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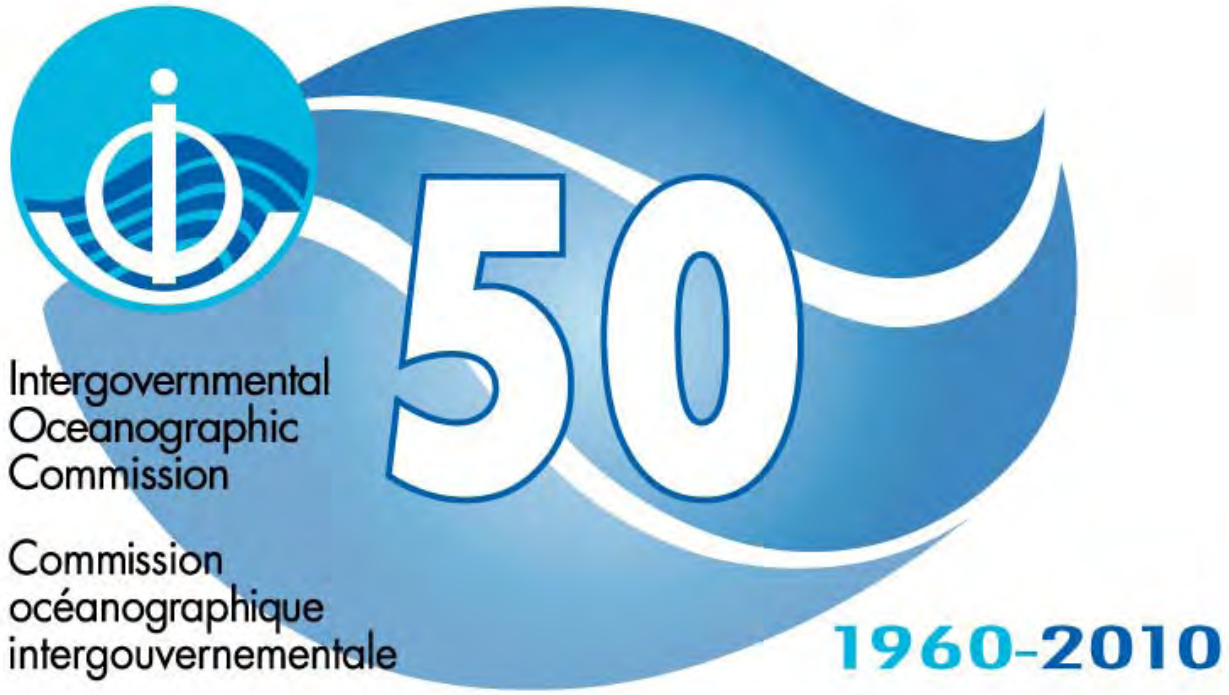
CMOS BULLETIN SCMO

Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

October / octobre 2010 Vol.38 No.5



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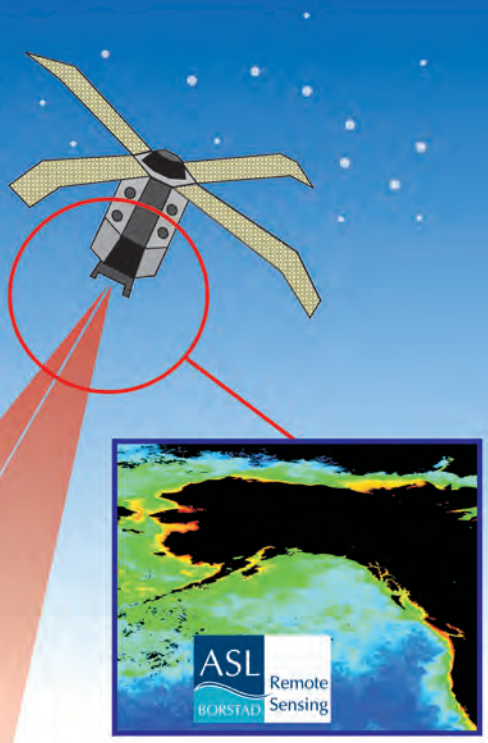

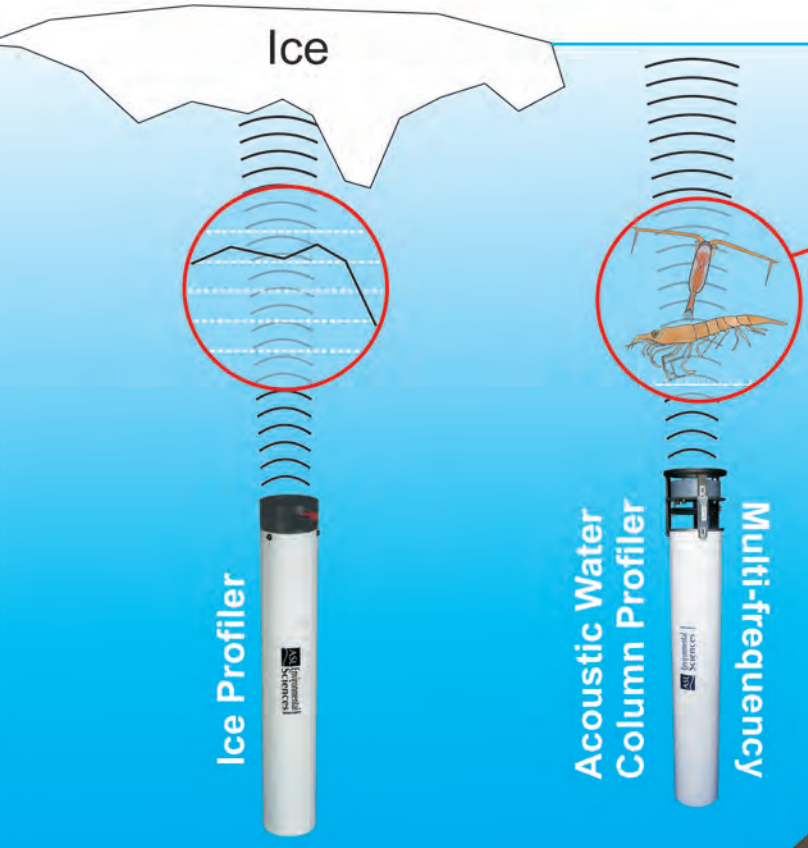

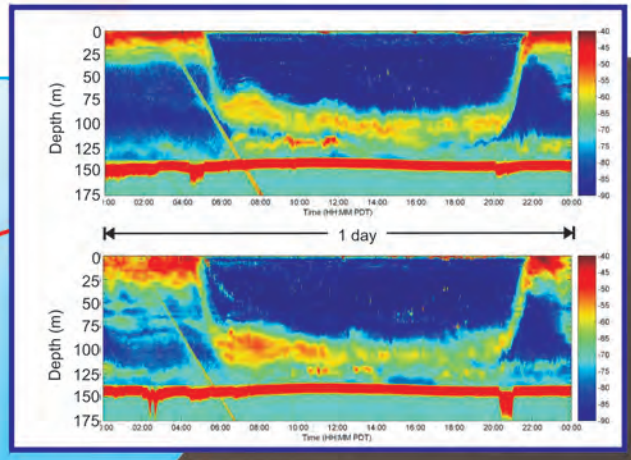

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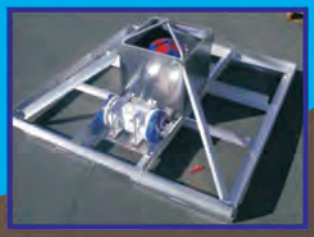

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....from the President's Desk

Friends and colleagues:

David Fissel
CMOS President
Président de la SCMO

With the onset of autumn (and the hockey season!), many of us are now back into our work and home activities that will take us through the winter holidays and into the New Year. With this in mind, I wish to remind you of the services that CMOS provides to its members (and many others) on a regular and ongoing basis throughout the year.

Perhaps the most prominent is the CMOS/SCMO Annual Congress. The very successful Ottawa Congress in Ottawa this past June (jointly held with the Canadian Geophysical Union) will be followed by the CMOS/SCMO 2011 Congress to be held in beautiful Victoria British Columbia from June 5-9. These congresses provide a great opportunity to present papers with the latest research results and new ideas, and also to network with colleagues from all across Canada and from outside Canada. The size and venue are very conducive to these vital networking activities.

Our CMOS publications also represent "flagship" activities provided by CMOS. This *CMOS Bulletin SCMO* is an important link to all our members, providing news on our Society's activities, interesting meteorology and oceanography articles and events of interest within Canada and beyond. Our publication, ATMOSPHERE-OCEAN, is undergoing some major changes, as discussed in our last issue of the Bulletin. The recent decisions made at the CMOS/SCMO Annual General Meeting will place ATMOSPHERE-OCEAN on a sustainable path over the foreseeable future. This publication will have expanded contents over the years ahead. As an incentive to our younger colleagues and to attract more publications, we are waiving our page charges for first publications by Canadian or Canadian-based authors.

(Continued on page 163 / Suite à la page 163)

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.

CMOS Bulletin SCMO
Volume 38 No.5
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Climate Change / Changement climatique

Our regular sections / Nos chroniques régulières

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

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Cover page: The Intergovernmental Oceanographic Commission (IOC) celebrates this year its 50th anniversary. You can read on **page 168** a short description of the kick off ceremony during the Oceans Day (June 8), a description of fifty years of services provided by the IOC to the society and a message from the actual executive secretary. The report ends with a message addressed to the Peoples and Nations of the World on behalf of the Ocean. Source: IOC website.

Page couverture: La Commission océanographique intergouvernementale (COI) célèbre cette année ses 50 ans d'existence. Vous pouvez lire en **page 168** une brève description de la cérémonie d'ouverture lors de la journée des Océans (8 juin), une description des services rendus à la société par la COI durant ces cinquante dernières années et le message de l'actuelle secrétaire exécutive à l'occasion de cette fête. Le rapport se termine par un message adressé aux peuples et aux nations du monde au nom des océans. Source: Site web de la COI.

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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 (Continued / Suite)

CMOS /SCMO also serves its members on a local and regional level through the operation of its 14 Centres located across Canada from Vancouver Island to Newfoundland and Labrador. These Centres host meetings, often featuring interesting scientific talks, from our members. The Centres also participate in local community events such as high school Science Fairs and in so doing, raise the profile of meteorology and oceanography across the country. The Centres host our CMOS/SCMO Annual Tour Speaker in the winter or spring of each year as well promoting the CNC-SCOR speakers who tour the country in the winter of each year. I encourage our CMOS members to get more involved in our Local Centres. It is a great way to increase the level of activity for meteorology and oceanography in your region and provides opportunities for networking with your peers and colleagues in your region.

Another important CMOS/SCMO activity is the collaborative work we do with other Canadian natural science societies and our involvement in international scientific organizations. I will leave further discussion of this important topic until our next *CMOS Bulletin SCMO*.

Finally, CMOS/SCMO acts as an effective advocate for meteorological and oceanographic issues on behalf of its members and to inform the general public. In past issues of this Bulletin, you have seen many examples of this, including presentations to public bodies such as the House [of Commons] Committee Finance, and the statements on Climate Change findings from the last Congress. A very recent example of our member advocacy activities is the recent intervention of CMOS/SCMO in dealing with a proposed amendment to the definition of "practice of professional engineering" in the Ontario Professional Engineers Act in the Ontario legislature (described elsewhere in this Bulletin). These changes would have been detrimental to our members and the general public in Ontario. CMOS/SCMO responded to this issue on very short notice: within one week of learning of this in late August, I signed a letter to the Attorney-General of Ontario. This was followed by a letter-writing campaign, in cooperation with other natural scientific societies, led by the Canadian Association of Physicists (CAP), which resulted in over 600 letters expressing concern being received by the Ontario Attorney General's Office. In less than two weeks of our first hearing of this matter, an agreement was reached with the Professional Engineers of Ontario (PEO) organization to have the exemption for natural scientists embedded into the Regulations of the Professional Engineers Act of Ontario. Although this issue is particular to the province of Ontario, it is potentially precedent-setting, with implications across Canada for all CMOS/SCMO members.

David Fissel
CMOS President
Président de la SCMO

Highlights of the August Executive Meeting

Congresses

2010 Ottawa
The 2010 Congress in Ottawa has resulted in a substantial financial surplus. Council is exploring ways to use the surplus for the benefit of CMOS and for future congresses. The Executive particularly acknowledges the efforts of the many volunteers who made this congress such a success.

2011 Victoria
The 2011 Congress website is expected to go online in early September, pending French translation. The venues are almost all organized, including a large hall for the Poster Sessions.

2012 Montréal
Two American Meteorological Society meetings will be held in conjunction with the 2012 CMOS Congress.

The Ontario Legislature has removed an exemption for natural scientists from an amended version of the bill that governs the practice of engineering in the province. The bill had already passed second reading before the change was brought to CMOS' attention. The removal of the exemption appears to allow Ontario's Professional Engineers to prosecute any non-engineer who practises any applied science that touches on health and safety. This could affect many members of CMOS who work in Ontario, including meteorologists, physicists, oceanographers and hydrologists. CMOS President, David Fissel, will write a letter to protest the move.

As Members of the Canadian Foundation for Climate and Atmospheric Science (CFCAS), CMOS Councillors recommend federal government representatives for the CFCAS Board of Trustees. There are currently two vacancies to fill, and CMOS Executives have been in correspondence with the Minister of the Environment to help fill these positions.

CMOS Membership continues to increase this year. The number of student members, in particular, is increasing.

Sophia Johannessen,
Recording Secretary / Secrétaire d'assemblée

Correspondance / Correspondence

From: Ian Rutherford
Executive Director
CMOS

To: All CMOS Members

Date: September 4, 2010

Subject: Ontario Engineering Act / Bill-68

As a result of quick action by the members of CAP, CMOS and many other natural science societies under the leadership of CAP, who wrote letters to the Attorney-General of Ontario, a tentative agreement has been reached with the Professional Engineers of Ontario (PEO) for an exemption for natural scientists working in Ontario. A Joint Communiqué prepared by the natural science societies involved in this effort appears below. Details of the Agreement and of the necessary follow-up actions to implement it will follow in the days to come. All those who wrote letters in support of this issue will receive a reply from the office of the Ontario Attorney-General.

Joint Communiqué (2010 September 3)

Over the past week we, as representatives of the scientific societies listed below, have been dealing with a proposed amendment to the definition of "practice of professional engineering" in the Ontario Professional Engineers Act through the Open for Business Act, 2010 (Bill 68). This Act removes an existing exemption clause for natural scientists. A letter-writing campaign resulted in over 600 letters expressing concern about this matter being received by the Ontario Attorney General's Office. As a result of this, the Attorney-General's Office raised the matter directly with the Professional Engineers of Ontario (PEO). On September 2, 2010, a CAP-led team of representatives from CAP, ACPO, CSC, CMOS, and COMP, on behalf of the natural scientists, met with the PEO's President, Diane Freeman, and CEO/Registrar, Kim Allen, to discuss this matter.

As a result of this discussion, an agreement in principle was reached between our societies and the PEO to introduce an exemption for natural scientists by modifying the Regulations in the Professional Engineers Act. These modifications will define a class of persons -- "Natural Scientists" -- that are exempt from being prevented by the Act from carrying out any act (including management) that requires the application of scientific principles, competently performed. The authorization for recognition of individuals that are in the category of "Natural Scientists" will reside with the respective scientific societies covered under this agreement. This agreement must still be ratified by the Councils of the various parties. Implementation of these procedures will be worked out by our respective societies as soon as possible. The Attorney General's Office of Ontario will be monitoring developments in this matter until an agreement is concluded to the satisfaction of all parties. The memorandum of agreement between the PEO and our societies is under review by the different groups to make sure it captured all of the points agreed to and should be finalized on Tuesday. It will be made available on our website as soon as it has been signed off by the parties involved.

Although this issue is particular to the province of Ontario, it is potentially precedent-setting, with implications across Canada. We believe that the proposed changes will greatly strengthen the practice of natural science, and we would not have reached this point were it not for the successful letter-writing campaign and the cooperation of the PEO and the Attorney-General's Office.

Our sincere thanks are sent to everyone who took the time to get involved. We will keep our respective communities informed of developments as they progress.

Canadian Association of Physicists	CAP
Association of the Chemical Profession of Ontario	ACPO
Canadian Astronomical Society	CASCA
Canadian Meteorological and Oceanographic Society	CMOS
Canadian Organization of Medical Physicists	COMP
Canadian Society for Chemistry	CSC
Chemical Institute of Canada	CIC

ARTICLES

2010 Pakistan Floods: Climate Change or Natural Variability?

by Madhav L Khandekar[1]

Résumé: Dans le contexte de la variabilité inter-annuelle de la mousson indienne, on a analysé les inondations historiques survenues au Pakistan au cours de la première semaine du mois d'août 2010. On a montré que les inondations au Pakistan, quoiqu'elles fussent uniques en son genre en apparence, sont bien dans les limites de la variabilité naturelle du climat de la mousson sur le sous-continent indien.

