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CMOS

BULLETIN

SCMO

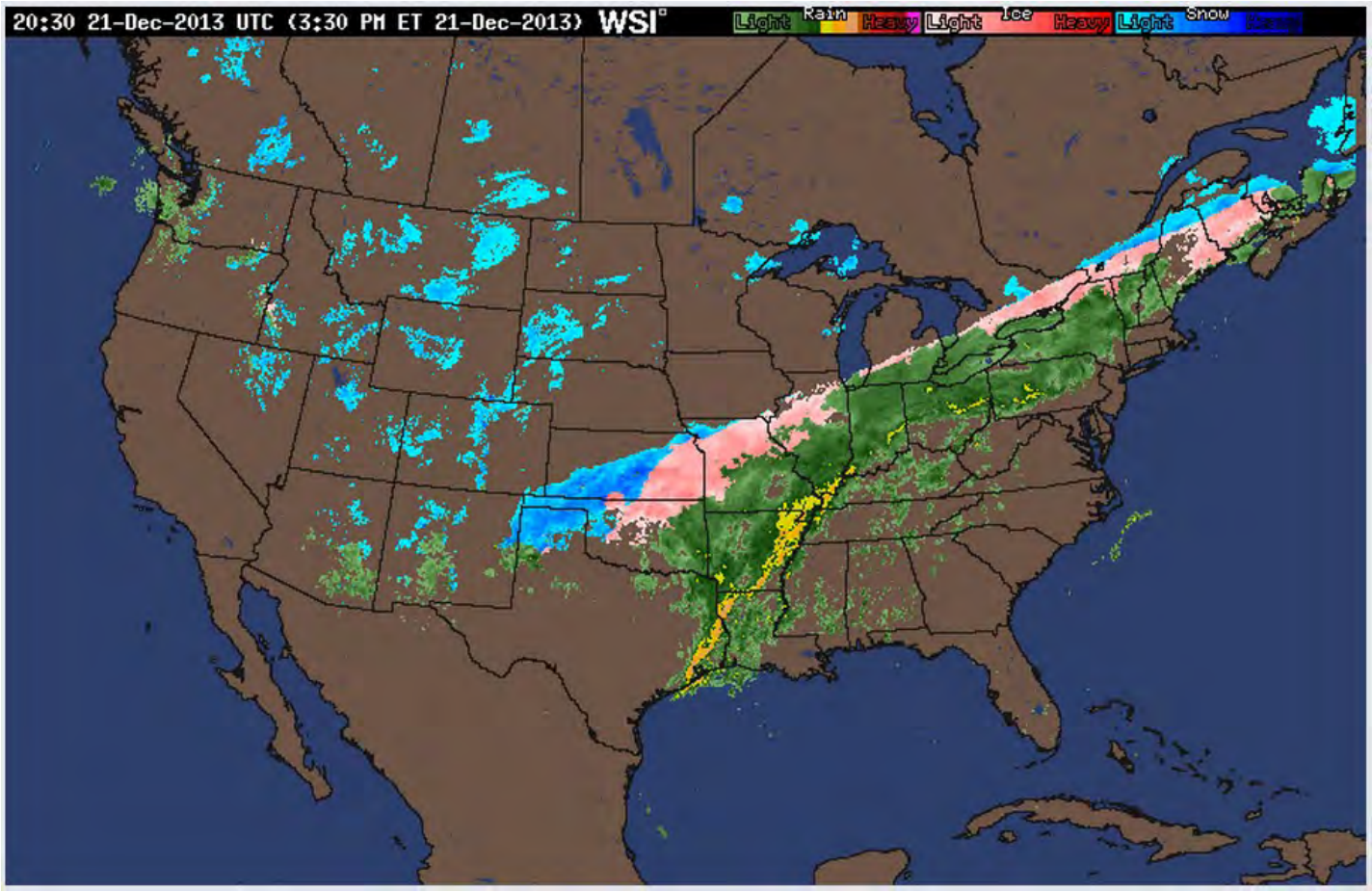
Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

February / février 2014

Vol.42 No.1

Continental composite radar view of the Eastern Ice Storm (December 21, 2013)



Vue radar composite de la tempête de glace continentale de l'est (21 décembre 2013)

ASL Environmental Sciences

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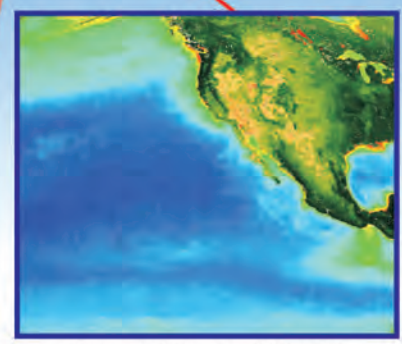
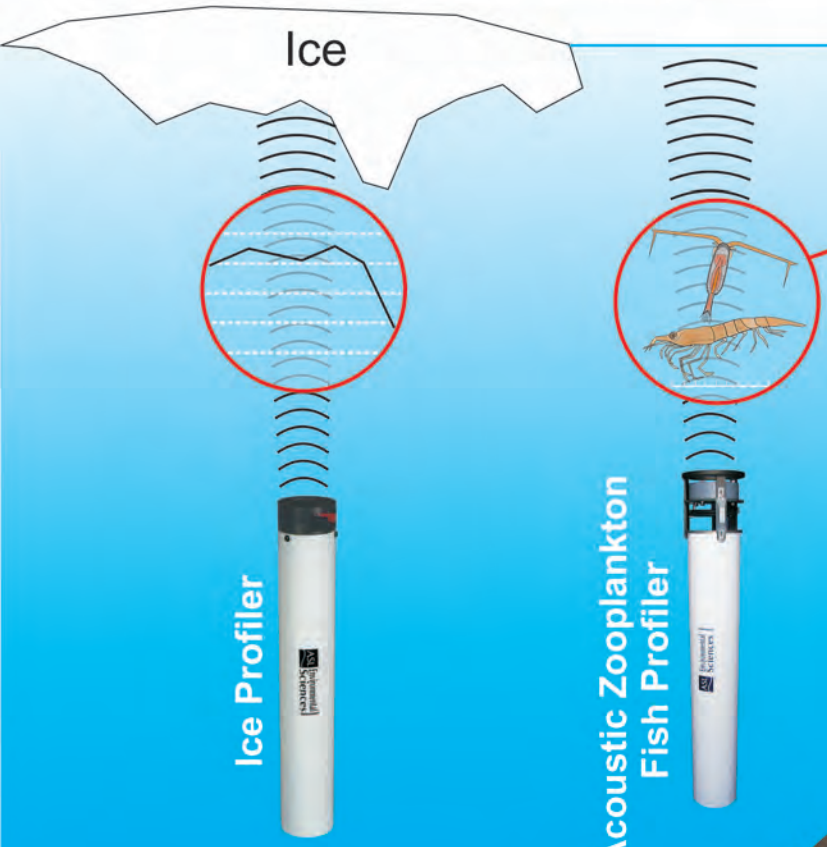
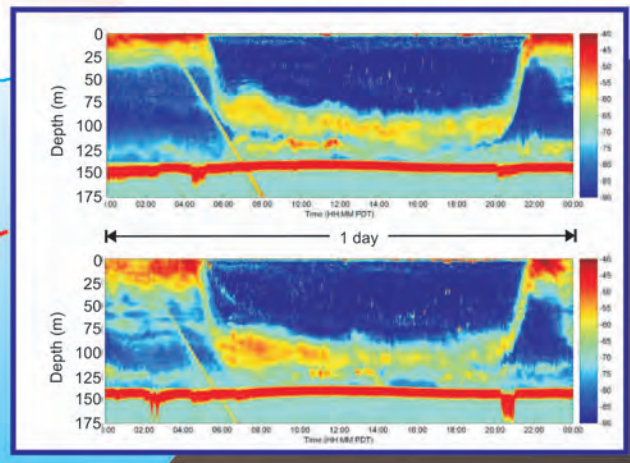


Ocean colours are chlorophyll concentrations and land colours are NDVI





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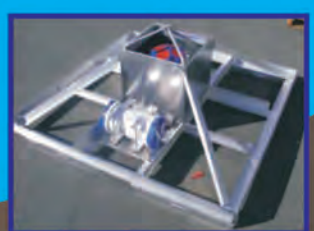

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.... Allocution du président

Chers amis et collègues:

Pierre Gauthier
Président de la SCMO
CMOS President

[English version follows on page 3]

C'est le début d'une nouvelle année et je nous souhaite une Bonne et Heureuse Année. À ce temps-ci de l'année, la SCMO s'active à préparer son Congrès annuel de 2014 à Rimouski du 1er au 5 juin 2014. Le comité organisateur et le comité du programme scientifique travaille très fort pour en faire un événement intéressant qui nous réunira encore une fois. L'appel à contributions est lancé à la parution de cette colonne et j'ai hâte de voir les nombreux articles soumis qui témoignent de la vitalité de notre communauté. Lors des congrès précédents, nous avons observé un déclin de la participation des professionnels gouvernementaux. La SCMO a écrit à la ministre de l'Environnement, l'Honorable Leona Aglukkaq, pour exprimer notre inquiétude. Dans une lettre envoyée au mois d'octobre, elle nous a répondu avoir pris bonne note du problème et pris des mesures pour que les autorisations à participer aux congrès de la SCMO soient envoyées au personnel d'Environnement Canada beaucoup plus tôt pour que les organisateurs du congrès n'aient pas à faire face aux annulations de dernière minute. Je lui ai répondu pour la remercier et du même souffle, l'inviter à dire quelques mots lors de la cérémonie d'ouverture du congrès. J'ai également envoyé une invitation similaire à l'Honorable Gail Shea, ministre de Pêches et Océans. J'en ai profité pour l'informer de la faible participation des professionnels de son ministère aux congrès de la SCMO. La participation du Ministère des pêches et océans (MPO) devrait être importante cette année puisque cette année, le thème du congrès porte sur l'océanographie en incluant les défis reliés à l'exploitation des ressources naturelles dans les eaux froides canadiennes.

[Suite à la page 3]

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

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

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Articles

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

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Cover page: Shown on the cover page is a continental composite radar view of the Eastern Ice Storm of last December 21, 2013. Every type of precipitation is represented: thunderstorms or heavy rain including some tornadoes (yellow); rain (green); ice pellets and freezing rain (pink); and snow (blue). Other meteorologists, who have been taught that in the atmosphere "everything is curved" have said this is the best example of straight line action they have ever seen. For more information, please read Bob Jones' article on **page 9**. Photo credit : Intellicast.

Page couverture: Illustrée sur la page couverture est la vue radar composite de la tempête de glace continentale de l'est du 21 décembre dernier. Tous les types de précipitations sont représentés: orages ou pluie forte incluant les tornades (en jaune); pluie (en vert); granules de glace et pluie verglaçante (en rose); et neige (en bleu). Les météorologues qui ont appris que tout dans l'atmosphère est courbé ont dit que cet événement est le meilleur exemple jamais observé d'une action rectiligne. Pour plus d'information, prière de lire l'article de Bob Jones en **page 9**. Photo courtoisie de : Intellicast.

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

Executive / Exécutif

.... Allocution du président [Suite de la page 1]

Il est important pour la SCMO de mieux connaître les attentes de ses membres. Nous avons donc l'intention dans les prochains moins de sonder nos membres pour avoir votre avis concernant vos attentes de la SCMO. L'exécutif a pris quelques initiatives qui, nous croyons, répondent à vos attentes. Ceci inclut un nouveau site Web où vous pourrez trouver de l'information pertinente que nous nous attendons à trouver sur un tel site (e.g., nouvelles, annonces pour différentes réunions et conférences, affichages de postes ouverts, forums). Si nous avons une meilleure connaissance de vos attentes, nous serons en mesure de faire de notre mieux pour y répondre. Et ainsi, on espère que ceci attirera plus d'intérêt pour la SCMO et, conséquemment, de nouveaux membres. À cet égard, notre vice-président, le Dr. Harinder Ahluwalia, a lancé une initiative visant à contacter nos membres présents et passés pour les inviter à renouveler leur carte de membre. Il le fait avec le Comité d'adhésion qui inclut des représentants des centres régionaux de la SCMO. On cherchera également à recruter des membres corporatifs potentiels. Plusieurs secteurs d'activités dépendent d'informations fiables concernant la météorologie, l'océanographie et le climat. Leurs intérêts sont donc bien servis par la SCMO qui a pour mission d'encourager une recherche rigoureuse et une formation solide dans ces domaines. Ces arguments pourraient les convaincre de supporter la SCMO.

Dans le numéro d'octobre du *CMOS Bulletin SCMO*, j'ai traité des problèmes reliés au financement de la recherche en sciences atmosphériques et océaniques. Plusieurs dépendent maintenant du Programme de Frontières de la Découverte (FD) pour financer leur recherche. Or, il y a cinq ans, les règles ont changé pour le programme FD ce qui a conduit à des subventions de recherche plus importantes, mais également moins nombreuses étant donné que le montant total est demeuré sensiblement le même. Auparavant, si votre renouvellement était refusé, il était très difficile de revenir mais, maintenant, il est possible de le perdre une année mais l'obtenir l'année suivante. Comme environ 45% des applications sont refusées, les comités du CRSNG doivent traiter beaucoup plus des demandes qu'auparavant puisque ceux ayant été refusés l'année précédente en soumettent une nouvelle l'année suivante et qu'ils peuvent le refaire quelques fois avant de voir leur demande accordée. Le Comité Géosciences comprenait 12 personnes auparavant, était de 22 personnes en 2013 et comprend 29 pour 2013. Ceci est rendu nécessaire pour traiter un plus gros volume de demandes en plus d'avoir à couvrir tous les sujets reliés à ce comité. La tâche pour chacun des membres est colossale au point d'avoir un impact sur la qualité du processus d'évaluation.

Je ne suis pas convaincu que plus de fonds à moins de chercheurs soit la meilleure politique de gestion de la recherche. Plusieurs peuvent faire beaucoup avec un financement modeste mais les priver de ce minimum vital peut faire péricliter leur carrière. Lors de la prochaine revue de programme du CRSNG, il serait opportun d'être prêt à présenter à ce moment un rapport pour exprimer nos inquiétudes et recommandations. Comme d'autres sociétés partagent ce point de vue, ceci pourrait être fait conjointement via le forum Canadian Societies for the Geophysical Sciences (CSGS).

Pierre Gauthier, Président de la SCMO

[La version française précède en page 1]

.... Words from the President

Friends and colleagues:

This is the beginning of a new year and I wish us all a Happy New Year. At this time of year, CMOS is getting busy to prepare for its 2014 annual Congress in Rimouski, June 1-5, 2014. The local organizing committee and the scientific program committee are working very hard to make this an exciting event which will bring us all together. The call for papers should be out when this column appears and I look forward to see your contributions which show how vibrant our community is. In previous congresses, we have seen a decrease in the participation from government professionals. CMOS sent a letter to the Minister of Environment, the Hon. Leona Aglukkaq in which we expressed our concern about this. Last October, she replied that she acknowledged this and acted to have the travel authorizations given to EC people in a timely manner so that we do not have to cope with a large number of last minute cancellations. I expressed our appreciation and at the same time invited her to say a few words at the opening ceremony of the congress. I sent also a similar invitation to the Hon. Gail Shea, Minister of the Department of Fisheries and Oceans. I took the opportunity to make her aware of the low participation from DFO employees at congresses. Participation from DFO should be significant this year since this congress will give a lot of attention to oceanography including the challenges associated with the natural resources exploitation in the cold Canadian waters.

It is important for CMOS to know more about the expectations from its members. We intend in the next few months to poll our members to get your input about your expectations from CMOS. The executive has taken some initiatives which we think are expected from you. This includes a new website where you will be able to find relevant information expected in such websites (e.g., news, announcements for meetings, postings of job opportunities, forums). If we have a better knowledge of your expectations, we can do our best to meet them. This in turn we hope will bring more interest for CMOS and attract new members. In that regard, our vice-president, Dr. Harinder Ahluwalia, is leading an initiative to approach current and

past members to renew their membership. He does that in conjunction with the membership committee that includes representatives from all regional centres. Potential corporate memberships will be sought as well. Several sectors depend on reliable information regarding meteorology, oceanography, and climate. Their interests are therefore well served by CMOS who fosters rigorous research and solid training in these areas. Those arguments could convince them to support CMOS.

In the October issue of the Bulletin, I discussed the issue of funding of research in atmospheric and oceanic sciences. Many now rely on the NSERC Discovery Grant (DG) program to support their research. Five years ago, the rules for the DG program were changed which resulted in more significant amounts being granted to fewer proposals being accepted given that the budget was more or less the same. Before, when you were not renewed, it was very difficult to get back in but now you can more easily lose it one year and get it the year after. At the moment, about 45% of the applicants are turned down. The net result is that the NSERC committees now have to process a lot more applications than they used to since many reapply the year after and can do it a couple of times before they get it again. The geoscience committee comprised 12 people before, was 22 in 2012 and goes up to 29 this year because they require the breadth of expertise necessary to cover all topics associated with this committee on top of having more applications to deal with. Even then the task for each member is colossal to the point of impairing the quality of the review process.

I am not convinced that more funds to fewer is the best policy. Many with little money can do a lot but depriving them from that minimum is the way to a declining career. When NSERC will undergo a program review process, we should be prepared to present a report to express our concerns and recommendations. This could be done jointly through the CSGS (Canadian Societies for Geophysical Sciences).

Pierre Gauthier, President of CMOS

Letter to the Editor / Lettre au rédacteur

From: Geoff Holland
Date: January 1, 2014
Subject: Ocean Science in Canada

The December *CMOS Bulletin SCMO* reported on the Review of Ocean Science in Canada (Vol.41, No.6, page 197), a review that I had read myself some weeks before and which had raised some questions based on my own experience and which prompted a letter from myself to the editors of the review. I have been retired from the government ranks of ocean science for fourteen years and have been relatively inactive in the field for the last few but as with most of us retirees, still retain my own views and opinions. I thought that the review covered the academic field comprehensively, and I felt some comfort in the depth and good academic standing of our scientists as generally expressed in the text. However, I confessed some surprise in the overall optimism of the report as regards the future, which seemed to me to neglect the leadership role of government, which seems to me to be weakening. I must admit that my viewpoint is coloured by my own experience in Ottawa, where the last half of my service saw a continual degradation of national guidance in ocean science and ocean science affairs. 1986 was the last time we had an ADM responsible for ocean science, in 1996 we lost the top position of Director General and, I understand that presently the Ottawa presence has virtually disappeared.

I was never regarded myself as a bureaucrat, believing my function in Ottawa was to preserve the science and technology in our laboratories. However ocean science is so complex and expensive that we do need a government that is committed to the demands of ocean research, ocean services, and the social and economic policies that they address. Universities cannot be expected to bear the cost of continuous data collection, the maintenance of national infrastructure services, and the necessary commitment to global cooperation. For this we need champions at both the ministerial level and the commitment of our senior civil service managers. It seems a regrettable fact that Canadian ocean scientists and their achievements are better known in the global community than they are in our own political venue. Ocean science responsibilities span the majority of federal departments. About twenty years ago, an attempt was made to coordinate the ocean policies and programs of government through a Deputy Minister level Interdepartmental Committee on Oceans (ICO). It was never given any attention and was soon abandoned. The probable reason for its failure was a lack of priority and status in the governmental agenda.

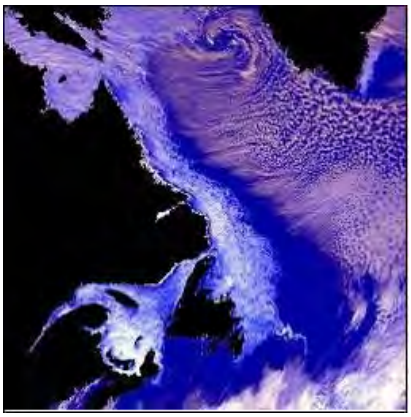
I am passionate about the oceans and in awe of the size of our ocean exposure and the length of our coastline. They present a huge challenge and hold an equally huge promise. Our scientists need recognition, coordination, and adequate support from our government.

ARTICLES

Ventilation, Interactions, and Transports Across the Labrador Sea (VITALS)

by Paul G. Myers[1]

The Labrador Sea and surrounding shelves are critical for the ecological, economic, and societal health of North America and Europe. Canada has a national investment in offshore fisheries and transportation within this basin, and a growing presence as resource exploration and exploitation moves northward and farther offshore. Eastern Canada's weather and climate are also strongly influenced by the Labrador Sea. The Labrador Sea is important strategically as the Canadian gateway to the Arctic. It is therefore critical that Canada, as the only G8 nation that borders this important basin, has a strong voice on the world stage about events occurring in this basin. Canada also has a long tradition of scientific firsts in this globally important region in climate studies, including the earliest recognition of the variability of Labrador Sea Water formation, and the first process-oriented and tracer studies of deep convection and ocean acidification. Scientific studies, as well as intensive programs (such as the Labrador Sea Convection Experiment) have been carried out intermittently in the basin by Canadian, German, U.S., and U.K. groups, among others. On top of this is the long-term monitoring program of Fisheries and Oceans Canada (DFO), which has components both on (Atlantic Zonal Monitoring Program) and off the shelf (Atlantic Zonal Offshore Monitoring Program).



Labrador Sea

As well, the Labrador Sea is one of the few oceanic regions where the deep ocean exchanges gases such as oxygen and carbon dioxide (CO_2) directly with the atmosphere. This gas exchange, driven by wintertime deep convection, is the ocean's "*deep breathing*" and the Labrador Sea can be viewed as a "*lung*" in the Earth System. Localized deep convection releases large amounts of heat to the atmosphere and the resulting Labrador Sea Water contributes to the global ocean thermohaline circulation that redistributes heat from low latitudes to the poles. Deep water formation in the Labrador Sea is one of several tipping points in the Earth's climate system. Convection also drives a large flux of oxygen and anthropogenic CO_2 into the North Atlantic, oxygenating subsurface layers and slowing the accumulation of CO_2 in the atmosphere, but exacerbating ocean acidification along Canada's sensitive eastern continental margin. The combined action of convection and horizontal circulation redistributes nutrients and contaminants (e.g. from future deepwater oil production along the deep Labrador slope) potentially affecting ocean productivity and marine ecosystem health. These globally significant processes of direct importance to Canada are regionally localized, temporally variable, and sensitive to the effects of ongoing climate changes.

