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CMOS BULLETIN SCMO

Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

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

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Cover page : There are many aspects to philately. Some people collect the stamps of a single country, while others explore a certain topic through postal items issued by countries from around the world. Postage stamps, first day covers and souvenir sheets reflecting the science of meteorology are not uncommon and can form the basis of a specialized collection examining various facets of weather and climate. To learn more, please read the article on **page 197**.

Page couverture: La philatélie se pratique sous diverses formes. Certaines personnes s'intéressent aux timbres-poste d'un seul pays, pendant que d'autres préfèrent étudier un thème particulier à travers des items philatéliques émis n'importe où dans le monde. Il n'est pas difficile de trouver des timbres-poste, des plis premier jour et des feuillets souvenir qui traitent de la météorologie. Ces items peuvent ensuite se regrouper dans une collection spécialisée qui présente de divers aspects du temps et du climat. Pour en apprendre plus, prière de lire l'article en **page 197.**

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Canadian Meteorological and Oceanographic Society (CMOS)

Société canadienne de météorologie et d'océanographie (SCMO)

Executive / Exécutif

....from the President's Desk

Friends and colleagues:

Geoff Strong, CMOS President
Président de la SCMO

As I write this during late-October, I am reviewing three objectives for CMOS set out in the August Bulletin – in short: (1) increase *CMOS visibility* publicly and politically; (2) address *membership issues*; and (3) encourage formal *collaboration with other societies and scientific groups*. Our Executive, Council, and various CMOS committees are starting to make some progress on these objectives, so I make this the main theme of my message.

Regarding the first objective, few people in the general public would recognize either our name or the acronym CMOS, yet we need that *visibility* in order to effectively represent our membership on issues of science and science policy in Canada. The climate change issue is one important example. Earlier this year, the federal government acknowledged correspondence and signatures from a group of 60 non-CMOS 'scientists' who stated their doubts on IPCC reports on anthropogenic warming through increased greenhouse gases (GHGs), along with their general opposition to the Kyoto Protocol. The prime minister himself has repeated these doubts. A contrary letter from CMOS, which represents most of Canada's atmospheric, oceanographic and climatological scientists, and which confirmed general support for the conclusions of the IPCC report and for Kyoto, received comparatively little acknowledgment or press. CMOS does have among its membership internationally recognized scientists who have individually added their support to the climate issue, but our united stand on such issues is not really seen or understood by the general public. In other words, we are sometimes already 'divided and conquered' by united opposition, simply because we do not have that visibility. As one member put it at our Congress meetings, CMOS needs 'branding' to be acknowledged. We are currently considering the possibility of having a Communications Officer for CMOS who could address visibility (and branding) issues. In the meantime, the CMOS Science Committee has been tasked with an updated policy statement on climate change for possible press release. This updated statement will clarify our stand with respect to climate change, urge government to take immediate actions to curb GHG emissions, and advocate a coordinated global response through the Kyoto Protocol. Previous CMOS policy statements are published at http://www.cmos.ca/policies.html.

(Continued on page 182 / Suite à la page 182)

Volume 34 No.6
December 2006 — Décembre 2006

Inside / En Bref

Articles

Our regular sections / Nos chroniques régulières

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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.

Membership issues are being addressed in various ways by several committees, including the *ad hoc* Strategic Planning and Student Committees, Finance and Investment Committee, Science Committee, and always by Executive and Council of course. Our new Student Committee held its first teleconference meeting during October. Main issues that they discussed included student travel support for the 2007 Congress in St. John's, student outreach, including talks to elementary and high schools, participation in science fairs, plus many suggestions for content in a proposed CMOS electronic newsletter. This is a first great effort by the Student Committee, and we encourage all CMOS centres to give their support to this effort locally, particularly by including students on Centre executives, as students are the current and future lifeblood of CMOS. Another membership enterprise involves the launch of a Flight Service Specialist Accreditation Committee by CMOS, with potential membership of up to 400 flight service specialists (Note: CMOS currently has just over 800 members total). Meanwhile, we welcome other suggestions for increasing membership from our Centres.

On *collaboration*, we are cooperating with several societies, including the Canadian Geophysical Union (CGU), the Royal Meteorological Society (RMS), and the Canadian GeoSciences Council (CGC). During November we will meet with CGU executive to discuss climate change issues and the upcoming joint congress. We have reciprocal agreements for reduced-rate associate memberships with both CGU and RMS. Our collaboration with CGC is limited to attending their annual meeting, as their membership largely consists of geologists and geophysicists and where the time/space scales are orders of magnitude greater than ours.

Other Issues and Events . . . .

● We welcome the opinions of our membership on CMOS Policy Statements – what issues do you feel need to be addressed, how frequent should such statements be made, how should these be publicized (i.e., beyond our web site)?

● Our Tour Speaker, Fraser Davidson (with back-up from Dan Wright), is starting his rounds of centre talks during November. His talk on "*Ocean Forecasts for Canadians: Improving Safety at Sea through Prediction of Ocean Behaviour*" promises to be an interesting one. Please support this program by attending Fraser's (or Dan's) talk in your respective centre.

● Did you know that CMOS is a registered charity and able to issue receipts for donations made to the Society? Donations provide us revenue for CMOS scholarships, for the Roger Daley Postdoctoral Publication Award and for the CMOS Development Fund. If you are interested in contributing, please find the link for "*Donations to CMOS*" on our web site. A good time to do this may be while you are renewing your annual membership.

● Finally, please note that our annual drive to have memberships renewed for 2007 has started. It is especially helpful to receive early renewals in order to replenish low cash reserves at the end of the year and to avoid having to borrow or dip into the reserve fund. Membership fees are the largest single revenue source for the operating budget, closely followed by congress surpluses. Since fees have not changed since 2001, whereas activities and costs have increased substantially since then, it is time to consider raising our fees to bring them back into line with actual costs. This is **your society**, so support it by participating and renewing your membership. We invite you to renew early and easily on-line at www.CMOS.ca.

Sincerely,

Geoff Strong
President / Président

Highlights of Recent CMOS Meetings

September and October were very busy months for CMOS meetings, including Executive meetings (20 September and 18 October), Council meeting (27 September), *ad hoc* Strategic Planning Committee meetings (13 September and 11 October), and the new *ad hoc* Student Committee (05 October). Some highlights of these meetings follow.

Strategic Planning Committee:

• Discussed the need for a CMOS Communications Officer; we are presently collecting a list of tasks for a tentative job description and budget to recommend to Council in December.

• Extensive discussion of climate change issues.

• Discussed potential and ideas for an electronic newsletter for CMOS, likely a monthly publication to supplement the Bulletin with non-conflicting topics such as job postings, timely meteorological/oceanographic events, upcoming workshops, summaries of field research activities, etc. A major focus would be towards graduate students. The main problem with this is having adequate volunteer manpower to oversee, produce and distribute this on a regular basis. No final decision was made, as it requires extensive further discussion.

• Our Executive Director (Ian Rutherford) offered and then drafted a framework for a scientific statement on climate change. This will be submitted to the Science Committee for completion following inputs from several prominent members involved in this area of research.

• Discussed various ways that CMOS could contribute to the International Polar Year (IPY, 2007-2008). This will be reported in a future Bulletin issue.

CMOS Executive and Council Meetings:

• Much discussion on climate change issues has taken place, including the federal environmental audit and proposed new bills on Kyoto and the Clean Air Act, while updated policy statements are also in progress by our Science Committee.

• Routine business items of the Society were discussed and approved at these (3) meetings.

Some revisions to By-Laws are being reviewed by Council members, to be approved at the December meeting.

• Future congress updates are reviewed routinely, including St. John's in 2007 (hosted jointly with CGU), Kelowna in 2008, and Halifax in 2009.

Student Committee:

• Student Committee members discussed student travel support for the 2007 Congress, and are compiling lists of students wishing to attend, while addressing funding needs.

• Discussed participation at regional science fairs and providing talks to elementary and high schools.

• Discussed the potential CMOS electronic newsletter, and came up with a possible list of regular topics, such as job postings, textbook and other book reviews, film reviews (e.g., the Al Gore documentary on climate change), monthly photos, event announcements, summer schools, a Q & A section, fundraising for local student events, and web links. They even produced a tentative outline for a first newsletter.

Next scheduled CMOS meetings are:
• Science Committee, early-November (tentative);
• *ad hoc* Student Committee, November (day TBA);
• *ad hoc* Strategic Planning Committee, 15 November;
• Executive, 29 November;
• Council, 13 December.

Next Issue *CMOS Bulletin SCMO*

Next issue of the *CMOS Bulletin SCMO* will be published in **February 2007.** Please send your articles, notes, workshop reports or news items before **January 5, 2007** to the address given on page ii. We have an URGENT need for your written contributions.

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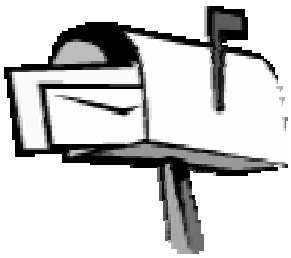
Prochain numéro du *CMOS Bulletin SCMO*

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en **février 2007.** Prière de nous faire parvenir avant le **5 janvier 2007** vos articles, notes, rapports d'atelier ou nouvelles à l'adresse indiquée à la page ii. Nous avons un besoin URGENT de vos contributions écrites.

Letter to the Editor

Date: 20 September 2006

Subject: CMOS Tour Speaker



I would like to express my sincere appreciation to the kind and generous support that the Canadian Meteorological and Oceanographic Society has extended during my tenure as Tour Speaker. Pending any future engagements, the final CMOS Tour Speaker presentation for me was yesterday in Toronto - "Downsview: CSI". I visited all of the CMOS chapters except Newfoundland and Labrador. That makes for a total of sixteen presentations of ***"Art and Weather***" although I have delivered another ten or so for other groups during the past year. Each presentation was different and tailored as much as possible to the venue, location and time.

Quite frankly, I had a "blast". The audiences were very receptive and supportive and I believe we bridged the gap between science and art. There really should be no gap at all between these disciplines. Some even say that "art is the highest form of science". I know that art has helped me with my meteorology and vice versa. The public do appreciate a "realistic forecast" while my art drifts off to impressionism.

The meteorological and oceanographic sciences are both exciting, relevant and vital careers and I feel that CMOS is working hard to promote these truths. The Tour Speaker initiative is just one of the ways to achieve these goals. I look forward to great things from CMOS and these sciences as the world faces the challenges of our changing ecosystem.

As my career as a meteorologist winds down, I will look back fondly at the past year as a definite highlight. Of course, August 2nd, 2006 and "Hurricane Opal, 1995" will be up there as well. These two big events are highlights among many big weather days which I will remember. Of course, I have already forgotten all of the "bust" forecasts. There were indeed "busts" but we hopefully learn from them more efficiently than we do our successes.

Thank you once again for such a wonderful opportunity! I hope to see many of you next year at the CMOS Congress in St John's.

Warmest regards,

Phil "the Forecaster" Chadwick

Micro Meteorological Network in Greater Victoria Schools
www.victoriaweather.ca

by Andrew J. Weaver and Edward C. Wiebe

School of Earth and Ocean Sciences, University of Victoria, Victoria, B.C., Canada

Résumé (traduit par la direction): Les éducateurs travaillant dans le secteur universitaire ont réalisé l'importance d'intéresser toute la communauté dans notre recherche, étant donné que ces gens, comme payeurs de taxes, pourvoient à son financement. Puisque nos domaines de recherche sont pertinents et familiers à la communauté dans son ensemble, la tâche des scientifiques de l'atmosphère et de l'océanographie d'informer le public est plus facile à réaliser. Parmi les défis auxquels nous faisons face, il y en a un toutefois qu'il s'agit de faire comprendre aux éducateurs que la météorologie et le climat fournissent des applications faciles et observables dans les domaines de la physique, de la chimie et des mathématiques.

Introduction

Academics working in the University sector have realized the importance of engaging the greater community in our research as they are the ones who, through their taxes, ultimately fund it. The task of public outreach for atmospheric and oceanic scientists is made easier since our fields of research are so relevant and familiar to the community as a whole. One of the challenges we face, however, is getting across the message to educators that weather and climate provide for easily observable applications of basic physics, chemistry and mathematics. The March 2002 newsletter of the Canadian Association of Physicists (CAP) reported that:

> "At the fall CAP Council meeting, Pedro Goldman of UWO, Chair of the Division of Physics Education (DPE), spoke strongly to draw attention to the serious decline in undergraduate enrolments in physics. He pointed out that this is a major threat to the health of physics in Canada, and proposed a preliminary study to better understand the factors underlying it. … CAP Council agreed that the matter is so serious that seed funding should be made available."

This general observation is supported by data from the US National Center for Education. Statistics that show the total number of physics bachelor degrees has generally declined or remained stagnant since the 1960s, whereas the overall number of bachelor degrees has more than doubled since that time (Figure 1a). A trend similar to the trend in the overall number of bachelor degrees awarded exists with bachelor degrees awarded exclusively in the natural sciences, mathematics and engineering (Figure 1b), although this overall trend is dominated by substantial increases in the computer and biological sciences as well as engineering (Figure 1c).

While the purpose of this article is not to provide an extensive survey of the literature, it is well known that one of the primary reasons for low enrollments in high school and university physics courses is that physics is perceived as being hard and of little practical importance.

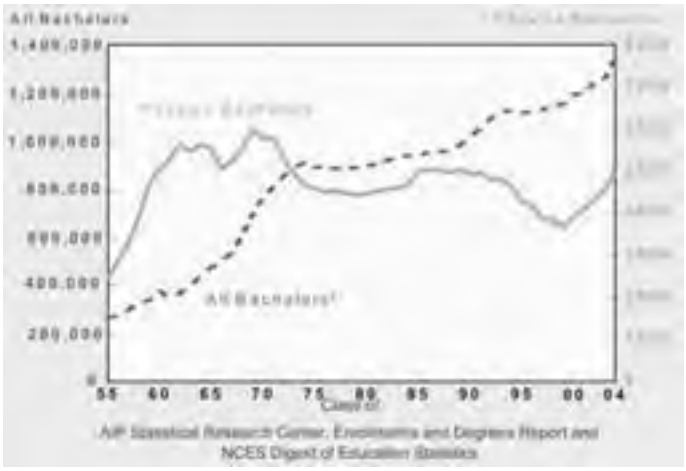


Figure 1a

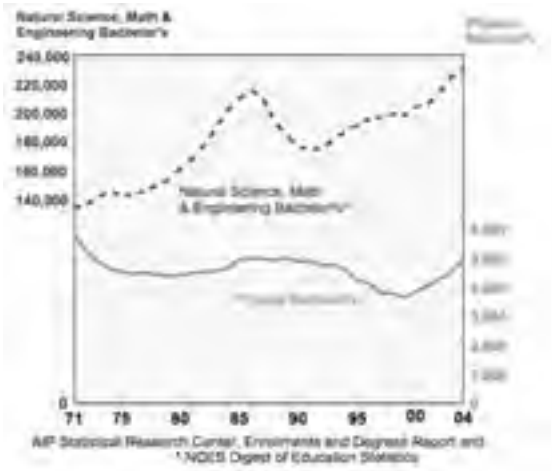


Figure 1b

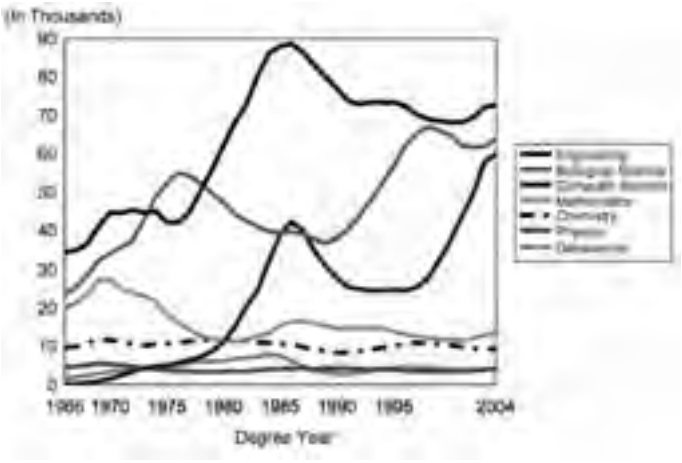


Figure 1c

Figure 1. a) Total number of physics bachelor degrees (orange curve) compared to the total overall number of bachelor degrees (dashed line) from 1955-2004 in the United States. **b)** Total number of physics bachelor degrees (orange curve) compared to the total overall number of Natural Science, Mathematics and Engineering bachelor degrees (dashed line) from 1971-2004 in the United States. **c)** Total number of physics bachelor degrees compared to the total overall number of bachelor degrees in the United States from 1966-2004. Figures provided by Patrick Mulvey, American Institute of Physics, College Park, Maryland.

For example, Williams et al. (2003) conclude that:

> "The major general reasons for finding physics uninteresting are that it is seen as difficult and irrelevant. … Males and females offer different reasons for finding physics boring, with males enjoying practical exercises and females valuing where physics can be seen as relevant."

whereas King and Kennett (2002) point out that:

> "Physics teaching can be made more relevant to 11-16 year-old students by setting the physics content in Earth contexts that pupils can relate to and understand."