Introduction

Among the extreme weather events of summer 2010, the extensive floods in Pakistan and their widespread impacts garnered maximum attention in the media as well as in the scientific community. Several climate scientists expressed concern about such weather extremes becoming more common with future climate change, while the WMO (World Meteorological Organization) issued a statement that *the weather related cataclysms of July and August (2010) fit patterns predicted by climate scientists.* The extensive damage due to floods and plight of thousands of people marooned over waterlogged areas were graphically covered in heart-wrenching details by most newspapers and TV news stories in Canada. Per latest estimates, the floods have claimed over 1500 human fatalities so far and over two million more have been rendered homeless. From a personal perspective, the TV footage of women & children in knee-deep water brought back poignant memories of a similar situation I witnessed in Pune, my former *home-town* (a city 200 km southeast of Mumbai, the largest Indian city on the west coast) in July 1961 when incessant monsoon rains in the first week of July 1961 led to the breaking of a dam resulting in massive flooding of the city, destroying hundreds of homes and drowning dozens of people living along the riverside. Several other cities and regions suffered from similar flooding during the 1961 summer monsoon. As it turned out, the 1961 summer monsoon over India and vicinity was the rainiest monsoon season in the 150-year instrument data which caused extensive flooding and loss of life and property in many regions of the country (India Meteorological Department 1962). This year's monsoon has been quite vigorous since the third week of July 2010 and heavy rains have caused flooding in the peninsular regions of India and also in the northwest regions bordering with Pakistan. Has the vigorous Indian monsoon of 2010 led to the historic floods in Pakistan? Let us briefly consider the monsoon climatology.

Floods & droughts in the Indian monsoon

It should be noted first that the monsoon season in Pakistan is almost in tandem with the Indian monsoon, which is primarily driven by regional as well as global scale features like the ENSO (El Niño-Southern Oscillation) phase, Eurasian snow cover during the (previous) winter season and the QBO (Quasi-Biennial Oscillation) phase of the equatorial stratospheric wind oscillation (see e.g., Khandekar 1996). The monsoon season in Pakistan is generally of a shorter duration, from about 1st of July till about third week of September. Pakistan as a whole receives just about 50 cm (~ 20 inches) monsoon rains, compared to about 85 cm for the whole of India during the June-September season. Based on an excellent dataset of close to 150 years, some of the most severe floods and droughts in the Indian monsoon have been identified as shown in Figure 1. This figure shows how the floods and droughts have occurred irregularly throughout the 150-yr period and do not appear to reveal any increasing/decreasing trend. As mentioned earlier, the 1961 summer monsoon was the rainiest with extensive flooding while the year 1877 witnessed the most severe drought with over 40% deficit in total seasonal rains. Among other droughts and floods, the monsoon rains were exceptionally heavy in 1917 with extensive floods over many areas of the country, while 1972 was a major drought year resulting in sharply reduced grain yields. The decade of the 1930s experienced in general surplus rains over most of India with three flood years, namely 1933, 1936 and 1938 (Bhalme & Mooley 1980). It is of interest to note that the1930s were part of the *dust bowl* years on the Canadian/US Prairies. A possible teleconnective link between Indian monsoon flood and Canadian Prairie drought has been speculated by Khandekar (2004).

[1] Markham, Ontario. Madhav Khandekar is a former research scientist from Environment Canada and was an expert reviewer for the IPCC (Intergovernmental Panel on Climate Change) 2007 Climate Change Documents. Khandekar has been in weather and climate science for over 53 years and is presently studying monsoon inter-annual variability in the context of global warming and climate change issues.

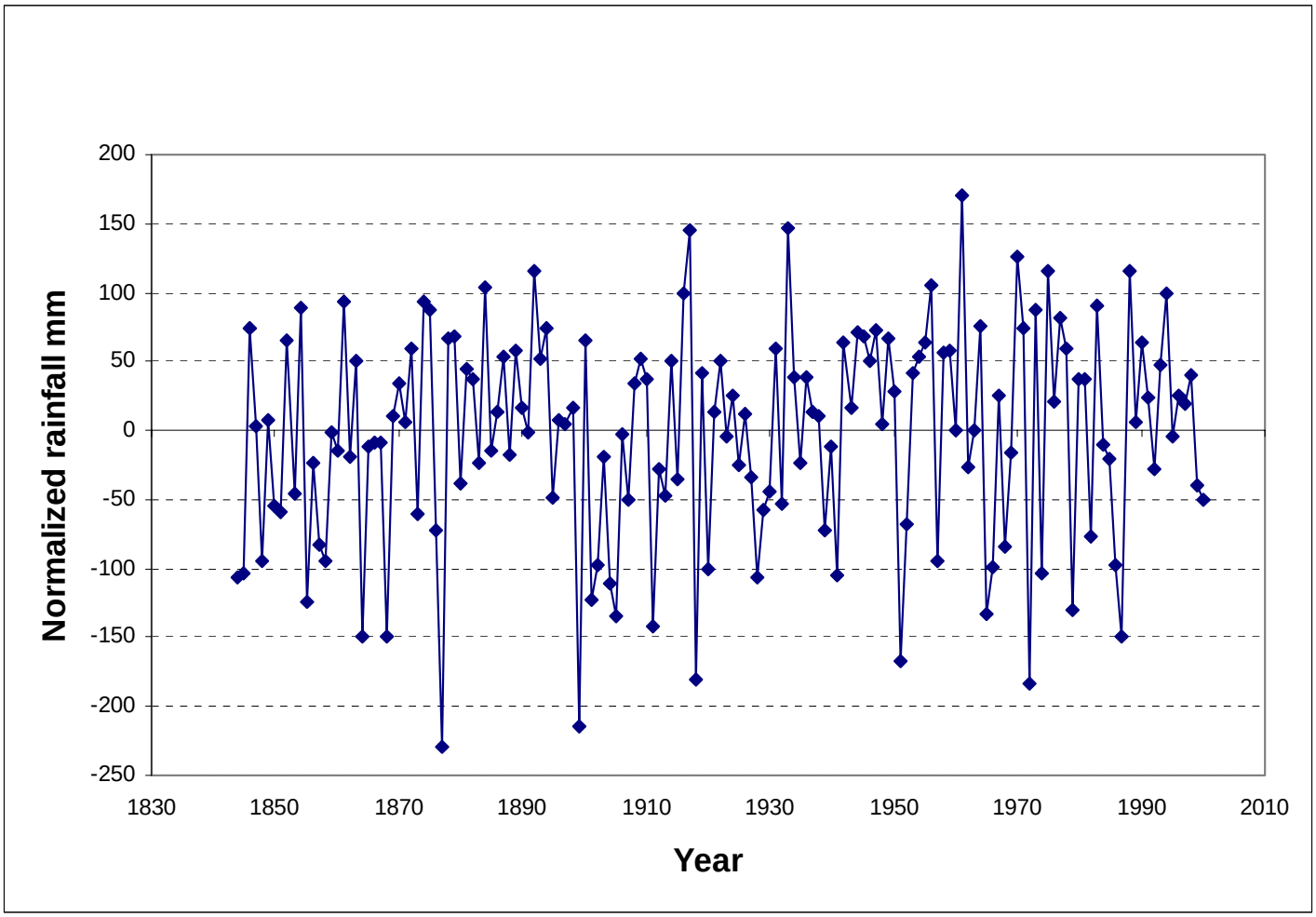

Figure1: Variability in the Indian summer monsoon rainfall, 1844-2000, with seven major droughts (1868, 1877, 1899, 1918, 1951, 1972 and 1987) and six major floods (1892, 1917, 1933, 1961, 1970 and 1975) as shown.

Besides these floods and droughts occurring irregularly, the inter-annual variability of monsoon shown in Figure 1 reveals several consecutive years with a flood following a drought. For example, the years 1941, 1972 and 1987 were drought years, while the following years 1942, 1973 and 1988 were flood years. Such a flood-drought sequence seems to suggest a biennial mechanism for the Indian monsoon driven by large-scale atmosphere-ocean circulation patterns and has been analyzed by Terray (1987) among others. The primary mechanism driving such back-to-back flood & drought monsoon seems to be the ENSO phase and its evolution from an El Niño (warm) event to a La Niña (cold) event. The years 1941, 1972 and 1987 were El Niño years, while the succeeding years 1942, 1973 and 1988 were La Niña years. An El Niño event helps suppress convective activity over the Bay of Bengal region (Francis & Gadgil 2009) wherefrom moisture is transported towards the northern Gangetic Plains region and further into northwest India along the *Axis of Monsoon Trough* which by July is established in a southeast-northwest track from the Bay of Bengal to the northwest region of India bordering Pakistan. (see Figure 2). A few monsoon depressions in the Bay of Bengal help transport moisture in the northwest regions of India and occasionally into Pakistan during the active period of the monsoon season, approximately from early July through mid-August.

Possible cause of flood in Pakistan & northwest India during 2010

The El Niño event of 2009, which produced one of the warmest winters in Canada, was coming to an end by spring 2010. By June 2010, a La Niña (cold phase of ENSO) was developing in the equatorial Pacific, which became intensified by early July. In response to this developing La Niña, the convection over the Bay of Bengal was enhanced and several monsoon depressions helped steer the monsoonal flow into the northwest parts of the Indian subcontinent. During the third week of July 2010, a persistent low pressure over the State of Rajasthan in the northwest part of India helped steer additional moisture into northwest Pakistan resulting in heavy rain events and subsequent flooding. Similar flooding occurred in the Indian

States of Rajasthan, Punjab and Kashmir which are adjacent to Pakistan. Per latest statistics (as of August 25 2010), from the India Meteorological Department, the seasonal rainfall over the northwestern Indian States has already exceeded 125% of the normal. For the 2010 summer monsoon, the total all-India wide rainfall amount until 15 September 2010 is at 836 mm. It is estimated that this summer's rainfall amount (June - September) will be about 900 mm, which is 105% of long-term normal of 852 mm.

Figure 2: Outline map of India and Pakistan showing normal July position of monsoon trough axis.

It is worth noting that in a given monsoon season, localized and/or regional flooding can occur in some parts of the Indian subcontinent, while some other parts may be suffering from rain deficit at the same time. Such surplus/deficit rain patterns are an integral part of the monsoon season which rarely ever produces evenly distributed rainfall in a season. During the rainiest monsoon season of 1961, central India received about 30% more rain than normal, while the northeast region (where the world's wettest spot Cherrapunjee is located) the seasonal rains were in deficit by 25%.

Concluding Remarks

A rapid transition of the ENSO phase from El Niño to La Niña between spring and summer of 2010 appears to be the key element in triggering a vigorous monsoon of 2010 over the Indian subcontinent. The La Niña phase was responsible for enhanced convective activity over the Bay of Bengal where several monsoon depressions were formed. The depressions while traveling along the axis of monsoon trough carried sufficient moisture towards northwest leading to extensive flooding. Local and regional factors like topography may have exacerbated the impact of floods in some areas. An examination of monsoon climatology as revealed by Figure 1 suggests that *the 2010 Pakistan floods, although seemingly unprecedented, were well within natural variability of monsoonal climate over the Indian subcontinent*. As I have suggested before (Khandekar 2009), there is an urgent need for an improved understanding of many complex features associated with the Indian/Asian monsoon system. An improved understanding may enable us to improve monsoon predictability, thereby minimizing adverse future impacts of such floods and droughts.

Acknowledgements

I wish to sincerely thank to my wife Shalan for her help with the diagrams.

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Next Issue *CMOS Bulletin SCMO*

Next issue of the *CMOS Bulletin SCMO* will be published in **December 2010.** Please send your articles, notes, workshop reports or news items before **November 5, 2010** to the address given on page 122. We have an URGENT need for your written contributions.

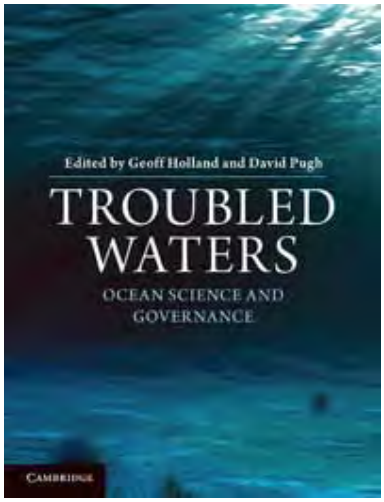
Prochain numéro du *CMOS Bulletin SCMO*

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en **décembre 2010.** Prière de nous faire parvenir avant le **5 novembre 2010** vos articles, notes, rapports d'atelier ou nouvelles à l'adresse indiquée à la page 122. Nous avons un besoin URGENT de vos contributions écrites.

REPORTS / RAPPORTS

50th Anniversary of the IOC

The Intergovernmental Oceanographic Commission of UNESCO kicked off the celebration of its 50th anniversary in Paris with a special celebration on Oceans Day, June 8. The IOC has, for half a century, been the UN organization responsible for fostering intergovernmental cooperation on global ocean SCIENCE issues. That special day was part of the 43rd session of the IOC Executive Council and was the first governing body meeting held under the direction of its new Executive Secretary, Wendy Watson-Wright, the former ADM of DFO. The Canadian delegation was led by Dr. Savi Narayanan, Dominion Hydrographer and D/G Ocean Sciences. The IOC has, for half a century, been the UN organization responsible for fostering intergovernmental cooperation on global ocean issues.



A book entitled "*Troubled Waters – Ocean Science and Governance*" was launched at the event. The anniversary volume, by Cambridge University Press, will be available early fall, but a proof copy was on display. It draws on the experience of 30 international experts to look at how governments use science to establish ocean policies, with chapters ranging from the history of ocean management to current advances in marine science, observation and management applications, and the international agencies that co-ordinate this work. The co-editors are Geoff Holland (Canada) and David Pugh (UK). Other Canadians - Allyn Clarke, Elizabeth Gross, and Ron Macnab - contributed chapters. Canada was also instrumental in supporting the publication costs that got the book off the ground.

With a focus on key topical issues such as marine pollution, exploitation, and hazards, Troubled Waters reflects on past successes and failures in ocean management and emphasises the need for knowledge and effective government action to direct decisions that will ensure a sustainable future for the ocean. It is fully illustrated and it is hoped to provide an attractive and accessible overview for anyone concerned about the future stewardship of our oceans.

Fifty years of IOC in the service of society[1]

"…While pioneering research and new ideas usually come from individuals and small groups, many aspects of oceanic investigations present far too formidable a task to be undertaken by any one nation or even a few nations."
(UNESCO, 1960)

Founded in 1960, the Intergovernmental Oceanographic Commission (IOC) has its Secretariat at UNESCO headquarters in Paris (France). IOC now focusses on four major themes:

Coordination of Oceanographic research programmes
IOC develops, promotes and facilitates international oceanographic research programmes to improve our understanding of critical global and regional ocean processes and their relationship to the sustainable development and stewardship of ocean resources.

Global Ocean Observing System and Data Management
IOC ensures the effective planning, establishment and co-ordination of an operational global ocean observing system. This provides the information needed for oceanic and atmospheric forecasting, for oceans and coastal zone management by coastal nations, and for global environmental change research as well as ensuring that data and information obtained through research, observation and monitoring are handled efficiently and made widely available.

Mitigation of Marine Natural Hazards
Following the December 2004 Indian Ocean Tsunami, IOC led the efforts to establish a global marine multi-hazards warning system to monitor and predict hazards and, when hazards occur, to issue rapid warnings and mitigation plans.

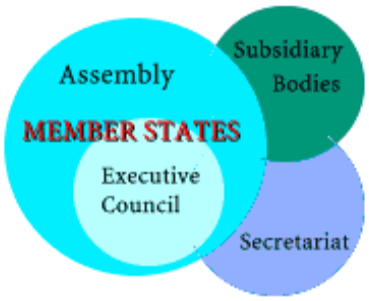
Support to Capacity Development
IOC provides international leadership for education and training programmes and the technical assistance that is essential for systematic observations of the global ocean

[1] IOC website at: www.ioc-unesco.org

and its coastal zone and related research, as well for the sustainable development of the countries involved.

Structure and organization of IOC

IOC currently has 138 Member States. Each Member State has one seat in the Assembly, which meets once every two years. The Assembly is the principal organ of the Commission and makes all decisions to accomplish the objectives of IOC. An Executive Council meets every year to provide guidance to the Secretariat for the implementation of activities, between meetings of the Assembly.



Administrative structure of the IOC

A maximum of 40 Member States sit on the Executive Council at any time. The Executive Council reports to the Assembly. The activities coordinated by the Secretariat are implemented through technical and regional subsidiary bodies such as ICAM (Integrated Coastal Area Management), GOOS (Global Ocean Observing System), IODE (International Oceanographic Data and Information Exchange), JCOMM (Joint Technical Commission for Oceanographic and Marine Meteorology) and others. For more information see:

http://ioc-unesco.org/

Message from the Assistant Director General and Executive Secretary of the Intergovernmental Oceanographic Commission (IOC) of UNESCO

by Wendy Watson-Wright[2]

The Intergovernmental Oceanographic Commission (IOC) is celebrating 50 years since the historic decision of the 1960 UNESCO General Conference to establish an organization that could coordinate among governments the operational, logistical, and legal support necessary for conducting marine science on an international scale. Forty States joined as Members of the new Commission during its first year. Today IOC has 138 Member States and works as a body with functional autonomy within UNESCO.

[2] Former ADM, Science, Department of Fisheries and Oceans, Ottawa, Canada

In partnership with other UN agencies -- such as WMO (World Meteorological Organization), FAO (Food and Agriculture Organization) and UNEP (United Nations Environment Programme) -- as well as with hundreds of oceanographic and marine research laboratories, the IOC is playing a critical role in addressing the major challenges facing the world's ocean. Key programs include identifying and protecting marine biodiversity, monitoring the ocean's response to global climate change, and coordinating a global coastal hazards and tsunami early warning system.

The services that the IOC has offered over the last 50 years are to be commended. But during this 50th anniversary we are especially excited to look forward toward the future. Never has the IOC been so necessaryas it is today. We are increasingly confronted with challenges of a global nature, requiring exactly the kind of intergovernmental platform that IOC offers.

