barney retired from the MSC after the formation of the CCC and took a position at the WMO to work on the World Climate Programme. When he returned to Canada he was recruited to set up an atmospheric science program at York University and we had many occasions to interact scientifically. When he finally really retired he took up golf avidly and we enjoyed many games together.

Barney did me the honour of making the significant effort necessary to be present in the MSC auditorium on Dufferin Street when my family and I were feted on the occasion of my retirement from MSC in March of 1997. Barney was a wonderful human being, and had a tremendous impact on Canadian meteorology as well as international meteorology. I will always be very grateful for the many opportunities he provided to me throughout my career.

Philip E Merilees

Note from the Editor: You can read more about Barney Boville's death with several tributes from CMOS Members in the last issue of the *CMOS Bulletin SCMO*, Vol.29, No.3, pages 87-88.

Robert Barry Charlton

Bob Charlton, retired Professor of Earth and Atmospheric Sciences, passed away on July 5, 2001, at home with his family, following a brief illness. Bob obtained his PhD at the University of Toronto under the supervision of Prof. Roland List, FRSC. He then taught for three years at the State University of New York at Oswego, but moved to Edmonton in 1973, with his wife Pat and new daughter, Maggie, in order to join the Department of Geography. Bob had an active career at the University of Alberta for over a quarter of a century. In addition to his academic credentials, Bob was also an experienced weather forecaster, and he put that experience to good use in his teaching. Former students will remember his eclectic and challenging courses, from introductory meteorology to advanced synoptic meteorology. They will also remember his love of ice racing and his passion for trains. Bob took great delight in his research and in his graduate students. Many international students looked to the Charlton home as their "home away from home", and Bob often kept in touch with them years after they graduated. Bob's research interests lay chiefly in the area of severe storms.

Many summers, you would find Bob chasing hailstorms and tornadoes around the province - often with his vacationing family in tow, and driving his beloved "woodie", a 1951 Woodie Station Wagon. In the past few years, Bob published two weighty monographs – one on urban hailstorms and the second on the Edmonton tornado of July 31, 1987. Bob used the latter as the basis for a website about the tornado: (http://datalib.library.ualberta.ca/tornado/). To quote Bob, "It is hoped that this report will help us look back to the fateful day when Edmonton was struck by the unimaginable". Bob's vocation and avocation met in his love of ice racing, an activity that he pursued between hail seasons. He enjoyed great success racing his turbocharged Corvair with the NASCC. After his racing retirement, Bob happily partook in marshalling, timing and scoring. Bob was an independent thinker, with innovative ideas and a knack for expressing them, especially in letters to the editor. For Bob, life was always an adventure. He was a devoted family man, a sympathetic colleague, an advocate for the underdog and a generous soul, who will be sorely missed.

Edward Lozowski
University of Alberta

SHORT NEWS - NOUVELLES BRÈVES - SHORT NEWS - NOUVELLES BRÈVES

Conference on Coastal, Estuarial and Offshore Engineering

A national conference on offshore, coastal, and estuarial engineering and environmental management will be held on 4-7 June, 2003 in Moncton, New Brunswick. The Conference will be of interest to coastal engineers, geomorphologists, oceanographers, and related professionals. It is being organized under the auspices of the Hydrotechnical Division of the Canadian Society for Civil Engineering (CSCE). A Call for Papers will be issued in early 2002. For information, email Brian Burrell at bburrell@nbnet.nb.ca

Earth Summit 2002 Website and Newsletter

The Earth Summit 2002 website provides comprehensive information on preparations for the Summit in South Africa. Network 2002 is the monthly e-newsletter reporting on current progress. For information and to subscribe to the newsletter, please access the Summit website at http://www.earthsummit2002.org/

Climate Change in the North Atlantic Ocean

A NASA satellite confirms that 'overturning' in the North Atlantic Ocean - a process where surface water sinks and deep water rises due to varying water densities - speeds up and slows down by 20 to 30 percent over 12 to 14 year cycles. Scientists previously believed that a change of this magnitude would take hundreds of years.