Efforts to expose the wonders of physics and mathematics to children should occur at the elementary school level. We believe that by the time students reach high school it is too late as attitudes towards science have already developed. In fact, in British Columbia, atmospheric science has been increasingly incorporated in the science curriculum almost certainly in recognition of the relevance of the science of weather to our daily lives. Weather and climate are perhaps the most easily observable application of basic physics and chemistry (forces, energy, etc.) and the data generated by weather stations allow for 'hands on' examples for use in mathematics and statistics.

Atmospheric Sciences in the K-12 BC Education Curriculum

The British Columbia Ministry of Education undergoes a review and revision of its K-12 curriculum every eight years to ensure that it is both "current and relevant"[1]. A substantially revised and updated K-7 science curriculum was fully implemented effective September 2005, whereas the K-7 mathematics curriculum is being revised slowly over the next few years. A revised Science 8 curriculum will be introduced in 2006-2007, with Science 9 and 10 following in 2007-2008 and 2008-2009, respectively.

The BC K-7 science curriculum is categorized by four curriculum organizers which span all grades (see Table 1). These include *Processes and Skills of Science*, *Life Science*, *Physical Science* and *Earth and Space Science*, with *Processes and Skills of Science* being integrated with and hence cross-cutting between the other three. Atmospheric science and weather play a prominent role in the *Earth and Space Science* theme of the curriculum, especially at the Grade 1 and 4 levels. Weather can also be integrated into the *Life Science, Physical Science* and other *Earth and Space Science* themes at most grade levels.

Similarly, the BC K-9 mathematics curriculum is described by four curriculum organizers: *Number*, *Patterns and Relations*, *Shape and Space*, *Statistics and Probability*. The Statistics and Probability component is further broken down into two curriculum sub-organizers (*Data Analysis* and *Chance and Uncertainty*). Within this latter organizer, and in particular the *Data Analysis* sub-organizer, data obtained from weather stations would provide for real world applications. Finally, two high school courses Earth Sciences 11 and Geography 12 have extensive atmospheric science and weather components to them.

Goal of the project

Over the years we have hosted a number of school tours to our laboratory at the University of Victoria and each time we witnessed first hand the fascination of children with atmospheric science-related demonstrations. We decided that it would be both useful to provide teachers with resources and state-of-the-art interactive technologies to assist them with their delivery of the K-12 science and mathematics curriculum. To this end, an application for funding was submitted to the NSERC PromoScience programme which allowed us to develop a pilot project wherein we installed weather stations (see Figure 2 for a picture of a typical installation) at 20 schools in School District 61 (Victoria).

[1] Source: BC Ministry of Education website: http://www.bced.gov.bc.ca/irp/implement_sched.pdf

	Processes and Skills of Science	Life Science	Physical Science	Earth and Space Science
Kindergarten	• Observing • Communicating (sharing)	Characteristics of Living Things	Properties of Objects and Materials	Surroundings
Grade 1	• Communicating (recording) • Classifying	Needs of Living Things	Force and Motion	Daily and Seasonal Changes
Grade 2	• Interpreting Observations • Making Inferences	Animal Growth and Changes	Properties of Matter	Air, Water and Soil
Grade 3	• Questioning • Measuring and Reporting	Plant Growth and Changes	Materials and Structures	Stars and Planets
Grade 4	• Interpreting Data • Predicting	Habitats and Communities	Light and Sound	Weather
Grade 5	• Design Experiments • Fair Testing	Human Body	Forces and Simple Machines	Renewable and Non-renewable resources
Grade 6	• Controlling Variables • Scientific Problem Solving	Diversity of Life	Electricity	Exploration of Extreme Environments
Grade 7	• Hypothesizing • Developing Models	Ecosystems	Chemistry	Earth's Crust

Table 1: Topics in the British Columbia K-7 Science Curriculum arranged under the four curriculum organizing themes. Taken from: MOE (2005).

Figure 2. Photograph of the Davis Vantage Pro2 Plus weather station installed on top of Oaklands Elementary school in Greater Victoria School District 61.

The goals of this project are several fold. First, we wanted to raise the profile of meteorology in the school curriculum; second, we wanted to demonstrate to students and teachers that physics (meteorology) has great practical importance. Our ultimate goal was to engage and inspire children and young adults in science. The project was initially done in partnership with School District 61 (SD61), through funding obtained from the NSERC PromoScience programme, NEC Corporation and in-kind contributions from Davis Instruments Corporation. As detailed below, the overwhelming success of the initial pilot project led us to expand the network through collaborations with SD62 (Sooke), SD63 (Saanich), SD69 (Qualicum) and SD79 (Cowichan Valley) as well as the local AChannel (CHUM) television station.

Project history

As a first step towards the development of the network we selected 20 elementary, middle and secondary schools in Greater Victoria School District (SD61) that we believed would give the optimal spatial coverage for software development. Administrative staff from these 20 schools were invited by the superintendent of the school district to attend a meeting on January 5, 2005. At this meeting we

presented the objectives of the project and announced the availability of Science Education MEd projects in collaboration with researchers in the UVic Faculty of Education. Schools were invited at the end of the meeting to be involved in the project if they wished, and every one of the 20 schools chose to do so.

The Davis Vantage Pro2 Plus weather station was selected to be installed at each school. Each weather station measures atmospheric temperature, atmospheric humidity, UV Index, incoming solar radiation, wind speed, wind direction and atmospheric pressure (corrected to sea level). We had experience with the Davis weather station by way of the unit we installed on the roof of the Ian Stewart Complex at the University of Victoria on March 11, 2002. This instrument remained in place and provided continuous data for 2 ½ years without the need for maintenance. The first school to have a weather station installed, exactly three years after we installed the weather station at UVic, was Strawberry Vale elementary school (March 11, 2005). The remaining 20 schools on the initial list had stations installed by early June, 2005, a few weeks before the end of the school year.

In order to assist teachers with the delivery of the curriculum, two suites of lesson plans were developed and made available to teachers. The first, written by J. Ramsden (Eagle View Elementary School), provided a weather unit that incorporated the newly reorganized BC science curriculum. It focussed on the grade 4 science and math learning outcomes. The second, written by S. Toleikis (Monterey Elementary School) and A. Weaver (Toleikis and Weaver, 2005), provided an integrated unit for teaching the foundation of the science of weather to students in the late primary and early intermediate grades. We have supplemented The Weather Network learning resource with in-class visits wherein we bring in an uninstalled weather station, along with a number of other demonstrations, to engage classes in the physics of weather.

The initial pilot project received extensive media coverage and the data, available at www.victoriaweather.ca, were well utilized by both educators and the general public. In fact, during the first three months, visitors to victoriaweather.ca increased from 890 in the month of April, to 4,661 in June 2005. We subsequently granted the AChannel (CHUM) the exclusive rights to use the real time data in their live television weather segments in an effort to promote public education in general in the Greater Victoria, Sooke and Saanich School Districts, as well as to build community relationships and partnerships among UVic, the local school districts and the local media.

The project became so successful that we received numerous requests from schools around Greater Victoria, elsewhere on Vancouver Island and, more recently, throughout BC to install weather stations at their schools. We have accommodated all such requests from public schools on Vancouver Island between Victoria and Qualicum Beach. We further assisted the AChannel who added several other stations to the network at Vancouver Island landmarks and tourist locations such as Butchart Gardens, Ocean Trails Resort in Parksville, Tidemark Theatre in Campbell River and Comox Harbour. At the present time we have 67 active installations in Greater Victoria and 7 additional locations on Vancouver Island (see Figure 3). One year after the victoriaweather.ca became public, visitors to our site have increased from 4,661 in the month of June 2005 to 50,372 during the week ending June 18-24, 2006. We have now created an additional site (www.nanaimoweather.ca) to host other Vancouver Island weather stations and plan to install more stations over the coming months.

Resources offered and www.victoriaweather.ca

Each of the Davis Vantage Pro Plus weather stations provides real time observations of temperature, humidity, wind speed and direction, precipitation amount and rate, solar and UV intensity and atmospheric pressure (see also Alpert, 2006). The weather stations are solar powered and transmit data through wireless technology to a local base station which is connected to the internet. All data are visible in real time on a display on the base station which can be mounted on a wall (typically in school libraries, computer rooms or main offices) in public view. Connected to each base station in each school is a monitorless low-end PC which requires internet access. This PC reads the data at each location and forwards them to a central database server at UVic, as well as a mirror server.The web site www.victoriaweather.ca displays the data in real time (up to the minute) in digital form. Charts, graphs and the raw data are made available (see Figure 4 for some examples). Each school has its own web page which lists its local observations and daily, weekly and monthly timeseries (many schools have this linked from their homepage; other schools have students doing daily announcements of weather conditions). Extreme values are displayed for each school and a banner on the front page announces any historical records which are broken.

In addition to the individual school pages, there are summary pages that provide real time maps of weather conditions (temperature, humidity, precipitation accumulated since midnight, UV index, solar intensity, wind speed and direction) across the Victoria region (see Figure 5 for an example). We have also developed software to provide movie loops of recent conditions. Such a system allows students to watch real time movement of, for example, a cold front traveling across the city and allows them to understand the effects of localized land surface conditions and topography (mountains, hills, forests, water, etc.) and urbanization on the microclimate around Greater Victoria. Greater Victoria is an ideal site for such a project as there are extensive variations in the observed precipitation and temperature patterns across the city associated with different elevation, land surface type, proximity to water and direction of the wind.

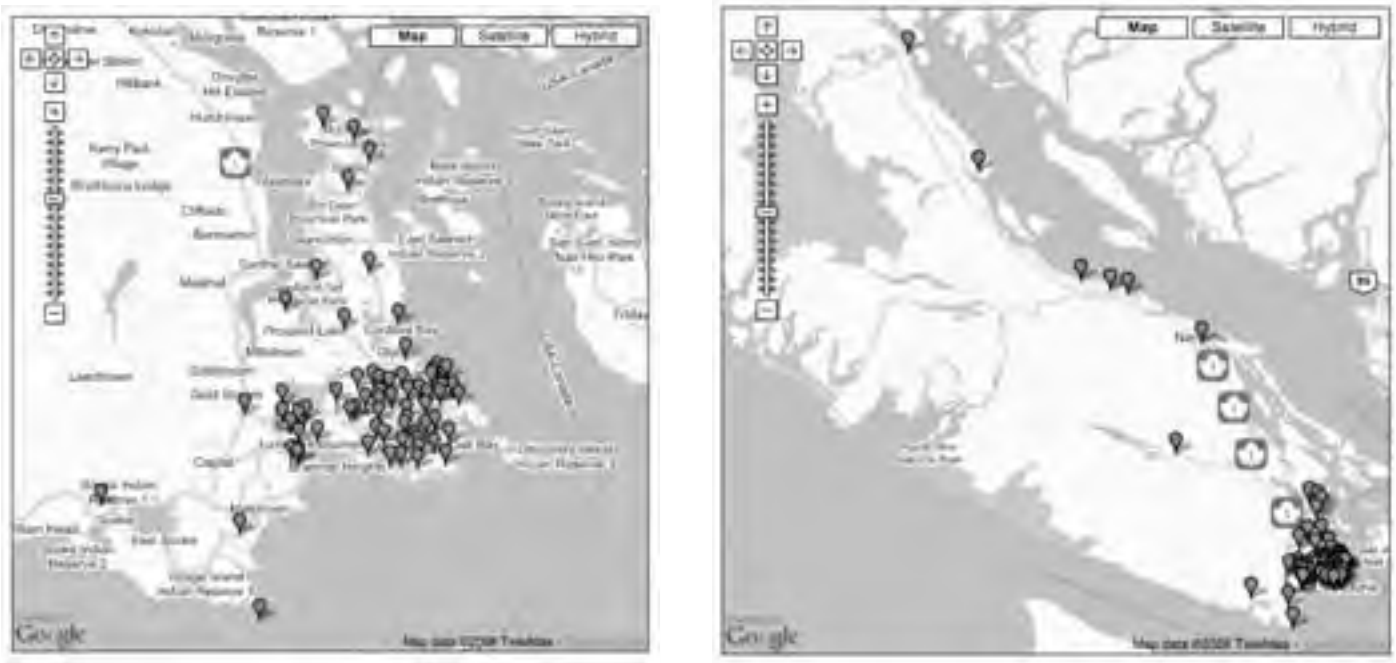


Figure 3. Left: Map showing the location of the 67 weather stations installed in Greater Victoria Schools. **Right:** Map showing the recent extension of the network to schools in Lake Cowichan, Parksville and Qualicum and, in partnership with the AChannel (CHUM), Campbell River, Comox, and Nanaimo (7 stations in total).

Figure 4a

Extreme Values at James Bay Elementary School

Month	Maximum Temperature	Minimum Temperature	Maximum Daily Rain	Maximum Insolation	Maximum Wind Speed	Maximum Wind Gust	Maximum Pressure	Minimum Pressure
January	11.6	2.3	24.8	632.4	53.1	75.6	1032.7	985.2
February	13.1	-2.1	12.4	764.7	50.7	74.0	1037.2	989.5
March	15.2	-0.8	12.2	1036.0	53.5	67.6	1021.0	993.1
April	21.1	2.7	10.2	1109.0	30.8	53.1	1029.9	992.5
May	25.7	5.3	13.7	1331.2	34.5	54.7	1030.2	999.8
June	26.3	8.7	7.9	1427.0	30.8	46.7	1026.1	1001.0
July	25.0	10.1	6.1	1308.0	30.6	45.1	1026.6	1008.9
August	24.1	10.4	21.8	1068.8	35.6	57.9	1022.9	1010.1
September	21.3	5.8	37.3	1143.0	25.4	39.6	1024.9	1005.4
October	17.2	5.1	19.1	868.0	33.9	51.5	1024.8	999.0
November	11.8	1.0	16.7	586.0	48.2	74.0	1036.7	990.6
December	13.4	-0.8	11.4	427.2	38.9	61.2	1034.1	984.9

Figure 4b

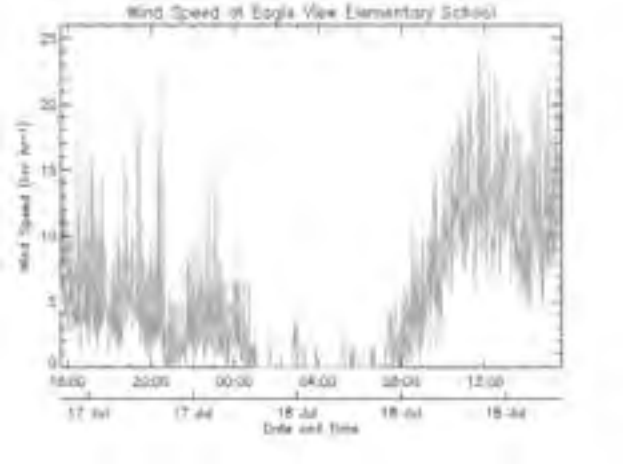


Figure 4c

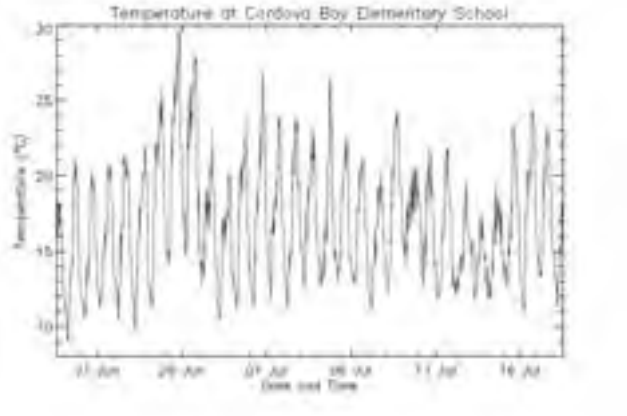


Figure 4d

Figure 4. Sample data displayed on the individual school pages at www.victoriaweather.ca. **a)** Snapshot of real time observations at Winchelsea elementary school in Parksville. **b)** Extreme values for James Bay Elementary School. **c)** An example of a daily timeseries Shown here is the 1-minute average wind speed (orange) and maximum gust (light blue) at James Bay elementary school. **d)** A month long temperature timeseries from Cordova Bay elementary.

As noted earlier, lesson plans and a teaching kit have been made available on the Teacher Resources page (www.victoriaweather.ca/resources.php). We have also added detailed descriptions and pictures of the sensors on the Davis Vantage Pro2 Plus and provide links to manuals on how to use the console in the school. A detailed description of how the weather stations were installed is also available on this site to assist administrators and staff with future installations.

How will the success of this project be measured

Over the past year we received many anecdotal stories from students, parents, teachers and administrators as to how the weather stations were being used in the schools. We were amazed by the diverse range of applications. For example, at some schools young children acted as weather reporters on the morning announcements; at some schools the weather data were used in the mathematics curriculum to understand graphing, addition/subtraction etc. (e.g., how much hotter is it today than yesterday); at some schools students built their own instruments and compared their observations with those from the network; at one school the weather station data were used in association with the operation of a dry kiln (drykiln.sd61.bc.ca) while at another, they were used by a class looking at the design of more energy efficient buildings.