The magnitude 9.0 earthquake of 26 December 2004 triggered a basin-wide Indian Ocean tsunami that killed more than 200,000 people in eleven countries -- over 30,000 of them in Sri Lanka, some 1600 kilometres away from the epicentre in Indonesia. Unlike in the Pacific Ocean, where IOC has been coordinating a tsunami warning centre since 1965, there was no early warning capacity for the Indian Ocean. As the UN-affiliated organization with responsibility for the oceans, the IOC was asked to coordinate a global effort to establish tsunami warning systems as part of an overall multi-hazard coastal disaster reduction strategy. After intense and delicate intergovernmental diplomacy involving 28 countries, an Indian Ocean tsunami warning system was set up in 5 years and will soon be owned by the Member States. Similar systems are also nearing completion for the Caribbean, Mediterranean and North Atlantic.

Much of what IOC does may not seem glamorous. It is often behind-the-scenes work such as meetings and consultations, agreements, and seminars. But at the grass-root level the main corpus of IOC are the scientists themselves, at sea and in laboratories around the globe. Through IOC, researchers are able to form networks of cooperation and share ideas and resources that enable them to tackle challenges that are too big for any one research centre, one nation, or even one region. Indeed one of the founding mandates of IOC has been to coordinate global observations of the ocean. The physical, chemical and biological characteristics of the ocean are important vital signs of the planet's well-being. But to understand indications of change it is critical to monitor these vital signs frequently, with as fine detail as possible, and from marine locations around the world. Just in the last 10 years, for example, the IOC has helped countries launch more than 3,000 Argo floats, which take more than 100,000 salinity and temperature profiles each year – more than 20 times the annual hydrography profiles taken from research vessels. Last year, IOC helped to develop the "Assessment

of Assessments" study– the first step in launching a Regular Process for assessing the state of the marine environment in order to have a more holistic and integrated picture of the ocean.

As a global organization, the IOC relies on the continued support of its Member States, in terms of commitment and funding, to help improve the level of research, data exchange and dialogue on ocean-related issues. Credible and timely scientific information is essential to understanding the impacts of global change and to guide responses. With economies around the world still coping with recession, it would be ill-advised to think that oceanographic research is an expensive luxury.

This 50th anniversary of IOC should help remind Member States why continued and strengthened support of IOC is a vital investment for our future.

Message du Sous-Directeur général et Secrétaire exécutif de la Commission océanographique intergouvernementale (COI) de l'UNESCO

par Wendy Watson-Wright[3]

La Commission océanographique intergouvernementale (COI) célèbre les cinquante années qui se sont écoulées depuis la décision historique, prise lors de la Conférence générale de l'UNESCO de 1960, d'établir une organisation qui puisse coordonner au niveau des gouvernements le soutien opérationnel, logistique et juridique nécessaire à la conduite de recherches en sciences de la mer à l'échelle internationale. L'année de sa création, quarante États sont devenus membres de la nouvelle Commission. Aujourd'hui, la COI est une entité composée de 138 États membres qui jouit d'une autonomie fonctionnelle au sein de l'UNESCO.

En partenariat avec d'autres agences de l'ONU, notamment l'OMM (Organisation météorologique mondiale), la FAO (Organisation des Nations Unies pour l'alimentation et l'agriculture) et le PNUE (Programme des Nations Unies pour l'environnement), ainsi que plusieurs centaines de laboratoires de recherche océanographique et en sciences de la mer, la COI joue un rôle crucial pour relever les défis majeurs auxquels les océans du globe sont confrontés. Les principaux programmes de la COI portent sur l'identification et la protection de la biodiversité marine, le suivi de la réaction des océans au changement climatique global et la coordination des risques côtiers et des systèmes d'alerte rapide aux tsunamis dans le monde.

[3] Jusqu'en décembre 2009, Sous-ministre adjointe, Science, Ministère des Pêches et Océans, Ottawa, Canada.

Nous pouvons bien sûr saluer les services que la COI a offert au cours des cinquante dernières années, mais, à l'occasion de cet anniversaire, nous avons plutôt le regard tourné vers l'avenir. En effet, la COI joue aujourd'hui un rôle plus important que jamais. Nous sommes de plus en plus confrontés à des défis de nature globale qui nécessitent exactement le genre de plate-forme intergouvernementale offerte par la COI.

Le tremblement de terre de magnitude 9 du 26 décembre 2004 a provoqué un tsunami dans tout l'océan Indien, faisant plus de 200 000 victimes dans onze pays, dont plus de 30 000 au Sri Lanka, territoire situé à quelque 1 600 kilomètres de l'épicentre en Indonésie. Contrairement à l'océan Pacifique, où la COI coordonne un centre d'alerte au tsunami depuis 1965, aucune capacité d'alerte rapide n'existait pour l'océan Indien. En tant qu'organisation responsable des océans affiliée à l'ONU, la COI a été chargée de coordonner les efforts déployés à l'échelle mondiale pour établir des systèmes d'alerte au tsunami dans le cadre d'une stratégie globale et multi-risques de réduction des catastrophes côtières. À l'issue d'intenses et délicates démarches de diplomatie intergouvernementale impliquant 28 pays, un système d'alerte au tsunami pour l'océan Indien a été mis sur pied en cinq ans. Il sera sous peu la propriété des États membres. Des systèmes similaires seront bientôt prêts pour les Caraïbes, la Méditerranée et l'Atlantique nord.

Vue de l'extérieur, la majeure partie du travail de la COI n'a rien de passionnant. Il s'agit rarement d'actions menées sous les feux des projecteurs, mais plutôt de réunions et de consultations, d'accords et de séminaires. En réalité, le cœur de la COI réside à sa base, dans la légion de scientifiques en mer et en laboratoire qui travaillent aux quatre coins du globe. Grâce à la COI, ces chercheurs sont capables de former des réseaux de coopération et de partager des idées et des ressources qui leur permettent de relever des défis trop vastes pour n'importe quel centre de recherche, nation ou région. En effet, l'un des mandats fondateurs de la COI consiste en la coordination des observations globales des océans. Les caractéristiques physiques, chimiques et biologiques des océans constituent d'importants signes vitaux de l'état de santé de la planète. Mais pour comprendre les indications de changement, il est crucial de surveiller fréquemment ces signes vitaux, de manière aussi approfondie que possible, sur des sites marins du monde entier. Ainsi, au cours des dix dernières années seulement, la COI a aidé plusieurs pays à lancer quelque 3 000 balises Argos qui ont permis de déterminer plus de 100 000 profils de salinité et de température chaque année, un chiffre plus de vingt fois supérieur au nombre de profils hydrographiques recueillis tous les ans par des bateaux de recherche. L'année dernière, la COI a participé à l'élaboration de l'«Évaluation des évaluations », une étude qui constitue la première étape du lancement d'une procédure régulière d'évaluation de l'état de l'environnement marin destinée à obtenir une image plus

holistique et intégrée des océans.

En tant qu'organisation internationale, la COI compte sur le soutien constant de ses États membres, en termes d'engagement et de financement, pour améliorer le niveau de la recherche, l'échange de données et le dialogue sur les sujets liés aux océans. Il est essentiel de disposer d'informations scientifiques crédibles et opportunes pour comprendre les répercussions du changement global et pour en guider les réponses. À l'heure où les économies du monde entier restent en proie à la récession, il serait malavisé de penser que la recherche océanographique représente un luxe onéreux.

Ce 50e anniversaire doit être l'occasion de rappeler aux États membres pourquoi il est fondamental pour notre avenir de poursuivre et de renforcer les investissements dans le soutien de la COI.

Calls for Action

Excerpt from the Report of the Canadian Delegation

"There were two Calls for Action delivered at this Ocean's Day celebrations [June 8th, 2010]. One was delivered by two young women representing the youth of the world; the second was delivered by Mr. Geoff Holland on behalf of the oceans community (Annex 1)."

ANNEX 1 to the Canadian Delegation Report

A Message to the Peoples and Nations of the World On Behalf of the Ocean

(*On the occasion of a celebration for the fiftieth anniversary of the establishment of the Intergovernmental Oceanographic Commission/UNESCO, June 08, 2010*)

For generations the ocean has been regarded as massive, impenetrable and invulnerable. This is a false concept that can no longer be accepted with impunity. Relatively, it is not massive, together with the land surface and atmosphere it forms only a thin skin between the thousands of kilometres of rock and magnum beneath and the infinity of space above. It is a planetary meniscus on which our present environment and our lives depend. Secondly, it is no longer impenetrable; today a growing fraction of our mineral resources comes from beneath the sea floor. Our automated instruments are scattered in the ocean waters across the globe.

Researchers are now reaching into the depths, and uncovering some of its secrets, although results suggest that these are merely harbingers of what is still unknown. Finally, the ocean is not invulnerable. The wastes of our society, flowing from the land, and through the atmosphere, from agriculture, industry and a growing urban population, can be seen in the fragile coastal waters and measured even in the centre of the water masses.

However, the context for this message to the world should not be one of doom. Thankfully our ocean is still vital; its life, beauty and power still amaze us. We can, and should, celebrate and recognize the importance of the ocean to the culture, economy and well-being of our society. But the ocean does deserve our attention. As a society we must collectively and unambiguously acknowledge the importance of the oceans to our existence on the planet. The ocean cleanses the air we breathe; it influences our weather, climate, and the water on which we depend. We must be aware of the changes we bring to the ocean and the consequences of our actions. For this we require information and the knowledge, insight and determination to use that information collectively and wisely.

We have a responsibility to our children, their children and their children's children. Our legacy must be a sustainable and healthy environment. It is a responsibility that transcends national, political and social differences. As one, we are the people of the Earth and we must act together to protect and perpetuate the environment on which we depend.

The attached call on behalf of the ocean is a plea to all for an adequate and responsive recognition of the importance of the ocean.

> *"...I must go down to the seas again, for the call of the running tide*
> *Is a wild call and a clear call that may not be denied...."*
>
> John Masefield (1878 - 1967)

The Ocean Call

TO *the peoples of the world, we ask for recognition that the oceans and their resources are a necessary element of life on the planet. We also ask that you respect the ocean and understand that actions and activities even deep within continents can impact the marine environment. Governmental responses can be ponderous but ultimately they must reflect the will and priorities of their constituencies. The ocean deserves your support.*

TO *those who finance and undertake capacity building programs, we ask that increased priority be given to programs in coastal and ocean management, ocean sciences and ocean technologies in order to provide safe, healthy and sustainable environments and reduce poverty through the promotion of effective and efficient marine stewardship.*

***TO** the scientists in all ocean disciplines, we ask that you continue your dedication to gather and interpret marine data, to inform the public and decision-makers of the results of your studies and to maintain a collegiate and multidisciplinary community.*

***TO** the extensive framework of learned professionals and environmental lobbyists in academia, industry, politics and law and to all those who have achieved leading positions and authoritative voices in our society, we ask that you will use your position and influence to further the support and attention needed to sustain and preserve our ocean environment.*

***TO** the media, whose role it is to inform our largely terrestrial society of the news and events of interest and importance, we ask that you recognise the ocean as an integral part of our environment and of our society. From tourism to trade, from energy to food, from high finance to indigenous fisheries and from megacities to mangrove habitats, there is a story with an ocean connection that needs telling.*

***TO** governments, we ask that you address the present deficiencies in the support of the marine environment. Nationally, to ensure that ocean research is adequately funded, that the infrastructure to distribute ocean information is in place, that sustainable marine management practices are fostered and that terrestrial and atmospheric policies take account of potential impacts on the ocean. Internationally, we ask you to adopt as a premise that sustaining the global environment remains the ultimate priority and that national differences must be overcome in working collectively for the future.*

***TO** the youth, we make the final and perhaps the most important request. We ask that you listen and learn, that you profit from the advances that we have achieved and avoid the mistakes that we have committed. You are the future. The ocean needs your enthusiasm, creativity and ability as scientists, managers, lawyers and politicians to champion its cause and to sustain its splendour and resources for generations to come.*

2009 NRC Annual Performance Review Questionnaire

(Abridged Report Version)

Background

The CNC/IUGG advises CGU and CMOS on matters related to IUGG. The National Research Council of Canada – NRC, on behalf of the Canadian scientific and engineering community, plays a key role in a number of international S&T networks of strategic importance to Canada. In particular, since 1931, the NRC has been adhered to 30 international scientific organizations, most of which fall under the International Council of Scientific Unions (ICSU). IUGG is one of these 30 scientific organizations.

Of particular importance to us, the IUGG comprises eight associations, each responsible for a specific range of topics or themes within the overall scope of its activities. The CNC/IUGG under the leadership of Prof. Zoltan Hajnal comprises eight senior and eight junior Canadian national representatives. The CNC/IUGG reports to both, the adhering body (NRC) and the IUGG.

Among the many tasks and objectives of the CNC/IUGG is the preparation of the Annual Performance Review (APR) to NRC that provides a means for the NRC, ICSU Secretariat, and the Committee on International Science, Engineering and Technology – CISET, to assess the impact of Canada's international affiliations. Based on a satisfactory APR, the NRC will continue to pay Canada's annual dues to IUGG, which currently amount to $16,750 USD. These dues maintain Canada's high level membership (level six) adherence to IUGG.

Section 1: Assessment of the Importance of the International Affiliation

Is the International Affiliation Important within a Canadian Context?

Yes, the fields of science represented by the IUGG (International Union of Geodesy and Geophysics) are vital components of the Government's *S&T* Strategy. They cover two of the four areas of focus identified in the *S&T* Strategy, namely environmental science and technologies and natural resources and energy.

IUGG is a non-governmental, scientific organization, dedicated to the international promotion and coordination of scientific studies of Earth and its environment in space. The current mission is promoting and communicating knowledge of the Earth system, its space environment and the dynamic processes causing change, including the gravitational and magnetic fields, the dynamics of the Earth as a whole and of its component parts, the Earth's internal structure,

composition and tectonics, the generation of magmas, volcanism and rock formation, the hydrological cycle including snow and ice, all aspects of the oceans, the atmosphere, ionosphere, magnetosphere and solar-terrestrial relations. [*IUGG detailed structure was omitted*].

The following statements are quotes from "*Mobilizing Science and Technology to Canada's Advantage, 2007*" [*Statements from pp. 7, 8 and 20 were omitted but the responses to the statements were retained*].

Response: IUGG provides guidance and forum that promote advanced research which directly benefits the quality of our environment and help manage our natural and energy resources. IUGG and its supporting associations provide international information exchange. This is critical for global issues, which also impact Canadian society and its economy. Examples of issues addressed by the IUGG include trans-continental transport of pollutants by winds, water quality, sequestration of greenhouse gases in the ocean and land, remote sensing technologies, impact of changing climate on our ocean, glaciers, water resources, fisheries, agriculture and forests.

[*Statements from p. 11 were omitted but the responses were retained*].

Response: Through IUGG participation Canada has developed satellite remote sensing capabilities in the environmental sciences that are sold or exported around the world. One example is RADARSAT which was partly developed to better assess water resources and sea ice cover. Other examples are Canadian water resource computer models that are used for global consulting activities by Canadian companies. The internationally recognized Weyburn CO_2 Sequestration Project is supported by Canada through several Federal and Provincial Government Agencies. It is also funded by partners, such as US Department of Energy, several Hydrocarbon producing Companies as well as Universities from Canada, United States, Great Britain, France and Italy. Currently the project is in the second 4 year phase. [*Details on the project were omitted*].

Canada hosted the 2009 Joint International Assembly of IAPSO (International Association for the Physical Sciences of the Ocean), IAMAS (International Association of Meteorology and Atmospheric Sciences), and the new IACS, (International Association of Cryospheric Sciences), which are all associations within IUGG. This meeting was held in Montréal 19-29 July, attracting over 2000 scientists from all nations. [*Details on the organizing committee omitted in this version*].

[*Statements from p.63 were omitted in this version but the responses were retained*].

Response: Leadership in public R&D performance requires international collaborations among all three sectors (public, academic, private) at the international level. IUGG provides these collaborations through its meetings and committees. International collaborations enable Canadians to leverage research programs carried out in other IUGG member countries, thus enhancing value for money spent by Canada's granting councils. An example of how Canada has strategically focussed international science onto its own national concerns is the creation of the International Association of Cryospheric Sciences (IACS). IACS was created by a Canadian (H.G. Jones, U. Québec) who convinced the IUGG council of the need for a new scientific focus on global snow and ice because of the importance of snow, sea ice, glaciers and their change to the planet and to cold regions environmental science, society and industry. IACS is the first new IUGG association in over 80 years. IAPSO supports formal and informal international forums permitting ready means of communication amongst ocean scientists throughout the world. IAPSO establishes commissions to co-ordinate new and advanced international research activities which address the Canadian goal of exploring new approaches to S&T. Similar commission structures are set up by IAHS and IAMAS.

[*Statements from p.86 were omitted in this version but the responses were retained*].

Response: IUGG strengthens Canada's ties to the global supply of ideas, talent and technology. IUGG is the international organization dedicated to advancing, promoting, and communicating knowledge of the Earth system, its space environment, and the dynamical processes causing change. Through its constituent Associations, Commissions, and services, IUGG convenes international assemblies and workshops, undertakes research, assembles observations, gains insights, coordinates activities, liaises with other scientific bodies, plays an advocacy role, contributes to education, and works to expand capabilities and participation worldwide. Data, information, and knowledge gained are made openly available for the benefit of society – to provide the information necessary for the discovery and responsible use of natural resources, sustainable management of the environment, reducing the impact of natural hazards, and to satisfy our curiosity about the Earth's natural environment and the consequences of human activities.

The IUGG supports a critical and highly developed Canadian scientific network. For example, the Canadian Foundation for Climate and Atmospheric Sciences has disbursed or will disburse over $110M to hundreds of researchers at most universities in Canada over the period 2000-2010. [*Details of research were omitted*]. A growing private sector is turning these advances into commercial products for clients in Canada and abroad.

