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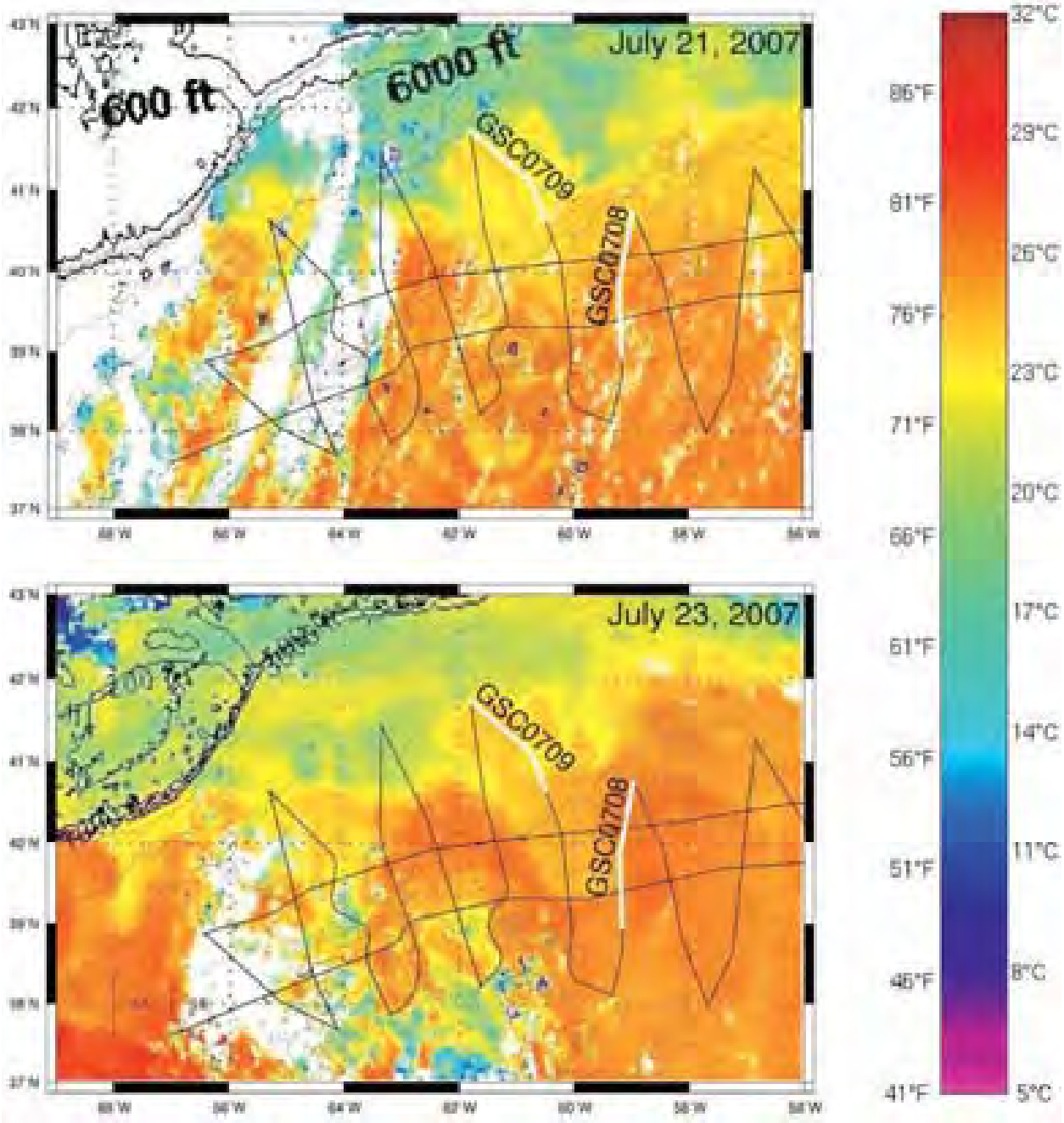

CMOS Bulletin SCMO
"at the service of its members / au service de ses membres"

Editor / Rédacteur: Paul-André Bolduc
Associate Editor / Rédactrice associée: Dorothy Neale
Canadian Meteorological and Oceanographic Society
Société canadienne de météorologie et d'océanographie
P.O. Box 3211, Station D
Ottawa, ON, Canada K1P 6H7
E-Mail: bulletin@cmos.ca; Courriel: bulletin@scmo.ca

Cover page : The cover page picture illustrates the collection of expandable bathythermographs (XBTs) along the seismic survey tracks during the summer of 2007 on board of the *RN Endeavor* off the East Coast of Canada. The XBTs were taken at the most hydrographically interesting section defined by sea surface temperature satellite images and are shown by the white lines along the tracks. Both the seismic and XBT data will be used in the **R**eflection **O**cean **S**eismic **E**xperiment - ROSE. To learn more, please read the article on **page 43**.

Page couverture : L'image de la page couverture illustre la collecte de bathythermographes largables (XBTs) le long des lignes de reconnaissance sismique durant l'été 2007 à bord du *RN Endeavor* opérant sur la côte Est du Canada. Les XBTs furent échantillonés aux sections les plus intéressantes du point de vue hydrographique tel que défini par les images satellitaires de température de surface, et sont illustrées par des traits blancs le long des lignes de reconnaissance. Les deux ensembles de données, XBT et données sismiques, seront utilisés dans la **R**eflection **O**cean **S**eismic **E**xperiment - ROSE. Pour en apprendre plus, prière de lire l'article en **page 43**.

CMOS Executive Office / Bureau de la SCMO
P.O. Box 3211, Station D Ottawa, Ontario, Canada, K1P 6H7 Fax / Fascimilé: 613-990-1617 homepage: http://www.cmos.ca page d'accueil: http://www.scmo.ca
Dr. Ian Rutherford Executive Director - Directeur exécutif Tel/Tél.: 613-990-0300 E-mail/Courriel: cmos@cmos.ca
Dr. Richard Asselin Director of / Directeur des Publications Tel/Tél.: 613-991-0151 E-mail/Courriel: publications@cmos.ca
Ms. Qing Liao Office Manager - Chef de bureau Tel/Tél.: 613-991-4494 E-mail/Courriel: accounts@cmos.ca

Canadian Meteorological and Oceanographic Society (CMOS)

Société canadienne de météorologie et d'océanographie (SCMO)

Executive / Exécutif

....from the President's Desk

Friends and colleagues:

Dr. Paul Myers
CMOS President
Président de la SCMO

As all of us in CMOS rightly know, weather has a huge impact on the day to day lives of Canadians, as well as the economic wellbeing of the country. That could not have been made more clear with the impacts of the severe storms that have struck central and eastern Canada over the past few weeks. From cities having spent their annual snow clearing budgets well before the end of winter, to the effects on transportation industries, to those stuck for hours and/or days in airports (of which I was one of those who spent the better part of 24 hours at/around Toronto airport), this all shows the importance of accurate short and long (seasonal) term predictions. We must continue to push governments to ensure that sufficient funding is in place to support a strong operational forecast service in Canada as well as continuing research at improving forecasts and forecast techniques. And we must continue to educate Canadians about the true nature of our science so that people understand what our field is about, why it is important to be well supported and why talented young people should consider it for a career.