For more information, please access http://earthobservatory.nasa.gov:81/Newsroom/NasaNews/2001/200107164999.html

Bedford Institute of Oceanography 2000

The BIO annual report series has been reinstated. The current report entitled "Bedford Institute of Oceanography 2000" highlights some of the ongoing research at the Institute, staffing, publications and products. To obtain a copy of the report, email BIOLibrary@mar.dfo-mpo.gc.ca

Environment and Sustainable Development Indicators

In September 2000, the National Round Table on the Environment and the Economy (NRTEE) launched its Environment and Sustainable Development Indicators (ESDI) Initiative, a three-year program to develop and promote a focused set of national indicators. For information, including a summary report of the recent National Conference on Sustainable Development Indicators in Ottawa, please access http://www.nrtee-trnee.ca/indicators

David Phillips a Member of the Order of Canada

The many friends and acquaintances of David Phillips will be pleased to learn that he has been appointed a Member of the Order of Canada. In the citation provided by the Governor General's office David is called "a skilled communicator who promotes awareness and understanding of our country's climate." Later this year David will be presented to the Governor General at Rideau Hall in Ottawa.

Over the past twenty or so years David had undoubtedly become Canada's best known weatherman of all time. He has tirelessly travelled from coast to coast for the Meteorological Service of Canada making appearances on radio and television and before the press and giving talks to local and national societies and institutions. Whenever any Meteorological Service employee or retiree travels throughout the country he or she is quite often asked, "Do you know David Phillips?" Then the enquirer always tells a story about where and when they met David or heard him address a meeting. Also they always remark on what a nice fellow he is and how good he is in explaining something they asked about meteorology and climate.

With his mid-morning coffee-drinking pals at the Meteorological Service Downsview building David is, on occasion, good-naturedly ribbed about not being a meteorologist. In response he proudly admits to being a climatologist and his friends agree that there has never been any climatologist like him before. David's undergraduate degree, from the University of Windsor in 1966, is in geography with his major in climatology. Professor Marie Sanderson of that university was the first to spot David's outstanding ability and interest in climatology. Later, Professor Ken Hare at the University of Toronto recognized his aptitude and competence in the subject and supervised his MA which was granted in 1971.

In 1967 David was employed in the Meteorological Service (then the AES) as a Physical Scientist in the Lakes and Marine Applications Unit of the old Climatological Section. There he worked with Lloyd Richards and Jim McCulloch on such projects as the International Field Year on the Great Lakes. David's interest and abilities in the entire climate/meteorology discipline soon became evident to others in the climate field such as Clarence Boughner, Gordon McKay and myself. As an extra duty he was asked to give the annual course in climatology to the new meteorological officers in 1972 and continued to do so until that training program was discontinued. In the mid-1970s he was "stolen" from Lakes and Marine and asked to work in the general climatology area. There his developmental efforts were outstanding. For example he invented and has been the researcher, writer and promoter of the annual *Canadian Weather Trivia Calendar* which first appeared in 1985. In 1993 he was named Senior Climatologist in the Canadian Climate Centre at Downsview where he has outlasted the Centre and still has his well-deserved title.

Probably few CMOS members know of the many outside activities David has been busy with over the years. For a term in 1972 he was a Visiting Assistant Professor at the University of Windsor and filled the same role in 1976 at McGill University. And, at York University he was a Seasonal Professor in 1977 and 1980. Beginning in the late 1970s David became active in affairs of the World Meteorological Organization. He was a Canadian Delegate to the Commission for Climatology (1979-1993) and to the Second World Climate Conference. During the 1980s, without diminishing his national contributions, he became an active worker for the WMO Commission. He edited the *WMO Guide to Climatological Practices* (1983), and has produced many reports on climate applications, training and education, new approaches for operational and planning purposes, and marketing and publicity. These have been of great value to foreign meteorological services especially those in developing countries. He has further served by being a member of different working groups in the Climatology Commission including the Advisory Working Group from 1989 to 1997 and several times has gone to the Geneva Secretariat to develop, write and edit various WMO publications.