IAGA is a diversified Association of IUGG. Its scientific divisions (Internal Magnetic Fields; Aeronomic Phenomena; Magnetospheric Phenomena; Solar Wind and Interplanetary Field; Geomagnetic Observatories, Surveys and Analyses) provide important and strong support in a number of Canadian *S&T* strategic areas, including Earth and space environment, space weather, natural resources and energy, space communications technologies, among others. In particular, it provides strong support to the *S&T* policy objectives of Natural Resources Canada (NRCan) and the Canadian Space Agency (CSA).

IAPSO has the prime goal of promoting the study of scientific problems relating to the ocean and the interactions taking place at the sea floor and the coastal and atmospheric boundaries, chiefly insofar as such study may be carried out by the aid of mathematics, physics and chemistry. The expected breakthroughs include important contributions to the understanding of climate change and its impact on the global and regional oceans and fisheries. Canadian scientists have made important contributions to international efforts, for which they were awarded the Nobel Peace Prize. Canadian scientists are also active in various IAPSO Working Groups.

IAMAS Commissions: The International Commission on Atmospheric Chemistry and Global Pollution are highly relevant to Canada since their activities include areas that affect Canada's environment, and through that Canada's industries and thus our national competitiveness.

IASPEI promotes studies of seismic waves propagated in the Earth interior. Over one thousand institutional, academic and private scientists are involved in these investigations. A component of the internationally recognized National LITHOPROBE project was development of a number of special portable recording systems. The instruments were designed and developed by scientists of the Earth Sciences Sector of the GSC. [*Details on the marketing of the technology omitted*].

IAHS and IACS members are active in the CGU and CWRA. IAHS commissions include remote sensing, tracers, continental erosion, snow and ice hydrology, water resources systems, coupled land atmosphere systems, water quality, and groundwater. The CGU has a Hydrology Section (~200 members) with committees that largely mirror these commissions and ensure Canadian implementation and coordination of this internationally recognized research. IACS members are involved in keeping an inventory and assessment of the health of Canada's glaciers with particular focus on the western cordillera where glaciers are declining rapidly, and the Arctic glaciers that have an important influence on the Arctic Ocean. [*Details on the CWRA omitted*].

CGU and CMOS are forming the Canadian Societies for the Geophysical Sciences (CSGS) to improve the internal networking ability of geophysical sciences in Canada. The first meeting of CSGS is planned for Ottawa in 2010 as part of a joint CMOS-CGU Congress. The first CMOS-CGU Congress was held in St. John's, NL, in 2007 and attracted 900 participants.

Section 2: Assessment of the Effectiveness of the Supporting NRC Partner/CNC

Does the NRC Partner/CNC ensure the representation, promotion, and protection of Canadian interests in the international scientific community?

CNC/IUGG effectively represents five autonomous scientific societies in Canada. These societies as well as their members are proactive at various levels to promote and protect Canadian interests in the international scientific community. The societies regularly hold annual meetings within their subject areas or meeting jointly with other societies within the group. A joint CMOS-CGU Congress is planned to be held in Ottawa in June 2010 with significant effort expended in organizing this during 2009. The theme of the Congress is "Our Earth, Our Air, Our Water, Our Future". This congress will be attended by over 1000 scientists.

CGU also frequently has joint scientific meetings and workshops with GAC where IUGG-related issues are presented and discussed. CGU was co-organizer of the JOINT ASSEMBLY in 2009 in Toronto, with AGU, GAC, MAC, MSA, GS, IAH-CNC, and SEG. Over 5000 delegates participated in the program. IUGG "News Letters" are regularly distributed to members of the CNC/IUGG committee and relevant information is further transmitted to members of their own societies.

The CGU/CNC for IUGG consults closely with the atmospheric and space physics community in Canada through the members appointed by the Canadian Association of Physicists (CAP) and the Division of Atmospheric and Space Physics (DASP). DASP holds an annual workshop meeting, which is attended by active researchers in the atmospheric and space research communities in Canada. [*Details of workshop omitted*]. The Canadian atmospheric and space physics community is well represented at IAGA. Several community members have served as members on the IAGA Executive and/or its Division leaders in the past 10-15 years.

Despite the relatively small size of the Canadian atmospheric and space research community, Canadian representation on IAGA has ensured strong protection of

Canadian interests in the international geomagnetism and aeronomy community. This is reflected, for example, by the prominent roles played by Canadian researchers in recent IUGG and IAGA Assemblies as main scientific organizers, session conveners, and invited speakers.

The CGU has annual general meetings where the issues relevant to IUGG associations are discussed and reports from CNCs for various associations are presented. There is feedback to chairs of the CNCs at these meetings which is then represented back to the associations of the IUGG. CMOS has similar arrangements for IAMAS and IAPSO. Changes in Canadian science policy and program delivery, e.g. at NSERC, NRC, Environment Canada are reported internationally at IUGG meetings by plenary speakers and others.

A new development in Canada is the Canadian Societies for the Geophysical Sciences, composed of CMOS and the CGU. This will meet every few years and provide a critical mass of IUGG research from solid earth to upper atmosphere and will provide special opportunities for consultation with Canadian scientists in one forum and a strong voice for Canada within IUGG and nationally.

Does the NRC Partner/CNC ensure the promotion of Canadian contributions to international decision-making?

Canada's significant size, unique natural setting, diversity of climate, topography, hydrology, environment and geology with a framework of very recent to early stages of the Earth, and temperate-to-cold and wet-to-arid climates presents an exclusive natural laboratory. The recognition of the immensity of resources also permitted development of scientific methods for practical economic applications. The unique conditions also helped us realize that many of the geophysical phenomena are global in nature, and therefore require collaboration with the international scientific community. Appropriately, Canada was one of the funding members of IUGG in 1919. Throughout the years, the world scientific community also recognized the talent and contributions of the Canadian members of the community. Beyond the major powers, and among the 96 member nations of IUGG, Canada is the only country who elected two Presidents (J.T. Wilson, G.D Garland), three Vice Presidents (J. T. Wilson, G. D. Garland and G. McBean) and one General Secretary (G. D. Garland) to the IUGG Assembly. Most recently, several Canadian delegates were elected to executive positions at the XXIV General Assembly of the IUGG in Perugia Italy July 2-13, 2007. [*List of delegates omitted*].

Does the NRC Partner/CNC encourage and support Canadian scientists to take advantage of emerging international networking opportunities?

Canadian scientists are developing productive relationships with their international colleagues through their participation in projects and networks sponsored by the IUGG and its member associations. Because of these contacts, there is significant international participation in projects in the Canadian north associated with the IPY. There is significant Canadian participation in international ocean observing programs such as ARGO (Dr. H. Freeland, co-chair of the Argo Steering Team) and in projects and programs managed by the World Climate Research Program, a joint effort of WMO, ICSU and IOC. There is also significant Canadian participation in PUB and in international working groups of IAHS on hydrometeorology.

For several years starting in 1996, GSC and U. of New Brunswick scientists contributed to seismic investigations, studying water table variations in Botswana. More recently, GSC provided instrumentation and scientific input to aftershock seismic investigations in Iran.

Beginning in 1991 a team of scientists from U. Saskatchewan and GSC, helped to initiate and made major contributions to the organization of the CELEBRATION 2000, ALP 2002, DANUBE 2004 active seismic experiments, some which included investigators from 14 countries of Central and Eastern Europe. [*Details on participants omitted*].

Canada sponsored the Snow Vegetation Working Group of IAHS-ICSI (1997-2007) which held several workshops, developed special issues of international journals on the topic, promoted the topic in the research of the WCRP and then developed NERC. [*Details on project content and participants omitted*].

Canada sponsored the Snow Ecology Working Group of IAHS-ICSI (1991-2002) which held meetings in Canada (Quebec, Waskesiu) and produced a book by Cambridge University Press. [*Editorial details omitted*].

Canada is a leader in the international commission on tracers and through the International Atomic Energy Commission (Austria) through the work of J Gibson (U Victoria) and J Buttle (Trent U). It leads the use of radioisotope tracers in international studies throughout the world and has proposed these to the WMO (A Henderson Sellers, Geneva) for hydrological and climate change monitoring.

Through the Weyburn project, Canadian scientists are playing a leading role in developing a comprehensive multi-dimensional technology for long-term CO_2 sequestration.

[*Details on project content and participants omitted*].

Does the NRC Partner/CNC encourage and support Canadian scientists to take advantage of opportunities to showcase Canadian achievements, technologies, and capacity?

CGU is hosting major international scientific conferences in Canada jointly with the American Geophysical Union (AGU), in the past, Montréal (1992, 1994 and 2004), recently in 2009 in Toronto. Although CGU is a smaller society than AGU, it enjoys equal billing at these meetings [*Details on the AGU Section structure omitted*]. The repeated return of the AGU meeting to Canada is a direct recognition by AGU of the high standard of contributions the Canadian community makes to Earth Sciences. Since the meetings are very international in nature, they also provide the opportunity for better global exposure of Canadian research. The number of attendees of the AGU meetings fluctuates between 8,000-10,000 participants. A significant number of the participants are from outside North America.

Canada successfully hosted the joint scientific assemblies of IAMAS, IAPSO and IACS in Montréal 19-29 July 2009). This was IACS' first scientific assembly. The meeting of these three associations in Canada reflects the strong organizational ability of CMOS and CGU in attracting these groups under the auspices of CNC-IUGG and the strong support of NRC in its invitation. This assembly was attended by 1338 delegates, of which 265 were from Canada. Delegates present at the assembly represented 49 countries. [*Details on the presentations omitted*].

Canadian scientists contribute and actively participate in numerous international projects and meetings. For instance, CGU President Pomeroy presented the AGU Frontier Lecture at Montreal in 2004. Four percent of the AGU membership are Canadian and a recent AGU Hydrology Section president was Canadian (Beckey, UBC). These ~ 2000 individuals represent more than 90 percent of the Canadian community. In IUGG, Canada is strongly represented. Of all the individuals who were elected as executives (see question 3) at the Perugia IUGG Congress, all made presentations at the different sessions. 144 Canadians attended and presented 160 papers at Perugia. Canadians also convened 8 symposia at the IUGG Congress in Perugia. [*Details on participant names omitted*].

The significance of the Canadian Scientific research is recognized by the high standard and novelty of presentations of the Canadian delegates. The international participants expressed their recognition of the advanced level of the Canadian research by electing a disproportionately high number of the Canadian presenters to prominent leadership positions.

At the joint assembly of IAMAS-IAPSO-IACS in Montreal in July 2009 (MOCA-09), 265 Canadian researchers attended the meeting to present papers. [*Details on participant names omitted*].

Does the NRC Partner/CNC disseminate important scientific knowledge and information to Canadian stakeholders?

CGU-CNC/IUGG utilize every modern form of media to disseminate important information to its members and to inform associated societies about issues of significance. The CGU newsletter, Elements, contains much of this information in its twice-yearly serial publication. The CGU website http://www.cgu-ugc.ca/ also contains a page for CNC-IUGG and reports http://www.cgu-ugc.ca/cnc-iugg/index.htm.

As the CNC/IUGG effectively represents five independent autonomous societies, the communications and information distribution channel must consider these aspects. CGU and IAHS-related hydrology members and IACS glaciologists always have their annual meeting together. CGU continues to host joint meetings and workshops with one of the other societies. Negotiations are in progress to establish regular cycles of joint conferences with CMOS and their associates.

Over the past years, the CGU-Hydrology Section (CGU-HS), through the Canadian National Committee for IAHS (CNC-IAHS), has provided a model for other societies and associations. The CNC-IAHS has broadened the responsibilities of the Canadian representatives to the IAHS international commissions and committees. The various commissions and committee reports provide the basis for the Canadian IAHS report http://www.cgu-hs.ca/ and ultimately the CNC/IUGG report. CGU is encouraging other associations represented within the CNC-IUGG to use the CNC-IAHS model for future quadrennial meetings. To make the model implementation more effective, CGU established the Geodesy Section that directly mirrors the International Association of Geodesy (IAG). CGU maintains a website covering IUGG related matters. CMOS distributes information on its IUGG activities in IAMAS and IAPSO through its CMOS Bulletin and its web site (www.cmos.ca).

Section 3: Membership Adherence

Is the level of membership to which the NRC Partner/CNC adheres within the International Affiliation appropriate?

The level of membership to IUGG should be increased to reflect Canada's effective 'major power' status within IUGG. Canada has hosted more IUGG meetings than any country except the USA. Canada has proposed a new association

in the IUGG for the first time in 80 years. Canada remains extremely active in all IUGG associations and has an overwhelming influence in IAMAS, IAPSO, and IAHS and in the World Climate Research Programme. Canada's current membership in IUGG is at level 6 which provides 6 votes for financial matters. Financial voting is by proportion to level of membership. China, Italy and Russia are also at level 6, France is at 7, Germany, Japan and the UK are at 8 and the USA is at 11. Given Canada's substantial influence, we should be at Level 7 which puts it in the "middle-power club" and above the large developing world group that it currently occupies.

Section 4: NRC Partner/CNC Feedback

How can the NRC Secretariat and CISET better serve the scientific community and NRC Partners/CNCs?

CNCs would greatly benefit from direct financial assistance in their operations. This would permit travel by correspondents to members associations to joint meetings and would help in planning international events in Canada. Given that IUGG members in Canada are members of many scientific societies, there is a special need for CNC-IUGG to have travel funds to meet in Canada between IUGG general assemblies.

Many members of the CNC-IUGG and the CGU were distressed that through this questionnaire Canada seemed to be questioning its membership and participation in IUGG. Canada is a founding member of IUGG (1919) and IUGG is devoted to lofty goals of international scientific development in the geophysical sciences. The nature of questions which seem to be largely focussed on "what is in the IUGG for Canada and its economy" are inconsistent with the global values of scientific development for the overall betterment of humanity and understanding and preservation of the world that drive many of the scientists who participate in IUGG, largely on a volunteer basis. It is hoped that Canada develops a more global outlook and altruistic approach to its science and technology policy that is more consistent with the values of IUGG and Canadian scientists. Only by investment in the core principles of science with global application can Canada achieve its potential as a scientific leader in IUGG and other organizations. To do less abrogates our responsibilities to the international community and ultimately will reduce our science to mere application of the ideas of others.

2010 Summer Weather Extreme Events

Unprecedented sequence of extreme weather events
Several regions of the world are currently coping with severe weather-related events: flash floods and widespread flooding in large parts of Asia and parts of Central Europe while other regions are also affected: by heatwave and drought in Russian Federation, mudslides in China and severe droughts in sub-Saharan Africa. While a longer time-range is required to establish whether an individual event is attributable to climate change, the sequence of current events matches IPCC projections of more frequent and more intense extreme weather events due to global warming. The Monsoon activity in Pakistan and other countries in South-East Asia is aggravated by the La Niña phenomenon, now well established in the Pacific Ocean.

The Pakistan Meteorological Department (PMD) has been issuing warnings since the onset of the pre-Monsoon season in mid-June and issues continuous weather and flood advisories and warnings to assist in emergency relief (http://www.pakmet.com.pk). Heavy and persistent rainfall has been recorded since July causing severe flash floods and widespread flooding. The event affected first the north-western part of Pakistan and later extended to large parts of the country, with Khyber-Pakhtonkwa, Punjab and Sindh among the most affected provinces. The province of Khyber-Pakhtonkwa received nearly 180 % excess of total July rainfall compared to the monthly long-term average.

According to Roshydromet, the Russian Federal Service for Hydrometeorology and Environmental Monitoring, July 2010 is the warmest month ever in Moscow since the beginning of modern meteorological records, 130 years ago. Temperature has exceeded the long-term average by 7.8° C (compared to the previous record in July 1938 with 5.3° C above average). Record high temperatures varying between 35° C and 38.2° C were registered for more than 7 consecutive days end of July, with the heatwave continuing into August. The daily temperature of 38.2° C on 29 July was the highest ever in Moscow (compared to a long-term average of approximately 23° C). The minimum temperature of nearly 25°C (recorded during the night before sunrise) also scored a significant increase compared to the historical average of about 14°C. Those temperatures are characteristic for a heatwave of a rare intensity and duration. For related information: Research on reactive gases

The World Meteorological Organization coordinates the global collection of climate data for long-term scientific research. The Organization, with its partners, is working towards a Global Framework for Climate Services, decided upon in 2009 by World Climate Conference-3, to provide information and services for adapting to climate change.

Scientists projected an increase in intensity and frequency of extreme weather events

Several diverse extreme weather events are occurring concurrently around the world, giving rise to an unprecedented loss of human life and property. They include the record heat-wave and wildfires in the Russian Federation, monsoonal flooding in Pakistan, rain-induced landslides in China, and calving of a large iceberg from the Greenland ice sheet. These should be added to the extensive list of extreme weather-related events, such as droughts and fires in Australia and a record number of high-temperature days in the eastern United States of America, as well as other events that occurred earlier in the year.

The heat-wave in the European part of the Russian Federation is associated with a persistent pressure ridge that appeared in June 2010. Initially, it was associated with the Azores high, but later was reinforced by a strong inflow of warm air from the Middle East. More than 20 daily temperature records were broken including the absolute maximum temperature in Moscow. The high temperatures triggered massive forest and peat fires in the European part of the country. Some villages were burned completely, with smoke and smog adversely and greatly affecting the health and well-being of tens of millions of people.