What became clear to us was that collecting the variety of ideas together in one place and then making them available to all educators in the region should be a high priority to maximize the use of the stations. We therefore initiated a survey of teachers and administrators at the 20 schools in SD61 that were first to have their weather stations installed. The survey consisted of a written questionnaire and a voluntary follow up interview. 50 teachers and 32 administrators filled in the written questionnaire and 12 teachers and 10 administrators volunteered for a ½ hour follow-up interview. While an extensive analysis of the surveys/interviews is only just beginning, we will be using the results to:

1) improve www.victoriaweather.ca by adding additional resources as requested by teachers;

2) collating the different ways in which the weather stations have been used in schools and making this available to all local educators;

3) providing in-service to teachers on professional development days.

Where do we go from here

The micrometeorological network in Greater Victoria schools project continues to expand monthly. We recently agreed to install weather stations at five more local schools as well as throughout SD69 in the Parksville/Qualicum area. We continue to work with the AChannel to facilitate continuous monitoring of stations they plan to install in local communities throughout Vancouver Island.

A high priority is also the creation of additional teaching kits and activities for other grade levels. Over the summer we will complete a “Build a Weather Network” teaching activity for the upper primary and intermediate grade levels. We will also build an online interactive statistical package to target the middle and secondary mathematics curriculum. It is hoped that archived data, currently being used by graduate and undergraduate students at the University of Victoria, will also form the basis of Science Fair projects in local schools.

We invite you to visit www.victoriaweather.ca and we would be delighted to receive your feedback and ideas. We can be reached by email at: weather@ocean.seos.uvic.ca.

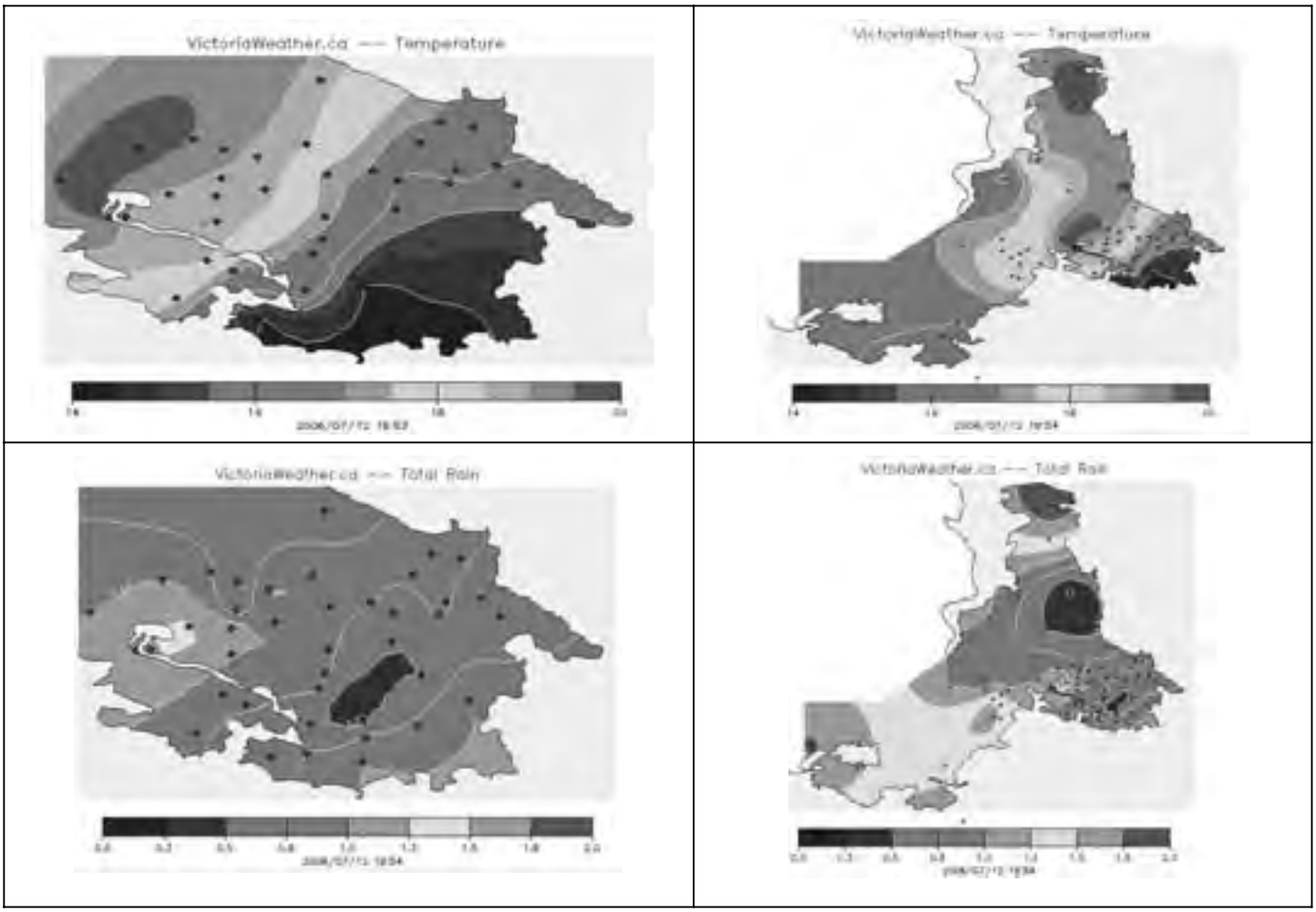


Figure 5. Left: An example of real-time temperature (**top**) and precipitation accumulated since midnight (**bottom**) data for Victoria displayed on www.victoriaweather.ca. **Right:** An example of real-time temperature (**top**) and precipitation accumulated since midnight (**bottom**) data for Greater Victoria including Sidney and Sooke displayed on www.victoriaweather.ca. The red dots indicate individual schools. Movie loops of these plots have also been developed. The data to produce these figures are archived and are available on demand.

Acknowledgements

We are grateful for funding from the NSERC PromoScience program and NEC corporation without which this project would never have been possible. Many scores of teachers, administrators and staff have assisted us across the districts for which we are extremely grateful. We are particularly indebted to J. Gaiptman, the superintendent of SD61, without whose help this project would never have been realised. While it is not possible to list everyone, we are especially grateful for the assistance from: SD61: J. Lutter, C. Parsons, J. Ramsden, S. Toleikis, W. Yee; SD62: G. Gustafson, G. Leamy, G. Treloar; SD63: B. Carbery, R. Pang, A. Sanford; SD69: J. Girard, I. Macdonald, J. Swanson; SD79: R. Rakimov, J. Turner, K. Walters; AChannel (CHUM): C. Basbaum, H. Mack, B. Williams. Finally, we thank S. Lambert of the CCCma and scores of people in Greater Victoria who view the site daily and provide us with valuable feedback.

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An Integrated Approach to Air Pollution, Climate and Weather Hazards[1]

by Gordon McBean[2]

Abstract: "Since climate is the statistics of weather," writes the former head of Canada's national weather service, "climate change is about changing the hazards of weather, and also its benefits, which include rain water for drinking and irrigation, snow for skiing, and warm, pleasant days for recreational enjoyment." Gordon McBean adds: "Weather-related hazardous events have always mattered to Canadians, but their impacts have been increasing." And the impact of such hazards will only increase with global warming. McBean offers some pertinent advice to federal and provincial governments for dealing with the impact of increased weather hazards.

Résumé: Selon l'ancien directeur du Service météorologique national du Canada, « les changements climatiques ont pour effet de modifier les risques liés à la météo mais aussi ses avantages, c'est-à-dire l'eau de pluie qui nous désaltère et irrigue nos terres, la neige indispensable à la pratique du ski ou les journées d'agréable chaleur qui agrémentent nos loisirs ». Gordon McBean ajoute que « les Canadiens se sont toujours intéressés aux incidents climatiques, dont les répercussions ne cessent toutefois de se multiplier ». Et leurs conséquences ne feront que s'aggraver avec le réchauffement planétaire. L'auteur offre aux gouvernements fédéral et provinciaux de sages conseils pour faire face aux dangers croissants liés au climat.

In 1869-70, horrific storms on the Great Lakes caused the deaths of more than 500 mariners. Prime Minister John A. Macdonald responded, and in 1871 the Meteorological Service of Canada was established to provide storm warnings on the Great Lakes and the St. Lawrence River areas. This followed the basic tenet of public policy that there is no role more fundamental for government than the protection of its citizens. Hence, most governments have armies, police and fire departments, and weather services. However, the capacity for governments to provide this protection varies considerably, as the Report of the UN Secretary General's High-Level Panel on Threats, Challenges and Change (2004) noted, "it cannot be assumed that every State will always be able, or willing, to meet its responsibility to protect its own peoples and not to harm its neighbours."

This paper is about this role of governments in protecting their citizens, and in particular about providing advice to the Canadian government on its role in the context of atmospheric-related hazards affecting Canadians. This role involves a mixture of informing and, where appropriate, warning Canadians about hazards, and regulating Canadian activities within the national and international context and the overall perspective of economic, health and environmental policy. Atmospheric hazards include storms, hot and cold days, smog, floods and drought. Since climate is the statistics of weather, climate change is about changing the hazards of weather, and also its benefits, which provide us with rain water for drinking and irrigation, snow for skiing, and warm, pleasant days for recreational enjoyment. The theme of this paper is that consideration of these hazards needs to be integrated across issues, across government ministries and between levels of government, and policy development needs to be based on surveillance and prediction systems and science (natural, physical, social, engineering, health, etc.).

Professor Gordon McBean

Hazards matter because of their impact on people, their property and their socio-economic activities. When the impact is large, we call it a disaster. In the field of disaster management, a hazard is defined as "a potentially damaging physical event, phenomenon or human activity that **may** cause the loss of life or injury, property damage, social and economic disruption or environmental degradation." I have emphasized "may", because the role of governments is to prevent hazards becoming disasters. The damage they cause depends largely on vulnerability, which is "conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards." Disasters result when hazards occur in vulnerable communities. Reducing the impact of disasters requires an approach that addresses both hazards and vulnerabilities.

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[1] Reprint from *Policy Options*, October 2006, pages 18-24, with the permission of the Editor and the author.

[2] Professor and director of policy studies for the Institute for Catastrophic Loss Reduction at the University of Western Ontario. Professor McBean is also Chair of the International Council for Science's International Planning Group on Natural and Human-Induced Environmental Hazards and Disasters and Chair of the Canadian National Committee for the Scientific Committee on Oceanic Research.

Weather-related hazardous events have always mattered to Canadians, but their impact has been increasing. Although the number of geophysical hazardous events (earthquakes, volcanoes, etc.) in Canada has remained approximately constant, the number of weather-related hazardous events has increased from 2-4 per year in earlier decades to about 12 per year in the last decade (with considerable year-to-year variability). Last April, the Prime Minister said in Gander, Newfoundland, that "Newfoundlanders and Labradorians deserve accurate forecasts that reflect the reality of the province's unique weather." I would say that weather is unique all across Canada and that all citizens equally deserve accurate forecasts. If you lived in Nova Scotia in September 2003, you would have heard of the warnings from the Meteorological Service about Hurricane Juan, which hit Nova Scotia with wind gusts up to 230 km/h, waves in excess of 20 metres and widespread damage; at least 8 lives were lost and more than 300,000 people were without power for up to a week-and-a-half.

In Saguenay, Québec in 1996 it was heavy rains causing a flash flood and 10 deaths; a year later it was slower accumulation of water in the Red River creating another massive flood. In 1998, Québec and Ontario heard the warnings of freezing rain and then were hit by an ice storm, with at least 28 deaths and economic costs near $7 billion. In July 2004, it was heavy rains resulting in over $400 million in insured losses in the Peterborough area. In August, 2005, a line of severe thunderstorms swung eastward across southern Ontario, leaving a trail of damage totalling over $500 million — the greatest insured loss in the province's history. The Prairies were impacted by droughts in 2001 and 2002; agricultural production dropped an estimated $3.6 billion during these two years. Twice in the 1990s hailstorms hit Calgary with damages over $100 million each time. Tornadoes also wreak havoc across Canada, particularly the Prairies. In 1987, 29 people died in Edmonton, although Saskatchewan has the unfortunate lead in total number of deaths over the past 150 years. Ontario is second, with the Barrie tornado of 1985 with 12 deaths being the most recent major event. One of my more depressing days was in 2004 visiting the memorial at Pine Lake, Alberta, where on July 14, 2000, a tornado struck, resulting in 12 deaths and 140 injuries, and $15 million in economic losses to the small community. Families had been torn apart, bodies permanently scarred and life-savings lost. Yet the community had been rebuilt just as it was before the storm.

The impact of hazards on Canadians means that governments, insurance companies and individuals have financial obligations. Under the *Disaster Financial Assistance Act*, the federal government ends up paying most of the costs of these disasters, totalling $1.6 billion over the past 30 years. Canadian property insurers experienced record disaster claims in 2005, exceeding $2 billion, and a trend of alarming cost increases over the past few decades.

Climate change is expected to change our physical environment in a number of ways, including more frequent and intense hazardous events and rising sea levels. The 2001 report of the Intergovernmental Panel on Climate Change stated that "it can be expected that the severity of their (weather-related hazards) impacts will also increase in concert with global warming."

In Ontario, the number of hot and smoggy days has been increasing, setting new records in the past two years. According to the Ontario Medical Association, smog resulted in over 5,800 premature deaths and a total economic impact of $7.8 billion in 2005 in Ontario alone. In August 2003, over 35,000 Europeans, almost half in France, died in an extensive and record-setting heat wave. Climate scientists predict that this type of record-setter will occur about one summer in two by mid-century.

Hazard-human interactions range from the localized, short-lived phenomena such as tornadoes that come and go within a few hours, to events of a few days extending across an urban sprawl, such as urban smog or a major snow storm of several days, to regional droughts for seasons to global climate change over decades to centuries. They are interconnected. In the summer, there are smog and no-smog days, not because of different emissions, but because the weather sometimes blows the pollution away and sometimes causes it to accumulate. Drought conditions lead to the risk of wildfire triggered by the lightning. Each of these phenomena creates risks for Canadians, and we are augmenting those risks through the burning of fossil fuels and industrial processes that create the chemicals for smog, and the greenhouse gases for climate change.

It is important to understand the time-scales of hazardous events. Water goes into the atmosphere by evaporation and out by rain, typically within about 10 days. Many ingredients of smog, like sulphur dioxide, are very water soluble and are washed out by rain — acid rain — so they seldom spread beyond the continent. From a policy point of view, that means actions can be taken by governments on a regional basis and the impacts of changes in emissions will be seen quickly. Further, since the atmosphere takes a few years to mix chemicals around the globe, sulphur dioxide does not become globally mixed.

On the other hand, the main human-influenced greenhouse gases, carbon dioxide and methane, are removed by much slower processes, so their atmospheric lifetimes are about 100 years and about 10 years, respectively. Due to the slow response of the oceans, the climate system itself has not yet adjusted to the accumulated greenhouse gases, and it will continue to catch up for many decades after the greenhouse gases concentrations are stabilized. These long lifetimes mean that:

- A global policy approach is needed, because emissions from around the world become mixed and reductions in emissions anywhere have an equivalent global benefit.

- Emission reductions taken now will only deliver benefits in many decades to come.

- Since the developed countries have contributed about 80 percent of present accumulated extra carbon dioxide, the onus should be on the developed countries to take action first, and China and India, which have only recently become big emitters, should join in the emission reduction commitments in subsequent rounds.

Hence, since the benefits of reductions will come well after the next election, and global solutions are difficult to achieve and easier to opt out of, the political imperative for addressing climate change has been lacking.

We can compare these atmosphere-earth system time scales with some societal time-scales. It is estimated that to change energy end-use technologies (e.g., household appliances, automobiles, buildings) takes 1 to 10 years, while it takes 10 to 50 years to change energy-supply technologies (e.g., hydropower, nuclear, solar, wind). It is also estimated that it takes about 30 to 100 years to significantly change social norms and governance; think about how long it has taken to change society on cigarette smoking.

Since disasters result when hazards and vulnerable systems interact, we can decrease the occurrence of disasters by some combination of reducing the hazards and reducing the vulnerability. How can we reduce the hazards? For smog, we can reduce the quantity of pollutants that we put into the atmosphere. The government has said that clean air is a priority. The questions are, how much reduction in emissions is needed, and how can we use regulation and enforcement to make it happen? What about weather; does it not just happen? Yes, but we can influence the changes in weather hazards by addressing climate change through global greenhouse gas emission reductions.

The second and complementary approach is to reduce the vulnerability of communities. Comprehensive vulnerability analyses can lead to an adaptation strategy to reduce the impacts and capture the benefits, if any, of the hazard. An adaptation strategy would provide Canadians with information and advice and a regulatory regime to reduce their vulnerability to dangerous or hazardous extremes in weather, climate and air pollution. It would also involve modifications to existing regulations and legislation, such as land-use planning and building codes. Proactive adaptation, with direct intervention of government, is usually the most cost-effective and efficient plan of action. While we must act bi-nationally to address emissions of the chemicals causing smog and globally to address emissions of greenhouse gases, adaptation strategies need to be developed locally and the full benefits of the investment will come locally: a made-in-Canada approach.