For the past fifteen years or so David Phillips has been very active in programs of the Royal Canadian Geographical Society. For a dozen or so years beginning in 1988 he contributed his "Weather-wise" column of weather facts and myths to the Society's *Canadian Geographic*. He was a Director/Governor of the Society from 1987 to 1993 and several times was the featured speaker at the Society's public meetings at centres throughout the country including a 1992 trip to Iqaluit in the Arctic where he exchanged weather lore with Inuit elders. He has done so much for the Society that he was labelled "the Society's Goodwill ambassador" in 1993 when it presented him with its Camsell Award for "Outstanding Service to the Society."

Amongst his many publications David has published two "best-seller" books. His *Climates of Canada* in 1990 was a real labour of love and fills a great need for popular information and is used in schools and colleges. Following publication a British book review editor called it "a meteorological masterpiece, which describes the remarkable diversity of Canada's climates." Later, in 1993, David published *The Day Niagara Falls Ran Dry*, a collection of selected articles from his Weather-wise column in the *Canadian Geographic*. For several weeks this book was on the *Globe and Mail's* best seller list, most certainly a first for a Canadian meteorologist/climatologist.

In addition to the honours David has received outside his discipline his colleagues in meteorology/climatology have not ignored him. He was awarded an AES Achievement Award in 1984 and Public Service Merit Awards in 1986 and 1992. Our Society, CMOS, awarded him the Andrew Thomson Prize in Applied Meteorology in 1991 and in 1993 he was awarded the Patterson Distinguished Service Medal for "distinguished service to Meteorology in Canada."

On a personal note I must add that I have been a great admirer of David and his work for many years. Before his extensive meteorological and climatological activities began to take up all his free time, David was active in amateur theatrical productions.

A number of years ago I was present in the Newmarket Old Town Hall when he delightfully played the part of Sir Frederic Stupart (director of the Meteorological Service early last century) in a documentary film being made for Sudbury's Science Centre North. In wing collar, frock coat, false moustache, and wire glasses, David was superb. While Senior Climatologist is an excellent title for David the Governor General, when appointing him to the Order of Canada, should also name him "Dominion Climatologist" and thus revive a title used in the time of Sir Frederic.

Morley Thomas

Congratulations

The Editorial Board of the *CMOS Bulletin SCMO* wishes to congratulate David on this new honour. David has been in the past, and we are sure he will continue to be in the future, a faithful contributor to the Society's Bulletin. For this, the Editorial Board of the *CMOS Bulletin SCMO* wishes to thank him very much on this very special occasion.

Project Atmosphere 2001

The following is a report by Nancy Clarke, a Science Teacher/Supervisor at the University of Toronto School. She was this year's Canadian participant at the Project Atmosphere Workshop, which is organized yearly by the American Meteorological Society jointly with the National Oceanographic and Atmospheric Administration and the National Science Foundation. The Canadian participant is chosen and supported by CMOS and the Canadian Council for Geographic Education.

NURTURING THE METEOROLIGIST WITHIN

What follows a polite greeting and unlocks the door to greater communication? The weather! Although everyone has used it to segue into a conversation, many (I think) secretly long to have theoretically rich discussions on meteorological issues or at least know enough to plan appropriate vacations. As someone who enjoys the outdoors and who teaches high school science, I had sufficient "working" knowledge of weather, but not the depth that I felt was necessary for the new Ministry expectations for Grade 10 Science. Many people must have shared this viewpoint, since it was standing room only at the 2000 Science Teachers' Association of Ontario (STAO) Conference session on "Weather".

This is where it all began when I first heard about "Project Atmosphere". Once intrigued with the knowledge of this exciting summer course, I received more information from Environment Canada and the American Meteorological Society. After completing the application and much nail-biting as I eagerly hoped for acceptance, I was thrilled to learn that I would be the sole Canadian delegate selected to attend the American Meteorological Society's "Project Atmosphere" Workshop in Kansas City, Missouri. I would like to gratefully acknowledge and extend my sincere thanks to CCGE and CMOS for their financial support that made this possible.