The floods in Pakistan were caused by strong monsoon rains. According to the Pakistan Meteorological Department, the instant rain intensity reached 300 mm over a 36-hour period. The strong monsoon rains led to the highest water levels in 110 years in the Indus River in the northern part of the country, based on past records available from 1929. More areas in central and south Pakistan are affected by the floods. The death toll to date exceeds 1 600 and more than 6 million people have been displaced. Some reports indicate that 40 million citizens have been affected by the floods.

China is also experiencing its worst floods in decades. The recent death toll due to the mudslide in the Zhouqu county of Gansu province on 7 August 2010 exceeded 700, with more than 1 000 people missing. In addition, 12 million people are reported to have lost their homes owing to the recent floods.

On 5 August 2010, the MODIS sensor on NASA's Aqua satellite detected calving from the Petermann Glacier in northern Greenland. The largest chunk of ice to calve from the glacier in the past 50 years of observations and data (since 1962) measures more than 200 sq. km. Tens of thousands of icebergs calve yearly from the glaciers of Greenland. However, this one is very large and because of its size more typically resembles icebergs in the Antarctic.

Climate extremes have always existed, but all the events cited above compare with, or exceed in intensity, duration or geographical extent, the previous largest historical events. According to Roshydromet, studies of the past climate show no record of similar high temperatures since the tenth and eleventh centuries in Ancient Russia.

The occurrence of all these events at almost the same time raises questions about their possible linkages to the predicted increase in intensity and frequency of extreme events, for example, as stipulated in the IPCC Fourth Assessment Report published in 2007. The Report stated that "…*the type, frequency and intensity of extreme events are expected to change as Earth's climate changes, and these changes could occur even with relatively small mean climate changes. Changes in some types of extreme events have already been observed, for example, increases in the frequency and intensity of heat-waves and heavy precipitation events*" (Summary for Policy Makers, WG I, FAQ 10.1, p. 122).

Similar questions were also frequently asked following the summer heatwave in Europe in 2003, which was the hottest in continental Europe since at least 1540. In a number of studies, particularly *"Human contribution to the European heatwave of 2003*" (*Nature*, 2004) Stott, Stone and Allen stated that "it is very likely (confidence level >90%) that human influence has at least doubled the risk of a heat-wave" such as that which occurred in 2003. As Beniston and Diaz report in their paper published in *Global and Planetary Change* in 2004: "*although a single extreme event, however intense, is by no means proof of global warming, the lessons that can be learned from the recent heat-wave could be used to help shape future policy response. […] Society will face considerable challenges in trying to cope with heat waves of similar or even greater magnitude to 2003 that are projected to become more common in the latter decades of the 21st century*".

A series of recent publications indicate that main patterns of atmospheric variability exhibit noticeable changes and are predicted to be different in a warmer climate. Several reports state that climate phenomena such as El Niño and La Niña will be noticeably different from those observed in the past. This poses an urgent question for climate science: whether the frequency and longevity of the blocking episodes are going to change. Research on extreme climate events is one of the focusses of the World Climate Research Programme. For example, its forthcoming workshop on metrics and methodologies of estimation of extreme climate events, to be held in Paris, from 27 to 29 September 2010, will focus on the quantitative estimation of different climate extremes under observed and future climate conditions, thus creating a scientific and methodological basis for the assessment of risks associated with climate extremes and developing indices for their quantification to aid disaster risk management.

Source: WMO Website visited 20 August 2010.

CLIMATE CHANGE / CHANGEMENT CLIMATIQUE

Expert credibility in climate change[1]

by William R. L. Anderegg[2], James W. Prall[3], Jacob Harold[4] and Stephen H. Schneider[5]

Abstract: Although preliminary estimates from published literature and expert surveys suggest striking agreement among climate scientists on the tenets of anthropogenic climate change (ACC), the American public expresses substantial doubt about both the anthropogenic cause and the level of scientific agreement underpinning ACC. A broad analysis of the climate scientist community itself, the distribution of credibility of dissenting researchers relative to agreeing researchers, and the level of agreement among top climate experts has not been conducted and would inform future ACC discussions. Here, we use an extensive dataset of 1,372 climate researchers and their publication and citation data to show that (i) 97–98% of the climate researchers most actively publishing in the field surveyed here support the tenets of ACC outlined by the Intergovernmental Panel on Climate Change, and (ii) the relative climate expertise and scientific prominence of the researchers unconvinced of ACC are substantially below that of the convinced researchers.

Résumé: Bien que les estimations préliminaires, faites à partir des publications et des enquêtes d'experts, suggèrent une concordance frappante entre les scientifiques du climat sur les principes du Changement Climatique Anthropique (CCA), le public américain exprime des doutes sérieux à la fois sur la cause anthropique et le niveau de consensus scientifique qui sous-tendent le CCA. Une vaste analyse de la communauté scientifique du climat lui-même, de la répartition de la crédibilité des chercheurs dissidents par rapport aux chercheurs qui sont en accord, et du niveau de consensus, entre les meilleurs experts du climat, n'a pas été effectuée et cette analyse informerait les futures discussions du CCA. Dans cette étude, nous utilisons un vaste ensemble de données concernant 1 372 chercheurs du climat, ainsi que leurs publications et leurs commentaires, pour montrer que : (i) 97 à 98 % des chercheurs du climat, la plupart publiant de façon active dans le domaine étudié ici, supportent les principes du CCA formulé par le Groupe d'experts intergouvernemental sur l'évolution du climat ; (ii) l'expertise relative au climat et l'importance scientifique des chercheurs non convaincus du CCA sont sensiblement inférieures à celles des chercheurs convaincus.

Preliminary reviews of scientific literature and surveys of climate scientists indicate striking agreement with the primary conclusions of the Intergovernmental Panel on Climate Change (IPCC): anthropogenic greenhouse gases have been responsible for "most" of the "unequivocal" warming of the Earth's average global temperature over the second half of the 20th century (1-3). Nonetheless, substantial and growing public doubt remains about the anthropogenic cause and scientific agreement about the role of anthropogenic greenhouse gases in climate change (4, 5). A vocal minority of researchers and other critics contest the conclusions of the mainstream scientific assessment, frequently citing large numbers of scientists whom they believe support their claims (6-8). This group, often termed climate change skeptics, contrarians, or deniers, has received large amounts of media attention and wields significant influence in the societal debate about climate change impacts and policy (7, 9-14).

An extensive literature examines what constitutes expertise or credibility in technical and policy-relevant scientific research (15). Though our aim is not to expand upon that literature here, we wish to draw upon several important observations from this literature in examining expert credibility in climate change. First, though the degree of contextual, political, epistemological, and cultural influences in determining who counts as an expert and who is credible remains debated, many scholars acknowledge the need to identify credible experts and account for expert opinion in technical (e.g., science-based) decision-making (15-19).

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Furthermore, delineating expertise and the relative credibility of claims is critical, especially in areas where it may be difficult for the majority of decision-makers and the lay public to evaluate the full complexities of a technical issue (12, 15). Ultimately, however, societal decisions regarding response to ACC must necessarily include input from many diverse and nonexpert stakeholders.

Because the timeline of decision-making is often more rapid than scientific consensus, examining the landscape of expert opinion can greatly inform such decision-making (15, 19). Here, we examine a metric of climate-specific expertise and a metric of overall scientific prominence as two dimensions of expert credibility in two groups of researchers. We provide a broad assessment of the relative credibility of researchers convinced by the evidence (CE) of ACC and those unconvinced by the evidence (UE) of ACC. Our consideration of UE researchers differs from previous work on climate change skeptics and contrarians in that we primarily focus on researchers that have published extensively in the climate field, although we consider all skeptics/contrarians that have signed prominent statements concerning ACC (6-8). Such expert analysis can illuminate public and policy discussions about ACC and the extent of consensus in the expert scientific community.

We compiled a database of 1,372 climate researchers based on authorship of scientific assessment reports and membership on multisignatory statements about ACC (SI Materials and Methods). We tallied the number of climate-relevant publications authored or coauthored by each researcher (defined here as expertise) and counted the number of citations for each of the researcher's four highest-cited papers (defined here as prominence) using Google Scholar. We then imposed an a priori criterion that a researcher must have authored a minimum of 20 climate publications to be considered a climate researcher, thus reducing the database to 908 researchers. Varying this minimum publication cutoff did not materially alter results (*Materials and Methods*).

We ranked researchers based on the total number of climate publications authored. Though our compiled researcher list is not comprehensive nor designed to be representative of the entire climate science community, we have drawn researchers from the most high-profile reports and public statements about ACC. Therefore, we have likely compiled the strongest and most credentialed researchers in CE and UE groups. Citation and publication analyses must be treated with caution in inferring scientific credibility, but we suggest that our methods and our expertise and prominence criteria provide conservative, robust, and relevant indicators of relative credibility of CE and UE groups of climate researchers (*Materials and Methods*).

Results and Discussion

The UE group comprises only 2% of the top 50 climate researchers as ranked by expertise (number of climate publications), 3% of researchers of the top 100, and 2.5% of the top 200, excluding researchers present in both groups (Materials and Methods). This result closely agrees with expert surveys, indicating that ≈97% of self-identified actively publishing climate scientists agree with the tenets of ACC (2). Furthermore, this finding complements direct polling of the climate researcher community, which yields qualitative and self-reported researcher expertise (2). Our findings capture the added dimension of the distribution of researcher expertise, quantify agreement among the highest expertise climate researchers, and provide an independent assessment of level of scientific consensus concerning ACC. In addition to the striking difference in number of expert researchers between CE and UE groups, the distribution of expertise of the UE group is far below that of the CE group (Fig. 1). Mean expertise of the UE group was around half (60 publications) that of the CE group (119 publications; Mann-Whitney *U* test: W = 57,022; $P < 10^{-14}$), as was median expertise (UE = 34 publications; CE = 84 publications).

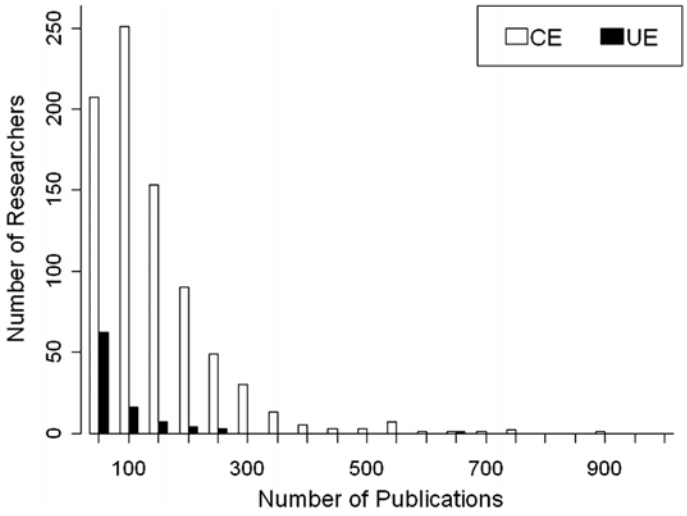

Fig. 1: Distribution of the number of researchers (*n* = 908) in convinced by the evidence (CE) of anthropogenic climate change and unconvinced by the evidence (UE) categories with a given number of total climate publications. Tick marks indicate the centre of right-inclusive categories (e.g., 20-50, 51-100, 151-150, etc.).

Furthermore, researchers with fewer than 20 climate publications comprise ≈80% the UE group, as opposed to less than 10% of the CE group. This indicates that the bulk of UE researchers on the most prominent multisignatory statements about climate change have not published extensively in the peer-reviewed climate literature.

We examined a sub-sample of the 50 most-published (highest expertise) researchers from each group. Such sub-sampling facilitates comparison of relative expertise between groups (normalizing differences between absolute numbers). This method reveals large differences in relative

expertise between CE and UE groups (Fig. 2). Though the top-published researchers in the CE group have an average of 408 climate publications (median = 344), the top UE researchers average only 89 publications (median = 68; Mann-Whitney *U* test: W = 2,455; $P < 10^{-15}$). Thus, this suggests that not all experts are equal, and top CE researchers have much stronger expertise in climate science than those in the top UE group.

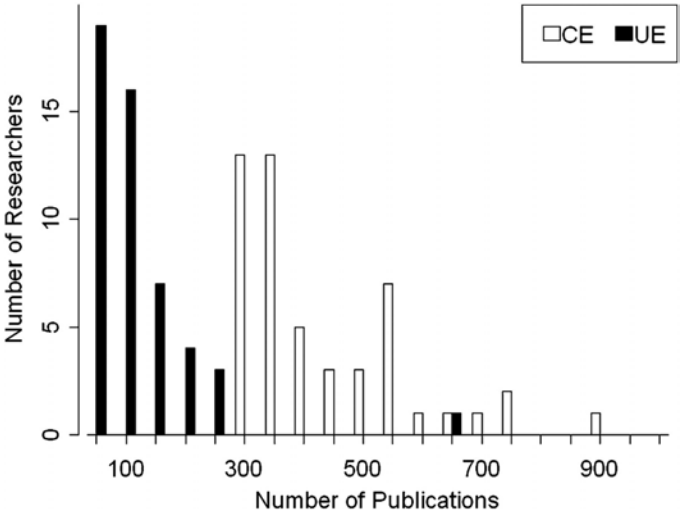

Fig. 2: Distribution of the number of the top 50 most-published researchers from CE and UE categories with a given number of total climate publications. Tick marks indicate the centre of right-inclusive categories (e.g., 20-50, 51-100, 101-150, etc.).

Finally, our prominence criterion provides an independent and approximate estimate of the relative scientific significance of CE and UE publications. Citation analysis complements publication analysis because it can, in general terms, capture the quality and impact of a researcher's contribution - a critical component to overall scientific credibility - as opposed to measuring a researcher's involvement in a field, or expertise (*Materials and Methods*). The citation analysis conducted here further complements the publication analysis because it does not examine solely climate-relevant publications and thus captures highly prominent researchers who may not be directly involved with the climate field.

We examined the top four most-cited papers for each CE and UE researcher with 20 or more climate publications and found immense disparity in scientific prominence, between CE and UE communities (Mann-Whitney *U* test: W = 50,710; $P < 10^{-6;}$ Fig.3). CE researcher's top papers were cited an average of 172 times, compared with 105 times for UE researchers. Because a single, highly cited paper does not establish a highly credible reputation but might instead reflect the controversial nature of that paper (often called the single-paper effect), we also considered the average citation count of the second through fourth most-highly cited papers of each researcher. Results were robust when only these papers were considered (CE mean: 133; UE mean: 84; Mann-Whitney *U* test: W = 50,492; $P < 10^{-6}$). Results were robust when all 1,372 researchers, including those with fewer than 20 climate publications, were considered (CE mean: 126; UE mean: 59; Mann-Whitney *U* test: W = 3,5 X 10^{5}; $P < 10^{-15}$). Number of citations is an imperfect but useful benchmark for a group's scientific prominence (*Materials and Methods*), and we show here that even considering all (e.g., climate and non-climate) publications, the UE researcher group has substantially lower prominence than the CE group.

We provide a large-scale quantitative assessment of the relative level agreement, expertise and prominence in the climate researcher community. We show that the expertise and prominence, two integral components of overall expert credibility, of climate researchers convinced by the evidence of ACC vastly overshadows that of the climate change skeptics and contrarians. This divide is even starker when considering the top researchers in each group. Despite media tendencies to present both sides in ACC debates (9), which can contribute to continued public misunderstanding regarding ACC (7, 11, 12, 14), not all climate researchers are equal in scientific credibility and expertise in the climate system. This extensive analysis of the mainstream versus skeptical/contrarian researchers suggests a strong role for considering expert credibility in the relative weight of and attention to these groups of researchers in future discussions in media, policy and public forums regarding anthropogenic climate change.

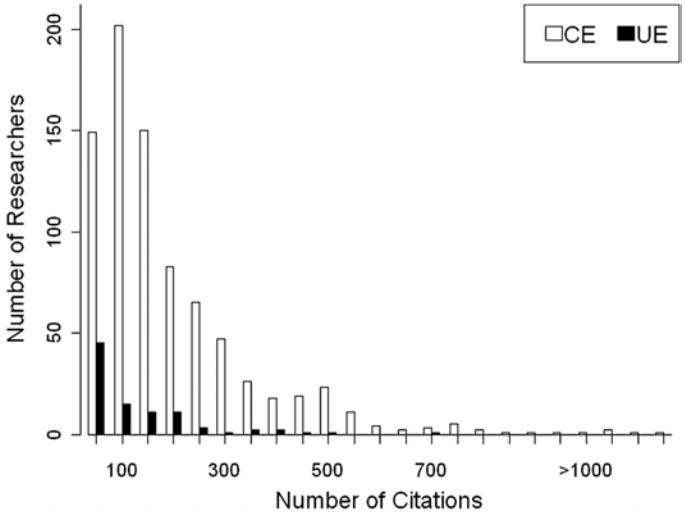

Fig. 3: Distribution of the number of researchers (n = 908) in CE and UE categories with a given number of times cited for each researcher's average of the first through fourth most-cited papers. Tick marks indicate the centre of right-inclusive categories (e.g., 0-50, 51-100, 101-150, etc.), stepped by increments of 50 until 1,000 citations, and 500 thereafter.

Materials and Methods

We compiled a database of 1,372 climate researchers and classified each researcher into two categories: convinced by the evidence (CE) for anthropogenic climate change

(ACC) or unconvinced by the evidence (UE) for ACC. We defined CE researchers as those who signed statements broadly agreeing with or directly endorsing the primary tenets of the IPCC Fourth Assessment Report that it is"very likely" that anthropogenic greenhouse gases have been responsible for "most" of the "unequivocal" warming of the Earth's average global temperature in the second half of the 20th century (3). We compiled these CE researchers comprehensively from the lists of IPCC AR4 Working Group I Contributors and four prominent scientific statements endorsing the IPCC (*n* = 903); *SI Materials and Methods*). We defined UE researchers as those who have signed statements strongly dissenting from the views of the IPCC. We compiled UE names comprehensively from 12 of the most prominent statements criticizing the IPCC conclusions (n = 472: *SI Materials and Methods).* Only three researchers were members of both the CE and UE groups due to their presence on both CE and UE lists) and remained in the dataset, except in calculations of the top 50, 100, and 200 researchers' group membership.