The deadlines for nominations for CMOS awards was February 15th. This deadline had to be extended because of a paucity of nominations. I know this can't be because of a shortage of candidates, since Canada has many outstanding individuals who have devoted their lives to meteorology and oceanography. Additionally, CMOS manages the competition for a number of student prizes and scholarships, at both the undergraduate and graduate levels. These range from those with an interest in atmospheric sciences to supplements for NSERC winners in both meteorology and oceanography. Despite the fact that I am sure there are many deserving students who could use the extra funding, we often get very few applications.

(Continued on next page / Suite à la page suivante)

Volume 36 No.2
April 2008 — Avril 2008

Inside / En Bref

Articles

Reports / Rapports

Our regular sections / Nos chroniques régulières

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...from the President's desk (Continued / suite)

So, if you are a student and reading this, consider applying to everything you are eligible for. If you are a faculty member at a university, make sure information about these awards gets out to your student population. The deadline for application is 15 April.

Finally, the congress is fast approaching. Look into making your plans for travel as soon as possible as hotels are filling up, as I am sure are flights into Kelowna.

Et sur un tout autre sujet, toutes les présentations au Congrès de Kelowna peuvent être faites dans une ou l'autre des deux langues officielles - l'anglais ou le français. Je sais que, pour le plupart d'entre vous qui suivrez le Congrès, l'anglais sera votre premier choix, mais c'est important que tout le monde sache que la SCMO est une société bilingue.

Paul Myers
CMOS President / Président de la SCMO

Highlights of Recent CMOS Meetings

January - March 2008

January and March Executive Meetings

- Finalizing reports from 2007 St. John's Congress;
- Planning for 2008 Kelowna Congress;
- Initial items for 2009 Halifax Congress;
- Defining a formal society policy on travel expenses;
- Providing matching funds for science fair and conference requests;
- Examining a discussion paper on how the society handles congress financing;
- Examining a discussion paper on CMOS' financial investments;
- Preparing and discussing the society's draft budget for 2009.

Paul Myers,
CMOS President
Président de la SCMO

URGENT - URGENT - URGENT - URGENT

Next Issue *CMOS Bulletin SCMO*

Next issue of the *CMOS Bulletin SCMO* will be published in **June 2008.** Please send your articles, notes, workshop reports or news items before **May 9, 2008** to the address given on page ii. We have an URGENT need for your written contributions.

URGENT - URGENT - URGENT - URGENT

Prochain numéro du *CMOS Bulletin SCMO*

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en **juin 2008.** Prière de nous faire parvenir avant le **9 mai 2008** vos articles, notes, rapports d'atelier ou nouvelles à l'adresse indiquée à la page ii. Nous avons un besoin URGENT de vos contributions écrites.

Oups ! Oups ! Oups ! Oups !

On the cover page of the last issue of *CMOS Bulletin SCMO*, the year number was not increased by one as it should have been for the February issue (Vol.36, No.1). We apologize for this to our readers and for any inconvenience this may had caused. For those keeping old issues of the Bulletin and for librarians, please use your black marker and replace that old **7** on the cover page with a new **8**. Please note that the electronic version has already been corrected.

Oups ! Oups ! Oups ! Oups !

Sur la page couverture du dernier numéro du *CMOS Bulletin SCMO*, le numéro de l'année n'a pas été augmenté d'une unité comme il aurait fallu le faire pour le numéro de février (Vol.36, No.1). Nous regrettons cette erreur et nous nous excusons auprès de nos lecteurs pour les inconvénients causés. Pour ceux qui conservent leurs vieux numéros du Bulletin et pour les bibliothécaires, prière d'utiliser votre marqueur noir et remplacer ce vieux **7** sur la page couverture par un nouveau **8**. Prière de noter que la version électronique a déjà été corrigée.

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.

ROSE – Reflection Ocean Seismic Experiment

by Blair Greenan[1], Mladen Nedimovic[2], Keith Louden[3], Ramzi Mirshak[3], Barry Ruddick[3] and John Shimeld[4]

Résumé: Au cours de l'été 2007, sur la Plaine Sohm Abyssal, le gouvernement du Canada a contracté un levé sismique multicanaux («MCS») de 6 900 km afin de définir l'autorité territoriale canadienne des fonds marins et de ses ressources naturelles en accord avec l'Article 76 de la Convention des Nations Unies sur le droit de la mer («UNCLOS»). Les lignes de levé traversent une limite océanographique importante entre le Gulf Stream et les eaux du talus continental. En tenant compte de cette opportunité, le navire de recherche océanographique *RN Endeavor* a été utilisé pour rassembler des données océanographiques en accord en partie avec le levé UNCLOS MCS. En utilisant les sondes XBT et CTD, on a recueilli, approximativement sur une distance de 350 km, des ensembles de données spatiales (500 – 1500 m). Les données combinées provenant du MCS et des données océanographiques fournissent une base pour l'Expérience de sismique réflexion océanique – ROSE. Ces données composites peuvent mener à des analyses quantitatives donnant lieu à un ensemble d'information dans la colonne d'eau pour produire des sections correspondantes de la réflexion synthétique et du champ de réflexion et pour étudier les limites de la résolution spatiale de l'océanographie sismique. Elles fourniront aussi de site témoin pour les structures MCS et amélioreront la compréhension des liens entre les structures physiques et les réflexions sismiques.

Introduction

Imagine a vessel steaming south from Halifax in April 2002 recording sea surface temperature (SST) along its track (Figure 1). Oceanographers interpreting this trace would likely comment on cold coastal waters present over the Scotian Shelf, a number of small but strong temperature features, and the Gulf Stream at 41.5°N. One month later, a second transect would yield essentially the same interpretation with slight spatial shifts. A satellite SST image (Figure 2) is much more informative. The warm waters of the meandering Gulf Stream separate the Sargasso Sea waters of the mid-latitude North Atlantic from the colder waters of the sub-polar gyre. These colder waters originate from the Labrador and Newfoundland shelves as well as from the Gulf of St. Lawrence (*Petrie and Drinkwater*, 1993). The image clearly shows Gulf Stream meanders growing to the point of forming a Warm-Core Ring (WCR), a core of Sargasso Sea water surrounded and contained by clockwise current, centered at 62°W, 40°N. The development of WCRs has been linked to the New England Seamounts southeast of Georges Bank (*Richardson*, 1981).

One month later, the SST image shows the newly-formed WCR and a number of smaller eddies and tendrils that likely resulted from the meandering instability. Related sub-surface physical processes associated with vertical mixing have been observed: internal waves and tides (*Kunze*, 1986; *Kunze and Lueck*, 1986), internal solitons propagating onto the shelf (*Sandstrom and Oakey*, 1995), and thermohaline intrusive layering at fronts (*Horne*, 1978; *Ruddick*, 1983; *Ruddick and Bennett*, 1985). The surprisingly rapid time variation, rich spatial structure, and complex variety of physical mixing processes, both lateral (*Hebert*, 1987) and vertical, make this region a challenging one to understand physically and to forecast or model accurately.