As National Weather Service Training Center (NWSTC) students, I, along with delegates from 17 states, South Africa, and Belize was overwhelmed with the availability of resources and the experience of the dedicated instructors and guest lecturers. I came away with a renewed vigour for curriculum development and a truer appreciation for the challenges of weather studies. My goal now is to have students retrieve (if lost due to the effects of aging), maintain, and hopefully enhance that feeling of wonderment when they gaze up at the sky and recognize the magnitude of data that can be obtained from cloud observations. I want them to be able to anticipate the forecast when satellite or radar imagery is displayed on the television, to recognize the variety of careers related to meteorology, and to understand the enormity of decisions made to evacuate a storm-laden area. I want to nurture the meteorologist within.

An expectation of the workshop acceptance is to share the knowledge and experiences gained through this incredible opportunity. I am now anxiously awaiting the STAO 2001 conference, where I will be presenting an overview of some of the many topics covered this past summer. However, my preferred format will be smaller workshops that I would like to organize for individual schools and districts to allow for a more thorough coverage of selected activities. I have been very fortunate this past year to be the recipient of a Eureka! Fellowship with the University of Toronto Schools (UTS), and as such have been afforded the time to visit other schools and assist with developing and implementing creative approaches to the Grades 9 and 10 Science programs. It is with the generosity of this fellowship that I can extend the impact of these valuable experiences for professional development.

I must warn you though once you have attended the NWSTC workshop, your expertise will be in demand at work, home, and any social gathering!

Although we are not in Kansas anymore (hmmm that phrase sounds familiar), I have already been in contact with many of my summer colleagues to exchange lesson ideas, approaches, and stories, as well as been on the receiving end of more exceptional resources. This is truly global education at its best!

For more information on how I can be of assistance to you and your class, please do not hesitate to contact me at (416) 946-7561 or e-mail me at nclarke@oise.utoronto.ca.

Nancy Clarke, Hons.B.Sc., B.Ed.
Eureka! Fellow at UTS

Job Wanted

DR. PARMJIT SINGH SEHRA

Prospective Canadian Immigrant from India; Ph.D. in Meteorology & Atmospheric Sci.; F.R.Met.S. and member of AMS and CMOS; WMO/UN Expert; NASA/USA Consultant; Res. Scientist, Academy of Athens, Greece, & ICTP, Trieste, Italy; Prof. of Met., Al-Fateh Univ., Tripoli, Libya; Sr. Scientist, SAC/ISRO & PRL, Ahmedabad, India. Interested in a suitable position.

Fax. 00-91-161-511490.

CMOS Prizes and Awards: NOMINATIONS

The Canadian Meteorological and Oceanographic Society's annual call for nominations for Prizes and Awards is under way. All Society members are encouraged to consider nominating individuals of the meteorological or oceanographic community who have made significant contributions to their fields. The award categories are:

a) The President's Prize;
b) The J.P. Tully Medal in Oceanography;
c) The Dr. Andrew Thomson Prize in Applied Meteorology;
d) The Prize in Applied Oceanography;
e) The Rube Hornstein Medal in Operational Meteorology;
f) Tertia M.C. Hughes Memorial Prize;
g) Citations (including Environmental Citations).

Each category has different and specific nomination criteria which must be met before any nomination can be considered. For details, please see p. 134-135 of Vol. 24, No.5, Oct. 1996 issue of the CMOS Bulletin SCMO or contact Mike Leduc at the address given below.

This year the deadline is February15, 2002 for nominations to be received by the Secretary.

Mike Leduc (Secretary)
Meteorological Service of Canada
4905 Dufferin Street
Downsview, ON M3H 5T4
Tel: 416-739-4474; Fax: 416-739-4603
email: mike.leduc@ec.gc.ca

CMOS Prizes and Awards Committee Members

- Rick Thomson (IOS), (Chair) ThomsonR@pac.dfo-mpo.gc.ca
- Jean-Guy Desmarais (CMC) jean-guy.desmarais@ec.gc.ca
- Henry Leighton (McGill) henry@zephyr.meteo.mcgill.ca
- Lawrence Mysak (McGill) mysak@zephyr.meteo.mcgill.ca
- Keith Thompson (Dalhousie) keith.thompson@dal.ca
- Mike Leduc (Secretary) mike.leduc@ec.gc.ca