As a basis for these approaches, governments need to undertake environmental surveillance and prediction. Surveillance, which needs enhanced investment, in part to compensate for lack of investment over the past decade, is the basis for prediction of what will or might happen and how actions taken will affect the level of protection. As we look ahead, there will always be some uncertainty in the predictions and impact. In the end, one of the roles of government is the management of risk: how much risk is acceptable?

Daily smog forecasts allow individuals to respond to reduce their vulnerability by reducing exposure. Smog forecasts for a few days allow governments, through regulation, to control emissions and reduce the smog hazard. These predictions of future states should lead to actions that change the outcome; fate can become a choice and choices can make the prediction wrong. A conflict can arise if one agency issues a multi-day smog forecast and another is then pressured to invoke emission reduction regulations.

To achieve acceptable levels of impact on human health, or other risks, what level of emissions can be allowed and how should those emissions be allocated across the economy? The assumption is that there is a threshold value below which human health is not affected, but the threshold usually turns out not to be the same for all people. This puts governments in the position of deciding how much protection is appropriate, given the economic implications and recognition that some Canadians will still be impacted. One helpful approach is that being taken in Atlantic Canada. Combined forecasts of weather and an air quality index are given all the time, with a health advisory included, so that individual Canadians can “self-calibrate” and respond appropriately. This approach needs to be undertaken across Canada. Another issue is that there will often be pollutants transported across provincial and national boundaries, so one government does not have the authority to directly limit all emissions.

When we think about climate change, there is an analogous situation. The objective of the UN Framework Convention on Climate Change (UNFCCC) is the “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic [human-induced] interference with the climate system.” A key question has been, what is “dangerous,” and to whom and when? Canada needs to undertake its own analysis of this question.

Governments, particularly our federal government, now need to address the issues of climate change, lack of clean air and weather-related hazards. My concern is that the approach, based on past history, will be to look at them as separate issues, whereas there is need for a common national strategy. Speaking on Clean Air Day on June 7, 2006, Minister Ambrose said that she “arrived without the preconceived notions and the silo mentality that exists all too often in this [climate change] debate.” I would suggest that breaking down the silos across these issues and

between and within levels of government is what is needed.

At the UNFCCC Workshop on the Adaptation Fund, the minister stated, “To be successful, greenhouse gas mitigation, coupled with adaptation measures, should be integrated into broader sustainable development objectives, such as economic development, energy security, public health, air quality and local environmental protection.” The minister later followed up with these themes at a preliminary session of the UNFCCC conference in Bonn, saying that, “Under the Convention Dialogue, we are to find new ways to work together that can stimulate sustainable development, effectively address the issue of adaptation, realize the full potential of technology, and fully utilize all of the policy tools available to us.”

The concept of sustainable development: “to ensure that development meets the needs of the present without compromising the ability of future generations to meet their own needs,” may be the way to bring together the issues. There are tools now in place, with the requirements for each federal ministry to prepare a sustainable development strategy and the position of the commissioner for sustainable development within the Office of the Auditor General. What is needed is the mainstreaming of these issues into all the functions of government.

The minister has clearly identified “adaptation” as a key issue in the context of climate change and that equally applies to air quality and hazards. There is need for government leadership in the development and implementation of proactive adaptation strategies that deal with the integrated effects of changing air quality, weather and climate and hazards. An adaptation strategy must include actions on disaster management, where the responsibilities at the federal level fall to the Department of Public Safety, which is currently largely fixated on terrorism-related issues. A national disaster risk reduction strategy has been talked about for about a decade but never moved beyond that stage. It needs to be part of this integrated strategy and include investments in disaster risk reduction or adaptation, which will reduce the long-term costs to governments under the present disaster financial assistance mechanisms. That means investing now for benefits to come — which is part of what sustainable development and protecting citizens is all about.

The second part of the national strategy must be to constrain emissions of air pollutants and GHGs into the atmosphere that are causing or will cause Canadians (and others) grief in the decades to come. There is only one atmosphere, and the sources of pollutants are very similar. Because a significant fraction of smog pollutants cross provincial and international boundaries, the approach must be nationally and bi-nationally coordinated. Real targets with measurable benefits and time schedules should be set, so that Canadians can hold governments accountable — part of the accountability regime.

Climate change is a long-term issue. It is unfortunate that the issue too quickly became one of Kyoto — Yes or no? rather than using Kyoto with its limitations as one part of the UNFCCC process. Why should Canada do anything to reduce emissions, since we contribute only about 2 percent of global emissions? Most important is that the climate matters to Canada; warming of our weather, with more extreme events, will have impacts. We have vested interests in limiting climate change, and we must work internationally. We cannot expect China and India to undertake emission reductions if Canada and other developed countries do not lead.

While I was writing this paper the *Economist* magazine came out with a special report on climate change, “The Heat Is On.” It framed the argument from a management-of-risk point of view. It asks whether it is really worth using public resources to avert an uncertain, distant risk, and it concludes “yes.” As it notes, Canada and other countries maintain armies for just such threats. Canada is now engaged in Afghanistan on the basis of the principal logic that the investments are reducing a long-term risk to Canadians and to the world, and that we should do our part. Well, the *Economist* and climate scientists have concluded that action on climate change also deserves investment. The question, then, is, “How much investment and on what time scale?” Since we are going to make investments in clean air, let’s look at how much in the way of co-benefits for greenhouse gas reductions can be gained as well. Can we not analyze each step and have an additional set of criteria, so that our choices maximize the payoff for climate change? Economic efficiency and energy security should be part of the drivers. The National Roundtable on the Environment and the Economy, in its report *Advice on a Long-term Strategy on Energy and Climate Change*, looking to 2050, also linked clean air and climate change and provided specific recommendations. That long-term view is critical and must become part of the public and political debate.

Speaking at the UNFCCC in Bonn, the minister also said that “The situation that each country faces is unique. Each country’s stage of development, levels and sources of emissions, vulnerabilities, adaptation needs and the make up of their economies all differ.” Canada needs to integrate these issues into our international development assistance strategy.

Given that there is agreement on an integrated approach to clean air and climate change, what about weather and related natural hazards? One issue is the fragmented approach within our federal system not only on the emission reductions but also on adaptation. Prime Minister Mulroney gave us some of the tools that are needed for the effective development of policy on these linked issues, namely the National Round Table on the Environment and the Economy, the International Institute for Sustainable Development, and the position of ambassador for the environment.

Hurricane Katrina blows through the Gulf Coast in August 2005. Gordon McBean recommends establishing a national service agency in Canada “on the issues of weather, climate, air quality, water resources and related hazards ... including information about how our activities may impact on the future so that the future could become a choice.”

However, we also need an operational side. We can note that the responsibility for forecasting the weather falls to the Meteorological Service, the usually forgotten part of Environment Canada. The provinces have responsibility for predictions of floods and smog, while there is a mix of players on the drought scene. It is unlikely that a province will give up its regulatory role, but perhaps there could be a merging of responsibilities on the information, as the scientific basis for adaptation and emission reductions. A national agency, implying a merging of federal, provincial, territorial and perhaps municipal interests, in these very scientific, technical areas, could be made to happen with the right leadership. A national service agency would provide — on the issues of weather, climate, air quality, water resources and related hazards — information to make informed decisions on personal and economic matters, on our changing future, for today, tomorrow, next season and next decade, including information about how our activities may impact on the future so that the future could become a choice. The information would be policy-relevant but also policy-neutral. A national adaptation strategy is dependent on this information. Such an agency would need to have responsibilities and be resourced to also do surveillance of the appropriate systems.

Science would form the basis of this service and policy-making. Since the mid-1990s, the government has invested increasing funds in Canadian universities in support of the innovation agenda, but little of that has gone into what I would call science in support of public-good decision-making. Investments in science to provide the best information on clean air, weather, climate, hazards and other areas such as fisheries management result in strong return on investment. There are also functions, such as monitoring our natural environment and the maintenance of major facilities, which are the appropriate direct role of governments. Lack of funding support has now eroded the capacity of government science to deliver the necessary scientific advice, and we have no mechanisms to effectively bring in the university researchers. There is now a need for re-appraisal of our traditional model of science for decision-making. Better integration of university and government-based research capacity, specifically for advice, needs to be pursued. A model could be scientific research institutions, based on sustained government support and directly linked to universities, with accountable roles for delivery of science-based information for decision-making.

During the time of writing this paper, my ideas on the importance of adaptation and linking climate change and hazards were repeatedly reinforced. From September 11 to 14, I participated as a review editor for the North American chapter at the meeting of authors for the Intergovernmental Panel on Climate Change fourth assessment report on climate change impacts, adaptation and vulnerability. The meeting, bringing together authors from around the world, was held in Cape Town, South Africa, and their Minister of Environmental Affairs and Tourism opened the meeting with a call for "real action on adaptation" as the top priority for African countries. He also spoke of the need for deeper emission reductions in the post-Kyoto regime. Another speaker was the Western Cape provincial minister of environmental affairs and planning, whose comments reflected the title of her department. The following week I was in Kuala Lumpur, Malaysia, as the opening scientific speaker at a Regional Conference on Natural and Human-Induced Environmental Hazards and Disasters. Among my comments were that since the beginning of this century, there have been about 470 disasters per year globally, more than one per day where a community was likely overwhelmed beyond its capacity to cope. Weather was the trigger for over 75 percent of the events. At the welcoming ceremonies, the Malaysian deputy prime minister expressed his deep concerns about the impacts on countries. On the way home, I met with economics professors at the National University of Singapore who have established a new institute on risk management.

I opened this paper noting the creation of the weather service by Prime Minister MacDonald 135 years ago. Three factors made that possible. First, the science had progressed enough to make a useful weather forecast possible; second, technology had provided the telegraph to make dissemination of the forecast quick enough to be useful; and third, the disaster provided the political motivation to do it. We have the science and technology, and now we need the motivation; hopefully we do not need await another major disaster.

The challenge before government is then to integrate approaches to these issues and provide the capacity for adaptation strategies for Canadians while addressing emission reductions for Canadian interests. And to provide the institutional change that can make these happen — as a long-term legacy to Canada and global humanity. It is a challenge worth addressing without preconceived notions.

Positions in Oceanic and Atmospheric Sciences

The Centre for Earth Observation Science (CEOS), Faculty of Environment, Earth and Resources, University of Manitoba is seeking qualified candidates for several positions focussing on research into oceanic and atmospheric forcing of sea ice in the northern hemisphere. These positions will work collaboratively within a Network of Centres of Excellence known as ArcticNet on Storms in the Arctic (STAR) (CFCAS funded) and Canadian-led International Polar Year (IPY) projects (pending). Candidates will be expected to have advanced degrees in the physical and/or biological sciences. We seek at least **four** candidates to fill the following positions:

1) Full time field technician to support meteorological and oceanographic research. We seek a bachelor's or master's level candidate with 2 years experience in meteorological and oceanographic instrumentation and field work (http://umanitoba.ca/cgi-bin/human_resources/jobs/view.pl?posting_id=75719);

2) Post Doctoral or Research Associate to examine processes governing physical-biological coupling associated with radiative and freshwater fluxes in the marginal ice zone;

3) Post Doctoral or PhD studentship in the area of meteorological forcing of sea ice within polynyas and marginal ice zones;

4) PhD/MSc studentships to work on oceanic and atmospheric forcing of sea ice growth and decay at a hemispheric scale (remote sensing and/or modelling).

Further information can be obtained by contacting Prof. David Barber (dbarber@cc.umanitoba.ca) or through our web site at www.umanitoba.ca/ceos.

What is Meteorological Philately?

by Garry Toth[1], Don Hillger[2] and Bob Kochtubajda[1]

Résumé: La philatélie se pratique sous diverses formes. Certaines personnes s'intéressent aux timbres-poste d'un seul pays, pendant que d'autres préfèrent étudier un thème particulier à travers des items philatéliques émis n'importe où dans le monde. Il n'est pas difficile de trouver des timbres-poste, des plis premier jour et des feuillets souvenir qui traitent de la météorologie. Ces items peuvent ensuite se regrouper dans une collection spécialisée qui présente de divers aspects du temps et du climat

1. Introduction to Philately

We all know about stamps. Some of us accumulated them as children. Philately is the collection and study of postage stamps and related postal items (e.g. cancellations and postal envelopes and cards with pre-printed stamps). It is a pastime for some and an area of serious research for others. Ever since the first postage stamp was issued by Great Britain on May 6, 1840 (the Penny Black), there have been people who collect and study stamps.

Why do people collect stamps? The reasons are many. As in any type of collection, there is a challenge in putting order into a large mass of material. Postage stamps can be miniature works of art, and so appeal to the esthetic sense of some people. Others are interested in the history of postal services as illustrated by postage stamps and related postal items. Still others are interested in the mini geography lesson implicit in stamps, while a few have the urge to compete and win recognition in philatelic expositions. And, of course, there is a social aspect to the local "stamp club" meetings. It all boils down to people doing something they enjoy.

Philatelists keep track of stamps through the use of stamp catalogues that identify and number stamps, by date and country of issue. In North America, the American *Scott Standard Stamp Catalogue* is most commonly used. Others include the *Stanley Gibbons* from Great Britain, the *Yvert et Tellier* from France and the *Michel* from Germany.

Stamps are often issued in a special pane known as a souvenir sheet: a sheet including one or more stamps and a wide margin with artwork and/or an inscription describing the event being commemorated. Stamps are also found on special envelopes known as first day covers (FDCs): envelopes issued by the official postal authority of a country with a cancellation dated on the first day of issue of the stamps. Destined for collectors, most FDCs include illustrative artwork known as a cachet.

Different people collect stamps in different ways. The traditional collection concentrates on all the different stamps issued by a single country. Another philatelic style involves a particular topic. In such a collection, stamps from any country that relate to the topic are included. Topics are as varied as people's imagination and interests. Some are interested in historical, others in the arts, others in the sciences, and so on.

Figure 1: A Canadian souvenir sheet featuring SARSAT search and rescue activities. A NOAA polar orbiting weather satellite is found to the left of the sheet margin and also on two of the stamps.

Topical stamp collectors often like to collect stamps related to a topic they know well: doctors may collect medicine on stamps, while military people might gravitate toward topics related to the armed forces. People with a scientific background find it natural to work with a scientific topic. For a meteorologist who has some interest in philately, what more natural area of specialization could there be than meteorology and climate on stamps? It turns out that many such stamps that have been issued by countries around the world.

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Figure 2: Three Canadian stamps: a) celebrating the 200th anniversary of Canada's first long-term weather observations from a single location; b) featuring the Chinook wind; and c) commemorating the International Hydrological Decade with tipping bucket rain gauge.

2. Meteorology and Philately

There are stamps that illustrate various meteorological instruments and radiosondes. Other stamps feature national meteorological centres, or weather maps with fronts and isobars, or tropical storms, or meteorological satellites, or meteorologists. Climate is the theme of many meteorological stamps, and climate change and the greenhouse effect are referred to on a few. Since the late 1980s, many stamps relating to ozone have been produced. There are also a large number of stamps that relate to the World Meteorological Organization. For example, the World Meteorological Day, which takes place each March 23, has been celebrated by the WMO since 1961. Through the years since then, over 200 stamps that commemorate the World Meteorological Day have been issued by countries around the world. Similarly, 1973 marked the centenary of international meteorological cooperation (the precursor to the WMO, known as the International Meteorological Organization, was founded in September, 1873 at the International Meteorological Conference in Vienna). Many stamps were issued to commemorate that anniversary. The WMO itself was proclaimed a United Nations Agency in 1949, and came into formal existence in 1951. In 2000 and 2001, 35 stamps were issued around the world to commemorate the 50th anniversary of the WMO. Of course some of these stamps can have multiple meteorological themes: many stamps issued in relation to the WMO also show, for example, Stevenson screens, radiosondes and other meteorological instruments.

International science programs have also been recognized. Research activities associated with efforts such as the 2nd International Polar Year (1932-33), the International Geophysical Year (1957-58), the International Years of the Quiet Sun (1964-65) and the International Hydrological Decade (1965-1974) have appeared on many stamps. Some of these stamps contain meteorological elements.