Between December 2008 and July 2009, we collected the number of climate-relevant publications for all 1,372 researchers from Google Scholar (searh terms: "author:filastname climate"), as well as the number of times cited for each researcher's four top-cited articles in any field (search term "climate" removed). Overall number of publications was not used because it was not possible to provide accurate publications counts in all cases because of similarly named researchers. We verified, however, author identity for the four top-cited papers by each author.

To examine only researchers with demonstrated climate expertise, we imposed a 20 climate-publications mininum to be considered a climate researcher, bringing the list to 908 researchers (N_{CE} = 817; N_{UE} = 93). Our dataset is not comprehensive of the climate community and therefore does not infer absolute numbers or proportions of all CE versus all UE researchers. We acknowledge that there are other possible and valid approaches to quantifying the level of agreement and relative credibility in the climate science community, including alternate climate researcher cutoffs, publication databases, and search terms to determine climate-relevant publications. However, we provide a useful conservative and reasonable approach whose qualitative results are not likely to be affected by the above assumptions. We conducted the above analyses with a climate researcher cutoff of a minimum of 10 and 40 publications, which yielded very little change in the qualitative or strong statistically significant differences between CE and UE groups. Researcher publication and citation counts in Earth Sciences have been found to be largely similar between Google Scholar and other peer-review-only citation indices such ISI Web of Science (20). Indeed, using Google Scholar provides a more conservative estimate of expertise (e.g., higher levels of publications and more experts considered) because it archives a greater breadth of sources than other citation indices. Our climate-relevant search term does not, understandingly, capture all relevant publications and exclude all nonrelevant publications in the detection and attribution of ACC, but we suggest that it generally provides a conservative estimate of expertise (i.e., higher numbers of experts) that should not differentially favour either group.

Publication and citation analyses are not perfect indicators of researcher credibility, but they have been widely used in the natural sciences for comparing research productivity, quality and prominence (21-24). Furthermore, these methods tend to correlate highly with other estimates of research quality, expertise and prominence (21-26). These standard publication and citation metrics are often used in many academic fields to inform decisions regarding hiring and tenure. Though these methods explicitly estimate credibility to other academics, which might not directly translate to credibility in broader discourse, polls suggest that about 70% of the American public generally trust scientists' opinions on the environment, making this assessment broadly relevant (27). Criticisms of the two methods centre around issues of self-citation, additionality of multiple authors, clique citation and age demographic (e.g., age distribution where older researchers can accrue more publications and citations) differences between groups (21-26, 28, 29). All of these criticisms are expected to have the least influence at high levels of aggregation (e.g., an entire field) and high levels of citations, both of which are analysed here (21-23, 25, 28, 29).

Regarding the influence of citations patterns, we acknowledge that it is difficult to quantify potentials biases of self-citation or clique citation in the analysis presented here. However, citation analysis research suggests that the potential of these patterns to influence results is likely to decline as sample size of researchers, possible cliques, and papers analyses for citations considered increases (22, 25-28). By selecting an expansive sample of 1,372 researchers and focussing our analysis only on the researchers' four most-cited papers, we have designed our study to minimize the potential influence of these patterns. Furthermore, we have no a priori basis for assuming any citation (e.g., self-citation rates) or demographic differences (e.g., age effect on publications or citations) between CE and UE groups. Preliminary evidence suggests these differences would likely favour the UE group. From the ˜60% of researchers where year of PhD was available, mean year of receiving a PhD for UE researchers was 1977, versus 1987 for CE researchers, implying that UE researchers should have on average more publications due to an age effect alone. Therefore, these methods are likely to provide a reasonable estimate of the preeminent researchers in each group and are useful in comparing the relative expertise and prominence between CE and UE groups.

Ultimately, of course, scientific confidence is earned by the winnowing process of peer review and replication studies over time. In the meanwhile, given the immediacy attendant

to the state of debate over perception of climate science, we must seek estimates while confidence builds. Based on the arguments presented here, we believe our findings capture the differential climate science credentials of the two groups.

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CMOS BUSINESS / AFFAIRES DE LA SCMO

Historical Photo Project on the CMOS Web Site – Major New Additions

Many of you have visited the collection of historical photos since it was started in 2005. They are on the web site at:

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

Photos of all courses and classes studying meteorology in Canada at any level are a major part of this display. There is an excellent probability that your course is there. You can find out by searching for your name on that page.

Over the summer of 2010, a large collection of photos of participants in the **University of Alberta (Edmonton)** meteorology program from 1975 to 1998 was scanned and added. There will be many familiar faces in these new additions. To see them at the above web site, please look at Table 3 with all the "New" tags.

Credit for this collection goes to **Laura A. Smith** who provided administrative support to the meteorological faculty during those years. **Ed Lozowski**, past president of CMOS, was a professor of meteorology at U of A during most of the period photographed. Ed provided information on the existence of the collection and helped arrange loan of the photos. Laura Smith's organization and excellence of documentation of names equals the photographic efforts done by decades of civilian and DND training staffs who took photos of their course members. A truly remarkable effort, and we are very grateful for her co-operation in sharing this collection.

I cannot conclude this note without the usual plea to everyone who may have new group photos in their albums. Please get in touch if you have any.

Bob Jones
CMOS Webmaster

Next Photo Contest

Keep your cameras at the ready. Plans are under way for the 5th Annual Photo Contest to celebrate the artistic and creative talents of CMOS members.

A-O Abstracts Preview

Avant Première des résumés de A-O

The following abstracts will soon be published in your next *ATMOSPHERE-OCEAN* publication.

Les résumés qui suivent paraîtront sous peu dans votre prochaine revue *ATMOSPHERE-OCEAN.*

A Decade of Cloud-to-Ground Lightning in Canada: 1999-2008 Part 1: Flash Density and Occurrence

by WILLIAM R. BURROWS and BOHDAN KOCHTUBAJDA

Abstract
Flash density and occurrence features for more than 23.5 million cloud-to-ground (CG) lightning flashes detected by the Canadian Lightning Detection Network (CLDN) from 1999 to 2008 are analyzed on 20x20 km equal area squares over Canada. This study was done to update an analysis performed in 2002 with just three years of data. Flashes were detected throughout the year, and distinct geographic differences in flash density and lightning occurrence were observed. The shape and locations of large scale patterns of lightning occurrence remained almost the same, although some details were different. Flash density maxima occurred at the same locations as found previously: the Swan Hills and Foothills of Alberta, southeastern Saskatchewan, southwestern Manitoba and southwestern Ontario. A region of greater lightning occurrence but relatively low flash density south of Nova Scotia occurred at the same location as reported previously. New areas of higher flash density occurred along the US border with northwestern Ontario and southern Quebec. These appear to be northward extensions of higher flash density seen in the previous study. The greatest average CG flash density was 2.8 flash km^{-2} y^{-1} in southwestern Ontario, where the greatest single-year flash density (10.3 flash km^{-2} y^{-1}) also occurred. Prominent flash density minima occurred east of the Continental Divide in Alberta and the Niagara Escarpment in southern Ontario.

Lightning activity is seen to be highly influenced by the length of the season, proximity to cold water bodies and elevation. The diurnal heating and cooling cycle exerted the main control over lightning occurrence over most land areas; however, storm translation and transient dynamic features complicated the time pattern of lightning production. A large portion of the southern Prairie Provinces experienced more than 50% of flashes between

22:30 and 10:30 local solar time. The duration of lightning over a 20x20 km square at most locations in Canada is 5-10 h y^{-1}, although the duration exceeded 15 h y^{-1} over extreme southwestern Ontario. Lightning occurred on 15-30 days each year, on average, over most of the interior of the country. The greatest number of days with lightning in a single year was 47 in the Alberta foothills and 50 in southwestern Ontario. Beginning and ending dates of the lightning season show that the season length decreases from north to south; however, there are considerable east-west differences between regions. The season is nearly year-round in the Pacific coastal region, southern Nova Scotia, southern Newfoundland and offshore.

Résumé
Nous analysons les caractéristiques de densité et d'occurrence de la foudre à partir de plus de 23,5 millions d'éclairs nuage–sol détectés par le Réseau canadien de détection de la foudre (RCDF) entre 1999 et 2008 dans des cellules de surface uniforme de 20 km de côté au Canada. Cette étude a été réalisée pour mettre à jour une analyse effectuée en 2002 avec seulement trois années de données. Les éclairs ont été détectés tout au long de l'année et nous avons observé des variations liées à la géographie dans la densité des éclairs et l'occurrence de la foudre. La forme des configurations de foudre à grande échelle et les endroits où ces configurations se sont produites sont demeurés à peu près les mêmes, sauf pour quelques détails. Les maximums de densité d'éclairs se sont produits aux mêmes endroits que ceux trouvés précédemment : les collines Swan et les contreforts des Rocheuses en Alberta, le sud-est de la Saskatchewan, le sud-ouest du Manitoba et le Sud-ouest de l'Ontario. Nous avons observé une région de plus grande occurrence de foudre mais de densité d'éclairs relativement faible au sud de la Nouvelle-Écosse, au même endroit que là où elle avait été observée auparavant. De nouvelles zones de densité d'éclairs plus forte s'observent le long de la frontière séparant les États-Unis du nord-ouest de l'Ontario et du sud du Québec. Ces zones semblent être des extensions vers le nord de zones de densité d'éclairs plus forte observées dans l'étude précédente. La densité moyenne la plus élevée d'éclairs nuage–sol était de 2,8 éclairs km^{-2} a^{-1} dans le Sud-ouest de l'Ontario, où l'on observe aussi la densité d'éclairs la plus élevée pour une année donnée (10,3 éclairs km^{-2} a^{-1}). Des minimums marqués de densité d'éclairs se sont produits à l'est de la ligne continentale de partage des eaux en Alberta et sur l'escarpement de Niagara dans le sud de l'Ontario.

Nous constatons que l'activité de la foudre est fortement influencée par la durée de la saison, la proximité de masses d'eau froide et l'élévation. Le cycle de réchauffement et de refroidissement journalier a été le facteur le plus déterminant dans l'occurrence de la foudre dans la majeure partie des régions continentales; cependant, le déplacement des perturbations et les caractéristiques dynamiques transitoires ont compliqué le calendrier de la production de foudre. Dans une grande partie du sud des provinces des Prairies, plus de 50 % des éclairs se sont produits entre 22 h 30 et 10 h 30, temps solaire local. La durée des éclairs dans une cellule de 20 km de côté dans la majorité des endroits au Canada est de 5 à 10 heures par année, bien que cette durée ait excédé 15 heures par année dans l'extrême Sud-ouest de l'Ontario. À chaque année, la foudre s'est produite entre 15 et 30 jours, en moyenne, dans la majeure partie de l'intérieur du pays. Le plus grand nombre de jours avec foudre au cours d'une année donnée était de 47 dans les contreforts albertains des Rocheuses et de 50 dans le Sud-ouest de l'Ontario. Les dates de commencement et de fin de la saison de la foudre montrent que la durée de la saison diminue en allant du nord au sud; cependant, il y a des différences est–ouest condidérables entre les régions. La saison dure presque toute l'année dans la région de la côte du Pacifique, dans le sud de la Nouvelle-Écosse, dans le sud de Terre-Neuve et au large des côtes.

A Decade of Cloud-to-Ground Lightning in Canada: 1999-2008. Part 2: Polarity, Multiplicity and First-Stroke Peak Current

by BOHDAN KOCHTUBAJDA and WILLIAM R. BURROWS

Abstract
We summarize the temporal and spatial characteristics of polarity, multiplicity and first-stroke peak current of approximately 23.5 million cloud-to-ground (CG) lightning flashes detected by the Canadian Lightning Detection Network for the period 1999-2008. Regional differences in these parameters reflect the complex nature and structure of thunderstorms across the country. The annual mean percentage of positive CG flashes was found to be lowest in eastern Canada (11%) and highest in northern Canada (17%). The data do not show any trends over the years in any region. The monthly distribution of positive CG flashes reflects a strong seasonality in all regions, with higher values in winter than in summer. Areas of more than 25% positive flashes are observed along the west coast of British Columbia, in Yukon extending southeast into central British Columbia, in southern Manitoba, northern Quebec, Newfoundland and off the coast of Nova Scotia. The percentages of single-stroke positive and negative flashes for northern (western, eastern) Canada are 93% and 63%, (89% and 48%, 90% and 50%), respectively. The monthly distribution of multiplicity for negative CG flashes peaks between 2 and 2.4 strokes per flash in the summer and early fall in all regions. The multiplicity of positive flashes (slightly higher than 1 stroke per flash) shows little variation throughout the year in all regions.

The annual variation of median negative and positive first-stroke peak currents reflects a latitudinal dependence over

the past decade. The lowest values for each polarity are observed in southern Canada and the highest values occur in the North. The data do not show any trends in peak currents over the years in the eastern or western regions of Canada. The monthly median first-stroke peak currents for both polarities are strongest in winter and reach a minimum during summer in all regions. Large current flashes ≥ 100 kA are usually detected in summer and comprise less than 1% of the average annual CG flashes detected in Canada. Large current flashes with stroke multiplicity ≥ 10 are usually associated with negative polarity. These CG flashes are mostly detected in western Canada.

Résumé
Nous résumons les caractéristiques temporelles et spatiales de polarité, de multiplicité et de courant de pointe de la première décharge d'approximativement 23,5 millions d'éclairs nuage–sol détectés par le Réseau canadien de détection de la foudre (RCDF) entre 1999 et 2008. Les différences régionales dans ces paramètres reflètent la nature et la structure complexes des orages se produisant au pays. Nous avons trouvé que le pourcentage annuel moyen d'éclairs nuage–sol positifs affiche une valeur minimale dans l'est du Canada (11 %) et une valeur maximale dans le nord du Canada (17 %). Les données ne montrent aucune tendance au fil des années dans quelque région que ce soit. La distribution mensuelle des éclairs nuage–sol positifs présente une forte saisonnalité dans toutes les régions, les valeurs élevées s'observant davantage en hiver qu'en été. On observe des zones dans lesquelles plus de 25 % des éclairs sont positifs le long de la côte ouest de la Colombie-Britannique, au Yukon en s'étendant vers le sud-est jusque dans le centre de la Colombie-Britannique, dans le sud du Manitoba, dans le nord du Québec, à Terre-Neuve et au large de la côte de la Nouvelle-Écosse. Les pourcentages d'éclairs positifs et négatifs à décharge unique pour le nord (l'ouest, l'est) du Canada sont 93 % et 63 % (89 % et 48 %, 90 % et 50 %), respectivement. La distribution mensuelle de la multiplicité pour les éclairs négatifs nuage–sol touche un sommet entre 2 et 2,4 décharges par éclair en été et au début de l'automne dans toutes les régions. La multiplicité des éclairs positifs (légèrement supérieure à 1 décharge par éclair) affiche peu de variation durant l'année dans toutes les régions.

La variation annuelle des courants de pointe médians des premières décharges négatives et positives révèle une dépendance par rapport à la latitude au cours de la dernière décennie. Les valeurs les plus basses pour chaque polarité s'observent dans le sud du Canada et les valeurs les plus élevées, dans le nord. En ce qui concerne les courants de pointe, les données ne montrent aucune tendance au fil des années dans les régions de l'est ou de l'ouest du Canada. Les courants de pointe médians mensuels des premières décharges pour les deux polarités sont plus forts en hiver et atteignent un minimum en été dans toutes les régions. Les éclairs de courant élevé (≥ 100 kA) sont habituellement détectés en été et comptent pour moins de 1 % du nombre annuel moyen d'éclairs nuage–sol détectés au Canada. Les éclairs de courant élevé ayant une multiplicité de décharges ≥ 10 sont généralement associés à une polarité négative. Ces éclairs nuage–sol sont principalement détectés dans l'ouest du Canada.

ATMOSPHERE-OCEAN 48-3 Paper Order

Trends in Canadian Surface Temperature Variability in the Context of Climate Change
by JESSICA K. TURNER and J. R. GYAKUM

The Semi-Diurnal Tide in Hudson Strait as a Resonant Channel Oscillation
by PATRICK F. CUMMINS, RICHARD H. KARSTEN AND BRIAN K. ARBIC

A Decade of Cloud-to-Ground Lightning in Canada: 1999-2008. Part 1: Flash Density and Occurrence
by WILLIAM R. BURROWS and BOHDAN KOCHTUBAJDA

A Decade of Cloud-to-Ground Lightning in Canada: 1999-2008. Part 2: Polarity, Multiplicity and First-Stroke Peak Current
by BOHDAN KOCHTUBAJDA and WILLIAM R. BURROWS

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This study is being conducted by ECO Canada in partnership with CMOS and Environment Canada with funding from Human Resources & Social Development Canada (HRSDC).

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Cette étude est réalisée par ECO Canada en partenariat avec la SCMO et Environnement Canada grâce au financement de Ressources humaines et Développement social Canada (RHDSC).