Gas uptake and redistribution processes (*"breathing and circulation*") are expected to respond to and feedback on climate change, as the high latitude warming surrounding the Labrador Sea increases stratification. Stratification changes may come from direct surface warming as well as the enhanced freshwater input from the melting of snow, multi-year sea ice, and glaciers in Greenland and Canada. In either case, enhanced stratification will likely lead to a decline in deep water oxygen and anthropogenic CO_2 sequestration. With the accelerating rate of warming in the high North, multiple sources of freshwater now converge on the Labrador Sea, with the potential to disrupt deep convection, meridional ocean heat transport, climate, and ocean biogeochemistry at regional and global scales. A present concern, which still requires evaluation, is that a slowdown in deep water formation will cut off the source of oxygen and "*suffocate*" the deep ocean, and reduce a critical sink of anthropogenic CO_2. Thus, it is essential that "*breathing and circulation*" processes be represented properly in coupled ocean-ice-atmosphere climate models. Currents bringing low-oxygen and high biological CO_2 water from the Arctic and subtropics are analogous to the "*veins*" of the system. Regional mixing and biogeochemical processes within the Labrador Sea transform the source waters within the basin. Advective-diffusive export pathways ("*arteries*") connect the oxygenated and transformed water masses to the Atlantic Ocean interior.

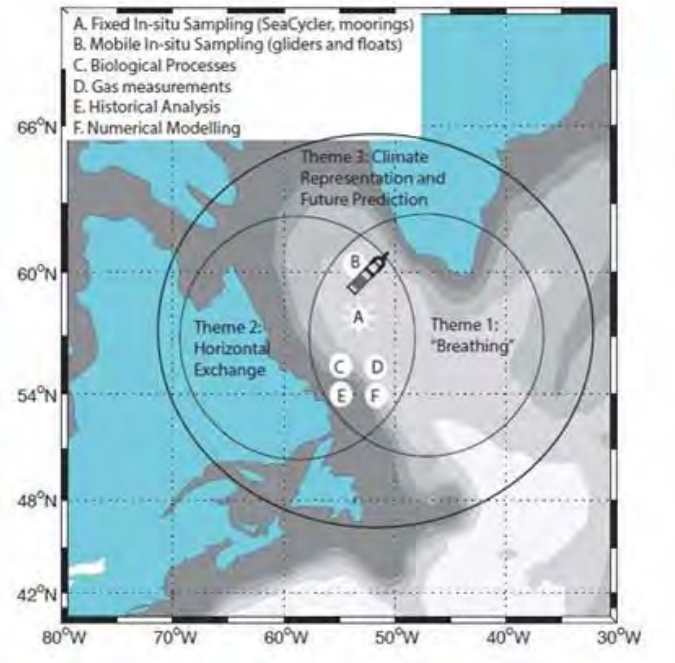
Given these issues, the Ventilation, Interactions and Transports Across the Labrador Sea, or VITALS, project, a recently funded NSERC Climate Change and Atmospheric Research (CCAR) project will spend the next five years addressing these questions. VITALs is a pan-Canadian initiative involving scientists from 11 Canadian universities as well as multiple federal government laboratories

[1] Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton. Alberta

(Fisheries and Oceans Canada, as well as Environment Canada), industrial and foreign partners.

Its main research goal is to understand and model the functioning and vulnerability of the Labrador Sea as a key component of the earth's climate system including its uptake of oxygen, anthropogenic carbon, and exchange of heat with the atmosphere. It will measure oxygen, carbon dioxide, and other climate-relevant gases over several seasonal cycles, characterize their temporal and spatial variability in the Labrador Sea, and determine the factors controlling their uptake, storage, and circulation. It will parameterize the fluxes in terms of the forcing factors so that models have the appropriate physics and flexibility to simulate their evolution in a changing climate. It will tie the understanding developed to models of global climate change through the study of one of the few areas in the world, and the only one near Canada, that directly links three important reservoirs within the carbon cycle - the atmosphere, the upper ocean, and the deep ocean. Within this high-profile internationally-linked study we will highlight the strengths of the Canadian marine technology industry, by showcasing the latest advanced developments of several Canadian companies in our field program. The working hypothesis is that deep convection in the Labrador Sea, which allows for exchange of oxygen and natural and anthropogenic carbon to the deep ocean, is sensitive to the warming that is taking place at high latitudes. Validating and quantifying this sensitivity is central to the research network and also the broader community of climate change researchers and policy makers interested in characterizing, and possibly minimizing, the effects of global climate change.

The VITALS strategy revolves around three specific research themes that will be addressed by six implementation teams. These three themes are tightly linked. The central core of VITALS is the Breathing Theme that focuses on the key question of how physical, chemical, and biological processes control gas exchange between the deep ocean and the atmosphere. The Labrador Sea does not function as an isolated basin with quasi-vertical exchanges; instead, processes occurring in the central basin are sensitive to horizontal exchanges and dynamics at small scales, including those operating within the basin, as well as at the boundaries. Consideration of all aspects of the horizontal exchange and associated scales is beyond VITALS in scope. However, it will leverage our work through collaboration with other international programs like OSNAP in the United States, and our Horizontal Exchange Theme will address the key lateral processes influencing the water column in the central basin. Finally, the Climate Representation and Future Evolution Theme will integrate the observational work with the use of numerical models. A significant component of the work that will be carried out within this theme is the use of the models to place the present day in a context that can be compared with the past, as well as examine questions related to future evolution and climate predictability.



The implementation teams will apply different sets of instrumentation and approaches that are appropriate for studying the Labrador Sea and its functionality with respect to the "*breathing*" process and its climatic vulnerability. Given the need to measure key physical and biogeochemical processes over the full annual cycle within the Labrador Sea, our observational program will be centered around a Fixed in-situ Sampling Team that will deploy a central mooring array incorporating innovative Canadian technology including the SeaCycler (see next page for explanation on SeaCycler). To provide spatial structure for our measurements, as well as address questions of horizontal exchange, a Mobile in-situ Sampling Team will carry out innovative experiments using robotic gliders and floats. Given the key role that biological and biogeochemical processes have in controlling the "*breathing*" process, a Biological Processes Team will characterize these processes and address questions about their climate sensitivity. Our investigation also requires accurate measurements of the gases involved in the "*breathing process*"; therefore, we will also include a Gases Team to provide accurate and innovative measurements of this key aspect of our program. To help place the present measurements in context and take advantage of the extensive data collected via DFO's monitoring programs, a Historical Analysis Team will use the existing observational databases and annually- to decadally-resolved geological archives to document the natural variability of carbon fluxes and ocean water properties on interannual to centennial time scales. Finally, to ensure that our modern and historical observations are understood at a mechanistic level and fully exploited to improve climate representation

and future evolution, we will carry out extensive numerical simulations with both physical and biogeochemical models in our Numerical Modelling Team.

SCRIPPS INSTITUTION OF OCEANOGRAPHY

SeaCycler

Investigators: U.Send, G.Fowler, R.Pinkel, E.Slater, D.Checkley, C.Waldmann, J.Karstensen

SeaCycler
Graphics by Sunke Schmidt

We are participating in an international collaboration to develop a submerged winching system, which would be built into an oceanographic mooring and winch a sensor package up and down through the upper water column from beneath. The entire structure would be under water, only the sensor package can ascend to the surface if wanted. The benefits of this approach are:

• Profiling capability: one sensor can measure in many different depths as the sensor package ascends or descends. This is particularly valuable for expensive sensors, and for scientific questions that relate to an extended water column rather than fixed depths.

• Reduce wear and tear on the mooring by avoiding the surface wave field with the main mooring structure.

• Allows data telemetry when the sensor package reaches the surface.

• Flexibility to adapt ascent-descent cycles and measurement locations to conditions.

The technical challenges are, amongst others:

• to withstand water motion, pressure, and corrosion during long-term deployments.
• to provide enough power for long-term deployments.
• to be small enough to handle on a ship, yet big enough to have sufficient spooling length and force.

The SeaCycler is developed and built at the Bedford Institute of Oceanography in Canada. Open-ocean tests are ongoing since 2010.

VITALS Research Teams

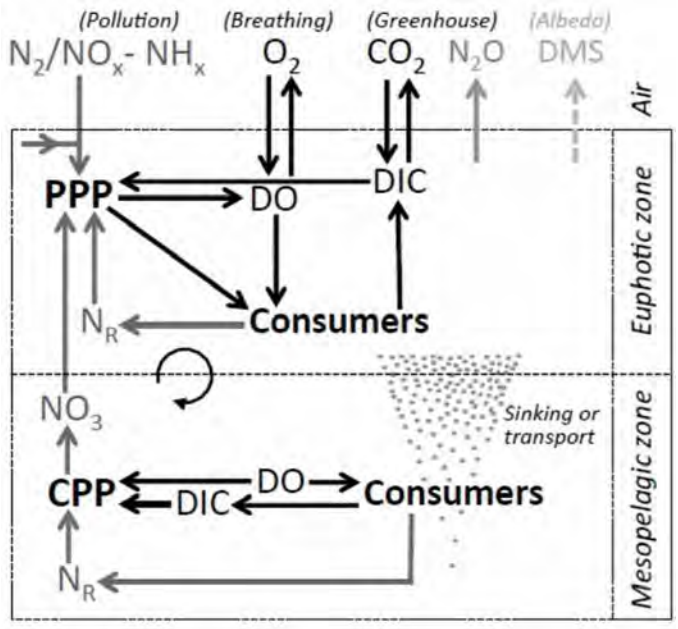
1) Fixed Sampling Team

- **Team Leader**: Doug Wallace, Oceanography Department, Dalhousie University
- **Investigators**:
  - Brad de Young, Memorial University
  - Roberta Hamme, University of Victoria
  - Jody Klymak, University of Victoria
  - Barry Ruddick, Dalhousie University
- **Collaborators**:
  - Uwe Send, Scipps Institute of Oceanography
  - Igor Yashayaev, Bedford Institute of Oceanography
  - Arne Kortzinger, GEOMAR
  - Johannes Karstensen, GEOMAR
  - Daniela Turk, Dalhousie University
  - Martin Visbeck, GEOMAR

2) Mobile Sampling Team

- **Team Leader**: Brad de Young, Physics and Physical Oceanography Department , Memorial University
- **Investigators**:
  - Jody Klymak, University of Victoria
  - Jaime Palter, McGill University
  - Barry Ruddick, Dalhousie University
  - Doug Wallace, Dalhousie University
  - Ralf Bachmayer, Memorial University
  - Kumiko Azetsu-Scott, Dalhousie University
  - Claude Hillaire-Marcel, UQAM
  - Evan Edinger, Memorial University
- **Collaborators**:
  - Erica Head, Bedford Institute of Oceanography
  - Igor Yashayaev, Bedford Institute of Oceanography

3) Biological Processes Team



- **Team Leader**: Jean-Eric Tremblay, Biology Department, Laval University

- **Investigators**:
  - Roxanne Maranger, University of Montreal
  - Marcel Babin, Laval University
  - Simon Belanger, UQAR
  - Kumiko Azetsu-Scott, Dalhousie University
- **Collaborators**:
  - Nicolas Cassar, Duke University
  - Julie Granger, University of Connecticut
  - Maurice Levasseur, Laval University
  - Connie Lovejoy, Laval University
  - Bill Li, Bedford Institute of Oceanography
  - Erica Head, Bedford Institute of Oceanography
  - Igor Yashayaev, Bedford Institute of Oceanography
  - Jeff Anning, Bedford Institute of Oceanography

4) Gases Team

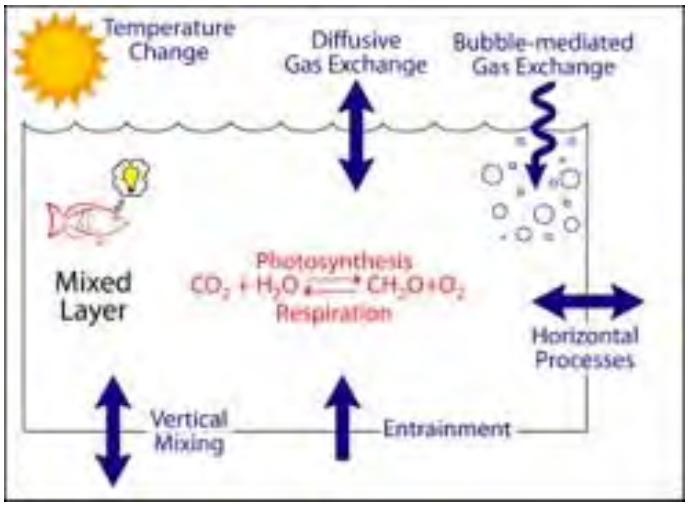


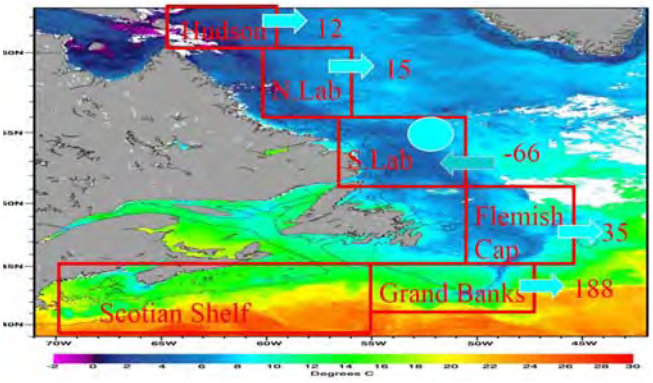
Diagram courtesy of Roberta Hamme, University of Victoria

- **Team Leader**: Roberta Hamme, School of Earth and Ocean Sciences, University of Victoria
- **Investigators**:
  - Doug Wallace, Dalhousie University
  - Kumiko Azetsu-Scott, Dalhousie University
  - Roxanne Maranger, University of Montreal
- **Collaborators:**
  - Denis Gilbert, Maurice-Lamontagne Institute

5) Historical Analysis Team

- **Team Leader**: Jaime Palter, Atmospheric and Oceanic Sciences, McGill University
- **Investigators**:
  - Paul Myers, University of Alberta
  - Markus Keinast, Dalhousie University
  - Barry Ruddick, Dalhousie University
  - Jean-Eric Tremblay, Laval University
  - Anne de Vernal, UQAM
  - Claude Hillaire-Marcel, UQAM
  - Evan Edinger, Memorial University
  - Roger Francois, University of British Columbia
- **Collaborators**:
  - Igor Yashayaev, Bedford Institute of Oceanography

6) Numerical Modelling Team

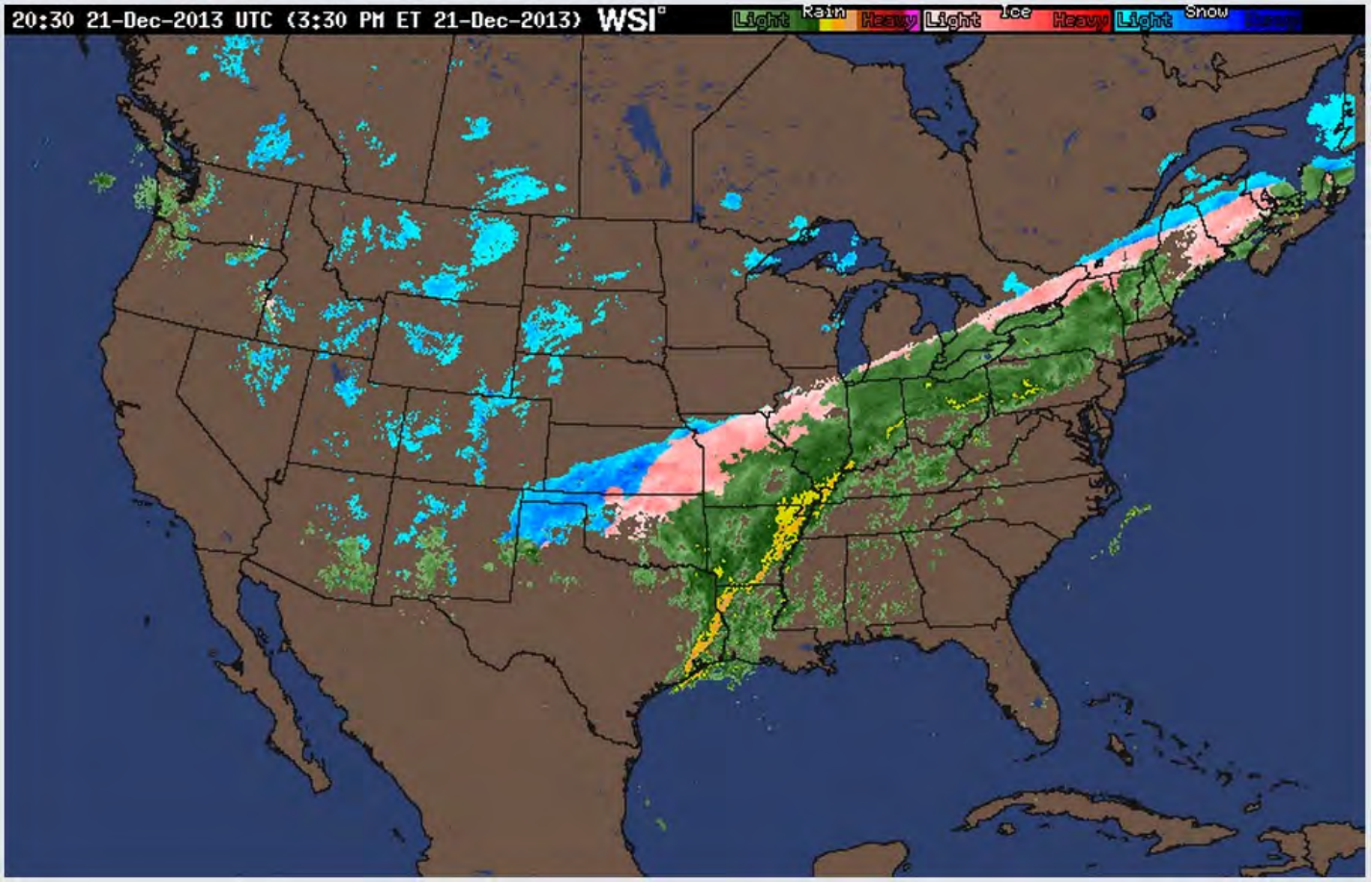


- **Team Leader**: Paul Myers, Earth and Atmospheric Sciences, University of Alberta
- **Investigators**:
  - Entcho Demirov, Memorial University
  - Brad de Young, Memorial University
  - Morris Flynn, University of Alberta
  - Eric Galbraith, McGill University
  - Jaime Palter, McGill University
  - Andrea Scott, University of Waterloo
  - Bruce Sutherland, University of Alberta
- **Collaborators**:
  - Fraser Davidson, Fisheries and Oceans Canada
  - Youyu Lu, Bedford Institute of Oceanography
  - Greg Smith, Environment Canada

Note: First publication in the Canadian Ocean Science Newsletter, # 73, November 2013. Reproduced here with permission of the author, Paul G. Myers.

Unusual Radar Signature from Christmas Eastern Ice Storm

by Bob Jones[1]



Continental composite radar view of the Eastern Ice Storm on December 21, 2013. Photo credit: Intellicast.

On December 21, 2013, Bob Jones captured a continental composite radar view of the Eastern Ice Storm.

This was about the time it was starting to hit the Toronto area. What is interesting about this image is the extent of the almost perfect linear signature of the edge of various precipitation types. Every type is represented: thunderstorms or heavy rain including some tornadoes (yellow); rain (green); ice pellets and freezing rain (pink); and snow (blue). Other meteorologists, who have been taught that in the atmosphere "everything is curved" have said this is the best example of straight line action they have ever seen.

Comparisons are already being made with the 1998 Great Eastern Ice Storm, but there are differences:

● The jet stream this time was extremely strong and zonal from about New Mexico out to the Maritimes. No curvature at all. Other than rapid northeasterly motion of the front as it slid past Toronto, the only other movement of the whole system was very gradually to the south east, but this did not save Southern Ontario from a very serious ice event. The warm side of this was much warmer than in 1998 with near 20 degree temperatures not far to the south. The cold side was colder too, ranging from minus 3 or 4 degrees in the freezing rain to much colder only a few kilometres northwest of the precipitation line.

[1] Retired meteorologist / CMOS Webmaster

● Even with the gradual southeastward movement of the frontal edge, the system still lasted about two days because of its extreme length. Ottawa escaped this ice, like Toronto did in 1998 - instead they got 40 cm of snow and ice pellets in two dumps, little ice accretion and no power outages. The 1998 storm lasted five or six days and, as I recall, some sort of upper air blocking was in place.

● Total accumulations of ice were: in the two-day Toronto Storm, 20 to 30 mm; in the six-day 1998 Eastern Ice Storm, from 70 to 100 mm - enough in some places to bring down major high voltage hydro transmission towers. Both storms caused major power losses to residences where overhead wires were snapped by falling tree branches. The damage may have been worse in Toronto because their warmer climate fosters the growth of larger versions of typical eastern North American trees.

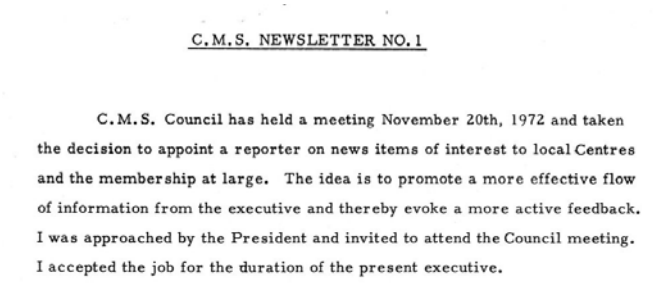
● The last difference from 1998 is that, since the temperature contrasts then were less, the post-storm temperatures hovered around the freezing point for several days enabling gradual removal of the ice which had adhered. This time there followed a strong cold surge in the East which was more serious, complicating removal of the ice and survival of folks in cold houses.

I am sure later re-analyses of this situation will bring out other points and comparisons, but this summary may provide a starting point.

40+ Anniversary: Survey of the *CMOS Bulletin SCMO* Early Years

by Paul-André Bolduc[2]

It all started in November 1972 when the C.M.S. Council appointed a reporter on news items of interest to local Centres and the membership at large. The first Editor (reporter) of the *Newsletter* was R.A. Treidl from Downsview, Ontario. It was a 5-page document announcing, for example, the 7th C.M.S. Annual Congress at Dalhousie University, Halifax, NS, and discussing the activities of the Standing Committee on Scientific and Professional Matters. As a matter of curiosity, the Editor was announcing the new postal code system which is now familiar to all of us. Covered by a light cardboard, it was mailed to some 550 C.M.S members across the country. The *CMOS Bulletin SCMO* was born under the name "*C.M.S. Newsletter*"! G.A. McKay was at that time the President of C.M.S.



C.M.S. NEWSLETTER NO. 1

C.M.S. Council has held a meeting November 20th, 1972 and taken the decision to appoint a reporter on news items of interest to local Centres and the membership at large. The idea is to promote a more effective flow of information from the executive and thereby evoke a more active feedback. I was approached by the President and invited to attend the Council meeting. I accepted the job for the duration of the present executive.

Copy of the first paragraph of the first issue of C.M.S *Newsletter* published by R.A. Treidl in November 1972.