Satellites can give highly detailed, synoptic images, often with less precision than *in situ* instrumentation but with qualitative information on the structures and connections between structures on a variety of scales. The value of the spatial context that such images provide is illustrated by comparing the traces of Figure 1 with the full SST images (Figure 2). Although the traces of Figure 1 show strong thermal features at varying scales, it is difficult or impossible to identify these features or see how they are connected. It is for this reason that satellite imagery has become a common tool for oceanographers, which they use to augment hydrographic observations. For example, *Kunze* (1986) and *Kunze and Lueck* (1986) used satellite images, hydrography, and current profiles to learn much about how the near-inertial wave field is affected by WCRs, and about the consequences for mixing and evolution of the WCRs.

[1] Ocean Sciences Division
Bedford Institute of Oceanography
Fisheries and Oceans Canada
Dartmouth, NS

[2] Department of Earth Sciences
Dalhousie University
Halifax, NS

[3] Department of Oceanography
Dalhousie University
Halifax, NS

[4] Geological Survey of Canada
Bedford Institute of Oceanography
Natural Resources Canada
Halifax, NS

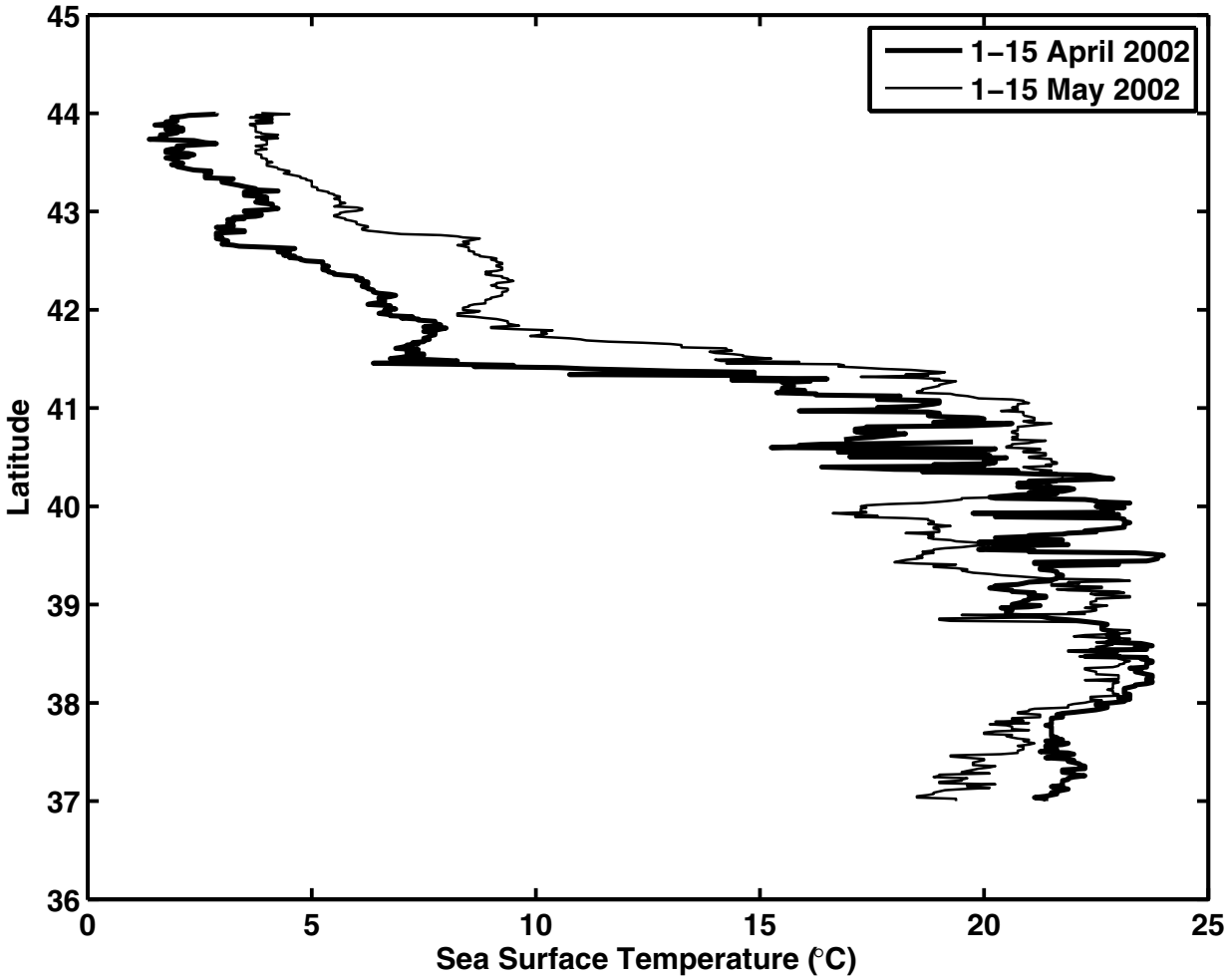

Figure 1. Sea surface temperature across the Scotian Shelf and Slope waters extending to the Gulf Stream at longitude 63° W.

Holbrook et al. (2003) discovered that fine-scale structures (of order centimetres to tens of metres) within the water column can be imaged with ~10 m lateral and vertical resolution using multi-channel seismic (MCS) data, thus obtaining a near-synoptic view of ocean fine structure in the vertical plane. Traditional hydrographic methods provide individual profiles of salinity (S) and temperature (T) vs. depth, but at such wide horizontal and temporal spacing that adjacent profiles are only partially coherent. In contrast, highly resolved seismic oceanography (SO) images show how fine-scale features, likely associated with important physical processes such as internal waves and tides, internal solitons, and thermohaline intrusions, are associated with larger-scale structures such as currents, water masses, and eddies. This is the same advantage that satellite images give to oceanography (*Ruddick*, 2003), and radar has given to weather forecasting in the horizontal plane. Furthermore, the estimates of sound speed obtained during MCS processing give a remotely sensed proxy for the oceanic temperature structure. In addition to demonstrating that MCS data can be used to image water column reflectors, *Holbrook et al.* (2003) showed by direct comparison to a coincident expendable bathythermograph (XBT) trace that the measured temperature fluctuations were directly associated with water column reflectors.

Major questions in the field of SO follow two themes:

■ Exactly what (in physical oceanographic terms) are the water column structures that are imaged by MCS data? This question is analogous to the early days of MCS exploration, when the links between the images and underlying structures causing the reflections were not understood.

■ What quantitative, physical process-oriented information can be obtained using SO?