3. Canadian Meteorology-Related Stamps

Has Canada issued any stamps related to meteorology? Yes, there are a few. The most recent, issued in 2005, is found in is a souvenir sheet of four different stamps featuring SARSAT search and rescue activities (*Scott* 1831 – Figure 1). A recent NOAA polar orbiting weather satellite (some of those satellites carry the transponders used in the SARSAT program) is illustrated on one of those stamps and also on the border of the souvenir sheet. A stamp from 1968 (*Scott* 479 – Figure 2a), was issued for the 200th anniversary of the first regular weather observations in Canada: William Wales conducted weather observations near present-day Churchill for approximately one year, in 1768. This stamp also shows a weather balloon and a weather radar antenna. The interested reader can consult http://peel.library.ualberta.ca/cocoon/peel/39/3.html for a fascinating summary of the observations taken by Wales. The chinook wind (*Scott* 1336 – Figure 2b) is included in a set of stamps issued to celebrate Canadian folklore in 1991. Another stamp from 1968 (*Scott* 481 – Figure 2c), issued to commemorate the International Hydrological Decade, also shows a tipping bucket rain gauge. Lastly, a stamp from1990 (*Scott* 1287 – Figure 3) commemorates the 150th anniversary of continuous weather observations in Canada (they started in 1840 in Toronto). This stamp features a summertime weather observation presented in the standard plotting model one would find on a surface weather analysis. It is the only known stamp featuring all the standard weather elements plotted together in this way. The background illustrates what the weather situation for this case might be like.

Figure 3: Stamp honouring the 150th anniversary of continuous weather observations in Canada and including a weather observation in the standard surface plotting model.

Figure 4: Souvenir sheet from Dominica of two stamps illustrates a satellite image and computer-generated weather map. Surrounding the stamps are the eight Greek gods of wind: Boreas (north wind), Notus (south wind), Apeliotes (east wind), Zephyrus (west wind), Lips (southwest wind), Skiron (northwest wind), Eurus (southeast wind) and Kaikias (northeast wind).

Figure 5: A recent first day cover issued by th British Antarctic Territory illustrating the topic of climate change and related research activities.

4. Meteorological Stamps from Around the World

Canada, of course, has no monopoly on stamps related to meteorology. They have been issued by almost every country in the world. In this section we present just a few examples of the wide variety of international meteorological philately stamps. In Figure 4 is a nice souvenir sheet from Dominica (*Scott* 360a). Issued for the centenary of international meteorological cooperation in 1973, this sheet includes two stamps showing a satellite photo and a computer-generated weather map, possibly of mean sea level pressure. In the border are found representations of eight Greek wind gods. Figure 5 shows a recent first day cover including a set of stamps issued by the British Antarctic Territory (*Scott* 342-344) with the theme of climate change. In this case the theme of climate change is specified on the envelope, and an Antarctic scene is illustrated. In Figure 6a is a German stamp (*Scott* 1102) with a weather map including fronts and isobars. This one was also issued in 1973 for the centenary of international meteorological cooperation. Hurricanes are found on quite a few stamps. Figure 6b depicts hurricane Gilbert on a stamp from Belize (*Scott* 974). Clouds are also nicely illustrated on some stamps. For example, Figure 6c shows a cumulonimbus cloud on a stamp issued by Zimbabwe (new issue, catalogue number not yet known). Finally, another new issue from the French Southern and Antarctic Territory (Figure 6d), includes a graphic of the increasing concentration of atmospheric CO_2 at the Port Amsterdam observing station during the last 25 years.

5. Virtual Meteorology Philately

There are many on-line sources for stamp information, including some with information on meteorology philately. The most comprehensive Internet site for viewing meteorological stamps and associated philatelic materials is:

http://www.cira.colostate.edu/ramm/hillger/weather.htm

This website contains detailed lists and many images of stamps and postal items in various meteorological categories. A detailed philatelic listing of scientific satellites in general, and meteorological satellites in particular, is found at:

http://www.cira.colostate.edu/ramm/hillger/satellites.htm

These sites are a good starting point for someone who wants to get into meteorological philately, or a reference for someone already working in the field of weather and climate.

6. Conclusion

We hope that the reader has enjoyed this brief tour through the wonderful world of meteorological philately. For those working in the field of weather and climate, a thematic meteorology philately collection is a fine way to combine professional interest with personal pleasure. The authors would be pleased to correspond with people who wish to learn more about weather and climate on stamps.

(Continued on next page)

Figure 6a

Figure 6b

Figure 6c

Figure 6d

Figure 6: Some examples of different stamps highlighting a) a weather map; b) hurricane Gilbert; c) CB cloud; and d) atmospheric CO_2 increase.

Appel de mises en candidature pour la médaille Timothy R. Parsons (sciences de la mer)

Nous sollicitons des mises en candidature pour la médaille Timothy R. Parsons, remise à des scientifiques qui se sont distingués dans un domaine de recherche multidisciplinaire lié aux sciences de la mer. Veuillez nous les faire parvenir d'ici le 28 février 2007. En 2006, Ken Denman et Trevor Platt ont tous deux reçu une médaille. Les chercheurs qui œuvrent au sein d'une institution canadienne et dont les travaux profitent au Canada sont admissibles. Une médaille sera décernée pour souligner une carrière extraordinaire ou une réalisation récente extraordinaire. Pêches et Océans Canada remettra la médaille Timothy R. Parsons 2007 durant le congrès de la Société canadienne de météorologie et d'océanographie, qui se tiendra en mai 2007, à St. John's, Terre-Neuve-et-Labrador.

Vous pouvez remplir le formulaire en ligne disponible à l'adresse suivante :

http://www.dfo-mpo.gc.ca/science/Awards/Parsons_f.htm,

et nous le faire parvenir par télécopieur, au 613-990-0313, ou par la poste au :

Comité de la médaille Timothy R. Parsons
Bureau de la promotion stratégique des sciences
200, rue Kent, bureau 8W135
Ottawa (Ontario) K1A 0E6

Did the current El Niño arrive as a surprise?

by William W. Hsieh[1], Aiming Wu[1] and Benyang Tang[2]

Introduction

The sea surface temperature (SST) anomalies in the tropical Pacific have been displaying the patterns of a developing El Niño episode. The warming has started relatively late in the calendar year for an El Niño; in fact, as late as 17 August, 2006, the forecast from the International Research Institute for Climate and Society (IRI) read:

> "The observations and models suggest that neutral conditions will most likely be in place through 2006. Out of a large set of dynamical and statistical forecast models, most predict neutral conditions continuing throughout 2006. Overall, based on model forecasts and current observations of the ocean surface and subsurface, the probability of a La Niña is much less than the climatologically expected odds of 25%. The probability of developing El Niño conditions is between 35-40%, and that of maintaining neutral conditions through the end of 2006 is 60%." By September, the tropical Pacific SST anomalies have started to resemble a weak El Niño pattern.

If this El Niño has been somewhat of a surprise, how well has it been forecasted?

Methodology

Around the middle of each month, IRI collects the seasonal forecasts from 12 dynamical and 8 statistical models from the international community, and plots the prediction plume of the SST anomalies in the Nino3.4 region (in the eastern-central equatorial Pacific) from the 20 models

(http://iri.columbia.edu/climate/ENSO/currentinfo/SST_table.html).

From the IRI monthly archive, we can go back to early 2006 and see how the individual model forecasts evolved as the year progressed. For instance, in April, 2006, the individual models issue forecasts for AMJ (April-May-June), MJJ, ..., DJF. Among the AMJ to DJF values, we recorded the maximum Nino3.4 SST anomaly value forecasted, as an indication of the maximum warming forecasted by the individual model as of April 2006. This process was repeated for the model forecasts issued in May 2006 to October 2006. We then plotted the forecasted maximum SST anomalies issued in the months from April 2006 to October 2006 by each model.

IRI defines the thresholds for El Niño and La Niña by the top and bottom 25-percentiles in the Nino3.4 SST anomalies. The thresholds vary seasonally-- for OND the threshold for El Niño is 0.75°C, and somewhat lower for other seasons. We will apply the threshold of 0.75°C to the maximum Nino3.4 SST anomaly issued by an individual model to determine if the model has forecasted an El Niño for 2006-2007.

Results

In Figure1a, the forecasts by the 12 dynamical models are shown. Once a model has forecasted a maximum Nino3.4 SST anomaly of at least 0.75°C, it needs to maintain its forecasts above this threshold in order to be considered as having made a *consistent* El Niño forecast. After all, a model which simply flip-flops every month between El Niño and La Niña could "forecast" every El Niño and La Niña, but such forecasts would be completely useless. For instance, the NASA/NSIPP model went above this threshold in its forecasts issued in April 2006, but then fell below this threshold in May, June and August, so a *consistent* El Niño forecast has only been achieved since September 2006. The 0.75°C threshold has been consistently surpassed in the SNU (Korea) model since April 2006, in the Scripps Inst. HCM (hybrid coupled model) since June 2006, and in the UKMO model and the COLA ANOM model since July 2006.

In Figure 1b, the forecasts by the 8 statistical models are shown. The 0.75°C threshold has been consistently surpassed in the Univ.BC Neural network model since June 2006 and in the Landsea/Knaff CLIPER model and the FSU Regression model since July 2006.

Conclusion

Although this current El Niño has made a somewhat surprise appearance in September, three models, namely the SNU (Korea) model, the Scripps Inst. HCM and the Univ.BC Neural Network model, have been able to provide useful forecasts at least 3 months in advance. The strength of the developing El Niño is quite different in the 3 models--the SNU and Scripps models forecasted only a weak El Niño (0.9°C maximum warming in Nino3.4 in their October 2006 forecasts), whereas the UBC model forecasted a moderate El Niño (maximum warming of 1.6°C). Over the next few months, Mother Nature will tell us which of the models correctly forecasted the strength.

Reference

http://www.emc.ncep.noaa.gov/research/cmb/sst_analysis/images/tpacv2.png

Note: Figures 1a and 1b are shown on next page.

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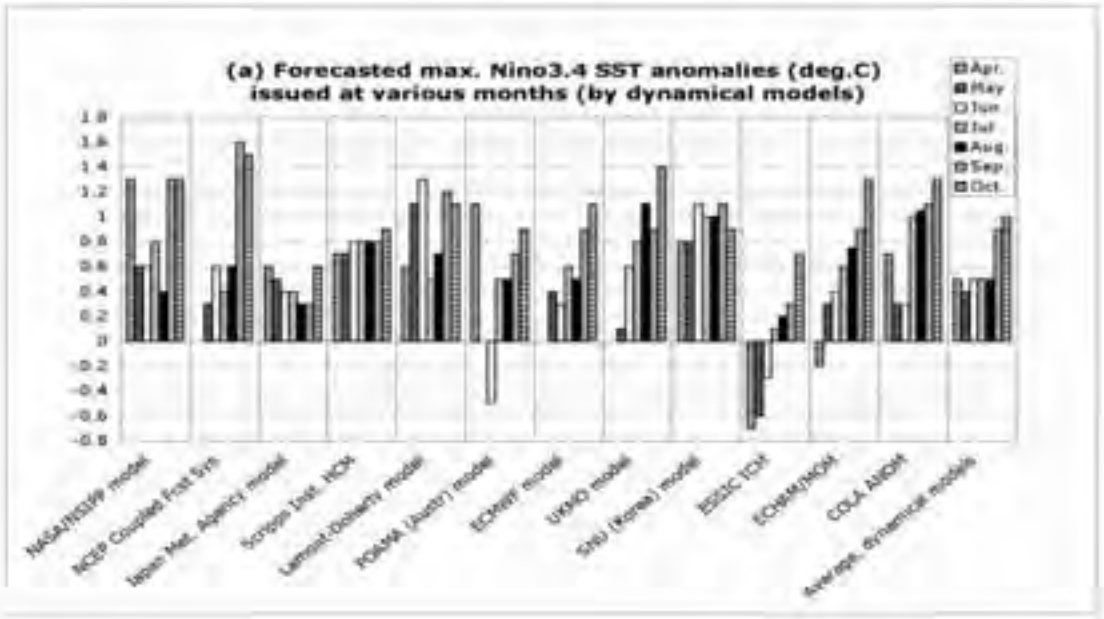
[2] Jet Propulsion Lab, Pasadena, CA, USA



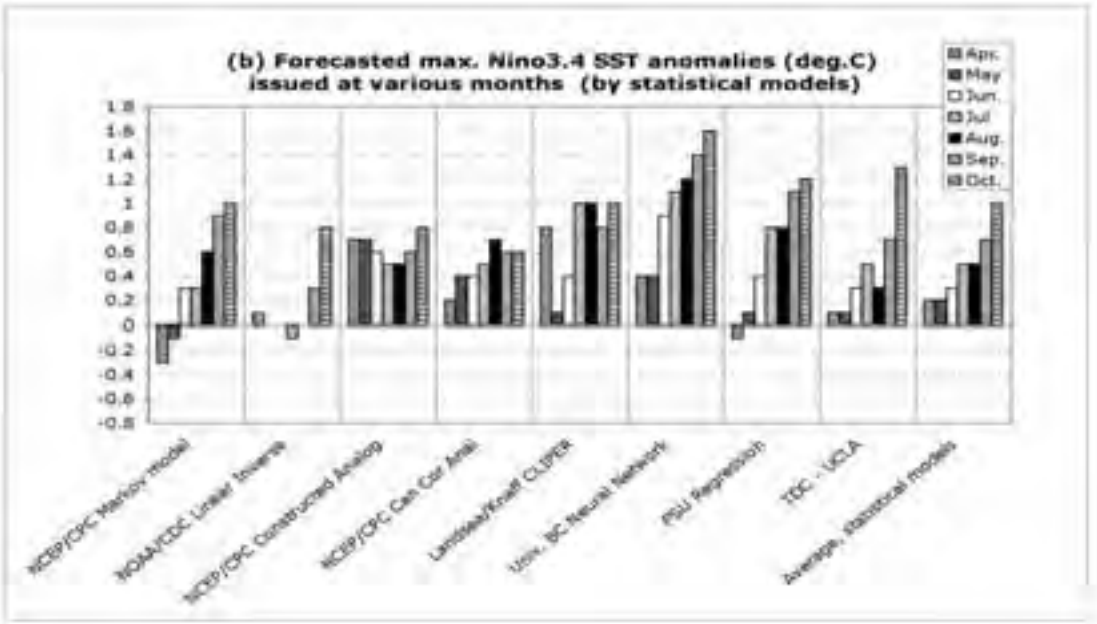


Figure 1. Maximum Nino3.4 SST anomalies forecasted by (a) dynamical and (b) statistical models issued at various months from April 2006 to October 2006. (Any missing value was linearly interpolated from its two nearest neighbours, as was done for the June value in the TDC-UCLA model, and the August value in the ECHAM/MOM model and the COLA ANOM model).

The Oceans and Climate
2nd Edition

by Grant Bigg

Cambridge University Press, Cambridge, UK
2003, 273 Pages
Paperback, 0-521-81570-3, US$50 (Reviewed)
Hardback, 0-521-01634-7, US$100

Book reviewed by Chris Wielki[1]

Since the oceans are a primary component of the earth's climate system, knowledge of them and their interaction with the other components are vital to knowing where our climatic state has been, and where it is going. This book addresses these issues in seven chapters, and four appendices. The first chapter discusses the five components of the climate system and climatic feedbacks. The next four chapters discuss atmosphere and ocean interactions with a break- down into chemical, geochemical, physical and large-scale interactions. The last two chapters go through climatic states in the past and present, and discuss possibilities for the future. Additions to the second edition include: updated international views on climate (the previous edition was published before the 1995 IPCC report), additional information on thermohaline processes, and reorganization to reflect changing importance in climatic modelling.

The book begins with a historical reference to Jean-Baptiste Fourier who speculated in 1827 that human activities had the capacity to affect the climate of the earth. In 1897 Svante Arrenhius discovered that the amount of carbon dioxide in the atmosphere had effects on the global temperature through the greenhouse effect. Furthermore, G.S. Callendar showed that carbon dioxide in the atmosphere was increasing due to human activities.

Chapter one (the climate system) opens by defining climate and discussing the variables and assumptions associated with the definition. The chapter goes on to discuss solar radiation with sections pertaining to both Stefan-Boltzman and Planck's Laws and has a calculation of an effective temperature of the earth. These concepts are glossed over fairly quickly and are covered better in most introductory atmospheric science texts (such as Hobbs and Wallace, 1977). The chapter then goes through the components of the climate system (atmosphere, biosphere, ocean, geosphere, and cryosphere). These sections are well written and are a good introduction to each component. However, a reader without a background in ocean sciences could easily be confused by black and white figures depicting the three-dimensional thermohaline circulation. It should be noted that the figures are generally a weakness of this book. Final sections review timescales of climatic processes, feedbacks within the climate system, numerical modelling, and how the climate has varied over time. The section on past climate positions is a very good introduction as is most of this chapter.

In chapter two (physical interaction between the ocean and atmosphere) energy and matter exchange between the atmosphere and ocean from a physical perspective is the focus. The chapter begins with a look at radiation, going over Rayleigh scattering, and the changes in the reflectivity of water at varying angles. Bigg then has a section on heat exchange, with an interesting discussion on how winds influence the energy exchange between the oceans and atmosphere. The strength of this chapter is the section on the Ekman spiral and Langmuir circulation, which are very well illustrated and described. The chapter is very busy, as there is a lot of material to go over; however, concepts are well described. Other material covered in this chapter includes momentum transfer, wave production, monsoonal circulation, thermohaline circulation, coastal upwelling, and hydrostatic balance, to name a few.