W.S. Creswick took over as Editor with the September 1973 issue after the Halifax Congress. His first issue reported on Stanstead Seminars held at Bishop's University. Jacques Derome was the organizer of these well-attended seminars. Bill Creswick retired as Editor after approximately five years on the job. The first employment opportunity ad appeared in the December 1973 issue with a private company based in Willowdale, Ontario. The October 1974 issue reported on the well-known GARP experiment in which the Canadian ship QUADRA played a major role particularly with meteorological observations. Geoff Austin and Gordon McBean were among scientists who worked on that ship, travelling between Panama and Dakar. Worth mentioning, the first French text was published in the February 1975 issue, requesting scientific contributions for the next congress to be held at UBC, Vancouver. The same issue carried an ad from Public Service Canada for a position as a Meteorologist Scientist with the Forest Fire Research Institute, DOE, in Ottawa, at a salary of up to $27,280. The third issue in 1975 reported on Canada going metric with A.E.S. being selected by the federal government as the lead agency for metric conversion. Issue number 3, 1976, carried the reproduction of photographs for the first time, showing winners of a science fair in Brandon, Manitoba, and two memorable moments of the 10th C.M.S. Congress held in Québec City.

[2] *CMOS Bulletin SCMO* Editor

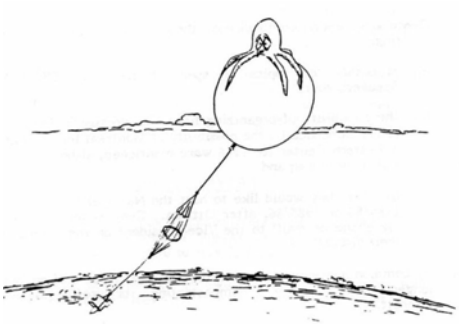
Issue number 4, 1976, reported the inclusion of oceanographers within C.M.S. for the first time with a statement from President John Hay. There was an extensive list of changes to the By-laws for adding "oceanography" as being a science recognized by the Society and including oceanographers as full-pledged members. One of the first applicants was Dr. Neil.J. Campbell in October of that year. The subsequent issue carried a couple of letters from members discussing this major change within the Society. The discussion was whether or not to include oceanographers within the Society, but rather was of what would be the name of the new entity. In October 1977, the new Editor, Mert Horita, published the first *Newsletter* with the new CMOS banner and it became a bi-monthly publication. Of course, in this 11-page document, the President was requesting more funding for the new publication *Atmosphere-Ocean* to more effectively meet the publishing needs of two scientific communities. A larger budget was also requested for the *Newsletter* itself, telephone and telegraph! The same issue covered substantive reports from local Centres across the country. An obvious sign that oceanography was then part of the Society is the announcement of the International Symposium on Long Waves in the Ocean, organized by the Department of Fisheries and Oceans in Ottawa. As of February 1978, oceanographers formed about 15% of the total CMOSmembership. Vol.6, No.4, published in August 1978, included, for the first time, a book review written by Paul H. LeBlond on *"Earth, Water, Wind and Sun: Our Energy Alternatives*". Vol.7, No.2, 1979, an interesting article was writen by the same Paul LeBlond on the first reported tsunami in the Americas, in which he quoted Christopher Columbus.

In June 1979, Avard S. Mann, from Edmonton, Alberta, became the new Editor of the CMOS *Newsletter*. With Mann on the job, the *Newsletter* became more elaborate with the publication of short articles,one of which was by Morley Thomas on "*Origins of the Canadian Meteorological and Oceanographic Society*". The article was published in two consecutive issues of the *Newsletter*. Someone had artistic talent as cartoons were drawn regularly to highlight text. With the August issue, the first page of the *Newsletter* was published in a two-column format. The first scientific curve was printed in February 1980, Vol.8, No.1, and it represented the "*Tuktoyaktuk Mean Daily Air Temperature in 1979*". The article was titled "*1979 Beaufort Sea Environmental Forecast Operations*" with Bill Hart and of the Arctic Weather Centre staff in Edmonton as authors. Page 22 of the same issue carried a questionnaire on *Chinook* Magazine asking members if they wished to have it as part of their membership package. Of interest, although there are always been a regular message from the President, the July 1980 issue carried a letter from both incoming and outgoing Presidents. Also interesting is the fact that the same issue carried a long report on the Code of Ethics for Professional members. The October issue of the same year discussed sharing of offices with CAP (Canadian Association of Physicists), while Ed Lozowski was preparing the ground for the creation of a new logo, the snowflake being outdated as an appropriate symbol of the Society. Interesting enough, the following pages described the oceanography program at Université du Québec à Rimouski, the atmospheric science program at UBC, and the oceanography program at the Royal Roads Military College in Victoria. This showed that the Canadian universities had close links with the Society at that time. And for a mean nine dollars ($9), you could receive a one-year subscription to the *Chinook* Magazine. The close links with universities became apparent as the April 1981 issue listed both MSc and Ph.D. graduate theses which were completed in 1980 from eight different Canadian institutions. For the first time, a black and white photograph of the newly elected President, Professor Edward Lozowski, was published in the July 1981 issue. In addition, six different designs of the new CMOS logo were presented on page 13, while the December 1981 issue saw the first obituary notice, that of Dr. Louis M. Lauzier, a famous oceanographer and a recognized authority in Atlantic region. The 16th CMOS Annual Congress (1982) was held at the University of Ottawa and the April issue showed street maps of downtown Ottawa near the campus. It is worth mentioning that the *Newsletter* was a mature publication as a full 36-page document. This was the last issue produced by Avard Mann.

Marine Meteorologist!

The July 1982 publication,with Dave Mudry as its new editor, carried a photograph of a new President, now our Director of Publications, Dr. Richard Asselin, with full head of hair and long beard! And to top it all, two Associate Editors were part of the Editorial Board, Rick Lee and Paul-André Bolduc. With Dave Mudry on board, the *Newsletter* adopted the two-column format throughout and cartoons continued to play a large role as illustrated by the two cartoons shown on this and the next page on a marine meteorologist and remote sensing. We were to learn in the subsequent issue that they were the product of Dr. Ford Burgwell from the Alberta Research Council and that they were visual reproductions of posters shown at the last CMOS Congress held in Ottawa. The October issue advertised for the first time the Centennial of the Canadian Hydrographic Conference that was to be held in Ottawa. Page 12 of that issue carried an ad showing the advertising rates for *Atmosphere-Ocean* and *CMOS Newsletter*. Worth mentioning is that with Richard Asselin as President, the

Words from the President were published in both languages. CMOS *Newsletter* was then 10-years old!



Remote Sensing!

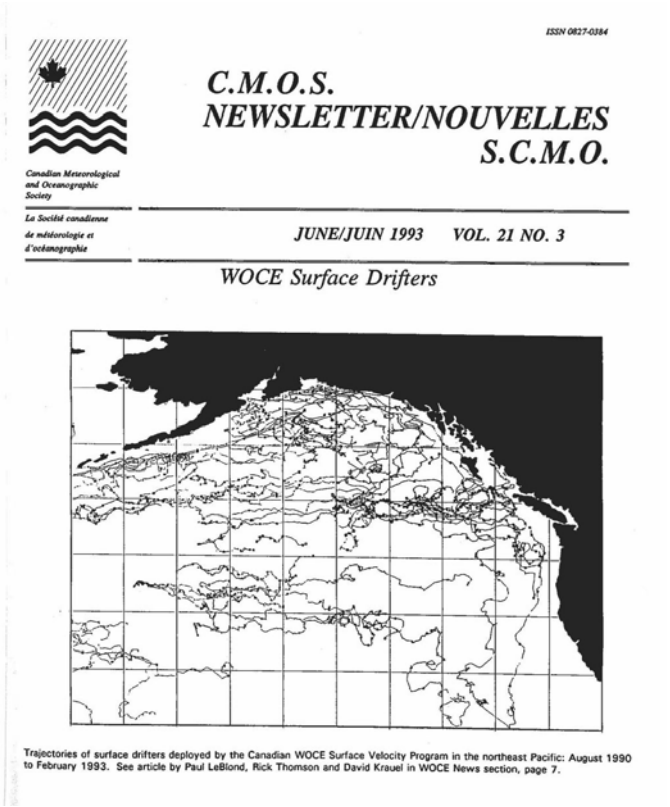
The February 1983 issue reported on the appointment of Uri Schwarz as Executive Director of the Society. After a requirement identified by President Asselin, an ad had been published in the previous issue and Uri volunteered very quickly, having just completed 25 years of faithful service with the Secretariat of the International Civil Organization (ICAO). The same issue showed a speech delivered by the President on the retirement of Morley K. Thomas. Morley was the star of this issue with an announcement by Environment Canada of the Morley K. Thomas Long-Service Award giving recognition to volunteer observers with many years of service (30 years) to Canada. The June issue published after the Congress held in Banff reported on two interesting points: 1) the suggested (iceberg) logo was defeated and a motion to hold a ballot with numerous candidate logos; and 2) a new Special Interest Group on Sea Ice was formed with Joe Eley of Gulf Canada as acting Chairman. The same issue included a request to send photos showing Canadian Weather, the precursor of our current Annual Photo Contest which is now running its seventh contest. It is most likely during that time that Environment Canada (Weather Services Division) started to include probability percentages in the rainfall forecast with values ranging between 0 and 100% with a 10% increment. Most importantly, pages 6 and 7 showed suggestions of a new logo asking readers to submit their choices. The actual logo later selected was a modified version of suggestion # 5. The October issue presented a short biography of Dr. René Ramseier, the new CMOS President, who had been selected to be the Tour Speaker with a presentation on *"Passive Microwave Remote Sensing of Sea Ice from Research to Operations*". There were also changes to the Editorial staff changes with Rick Lee leaving Ottawa for Gander and being replaced by Micheline Gilbert, a full-time Editor with DFO. With the departure of Dave Mudry (exact time unknown), the editorship was carried for a short while by Paul-André Bolduc with the assistance of Micheline. This October 1983 issue reported on two prestigious prizes: Dr. Reuben Lasker receiving the A.G. Huntsman Award for excellence in marine sciences and Dr. George Boer receiving a merit award from Jim Bruce (then ADM, AES) for developing a "state of the art" climate modelling system. The December issue reported on the meeting of a small group of oceanographers (Rick Thomson, Sus Tabata, Neil Campbell, and Paul LeBlond) at the Banff Congress to discuss the possibility of instituting a medal to honour major contributors to Canadian oceanography. After this informal meeting, the Tully Medal became part of the prizes and awards given each year by the Society. Oceanography became more and more part of the Society with SCOR (Scientific Committee on Oceanic Research) reporting lengthy on its activities.

The June 1984 issue (Vol.12 No.3) announced the nomination of Dr. Neil Campbell as President of the Society. Dr. Campbell was the first oceanographer to become President. The October issue announced the first recipient of the Tully Medal, Dr. John Patrick Tully, *"the Father of West Coast Oceanography*". The same issue carried a short note reporting on a new oceanographic product available from MEDS (Marine Environmental Data Service) regarding mean sea level for the Pacific. The August 1985 issue, after the successful congress held in Montreal, presented the new *Newsletter Editor*, C. Fraser MacNeil, from Bedford, Nova Scotia. Interestingly, according to the February 1986 issue, the Tully Medal was presented to the Canadian Hydrographic and Oceanographic Ship of the same name of the Medal. This ship was based at the Institute of Ocean Sciences and the medal was presented by Dr. C.R. Mann, then Director General of this institute. The logo was once again a hot topic for discussion as it was thought that the adopted logo lacked Canadian identity. The Executive proposal included a red maple leaf on the left top corner of the CMOS logo, which is the existing logo. Surprisingly, the publication of the entire CMOS membership appeared in the August issue, and this in itself would be considered a breach to the current CMOS privacy policy. In 1986, Special Interest Groups were popular as the December issue published a list of six groups (Agricultural and Forest Meteorology, Air Pollution Meteorology, Floating Ice, Hydrology and Operational Meteorology). The same issue reported that, after two years of development, applications for accredited consultant certification in meteorology and oceanography may be received by CMOS. The February 1987 issue was completely devoted to the promotion of the CMOS congress to be held in St. John's, Newfoundland and Labrador. The Operational Meteorology Special Interest Group was very active as it carried a special section in the *Newsletter* (OMNI). This section was included in every issue for some time after this premiere. A visit to England by Executive Director Uri Schwarz included a discussion with the Royal Meteorological Society (RMS), during which time a long list of RMS field courses was generated and published in the June issue. It also reported that Canada was the first nation to ratify the Vienna Convention for the Protection of the Ozone Layer. The August 1987 issue published the first list (13 consultants) of Accredited Consultants. The second list (five consultants) was published in the December issue which also included the CMOS Constitutions and By-Laws for approval at the Annual General Meeting to be held in June 1988 at the "*Severe Weather and its Impact*" Congress. Following the success of the Accredited Consultants program, CMOS

announced the Accreditation of Media Weather Broadcasters in the February 1988 issue. "*The Changing Atmosphere: Implications for Global Security*" conference was first announced in this issue. This major conference with the participation of many government officials (e.g., Canadian Prime Minister Brian Mulroney) was a real success and reported in two recent issues of the *CMOS Bulletin SCMO* (Vol.36, No. 5, pages 159-161 and Vol.41, No.5, pages 162-164). Accredited Consultants' ads were first published in the subsequent issue (June 1988) when Malcolm Still took over the editorship of the *Newsletter*.

The April 1989 issue presented two projects, one in oceanography (The Greenland Sea Project) and one in meteorology (The Limestone Mountain Experiment: LIMEX). The Greenland project was developed and coordinated under the auspices of the Arctic Ocean Science Board and was co-sponsored by ICES (International Council for the Exploration of the Seas). It was carried out by national surveys , which resulted in new data sets covering time scales from seasonal to multi-year events. Allyn Clarke (CMOS President, 2003) from the Bedford Institute of Oceanography was involved in this major oceanographic project. The LIMEX experiment was carried out by Geoff Strong (CMOS President, 2006) and was to study mesoscale processes by analysing basic upper air thermodynamic and wind data. The project was carried out by the Alberta Research Council Hail Project over the foothills regions of southwestern Alberta. The same issue reported on an ongoing recruitment problem for CMOS with Morley Thomas' plea to *"Join the Society"* . The June 1989 issue announced that a CMOS pin was available at a cost of five dollars. The October issue outlined an ongoing problem for the Society: communication with all of its members. The Executive Director (Uri Schwarz) decided to address this problem. The same issue reported on a commitment by CMOS to promote awareness of science in young Canadians by awarding a prize to two young Canadians from North Bay for their project on the total vertical column sampler. Dr. Keith Thompson represented CMOS during the 28th Annual Canada-Wide Science Fair held by the Youth Science Foundation at Memorial University, Newfoundland. The December 1989 issue (Vol.17, No.6) reported on hard decisions taken by the Annual General Assembly to discontinue the Climatological Bulletin and Chinook Magazine. The CMOS *Newsletter* was to be remodelled and a publication manager was to be appointed to oversee this major reorganization.

In 1990, the Executive took steps to implement the decisions taken at the last congress regarding the new structure of CMOS publications. The April 1990 edition included a report written by Paul LeBlond on a major international programme called WOCE (World Ocean Circulation Experiment) and on WOCE in Canada. This was a three-page report on two columns. Meteorology was not left behind with a substantive report on CMOS Mesoscale Sub-Committee. The August issue reported again on the Canada-Wide Science Fair held at the University of Windsor. Interestingly, the prize was presented by Dr. Peter Taylor (CMOS President, 2000) to Mark Alexander for "*Blowing in the Wind*", a computer simulation of a variety of smoke stack emissions. In the same issue, we can read on the sesquicentennial celebration (150th anniversary) of the establishment of the first Canadian operational weather observing station on the grounds of King's College, now the University of Toronto. The October issue reported on the inaugural meeting of a Fisheries Oceanography SIG (Special Interest Group) at Royal Roads Military College, Victoria, with Tim Parsons and Austin Oake as co-chairs. A Mesoscale Meteorology SIG was also established with Ron Stewart on the fire line. The December issue presented "WOCE News", a one-page report on its many activities including a numerical workshop at IOS (Institute of Ocean Sciences), Sidney, with a contribution by W.W. Hsieh. A WOCE Secretariat was also established at UBC, University of British Columbia). On the same page we can read that McGill University approved the formation of the Centre for Climate and Global Change Research (C^2GPR) chaired by Dr. Lawrence Mysak.


ISSN 0827-0384

C.M.O.S.
NEWSLETTER/NOUVELLES
S.C.M.O.

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

JUNE/JUIN 1993 VOL. 21 NO. 3

WOCE Surface Drifters

Trajectories of surface drifters deployed by the Canadian WOCE Surface Velocity Program in the northeast Pacific: August 1990 to February 1993. See article by Paul LeBlond, Rick Thomson and David Krauel in WOCE News section, page 7.

Sample copy of the Cover Page of the *C.M.O.S. Newsletter/Nouvelles S.C.M.O.*

WOCE continued to be in the news in the February 1991 issue with reports by Paul LeBlond, Allyn Clarke, William H. Hsieh, and John Lazier. The same issue also reported that three Canadians (Steve Calvert from UBC, Ken Denman from IOS and Trevor Platt from Bedford Institute of

Oceanography) were members of the committee to undertake a decade-long research program into ocean biogeochemical cycles to provide the basic knowledge required for understanding the ocean's role in the global carbon cycle and climate change. This committee was part of the Joint Global Ocean Flux Study and was organized by SCOR (Scientific Committee on Oceanic Research). The April issue continued with more reports on WOCE by Dan Wright, Dan Kelley, Dave Brickman, Barry Ruddick, Neil Oakey, Richard Greatbatch, William Hsieh, Greg Holloway, Patrick F. Cummins, Michael Eby, and Charles Lin. Based on a comment written by the Executive Director (Uri Schwarz) membres were quite pleased with the new contents of the CMOS *Newsletter*. The June 1991 issue proudly presented four CMOS members elected Fellows of the Royal Society of Canada (Ann E. Gargett (IOS), Peta Mudie (Atlantic Geosciences Centre), Tim Oke (UBC), and Doug Whelpdale (AES). The new Editor, Howard Freeland, Institute of Ocean Sciences, announced a new regular column to appear in the *Newsletter* under the signature of Savonius Rotor. WOCE news was again well covered with reports by Greatbatch, LeBlond, and Stucchi. This issue also indicated that Rube Hornstein had been named to the Order of Canada. On pages 6 and 7 of that same issue, one can read the preface in English and French of the R.W. Stewart issue of *Atmosphere-Ocean* (29.(2)). This preface, under the signature of Blyth Hughes from the Symposium Organising Committee in honour of Dr. Stewart, related the exceptional career of Dr. Stewart who was the first Director General of the Institute of Ocean Sciences (IOS). The *Newsletter* continued to publish technical (semi-scientific) reports: 1) The *July 17, 1990, Ottawa Microburst Event Results of a Field Survey* with two photos of uprooted maple trees by Gilles Fournier and Marc Beauchemin, two meteorologists with Transport Canada; 2) *Annual CNC-WOCE Meeting* report and *Where are they Now?* Both reports by Paul LeBlond; 3) *A Global Coordinate Rotation Utility* by Michael Eby; and, 4) *WOCE in the News* by Howard Freeland. The October issue presented again the results of the Canada-Wide Science Fair where the prize was awarded to two students from North Bay. Lawrence Mysak reported on C^2GCR news while Ambury Stuart presented a long essay "*On Canadian Small Business in the Atmospheric Sciences*". WOCE continued to be an integral part of the *Newsletter* with four short articles by Paul LeBlond (twice), Rick Thomson (twice), Dave Brickman, and Dan Kelley. After presenting a full picture of the Council Members meeting at Royal Roads Military College, the December issue announced the Physical Oceanography and Atmospheric Science Program at Dalhousie University. WOCE News featured contributions by Ross Hendry, Warren Lee and William Hsieh.

Savonius Rotor continued to write weird stories but the February 1992 issue contained a special cartoon on "potential vorticity" which is reproduced on this page. The Physical Oceanography Program at Memorial University was presented and the Royal Roads Military College, which received a university charter in 1975, also presented their program. The *ODEN* 91 Expedition to the Arctic Ocean was described naming three Canadian scientists on board the ship. This particular issue reported on the death of Henry Melson Stommel and William L. Ford. Climate Research and WOCE News filled a major portion of this issue with reports by Ross Brown, Ross Hendry' (reprint), Patrick Cummins, Howard Freeland, Josef Cherniawsky, Greg Holloway, and Ron Wilson. WOCE role at the birth of PICES (Short name for North Pacific Marine Science Organization) was reinforced. The durability of Canadian WOCE Drifters was estimated by the Canadian WOCE Surface Velocity Program Team (David Krauel, Bill Large, Paul LeBlond, Rick Thomson, and Gordon Swaters) and the problem of coupling ocean models with the atmosphere was discussed by JPOD (Joint Program in Ocean Dynamics) with contribution of Kelly Choo, Michael Eby and Greg Halloway.

WHAT'S GOING AROUND?
by Savonius Rotor

Judging by the posters on the walls of various offices I have visited recently there can be little doubt that the above cartoon is going around right now.

If we think that the effect of greenhouse gases is a contemporary problem, we are wrong. Savonius Rotor presented a short note claiming that a paper was presented at a meeting of the Royal Swedish Academy of Sciences (the paper was subsequently translated) in December 1895 under the title *"On the influence of carbonic acid in the air upon temperature of the ground*". The author, Professor Arrhenius, estimated that, if CO_2 particulates were doubled in the atmosphere, the mean temperature of the atmosphere might rise by 5°C with a larger effect on polar regions! Climate Research News, WOCE News, JGOFS News continued to be important parts of the *Newsletter* with a major article on the ERS-1 Calibration-Validation Experiment but the highlight of this April 1992 issue was a statement on Atmospheric Change prepared by CMOS.

The second Toronto Magnetic and Meteorological Observatory. The Meteorological Service of Canada, founded in 1871, was administered from this observatory until 1909. This scene was reproduced from "*The Beginnings of Canadian Meteorology*" by Morley Thomas, Toronto: ECW Press, 1991. Source: *CMOS Newsletter/Nouvelles* Cover Page, June 1992 issue.

It must be pointed out here that, since the April 1992 issue, the Editor, Howard Freeland, made sure to present each issue with a very appealing and attractive cover page. It would included a picture relating to our work (oceanography or meteorology) with a legend explaining the reason for which the picture was chosen (see sample copy on page 13). The June issue presented a picture of the birthplace in Toronto of the Meteorological Service of Canada in 1871. The picture (shown above) was taken from a book written by Morley Thomas on "*The Beginnings of Canadian Meteorology*" with a review of the same book written by James Bruce. A water spout off Southern Vancouver Island was illustrated in the August issue while a hand-drawn picture of the Topex/Poseidon satellite filled the cover page of the October issue. This issue carried a long and exhaustive list of Canadian disasters with an analysis written by Robert Jones, our present Webmaster. During the 1990s, the cover page of each December issue inevitably carried the picture of members at CMOS Executive meetings across Canada, the picture having been shot by Executive Director, Uri Schwarz. The year 1992 concluded with more reports on WOCE, JGOFS, and Climate Research News. With the production of many such reports repeatedly from one issue to the next, the life of the Editor was pretty easy! Those were the prolific years of the *Newsletter* as it fulfilled its mandate by reporting on the many activities of CMOS Members. At 20-years old, it was a mature publication.