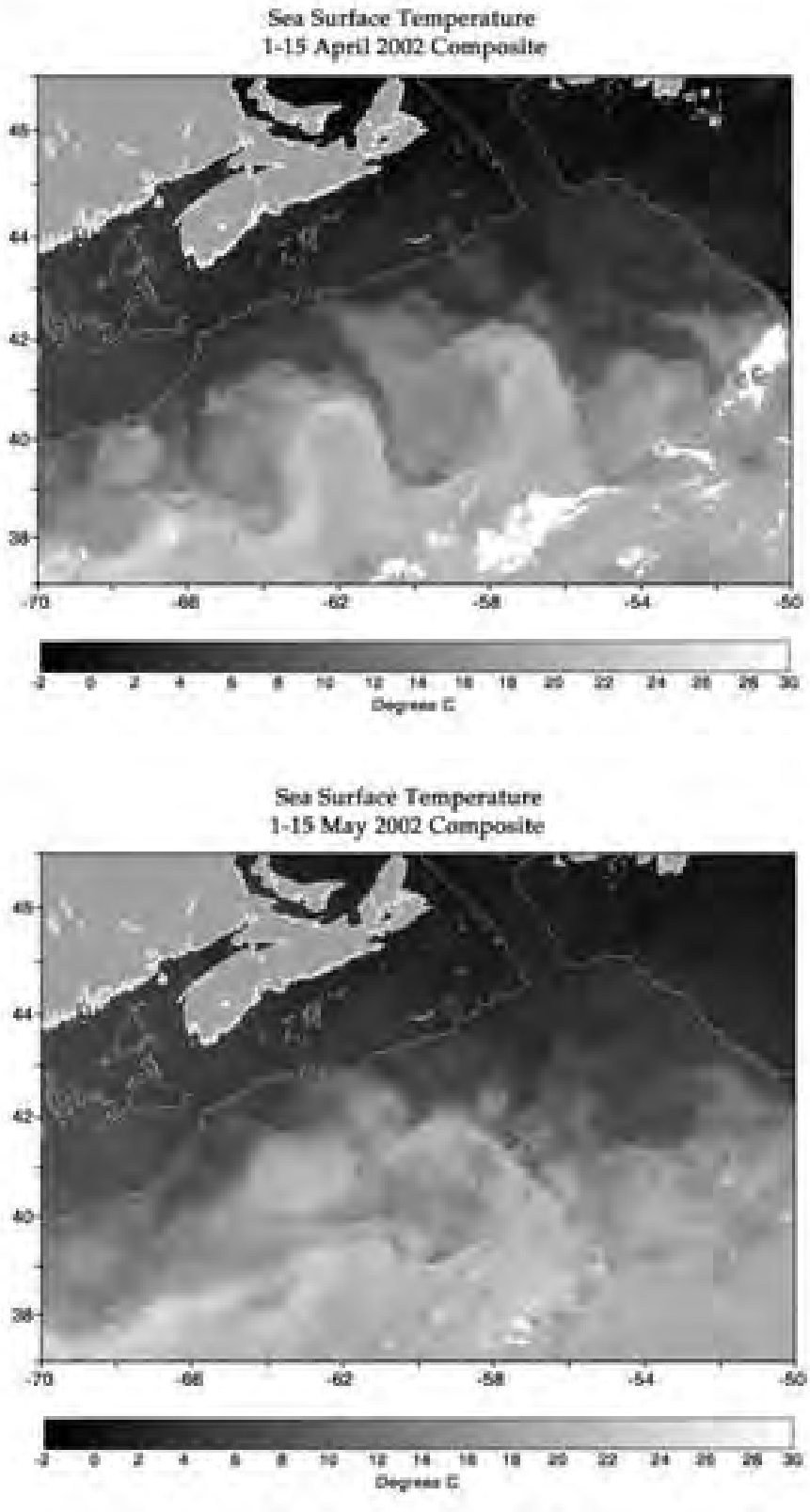

Figure 2. Composite sea surface temperature (SST) images offshore Nova Scotia from (a) 1-15 April 2002 and (b) 1-15 May 2002.

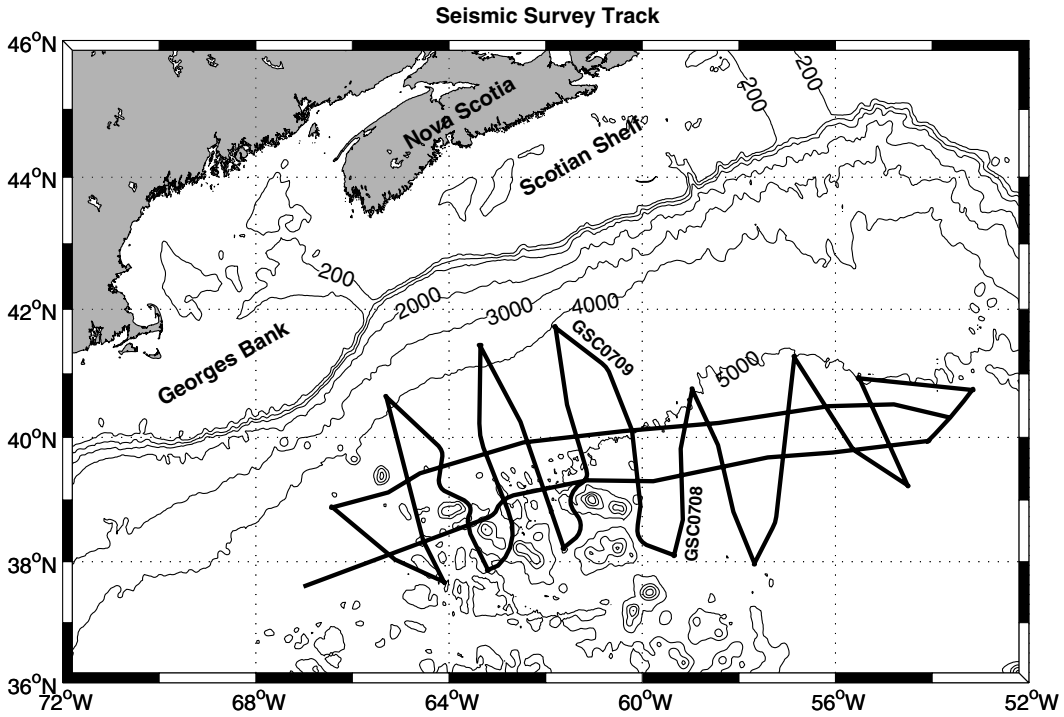

Figure 3. UNCLOS MCS profiles offshore Nova Scotia as outlined by the Geological Survey of Canada (GSC) and collected under contract by GSI. Depth contour labels are in metres.

Answering the first question requires well-resolved hydrographic measurements to be taken concurrently with MCS observations to allow direct comparison of imaged and measured structures. In one of only a few such studies to this point, *Nandi et al*. (2004) verified that water mass boundaries in the Norwegian Sea were clearly and reliably imaged by MCS; this was further confirmed in the Kuroshio region south of Japan by *Nakamura et al.* (2006). Given the limited number of coincident data sets and the relatively coarse spatial resolution of the hydrographic data in these data sets, more research is still needed to "ground truth" new data.

Quantitative oceanographic results will be possible once a causal and well-understood relationship is established between MCS-imaged structures and associated oceanographic features that generate the images. *Nandi et al.* (2004) showed that thermal finestructure associated with thermal contrasts as weak as 0.03°C can be imaged, and mapped with resolution and synopticity not achievable by other methods. Any physical process that creates, deforms, disrupts, or otherwise alters finestructure (e.g. internal wave strains, thermohaline intrusions, staircases and turbulence) may be amenable to study by seismic reflection methods. *Holbrook and Fer* (2005) showed that horizontal wavenumber spectra produced from digitized seismic reflections match the Garrett-Munk spectrum, suggesting that seismic reflection data can provide quantitative information about the internal wave field. *Holbrook and Fer* (2005) also found enhanced internal wave energy near a continental slope; this may indicate enhanced mixing near zones of critical internal wave bottom reflection, a process that has been suspected but poorly observed in the past. The confirmation that reflector displacements can be at least potentially interpreted as isopycnal displacements opens the way to new quantification methods. It should be possible, for example, to observe and quantitatively interpret the "break" in the spectrum at wavelengths of ~100 m corresponding to the boundary between internal waves and turbulence (*Holbrook, pers. comm*., 2006, *Klymak and Moum,* 2007a,b). Variations in the measured internal wave spectrum inferred from seismic reflection data might be directly related to variations in internal wave-driven turbulent mixing (*Gregg*, 1989, 1998, *MacKinnon and Gregg*, 2003). It should also be possible to obtain the spectrum of vertical mode numbers (specifically, internal wave strain) along with the horizontal wavenumber spectrum. Such a project is beginning with an MCS section from the S. China Sea. (L. Pinhiero, pers. comm., 2007).