NOMINATIONS: Prix et Honneurs de la SCMO

L'appel annuel de la Société canadienne de météorologie et d'océanographie pour les prix et honneurs est lancé. Tous les membres de la société sont encouragés à présenter des nominations de personnes considérées comme ayant contribué de façon significative dans leur sphère d'activités tant en océanographie qu'en météorologie. Les catégories de prix sont:

a) Prix du président;
b) Médaille de J.P. Tully en océanographie;
c) Prix du Dr. Andrew Thomson en météorologie appliquée;
d) Prix en océanographie appliquée;
e) Médaille de Rube Hornstein en météorologie opérationnelle;
f) Prix commémoratif Tertia M.C. Hughes;
g) Citations (citations environnementales incluses).

Chaque catégorie a des critères différents et spécifiques de sélection qui doivent être rencontrés pour être considérés. Pour de plus amples détails, prière de consulter les pages 134-135 du CMOS Bulletin SCMO (Vol.24, No.5, Oct. 1996) ou de contacter Mike Leduc à l'adresse donnée plus bas.

Cette année toutes les soumissions doivent être reçues par le secrétaire avant le 15 février 2002.

M. Mike Leduc (secrétaire)
Service Météorologique du Canada
4905, rue Dufferin
Downsview, ON M3H 5T4
tél.: 416-739-4474; téléc.: 416-739-4603
courriel: mike.leduc@ec.gc.ca

Membres du Comité des Prix et Honneurs de la SCMO

- Rick Thomson (IOS), (président) ThomsonR@pac.dfo-mpo.gc.ca
- Jean-Guy Desmarais (CMC) jean-guy.desmarais@ec.gc.ca
- Henry Leighton (McGill) henry@zephyr.meteo.mcgill.ca
- Lawrence Mysak (McGill) mysak@zephyr.meteo.mcgill.ca
- Keith Thompson (Dalhousie) keith.thompson@dal.ca
- Mike Leduc (secrétaire) mike.leduc@ec.gc.ca

CALL FOR PAPERS
36th Annual CMOS Congress
May 22 - 25, 2002

Rimouski, Québec, Canada

THE NORTHERN ENVIRONMENT

The 36th Annual Congress of the Canadian Meteorological and Oceanographic Society will be held in the charming city of Rimouski, Québec, Canada, 22-25 May 2002. The theme of the Congress is the Northern Environment, with presentations by internationally known keynote speakers and by scientists and students from across Canada and abroad. We welcome oral and poster presentations in the fields of meteorology, climatology, oceanography, and hydrology dealing with all aspects of the Northern Environment such as the dynamic and variability of the cryosphere, the exchanges between the atmosphere and ocean, the carbon cycle, contaminants, and all studies dealing with the limnology, biogeochemistry, and chemistry in arctic and subarctic ecosystems, including fjords, polynyas, marginal sea-ice zones, and the boreal forest. Contributions are also welcomed in all fields of meteorology, climatology, oceanography and hydrology, such as boundary layers, cloud physics, energy and radiation, measurement methods, marine forecasting or operational meteorology, climate modelling, and climate change and variability including palæoclimatology.

Abstracts: Abstracts should be 300 words or less and include the name, title, affiliation, mailing address, phone and fax numbers, and email address (if available) of each author, and the thematic area(s) where the paper might best fit in the program. Abstracts must be received no later than February 1, 2002. The accepted abstracts will be published at the time of the meeting.

Online submission of Abstracts: Abstracts may be submitted online via the web site http://scmo-cmos-2002.osl.qc.ca/ Although online submission is preferred, you may also email (please identify your theme area and whether poster or oral presentation when submitting) your abstract to:

CMOS 2002, Ocean Sciences Directorate
Maurice Lamontagne Institute
Fisheries and Oceans Canada
850, Route de la Mer
Mont-Joli (Qc), Canada G5H 3Z4
Fax # (418) 775-0546
Email: royf@dfo-mpo.gc.ca

Deadline for abstracts.................. February 1, 2002
Notification of acceptance........... March 1, 2002

For more information about the congress, facilities, location and special events, you can visit the web site: http://scmo-cmos-2002.osl.qc.ca/.