1993 was going to be the last year of the CMOS *Newsletter*. It carried the usual material of previous years: WOCE and JGOFS News, Climate Change and Climate Research News, Arctic Climate System Study (ACSYS) and GEWEX to name a few. The August issue carried a ballot asking members their opinion on the amalgamation of *Climatological Bulletin* and *Newsletter*. Since members were actually in favour of this major change, the *CMOS Bulletin SCMO* was created, an enhanced publication with the mandate to include articles on meteorological and oceanographic applications as well as on climatology. The last Editor of the *Newsletter*, Howard Freeland, became the first Editor of the *CMOS Bulletin SCMO*.

The transition to the *CMOS Bulletin SCMO* in 1994 (Vol.22, No.1[3], February 1994) arrived like dynamite.The very first issue carried the current banner and reported that Uri Schwarz became Emeritus Executive Director, that Dr. Neil Campbell was appointed as the new Executive Director, that Dorothy Neale had joined the Society as Executive Secretary, and that Gordon McBean, CMOS President, was nominated Assistant Deputy Minister of Atmospheric Environment Service. The rest is modern history.

References: *C.M.S. Newsletter* and *C.M.O.S. Newsletter/Nouvelles SCMO*, Vol.1 - Vol. 21, + *CMOS Bulletin SCMO,* Vol.22-1.

Acknowledgement: The author wishes to acknowledge the support of Richard Asselin to complete this survey. His valuable assistance and suggestions throughout the process are also recognized.

[3] It was decided that the first issue of the *CMOS Bulletin SCMO* would continue the numbering sequence established by the *Newsletter* despite the name change.

Canada's Top Ten Weather Stories for 2013

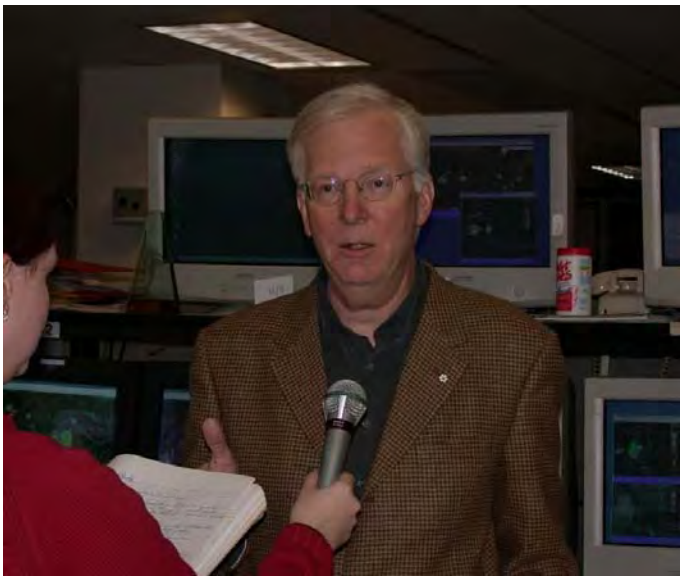
by David Phillips[1]

2013- A Year in Review

Floods were the big newsmakers in Canada in 2013. In some cases it was fast and furious rains that were to blame; in others it was a mix of rainfall and snowmelt. Add an urban landscape with little capacity to absorb the aftermath and you have all the key ingredients for an ominous overflow. The biggest flood hit in June when torrential downpours overwhelmed Calgary and vast areas of southern Alberta forcing 100,000 Albertans from their homes and causing billions of dollars in damages. Three weeks later, large parts of Toronto's core were flooded by one of the heaviest one-day rainfalls in the city's history. Canadians were wowed by images of the immediate and powerful forces of nature on our streets and in our backyards. According to the Insurance Bureau of Canada, those two events constitute the first and third largest natural insured catastrophes in Canadian history. Worth noting is nature's apparent interest in Calgary. This year's flooding made it the fourth year in a row that violent weather struck the city hard. Last year, as it was in 2010, a monstrous hailer inflicted multi-million dollar property losses. In 2011, powerful Chinook winds ripped through the downtown at hurricane-force speeds, causing millions more in damages.

Other flood stories included torrential April showers and a sudden snowmelt in central Ontario's cottage country that engorged rivers and raised water to historic flood levels not seen in 100 years. In June it was swollen rivers that burst their banks in Fort McMurray forcing hundreds to evacuate. Perhaps the most surprising story among them was the actual lack of flooding experienced in the eastern Prairies. The region was facing predictions of yet another major flood in 2013, which would be its third in five years, but what experts considered a "sure" flood became an also-ran when a cold spring eased snowmelt and kept water flows manageable.

"Rebound" was a descriptor for two of this year's top weather stories. In the eastern Arctic, the coldest summer in 15 years (among other factors) helped slow sea ice melting in the Canadian Arctic Ocean to within three per cent of the normal minimum coverage and resulted in the greatest ice extent since 2005. For the Great Lakes/St. Lawrence, it was one of the wettest years on record – more than 13 per cent wetter than normal – which helped restore water levels. A single year does not a trend make, especially considering the inherent variability of the global climate system. One weather feature that is a sure thing in Canada is a big storm and our big storms always make the news. In 2013, our biggest newsmakers included two powerful February storms: one that began as an Alberta clipper but soon turned into a powerful Atlantic nor'easter putting millions of Canadians in the East on alert; and another that led to the drowning of five young fishers from Nova Scotia and saddened us all.



David Phillips with Media

On a positive note, we were spared deadly tornadoes and severe drought in 2013. Our air was also clearer than in most years, it was a quiet year for interface wildfires and there were fewer West Nile virus-carrying mosquitoes. The hurricane season was also uneventful – quiet and gentle in the Atlantic Ocean and Caribbean Sea despite dire predictions and the emergence of Typhoon Haiyan on the other side of the world, which was one of the most intense tropical storms on Earth. For farm producers in the West, it was a bumper year for crops. And British Columbia experienced a near-perfect summer featuring the driest and sunniest July on record.

Incredible as it may seem it was another warm year in Canada - our 17th year in a row - although not as warm as it's been in recent years. Every region was warmer or near normal, especially southern British Columbia where climatologists recorded the region's fourth warmest December (2012) to November (2013) period in 66 years. On the other hand, the Prairies measured in at a mere 0.1°C warmer than normal in 2013. Not surprising since they experienced what seemed to be a never-ending

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seven-month winter. For those in the East, warm weather was also scarce with a summer that was more of a teaser than a pleaser. High temperatures made a brief appearance for one week in July and offered a brief encore in September in what was otherwise one of the shortest summers in years.

Canada's top weather stories for 2013 are ranked from one to ten based on the degree to which Canada and Canadians were impacted, the extent of the area affected, economic effects and longevity as a top news story:

Top Ten Canadian Weather Stories for 2013

1	**Alberta's Flood of Floods**
2	**Toronto's Torrent**
3	**Bumper Crops in the West, So-So for the Rest**
4	**To Flood or Not to Flood?**
5	**Rebound in the Arctic Ocean and the Great Lakes**
6	**Wicked Winter Weather Wallops the East**
7	**Spring Flooding in Ontario's Cottage Country**
8	**Prairie Winter Went on Forever**
9	**Stormy Seas and Maritime Tragedy**
10	**Sunny and Rainless in BC**

1. Alberta's Flood of Floods

Alberta's super flood of 2013 washed across one-quarter of the province and through the heart of Calgary – the fourth largest city in Canada.The disruptive flood cut off dozens of communities throughout the province and prompted the largest evacuation across Canada in more than 60 years with up to 100,000 Albertans told to leave their homes.

It was also Canada's costliest natural disaster – more expensive than eastern Canada's 1998 ice storm. Economists project damage losses and recovery costs from the flood to exceed $6 billion, including a record $2 billion in insured losses. In its wake, the flood caused unbelievable infrastructure losses from 1,000 km of destroyed roads and hundreds of washed-away bridges and culverts. Among insured losses were thousands of cars and homes demolished and damaged by backed-up sewers and small rivulets that exploded into raging torrents.

Southern Alberta is no stranger to flooding, especially in June – typically the wettest month of the year and a time when mountain snowmelt begins to appear on the Prairies. This year's super flood, which extended from Canmore to Calgary and beyond, was exacerbated by several antecedent hydrometeorological events in the headwaters of the Bow River watershed. To begin with, it began snowing in southern Alberta before Thanksgiving 2012 and didn't stop until a month after Easter. The mountain snowpack in May was immense, over one metre in places. Further, the spring was wet leaving the ground saturated and streams and rivers bloated. Calgary and some foothill weather stations had greater rainfall amounts between May 23 and 24 than those experienced during the flood a month later. At Livingstone, 96 mm of rain fell on May 25. And a brief warm-up that month started melting the nearly one-metre deep snowpack at the treeline. Weeks before, satellite imagery had revealed basin groundwater to be higher than average leaving the land with little extra capacity to take up additional water from rain and melting snow.

So it was no surprise that the water bomb that hit on June 19 wreaked havoc. The storm featured an intense and slow-moving moist upper low that parked itself over southern Alberta, delivering three days of torrential rains. What was not typical was that it stalled and sat over the mountains for days due to a massive high-pressure ridge to the north that blocked it from moving east and pinched it up against the Rocky Mountains. The stationary, wide-ranging low drew in warm air and cargoes of moisture from the Pacific Ocean, the Gulf of Mexico and beyond before drenching the Rockies watershed in southeastern British Columbia and southern Alberta. Interestingly, the same high-pressure system had earlier contributed to the devastating forest fires in Colorado and record-high temperatures in Yukon and Alaska. Beginning late on June 19, the skies opened and poured for 15 to 18 hours - a fire hose aimed directly at southwestern Alberta. The trapped low studded with thunderstorms just kept drenching the mountains, melting the snowpack but not thawing the partially frozen ground. The already saturated soil on thinly covered steep slopes couldn't take any more water.

Calgary received 68 mm over 48 hours, but the rainfall west of the city in the elevated headwaters of the Bow and Elbow rivers was exceptionally heavy and torrential – more typical of a tropical storm in quantity and intensity. Rainfall rates of 3 to 5 mm/h are considered high; rates from this storm were 10 to 20 mm/h in the higher elevations, with several stations reporting 50 to 70 per cent of their storm rainfall in the first 12 hours. Totals averaged 75 to 150 mm over two and a half days, with Burns Creek (west of High River at 1,800 m elevation) recording a phenomenal 345

mm. At Canmore, over 200 mm of rain fell – ten times that of a typical summer rainfall. Also contributing to the flood, the warm air and rain melted up to 60 cm of snowpack, which was about 25 per cent above normal for that time of year, instantly engorging streams and rivulets.

Rampaging floods and mudslides forced the closure of the Trans-Canada Highway, isolating Banff and Canmore at the epicentre of the mountain flooding. Raging creeks ate away at riverbanks and backyards, leaving behind crumbling decks and twisted fences. Trees were literally skinned of their bark 10 metres above the ground by gravel and boulders barrelling along in rushing waters. In Canmore, the swirling Cougar Creek left entire homes teetering along its widening banks and sent residents in waist-deep water scrambling to safety. Emergency crews used helicopters, boats, combines, front-end loaders and manure spreaders to rescue stranded residents. More than two dozen towns declared states of emergency. Entire communities, including High River and Bragg Creek, were under mandatory evacuation orders. The rate at which the river sped through High River, a town of nearly 13,000, was faster than that over Niagara Falls, submerging over half the town. Several First Nations communities were particularly hard hit by the floods, with many residents still not back in their homes six months later.

In Calgary's downtown, 4,000 businesses were impacted and 3,000 buildings were flooded. Water rose at the Saddledome up to the 10th row. In Stampede Park, stables and barns were under more than two metres of water. And at the partially submerged Calgary Zoo, officials moved several exotic animals to its ranch facility south of the city. The debris flood of the Bow and Elbow rivers washed away roads, rail lines and transit systems as well as several pedestrian bridges, and inundated dozens of city parks and more than 100 km of riverside pathways with water, mud, downed trees and other debris. The tragedy associated with the flooding went beyond the cost of replaceable property and belongings. Four people died after being swept away in the fast-moving waters, and the lives of thousands of Albertans and their families were changed. The sheer volume and force of raging waters caused visible and permanent changes to the landscape and beauty of southern Alberta forever, including natural carving of the landscape and river channels that would normally take centuries to evolve being destroyed in less than two days.

2. Toronto's Torrent

A summery air mass with embedded "garden-variety" thunderstorms tracked across much of southern Ontario during the afternoon and evening hours of July 8. The only thing worrying forecasters was its exceptionally high precipitable water content and slow motion. What had been an uneventful day began to change mid-afternoon when a small cluster of thunderstorms passed over Georgian Bay and continued south-southeastward. By 5:00 p.m. it was raining heavily at the centre of the storm just north of Highway 401 and at Toronto Pearson International Airport. At the same time, another weaker line of thunderstorms formed northwest of the Greater Toronto Area (GTA) and travelled southeastward toward the city's downtown. By 5:30 pm the relatively weak storm blossomed dramatically. Suddenly, Toronto faced two separate storm cells – one on the heels of the other – that slowed then stalled over the city. The one-two weather punch delivered more rain in two hours than Toronto usually sees during an entire July. Moreover, the storms were targeting the most urbanized area in Canada. Rarely before had such a drenching thunderstorm soaked a surface with more cement than grass. The following rainfall totals (mm) from in and around the GTA help to illustrate the bull's-eye target of the event on the downtown: Toronto Pearson 126.0; Toronto City 96.8; Toronto Island 85.5; Downsview 65.8; East York 51.5; Richmond Hill 19.8; Oshawa 4.8; Oakville 4.2; and Hamilton 4.2. The storm was noteworthy because of the rain's intensity, far exceeding storm sewers' capacity, which caused flooding runoff to travel along city streets to creeks and rivers. The majority of rain fell in two hours from approximately 4:20 p.m. to 6:30 p.m. Many compared the storm's rainfall to that from Hurricane Hazel in October 1954.

Exacerbating the storm's impact was the 38 mm of rain that had fallen on the city the day before. Adding to that was an abnormally wet spring and early summer – the dampest since 2000. From April 1 to July 7, Toronto Pearson got between 50 and 75 per cent more rain than normal. And talk about timing. The storm hit during afternoon rush hour leaving millions of vulnerable commuters in transit between work and home. The 126.0 mm was a new daily rainfall record at the airport (station records date from November 1937) and a record for any July date (the previous daily rainfall record for July was set on July 28, 1980 when 118.5 mm of rain fell). The previous daily record for any day at Toronto Pearson was set during Hurricane Hazel when 121.4 mm fell on October 15, 1954. The July 8 storm also set a record for 30-minute and 1, 2, 6 and 12-hour rainfall totals at Toronto Pearson, all in excess of 100-year return periods. Interestingly, the storm's daily rainfall was NOT the highest recorded value at any Environment Canada archived rain gauge within the GTA. At North York (Downsview), 140.6 mm of rain was recorded on August 19, 2005, with maximum accumulation of 175 mm (unofficial) in a Thornhill backyard. The highest historical daily rainfall outside of Toronto occurred northwest of Pearson Airport at Snelgrove where 181. 6 mm fell during Hurricane Hazel.

The Insurance Bureau of Canada estimated the July 8 storm costs at close to $1 billion in damages – the most expensive natural disaster ever in Toronto and Ontario. The storm caused major transit halts and delays, road closures, flight cancellations and flooding across Toronto and Mississauga. The epic rainfall left several roads and underpasses under water, forcing motorists to abandon

their vehicles. Videos captured cars bobbing up and down on streets and highways, sinkholes opening up and snakes swimming inside stalled commuter trains. Thousands were stranded, necessitating rescue by boat in some instances. Others abandoned their vehicles and walked thigh-high in water along roads that looked more like canals. About 500,000 households, mainly in the GTA's west end, were without power ranging from hours to days. Some 3,000 basements flooded in the rainstorm, causing major damages.

3. Bumper Crops in the West, So-So for the Rest

Farmers rarely describe the weather as perfect. And for good reason! The growing season is long and the weather can quickly turn bad any time between seeding and harvesting. In the West, the growing season wasn't perfect this year but it came pretty darn close with usually cautious food producers describing it as incredible, unbelievable, stupendous, bin-busting and the best in a lifetime. Heading eastward, the growing season was more of a rollercoaster – some crop yields were up and some were down with plenty of challenges in between.

The growing season in the West didn't start with much promise given the long, drawn-out winter and a cool, wet start to spring. While flooding was not widespread, soil was cold and saturated leaving field work three weeks behind. By late August, the season was back on track due to an absence of scorching temperatures and drought. Soil moisture was also good to excellent throughout the season. And, in sharp contrast to last year, severe weather was localized and less frequent. In fact, the Canadian Crop Hail Association reported that, compared to 2012, crop hail claims were down by one-third in Alberta and two-thirds in Saskatchewan. During the last half of July and first half of August very cool temperatures and adequate rains benefitted crops that were mostly in the reproductive growth stage.Farmers pulled off a record crop owing to ideal growing weather and perfect ripening and drying conditions. September temperatures were among the warmest in history. Further, there was no killing frost and zero snowfall at harvest, with only a touch of frost in the middle of September that caused minimal damage given that most crops had matured. By the end of September the harvest was 85 per cent complete; by Thanksgiving it was all wrapped up. Statistics Canada forecasted that western farmers harvested a record 30.5 million tonnes of wheat in 2013. In some areas, durum yields were 20 bushels above grower's historical bests. Both yield and quality were superb; prices not so much! This year's grain harvest was so large that some farmers had to pile grain on the ground because their bins were bursting and silage bags were sold out.

In British Columbia, long stretches of dry, sunny weather and warm days without scorching highs and cool nights produced some of the largest and sweetest berries on record and a fantastic vintage in the winery. In Kelowna, for example, days with afternoon temperatures below 30°C and nights above 10°C numbered 64, which is twice the ideal thermal combination seen in recent years. The only blemish was a brief hail storm on September 29 that bruised apples still on trees and stored on the ground in open bins.

In Ontario and Quebec, yields were sweet for maple syrup producers – a vast improvement over last year's abbreviated season hurt by record March warmth. Ontario apple producers were equally thrilled as they rebounded dramatically from a horrible growing season in 2012 when frost and severe weather wiped out about 80 per cent of the crop and pushed some growers out of business. But farmers in southwestern Ontario were on a bit of a ride depending on where and what they farmed. Some fields either received too much rain or just enough; a touch of early frost or none at all. That left some farmers having to replant three times after rain washed out the first two plantings, losing a whole month to weather. And the drenching continued into summer as some locations, including Windsor and Toronto, experienced their wettest month ever in July. Vast hectares of vegetables and wheat drowned from root rot. In Essex County, tomato crops were reduced by 25 per cent due to heavy rains. Another concern was the once-promising wheat crop. Plants lay flat because root systems couldn't support the stalks, making the wheat unharvestable. And fusarium appeared making contaminated crops unfit for human and animal consumption. More wetness in October hurt the edible bean crop and made it nearly impossible to plant next year's winter wheat. In the end, yields and quality were variable from crop to crop and area to area, but ideal finishing-up weather between September 22 and October 5 saved farmers with a better harvest than expected.

Quebec food producers also faced variable conditions for much of the growing season, but in the end crop yields were near or slightly below historical averages. The growing season started early with some welcomed warmth in the first week of May, but cool and very wet conditions for the remainder of the month and into June "dampened" the enthusiasm of farmers. Warm and fair weather in July helped to recuperate what was lost in late May and June, however, a cool wet August again hindered crop development. September was more or less near normal followed by a great October that helped crops reach maturity on time.

Across the Maritimes, the growing season began early but weeks of cool and very wet weather in May, June and July

slowed progress. Late pollination was a problem and excessive spring rains forced growers to replant, while others dealt with water erosion. It was even too cool and wet for bees to do their work. One potato grower in Perth-Andover, New Brunswick said he couldn't remember worse planting and growing conditions. Seeds and seed pieces rotted in the mud. Strawberry producers also fretted over rain-soaked patches. In Fredericton, it was the wettest July on record – more than two and a half times the normal amount of rain. Even worse, the growing season between May and August had 170 per cent more rain than normal making it the wettest May to August in over 130 years. In Nova Scotia, it wasn't so much the amount of rain but the long stretch of damp, grey skies. Between the second week of May and the end of June, it rained on over 40 of 50 days. Only PEI bucked the trend, with every month between April and October warmer than normal and the total April to October rainfall just two-thirds of normal amounts. Across the region, a long stretch of sunny warm weather in September and October was ideal for crop growth and harvesting. Potato growers enjoyed some of the finest weather in years as they completed the fall harvest on time. The apple harvest was a week early and quality was especially good for fruit size and coloration. Further, the absence of tropical storm weather ensured the apples stayed on the trees until ripened and picked.

4. To Flood or Not to Flood?

At the beginning of March, flood forecasters in Manitoba and Saskatchewan were worried that a record snowpack (triple the average in some places), thick river ice and a slower-than-normal thaw would collectively raise the flood threat. Whether the Red River Valley would be facing its third major flood in five years was up to yet-to-be-determined factors such as spring storms and the phasing of overland snowmelt with the ice break-up in ditches and rivers. On a positive note, there was less moisture in the soil when the ground froze the previous fall, meaning it had more capacity to absorb the runoff from the spring snowmelt. Flood fears continued to grow as stubborn winter weather lingered well into spring. By mid-April at least 70 per cent of the ground was still covered with snow. Further, spring snows were high in water content and were twice normal accumulations across the American/Canadian portions of the Red River Basin. Temperatures in March and April (barely above freezing during the day and frigid at night), were the coldest in 16 years, slowing the spring melt considerably and worsening the flood outlook along the Red, Assiniboine, Pembina, Souris and Qu'Appelle rivers.

With Prairie rivers expected to peak about two to three weeks later than usual, officials were not sure what to wish for. On the one hand, a warm spring would get rid of the snow and ice before late April rain showers. A delayed thaw increases the risk of triggering a sudden and inevitable warm-up, ensuing melt, possible ice jamming, spring rains and an instant freshet. On the other hand, a cold spring can ease flooding by slowing the melt and letting melt water move gradually through the system. The water is more likely to move in stages – slowly overland, into ditches and rivers, out through tributaries and into the main, rather than all at once.

As it turned out, the potential epic flood didn't happen. The insufferably frigid spring that Prairie residents had been cursing actually worked in their favour. The cold days and very cold nights slowed the disappearance of the late record snowpack, which had a calming effect, allowing a slow, gradual melt. Main rivers started flowing before their tributaries came rushing in, Canadian rivers ran their course before water from American watersheds arrived and multiple melt-stages instead of one large gush of water combined to deliver the best possible news.