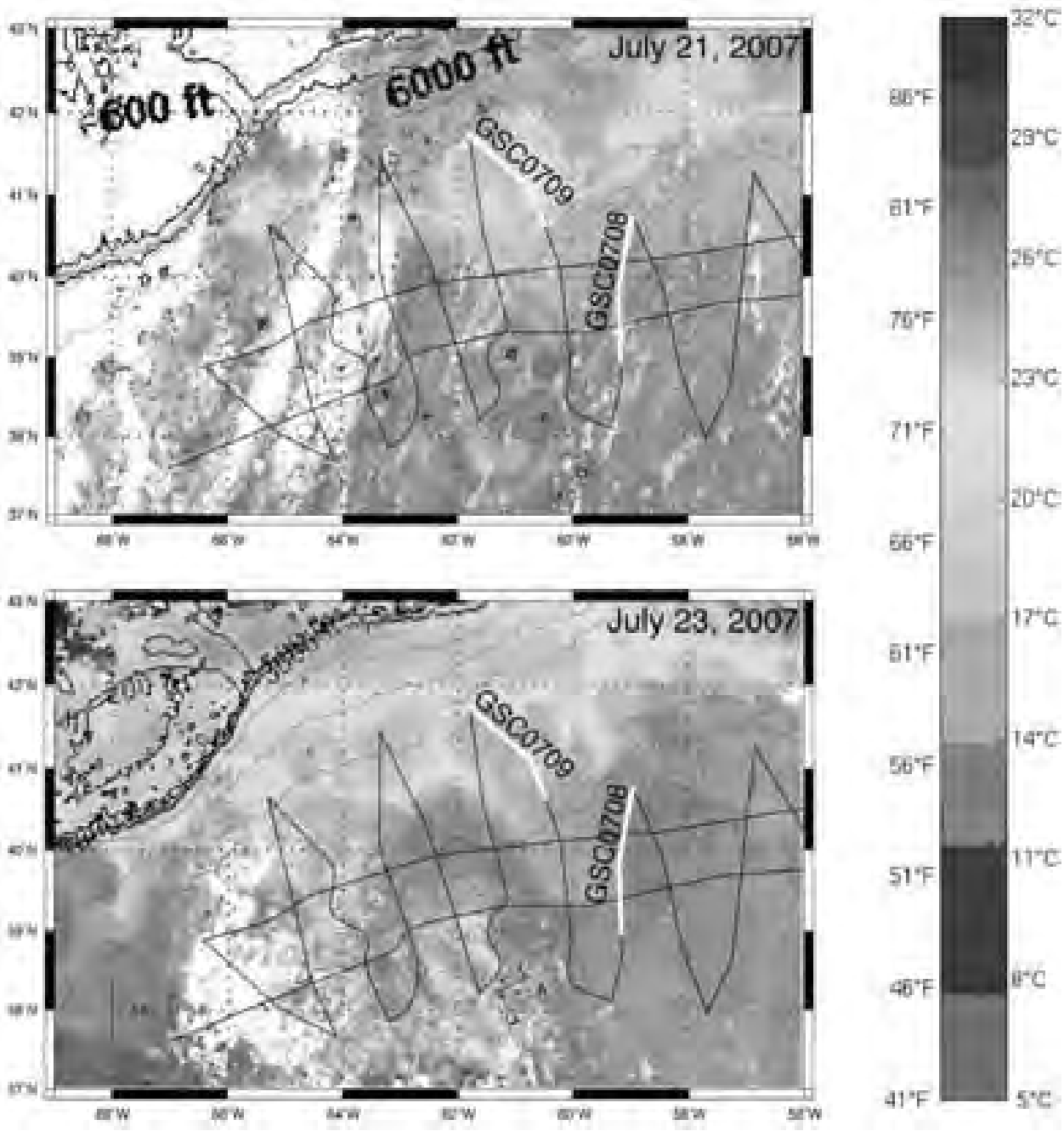

Figure 4. Sea surface temperature (SST) images were used to locate the most hydrographically interesting sections of the UNOLS MCS profiles collected during the time window of the EN438 cruise. The white lines represent segments covered by the ROSE XBT survey along GSC0708 (21-23 July 2007) and GSC0709 (23-24 July 2007).

UNCLOS and ROSE

On 7 November 2003, the Government of Canada ratified the United Nations Convention on the Law of the Sea (UNCLOS). Under this agreement, coastal states have sovereign rights in a 200-nautical mile exclusive economic zone with respect to natural resources and certain economic activities, and exercise jurisdiction over marine science research and environmental protection. Article 76 of the UNCLOS allows coastal states to define an extended continental shelf boundary, beyond 200 nautical miles, within which the coastal state can exercise jurisdiction of resources on and below the seafloor. To prepare the necessary scientific case in support of an extended continental shelf, 6900 km of MCS data (Figure 3) were acquired by Geophysical Services International (GSI) under contract to the Geological Survey of Canada, a branch of Natural Resources Canada. The total volume of the seismic source was 4410 cubic inches (~0.07 m^3) and the length of the receiver array was 4000 m. The source and receiver array were towed behind the acquisition vessel at approximately 10 m below the ocean surface.