Chapter three (chemical interaction of the atmosphere and ocean) is well done; however, readers would want basic knowledge of chemistry to fully appreciate this chapter. Bigg goes through the solubility of common atmospheric gases and has a very interesting section on sea-states and its impact on gas transfer. He goes on to a description of the carbon cycle, which includes a significant amount of chemistry with limited text to accompany it. The carbon cycle discussion goes over the annual carbon cycle, and differences between the Atlantic and Pacific oceans (primarily a discussion of upwelling). The chapter closes by going over the O^{16} to O^{18} ratio and its correlation to temperature. This is a quick discussion and is covered much better in chapter 6. Other topics covered include: oxygen in the ocean, photochemical reactions in sea water, cloud and precipitation formation, as well as winds in the planetary boundary layer and their correlation to sea salt concentration.

Chapter four (biogeochemical interaction of the ocean and atmosphere) discusses biological processes that may influence the climate, and assesses their importance. It starts with a thorough section on phytoplankton, the tiny organism that is the base of numerous food chains. There is a good discussion about controls on phytoplankton growth (such as nitrate, radiational penetration into the ocean, and phosphorous). Bigg also discusses the spring bloom, vertical variation and ocean colour, and the geographic variation of phytoplankton. The chapter goes on

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to overview various biogeochemical cycles and dimethyl sulphide's impact on climate.

In chapter five (large scale air-sea interaction) El Niño, coupling of the atmosphere-ocean accompanying abrupt changes in thermohaline circulation and longitudinal biases in the positioning of pressure systems are the focus. The section on El Niño is very good. It touches on what El Niño is, reasons for El Niño and the effects around the world, to name a few. Abrupt thermohaline catastrophes talks about freshwater moderators, Heinrich events (with a focus on the Younger Dryas), and the potential impact of the Mediterranean outflow on climate. The other section on tropical pressure systems and the ocean goes over mean sea level pressure patterns (seasonally) and their effects on the ocean, North Atlantic Oscillation (NAO), and cyclogenesis and its effects on the ocean (with a focus on the ocean's biosphere).

Chapter six (the ocean and natural climatic variability) explores how the mechanisms from the previous chapters have influenced climatic variability. It goes through the ocean's role in climate during the Paleozoic, early Mesozoic, Cretaceous and Tertiary geological times. There is a special focus on the Quaternary glaciation, which includes a section on the Milankovitch cycle. The chapter ends looking at the recent past of the twentieth century by discussing the instrumental record (ways of measuring variables such as temperature, sea surface temperature, cloud cover, and air pressure) and standards of their measurement. There have been numerous changes to measurement standards and many of these changes alone could be thought to be climate change if you did not know of them. Furthermore, the chapter goes over the Pacific (ENSO, the effect of stronger Aleutian lows on the twentieth century climate over the Pacific), Indian (focussing on monsoons), and Atlantic (NAO and the great salinity anomaly) ocean climates.

Chapter seven (the ocean and climatic change) looks at the reasons for the present state of the earth system, both natural and anthropogenic and identifies the ocean's contribution to the question "where next?" The chapter is broken into 3 sections. The first section goes through natural variability by looking at previous climatic states. The section starts with solar variability going over the faint young sun hypothesis, sunspot cycles, and the Maunder minimums correspondence to the little ice age. Orbital changes and volcanic impacts are briefly discussed, and an interesting section on how comet impacts affect climate concludes this section. Comets have previously impacted upon the earth. In 1908 a small asteroid landed in Siberia, and the year of the impact the global temperature was about 0.2 degrees cooler than recent years. Impacts of a comet on the ocean could have a large effect on climate by flooding lands and increasing atmospheric water vapour, a significant greenhouse gas.

The second section discusses anthropogenic forcing. Aside from the obvious effects of combustion, humans also affect climate through changing surface properties of the terrestrial environment, and changes in aerosol type and distribution. The section closes by going through some possible climatic feedbacks, such as the ice-albedo feedback mechanism. The final section is on the climate of the future, and focuses on climate models with numerous interesting figures to accompany the text.

Overall this is a well-written book, and would be a potential textbook for a class with a reasonable background in environmental sciences and chemistry. Most ocean and atmospheric concepts are not reviewed in depth, and I feel would confuse most students without such a background. The book is a useful reference tool as all cited sources have a short description of what the source contains. This allows you to delve deeper into a subject that Bigg may only briefly cover. Organization of the book could be improved as many concepts are mentioned previous to a thorough discussion, such as O^{16}/O^{18} and its relation to past temperature. This would cause someone without a solid background great confusion and they would most likely jump between sections of the text. Aside from these comments, I would recommend this book for those interested in ocean sciences and climate.

Note from the Editor: The above review was received late in 2004 but was unfortunately lost in the Editor's computer. My apology to the reviewer, to the author and to *CMOS Bulletin SCMO* readers.

Sounds in the Sea: From Ocean Acoustics to Acoustical Oceanography

by Herman Medwin and colleagues

Cambridge University Press, 2005
Hardbound, 643 pages, US$100

Book Reviewed by Anthony W. Isenor[2]

This book is about sound in the ocean. The book is divided into two parts. Part one is essentially a university textbook that I would consider appropriate for first year graduate level. These nine chapters were written by Herman Medwin, a well known name in acoustical oceanography. The chapters are based on content from Medwin and Clay, *Fundamentals of Acoustical Oceanography*, but the material has been updated and rewritten for this book. Part two concentrates on ocean research involving acoustic signals. It was written by an assortment of researchers working in the fields of acoustics, oceanography, electronics, physics,

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Dartmouth, Nova Scotia, Canada

fisheries science, biology, defence, engineering and geophysics.

Chapters 1-9 provide the foundation material for ocean acoustics. Chapter 1 starts with the speed of sound in a simplified ocean and then describes pulse wave propagation, reflection off surfaces (e.g., the ocean bottom) and diffraction. Newton's law for acoustics, conservation of mass and the wave equation are also introduced. Chapter 2 introduces transmission and attenuation. This chapter describes energy and power in a wave signal, conservation of energy, ray paths and the sonar equation. Personally, I thought the presentation in this chapter was excellent. The ray diagrams, figures, equations and text all come together into what is best described as a very refined description. Chapter 3 deals with sources and receivers. This chapter introduces discrete and continuous line arrays, and the various types of sonars such as side-scan, multi-beam and Doppler. Chapter 4 examines non-linear phenomena of intense sounds. This chapter covers topics such as explosive sound sources and cavitation. Chapter 5 begins with a section on the process of interpreting ocean sounds. Spatial sampling examples include net tow simulations that might remind you of your days in biological oceanography class. This chapter also has sections on physical sounds, biological sounds and ship noise. Chapter 6 describes sound scattered by objects including marine bodies and bubbles. The section on scattering from a sphere provides the foundation mathematics and is followed by numerous sections on bubbles. Chapter 7 examines ocean bioacoustics. It considers sound backscattered from mammals, fish and zooplankton. Chapter 8 introduces scattering by rough surfaces, barriers and seamounts. This chapter introduces waveguides, phase and group velocities. Chapter 9 completes the "textbook" component of the book, with a description of scattering, transmission and backscattering at the different types of interfaces.

These first nine chapters are equation rich, with about 550 numbered equations in total. At the end of eight of these chapters is a section called Problems. There are about 100 problems in total, with only 13 provided answers. Personally, I think a few more answers would have been useful.

Chapters 10-24 are contributions from 25 ocean researchers from the United States, the United Kingdom and Australia. These chapters constitute the second part of the book and provide a current view of using sound in ocean research. This second part is divided into topics: near-surface ocean, bioacoustics, ocean dynamics and the ocean bottom.

Chapters 10 and 11 deal with the near-surface ocean. These chapters cover acoustical studies of the upper boundary layer and acoustical measurements of raindrop size distribution. I found the rain drop chapter (by Jeffrey A. Nystuen, Univ. of Washington) to be very interesting. It clearly outlined the cause of raindrop sound and then related the acoustic signal to raindrop size. The bioacoustics chapters are 12-17. These chapters cover acoustical assessment of plankton, backscatter from fish for detecting numbers and lengths, marine mammals and specifically whale monitoring. Chapters 18-21 deal with ocean dynamics, covering topics such as ocean tomography, turbulence and coastal acoustics. Finally, Chapters 22-24 relate to the ocean bottom and describe acoustic measurements of hydrothermal flows, imaging of underwater mountain ranges and acoustical sensing of the seabed.

The book's reference section is lengthy at 26 pages. However, I did manage to find a few references in the book that were not included in the reference section. The list of symbols is very good. The list is 13 pages in total and it saved me, on more than one occasion, from searching backward for symbol definitions. The Index could be improved. The Index is four pages in length, containing about 282 referenced pages. Personally, I think a book of this size should have a much larger Index.

In summary, for those interested in getting both a background textbook on ocean acoustics and a book on current research in acoustical oceanography, this book is excellent. I think this book would make a great addition to a university class at the first year graduate level or to a library at a university or research lab. It is well written and is enjoyable to read.

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

The High-Latitude Ionosphere and its Effects on Radio Propagation, by Robert Hunsucker and John Hargreaves, Cambridge University Press, Hardback, 0-521-33083-1, US$140.00.

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

Extreme Events, A physical Reconstruction and Risk Assessment, by Jonathan Nott, Cambridge University Press, May 2006, pp.297, ISBN 0-521-82412-5, Hardback, US$70.00.

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

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

Introduction to Coastal Dynamics and Shoreline Protection, by G. Benassai, Wessex Institute of Technology Press, July 2006, pp.331, ISBN 1-84564-054-3, Hardback, US$195.00.

Atelier d'été en météorologie
Projet Atmosphère 2007

Demande de candidats professeurs 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 en 2007. Il s'agit d'un atelier d'été à l'intention des enseignants 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 16 au 27 juillet 2007 au centre de formation du National Weather Service à Kansas City au Missouri.

Les dépenses de l'enseignant choisi 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 canadien choisi.

Developing storm cloud over Kansas City, Missouri, USA. Photo credit: Natalie Jalette, 2006 Project Atmosphere Canadian Teacher.

Les anciens participants 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 enseignants sont revenus avec du matériel, des ressources et des modules didactiques qu'ils peuvent facilement adapter dans leurs cours.

Les enseignants intéressés peuvent obtenir plus d'information en visitant le site de la SCMO sur la toile à www.scmo.ca/hsworkshop.html où ils peuvent obtenir un formulaire d'application. Ils peuvent également obtenir un formulaire en le demandant le plus tôt possible à l'adresse suivante:

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

Ces demandes doivent être soumises au bureau ci-haut mentionné au plus tard le **15 mars 2007**.

Summer Meteorology Workshop
Project Atmosphere 2007

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 in 2007. 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 July 16-27, 2007 at the National Weather Training Center, Kansas City, Missouri.

The 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.

Interested teachers can obtain more information on the workshop from the CMOS website www.cmos.ca/hsworkshop.html from where they can also download an application form. They can also request an application form by writing, as soon as possible, to the following address:

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

These requests should be submitted to the above office not later than **March 15, 2007**.

Call for Nominations for CMOS Prizes and Awards

Background:

The Prizes and Awards Committee is anxious to receive nominations for CMOS awards and offers the following background information for potential nominators. The Committee is made up of meteorological and oceanographic researchers and managers from academia, government and non-government agencies.

1) The Committee requires a nominating letter that should include an up-to-date CV and a summary of the candidate's work that is to be considered for an award. Note that the President's Prize and the Roger Daley Postdoctoral Publication Award pertain to a specified scientific paper, book or other major publication.

2) Letters of support are essential and should indicate the extent of influence of the candidate's work.

3) The Committee prefers that nominations and supporting documentation be submitted in electronic format; however, hard-copy material will be accepted if electronic material is not available.

All Society members are encouraged to consider nominating individuals of the meteorological or oceanographic community who have made significant contributions to their fields. The award categories are:

a) The President's Prize
May be awarded each year to a member or members of the Society for a recent paper or book of special merit in the fields of meteorology or oceanography. The paper must have been accepted for publication in "ATMOSPHERE-OCEAN", the CMOS Bulletin SCMO or another refereed journal.

b) The J.P. Tully Medal in Oceanography
May be awarded each year to a person whose scientific contributions have had a significant impact on Canadian oceanography.

c) The Dr. Andrew Thomson Prize in Applied Meteorology
May be awarded each year to a member or members of the Society for an outstanding contribution to the application of meteorology in Canada.

d) The Prize in Applied Oceanography
May be awarded each year to a member or members of the Society for an outstanding contribution to the application of oceanography in Canada.

e) Rube Hornstein Medal in Operational Meteorology
May be awarded each year to an individual for providing outstanding operational meteorological service in its broadest sense, but excluding the publication of research papers as a factor, unless that research has already been incorporated into the day-to-day performance of operational duties. The work for which the medal is granted may be cumulative over a period of years or may be a single notable achievement.

Appel de mises en candidature pour les Prix et Honneurs de la SCMO

Préambule:

Le Comité des prix et honneurs de la SCMO attend avec impatience les mises en candidature pour les prix de la SCMO et désire donner l'information pertinente suivante aux personnes faisant des nominations. Le Comité est constitué de chercheurs et gestionnaires en météorologie et océanographie du monde universitaire, du gouvernement et des agences non-gouvernementales.

1) Le Comité demande une lettre de nomination dans laquelle on devrait trouver un curriculum vitae mis-à-jour et un sommaire du travail du candidat qui devrait être considéré pour l'attribution d'un prix. Prière de prendre note que le Prix du Président et le Prix de publication postdoctoral Roger Daley s'adressent spécifiquement à une communication scientifique, un livre ou une publication d'importance.

2) Des lettres supportant la candidature sont essentielles et devraient indiquer l'étendue de l'influence du travail du candidat.

3) Le Comité préfère recevoir les nominations et les documents les supportant sous forme électronique; par contre, des copies papier seront acceptées en l'absence de document électronique.

Tous les membres de la société sont encouragés à présenter des nominations de personnes considérées comme ayant contribué de façon significative dans leur sphère d'activités tant en océanographie qu'en météorologie. Les catégories de prix sont:

a) Prix du président
Peut-être décerné chaque année à l'un ou plusieurs des membres de la Société pour une excellente communication ou un livre de grande valeur traitant de météorologie ou d'océanographie. La communication doit être acceptée pour publication dans Atmosphère-Océan ou tout autre périodique avec comité de lecture.

b) Médaille de J.P. Tully en océanographie
Peut-être décernée à un individu dont la contribution scientifique dans le domaine de l'océanographie canadienne a été jugée exceptionnelle.

c) Prix du Dr. Andrew Thomson en météorologie appliquée
Peut-être décerné chaque année à l'un ou plusieurs des membres de la Société pour un travail exceptionnel dans le domaine de la météorologie appliquée au Canada.

d) Prix en océanographie appliquée
Peut-être décerné chaque année à l'un ou plusieurs des membres de la Société pour un travail exceptionnel dans le domaine de l'océanographie appliquée au Canada.

e) Médaille de Rube Hornstein en météorologie opérationnelle
Peut-être décerné chaque année à un individu pour un travail exceptionnel dans l'exploitation des services météorologiques, au sens large du terme. Ceci exclut cependant comme critère d'évaluation les publications scientifiques, à moins que leurs résultats ne soient déjà utilisés pour améliorer la performance quotidienne des services d'exploitation. Le travail pour lequel la médaille est donné peut avoir été réalisé sur plusieurs années précédant l'année en cours ou encore, en récompense d'un

f) The Graduate Student Prizes
One or more prizes may be awarded each year for contributions of special merit by graduate students registered at a Canadian university or by Canadian graduate students registered at a foreign university. One of these prizes shall be named the **Tertia M. C. Hughes Memorial Prize.**

g) Roger Daley Postdoctoral Publication Award ($2000)
May be awarded to a candidate who at the time of nomination is working in Canada in a non-permanent position as a postdoctoral fellow or research associate and is within 5 years of having received a doctoral degree. The award is to be based on the excellence of a publication in the fields of meteorology or oceanography that has appeared or is in press at the time of nomination.

h) Environmental Citations
May be awarded to individuals or groups who have made some outstanding contribution in helping to alleviate pollution problems, in promoting environmental improvement, stewardship or awareness, or in developing environmental ethics.

i) Citation for Outstanding Radio and Television Weather Presentation
Only Canadian weather products or programs will be considered. Nominations can be made for high standards of performance over a period of time or the media outlet's response to a particular event. Normally, submissions include audio tapes of three consecutive radio broadcasts or VHS recordings of three consecutive telecasts along with the date and time of the programs, and the names and addresses of the presenter and station. However, letters of support can also be provided by either Centres or individual Society members. Nominations will be judged on the quality of information, the educational value, the appeal to the audience, and the level of technical and professional presentation.

Additional Information

1. Some prize categories require that a nominee be a member of CMOS.
2. Receipt of submissions by CMOS Office will not be acknowledged unless requested. Acknowledgement when requested will be by telephone.

3. The current title, full address and phone number of the nominee must accompany the submission.

4. Nominees (who have not received awards) in previous years may be re-nominated. All criteria provided above apply to re-nominations. The Committee has recently adopted a policy of considering nominations (kept on file) submitted in the two preceding years. Nominators are encouraged to re-affirm and/or update these nominations.