INVITATION - APPEL DE CONTRIBUTIONS
36e Congrès annuel de la SCMO
22 au 25 mai 2002

L'ENVIRONNEMENT NORDIQUE

Le 36e Congrès annuel de la Société Canadienne de Météorologie et d'Océanographie se tiendra dans la charmante ville de Rimouski, du 22 au 25 mai 2002. Le thème du congrès est l'Environnement Nordique, avec des conférences inédites présentées par des scientifiques reconnus sur la scène internationale et par des chercheurs et des étudiants du Canada et de l'étranger. Vos contributions scientifiques sont sollicitées dans les domaines de la météorologie, de la climatologie, de l'océanographie et de l'hydrologie qui traitent des différents aspects de l'environnement nordique tels que la dynamique et la variabilité de la cryosphère, du pergélisol, du cycle du carbone et des contaminants, et également toutes les études portant sur la limnologie, la biogéochimie, et la chimie des écosystèmes arctiques et subarctiques, incluant en particulier les fjords, les polynies, les marges de glace marine et la forêt boréale. Vos contributions sont aussi sollicitées dans tous les domaines clés de la météorologie, de la climatologie, de l'océanographie et de l'hydrologie, tels l'étude des couches limites, la physique des nuages, l'énergie et la radiation, les méthodes de mesure, la prévision maritime ou la météorologique opérationnelle, la modélisation climatique, et le changement et la variabilité du climat incluant la paléoclimatologie.

Résumés: Les résumés doivent être de 300 mots ou moins et contenir le nom, l'affiliation, l'adresse postale et électronique (si disponible) de chaque auteur ainsi que le thème général auquel la contribution pourrait le mieux correspondre. Les résumés doivent être reçus au plus tard le 1er février 2002. Les résumés acceptés seront publiés au moment du congrès.

Soumission des résumés en ligne: Les résumés peuvent être soumis en ligne via le site Internet http://scmo-cmos-2002.osl.qc.ca/. Les soumissions en ligne sont fortement encouragées mais vous pouvez aussi envoyer votre résumé (en indiquant clairement vos préférences pour un thème et pour le format de la présentation, soit orale ou par affiche) à:

SCMO 2002, Direction des Sciences Océaniques
Institut Maurice Lamontagne
Pêches et Océans Canada
850, Route de la Mer
Mont-Joli (Qc), Canada G5H 3Z4
Fax # 418-775-0546
Courriel: royf@dfo-mpo.gc.ca

Date limite pour soumettre les résumés....1er février 2002
Notification d'acceptation........................1er mars 2002

Global Warming & Extreme Weather
A Special Issue on Natural Hazards

The present ongoing debate on Global warming highlights the possiblity of increased incidences of extreme weather events world-wide, as the Earth's mean temperature is expected to rise steadily in response to increased concentrations of atmospheric greenhouse gases. Several recent studies and media reports point out the increased risk of more violent weather events in future (more severe cyclones and mid-latitude storms, increased thunderstorms, severe windstorms and accompanying localized and regional flooding, increased instances of regional and local droughts, etc.) as a result of increasing concentrations of greenhouse gases.

Due to the importance of this topic, a Special Issue of the Journal NATURAL HAZARDS (Kluwer Academic Pub., Netherlands) devoted to the general topic of **Global Warming & Extreme Weather (land and marine based)** is planned for publication by the Spring of 2002.

The Special Issue is aimed at focusing on the scientific basis of the possible link between Global Warming & Extreme Weather and on providing a suitable documentaion of the link through a careful analysis of available data.

Articles and papers (12 to 15 pages in length) as well as short essays dealing with any of the issues relating to Global Warming/Extreme Weather are sought. Scientists and researchers working in the general area of Global Warming are encouraged to submit papers for this Special Issue. All submitted manuscripts will be subject to a standard Journal review process. Manuscripts may be directly submitted to one of the following Guest Editors:

1. Dr. Madhav L. Khandekar, Consulting Meteorologist, 52 Montrose Crescent, Unionville, Ontario, L3R 7Z5, CANADA: E-mail: mkhandekar@home.com / Phone: 905-940-0105

2. Dr. Gabriele Goennert, Department of Port and River Engineering, Dalmannstr. 1-3, 20 457 Hamburg, GERMANY: E-mail: Gabigoennert@aol.com

Papers may be submitted by regular or elctronic mail. For additional details please contact the Guest Editors directly. Manuscripts may be submitted preferably before 31 December 2001.