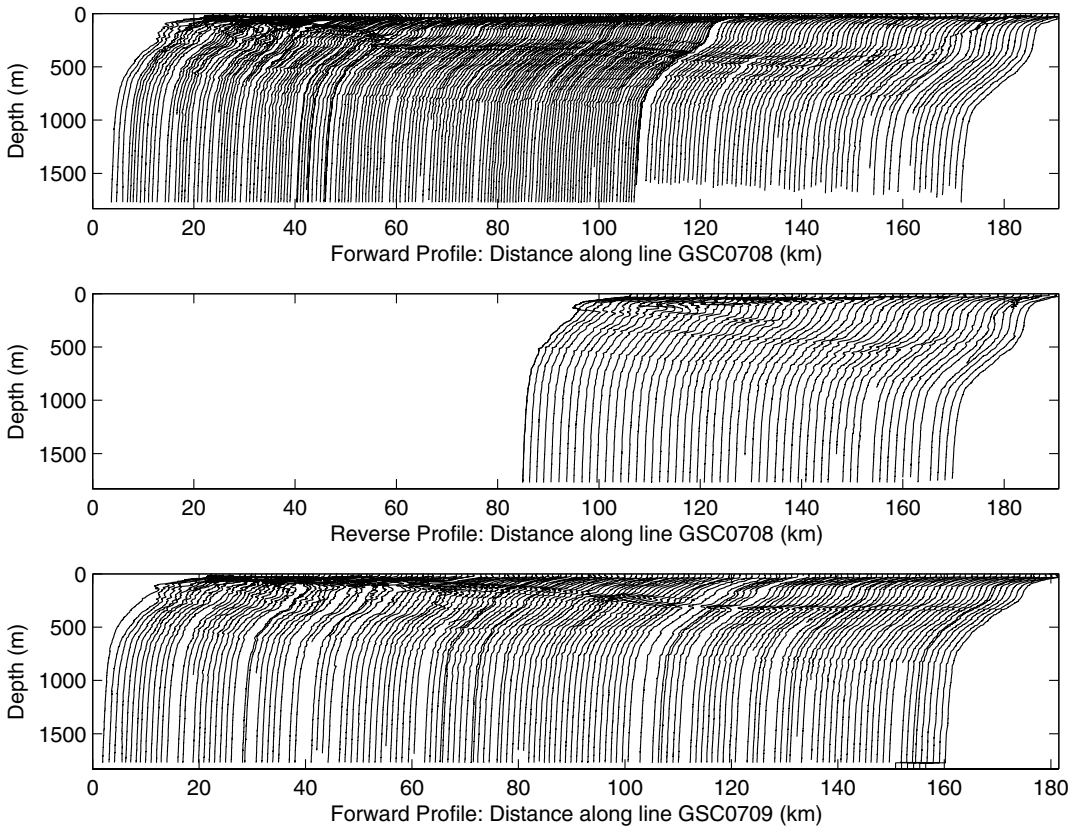

Figure 5. Waterfall plots of temperature recorded as a function of depth by T-5 XBT probes launched during EN438 cruise on R/V Endeavor. (Top) Forward XBT profile along the northern and central sections of UNOLS MCS GSC0708 profile. This includes a few parts with repeated XBT profiling making the XBT survey appear particularly dense. Note that the survey density is reduced after a CTD cast at about 110 km along the transect, as the R/V Endeavor had to speed up and catch up with the GSI Pacific. Also note that the XBTs stop recording in this section at depth of about 1600 m because the ship speed was increased to 7 knots. (Middle) Reverse traverse along a section of the forward profile (Top) at reduced density. (Bottom) XBT profile along the northern section of line GSC0709.

The Reflection Ocean Seismic Experiment (ROSE) was designed to take advantage of this opportunity by acquiring coincident physical oceanographic data during the MCS survey. ROSE focussed on probing the Gulf Stream and adjacent waters with coincident seismic and hydrographic data to study in great detail how large-scale oceanographic features interact with fine-scale structures that cause ocean mixing. Such research requires close collaboration between marine geophysicists and physical oceanographers, but few of these studies have taken place because seismic oceanography is a relatively new field and the costs of MCS data acquisition are substantial. The initial research in ROSE will concentrate on addressing the first SO question described in the Introduction. The unique advantage that ROSE provides over other SO data sets to this point is the high spatial resolution of its hydrographic data.

Field Program

The timing of funding, difficulty of finding an appropriate research vessel on short notice, and the logistical constraints imposed by having to coordinate plans with a commercial company contracted to acquire the MCS data were all factors in planning and execution of the field program. A plot of the entire survey plan for collection of MCS data for the UNCLOS project is shown in Figure 3. The *R/V Endeavor*, operated by the University of Rhode Island (URI), was chartered for nine days to carry out the ROSE hydrographic survey. Concurrent acquisition of both hydrographic and MCS data occurred along lines GSC0708 and GSC0709 (Figure 4). The *R/V Endeavor* maintained a minimum distance of 8 km behind the seismic vessel *GSI Pacific* to provide a safe clearance from the 4 km streamer.

Daily satellite imagery (individual and composite SSTs from the Rutgers University Coastal Ocean Observation Lab, http://krill.rutgers.edu/cool/data.html) was used to identify surface features of interest (fronts, Gulf Stream, WCRs, etc.) and adjust the hydrographic survey plan. The two most relevant and complete SST images are shown in Figure 4. White areas in these images indicate no data due to cloud cover. Clouds are also responsible for the very cold temperatures observed in lower central part of the image

from 23 July 2007. These SST images demonstrate that the ROSE survey took place in the core of the Gulf Stream along line GSC0708 and in the region of the Gulf Stream front along line GSC0709.

The primary instrument used in the ROSE program was the Sippican T-5 expendable bathythermograph (XBT). T-5 XBT probes are designed to measure water temperature to depth of about 1800 m at ship speeds of up to about 6 knots. At greater ship speeds, T-5 probes terminate at a shallower depth. For much of the survey the vessel speed was 6 knots or less (relative to the water), and most of the XBT probes recorded water temperature up to a depth of about 1800 m (Figure 5). Only for the southern part of line GSC0708, when the *R/V Endeavor* had to speed up to about 7 knots after doing a CTD (conductivity, temperature, depth) cast in order to catch up with the *GSI Pacific*, did probes consistently terminate at a depth of about 1600 m (Figure 5). Because the connecting copper wire is very fine and the marine environment can be harsh, occasional XBT probes terminated at shallower depth than expected due to wire breaks. Less than 20 of the probes launched terminated this way and these are visible as lines which deviate significantly in the waterfall plots in Figure 5.

T-5 XBT probes are designed to fall through water at a rate of about 6 m/s and reach the termination depth of 1800 m in about 5 minutes. Since the reloading and launching of a new probe requires little time, spacing between XBT profiles was in the range of 500-1500 m (Figure 5). Altogether, 490 T-5 XBT probes were deployed and covered more than 350 km of coincident MCS profiles.

CTD measurements are critical for seismic oceanography experiments. They essentially provide the same type of information for interpretation of seismic oceanography images that drilling and well-logging do for interpretation of seismic images of rock formations. Furthermore, they can be used to map XBT profiles to velocity and density, and from there relate this to acoustic reflectivity. This is important because unlike CTD casts, which require significant time to complete (~2 hours), XBT probes require little time to complete and can be used for dense oceanographic surveying that is near-coincident with MCS observations. Eight CTD casts were completed during the three days of hydrographic surveying, five on line GSC0708 and three on line GSC0709.

Shipboard Acoustic Doppler Current Profiler (ADCP) data were acquired on R/V Endeavor with an RDI Ocean Surveyor 75 kHz system. This instrument measured water velocity from near-surface to a depth of about 700-800 m in 8 m vertical bins and will be used to help interpret the other data collected.

Preliminary Results

With the survey time available during ROSE, it was decided to conduct a very high-density hydrographic survey, including a repeat survey along one of the profiles. This is a unique feature of the ROSE dataset that no other seismic oceanography field program has accomplished to this point. The close horizontal spacing of the XBT profiles will allow researchers to carry out full waveform seismic modeling to study the resolution limits of seismic oceanography. The repeat survey along GSC0708 will also enable a study of the changes in small-scale structure that occurred over a one-day period. Determining spatial resolution limits of seismic oceanography and temporal imaging limits for particular types of structures should lead to fundamental information required for further development of this scientific discipline.