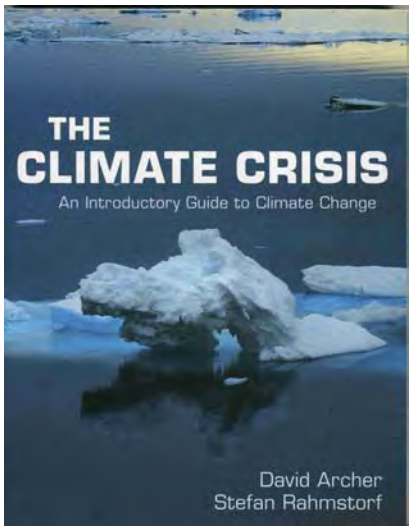
BOOK REVIEWS / REVUES de LITTÉRATURE

The Climate Crisis - An Introductory Guide to Climate Change

by David Archer and Stefan Ramsdorf

Cambridge University Press, 2010, 249 pages
Hardback, US$90, Paperback US$29.99
ISBN 978-0-521-73255-0

Book reviewed by John Stone[1]



The title of this book would seem to position clearly how the authors regard climate change, although the only actual use of the word "crisis" that I could find was on the last page of the book. The book transmits the authors' deeply-held conviction that the threat of climate change is not only scientifically now beyond any doubt, but that the climate system might be far more sensitive ("tippier" to use their expression) than we have assumed.

The book has been written by two scientists; one, David Archer, who is a marine chemist, and the other, Stephan Ramsdorf, a climate modeller, both of whom have given a lot of their time to communicating the science of climate change particularly through the web-site realclimate.org. Stephan Ramsdorf has been an active contributor to the Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC) and is a member of the German government's Advisory Council on Global Change.

The authors' intention in this relatively slim volume (250 pages) is to provide a more accessible iteration of the science reported in the IPCC's Fourth Assessment Report. This it does reasonably well, although in a somewhat uneven manner, and I'm not sure an interested reader could not gain as much understanding by reading the IPCC's Working Groups' Technical Summaries. The problem as I see it however is that the objective of this book has been attempted elsewhere and more successfully. I am particularly thinking of John Houghton's *Climate Change: The Complete Briefing*, which was reviewed in the CMOS Bulletin (Vol. 37, No. 5), and Andrew Weaver's book: *Keeping our Cool: Canada in a Warning World,* which deserves a good review in the CMOS Bulletin SCMO.

The book focusses mostly on the science contained in the contribution of WGI to the AR4. However, no detailed references are given leaving the reader at a loss to know where to go for more information. There is also no mention of the debates that went on in developing the Assessment Report, particularly of the interaction with governments. This would have given more life to the book and introduced the reader to the different interpretations of the data and model results. Interestingly, the authors suggest that the IPCC is maybe reaching the limits of its approach of projecting the future climate based on models since this does not represent a proper risk assessment exploring all eventualities.

The book begins with a resume of the development of the science of climate change followed with chapters on the expected range of topics including radiative forcing (Chapter 2), observed climate change (Chapter 3), the cryosphere (Chapter 4), oceans (Chapter 5), paleoclimate (Chapter 6) and future climate scenarios (Chapter 7). While this material occupies more than half of the book, there follows a well-written chapter on potential impacts (Chapter 8) although some of the examples are rather surprising - the European white stork has expanded its range upwards by 240 metres, north Atlantic plankton have moved north by 1,000 km over the past 40 years, and the Lyme disease vector will move north by 1,000 km in Canada in 75 years. This chapter is followed by a somewhat pedestrian account of available options to addressing emission reductions (Chapter 9). The authors optimistic vision of the technological possibilities provides a counterweight to the sometimes alarmist descriptions of of the potential impacts found elsewhere. The final chapter deals with climate change policy where the authors step outside the strict IPCC role of not being policy prescriptive and share their personal views. In fact they stray even further and use several pages to criticize the climate denier community abetted by "common journalistic practices".

The book seems to have been written in a bit of a hurry and certainly could be improved by a diligent editor. For example, the book makes extensive use of diagrams from the IPCC AR4, many of which were developed with considerable thought and care, but this book too often omits the richness of the diagram's captions and leaves much in the diagrams unexplained. Furthermore, some of the diagrams are occasionally wrongly identified in the text. The book also slips from time to time into the vernacular with

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

such phrases as "the slow stew of chemical reactions", "N_2O is blasted apart by ultraviolet light", "ice can flow like crazy", and "an ice-shelf… explodes into bergs", which leaves one asking who is the intended audience. There is also a slightly annoying tendency for some repetition, almost as though the two authors had not compared drafts sufficiently. Finally, as with any book on climate change science (although hardly any on climate change actions) the material quickly gets out of date as our scientific understanding improves. This allows the authors to rather gently suggest that the assessment of the science in the AR4 was somewhat conservative.

Presumably the final editing of the book occurred in the last few months of 2009 so it is not surprising that there is no mention of "ClimateGate". This is a little unfortunate since any reader approaching climate change for the first time would likely have heard about the criticisms of the conclusions in the IPCC AR4 and might wish to read how scientists have responded. Indeed, to return to the message in the title of the book, the authors have adopted exactly the tone that some of the official reviews of the incident have criticised.

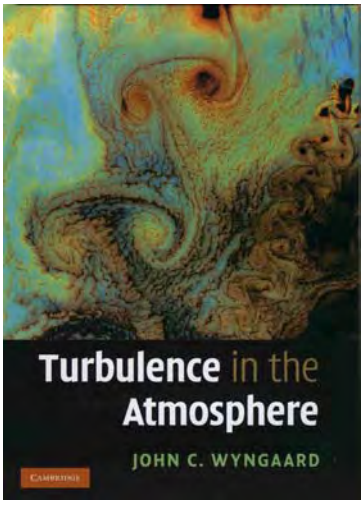
Turbulence in the Atmosphere

by John C. Wyngaard

Cambridge University Press, 2010, pp.393
Hardbarck, ISBN 978-0-521-88769-4, US$75.

Book reviewed by Marek Stastna[2]

It is quite likely that those of us who arrived at a career of studying the atmosphere or ocean through either physics or applied mathematics did so because the study of turbulence both fascinated us with its ubiquity and tempted our intellectual ego with its intractability. While the closure problem of turbulence is reasonably well known to most meteorologists and oceanographers, the theories of turbulence themselves are often hidden behind a curtain of mathematical notation and hence often ignored. At the same time, computer models increase in sophistication and complexity while the computers they are run on continue to increase in speed. This offers unprecedented opportunities to construct "virtual laboratories" that probe the detailed, and often invisible, motions of fluids. At the same time, however, it can lead to a culture that replaces rational inquiry with a hodge-podge of borrowed methods whose limitations and implications are unclear to the user. Perhaps because of the above described tension, the past few years have seen a minor gold rush of books dedicated to turbulence. These have ranged from those directed at the theoretically minded engineer ("Turbulent Flows", S. B. Pope, Cambridge University Press), the applied mathematician or theoretical physicist ("Turbulence", P. A. Davidson, Cambridge University Press), the oceanographer ("The Turbulent Ocean", S. A. Thorpe, Cambridge University Press) and the meteorologist ("Turbulence in the Atmosphere", J. C. Wyngaard, Cambridge University Press). While each of these books presents a unique and modern point of view, and indeed each could be used for one sort of graduate course or another, I found Wyngaard's book to be the most succinct collection of sharp insight that is both careful with its mathematics, yet careful not to overdo its mathematics.



The book is divided into 16 chapters organized into three parts. In part I, the author introduces his "Grammar of Turbulence" via seven short chapters. This includes the standard aspects of the Reynolds decomposition, the equations of mean and fluctuating parts (e.g. the turbulent kinetic energy), and the phenomenology due to Kolmogorov. This presentation is not unique, though the historical notes are presented in an unobtrusive and insightful style, and the brevity of the chapters should suit the learning habits of today's graduate students. The discussion of turbulence simulation, and of spatial filtering in the framework of Large Eddy Simulation, in particular, is unique. It likely stems from the strong historical link between turbulence and the actual computation of flows in meteorology.

In part II, the author turns his attention to the atmospheric boundary layer (ABL) over five chapters. The coverage ranges from the equations of a moist atmosphere, basic observations of the ABL, the standard similarity theories (e.g. Monin-Obhukov) and the differences between stable and unstable situations. Again, I found the short chapters held my attention and presented an amazing amount of material in very few pages. For students, part II should provide the perfect "real world" foil to part I. Even better, for those who put in the effort, the many references in the text point to interesting problems awaiting the efforts of the numerically nimble and theoretically proficient.

In part III, the author turns his attention to the statistical theories of turbulence. This is probably the most difficult part of the book, and I suspect many graduate courses would pick and choose a subset from the many threads presented here. One example I personally liked was a return to the

[2] Department of Applied Mathematics, University of Waterloo, Waterloo, Ontario, Canada

discussion of Kolmogorov's local isotropy assumption and the extent to which it has, or has not been borne out by measurement.

The book is ideal as a text for a graduate course to students familiar with an equation-based description of fluid mechanics, though it is not heavy on mathematical pre-requisites. Nevertheless, it is probably true that many students would need to brush up on background, or learn the basics they were never taught. My guess is that the book is thus about 75% self-contained. I intend to use it for a graduate course taught to applied mathematics students in the winter of 2011. Each chapter concludes with a compendium of concept questions as well as problems (solutions are available through the publisher's website). The illustrations, graphs and diagrams are well thought out and clear, with well put together black and white figures that cover half a page or so being the rule. Throughout the text, the history of the subject is brought to light through comments, anecdotes and footnotes.

I often try to impress on both the undergraduate and graduate students I teach the importance of the editorial staff behind a good textbook; something the admittedly useful world of online, instantly available knowledge does not really have an equivalent form of. This book, which in many ways is as much a work of art as it is of science, makes the point far more eloquently than I ever could.

A) **The Climate Crisis: An Introductory Guide to Climate Change**

by David Archer and Stefan Rahmstorf

Cambridge University Press, 2010, Paperback
ISBN 978-0-521-73255-0, pp.249, US$29.99

. . . . . .

B) **Integrated Regional Assessment of Global Climate Change**

Edited by C. Gregory Knight and Jill Jäger

Cambridge University Press, 2010, Hardback
ISBN 978-0521-51810-9, pp.412. US$125.

. . . . . .

C) **Controlling Climate Change**

by Bert Metz

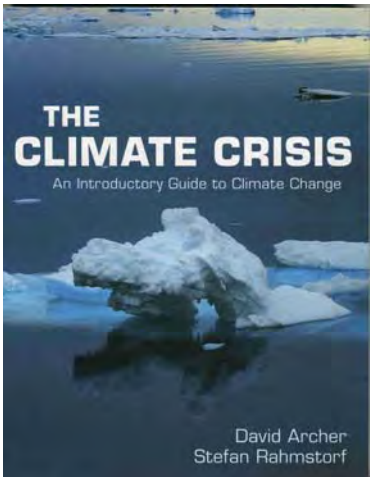
Cambridge University Press, 2010, Hardback
ISBN 978-0-0521-76403-2, pp. 359. US$125.

3 Books reviewed by Ted Munn[3]

These three books have much in common. They are about climate change, and they are published in 2010 by Cambridge University Press, which ensures high quality of production. I am amazed that there does not appear to be any repetition of figures from one volume to another. But I am disappointed that the three volumes went to press before December 2009, and thus contain no significant mention of sceptics, Climategate or the Copenhagen Climate-Change Summit of December 2009. An account of that historical period would have demonstrated once again that truth is stranger than fiction!

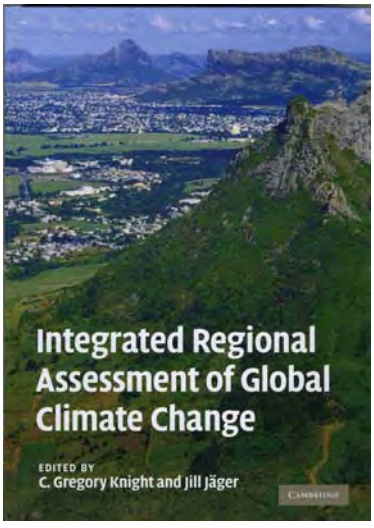
Comments on each of the three volumes are as follows:

A) The Climate Crisis: An Introductory Guide to Climate Change



The co-authors are David Archer, University of Chicago, and Stefan Rahmstorf, Potsdam Institute for Climate Impact Research. Both scientists contributed to IPCC(1997) Vol. 1, and are well qualified to write on this topic. Neither of them is a sceptic. As the subtitle *An introductory Guide* implies, the book is suitable for undergraduates and first–year graduate students.

B) Integrated Regional Assessment of Global Climate Change



The co-editors are C. Gregory Knight, Penn State University, and Jill Jäger, an environmental and energy consultant for many years. I know quite a few chapter co-authors personally or by reputation. I worked with two of them in the 1970s - Ian Burton and Diana Liverman at the University of Toronto.

The title of this book may be difficult for a physical scientist to understand.

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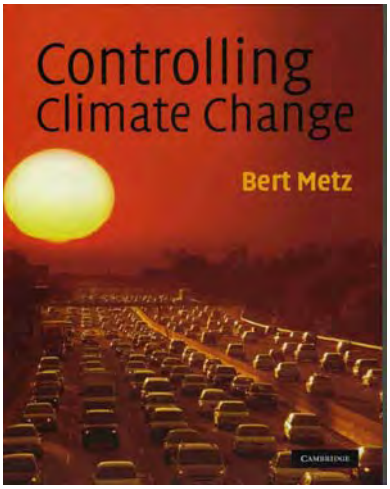
[3] University of Toronto, CMOS Member, Toronto Centre.

Quoting Jill Jäger and Gregory Knight (pg. 394), the subject matter refers to "*an interdisciplinary iterative process that involves scientific researchers, policy makers and societal stakeholders. Its aim is to promote a better understanding of, and more informed decisions on – how regions contribute to and respond to global environmental change*". Now that's a mouthful, but even so, this is a book that every physical climatologist should read. Quoting Diana Liverman (pg. 364) in the context of the Inter-American Institute for Global Change: "*Moreover, American and Canadian physical scientists are not necessarily any more willing or aware of social science issues than Latin American colleagues and may view them as too political or "soft" for serious attention".*

C) *Controlling Climate Change*

The author of this volume is Bert Metz, who was co-chairman of Working Group 3 (Mitigation) of the IPCC Climate Change Fourth Assessment (2007) Report. He is also a member of the Netherlands Environmental Assessment Agency. As might be expected from its title, this book contains some comments about geoengineering; Archer and Rahmstorf do not index the word.



Canadian climate-change issues

These three books were written for an international audience but how well do they cover Canadian climate-change concerns? Some topics of particular interest to Canadians are listed below, followed by a few notes about each text.

1. Melting of the Arctic ice cover and thawing of the tundra;

2. Methane hydrates released from the Arctic ocean floor;

3. Sea level rise in coastal zones;

4. Falling lake levels at inland locations;

5. Bark beetle damage in British Columbia;

6. Impacts of climate change on Canadian fisheries;

7. Agriculture: movement of vegetation northward and to higher elevations;

8. Studies of the effects of climate change on the Inuit peoples.

Notes:

A) Archer and Rahmstorf – The Arctic is listed 17 times, bark beetle damage is mentioned once (pg 158); the other factors included in the list above are not mentioned in any significant manner in the index.

B) Knight and Jäger – Socioeconomic studies of Inuit populations as a result of climate-change

C) Metz – No significant mention of any of the issues listed above.

Final summary

1. Archer and Ramsdorf, and Metz, are recommended texts for undergraduate science students, or as supplementary reading material for graduate students in meteorology or physical geography.

2. Knight and Jäger is recommended as a text for a joint course offered by two instructors – one a physical climatologist and the other a social scientist.

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

2010-01) *Remote Sensing for Biodiversity and Wildlife Management, Synthesis and Applications*, Steven E Franklin, McGraw-Hill, Hardback, 2010, ISBN 978-0-07-162247-9, pp. 346.

2010-04) *Challenged by Carbon, The Oil Industry and Climate Change*, Bryan Lovell, Cambridge University Press, Paperback, 2009, ISBN 978–0 521-14559-6, pp.212, US$30.

2010-05) *Measuring Global Temperatures, Their Analysis and Interpretation*, Ian Strangeways, Cambridge University Press, Hardback, 2009, ISBN 978–0 521-89848-5, pp.233, US$115.

2010-07) *Ocean Circulation, Wind-Driven and Thermohaline Processess*, Rui Xin Huang, Cambridge University Press, Hardback, 2009, ISBN 978–0 521-85228-9, pp.791, US$85.

2010-09) *Climate Change and Small Pelagic Fish*, Edited by Dave Checkley, Jürge Alheit, Yoshioki Oozeki and Claude Roy, Cambridge University Press, Hardback, 2009, ISBN 978–0 521-88482-2, pp.372, US$155.

2010-13) *Water Resources and Environmental Issues, Introduction*, Karrie Lynn Pennington and Thomas C. Cech, Cambridge University Press, Hardback, 2010, ISBN 978-0-521-86988-1, pp.457, US$65.

2010-16) *Controlling Climate Change*, Bert Metz, Cambridge University Press, Hardback, 2010, ISBN 978-0-521-76403-2, pp.359, US$125.

2010-17) *Introduction* to *Coastal Processes* and *Geomorphology*, Robin Davidson-Arnott, Cambridge University Press, Hardback, 2010, ISBN 978-0-521-87445-8, pp.442, US$125.

2010-19) *Stochastic Physics* and *Climate Modelling*, Edited by Tim Palmer and Paul Willimas, Cambridge University Press, Hardback, 2010, ISBN 978-0-521-76105-5, pp.480, US$150.

2010-20) *Beyond Smoke and Mirrors, Climate Change and Energy in the 21st Century*, by Burton Richter, Cambridge University Press, Paperback, 2010, ISBN 978-0-521-74781-3, pp.226, US$30.