By early May, the worst of the flood threat seemed to be over. River flow got underway as water levels in most tributaries were declining. A lot of snow simply evaporated or disappeared through sublimation, while melt water was absorbed by the ground. In addition, rivers were ice free and controlled river diversions helped ease the flood threat. While water levels were high in some regions, flood risks were certainly much lower than predicted only three weeks earlier and any flooding that did happen was manageable. That didn't mean hard work and hardship were absent. Dire forecasts prompted communities from North Battleford to Winnipeg to rush preparations for the coming flood. Volunteers filled millions of bags with sand and dozens of Tiger dams (large flexible containers) with water. Work teams cleared culverts and catch basins, laid sandbags, dug channels, rerouted water and corralled the runoff with air-filled booms. Provincial water agencies also released more water from reservoirs to make room for the spring runoff.

Several dozen people had to leave their homes in First Nations communities across Saskatchewan and Manitoba. At times, roads were covered with water or washed out. Pumps worked continuously. In Saskatchewan, 14 communities were under states of emergency compared to 60 in 2011. Flood waters were blamed for a passenger train derailment in eastern Saskatchewan and closed a stretch of the Trans-Canada Highway between Indian Head and Whitewood, and the Yellowhead Highway near Radisson. The final disruption was a delay in seeding for farmers who had to wait several weeks for waterlogged fields to drain.

5. Rebound in the Arctic Ocean and the Great Lakes

Arctic sea ice continued to make news in 2013. Satellite observations from the European Space Agency showed that in March and April – typically the time when the ice floes are at their thickest – the sea ice cap was larger than a year ago, but the volume (area x thickness) continued to decline as it has each year since 1979. Hitting a new record low in spring 2013, it was now half the volume that it was 30 years ago. Further, the University of Colorado at

Boulder, Colorado reported that multi-year ice more than four years old decreased from 18 per cent of the March peak ice cover in 1984 to three per cent in 2013. There was also some shipping news. China reported that, for the first time, one of its cargo ships had successfully plied the waters of the Northeast Passage along the northern coast of Russia, effectively cutting two weeks from its conventional route to the Netherlands. And just a week later, a Danish-owned cargo ship sailed for the first time through the Northwest Passage without incident.

There was even bigger news in September – a time when sea ice coverage usually reaches its minimum. While summer ice coverage varies widely from area to area and year to year, the US National Snow and Ice Data Center (NSIDC) reported that ice extents this year had recovered to somewhat closer to normal given that last September the ice cover shrunk to its lowest extent since satellite records began 34 years ago. Still, the ice was more than a million square km less than the 30-year average - the sixth smallest extent ever recorded and half of what the concentration was in the 1950s. Clearly, ice melting was slowed by cooler summer air temperatures and more cloud cover over most of the central Arctic Ocean, Greenland and the Canadian Archipelago. According to the NSIDC, summer air temperatures in the lower atmosphere were 0.5 to 2.0°C below average. Wind and storm patterns also affect ice conditions. In summer 2013, favourable winds caused the ice cover to spread out and cover a larger area.

In 2013, as reported by the Canadian Ice Service of Environment Canada, sea ice coverage in Canadian arctic waters (not including Hudson Bay) reached a minimum of 27.2 per cent (or 0.76 million square km) during the week of September 3. That's only 2.8 per cent less than the 1981-2010 normal minimum coverage and the most ice coverage at the summer minimum point since 2005. In the Canadian portion of the Arctic Ocean, limited heat transport from the south slowed the ice melt and new ice began forming in the northern reaches near the end of August. Although the southern route of the Northwest Passage has been navigable since 2006, certain sections were difficult to navigate this year – just as they were in 2009 – and the northern route was closed to all ships except icebreakers. At the peak of ice coverage disappearance, ice extent along the northern route of the Northwest Passage was 9 per cent less than normal. The "rebounding" of the sea ice coverage from its record low of 2012 highlights the large interannual variability of both arctic sea ice and the global climate system.

At the beginning of the year, the Great Lakes were not looking so great. Water levels on each of the lakes were well below their long-term average. In fact, Lake Michigan-Huron was at its lowest level in recorded history. Too many warm record-dry seasons combined with year-round evaporation and half the ice cover of 30 years ago were to blame. Nature just couldn't deliver enough runoff, rain and snow to counterbalance the moisture loss and outflows. In January, Lake Michigan-Huron dipped 1 cm below its previous record low monthly level set in March 1964. The water level was more than two metres below the lake's record high set in October 1986 and lower than it had ever been for any month since modern record-keeping began in 1918. The lower lake levels and expanding shorelines spelled trouble for lakeside businesses, commercial shippers and the environment, and were leaving cottagers and recreational boaters high and dry. At the beginning of spring, water levels ranged from 17 cm below the 1918-2012 average in Lake Ontario to 68 cm below the long-term average for Lake Michigan-Huron, and were significantly lower than levels the same time last year. Levels and flows in connecting rivers were also lower than normal, including the St. Lawrence at Montreal where an exceptionally dry summer in 2012 resulted in record low water levels from July through September.

By summer of 2013 there was some good news – a snowy winter and a much wetter-than-normal spring resulted in water levels throughout the Great Lakes-St. Lawrence River system rising significantly. This year was one of the top five wettest in 66 years and the Great Lakes levels responded with a welcome rise. All ended the year higher than they were at the same time last year. The level of Lake Ontario was a few centimetres above its 1918-2012 long-term average, and lakes Superior, St. Clair and Erie were within 15 cm of their long-term averages. While Lake Michigan-Huron remained 40 cm below the average, wet conditions kept it well above its record low levels. By the beginning of November, all the Great Lakes had gained between 10 and 31 cm relative to the monthly average over the course of the year. Downstream, levels in the St. Lawrence River also recovered, fluctuating around average values throughout much of the spring and early summer before falling somewhat below average during the late summer. Still, they were well above the record lows experienced the previous year.

Comparison of water levels in centimetres at beginning-of-month compared to average (1918-2012)

Location	January	November	11-month Recovery
Superior	34 cm below	7 cm below	+27 cm
Michigan-Huron	71 cm below	40 cm below	+31 cm
St-Clair	39 cm below	13 cm below	+26 cm
Erie	19 cm below	1 cm below	+18 cm
Ontario	21 cm below	7 cm above	+28 cm

6. Wicked Winter Weather Wallops the East

At the end of the first week of February, a fast-moving weather disturbance from Alberta and a moist low from Texas began influencing weather across eastern North America when the two systems morphed into the biggest blast of winter weather in years. The Alberta clipper featured cold air from the Arctic while the Texas low packed tropical moisture from the Gulf of Mexico. Together the hybrid storm intensified into a blizzard of historic proportions with as much as 60 cm of snow falling along the Atlantic coast from New York City to Halifax and beyond. Millions of residents were affected on both sides of the border. For many in southern and eastern Ontario and southern Quebec, it was a one-day event that packed a punch with strong gusty northwesterly winds, and tons of blowing and drifting snow. At its worst, the storm dumped between two to four centimetres of snow every hour, wreaking havoc on roads, rail lines, and runways. Snowfall amounts ranged between 25 and 35 cm, with the highest totals at St. Catharines (44 cm), Peterborough (41 cm), and on elevated terrain near the Great Lakes (35 cm). The storm left tragedy in its wake as four people in Ontario died amid treacherous roads and blinding blizzards. It also grounded 800 flights, stranded motor traffic, and shut down schools and universities, especially in the Toronto-Hamilton-Niagara area.

In Toronto alone, the storm's clean-up costs exceeded $4 million. Because the storm skirted the southern reaches of Quebec near the Canadian-American border, the province emerged from the wintry lashing comparatively unscathed. Snowfall totals ranged from 10 to 20 cm with Hemmingford recording up to 30 cm. Following the storm, wind chills dipped close to -30 in blowing snow. Road conditions deteriorated rapidly on February 8 and hundreds of motorists in Quebec were involved in collisions or ended up in a ditch. On a more positive note, the snowfall was a boon to Ontario and Quebec ski resorts.

Over Atlantic Canada, the storm got a second wind and turned into a powerful nor'easter energized by cold air to the north, warm air to the south, and an infusion of energy from warm Gulf Stream waters. The worst of the storm was felt south of the border with as much as a metre of snowfall and hurricane-force winds cutting power to hundreds of thousands and leading to 18 deaths in New York and New England. Taking stock of the carnage, Maritimers prepared for the assault from the winter behemoth that brought the heaviest snowfall in years to Atlantic Canada on February 8 and 9. At one time on the weekend, it was snowing across the entire Maritimes. Nasty conditions shut down the region and every mode of transportation. Nova Scotia got the worst winds, upward of 140 km/h., while east of Yarmouth at Woods Harbour and Cape Sable Island extreme gusts peaked at 164 km/h. A storm surge at Shelburne, Nova Scotia was the biggest since a major storm nearly 40 years ago. The storm blew the roof off mobile homes and damaged the fronts of some retail stores. Many trees were toppled and power outages left thousands throughout the Maritimes in the dark. Snowfall amounts were highly variable, measuring as much as 66 cm at Debert and 50 cm in Greenwood with drifts metres deep, while Halifax received 26 cm and Sydney 31cm. The storm surge at high tide flooded roads, damaged docks and shore buildings, and lifted boats onto wharves on Cape Sable Island. The majority of flights at Halifax were cancelled and nearly all Marine Atlantic ferries stayed tethered to shore over the weekend. In places, chunks of floating ice and large rocks were pushed or tossed onshore landing on the front steps of homes and shops. Snowplows were used to clear highways of rocks and gravel.The epic storm continued its journey eastward, bringing blustery winds and snow to Newfoundland and Labrador. By February 10, between 15 and 40 cm of snow fell amidst wind gusts of more than 100 km/h that pummelled the province. Even after crossing the Atlantic, the dying stormstill had the power to dump 15 cm of snow on Ireland and the United Kingdom between February 15 and 18, inflicting major travel disruptions and flooding.

7. Spring Flooding in Ontario's Cottage Country

A burst of spring weather in mid-April pushed temperatures into the 20s across southern and central Ontario. The unseasonably warm and unstable air triggered Canada's first tornado of the season on April 18 around Shelburne, Ontario. More significantly, the warm, moist air led to major flooding north and east of Georgian Bay in Ontario's cottage country. In addition, copious amounts of warm rain melted a later-than-normal snowpack in Algonquin Park and the surrounding woodland. With rain coming down in torrents - nearly 90 mm in two days - steam billowed from the ground. The ensuing melt water and rains funnelled quickly into rivers, lakes and streams causing some of the highest and fastest rising water levels in recent memory – as much as 3 m in 24 hours. At one dam in the Kawarthas flood waters sped at a rate of 8,700 m3/s – vastly more powerful than the previous record rate of 5,200 m3/s. It was estimated that river volumes exceeded a 100-year occurrence.

Authorities quickly declared states of emergency in eight regions across central Ontario from the south end of Algonquin Park to the Kawartha Lakes, including the towns of Huntsville, Bracebridge, Haliburton, and Bancroft. The flooding forced evacuations, with 1,000 residents being displaced in Bracebridge alone. Hundreds more were trapped in their homes by surrounding water. The fast-rising waters breached dams sending crushing ice into boat houses and docks, and inundating dozens of properties under a metre of water. Scores of streets, roads, culverts, and highways in several mid-Ontario towns were flooded. And a huge sinkhole on Highway 11, south of Huntsville, forced traffic to detour. During the worst of the flood, the popular Deer Lake Resort Park was nearly three-quarters underwater. Power was shut off for several days as a safety

precaution. The resulting damages totalled several millions of dollars.

The historic flood was due to a combination of partially frozen ground, later-than-usual snowmelt, persistent lake ice and, largely, heavy warm rains over two or more days. Before temperatures shot above 20°C, early spring temperatures were averaging as much as five degrees colder than normal. That left the still frozen ground unable to handle the sudden overflow of water. A protracted warm spell in the final two weeks of April saw temperatures climb two and a half degrees warmer than normal. Just north of Bracebridge, a weather station in Beatrice, Ontario with a 137-year record lost almost 48 cm of snowpack in three weeks before nearly 100 mm of rain soaked the region over three days, including 55 mm on the 18th – the wettest April day ever. The total monthly rainfall of 169 mm also set a new April record.

8. Prairie Winter Went on Forever

Environment Canada considers the months of December through February as winter. Tell that to Canadians on the Prairies, where cold, snow, and ice went on for seven months from October 2012 to April 2013, inclusive – the longest and coldest period in 16 years. Snows came early, stayed late and never disappeared. As a result, it felt and looked like winter from before Thanksgiving to a month after Easter. And with deep snow on the ground any warm-up was stalled until late May. At times, March and April felt colder than January and February. Perhaps the cruelest day of many was the first day of spring on March 20, which started a period of 30+ days of below normal temperatures. Also on that day, snow on the ground was at record or near-record depths: Fort McMurray 51 cm; Peace River 33 cm; Regina 107 cm; Weyburn 32 cm; Brandon 77 cm; and Winnipeg 55 cm. Entrenched Arctic air combined with an unseasonably late snow cover led to new record minimum temperatures day-after-day well into spring. For example, Regina's minimum temperature on April 29 was the coldest in Canada – more typical of temperatures at the end of January. In fact, it was the coldest April 29 since record-keeping began in 1884. Snow cover in Regina made the record books too! On April 1 and 25, the city's snow cover measured 62 cm and 30 cm respectively – the most ever recorded on those days since observations began in 1955.

Other highlights from winter's seven-month stretch included:

• Humongous snowfalls – from Grande Prairie to Winnipeg, snowfall consistently averaged between 50 and 100 per cent above normal. Regina owned bragging rights to snowfall amounts, with one weather station measuring seasonal snowfall at 207 cm – more than any other winter going back to 1883. The previous extreme was 195 cm in winter 1955-56. On average, the city experiences one or two days a year with more than 10 cm of snowfall. This year, there were nine days with amounts ranging from 10 to 20 cm.

• Record snow depth and endurance – on April 19, snow on the ground varied widely across Saskatchewan but generally measured 30 to 60 cm – likely the deepest since records began in 1955. Some areas went into May with snow on the ground. Although there's been snowfall in May and June before it's never stayed on the ground for so long. Of note, a weather station 25 km north of Edmonton had snow cover on 170 consecutive days from November 8 to April 26.

• Persistent cold – between March 1 and April 30, the average temperature in Regina was -8°C; eleven degrees colder than the previous year and the coldest period in 113 years. Saskatoon recorded its second coldest March-April in 65 years. Further, residents didn't see temperatures above 10°C for 189 consecutive days - the longest stretch on record. And the city had a whopping 57 days with temperatures below -20°C compared to just 15 cold days last year. In Winnipeg, the average temperature finally climbed above freezing for the first time in 25 weeks on April 26. The mean temperature for that month was -2.1°C, tying for the third coldest since records began in 1872. Edmonton International Airport reported 50 days with minimum temperatures below -20°C, compared to 20 such days last year. Between October 16 and April 24 there was only one day without a freezing temperature (January 15) spanning more than six months.

After more than half a year of tough winter weather Prairie residents were clearly fed up, feeling both its physical and psychological strains. An inordinate number of people of all ages suffered broken legs, ankles, and worse while navigating the frozen terrain. And, sadly, the long harsh winter doubled the number of cases of animal neglect as reported by the Saskatchewan SPCA. Winterkill was also partly to blame for a huge loss of bees in Manitoba and Saskatchewan. The prolonged winter was especially costly for governments. By the end of January, Saskatchewan had already spent $6 million more than usual on snow and ice control with much more to come. Bitterly cold temperatures at the end of January played a part in setting a new record for power usage in the province as residents spent 10 per cent more on energy to stay warm and comfortable. The unusually late arrival of warm weather delayed the start of seeding by at least two weeks, and increased concern about the possibility of even longer delays because of the likelihood of widespread spring flooding.

9. Stormy Seas and Maritime Tragedy

In a month of frequent winter storms across eastern North America, none was more tragic than the powerful storm that led to the drowning of five young fishermen off Nova Scotia on February 17. The deadly storm was the third one in two weeks but not the largest or most powerful. Still, it had the

intensity of a Category 1 to 2 hurricane. The low travelled northward up the United States eastern seaboard and became rejuvenated over the relatively warm waters of the Gulf of Maine. For Nova Scotia, the storm featured a mixed bag of wet snow, rain, and freezing rain making it especially challenging for road crews scraping away the crunchy frozen slush. New Brunswick received only snow – 30 cm in the southeast.

Everywhere along the coast, winds were gusty and strong, approaching 160 km/h in western Cape Breton Island and 180 km/h across southwestern Newfoundland and Labrador. Across the Maritimes, thousands of customers lost power and inter-city bus services were cancelled. Numerous flights in and out of Halifax and Saint John airports were delayed or cancelled. A host of community programs and services closed, including colleges, schools, daycares, public libraries and medical offices. Blood shortages reached critical lows as foul weather continued to close clinics and keep potential donors at home.

Turbulent seas along the Nova Scotia coast created treacherous conditions with 10 metre waves and high winds. Sadly, in the midst of hurricane force winds and zero visibility the Miss Ally from Woods Harbour and her five member crew of fishers went down in heavy seas. The five young halibut fishers lost their lives as conditions severely hampered massive search and rescue efforts.

10. Sunny and Rainless in BC

It is hard to imagine a better month of weather along the Pacific coast than in July 2013, which featured continuous sunshine and not a single drop of rain in either Vancouver or Victoria. The long stretch of perfect weather actually began around the first day of summer on June 21 thanks to a massive ridge of high pressure that sat stationary over the West coast and relentlessly pumped cloudless desert air from the southwest United States into British Columbia. On the south coast and in the BC Interior, daily temperatures soared in late June with little cooling during the short summer nights. Several stations set record warm overnight lows, including 16.5°C at Vancouver and 15.9°C at Victoria on June 29 that eclipsed records set in 2008. And on June 28, afternoon temperatures soared above 42°C in Kamloops, Lytton, and Osoyoos.

July was Vancouver's sunniest on record with almost 411 hours of bright sunshine, surpassing the 388-hour record set in 1985 (sunshine recordings began in 1953). Further, "Raincouver" set a record for its driest July, having never gone an entire month without at least a trace of rain (i.e. less than 0.2 mm). Even a July with only traces of rain is relatively rare with only two instances since record-keeping began: six traces in 1951 and two in 1985. The city's dry spell began on June 28 and lasted 34 days – a good stretch but no comparison to Vancouver's two longest rain-free summers. The most recent lasted 52 days during Expo 86 – between July 18 and September 7 – and included two trace amounts; the other ran a little longer with 58 rain-free days between June 14 and August 10, 1951 and six traces.

Victoria also broke and tied records for its sunniest and driest months, with 432.8 hours of bright sunshine and zero rainfall respectively. July was the sunniest month ever with records dating back to 1968. And at Victoria International Airport, no rainfall was measured in July – not even a trace. It was only the second time that there had been a rain-free July. The first was in 1958 when there were no days with measureable rain or traces over 33 days from June 30 to August 1. Several other cities in the province set records for their driest July in 2013: Vernon experienced 1.1 mm of rain; Revelstoke 6.2 mm; and Kamloops had a mere wetting at 0.6 mm. Adding to July's spectacle were unexpectedly comfortable temperatures given the record dry and sunny skies. In Vancouver, temperatures averaged 18.3°C – a mere 0.3°C warmer than normal.

July's delightful weather was good news for restaurants with patios but left many scrambling to find enough staff to work the overflow traffic. On the flip side, typical foul-weather venues such as museums, malls, and movie theatres experienced a dip in attendance. The lack of rain was also a boon for beach lovers and campers, although it did put Vancouver Island and the BC Lower Mainland on a high forest-fire alert. Surprisingly, the water supply in Greater Vancouver was only slightly lower than previous years with reservoir water levels at 85 per cent and no air-quality advisories were issued for the region.

As a side note, Vancouver just squeaked into the record books. Within minutes of rain-free July coming to an end, the skies opened up making it a very close call.

Source: "*Top Ten Canadian Weather Stories for 2013*", Meteorological Service of Canada - Environment Canada - Government of Canada. http://www.ec.gc.ca/meteo-weather visited on winter solstice day.

Les dix événements météorologiques canadiens les plus marquants en 2013

by David Phillips[2]

Bilan de l'année 2013

En 2013, les grandes vedettes de l'actualité au Canada sont les inondations. Dans certains cas, les pluies vives et déchaînées étaient mises en cause, tandis que dans d'autres situations, on mettait en avant le mélange des chutes de pluie et de l'eau de fonte. Ajoutez à cela un paysage urbain ayant une capacité limitée pour absorber les quantités d'eau qui s'ensuivent et vous obtiendrez les ingrédients clés d'un débordement inquiétant. La plus forte inondation s'est déroulée en juin, lorsque des averses torrentielles ont submergé Calgary et de vastes zones du sud de l'Alberta, obligeant 100 000 Albertains à quitter leurs foyers et causant des milliards de dollars de dommages. Trois semaines plus tard, de grandes portions du centre de Toronto sont à leur tour inondées par quelques-unes des plus fortes chutes de pluie quotidiennes qu'il a été donné d'observer dans l'histoire de la ville. Les Canadiens étaient stupéfaits à la vue des forces de la nature immédiates et puissantes qui balayaient leurs rues et leurs jardins. Selon le Bureau d'assurance du Canada, ces deux événements constituent la première et la troisième des plus grandes catastrophes naturelles assurées dans l'histoire du Canada. Il convient de noter l'intérêt évident de la nature pour Calgary. L'inondation de cette année marque une quatrième année consécutive où le temps violent frappe la ville durement. L'année dernière, comme en 2010, une tempête de grêle colossale a engendré des pertes de propriétés se chiffrant à plusieurs millions de dollars. En 2011, un puissant chinook a traversé le centre-ville de Calgary à des vitesses de la force d'un ouragan causant des millions de dollars de dommages supplémentaires.

Parmi d'autres événements d'inondation, on compte les averses d'avril et une fonte des neiges soudaine dans la villégiature du centre de l'Ontario qui ont engorgé les rivières et fait monter l'eau à des niveaux d'inondation historiques qui n'ont pas été observés depuis 100 ans. En juin, des rivières gonflées sont sorties de leur lit à Fort McMurray, forçant ainsi l'évacuation de centaines d'individus. Parmi tous ces événements, le plus surprenant était peut-être le manque réel d'expérience en matière d'inondations dans l'est des Prairies. D'après les prévisions, la région devait faire face à une autre inondation importante en 2013, qui aurait constitué sa troisième en cinq ans; cependant, ce que les experts considéraient comme une inondation « certaine » n'a pas eu lieu en raison du

printemps froid qui a ralenti la fonte des neiges et qui a permis de gérer les débits d'eau.