Nominations should be received by **15 February** by the Executive Director at the postal address shown on page 211.

accomplissement exceptionnel.

f) Les Prix pour étudiants diplômés
Un ou plusieurs prix pour étudiants diplômés peuvent être décernés aux étudiants diplômés, inscrits à une université canadienne ou aux étudiants canadiens inscrits à une université étrangère, ayant accompli un travail exceptionnel. Un de ces prix devrait être dénommé le **prix commémoratif Tertia M. C. Hughes**.

g) Le prix de publication postdoctoral Roger Daley (2 000$)
Peut-être décerné chaque année à un(e) candidat(e) qui, au moment de la mise en candidature travaille au Canada dans un poste non-permanent à titre de boursier (ère) de recherche postdoctoral ou d'assistant(e) à la recherche et a obtenu son doctorat dans les cinq dernières années. Le prix sera remis en fonction de l'excellence d'une publication, dans les domaines de la météorologie ou de l'océanographie, déjà publiée ou en voie de l'être au moment de la mise en candidature.

h) Citations environnementales
Peuvent être décernées à des individus ou groupes ayant apporté une contribution importante aux problèmes de la pollution, en promouvant une meilleure qualité environnementale ou en développant un code d'éthique environnemental.

i) Citation pour l'excellence en présentation des prévisions météorologiques à la radio ou à la télévision Seules les productions canadiennes sont éligibles. La nomination peut être basée sur un standard élevé et soutenu de communications ou sur la reconnaissance des médias sur un événement particulier. Une bande audio de trois émissions radiophoniques consécutives ou un enregistrement VHS de trois émissions télévisées consécutives est requis. La date et l'heure des émissions, le nom du présentateur et la station doivent être indiqués. Toutefois, si désiré, une telle justification peut accompagner la bande afin d'aider le comité de sélection. Les extraits soumis seront jugés pour leur valeur informative et/ou éducative, leur attrait pour le public, et pour le niveau de présentation technique et professionnel.

Information supplémentaire

1. Certaines catégories de prix sont réservées aux membres de la SCMO.
2. Aucun accusé de réception pour les candidatures ne sera envoyé par le Bureau de la SCMO à moins d'une demande formelle. S'il est requis, l'accusé de réception se fera par téléphone.
3. Le titre actuel de chaque candidat, ainsi que son adresse complète et numéro de téléphone, doivent être envoyés avec la mise en candidature.
4. Les candidats des années précédentes, qui n'ont pas reçu de prix, peuvent être reconsidérés. Les critères énoncés ci-dessus s'appliquent également à ces nominations. Le comité considérera désormais les nominations antérieures et conservées durant les deux dernières années. Nous encourageons les personnes qui ont fait ces nominations à les réitérer ou à les préciser.

Les soumissions doivent être reçues au plus tard le **15 février** par le Directeur exécutif à l'adresse postale indiquée à la page 211.

The Canadian Meteorological and Oceanograpic Society (CMOS)

The Weather Network/Météomédia Scholarship

The Scholarship
The Weather Network/MétéoMédia Scholarship is designed to encourage and support Canadians toward establishing or furthering a career in the field of Meteorology. The Weather Network/MétéoMédia are wholly owned and operated by Pelmorex Inc, Canada's leading private sector weather information provider. Pelmorex is committed to the personal growth of Canada's future Meteorologists. The scholarship is offered to a female student, and provides educational assistance in pursuit of a career in the field of Meteorology. The Weather Network/MétéoMédia makes an annual donation of $1,500 to CMOS who coordinates the selection process. The first scholarship was presented during the 2003/04 academic year.

Eligibility and Criteria
- Officially registered in the 3rd or 4th year of an Atmospheric Science degree program at a Canadian University;
- Female student;
- Canadian citizen or permanent resident status;
- Student must be in "good academic standing", not failing any courses and have an average of 75% or more; and
- career aspirations as a Forecast Meteorologist, On-Air Meteorologist or Meteorological Briefer.

Application Process
Students are required to submit transcripts of academic studies, a personal letter of interest and intent and resumé. One sealed letter of recommendation (in confidence) from a university professor who is directly acquainted with and knowledgeable of the work of the student is to accompany the application. Please provide the following information:

- Name;
- Telephone number;
- University & Program;
- Citizenship;
- Address/City/Postal Code;
- e-mail;
- Graduating year;
- Signature & Date.

Pelmorex is committed to diversity in the workplace. Please note that applications should be sent to the Executive Director's Office by mail. Deadline for receipt of application is **February 28.**

CALL FOR NOMINATIONS

1) CMOS Fellows
The title "Fellow of the Society" may be granted to members of the Society who have provided exceptional long term service and support to the Society and/or who have made outstanding contributions to the scientific, professional, educational and weathercasting fields in atmospheric or oceanic sciences in Canada. A Fellow membership is proposed by Council on the recommendation of a "Fellows Committee", and must be approved by an Annual General or Special Meeting. A Fellow must be a member in good standing.

La Bourse Météomédia / The Weather Network

La Société Canadienne de Météorologie et d'Océanographie (SCMO)

La Bourse
La bourse MétéoMédia/The Weather Network a été conçue afin d'encourager et soutenir les Canadiens qui tentent d'établir ou de se diriger vers une carrière dans le domaine de la météorologie. Pelmorex Inc., chef de file des fournisseurs privés en météorologie, est l'unique propriétaire de MétéoMédia/The Weather Network dont il assure la gestion complète. Pelmorex s'engage dans la croissance personnelle des futurs météorologues du Canada. La bourse est offerte à une étudiante, et fournit un support éducatif dans la poursuite d'une carrière dans le domaine de la météorologie. MétéoMédia/ The Weather Network font une donation annuelle de 1 500 $ à la SCMO qui coordonne le processus de sélection. La première bourse fut présentée pendant l'année académique 2003/2004.

Éligibilité et critères
- Être officiellement inscrite dans la 3e ou 4e année d'un programme de Sciences atmosphériques dans une université canadienne;
- Étudiante (de sexe féminin);
- Citoyenne canadienne ou statut de résidente permanente
- L'étudiante ne doit pas avoir échoué aucun cours et doit avoir une moyenne de 75 % ou plus; et
- Aspirations de carrière en tant que Météorologue prévisionniste, Météorologue ''en- ondes'' ou chargée de l'information météorologique.

Processus de candidature
Les étudiantes sont tenues de fournir des copies de leurs relevés de notes, une lettre démontrant de leur intérêt, ainsi que leur curriculum vitae. Une lettre de recommandation (sous pli confidentiel) d'un professeur d'université qui connaît directement l'étudiante et qui est renseigné sur son travail doit accompagner la candidature. Veuillez SVP fournir les informations suivantes:

- Nom;
- Téléphone;
- Université & Programme;
- Citoyenneté;
- Adresse/ville/code postal;
- Courriel;
- Année de graduation;
- Signature & date.

Pelmorex souscrit à la diversité en matière d'emploi. Veuillez noter que les candidatures doivent être envoyées par la poste au bureau du Directeur exécutif. La date limite pour la réception des candidatures est le **28 février**.

APPEL DE MISE EN CANDIDATURE

1) Membres Émérites de la SCMO
Les membres qui ont offert à la Société leur soutien et des services exceptionnels au cours de nombreuses années, et/ou qui ont contribué exceptionnellement aux domaines scientifique, professionnel, éducatif et de la prévision dans les sciences marines ou atmosphériques peuvent être nommés "Membre émérite de la Société". La désignation "Membre émérite" doit être proposée par le Conseil sous la recommandation du "Comité des honneurs" et doit être approuvée à l'assemblée générale annuelle ou à une réunion spéciale. Les "Membres émérites" doivent être membres en règle.

2) Honorary Fellows
The title "Honorary Fellow" may be granted to persons who have made outstanding contributions to the scientific, professional, educational or forecasting fields in atmospheric or ocean sciences in Canada or abroad. An Honorary Fellow is proposed by the Council on recommendation of a Fellows Committee, and must be approved by an Annual General or Special Meeting.

3) The Neil J. Campbell Medal for Exceptional Volunteer Service
The Neil J. Campbell Medal for Exceptional Volunteer Service may be awarded each year to a member for service to CMOS as a volunteer. The award may be made for an exceptional contribution in a single year or for contributions made over an extended period. The contribution(s) should have resulted in (an) important advancement(s) for CMOS and/or its aims, nationally or locally.

Nominations for all of the above honours will be transmitted to the Fellows Committee if received by the Executive Director's Office before **15 March**.

4) CMOS Undergraduate Scholarships ($500)

Two undergraduate scholarships are offered by the Canadian Meteorological and Oceanographic Society, valued at $500 each, to successful student applicants planning a career in atmospheric, hydrological, oceanographic or limnological sciences. These scholarships are tenable at any Canadian university.

Applicants must be Canadian citizens or have landed immigrant status and be in their penultimate undergraduate year; the scholarships are to support the students' final university year.

To be qualified, students should be taking four or more half courses in one or more of the following areas in their final year: meteorology, physical or chemical oceanography or limnology, hydrology or climatology.

Details are to be provided in the application.

Students are required to submit transcripts of academic studies, a statement of interest and intent and details of relevant work experience.

Two sealed letters of recommendation (in confidence) from university professors who are directly acquainted with and knowledgeable of the work of the student are to accompany the application.

Find application forms at http://www.cmos.ca/ undergradschole.html and send to arrive by **15 April** to the Executive Director's Office.

2) Membres Honoraires
Les individus, canadiens ou étrangers, qui ont contribué exceptionnellement durant leur carrière aux domaines scientifique, professionnel, éducatif ou de la prévision dans les sciences marines ou atmosphériques, peuvent être nommés "Membre honoraire". La désignation "Membre honoraire" doit être proposée par le conseil sous la recommandation du "Comité des honneurs" et doit recevoir l'approbation de l'assemblée générale annuelle ou d'une réunion spéciale.

3) La Médaille Neil J. Campbell pour service bénévole exceptionnel
La médaille Neil J. Campbell pour service bénévole exceptionnel peut être décerné chaque année à un membre pour service bénévole à la SCMO. La médaille peut être décernée pour une contribution exceptionnelle dans une seule année ou pour des contributions sur plusieurs années. La contribution devrait avoir fait progresser d'une façon importante la SCMO ou ses buts, au niveau national ou local.

Des mises en candidature pour tous les honneurs mentionnés ci-haut seront transmises au Comité des honneurs si reçues au bureau du directeur exécutif au plus tard le **15 mars**.

4) Bourses d'études de premier cycle SCMO (500 $)

Deux bourses d'études de premier cycle, chacune d'un montant de 500 $, seront offertes par la Société canadienne de météorologie et d'océanographie aux étudiants dont la demande a été acceptée et qui planifient faire carrière dans les sciences atmosphériques, hydrologiques, océanographiques ou limnologiques. Ces bourses d'études ne sont valides que dans les universités canadiennes.

Les candidats doivent être citoyens canadiens ou détenir le statut d'immigrant admis et être dans l'avant-dernière année du premier cycle; ces bourses serviront à appuyer les étudiants lors de leur dernière année universitaire.

Afin d'être admissibles, les étudiants doivent suivre au moins quatre demi-cours dans au moins un des domaines suivants durant leur dernière année: météorologie, océanographie physique ou chimique ou limnologie, hydrologie ou climatologie.

Les renseignements doivent être indiqués sur le formulaire de demande.

Les étudiants doivent soumettre leurs relevés de notes d'études universitaires, un exposé d'intérêt et d'intention et les détails d'expérience de travail pertinent.

La demande doit être accompagnée de deux lettres de recommandation scellées (à titre confidentiel) de professeurs distingués qui connaissent personnellement le travail de l'étudiant.

Les formulaires de demandes se trouvent à http://www.cmos.ca/undergradscholf.html et doivent être envoyés au bureau du Directeur exécutif pour arriver au plus tard le **15 avril**.

5) The CMOS - Weather Research House NSERC Scholarship Supplement

The CMOS - Weather Research House Scholarship Supplement was established in 1997 by Dr. Neil Campbell, then Executive Director of CMOS and Dr. Ambury Stuart, President of Weather Research House and founding Chair of the CMOS Private Sector Committee to recognise the best student in Meteorology or Oceanography who had won an NSERC Postgraduate Scholarship in the year of the award. The scholarship supplement is valued at $10,000 over a two-year period and is funded equally by CMOS and Weather Research House. By making this award, CMOS hopes that individual members of CMOS and other private sector companies will be encouraged to establish similar awards to support graduate students in meteorology or oceanography.

Only those students who have succeeded in winning an NSERC Postgraduate Scholarship or a Canada Graduate Scholarship are eligible. An initial award of $5,000 is renewable for a second year provided that the student continues to hold an NSERC postgraduate scholarship.

The winning student will be selected by a committee of the Society made up of representatives of the CMOS Scientific Committee and the CMOS Private Sector Committee. The scholarship supplement will be announced and presented at the CMOS Annual Congress.

More information and instructions on how to apply may be found at: www.nserc.ca/sf_e.asp?nav=sfnav&lbi=2b_4

Applications must be sent to arrive at the Executive Director's Office by **15 April**.

Executive Director
Canadian Meteorological and Oceanographic Society
P. O. Box 3211, Station D
Ottawa, ON K1P 6H7
Tel: (613) 990-0300; Fax: (613) 990-1617
email: cmos@cmos.ca

5) Le Supplément SCMO - Weather Research House aux Bourses CRSNG

Le supplément SCMO-Weather Research House a été établi en 1997 par le docteur Neil Campbell, directeur exécutif de la SCMO à l'époque et le docteur Ambury Stuart, président de Weather Research House et président-fondateur du comité SCMO pour le secteur privé, afin de reconnaître le meilleur étudiant en météorologie ou océanographie titulaire d'une bourse d'études supérieures du CRSNG dans l'année du supplément. Le supplément peut attendre 10 000 $ si détenu pour une période de deux ans. Il est financé également par la SCMO et Weather Research House. En établissant ce prix, la SCMO espère d'encourager d'autres membres ou compagnies privées à établir de prix semblables pour les étudiants en études supérieures en météorologie ou océanographie.

Seulement les gagnants d'une bourse d'études supérieures du CRSNG ou d'une bourse d'études supérieures du Canada sont admissibles à présenter une demande. Un supplément initial de 5 000 $ peut être renouvelé pour une deuxième année à la condition que l'étudiant continue à détenir une bourse d'études supérieures du CRSNG ou une bourse d'études supérieures du Canada.

Un comité de membres choisis des comités scientifique et du secteur privé de la SCMO évaluera les demandes et recommandera le candidat jugé le plus qualifié. L'annonce et la présentation du supplément seront fait au congrès annuel de la SCMO.

Visiter le www.crsng.gc.ca/sf_f.asp?nav=sfnav&lbi=2b_4 pour obtenir de plus amples informations et des instructions sur la manière de présenter une demande.

Les demandes doivent parvenir au bureau du Directeur exécutif au plus tard le **15 avril.**

Directeur Exécutif
Société canadienne de météorologie et d'océanographie
C. P. 3211, Station D
Ottawa, ON K1P 6H7
tél.: (613) 990-0300; téléc.: (613) 990-1617
courriel: cmos@cmos.ca

Avis: l'utilisation du genre masculin dans le texte français n'a pour but que d'alléger le texte.

CMOS Accredited Consultants / Experts-Conseils accrédités de la SCMO

Gamal Eldin Omer Elhag Idris, C.Chem., MCIC

Chemical Oceanography,
Pollution Control and Water Technology

211-100 High Park Avenue
Toronto, Ontario M6P 2S2 Canada
Tel: 416-516-8941 (Home)
Email; omer86@can.rogers.com

Douw G. Steyn

Air Pollution Meteorology
Boundary Layer & Meso-Scale Meteorology

4064 West 19th Avenue
Vancouver, British Columbia,
V6S 1E3 Canada
Tel: 604-822-6407; Home: 604-222-1266

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

Air, Ocean, Earth and Ice on the Rock

May 28 - June 1 2007

Call for Papers

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

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

The Congress theme "*Air, Ocean, Earth and Ice on the Rock*", along with the key objectives of the International Polar Year, reflect the Congress' objective to explore, link, bridge and integrate the scientific interests of the CMOS, CGU, AMS and ESC. For information on planned special and general science sessions, please visit the Congress web site at:

http://www.cmos2007.ca

The deadline for submission of abstracts is **February 15, 2007**. Abstracts should be submitted electronically in English or French on the Congress web site at http://www.cmos2007.ca. Abstracts should be no more then 300 words, with no figures.