The collection of 490 XBT temperature profiles during ROSE is presented as a waterfall plot in Figure 5. This figure provides a two-dimensional visualization of the dataset showing the changes in temperature vertically as well as demonstrates the coherence of physical features horizontally. The seasonal and permanent thermoclines (areas of strong temperature change with depth) are the dominant features in the large-scale vertical structure of the temperature field. Finescale structures of O (10m) are also a prominent feature of the XBT dataset. Notably, there appears to be significant coherence in these features over tens of kilometres horizontally. The shifting in depth of these features may be caused by internal wave activity which can change the depth of isopycnals (surfaces of constant density). The majority of the finescale structures are observed in the upper 1000 m of the water column.

Summary

If it is possible to develop a strong relationship between temperature and salinity using the CTD profiles collected in the region during ROSE, then the XBT data set could also be used to infer salinity, density and sound speed at the same high-resolution as is available in temperature. The density field can be used to compute buoyancy frequency, which is a measure of stability throughout the water column. Combining buoyancy frequency with current shear measured with the shipboard ADCP will enable computation of the gradient Richardson number, which is a proxy for vertical mixing intensity.

ROSE is a multidisciplinary experiment designed to draw equally on the MCS data collected during the UNCLOS campaign and on the various hydrographic data collected coincidently in space and time along portions of the UNCLOS survey. Only a coordinated analysis of both datasets will provide answers to the key questions targeted by the experiment. We hope to begin analysis of the UNCLOS MCS data in early 2008. These data, together with the XBT measurements, will provide insight on the potential of the complete dataset to investigate the large variety of hydrographic features and structures recorded.

Acknowledgements
The authors would like to thank the officers and crew of the *R/V Endeavor* as well as the Marine Operations support staff at the University of Rhode Island. We would also like to thank Bob Ryan (DFO) and Roger Pettipas (DFO) for their assistance during the field program and Cathy Porter (DFO) for her help with satellite image processing. This research project was funded by the Natural Sciences and Engineering Research Council of Canada (NSERC) through the Special Research Opportunity (SRO) Program. Significant in-kind funding was provided by Fisheries and Oceans Canada and the Geological Survey of Canada (Atlantic).

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RAPPEL - RAPPEL - RAPPEL

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

John Patterson and the Three-Cup Anemometer

by Kenneth A. Devine[1]

The cup anemometer has been the universal symbol for a weather observing station. While the four-cup anemometer had been in existence for seventy eight years, John Patterson of the Meteorological Service of Canada (MSC) had concluded by 1922 that the three-cup anemometer was superior (Patterson, 1922). By 1924 anemometers with the three-cup cupwheel were being installed for operational use in the Canadian network (MSC, 1925). Called the Anemovane, it had the cupwheel and the wind vane mounted concentrically and was the first three-cup anemometer. An example of the Anemovane can be found at the Canadian Science and Technology Museum (CSTM) in Ottawa as item number 870501. The anemometer cupwheel converts the wind motion to a rotation, which can then be measured by a variety of transducers. After Patterson's paper of 1926 the three-cup cupwheel gradually became the norm for operational anemometers worldwide.

John Patterson joined the MSC in 1910 as a physicist. There had been a thirty-year hiatus in instrument development by the MSC following the departure of Professor George Templeman Kingston as Director of the service in 1880. Initially Patterson conducted the first aerological profiles in Canada using the 70-gram Dines meteorographs on free balloons and well as kites. He also inspected weather stations, including those in the arctic, a duty he continued to perform until he became Director of the service in 1929. In 1914 John Patterson began examining the MSC standard four-cup anemometer (CSTM 870505). The four 10.2 cm (4") diameter hemispherical cups (Patterson, 1930) were mounted on 17.1 cm tubular arms. This research may have prompted him to later examine ways of improving the response of the anemometer. He was seconded in 1917 for research work related to the extraction of helium from natural gas in support of the war effort. Returning at the end of the war he published his first anemometer study based on this earlier work (Patterson, 1919).

The Irish astronomer, Dr. Thomas Romney Robinson had developed the four-cup anemometer in 1846, at which time the British government ordered three anemometers (Fig.1). In 1847 one of these three anemometers was sent to replace the Osler pressure-plate anemometer at the Toronto Magnetic and Meteorological Observatory. The large, seventy-inch wide cupwheel was necessary to overcome the mechanical friction of the system even though a ball-bearing race had been used. Robinson's laboratory anemometer had had 7.7 cm (3") diameter hemispherical cups on 13.6 cm arms from which he determined that the wind speed (V) was three times the linear speed (v) of the center of the cups. The anemometer was mounted on a whirling table in the laboratory to develop wind speeds up to 4.5 m/s for these studies. Over half a century would elapse before the wind tunnel was developed and speeds could be accurately measured. The V/v ratio was called the anemometer factor and was critical for the design of the gear ratios for anemometers. The shaft outputs from Robinson's anemometer were geared down at the recorder, which were located in a shed some distance below the sensors. There was one circular chart for wind speed and a separate one for direction. The next generation of anemometers geared down the rotation at the cupwheel so that the rotation of the down shaft was much slower.

Figure 1. Thomas Robinson's Four-cup Anemometer of 1846

While the anemometer factor of three was used in subsequent mechanical designs into the next century, a few decades after Robinson's work there was concern (Stow, 1873), even by Robinson himself in 1878, that this speed ratio was incorrect. After research by W. H. Dines the British Meteorological Office (BMO) changed their anemometer factor from 3.0 to 2.22 in 1905 (Glazebrook, 1923). The BMO four-cup anemometer of 1910 is an example of anemometers for the preWWI period. This anemometer had 7.6 cm (3") hemispherical cups, 18.7 cm arms, and an anemometer factor of 2.73 so that it rotated 500 turns for each mile of wind. This graph (Fig.2) shows that this four-

[1] Meteorological Instrument Consultant
Aurora, Ontario

cup anemometer was not linear with speed (BMO, 1910).

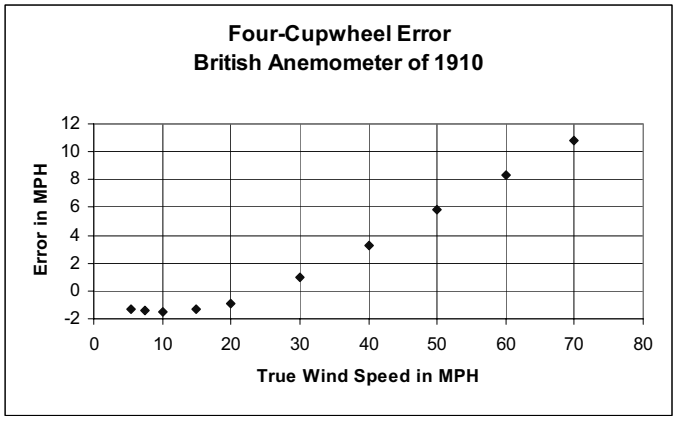

Figure 2. Four-cup Anemometer Error

Even into the 1930's many instrument developers felt that the four-cup anemometer was superior to other configurations since it was assumed it had a higher torque. But the three-cup anemometer delivered about the same average torque as the four-cup and the torque was more consistent. Since the three-cup had a lower inertia than the four-cup it responded more quickly to wind gusts and reduced the windmilling of the cupwheel after the wind speed dropped. The lighter weight and lack of vibration, to be discussed later, reduced bearing wear. But more important, the rotational rate was almost linear with speed, which was not true for the four-cup anemometer.