Cette « inversion » a constitué un descripteur pour deux des principaux événements météorologiques de cette année. Dans l'est de l'Arctique, l'été le plus froid enregistré depuis 15 ans (parmi d'autres facteurs) a aidé à ralentir la fonte de la glace de mer dans l'océan Arctique canadien à 3 % de la couverture minimale normale et a entraîné la plus grande étendue de glace depuis 2005. Dans le cas des Grands Lacs et du fleuve Saint-Laurent, c'est l'une des années les plus humides jamais enregistrées (13 % plus humide que la normale) qui a aidé à rétablir les niveaux de l'eau. Une seule année ne permet pas d'établir une tendance, surtout si l'on tient compte de la variabilité intrinsèque du système climatique planétaire. Les caractéristiques météorologiques constituant une valeur sûre au Canada sont les fortes tempêtes et celles que nous subissons font toujours la une de l'actualité. En 2013, les vedettes les plus importantes de notre actualité étaient deux puissantes tempêtes qui ont eu lieu en février : l'une d'elles a commencé en tant que système dépressionnaire en Alberta et s'est rapidement transformée en une puissante tempête du nord-est dans les provinces de l'Atlantique, mettant alors des millions de Canadiens vivant dans l'est sur un pied d'alerte. L'autre a conduit à la noyade de cinq jeunes pêcheurs originaires de la Nouvelle-Écosse, ce qui nous a tous attristés.

Sur une note positive, nous avons échappé à des tornades mortelles et à de graves sécheresses en 2013. Notre air était également plus clair que la plupart des années précédentes, l'année s'est révélée calme pour ce qui est des incendies de forêt et on a noté une quantité moins importante de moustiques porteurs du virus du Nil occidental. La saison des ouragans s'est également déroulée sans histoire – calme et tranquille dans l'océan Atlantique et dans la mer des Caraïbes en dépit des prévisions désastreuses et de l'apparition du typhon Haiyan de l'autre côté de la planète, qui était l'une des tempêtes

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tropicales les plus intenses sur Terre. Pour les producteurs agricoles vivant dans l'ouest, ce fut une bonne année pour les cultures. La Colombie-Britannique a également connu un été presque parfait avec le mois de juillet le plus sec et le plus ensoleillé jamais enregistré.

Aussi incroyable que cela puisse paraître, il s'agissait encore d'une année chaude au Canada (notre 17e année consécutive) même si elle n'était pas aussi chaude qu'au cours des années précédentes. Les températures de chaque région étaient plus chaudes ou presque normales, en particulier dans le sud de la Colombie-Britannique où les climatologues ont enregistré la quatrième période de décembre (2012) à novembre (2013) la plus chaude de la région depuis 66 ans. D'autre part, d'après les mesures, les températures dans les Prairies étaient plus chaudes que la normale en 2013 d'à peine 0,1°C. Cela n'est pas surprenant, puisqu'elles ont subi ce qu'il semble être un septième mois d'hiver interminable. Pour ceux qui sont situés dans l'est, les conditions météorologiques chaudes ont été également rares, avec un été qui s'est révélé aguicheur sans réellement se montrer. Des températures élevées ont été brièvement ressenties pendant une semaine en juillet et brièvement encore en septembre au cours de ce qui s'est révélé être l'un des étés les plus courts depuis des années.

Dix événements météorologiques canadiens les plus marquants en 2013

1	**L'inondation des inondations en Alberta**
2	**Pluies torrentielles à Toronto**
3	**Des cultures exceptionnelles à l'Ouest, mais plus ou moins bonnes pour le reste**
4	**Y aura-t-il des inondations?**
5	**Rétablissement de l'océan Arctique et des Grands Lacs**
6	**Des conditions météorologiques hivernales violentes frappent l'Est**
7	**Inondations printanières dans la région de villégiature de l'Ontario**
8	**Un hiver interminable dans les Prairies**
9	**Tempêtes en mer et tragédie maritime**
10	**Ensoleillé et sans pluie en Colombie-Britannique**

Les événements météorologiques les plus marquants du Canada pour 2013 sont classés de un à dix en fonction du degré auquel le Canada et les Canadiens ont été touchés, de l'étendue de la région touchée, des répercussions sur l'économie et du temps pendant lequel l'événement a fait la manchette.

1. L'inondation des inondations en Alberta

En Alberta, l'inondation majeure de 2013 s'est étendue sur un quart de la province et jusqu'au cœur de Calgary. Cette inondation, qui était probablement la plus dévastatrice dans l'histoire du Canada, a bloqué l'accès à des dizaines de collectivités et s'est soldée par une évacuation sans précédent, forçant plus de 100 000 Albertains à quitter leur domicile.

2. Pluies torrentielles à Toronto

Le 8 juillet, deux cellules orageuses distinctes ont frappé Toronto pendant l'heure de pointe du soir. En l'espace de deux heures, cette brève tempête a apporté davantage de pluie que Toronto n'en voit habituellement pendant tout le mois de juillet. On a rarement vu un orage aussi fort inonder une surface comportant plus de ciment que d'herbe.

3. Des cultures exceptionnelles à l'Ouest, mais plus ou moins bonnes pour le reste

Dans l'Ouest, la saison de croissance a été presque parfaite, les producteurs d'aliments l'ayant décrite comme incroyable, explosive, voire la meilleure qu'ils aient jamais vue. Du côté de l'est, la saison de végétation a connu des hauts et des bas : certaines cultures produisaient de bons résultats et d'autres pas.

4. Y aura-t-il des inondations?

Au début du printemps, une autre inondation importante de la vallée de la rivière Rouge semblait inévitable, mais les jours froids et les nuits encore plus froides du printemps ont ralenti la disparition de l'enneigement tardif record, ce qui a eu un effet apaisant, permettant une fonte lente et graduelle.

5. Rétablissement de l'océan Arctique et des Grands Lacs

Dans l'est de l'Arctique, l'été le plus froid subi depuis 15 ans a aidé à ralentir la fonte de la glace de mer dans l'océan Arctique canadien. Dans le cas des Grands Lacs et du fleuve Saint-Laurent, c'est l'une des années les plus humides jamais enregistrées (13 % plus humide que la normale) qui a aidé à rétablir les niveaux de l'eau.

6. Des conditions météorologiques hivernales violentes frappent l'Est

En février, deux systèmes météorologiques se sont transformés en un blizzard d'envergure historique entraînant la chute de 60 cm de neige le long de la côte Atlantique. Pour de nombreuses personnes au sud de l'Ontario et du Québec, ce phénomène d'un jour a fait sentir toute sa puissance avec des vents violents à rafales et des tonnes de poudrerie élevée.

7. Inondations printanières dans la région de villégiature de l'Ontario

L'air chaud et humide à la mi-avril a provoqué de graves inondations au nord et à l'est de la baie Georgienne, dans la région de villégiature de l'Ontario. D'énormes quantités de pluie chaude ont aussi fait fondre une accumulation de neige plus tardive que la normale, provoquant une montée des eaux parmi les plus fortes et les plus rapides dans l'histoire récente.

8. Un hiver interminable dans les Prairies

Environnement Canada estime que l'hiver dure de décembre à février. Allez dire cela aux habitants des Prairies, où le froid, la neige et la glace ont duré sept mois, d'octobre 2012 à avril 2013. En conséquence, l'hiver est arrivé avant l'Action de grâces et s'est terminé un mois après Pâques.

9. Tempêtes en mer et tragédie maritime

Parmi les fréquentes tempêtes des mois d'hiver dans l'est de l'Amérique du Nord, aucune n'a été plus tragique que la puissante tempête au cours de laquelle cinq jeunes pêcheurs se sont noyés au large de la Nouvelle-Écosse.

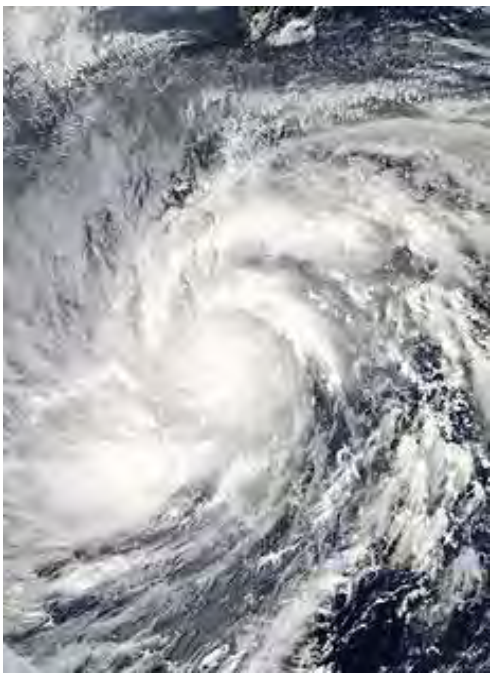
10. Ensoleillé et sans pluie en Colombie-Britannique

Il est difficile d'imaginer un meilleur mois de conditions météorologiques le long de la côte du Pacifique que celui de juillet 2013, au cours duquel le soleil a été présent en continu, battant ainsi des records, et il n'y a pas eu une seule goutte de pluie, que ce soit à Vancouver ou à Victoria.

Source: "*Les dix événements météorologiques canadiens les plus marquants de 2013*", Service météorologique du Canada - Environnement Canada - Gouvernement du Canada. http://www.ec.gc.ca/meteo-weather visité le jour du solstice d'hiver.

Événement météorologique majeur en 2013

Le typhon *Haiyan* (typhon *Yolanda* aux Philippines) est le 35e cyclone tropical de la saison cyclonique 2013 dans le nord-ouest de l'océan Pacifique et le douzième à avoir atteint le seuil de typhon. Le nom *Haiyan* signifie "pétrel" (oiseau palmipède vivant au large dans les mers froides et ne venant à terre que pour nicher). Ce super typhon, équivalent à un ouragan de catégorie 5 sur l'échelle de Saffir-Simpson, a donné des vents soutenus estimés de 230 km/h sur 10 minutes et de 315 km/h (170 noeuds) sur une minute. Il est considéré comme le typhon le plus intense de la saison dans cette région du globe et l'un des plus violents jamais enregistrés.



Typhon *Haiyan* le 8 novembre 2013 à 0505Z

Formé sous la forme d'une tempête tropicale à l'ouest des Îles Marshall et classé typhon lors de son passage au-dessus des États fédérés de Micronésie, il se dirige ensuite vers l'ouest-nord-ouest ; sa trajectoire le fait passer au-dessus des Palaos, des Philippines, du Viêt Nam, du Laos et du sud de la Chine. Le bilan provisoire au 15 novembre 2013 fait état de plus de 4 000 morts recensés par le gouvernement Philippin, et de dizaines de milliers de personnes souffrant de la faim, devant boire de l'eau non potable et sans abri. Ce bilan est encore évolutif, les recensements étant difficiles du fait des énormes problèmes de communication subsistants.

- Apparition: 3 novembre 2013
- Dissipation: 11 novembre 2013
- Typhon catégorie 5
- Pression minimale: 858 hPa
- Vent maximum (soutenu 1 minute): 315 km/h
- Morts confirmés: 5 632 morts + 1 759 disparus
- Blessés confirmés: 26 136
- Zones touchées par le typhon: Palaos, Micronésie, Philippines, Viêt Nam et Chine.

Source: Wikipédia.

Débat public au congrès 2014 de la SCMO à Rimouski

Exploitation des hydrocarbures dans le golfe du Saint-Laurent : quel rôle pour les chercheurs gouvernementaux et universitaires?

La réponse au prochain congrès de la SCMO à Rimouski

par Daniel Bourgault, Dany Dumont, Frédéric Cyr[1], et Angela Carter[2]

Le golfe du Saint-Laurent renferme potentiellement de grandes quantités d'hydrocarbures qui font saliver les pétrolières et les gouvernements. Le prospect le plus prometteur est celui d'*Old Harry*, situé dans le chenal Laurentien par près de 500 m de fond, et à une distance de moins de 100 km du Cape Anguille (Terre-Neuve et Labrador), du Cape Breton (Nouvelle-Écosse) et des îles de la Madeleine (Québec). C'est la pétrolière *Corridor Ressources* qui détient les droits sur ce prospect et envisage d'y effectuer un forage exploratoire d'ici la fin 2014. Cependant, toute une saga à lieu depuis 2012 entre *Corridor,* les ministères impliqués et l'Office Canada-Terre-Neuve-et-Labrador des hydrocarbures extracôtiers (ou simplement l'Office). C'est que pour l'obtention d'un permis de forage exploratoire, *Corridor* doit d'abord fournir une étude environnementale démontrant à l'Office que les risques associés à de telles opérations sont acceptables sur les plans social et environnemental. Cette saga, qui suscite de vifs débats dans l'est du pays, a débuté en 2012 suite au dépôt de la première version de l'étude environnementale en question.

Selon le rapport déposé par *Corridor*, les risques associés au forage exploratoire sont minimes. Par exemple, il y est démontré, à l'aide d'un modèle de dispersion d'hydrocarbure, que dans le pire des scénarios envisageables de déversement de surface, la zone affectée serait limitée à un rayon d'environ 10 km au-delà duquel le pétrole sera évaporé ou dégradé suffisamment pour qu'il n'y ait plus d'impact notable sur l'écosystème. C'est ainsi que, selon *Corridor*, les cinq provinces canadiennes qui bordent le golfe seraient épargnées d'une contamination advenant un déversement.

Cependant, cette étude a été sévèrement critiquée lors du processus de révision, particulièrement par Environnement Canada et Pêches et Océans Canada. Parmi ces critiques, notons qu'Environnement Canada a tenté de reproduire les résultats de déversement présentés par *Corridor*, mais en est arrivé à des conclusions complètement différentes. Selon les simulations d'Environnement Canada, il serait probable qu'un déversement à *Old Harry* affecte les côtes de Terre-Neuve, de la Nouvelle-Écosse et du Québec. Il est à la fois étonnant et troublant que des conclusions aussi différentes soient tirées d'une même question.

Corridor a répondu à cette critique en indiquant que les simulations d'Environnement Canada reposaient, entre autres, sur des valeurs erronées associées aux paramètres de l'hydrocarbure simulé. Un dialogue de sourd s'ensuivi entre *Corridor* et Environnement Canada jusqu'au point où Environnement Canada a demandé à l'Office, deux fois plutôt qu'une, de mettre un terme aux échanges, jugeant que ses recommandations n'étaient pas entendues. Le projet est actuellement en attente que l'Office rende une décision sur la base des documents qu'il possède[3].

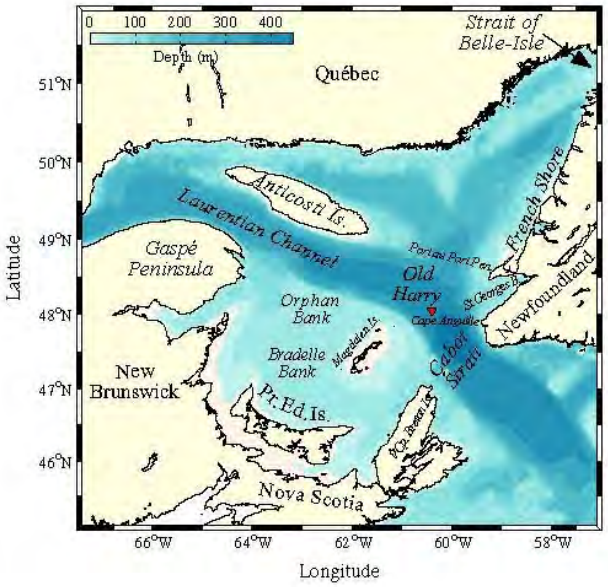
Ce cas sans précédent dans l'histoire de l'Office est symptomatique, selon nous, d'un manque criant de contributions scientifiques indépendantes à propos des questions soulevées par l'exploitation d'hydrocarbure dans les eaux canadiennes. Les chercheurs gouvernementaux ont joué un rôle remarquable en agissant un peu comme les chiens de garde dans ce dossier. Cependant, la décision qui sera prise prochainement par l'Office ne reposera pas sur des résultats scientifiques proprement dit, avec tout le désintéressement et la rigueur que ce type de recherche exige, mais sur une série de quiproquos qu'elle devra tenter de démêler. Il suffit de jeter un coup d'œil aux documents en question disponibles sur le site de l'Office pour réaliser la difficulté et l'ambigüité de la tâche.

Il est à la fois étonnant et déconcertant de réaliser qu'à la veille de forer dans le golfe du Saint-Laurent qu'aucune étude scientifique sérieuse n'ait été publiée sur le sujet sur laquelle des décisions plus éclairées pourraient se baser. Étant donné notre expertise collective à propos de l'océan, de l'atmosphère et du climat, notre communauté n'a-t-elle pas un certain devoir de s'intéresser et de se prononcer sur un sujet aussi important pour la société?

[1] Institut des sciences de la mer de Rimouski, Université du Québec à Rimouski et membres de Québec-Océan

[2] Department of Political Science, University of Waterloo

[3] Tous les documents (certains uniquement en anglais) de cette saga sont disponibles sur le site de l'Office: www.cnlopb.nl.ca/environment/corridorresinc.shtml



Position du prospect *Old Harry* dans le golfe du Saint-Laurent

C'est ce constat qui nous a récemment motivé à nous intéresser à la problématique environnementale reliée aux activités de forage autour d'*Old Harry*. Nous nous sommes d'abord demandé s'il était même possible de prétendre pouvoir produire à ce moment-ci des scénarios de dispersion d'hydrocarbures réalistes. Cela nécessite notamment la prise en compte des interactions biogéochimiques complexes, alors même que notre compréhension de la courantologie du golfe et des processus de dispersions physiques n'est encore que très élémentaire (p. ex. vagues, circulation de Langmuir, tourbillons, fronts, turbulence, etc). Nous avons donc décidé, dans un premier temps, d'aborder le problème simplement, c'est-à-dire en réalisant une étude qui ne porte que sur la courantologie de surface autour d'*Old Harry* à partir de données de courant horaires rendues disponibles en ligne par Pêches et Océans Canada via le site de l'Observatoire global du Saint-Laurent (www.ogsl.ca). Le but de notre étude était de fournir de l'information de base sur lesquelles d'autres études plus approfondies pourront s'articuler. Celle-ci présente, par exemple, le temps qu'une masse d'eau transitant par *Old Harry* pourrait prendre avant de toucher les côtes avoisinantes ainsi que la probabilité qu'un point donnée de la côte soit touché. Notre étude illustre aussi l'importance d'utiliser les courants instantanés plutôt que les courants saisonniers moyens - tel qu'utilisés par *Corridor* - pour simuler la dispersion de polluant. *Old Harry* est situé tout juste à cheval entre le courant de Gaspé sortant et le courant de Terre-Neuve Occidental entrant de sorte que ce sont les courants instantanés qui dictent la voie principale qu'emprunterait un déversement d'hydrocarbure. Ces résultats ont été soumis à *Atmosphere-Ocean* et nous sommes dans l'attente d'une décision de l'Éditeur (Bourgault *et al*., soumis)

Notre étude est la première étude scientifique indépendante sur le sujet et nous espérons que cela incitera d'autres groupes de recherche et membres de la SCMO à s'investir afin de jouer un rôle de premier plan pour un enjeu scientifique, environnemental et socio-économique aussi important pour le Canada. La communauté scientifique ne peut tout simplement pas regarder passer ce train sans monter à bord.

Les questions que cet enjeu soulèvent à propos de l'exploitation des ressources naturelles dans le golfe du Saint-Laurent et du rôle des scientifiques seront discutées et débattues lors d'un débat public qui aura lieu lors du **48e congrès de la SCMO** qui aura lieu **à Rimouski du 1er au 5 juin** prochain. Afin de favoriser un débat d'idées, nous avons invité autour d'une même table M. Steven Guilbeault d'Équiterre, M. Jean-Thomas Bernard de l'université d'Ottawa et l'un de nous (D. Bourgault) pour présenter, respectivement, les points de vue environnementaliste, économique et scientifique sur le sujet.

Notons qu'une grande partie de notre expertise collective sur le sujet réside parmi les chercheurs gouvernementaux fédéraux, particulièrement chez Pêches et Océans Canada et Environnement Canada. Aussi étonnant que cela puisse paraître, il semblerait, selon un récent sondage percutant de l'Institut professionnel de la fonction publique du Canada (IPFPC, 2013), que les chercheurs gouvernementaux ont de plus en plus de difficulté à exprimer librement et publiquement leurs savoirs ou leurs opinions sans craindre des réprésailles (voir aussi l'éditorial dans la revue *Nature*, 2012 à ce sujet). Nous osons espérer que ce sondage ne reflète qu'une légende urbaine et qu'en pratique les chercheurs gouvernementaux ont toute la liberté d'expression voulue et souhaitée dans ce domaine. Le musèlement des chercheurs par nos institutions publiques serait tout simplement inacceptable dans notre démocratie. Le savoir accumulé par les institutions via des fonds publics doit fondamentalement être retransmis librement à la population, surtout lorsqu'il s'agit d'enjeux socio-économiques et environnementaux aussi important que ceux reliés aux énergies fossiles et au climat. Nous espérons ardemment que plusieurs chercheurs fédéraux présents à Rimouski lors du congrès profiteront de ce débat public pour faire mentir les sondages en partageant librement leur expertise et leurs opinions à propos du climat, de l'océanographie et de l'exploitation des ressources naturelles dans le Saint-Laurent afin d'aider la population, les journalistes et les décideurs à se faire une idée plus juste sur le sujet.

Vous êtes donc tous attendus, chercheurs universitaires, chercheurs gouvernementaux, étudiants, journalistes, gens de l'industrie, riverains et tous ceux qui ont un intérêt envers le climat, l'économie et l'énergie, à participer bien librement à cette soirée unique d'échanges sur un enjeu qui nous touche tous de près.

Références

Bourgault D., Cyr F., Dumont D. et Carter A. Surface dispersion of a floating tracer released at the *Old Harry* prospect. Manuscrit soumis à *Atmosphere-Ocean* (juillet 2013).

Institut professionnel de la fonction publique du Canada (IPFPC) (2013). Coup de froid – Bâillonner la science au service de l'intérêt public : Un sondage. 7 pp. Téléchargé le 18 décembre 2013 de l'adresse suivante : www.pipsc.ca/portal/page/portal/website/issues/science/bigchill

Nature Editorial (2012). Frozen out. *Nature* 483. doi:10.1038/483006a.

Québec-Océan: Saviez-vous que Québec-Océan est un groupe inter-institutionnel de recherches océanographiques du Québec.