CMOS-ACCREDITED CONSULTANTS / EXPERTS-CONSEILS ACCRÉDITÉS de la SCMO

CANADIAN METEOROLOGICAL AND OCEANOGRAPHIC SOCIETY
LA SOCIÉTÉ CANADIENNE DE MÉTÉOROLOGIE ET D'OCÉANOGRAPHIE
112-150 Louis Pasteur, Ottawa, ON K1N 6N5
Tel - Tél: (613) 562-5616 Fax - Téléc: (613) 562-5615
E-mail - Courriel: cap@physics.uottawa.ca
Web: www.meds-sdmm.dfo-mpo.gc.ca/cmos/

MEMBERSHIP APPLICATION / RENEWAL FORM
DEMANDE D'ADHÉSION / RENOUVELLEMENT

☐ NEW APPLICATION / NOUVELLE DEMANDE ☐ RENEWAL / RENOUVELLEMENT

Name/Nom:

TITLE / TITRE ☐ DR. / DR. ☐ MR. / M. ☐ MS / MME ☐ OTHER / AUTRE

MAILING ADDRESS / ADRESSE POSTALE ☐ RESIDENCE / RÉSIDENCE ☐ BUSINESS / BUREAU

POSTAL CODE / CODE POSTAL

TEL (B) FAX (B)

TEL (R) FAX (R)

E-MAIL - COURIEL

HOMEPAGE - PAGE D'ACCUEIL

LANGUAGE PREFERENCE / LANGUE PRÉFÉRÉE ☐ ENGLISH ☐ FRANÇAIS

OPTIONAL / FACULTATIF ☐ MALE / MASC. ☐ FEMALE / FÉMININ D.O.B. / D.D.N. (Y-A - M-M - D-J)

AREA OF WORK / SECTEUR D'EMPLOI ☐ INDUSTRY / INDUSTRIE ☐ GOVT / GOUV. ☐ UNIV. / UNIV. ☐ RES. INST. / INST. RES. ☐ OTHER / AUTRE

MAIN INTEREST / INTÉRÊT PRINCIPAL ☐ METEOROLOGY / MÉTÉOROLOGIE ☐ OCEANOGRAPHY / OCÉANOGRAPHIE

SPECIAL INTEREST / INTÉRÊTS SPÉCIAUX

☐ HYDROLOGY / HYDROLOGIE
☐ FISHERIES OCEANOGRAPHY / OCÉANOGRAPHIE DES PÊCHES
☐ AGRICULTURE & FOREST / AGRICULTURE ET FORÊT
☐ MESOSCALE METEOROLOGY / MÉTÉOROLOGIE DE L'ÉCHELLE MÉSO
☐ FLOATING ICE / GLACES FLOTTANTES
☐ GLOBAL CHANGE / CHANGEMENT GLOBAL
☐ OPERATIONAL METEOROLOGY / MÉTÉOROLOGIE D'EXPLOITATION
☐ OTHER / AUTRE

LOCAL CENTRE or CHAPTER / CENTRE ou SECTION LOCALE ☐ INSERT CODE / INSÉRER LE CODE

VIS	VANCOUVER ISLAND CENTRE	MTL	CENTRE DE MONTRÉAL
BCM	B.C. MAINLAND CENTRE	QUE	CENTRE DE QUÉBEC
KEL	KELOWNA CHAPTER	RIM	CENTRE DE RIMOUSKI
ALT	ALBERTA CENTRE	HFX	HALIFAX CENTRE
SSK	SASKATCHEWAN CENTRE	NFD	NEWFOUNDLAND CENTRE
WIN	WINNIPEG CENTRE	NBK	NEWBRUNSWICK CHAPTER
TOR	TORONTO CENTRE	INT	INTERNATIONAL & USA
OTT	OTTAWA CENTRE		