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

Co-chairs, the Scientific Program Committee

- Guoqi Han (Fisheries and Oceans Canada, HanG@dfo-mpo.gc.ca, CMOS)
- Rod Blais (University of Calgary, blais@ucalgary.ca, CGU)
- Taneil Uttal (NOAA, Taneil.Uttal@noaa.gov, AMS)

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

Air, océan, terre et glace sur le roc

28 mai - 1 juin 2007

Appel de Communications

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

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

Le thème du congrès "*Air, Océan, Terre et Glace sur le Roc*", ainsi que les objectifs de l'Année polaire internationale, reflètent l'objectif du congrès qui est d'explorer, d'échanger et d'intégrer les intérêts scientifiques de la SCMO, de l'UGC, de l'AMS et du ESC. Pour plus d'information sur les sessions spéciales et générales qui sont planifiées visitez le site du congrès à:

http://www.cmos2007.ca

La date limite pour soumettre un résumé est le **15 février, 2007.** Les résumés doivent être soumis électroniquement en anglais ou en français sur le site du congrès au http://www.cmos2007.ca. Les résumés doivent contenir moins de 300 mots et ne pas contenir de graphiques.

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

Co-présidents du Comité du programme scientifique

- Guoqi Han (Pêches et Océans Canada, HanG@dfo-mpo.gc.ca, SCMO)
- Rod Blais (Université de Calgary, blais@ucalgary.ca, UGC)
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CMOS members appear before the House of Commons Standing Committee on Environment and Sustainable Development (HCSCESD)

On 7 November 2006, during hearings on bill C-288, ***An Act to ensure Canada meets its global climate change obligations under the Kyoto Protocol - Urgency to respond to anthropogenic Climate Change,*** two members of CMOS, Drs. John Stone and Ian Rutherford, appeared as witnesses. The following notes were the basis of their presentations to the committee.

1) Notes for the presentation of Dr. John Stone

Some Basic Science Underlying the Threat of Climate Change

Chairman, Members of the Committee, Good Morning. Thank you for the opportunity to appear before you and tell you about some of the science that underlies the threat of climate change. I would like to make four points. **First**, we have, mainly through the burning of fossil fuels, taken the atmospheric concentration of carbon dioxide, one of the main greenhouse gases, to levels that the Earth has not experienced for almost a million years – we are in unknown territory. **Second**, recent global temperatures are higher than we have been able to determine over the last millennium – we have detected global warming. **Third**, the only way we can satisfactorily understand this change is by invoking the known influence of greenhouse gases on the climate. And, **fourth**, we are now seeing some impacts occurring at a faster rate then we had previously anticipated and the longer we delay action the greater will be the risks and the more expensive will be the costs – there is a urgent need for action.

We can explain the threat of climate change either in simple terms or in terms of extraordinary technical detail. The climate system is extremely complex containing many interacting and mostly non-linear processes. Nevertheless, our understanding is sufficient to tell us that increasing the concentration of greenhouse gases in the atmosphere, as we have been doing by our burning of fossil fuels, will affect the radiation balance and hence the climate. This is a fundamental fact, based on well accepted physics, that we cannot avoid. It is the reason for my using the term “threat”.

This scientific understanding is not new. As long ago as 1824, the French mathematician Fourier, discussed the link between the climate and the atmospheric concentration of certain gases. These gases, collectively known as greenhouse gases, act like a blanket around the Earth. They are responsible for making this planet inhabitable – without them the World would be 32 ^{o}C colder. This hypothesis was taken up some 70 years later by a Swedish chemist Arrhenius who did some back-of-the-envelope calculations of how the Earth’s temperature would change with a doubling of the atmospheric concentrations of these gases – a situation we are rapidly approaching.

Scientists put the issue of climate change on the international political agenda in the mid-1980’s precisely because of their concern with the observed increases in the atmospheric concentration of carbon dioxide carefully measured on Mona Loa by Dr. Charles Keeling. The scientific concern was such that it dominated the conference on Our Changing Atmosphere held in Toronto in 1988. It also led the United Nations to take the initiative to establish the Intergovernmental Panel on Climate Change to provide governments with authoritative, policy-relevant but not policy-prescriptive assessments of the current state of our knowledge of climate change.

Now to my first point. Recently, scientists extracted a three-kilometer long core from the ice in the Antarctic. The snow that falls each year captures within its crystals samples of the ambient air at the time it was deposited. Layers are built up one year at a time. By examining the air trapped in each layer the scientists have been able to determine a record of past temperatures and concentrations of key greenhouse gases. They have now been able to take the record back some 650 thousand years, covering several ice-ages. These occur every 120 thousand or so years and are forced by the orbital variations of the Earth around the Sun. The concentration has varied over time. It has been lowest during an ice age and highest during an interglacial period. The most important point to register is that the atmospheric concentration of carbon dioxide has stayed within two bounds, never going above about 280 ppm. This was even so up until the mid-eighteenth century when the industrial revolution began. Today we are at 380 ppm, a 30% increase over the past 150 years, and concentrations are still increasing. By looking at the isotopic ratios of the carbon dioxide in the atmosphere today we can establish that most of it originates from the burning of fossil fuels. We are clearly taking the atmosphere into uncharted territory. We know from basic physics that this will affect the climate. I won’t claim that I can tell you exactly how the climate will change but I can assert with very little doubt that change it will.

Let’s turn now to what we’ve observed has happened to the climate. We’ll focus on temperature since it is the easiest parameter to understand. For the most recent period we use direct thermometer readings. There has been a considerable amount of work to make sure this temperature record is homogeneous and devoid of spurious effects such as enhanced warming in cities. For earlier periods we have to rely on carefully calibrated proxy-data such as tree-rings and ice-cores. Several groups of scientists have used that

data to reconstruct the temperature record for the past thousand years. The general characteristics of these reconstructions are all similar although some have larger variability at century time-scales than others. These reconstructions clearly show that there has been significant warming over the last 50 to 100 years and, more importantly, that this warming is outside the range of the variability over the period of the last millennium. As the IPCC's reports have concluded, it is very likely that the recent warming is outside of the natural variability of the climate. We have thus detected climate change.

Attributing climate change to human activities is quite different to detecting climate change and requires not only the use of data but also climate models and looking for fingerprints in the past climate. Our understanding and ability to model the climate has improved significantly. We know what have been the changes in the concentrations of greenhouse gases and aerosols in the atmosphere over the last 100 years. We also know what the changes have been in natural forcing such as the sun's output and volcanic activity. We can feed this information into climate models and compare the results with the observed record. If we take natural forcing alone, the fit for the first half of the last century is not bad but it begins to deviate afterwards. If we instead use both natural forcing and that due to greenhouse gases and aerosols the fit is remarkably good. Indeed, the only way to reproduce the observed temperature change over the last 50 years is by introducing greenhouse gases from fossil fuel burning and land-use changes.

The evidence in the IPCC 2nd Assessment leads to the carefully crafted conclusion that "the balance of evidence suggests a discernable human influence on global climate". By the time of the 3rd Assessment the conclusion was strengthened to: "There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities".

Finally, let me say a few words about the urgency of addressing climate change. Last year, in preparation for their chairmanship of the G-8, the UK government organised a conference on "dangerous climate change". The reference to dangerous is from Article 2 of the Framework Convention – what some refer to as the "ultimate objective", that is to avoid dangerous interference with the climate system. One of the conclusions of that conference was that we are experiencing some impacts at a faster rate than we had anticipated. We can see it in some ecosystems but perhaps the clearest evidence comes from the surprising acceleration of the movement of glaciers on the coasts of Antarctica and Greenland. In part this is surprising because we didn't fully understand glacier physics. But it does underline the fact that such surprises are possible. And some of these surprises may take us past a point where the changes are irreversible. As was concluded in the Summary for Policy-makers of the Working Group on Science's contribution to the IPCC's 2nd Assessment Report over ten years ago: "*Future unexpected, large and rapid climate system changes (as have occurred in the past) are, by their nature, difficult to predict. This implies that future climate changes may also involve "surprises". In particular, these arise from the nonlinear nature of the climate system. When rapidly forced, nonlinear systems are especially subject to unexpected behaviour".* The longer we delay in taking action the greater become the risks to ecosystems, to humans and our societies and economies. In addition the costs are also likely to be greater. One of the reasons for this is that the longer we delay action the higher will be the levels of atmospheric concentrations of greenhouse gases from which we will have to make reductions. Some scientists are now arguing that we may have as little as a decade to get on the right track to reduce our emissions and avoid dangerous climate change. I do not want to be an alarmist but I do believe that a scientist's duty is to warn.

Thank you.

2) Notes for the presentation by Dr. Ian Rutherford

Thank you Chairman and Members of the Committee for the opportunity to address you today on this matter of great importance to the members of The Canadian Meteorological and Oceanographic Society (CMOS).

CMOS is the national society of individuals and organizations dedicated to advancing atmospheric and oceanic sciences and related environmental disciplines in Canada. It is the major non-governmental organisation serving the interests of meteorologists, climatologists, oceanographers, limnologists, hydrologists and cryospheric scientists in Canada. It represents Canadian scientists carrying out research on the atmosphere, the oceans and related environmental issues. It has more than 800 members from Canada's major research centres, universities, private corporations and government institutes. CMOS is uniquely positioned to provide expert advice on the issue of climate change.The following statement of position is an updated version of a statement first issued following the CMOS Congress in June 2006.

The state of the climate and climate science:

- Climate change is happening now, both in Canada and around the world. Most of this change is attributable to human activities that have released greenhouse gases, notably carbon dioxide, into the atmosphere in increasing amounts since the beginning of the industrial revolution. The effect of these additional greenhouse gases on the global heat balance is now clearly detectable on continental and global scales.

- The removal processes for carbon dioxide are relatively slow and it becomes evenly mixed in the global atmosphere. This means that it takes a long time for the atmospheric burden of excess carbon dioxide to respond to changes in emissions. The mean lifetime for carbon dioxide in the atmosphere is measured in decades to centuries. It takes a long time to build up and a long time to decline. It

also means that the effects of local emissions are not felt locally but will eventually by manifested globally.

● The ocean component of the climate system has a very long response time to changes in energy input, because of its enormous heat capacity. This means that the climate system takes even longer to respond to changes in emissions and hence climate forcing. In particular, if emissions continue to increase or even if they were to simply stabilize at current levels the atmospheric burden will continue to increase and so will climate change.

The link to air pollution:

● The human activities that release carbon dioxide, notably the combustion of fossil fuels, also release other substances such as oxides of nitrogen and sulphur that lead to air pollution with both direct and indirect effects on the health of ecosystems and humans. These substances have a much shorter lifetime in the atmosphere, measured in hours to days. Their effects are mostly local and quickly reversed if emissions are reduced.

● Measures to reduce the emission of substances that lead to this kind of air pollution will not result in the reduction of emissions of carbon dioxide, unless they involve reducing the combustion of fossil fuels. Carbon dioxide is the inevitable chemical product of the combustion of carbon-containing fuels. Unless captured before release to the atmosphere, such combustion inevitably leads to an increase in atmospheric levels of carbon dioxide.

The urgent need for action to reduce emissions:

● If emissions of carbon dioxide continue to increase they will lead to an increasing rate of the build-up of carbon dioxide levels in the global atmosphere. Even if emissions were to stabilise at current levels, carbon dioxide would continue to increase resulting in an increasing effect on global climate.

● Even if emissions were to suddenly decrease to pre-industrial levels, the carbon dioxide content of the atmosphere and hence the climate would take decades to centuries to return to pre-industrial conditions.

● We must take immediate action to reduce emissions of greenhouse gases to mitigate future climate change and we must prepare for adapting to the climate change already set in train by past emissions.

On the Climate Convention and its Kyoto Protocol:

● CMOS advocates a co-ordinated, global response to climate change. We urge all governments to work together toward a single international agreement to address climate change, as was recognised in the 1992 U. N. Framework Convention on Climate Change.

● The Climate Convention's Kyoto Protocol is an important first step towards reducing the release of greenhouse gases into the atmosphere. However, the scientific evidence dictates that in order to stabilise the climate, global reductions in greenhouse gas emissions need to go far beyond those mandated under this Kyoto Protocol. We recognise the challenge of implementing the current agreement; nonetheless we urge Canada to contribute effectively to this global effort.

● It is to be noted that Canada also has other obligations under Articles 4, 5 and 6 of the Climate Convention and Article 10 of the Kyoto Protocol regarding research and systematic observations related to the climate system.

On preparing for climate change:

● Canada has no choice but to adapt to present and future climate change. A national adaptation strategy is needed.

● Further research is critical for making more accurate predictions of future climate on seasonal, decadal and century time scales, for defining options, for reducing the effects of climate change and for understanding and dealing with its impacts on Canada.

Thank you again for the opportunity to make this presentation.

Call for Nominations for Parsons Medal in Ocean Sciences

Nominations are being solicited for the Timothy R. Parsons Medal for distinguished contributions to multidisciplinary research in ocean sciences and are due **February 28, 2007.** In 2006, two awards were made, to Drs. Ken Denman and Trevor Platt. Researchers working for Canadian institutions to benefit Canada are eligible for nomination. Awards will be considered for either lifetime achievement or a recent outstanding accomplishment. Fisheries and Oceans Canada will present the 2007 Parsons Medal at the Canadian Meteorological and Oceanographic Society Congress in May 2007 in St. John's, Newfoundland and Labrador.

Please use the on-line form available at http://www.dfo-mpo.gc.ca/science/Awards/Parsons_e.htm

or send via fax to 613-990-0313, or mail to:

Timothy R. Parsons Medal Committee
c/o Strategic Science Outreach Branch
Station 8W135, 200 Kent Street
Ottawa, Ontario, K1A 0E6

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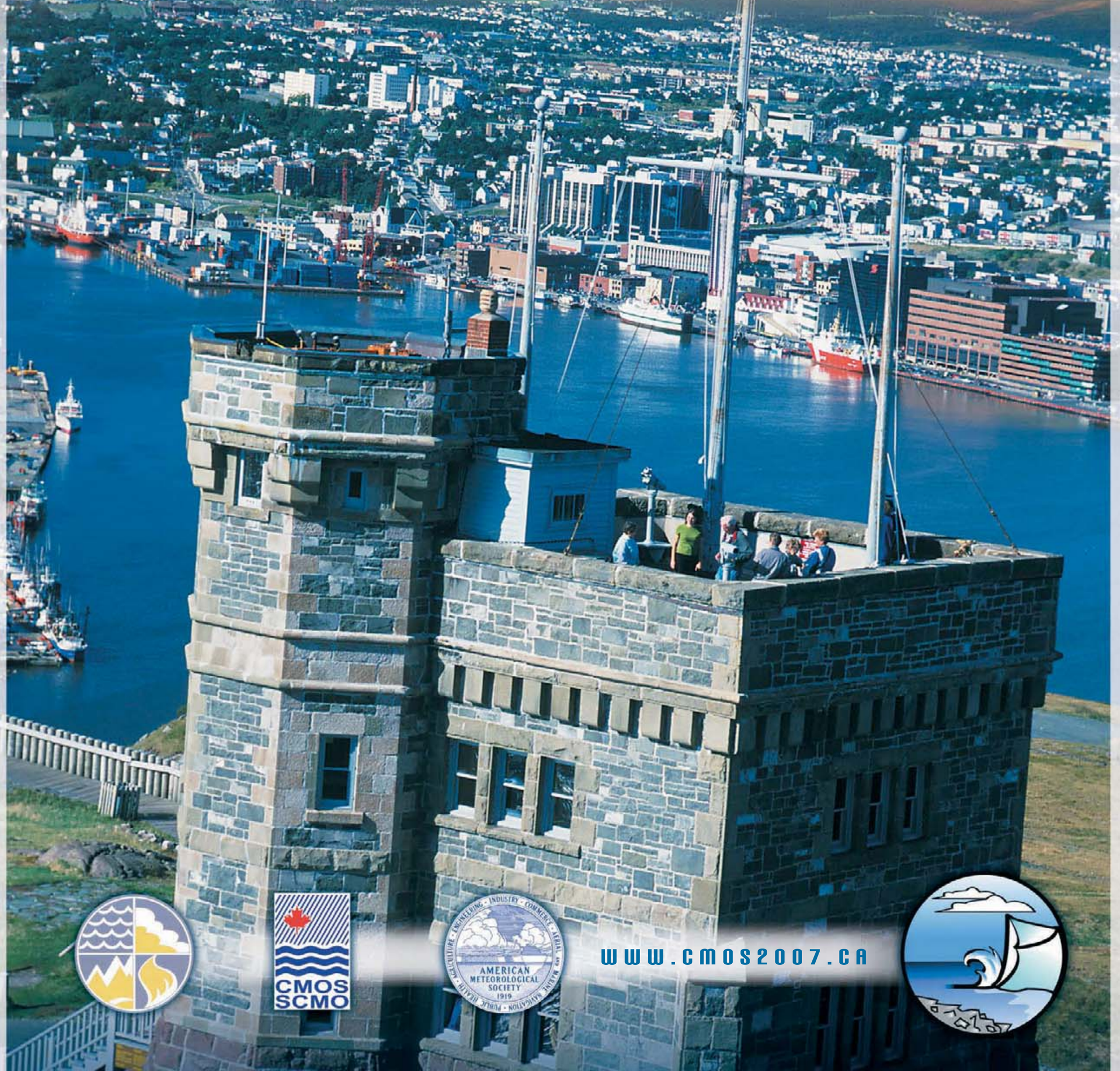

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