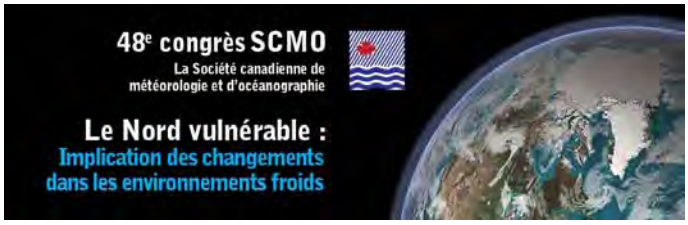
Next Issue *CMOS Bulletin SCMO*

Next issue of the *CMOS Bulletin SCMO* will be published in **April 2014.** Please send your articles, notes, workshop reports or news items before **March 7, 2014** to the address given at the top of page 2. We have an URGENT need for your written contributions.

Prochain numéro du *CMOS Bulletin SCMO*

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en **avril 2014.** Prière de nous faire parvenir avant le **7 mars 2014** vos articles, notes, rapports d'atelier ou nouvelles à l'adresse indiquée au haut de la page 2. Nous avons un besoin URGENT de vos contributions écrites.

Townhouse debate at the 2014 CMOS Congress in Rimouski



Oil and gas exploitation in the Gulf of St. Lawrence: what role for government and university researchers?

The answer at the next CMOS Congress in Rimouski

by Daniel Bourgault, Dany Dumont and Frédéric Cyr[4], and Angela Carter[5]

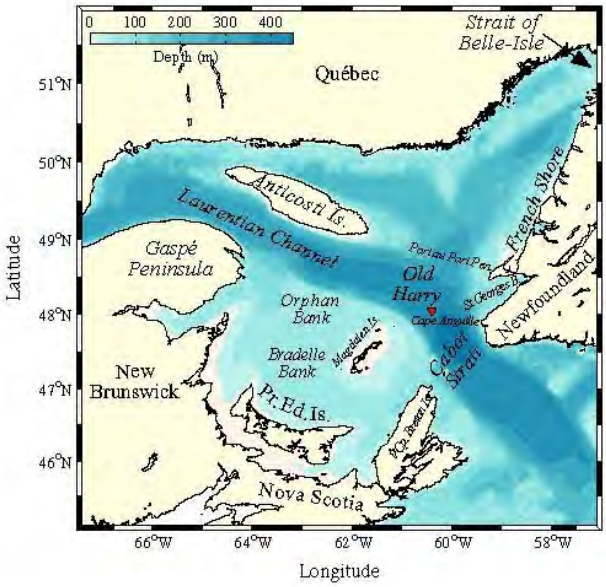
The Gulf of St. Lawrence potentially holds large amounts of oil and gas coveted by oil companies and governments. The most promising prospect is *Old Harry*, located at a depth of 500 m in the Laurentian Channel, and at less than 100 km from Cape Anguille (Newfoundland and Labrador), Cape Breton (Nova Scotia), and the Magdalen Islands (Quebec). *Corridor Resources* holds the rights for this prospect and plans to undertake exploratory drilling by the end of 2014. However, a saga has been unfolding since 2012 between *Corridor,* the involved ministries and the Canada-Newfoundland and Labrador Offshore Petroleum Board (or simply the Board). This arose because in order to get an exploratory license, *Corridor* first has to provide an environmental study demonstrating to the Board that the risks associated with such operations are socially and environmentally acceptable. This saga, that provokes lively debates in Eastern Canada, began in 2012 following the submission of the first version of the environmental study in question.

According to the report tabled by *Corridor*, the risks associated with the exploratory drilling are minimal. For example, it is demonstrated, using an oil spill model, that for conceivable worst-case scenarios of surface spillage, the affected area would be limited to an approximately 10 km radius, beyond which oil will be sufficiently evaporated or degraded to no longer have any noticeable impact on the ecosystem. Therefore, according to *Corridor*, the five Canadian provinces surrounding the Gulf would be saved from any contamination if there were to be an incident.

[4] Institut des sciences de la mer de Rimouski, Université du Québec à Rimouski et membres de Québec-Océan

[5] Department of Political Science, University of Waterloo

However, this study has been severely criticized during the revision process, especially by Environment Canada and Fisheries and Oceans Canada. Among those criticisms, Environment Canada has attempted to reproduce the spillage results presented by *Corridor*, but obtained completely different results. According to Environment Canada's simulations, it is likely that a spillage in Old Harry would affect the Newfoundland, Nova Scotia, and Quebec coasts. It is astonishing and troubling that such different conclusions are drawn from the same question.



Location of *Old Harry* prospect in the Gulf of St. Lawrence

Corridor replied to this criticism by indicating that the Environment Canada simulations were based, among other things, on incorrect values of the simulated oil parameters. A dialogue of the deaf then followed between *Corridor* and Environment Canada to the point where Environment Canada has asked the Board, not once but twice, to put an end to the exchanges, estimating that its recommendations were not taken into account. For now, the project is on stand-by, until the Board makes a decision on the basis of the documents at its disposal[6].

We feel that this unprecedented case in the history of the Board is symptomatic of a glaring lack of independent scientific contributions regarding questions about oil and gas exploitation in Canadian waters. Government researchers have played a key role in this file by acting somewhat as the watchdogs. However, the decision that the Board is about to make is not going to be based on scientific results *per se*, with all the objectivity and rigour required by this kind of research, but rather on a series of misunderstandings it will have to try to untangle. A quick look at the documents in question, available on the Board website, is sufficient to realize the daunting and ambiguous task the Board is facing.

It is astonishing and disconcerting to realize that while we may be just about to drill for oil in the Gulf of Saint-Lawrence there have not to date been any serious scientific studies that have addressed this issue, upon which more informed decisions could be based. Given our collective expertise about the oceans, atmosphere, and climate, don't we have a certain responsibility to show interest and to speak out on such an important issue for society?

This realization recently motivated us to become interested in environmental issues related to drilling activities near *Old Harry*. We started by asking ourselves whether it was currently even possible to pretend that we have the capacity to produce realistic oil spill scenarios. This requires taking into account complex biogeochemical interactions, while our understanding of the Gulf circulation and physical dispersal processes is still very basic (e.g. waves, Langmuir circulation, eddies, fronts, turbulence, etc). We have, therefore, decided to address the issue quite simply, performing a study exclusively on the surface currents, using hourly current data available online via the St. Lawrence Global Observatory website (www.ogsl.ca), thanks to Fisheries and Oceans Canada. The purpose of our study was to provide basic information upon which more extensive studies could be based. For example, our study shows the time a body of water passing through *Old Harry* could take before reaching the neighbouring coastlines, as well as the probability that a given point on the coast be touched. Our study also illustrates the importance of using instantaneous currents rather than average seasonal currents as used by *Corridor* to simulate pollutant dispersal. *Old Harry* straddles the outgoing Gaspé Current and the incoming West Newfoundland Current, so the trajectory that an oil patch would follow is dictated by instantaneous currents. Those results have been submitted to *Atmosphere-Ocean*, and we are currently awaiting the Editor's decision (Bourgault *et al*., submitted).

Our study is the first independent scientific study on the topic, and we hope that it will encourage other research groups and CMOS members to commit themselves in order to play a leading role in such an important scientific, environmental, and socioeconomic issue for Canada. The scientific community simply cannot just sit back and watch this unfold.

Questions arising from this issue regarding the exploitation of natural resources in the Gulf of St. Lawrence as well as

[6] All documents of this saga are available via the Board website:
www.cnlopb.nl.ca/environment/corridorresinc.shtml

the role played by scientists will be discussed and debated during a townhouse debate that will be held as part of the **48th CMOS Congress in Rimouski, from the 1st to 5th of June**. In order to stimulate public debate, we have invited Mr. Steven Guilbeault from Equiterre, Mr. Jean-Thomas Bernard from the University of Ottawa, and one of us (D. Bourgault) to the same table, to show the environmentalist, economic, and scientific points of view, respectively, on this topic.

It should be noted that a great deal of our collective expertise on the issue lies with federal governmental researchers, especially within Fisheries and Oceans Canada and Environment Canada. As astonishing as it might appear, it would seem, according to a striking and recent survey by the Professional Institute of the Public Service of Canada (PIPSC, 2013), that governmental researchers find it increasingly difficult to freely and publicly express their knowledge or opinions without fearing reprisals (see also the 2012 *Nature Editorial* on this topic). We dare to hope that this survey only reflects an urban legend, and that governmental researchers actually have all the freedom of expression that is required and desired. Silencing of researchers by our public institutions would simply be unacceptable within our democracy. Knowledge accumulated by institutions via public funding fundamentally has to be freely transmitted to the population, especially when socioeconomic and environmental issues as important as those related to fossil fuels and climate are at stake. We fervently hope that many federal researchers attending the meeting in Rimouski will take the opportunity offered by this general public event to prove the surveys wrong, by freely sharing their expertise and opinions about climate, oceanography and natural resources exploitation in the St. Lawrence. This should greatly help the public, journalists and policy makers to better grasp the situation.

You are therefore all welcome, university and government researchers, students, reporters, industry people, coastal residents, as well as all those who are interested in climate, economy and energy, to freely participate in this unique evening of exchanges about an issue that concerns us all.

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Bourgault D., Cyr F., Dumont D. and Carter A. Surface dispersion of a floating tracer released at the *Old Harry* prospect. Manuscript submitted to *Atmosphere-Ocean* (July 2013).

Professional Institute of the Public Service of Canada (PIPSC) (2013). The Big Chill – Silencing public interest science: A survey. 7 pp. Downloaded on December 18th 2013, from the following website : www.pipsc.ca/portal/page/portal/website/issues/science/bigchill

Nature Editorial (2012). Frozen out. *Nature* 483. doi:10.1038/483006a.

Québec-Océan: Did you know that Québec-Océan is an inter-institutional oceanographic research group in Québec.

IMPORTANT NOTE TO CMOS MEMBERS

This year we are required to modify our organisational Bylaws and Articles as described in the attachment in order to retain both our not-for-profit and charitable status under the new legislation on not-for-profits from the Government of Canada. Following consultations with legal council, it has been determined that the wording changes are necessary and will protect CMOS status under the new legal requirements for such organisations. The CMOS Council and Executive Office therefore recommend acceptance of the proposed changes to the assembly. You will find enclosed with the postal shipment of the *CMOS Bulletin SCMO* a copy of the proposed new By-Laws.

AVIS IMPORTANT AUX MEMBRES DE LA SCMO

Cette année, nous devons modifier nos règlements et articles organisationnels, tel que décrit dans la pièce jointe, afin de retenir notre statut "sans but lucratif" et "de charité" selon la nouvelle législation du gouvernement du Canada pour les organismes sans but lucratif. Suite à des consultations avec des conseillers légaux, on a déterminé que les changements de mots sont nécessaires et qu'ils protègeront le statut de la SCMO en vertu des nouvelles exigences légales pour de telles organisations. Le Conseil de la SCMO de même que le directeur général recommandent que l'assemblée accepte les changements proposés. Vous trouverez inclus avec l'envoi postal du *CMOS Bulletin SCMO* la proposition des nouveaux règlements.

CLIMATE CHANGE / CHANGEMENTS CLIMATIQUES

Climate Negotiations Stalled over Two Words

by John Stone[1]

In the early years of the 20th Century, Guy Callendar, an English steam engineer, estimated that with the current fossil fuel use at the time – mostly the burning of coal – carbon dioxide concentrations would reach 314 ppm by the year 2000. In fact we reached that level in the late 1950's. The concentration in 2000 was close to 370 ppm. Pre-industrial levels were about 280 ppm and today we are at 400 ppm - a 40% increase. The Intergovernmental Panel on Climate Change (IPCC) estimates that at the current rate of increase concentrations could be as high as 900 ppm by the end of the century. The threat to the climate and hence to the security of the environment and human society is glaringly clear.

Twenty-five years ago, Canada hosted the *"Conference on the Changing Atmosphere – Implications for Global Security*". It was the first global event in which scientists and governments came together to discuss the threat of climate change and the challenge to our common future. The Conference concluded with the stark statement that: *"Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war*." It also adopted a resolution recommending the reduction of CO_2 emissions by 20% from 1988 levels by the year 2005. Emissions actually grew from about 6 GtC/year in 1988 to almost 8 GtC/y in 2005, more than a 30% increase. This was the first "*aspirational*" commitment that we missed.

The year 1988 also saw the creation of IPCC. Its first Assessment Report in 1990 was presented to the Second World Climate Conference in that year. One of the outcomes of that Conference was the start of negotiations on what would become the United Nations Framework Convention on Climate Change (UN/FCCC). The Convention included a commitment by developed countries to aim to return their greenhouse gas emissions to 1990 levels by 2000 – a weaker aspirational commitment than was adopted in Toronto but sadly again one that we missed. The trend is unmistakable.

When the Convention entered into force in March, 1994, so began the parade of annual Conferences of the Parties (COP) - basically governments that had ratified the Convention. The 19th COP was recently held in Warsaw. Despite almost two decades of negotiations, emissions have relentlessly continued to increase. They are now close to 12 GtC/year and increasing at a rate that parallels the most extreme scenario developed by the IPCC in 2000. The negotiations clearly have not delivered the emission reductions needed, in the words of the UN/FCCC, to avoid dangerous interference with the climate system.

Great and unrealistic, expectations were focussed on the COP held in Copenhagen in the wake of the IPCC's Fourth Assessment Report and the awarding of the Nobel Peace Prize in 2007. Regrettable, the process all but collapsed with a damaging lack of trust between delegations that still has not been fully repaired. A last-minute Copenhagen Accord, negotiated outside of the formal process, attempted to salvage something from the meeting. According to estimate by the United Nations Environment Programme (UNEP), the commitments made in Copenhagen are not being met – there is a significant emissions gap. In an attempted to restart the process it was agreed in 2011 that negotiations would begin on a new global, legally binding regime under the UN/FCCC. The negotiations are to be completed by a COP in Paris in 2015 and come into force in 2020. I'm not sure we can wait.

As though to underline the urgency of taking action, the beginning of the meetings in Warsaw coincided with super-typhoon Hiayan devastating much of the Philippines. The more than 8 thousand participants, roughly half of whom were government delegates, heard an impassioned intervention from the head of the Philippines delegation announcing that he would go on a hunger strike until a "*meaningful outcome*" was reached in Warsaw. The meetings also occurred barely a month after the IPCC Working Group I (IPCC WG I) had concluded its contribution to the Fifth Assessment Report which made a clear case for ambitious mitigation (emission reductions), earnest adaptation (to present and future impacts), and resolute efforts to compensate developing countries (for the loss and damage incurred by climate change). Despite this evidence, according to observers at the Conference, a sense of resolve was sadly notably absent.

[1] Retired Meteorologist and Adjunct Research, Professor in the Department of Geography and Environmental Studies at Carleton University, Ottawa, Ontario.

The UNFCCC process has produced is a wealth of paper, processes, protocols, and mechanisms. We have also come to accept that progress is measured in small steps. One such in Warsaw was the decisions on reducing emissions from deforestation and forest degradation (REDD). This had been under negotiation for years. It goes beyond the use of "sinks" in the Kyoto Protocol to providing clear rules for developing countries to receive financial help for protecting forests.

The issue of "*loss and damage*" entered the UNFCCC's agenda at last year's COP. It turned out to be one of the major sticking points in the Warsaw meeting – mostly over one word: "***under***". The draft decision had put this issue under the rubric of adaptation but the poorer countries insisted on keeping it separate arguing that no emission reductions and adaptation can avoid the impacts that are now occurring and can be expected as a result of past emissions. It took a last minute huddle to remove that one word. Negotiators agreed to create a Warsaw Mechanism to address the issue, but the time line to actually set up a system to compensate countries that have been victims of extreme weather and climate events will not come into effect until after COP21 in Paris. It could all be a case of too little too late.

The second deadlock over one word concerned expectations for national reductions in greenhouse gas emissions. One of the mantras in the negotiations arises from wording that developing countries had written into the UNFCCC, namely that there should be "*common but differentiated*" responses to the threat of climate change depending on a country's past emissions and stage of development. For example, under the Kyoto Protocol only industrialized countries were to take on emission reduction commitments. Twenty years later the division between developed and developing countries is less clear and the wealthier countries, such as Canada, have been insisting that all countries should take on "***commitments***". In the end (literally at the 11th hour, the meeting concluded 27 hours after the scheduled closing time) another huddle was called and elicited a compromise – the use of the word "***contribution"***. The problem with such solutions is that everyone can interpret it as they wish.

Financing to assist developing countries "*contribute*" to tackling climate change remains an unfulfilled promise. Several Funds have been established but they are essentially empty shells and have remained under-subscribed and are insufficient to build the confidence among developing countries that the US$100 billion per year promised at an earlier COP would be realized.

The International Institute for Sustainable Development (IISD) produces an excellent and balanced reporting on a range of environmental negotiations. In its assessment of the Warsaw COP it wrote: "*For some, solely meeting the bare minimum was a further sign of increasingly diminishing confidence in the process, as issues of trust among Parties led to sober reflections on the process itself*." Since Copenhagen, concerns over transparency and process have cast a shadow over the UNFCCC. Unfortunately, for the present this is the only mechanism available. If the process is to be saved and the threat of climate change seriously addressed, a much greater sense of ambition from governments is clearly needed.

Quotes from UN Climate Change Conference in Warsaw

"If not us, then who? If hot now, when? And if not here, where?"

Naderev Sano, Commissioner for Climate Change in the Philippines

"*Warsaw has set a pathway for governments to work on a draft text of a new universal climate agreement so it appears on the table at the next UN Climate change conference in Peru. This is an essential step to reach a final agreement in Paris, in 2015*".

Marcin Korolec, President of the COP19 conference

"We have seen essential progress...

But let us again be clear that we are witnessing ever more frequent, extreme weather events, and the poor and vulnerable are already paying the price...

Now governments, and especially developed nations, must go back to do their homework so they can put their plans on the table ahead of the Paris conference".

Christiana Figueres, Executive Secretary of the UN Framework Convention on Climate Change (UNFCCC)

Reference: UNFCCC website visited November 30, 2013.

CMOS BUSINESS / AFFAIRES DE LA SCMO

Prière de noter que les versions françaises suivent.

Summer Meteorology Workshop
Project Atmosphere 2014

Call for Applications by Pre-College Teachers

As in previous years, the Canadian Meteorological and Oceanographic Society (CMOS) has been invited to select a Canadian teacher to participate in PROJECT ATMOSPHERE. This is a summer workshop for pre-college teachers of Atmospheric Science topics sponsored by the American Meteorological Society (AMS) and the National Oceanic and Atmospheric Administration (NOAA) of the United States. It will take place from **13 to 25 July 2014** at the National Weather Training Center, Kansas City, Missouri.

The essential expenses for the participating teacher are paid by AMS/NOAA, with a financial contribution from CMOS and the Canadian Council for Geographic Education (CCGE). This does not include the travel to and from Kansas City for which CMOS and CCGE provide $300 (Canadian) each (total of $600) to the selected Canadian participant.

Previous Canadian participants have found their attendance a very rewarding and significant experience. Presentations are made at the Workshop by some of the most respected American scientists in the fields of atmospheric and oceanographic sciences. Participants have returned with material, resources, and teaching modules readily adaptable to classroom presentations. The successful candidate will provide CMOS with a short report on his/her summer experience which may be published in the CMOS Bulletin.

Interested teachers can obtain more information on the workshop and an application form on the CMOS website www.cmos.ca/ProjectAtmosphere.html. An application form can downloaded from the CMOS website or requested by writing to the address below.

Completed application forms may be mailed or faxed to the address below no later than **March 15, 2014**.

CMOS - Project Atmosphere Workshop
P.O. Box 3211, Station D
Ottawa, ON K1P 6H7
Telephone: (613) 990-0300 / Fax: (613) 990-1617
e-mail: education@cmos.ca

Summer Oceanography Workshop
Maury Project 2014

Call for Applications by Pre-College Teachers

The Canadian Meteorological and Oceanographic Society (CMOS) has been invited to select a Canadian teacher to participate in THE MAURY PROJECT. This is a summer workshop for pre-college teachers of Oceanographic topics sponsored by the American Meteorological Society (AMS) and the US Naval Academy. This year's workshop is on **6-18 July 2014** at the US Naval Academy, Annapolis, Maryland.

The essential expenses for the participating teacher are paid by AMS, with a contribution from CMOS and the Canadian National Committee / Scientific Committee on Oceanic Research (CNC/SCOR). This does not include the travel to and from Annapolis for which CMOS and CNC/SCOR provide $300 (Canadian) each (total of $600) to the selected Canadian participant.

Previous Canadian participants have found their attendance a very rewarding and significant experience. Presentations are made at the Workshop by some of the most respected American scientists in the fields of atmospheric and oceanographic sciences. Participants have returned with material, resources, and teaching modules readily adaptable to classroom presentations.

The successful candidate will provide CMOS with a short report on his/her summer experience which may be published in the CMOS Bulletin.

For further details about the Workshop, please visit http://www.cmos.ca/ProjectMaury.html

Interested teachers should download the application form (in pdf format) and mail or fax the filled form as soon as possible not later than **March 15, 2014** to the address given below.

CMOS - Maury Project Workshop
P.O. Box 3211, Station D
Ottawa, ON K1P 6H7
Telephone: (613) 990-0300 / Fax: (613) 990-1617
e-mail: education@cmos.ca

Please note that you cannot save a completed copy of this form on your computer, but you can fill it on-screen and print copies afterward.

Please note that the English versions precede.

Atelier d'été en météorologie
Projet Atmosphère 2014

Demande de candidats enseignants de niveau pré-collégial

Comme par les années passées, la Société canadienne de météorologie et d'océanographie (SCMO) a été invitée à choisir un enseignant canadien qui participera au PROJET ATMOSPHÈRE. Il s'agit d'un atelier d'été à l'intention des enseignant(e)s de niveau pré-collégial spécialistes en sciences atmosphériques; cet atelier est parrainé par l'American Meteorological Society (AMS) et la National Oceanic and Atmospheric Administration (NOAA) américaine. Il aura lieu du **13 au 25 juillet 2014** au centre de formation du National Weather Service à Kansas City au Missouri.

Les dépenses de l'enseignant(e) choisi(e) seront assumées par l'AMS et la NOAA, avec une contribution financière de la SCMO et du Conseil canadien pour l'enseignement de la géographie (CCEG). Ceci n'inclus pas les déplacements à destination et au retour de Kansas City pour lesquels la SCMO et le CCEG offrent chacun 300 $ (canadiens), soit un total de 600 $, au participant(e) canadien(ne) choisi(e).

Les ancien(ne)s participant(e)s du Canada ont trouvé leur expérience très enrichissante et stimulante. Les exposés de l'atelier sont présentés par des experts américains les plus réputés dans les sciences atmosphériques et océanographiques. Les enseignant(e)s sont revenu(e)s avec du matériel, des ressources et des modules didactiques qu'ils peuvent facilement adapter dans leurs cours. Le candidat choisi devra écrire un court rapport pour la SCMO de son expérience estivale qui pourra être publié dans le Bulletin de la SCMO.