☐ DO NOT PUBLISH MY NAME IN DIRECTORY / NE PAS PUBLIER MON NOM DANS LE RÉPERTOIRE

☐ DO NOT CIRCULATE MY NAME OUTSIDE CMOS / NE PAS FOURNIER MON NOM À D'AUTRES ORGANISMES

FOR OFFICE USE ONLY - À L'USAGE DU SECRÉTARIAT

MEMBER SINCE / MEMBRE DUPUIS

MEMBERSHIP EXPIRES / ADHÉSION SE TERMINE

*	√	MEMBERSHIP FEES - FRAIS D'ADHESION	RATE / TARIF	REMITTANCE / REMISE
		REGULAR - RÉGULIER	45.00	
		STUDENT - ÉTUDIANT *	20.00	
		CORPORATE - CORPORATION * (FIRMS - CORPORATIONS, INSTITUTIONS)	225.00	
		SUSTAINING - DE SOUTIEN * (INDIVIDUALS ONLY - PARTICULIERS)	170.00	
		RETIRED - RETRAITÉ	30.00	
		* INCLUDES ALL PUBLICATIONS - DONNE DROIT À TOUTES PUBLICATIONS		
*	√	MEMBER'S PUBLICATIONS FEES / FRAIS DES PUBLICATIONS - MEMBRES		
		ATMOSPHERE - OCEAN	35.00	
		CMOS BULLETIN SCMO (INCL.)	GRATIS	
		PROGRAM & ABSTRACTS (ON REQUEST) / PROGRAMME ET RÉSUMÉS (SUR DEMANDE)	GRATIS	
		SUB TOTAL - SOUS TOTAL		
*	√	VOLUNTARY CONTRIBUTIONS * / CONTRIBUTION VOLONTAIRES *		
		CMOS SCHOLARSHIPS (UNDERGRADUATE AND GRADUATE - BOURSES SCMO (PREMIER ET DEUXIEME CYCLE)		
		DEVELOPMENT FUND - FONDS DE DÉVELOPPEMENT		
		* TAX DEDUCTIBLE - DONNE DROIT À DÉGRÈVEMENTS D'IMPÔT		

TOTAL NOTE: GST & HST EXEMPT - EXEMPT DE TPS ET TVH $

I WISH TO PAY BY: / JE DÉSIRE PAYER PAR: ☐ CHEQUE / CHÈQUE ☐ MONEY ORDER / MANDAT

OR / OU CHARGE MY / CARTE ☐ MASTERCARD ☐ VISA

CARD N° / NO DE CARTE

EXPIRY DATE - DATE EXP.

X SIGNATURE

If this is a student application please provide the name and signature of one of your professors. For records only; please indicate the institution and year studies will be completed and degree anticipated.

Si vous désirez devenir membre étudiant, S.V.P. obtenir le nom et la signature d'un de vos professeurs. Pour nos dossiers seulement; S.V.P. indiquez le nom de votre institution, l'année où vous finirez vos études et le diplôme attendu.

PROFESSOR'S NAME - NOM D'UN PROFESSEUR X SIGNATURE

YEAR - ANNÉE INSTITUTION

☐ BSc ☐ MSc ☐ PhD

X SIGNATURE OF APPLICANT - SIGNATURE DU DEMANDEUR DATE

CMOS-SCMO
Suite 112, McDonald Building
University of Ottawa
150 Louis-Pasteur Ave.
Ottawa, Ontario
K1N 6N5

Canadian Publications Product
Sales Agreement
0869228

Envois de publications canadiennes
Numéro de convention # 0869228

Please send address changes to the above address. / Prière d'envoyer les changements d'adresse à l'adresse ci-haut.

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

36e congrès annuel / 36th Annual Congress

L'environnement nordique / The Northern Environment

Rimouski, Québec, Canada

22 - 25 mai 2002
May 22 - 25, 2002

Information

Président Comité d'organisation: Gilles Simard (gilles.simard@ec.gc.ca)
Président Comité scientifique: François Saucier (saucierf@dfo-mpo.gc.ca
Responsable des exposants: Jean-Louis Chaumel (jean-louis_chaumel@uqar.qc.ca