2010-25) *The El- Niño-Southern Oscillation Phenomenon*, by Edward S. Sarachik and Mark A. Cane, Cambridge University Press, Hardback, ISBN 978-0-521-84786-5, pp.369, $75.00.

2010-27) *The Field Guide to Natural Phenomena, The Secret World of Optical, Atmospheric and Celestial Wonders*, by Keith Heidorn and Ian Whitelaw, Firefly Books, Paperback, ISBN 978-155407-707-6, pp.224, $24.95.

"It is a daunting task to consider that marine scientists are required to understand 7/10ths of the area of the world, and, by volume, ten times the land mass, using an army of scientists who probably number less than one percent of the world's scientific effort."

Timothy R Parsons
Scientist Emeritus
Institute of Ocean Sciences
Fisheries and Oceans Canada

Update Report on the SCOR-GEOTRACES Project

GEOTRACES officially opened its International Project Office (IPO) at the Laboratoire d'études en géophysique et océanographie spatiales (LEGOS) in Toulouse, France in January 2010. The IPO is managed by Elena Masferrer-Dodas as Executive Officer, with local scientific oversight by Catherine Jeandel, chair of the French SCOR Committee. The IPO will be funded by a consortium of sponsors, including the U.S. National Science Foundation, Centre national de la récherche scientifique, Université Paul Sabatier-Toulouse, LEGOS, Universitat Autònoma de Barcelona, and sources from Germany, Japan, India, and other countries active in GEOTRACES research.

GEOTRACES officially launched the cruise phase of the project at the Ocean Sciences meeting in Portland, Oregon, USA on 24 February 2010. The launch, attended by about 150 scientists, described the foundational accomplishments of GEOTRACES so far and cruise plans for the next few years. Several nations are planning cruises during this period, including Canada, France, Germany, India, Japan, Netherlands, Spain, the United Kingdom, and the United States. It is anticipated that the transect phase of GEOTRACES will last 10-15 years. A few proposals for process studies have already been approved by the GEOTRACES SSC and the number of process studies is likely to increase over time, as interesting phenomena are discovered through the transect cruises.

Source: Canadian Ocean Science Newsletter, Vol.51, July 2010.

GLOBEC Comes to an End

GLOBEC has formally come to its completion, as of the end of 2009. A major symposium, the GLOBEC 3rd Open Science meeting, was held in June 2010 in Victoria, BC, which was very successful; a special issue of Progress in Oceanography is in the works with papers from this meeting, with publication planned for late 2010. Follow-on activities nearing completion include a Summary for Decision-makers, and a compendium of highlight GLOBEC primary publications. Many GLOBEC activities, such as ESSAS (Ecosystem Studies of Sub-Arctic Seas), CLIOTOP (Climate Impacts on Top Predators), and the human dimensions of marine ecosystem changes, have been adopted by, and will continue under, IMBER.

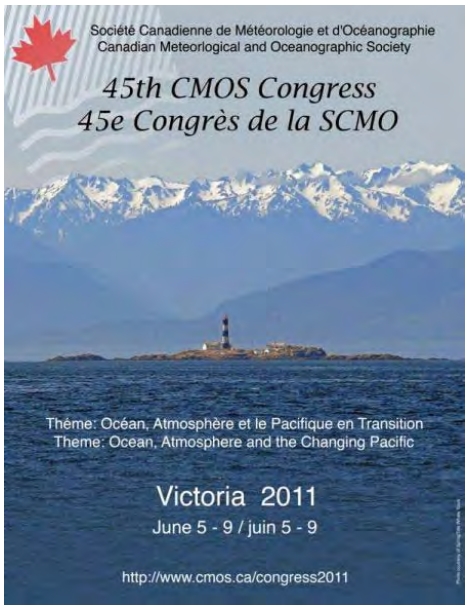
Source: Canadian Ocean Science Newsletter, Vol.51, July 2010.

SHORT NEWS / NOUVELLES BRÈVES

ANNOUNCEMENT

CMOS Congress 2011

The 45th Annual Congress of the Canadian Meteorological and Oceanographic Society will be held June 5th-9th 2011 at the Victoria Conference Centre, Victoria, BC. The Victoria Conference Centre has excellent facilities and is attached to the historic Empress Hotel, which is our main conference hotel, located in the heart of downtown Victoria. As many of you will know, Victoria is a great city to visit, surrounded by beautiful coastal and mountain scenery, and there is much to explore on Vancouver Island and the surrounding Pacific coast should you choose to extend your stay. The Local Arrangements Committee and Scientific Program Committee are already hard at work planning the 2011 Congress, and we look forward to welcoming you here. Further information is available à http://www.cmos.ca/congress2011.



Congress Theme and Scientific Program

The theme of next year's Congress, **"Atmosphere, Ocean and the Changing Pacific"**, encompasses how changes in this great ocean, both natural and human-induced, are affecting the planetary environment and its ecosystems. As we attempt to predict such changes and their many consequences across a broad range of time scales and to unravel the causes of such changes in the past, understanding the interconnections between the components of the earth system has become increasingly important; therefore, this theme will have a very broad reach. The Congress theme is, of course, only one facet of the meeting, and contributions in all areas will be sought and welcomed.

The scientific program for the 2011 Congress is taking shape and will feature an exciting slate of plenary and public lectures. The **Call for Session Proposals** is now completed. Workshops, business meetings and the icebreaker reception will be scheduled for June 5, and the Congress program will commence June 6. Those wishing to discuss or provide input to the program should contact the Scientific Program Committee at cccma_cmos2011@ec.gc.ca. For general enquiries please e-mail lac@cmos.ca.

COMMUNIQUÉ

Congrès SCMO 2011

Le 45è congrès annuel de la Société canadienne de météorologie et d'océanographie se tiendra du 5 au 9 juin 2011 au Victoria Conference Centre, à Victoria, en Colombie-Britannique. Le Victoria Conference Centre possède d'excellentes installations, et il fait partie de l'historique Empress Hotel, qui est notre principal hôtel pour les congrès, situé au cœur du centre-ville de Victoria. Comme plusieurs d'entre vous le savent, Victoria est une très belle ville à visiter, entourée de paysages côtiers et montagneux, et il y a beaucoup de choses à explorer sur l'île de Vancouver et la côte du Pacifique si vous décidez de prolonger votre séjour. Le Comité national organisateur et le Comité des programmes scientifiques travaillent déjà à planifier le congrès 2011, et nous avons hâte de vous accueillir ici. Pour de plus amples informations, consulter http://www.scmo.ca/congress2011.

Thème du congrès et programme scientifique

Le thème du congrès de l'année prochaine **«Atmosphère, Océan et le Pacifique en transition»**, comprend le sujet des changements dans ce grand océan, naturels et causés par l'homme, qui affectent l'environnement planétaire et ses écosystèmes. Alors que nous tentons de prédire de tels changements et leurs nombreuses conséquences sur une large gamme d'échelles chronologiques et de démêler les causes de tels changements dans le passé, le fait de comprendre les interconnexions entre les composantes du système terrestre est devenu de plus en plus important. Par conséquent, ce thème aura une très large portée. Le thème du congrès n'est bien sûr qu'une seule facette de la rencontre, et les contributions sont recherchées et bienvenues.

Le programme scientifique pour le congrès 2011 prend forme et présentera une liste intéressante de conférences plénières et publiques. **L'appel de propositions de sessions** est maintenant terminé. Des ateliers, des réunions d'affaires, et une réception brise-glace se dérouleront le 5 juin, et le programme du congrès commencera le 6 juin. Les personnes qui veulent discuter du programme ou y apporter des suggestions peuvent communiquer avec le Comité du programme scientifique à cccma_cmos2011@ec.gc.ca. Écrivez à lac@cmos.ca pour des questions d'ordre général.

Local Arrangements Committee
Comité local organisateur

- Nathan Gillett (Chair/Président, EC/CCCma)
- Michael Eby (UVic)
- Greg Flato (EC/CCCma)
- Bill Merryfield (EC/CCCma)
- Angelica Peña (F&O Canada/IOS)
- Daniel Roy (DND)
- John Scinocca (EC/CCCma)
- Knut von Salzen (EC/CCCma)
- Lisa Vitols (EC)
- Frank Whitney (F&O Canada/IOS)
- Kirsten Zickfeld (EC/CCCma)
- Nilgun Kulan (ASL Environmental Sciences)

Scientific Program Committee
Comité du programme scientifique

- Bill Merryfield (Chair/Président, EC/CCCma)
- Vivek Arora (EC/CCCma)
- Phil Austin (UBC)
- Alex Cannon (EC/PWC)
- Stephen Déry (UNBC)
- Mike Foreman (F&O Canada/IOS)
- Debbie Ianson (F&O Canada/IOS)
- Tara Ivanochko (UBC)
- Norm McFarlane (EC/CCCma)
- Adam Monahan (UVic)
- Francis Poulin (UofW)

EC: Environment Canada / Environnement Canada;
CCCma: Canadian Centre for Climate Modelling and Analysis; / Centre canadien de la modélisation et de l'analyse climatique;
Uvic: University of Victoria / Université de Victoria;
DND: Department of National Defence / Ministère de la Défense Nationale;
UBC: University of British Columbia / Université de la Colombie-Britannique;
UNBC: University of Northern British Columbia / Université du Nord de la Colombie-Britannique;
F&O Canada: Department of Fisheries & Oceans / Ministère des Pêches et Océans;
IOS: Institute of Ocean Sciences / Institut des Sciences de la mer;
PWC: Public Works Canada / Travaux Publics Canada;
UofW: University of Waterloo / Université de Waterloo;

The new face of green professionals: setting standards for a brighter future

August 9, 2010 – In an era when the environment is at the forefront of public concern, professional certification is becoming critical in separating the self-proclaimed environmental experts from the real ones.

In response the Environmental Careers Organization (ECO) Canada has created a new environmental designation that provides clarity, assurance and consistency throughout the environmental sector.

For over a decade, ECO Canada has awarded seven designations to formally recognize the unique skills and knowledge of environmental professionals in Canada but now in an effort to create a clear and strong identity, ECO Canada has merged these into the Environmental Professional (EP) designation.

The EP designation demonstrates an environmental professional's commitment to accountability and career development, as well as their desire to remain on top of current practices. It is also a measure of competencies against verified national standards, which sets them apart from others in the industry.

In an effort to increase mobility for environmental workers this designation transcends provincial borders. Furthermore, a memorandum of understanding for mutual recognition of the designation has been signed by Great Britain, Australia, and New Zealand in an effort to build global standards in environmental employment.

Background
ECO Canada is a not-for-profit organization that was first established in 1992 under the federal government's Sector Council initiative.

Over the past 17 years, ECO Canada has grown into its own as an organization focused on supporting Canada's environment industry by communicating with industry stakeholders, conducting research and creating the necessary resources required to address human resource needs in order to ensure the success of this dynamic sector.

Support for the development of professional standards increases as the Environment Sector expands

September 7, 2010 – With recent events such as the BP oil spill, professionals and employers worldwide are becoming wary of the potential risks they run when dealing with our fragile environment. Industry personnel have become acutely aware of the need for specific competencies, skills, and training within the workforce of the environmental

sector. But in a sector where the range of specializations is vast, understandably the development of certification with strong regulatory support takes time.

For over a decade, ECO Canada (Environmental Careers Organization) has offered professional certification for environmental professionals through seven designations that formally recognize their unique skills and knowledge. However, as a result of the recent increased demand for advanced skills recognition in the environmental sector, the past 6 months have seen significant progress.

In March, at the 2010 GLOBE Conference, a Memorandum of Understanding (MOU) was signed between ECO Canada and the Environment Institute of Australia and New Zealand (EIANZ). The document demonstrated a mutual understanding for the growing need for professional standards and certification in this field, both locally and internationally.

In May the Project Lead for the Nova Scotia Ministry of Environment announced the proposed Licensed Environmental Site Practitioners (LESP) Program, in which the province of Nova Scotia would recognize people holding the Canadian Certified Environmental Practitioner (CCEP) designation, among others, as qualified to sign reports related to contaminated sites.

In August ECO Canada merged the seven designations to form what is now the Environmental Professional (EP) designation. And, in doing so, have gained backing for EP and further developments of certification from the following employers:

CCS Corporation | Hazco Environmental Services
Maxxam Analytics | University of Toronto | Genivar
GLOBE Foundation | AMEC Earth & Environmental
SNC-Lavalin Group | Rescan Environmental Services
Watters Environmental Group | SLR Consulting
EBA Engineering | City of Calgary

To demonstrate their support SLR, Rescan and Genivar have either held meetings to discuss the value of certification or provided ECO Canada with the space, resources and contacts to communicate the value of certification to their environmental staff. AMEC Earth & Environmental alone currently employs 60 certified members. Furthermore, representatives from the above list of employers have publically supported the designation at industry events.

While the EP Certification is still making its way to the mainstream of everyday environmental practice, its recent momentum gained from industry support in Canada as well as the initiatives blossoming overseas is indicative of a global shift in environmental work – a shift to making business choices that use the most competent and qualified workers in order to ensure a protected environmental landscape for the public.

Background
Since 1997, ECO Canada Certifications have been administered by ECO Canada and awarded by the Canadian Environmental Certification Approvals Board (CECAB). In adherence to ISO 17024—the international standard for Personnel Certification Bodies, CECAB is held to strict operational standards. This third-party verification means that CECAB conforms to international standards in the areas of quality management, conflict of interest (prevention of), and best practices for certification program management.

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831 Experts Selected for the Fifth Assessment Report

■ Over 50% more nominations demonstrate increasing interest among scientists to contribute to the IPCC.

■ More women and more authors from developing countries reflect wide diversity of disciplines and scientific views.

Geneva, 23 June 2010 - The IPCC (Intergovernmental Panel on Climate Change) announces today the release of the final list of selected Coordinating Lead Authors, Lead Authors and Review Editors. This unique team of 831 climate change experts will dedicate almost four years to the three Working Group Reports of the IPCC Fifth Assessment Report (AR5) to be published between 2013 and 2014. These experts will also provide contributions to the Synthesis Report to be published in 2014.

In the selection of authors particular attention has been given to relevant expertise to ensure that IPCC author teams consist of leading experts in the respective fields with a range of scientific views on climate change. The 831 individuals are drawn from fields including meteorology, physics, oceanography, statistics, engineering, ecology, social sciences and economics. In selecting the author teams the IPCC stressed the need for regional and gender balance and recognized the importance of involving new and younger authors.

In total 831 experts will contribute to the AR5, divided between the three working groups (WG). WGI focusses on the physical science basis and will include 258 experts. WGII assesses the impacts, adaptation strategies and vulnerability related to climate change and will involve 302 experts. WGIII covers mitigation response strategies in an integrated risk and uncertainty framework and its

assessments will be carried out by 271 experts.

In March 2010, the IPCC received approximately 3,000 nominations. At the Bureau session held in Geneva, 19-20 May 2010, the three working groups presented their selected authors and review editors for the AR5. Each of the selected scientists, specialists and experts was nominated in accordance with IPCC procedures, by respective national IPCC Focal-Points, by approved observer organizations, or by the Bureau.

In comparison to the Fourth Assessment Report (AR4), participation from developing countries has been increased reflecting the on-going efforts to improve regional coverage in the AR5. About 30% of authors will come from developing countries or economies in transition. The proportion of female experts, has significantly increased since the AR4, reaching approximately 25% of the selected authors. More than 60% of the experts chosen are new to the IPCC process, which will bring in new knowledge and perspectives.

The IPCC received 50% more nominations of experts to participate in AR5 than it did for AR4. A total of 559 authors and review editors had been selected for AR4 from 2,000 proposed nominees.

"*This increase reflects the high regard of the IPCC's work within the scientific community*", said Dr. Rajendra Pachauri, Chairman of the IPCC. "*The IPCC is very grateful to all those scientists, specialists and experts who will give their time freely to participate in the work of AR5*".

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28 Canadian Experts Selected for Lead Roles in the IPCC Fifth Assessment Report

Hashem Akbari, Concordia University
George Boer, Environment Canada
Michael Brklacich, Carleton University
Ian Burton, University of Toronto
Graham Cogley, Trent University
Stewart Cohen, Environment Canada
Gregory Flato, Environment Canada
Howard Freeland, Fisheries and Oceans Canada
John Fyfe, Environment Canada
Nathan Gillett, Environment Canada
Danny Harvey, University of Toronto
David Keith, University of Calgary
Paul Kovacs, Institute for Catastrophic Loss Reduction
Liza Leclerc, Independent Consultant
Glenn Milne, University of Ottawa
Monirul Mirza, Environment Canada
Linda Mortsch, Environment Canada
Matthew Paterson, University of Ottawa
Terry Prowse, Environment Canada
Jake Rice, Fisheries and Oceans Canada
Theodore Shepherd, University of Toronto
Barry Smit, University of Guelph
Daithi Stone, University of Cape Town
John Stone, Carleton University
Andrew Weaver, University of Victoria
John Whalley, University of Western Ontario
Xuebin Zhang, Environment Canada
Francis Zwiers, Environment Canada

Ten (10) are from Environment Canada, two (2) from Fisheries and Oceans Canada and fourteen (14) from Canadian universities. Congratulations to the nominees!

CMOS Accredited Consultants Experts-Conseils accrédités de la SCMO

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

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

45th CMOS Congress
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Ocean, Atmosphere and the Changing Pacific
Océan, Atmosphère et le Pacifique en Transition

Victoria 2011

British Columbia / Colombie-Britannique, Canada

June 5 - 9 / 5 - 9 juin

http://www.cmos.ca/congress2011

Race Rocks Lighthouse. Photo coutresy of SpringTideCharters


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maintenance | la maintenance
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seconde nature
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