Les enseignant(e)s intéressé(e)s peuvent obtenir plus d'information en visitant le site de la SCMO sur la toile à www.scmo.ca/ProjectAtmosphre.html où ils peuvent obtenir un formulaire d'application. Ils peuvent également obtenir un formulaire en le téléchargeant du site web de la SCMO ou en le demandant à l'adresse ci-dessous.

Les formulaires dûment remplis doivent être envoyés par courrier ou télécopieur à l'adresse ci-dessous au plus tard le **15 mars 2014.**

SCMO - Atelier Projet Atmosphère
Casier postal 3211, Station D
Ottawa, ON K1P 6H7
Téléphone: (613) 990-0300 / Télécopie: (613) 990-1617
courriel: education@scmo.ca

Atelier d'été en océanographie
Projet Maury 2014

Demande de candidats enseignants de niveau pré-collégial

Comme par les années passées, la Société canadienne de météorologie et d'océanographie (SCMO) a été invitée à choisir un enseignant canadien qui participera au PROJET MAURY. Il s'agit d'un atelier d'été à l'intention des enseignant(e)s de niveau pré-collégial spécialistes en sciences océanographiques; cet atelier est parrainé par l'American Meteorological Society (AMS) et le US Naval Academy. Il aura lieu du **6 au 18 juillet 2014** au US Naval Academy à Annapolis au Maryland.

À l'exception des frais de déplacements à destination et au retour de Annapolis, toutes les dépenses de l'enseignant(e) choisi(e) seront assumées par l'AMS, qui recevra aussi une contribution de la SCMO et du Comité national canadien / Comité scientifique de la recherche océanographique (CNC/SCOR) à cette fin. La SCMO et le CNC/SCOR offrent aussi à l'enseignant choisi 300 $ (canadiens) chacun, soit au total 600 $, pour les déplacements.

Les ancien(ne)s participant(e)s du Canada ont trouvé leur expérience très enrichissante et stimulante. Les exposés de l'atelier sont présentés par des experts américains les plus réputés dans les sciences atmosphériques et océanographiques. Les enseignant(e)s sont revenu(e)s avec du matériel, des ressources et des modules didactiques qu'ils peuvent facilement adapter dans leurs cours.

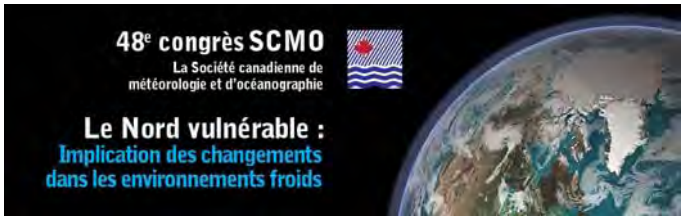
Le lauréat devra écrire un court rapport pour la SCMO de son expérience estivale qui pourra être publié dans le Bulletin de la SCMO.

Les enseignant(e)s intéressé(e)s peuvent obtenir plus d'information en visitant le site web http://www.cmos.ca/ProjectMaury.html. Si vous êtes intéressés, vous devez télécharger le formulaire de candidature (en format pdf) et, une fois rempli, le poster ou le télécopier à l'adresse donnée ci-bas avant le **15 mars 2014.**

SCMO - Atelier Projet Maury
Casier postal 3211, Station D
Ottawa, ON K1P 6H7
Téléphone: (613) 990-0300 / Télécopie: (613) 990-1617
courriel: education@cmos.ca

Prière de noter que vous ne pouvez pas enregistrer votre formulaire rempli sur votre ordinateur mais vous pouvez le compléter sur l'écran et imprimer des copies par la suite.

English version follows.



48ième congrès de la SCMO à Rimouski 2014

Le Nord vulnérable : implications des changements dans les environnements froids

Le 48e congrès de la Société canadienne de météorologie et d'océanographie (SCMO) se déroulera du 1 au 5 juin prochain à Rimouski sous le thème *Le Nord vulnérable : implications des changements dans les environnements froids*. Les conférenciers en provenance des quatre coins du pays et de l'étranger seront reçus à l'Hôtel Rimouski pour la tenue de l'événement.

Les activités débuteront le dimanche 1er juin avec des réunions professionnelles et des ateliers de travail conçus spécialement pour les étudiants et les jeunes chercheurs, dont une introduction au langage R et une formation sur les savoirs et la culture inuit avec les fondateurs d'ARCTIConnexion, une organisation fondée par des étudiants-chercheurs et des professionnels de recherche dont l'un des buts est de sensibiliser les scientifiques à la réalité des communautés inuit de l'Arctique canadien, et vice versa (http://www.arcticonnexion.ca).

Tous les participants seront attendus le dimanche soir à l'Université du Québec à Rimouski (UQAR) pour la réception de bienvenue (*icebreaker*) où seront servis fines bouchées et boissons. Les conférences scientifiques débuteront le lundi matin avec des plénières en lien avec le thème de la conférence. Comme à chaque année, plusieurs sessions de conférences thématiques se déroulant en parallèles permettront aux scientifiques de tous les domaines d'intérêt pour la SCMO de présenter leurs derniers résultats de recherche.

Un *débat public* se tiendra à l'auditorium de l'UQAR le mardi 3 juin où un débat sur le thème épineux de l'exploration des ressources naturelles autour et dans le golfe du Saint-Laurent sera animé par trois personnalités ayant des points de vue contrastés (voir texte de Bourgault et al., en page 28 de ce numéro du Bulletin). Une *journée des enseignants* permettra, par ailleurs, aux enseignants et aux enseignantes des niveaux primaire, secondaire et collégial d'assister à des conférences de chercheurs de renommée internationale et de participer à des activités éducatives et interactives reliées aux thématiques du congrès.

En plus d'un programme scientifique excitant et des traditionnelles remises de prix et de récompenses, le comité organisateur local proposera des activités sociales permettant aux participants de mieux se connaître (soirée étudiante, l'après-banquet au bar la *p'tite Grenouille* avec chansonnier) et de découvrir la belle région de Rimouski, une destination à caractère maritime où la nature occupe une place privilégiée (excursions guidées au Parc du Bic et au site historique de la Pointe-au-Père, etc).

Parc National du Bic; Photo courtoisie de Simon Bélanger

La programmation complète du congrès sera dévoilée au printemps. En attendant, le comité organisateur vous souhaite une belle saison hivernale et vous attend avec impatience aux premiers jours de l'été 2014 à Rimouski!

Programme scientifique

Douze ans après la tenue du congrès annuel de la SCMO à Rimouski portant sur l'*environnement nordique*, le Grand Nord a été témoin d'importants changements affectant l'ensemble des facettes du milieu nordique. On n'a qu'à penser à la fonte record de la banquise de glace de mer recouvrant l'Océan Arctique en 2007 où 1,6 millions de kilomètres carrés de glace ont été perdus, un résultat dépassant les prédictions les plus pessimistes.

Aujourd'hui 3 janvier, au moment d'écrire ces lignes, l'est du pays subit une vague de froid intense sous la barre des -30°C qui fracasse des records, alors que les provinces maritimes et les états du nord-est des États-Unis connaissent un premier blizzard hivernal accompagné de chutes de neige importantes. Des conditions hivernales qui semblent anormales pour la dernière décennie, mais qui étaient soit disant la norme quand nos parents et grands-parents étaient plus jeunes. Ainsi la forte variabilité climatique nous réserve toujours des surprises dans ce climat qui globalement se réchauffe.

Les enjeux, en liens avec les changements climatiques, pour les canadiens, et plus particulièrement pour les communautés nordiques, sont multiples: augmentation de l'accessibilité aux ressources Nord, exposition accrue aux aléas et aux risques naturels, modification des écosystèmes marins et terrestres, etc. Dans ce contexte, les recherches et l'expertise des membres de la SCMO dans les domaines des sciences du climat, de l'atmosphère et des océans se voient de plus en plus en demande dans ce monde en pleine mutation. Ainsi le congrès de 2014 permettra de faire l'état des lieux sur les changements qui s'opèrent rapidement dans les environnements froids, la variabilité

climatique, les prévisions météorologiques dans le nord, la modélisation climatique, les systèmes d'observation *in situ* et satellitaire, la pollution environnementale en milieu froid, les interactions océan-glace-atmosphère-continent, les énergies renouvelables, les impacts sur les communautés et sur les écosystèmes nordiques et bien plus.

Un appel aux contributions a été envoyé aux membres en décembre dernier. Les soumissions de contributions seront acceptées jusqu'au **15 février 2014**, alors que la date limite pour les inscriptions hâtives bénéficiant d'un rabais substantiel est le **11 avril 2014**. Afin de faciliter vos déplacements vers Rimouski, un service d'autocar sera organisé entre Québec et Rimouski avec des départs de l'aéroport de Québec le dimanche 1er juin et des retours le jeudi soir ou le vendredi matin les 5 et 6 juin respectivement. Les membres étudiants de la SCMO sont encouragés à appliquer pour une bourse étudiante d'aide au voyage (jusqu'à 500 $ par étudiant) lors de leur soumission. Pour de plus amples informations, consultez le site internet http://www.cmos.ca/congress2014 ou communiquez avec Simon Bélanger, responsable du comité organisateur local (simon_belan ger@uqar.ca) ou Michael Scarratt, président du comité du programme scientifique (michael.Scarratt@dfo-mpo.gc.ca).

48th CMOS Congress, Rimouski 2014

Northern Exposure : The implication of changes in cold environments

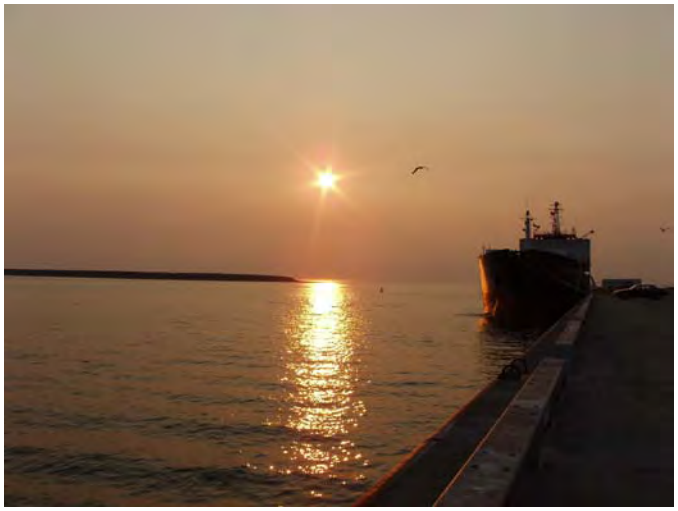
The 48th Congress of the Canadian Meteorological and Oceanographic Society (CMOS) will take place in Rimouski, from June 1 to 5, 2014, on the general theme of *Northern Exposure: The implication of changes in cold environments.* Participants from across Canada and around the world will gather at the Hotel Rimouski for this event.

The program will begin on Sunday June 1st,with business meetings and scientific workshops targeted especially at students and young researchers, including an introduction to the R language and a workshop on Inuit culture and knowledge with the founders of ARCTIConnexion, an organization of students and research professionals whose goal is to build bridges between scientists and Inuit communities in the Canadian Arctic (http://www.arcticonnexion. ca).

All participants are invited to the Sunday evening icebreaker reception at the Université du Québec à Rimouski (UQAR) where light refreshments will be served. The scientific sessions will begin on Monday morning, with plenary presentations complementing the congress theme. As at every CMOS congress, several parallel sessions will be on the program each day where scientists from all disciplines in CMOS can present their latest research.

A *townhouse debate* will be held in the UQAR auditorium on Tuesday June 3, with a deba,te on the thorny topic of natural resource exploration in and around the Gulf of St. Lawrence, led by three prominent figures with contrasting points of view (see article by Bourgault et al.,on page 30 in this issue of the Bulletin). A *Teachers' Day* will offer instructors at primary, secondary, and college levels the opportunity to hear presentations by internationally-renowned scientists and to participate in interactive learning activities related to the congress theme.

In addition to an engaging scientific program and the traditional awards ceremonies, the Local Organizing Committee is also proposing a number of social activities to allow participants to mingle and get to know each other, including a students' night, post-banquet musical entertainment at the "*P'tite Grenouille*" bar, and guided tours of the Rimouski region (Bic Park and the Pointe-au-Père National Historic Site).



Rimouski Pier; Photo credit: Pascal Huot, photograph

The complete congress program will be unveiled in the spring. In the meantime, the organizing committee wishes you all a pleasant winter, and eagerly awaits your arrival in Rimouski for the first days of summer 2014!

Scientific Program

Twelve years after the last CMOS congress in Rimouski, entitled *The Northern Environment*, we are witnessing great changes in the Arctic with major impacts on all facets of the North. Consider, for example, the record sea ice melt in 2007, where 1.6 million square kilometres of ice were lost,

exceeding the most pessimistic predictions. Today (January 3, 2014) as we write this, the country is in the grip of an intense cold wave, with temperatures below -30 °C, while the Maritimes and the northeastern US are being hit by a blizzard and heavy snow. Such conditions have been unusual in recent decades, but might have seemed more normal when our parents or grandparents were young. It seems that pronounced climatic variability can still surprise us in this globally warming climate.

Climate change has many implications for Canadians, and especially for northern communities: increasing accessibility to northern resources, greater exposure to risks and natural hazards, modification of the marine and terrestrial environments, etc. In this context, the research and expertise of CMOS members in the fields of climate, atmospheric and ocean sciences is in increasing demand. The 2014 Congress will provide an opportunity to take stock of the rapid changes in cold environments, climate variability and modelling, meteorological prediction, *in situ* and satellite observing systems, environmental pollution in cold environments, ocean-ice-atmosphere-continent interactions, renewable energy, impacts on communities and ecosystems, and much more.

A first call for papers was sent to CMOS members last December. Contributions will be accepted until **February 15, 2014**, and early registrants will benefit from a substantial discount until **April 11, 2014**. To facilitate transportation arrangements, a charter bus service will be organized between Quebec City and Rimouski, with departures from the Quebec City airport on Sunday, June 1, returning on Thursday, June 5 (evening) and Friday, June 6 (morning). CMOS student members are encouraged to apply for a Student Travel Bursary when submitting an abstract (up to $500 per student). For more information, please consult the congress website http://www.cmos.ca/congress2014 or contact Simon Bélanger, Local Arrangements Committee chair (simon_belanger@uqar.ca) or Michael Scarratt, Scientific Program Committee chair (Michael.Scarratt@dfo-mpo.gc.ca).

Books in search of a Reviewer (Partial list)
Livres en quête d'un critique (Liste partielle)

Latest Books received / Derniers livres reçus

2013-02) *Mesoscale-Convective Processes in the Atmosphere*, by Robert J. Trapp, Cambridge University Press, ISBN 978-0-521-88942-1, Hardback, CDN$86.95, 346 pages.

2013-05) *The Weather and Climate, Emergent Laws and Multifractal Cascades*, by Shaun Lovejoy and Daniel Schertzer, Cambridge University Press, ISBN 978-1-107-01898-3, Hardback, CDN$132.95, 475 pages.

2013-06) *The Self-Potential Method, Theory and Applications in Environmental Geosciences*, by André Revil and Abderrahim Jardani, Cambridge University Press, ISBN 978-1-107-01927-0, Hardback, CDN$121.95, 369 pages.

CMOS SCMO

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Atmosphere-Ocean

Atmosphere-Ocean 52-1 Paper Order

Applied Research / Recherche appliquée

AO-2012-0070
A Model Simulation of Future Oceanic Conditions along the British Columbia Continental Shelf. Part I: Forcing Fields and Initial Conditions
J. Morrison, W. Callendar, M.G.G. Foreman, D. Masson and I. Fine

AO-2012-0071
A Model Simulation of Future Oceanic Conditions along the British Columbia Continental Shelf. Part II: Results and Analyses
M.G.G. Foreman, W. Callendar, D. Masson, J. Morrison and I. Fine

Fundamental Research / Recherche fondamentale

AO-2013-0039
Comparison of Winter Precipitation Measurements by Six Tretyakov Gauges at the Valdai Experimental Site
Daqing Yang and Antonina Simonenko

AO-2013-0026
Aircraft Observations of Orographic Cloud and Precipitation Features over Southern Baffin Island, Nunavut, Canada
S. Fargey, J. Hanesiak, R. Stewart and M. Wolde

AO-2013-0025
Trends in Extreme Precipitation Events in the Indus River Basin and Flooding in Pakistan
Heike Hartmann and Hilary Buchanan

AO-2013-0034
Intercomparison of Oceansat-2 and ASCAT Winds with In Situ Buoy Observations and Short-Term Numerical Forecasts
S. Indira Rani, M. Das Gupta, Priti Sharma and V. S. Prasad

BRIEF NEWS / NOUVELLES BRÈVES

No major hurricanes formed in the Atlantic basin - first time since 1994

The 2013 Atlantic hurricane season, which officially ended on Saturday, November 30, had the fewest number of hurricanes since 1982, thanks in large part to persistent, unfavorable atmospheric conditions over the Gulf of Mexico, Caribbean Sea, and tropical Atlantic Ocean. This year is expected to rank as the sixth-least-active Atlantic hurricane season since 1950, in terms of the collective strength and duration of named storms and hurricanes.

"*A combination of conditions acted to offset several climate patterns that historically have produced active hurricane seasons*," said Gerry Bell, Ph.D., lead seasonal hurricane forecaster at NOAA's Climate Prediction Center, a division of the National Weather Service. *"As a result, we did not see the large numbers of hurricanes that typically accompany these climate patterns.*"

GOES East Satellite Tracks Subtropical Storm *Melissa*, the last storm of the 2013 season. Photo credit: NOAA

Thirteen named storms formed in the Atlantic basin this year. Two, *Ingrid* and *Humberto*, became hurricanes, but neither became major hurricanes. Although the number of named storms was above the average of 12, the numbers of hurricanes and major hurricanes were well below their averages of six and three, respectively. Major hurricanes are categories three and above.

Tropical storm *Andrea*, the first of the season, was the only named storm to make landfall in the United States this year. *Andrea* brought tornadoes, heavy rain, and minor flooding to portions of Florida, eastern Georgia, and eastern South Carolina, causing one fatality.

The 2013 hurricane season was only the third below-normal season in the last 19 years, since 1995, when the current high-activity era for Atlantic hurricanes began.

"*This unexpectedly low activity is linked to an unpredictable atmospheric pattern that prevented the growth of storms by producing exceptionally dry, sinking air, and strong vertical wind shear in much of the main hurricane formation region, which spans the tropical Atlantic Ocean and Caribbean Sea*," said Bell. "*Also detrimental to some tropical cyclones this year were several strong outbreaks of dry and stable air that originated over Africa*."

Unlike the U.S., which was largely spared this year, Mexico was battered by eight storms, including three from the Atlantic basin and five from the eastern North Pacific. Of these eight landfalling systems, five struck as tropical storms and three as hurricanes.

Reference: WMO website visited on December 1, 2013.

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48e congrès SCMO

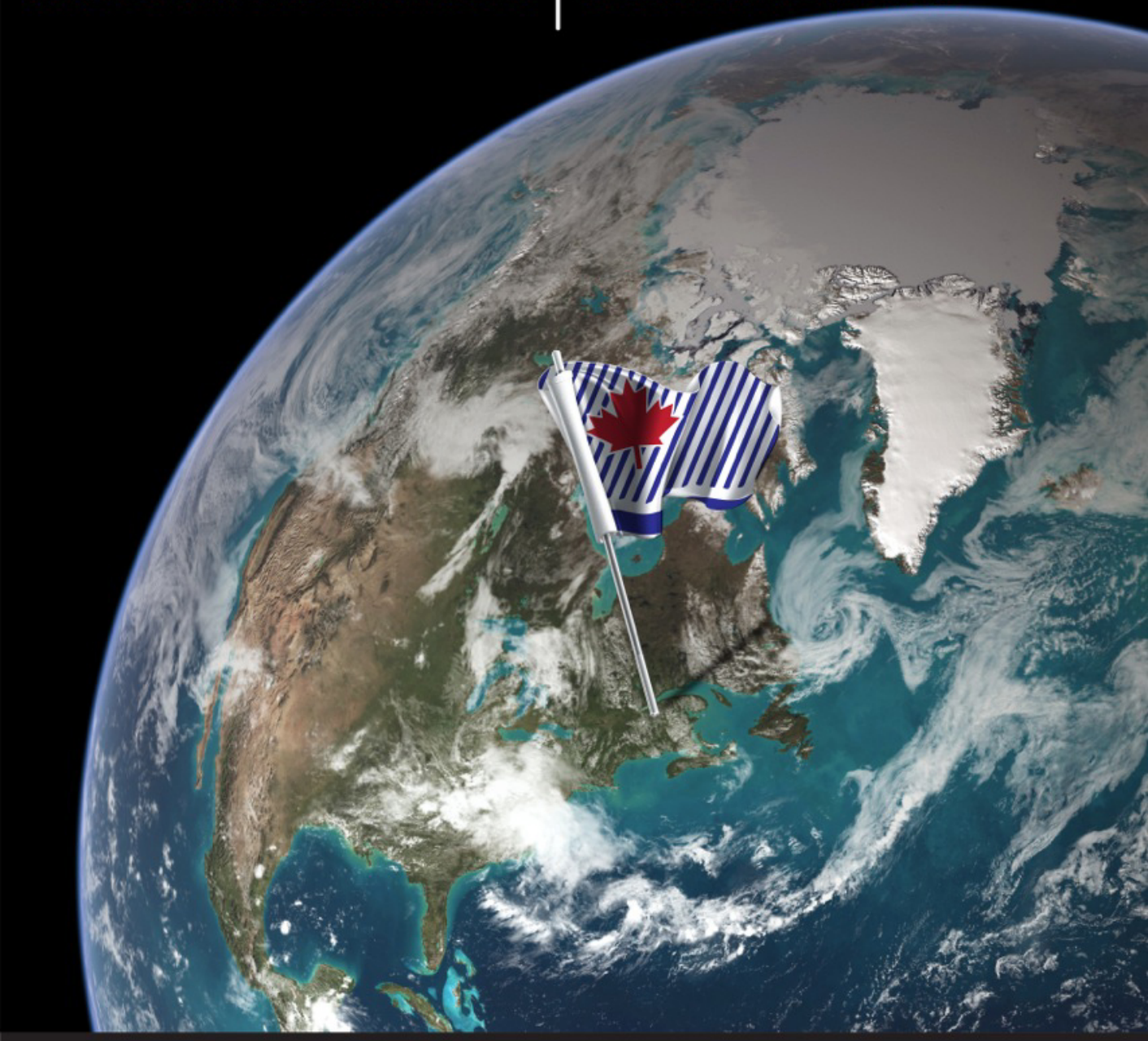
La Société canadienne de météorologie et d'océanographie

48th CMOS Congress

Canadian Meteorological and Oceanographic Society

Le Nord vulnérable : Implication des changements dans les environnements froids

Northern Exposure: The implication of changes in cold environments



Rimouski 2014

1-5 JUIN / JUNE

www.cmos.ca/congress2014

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