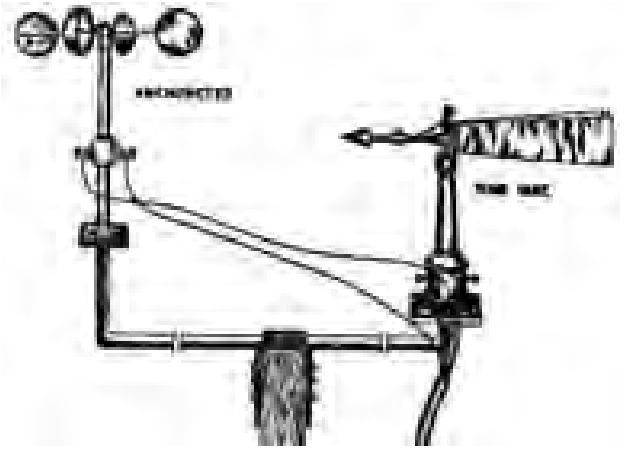

Figure 3. Foster's Four-cup Anemometer before 1914

For his initial research in 1914 Patterson mounted the standard MSC four-cup anemometer (Fig.3) and a Dines pressure-tube anemometer ten feet above a forty-foot tower on Toronto Island giving the anemometers an excellent exposure (Patterson, 1919). The MSC cupwheel was identical to that used in the USA at that time. With this anemometer, which was made by John Foster of Toronto, MSC had used a splayed vane for wind direction, which consisted of two trailing vanes inclined at an angle of 30° to each other. The Dines anemometer had a linear response above 8 mph and with an error of only 1% was more accurate than the cup anemometers of the period. During the year and a half trial, the anemometers agreed at 10 mph (4.5 m/s) but the bias of the MSC cupwheel increased to +15% at 30 mph (13.4 m/s) like the previously mentioned BMO anemometer. Dr. Robinson's anemometer factor of three appeared satisfactory for the MSC anemometer below 15 mph (6.7 m/s) but was too high at greater velocities. Evidently the MSC four-cup anemometer was nonlinear, leading to significant errors for geared anemometers. Patterson stated that the four-cup anemometer did not respond adequately to gusts. This was due in part to the four-cup design but also due to the friction in the output gears.

Since Patterson was seconded for military work during World War I, he had to wait to publish his first anemometer paper in 1919 based on those earlier studies. He returned to the study of anemometer cupwheels when the opportunity arose to use the wind tunnel at the University of Toronto in 1921. The wind tunnel was later dismantled for a period of time but he finalized his research (Patterson, 1926) when the tunnel was returned to service in the spring of 1924. Patterson continued his research during that intervening period using a whirling machine (Patterson Notebooks), like Robinson had, in the basement of the headquarters at 315 Bloor Street in Toronto. The rebuilt wind tunnel was 1.2 m square and capable of speeds of 3 to 25 m/s. Tunnel wind speeds were measured to an accuracy of 1% with a pitot tube connected to a Chattock tilting micromanometer.

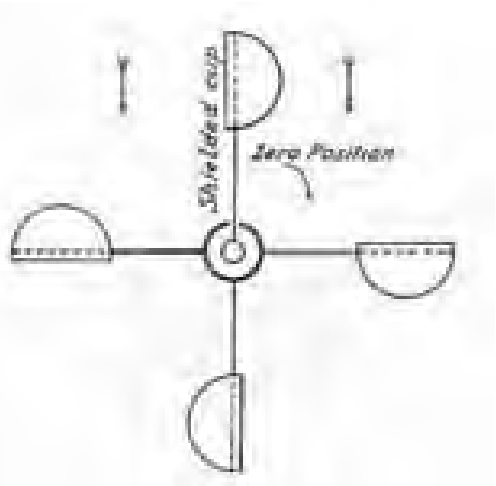

Figure 4. Four-cup Static Testing Jig

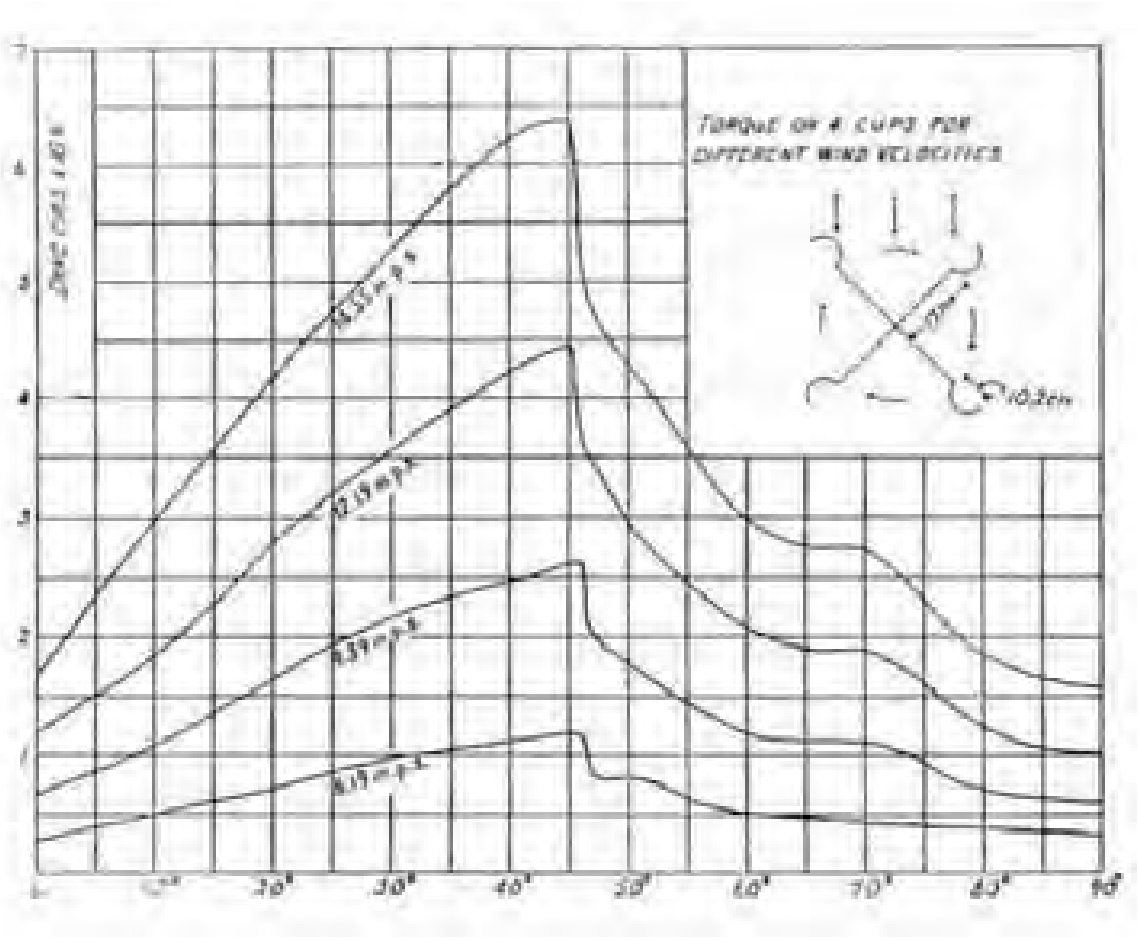

Figure 5. Static Torque on a Single cup of the Four-cup Cupwheel

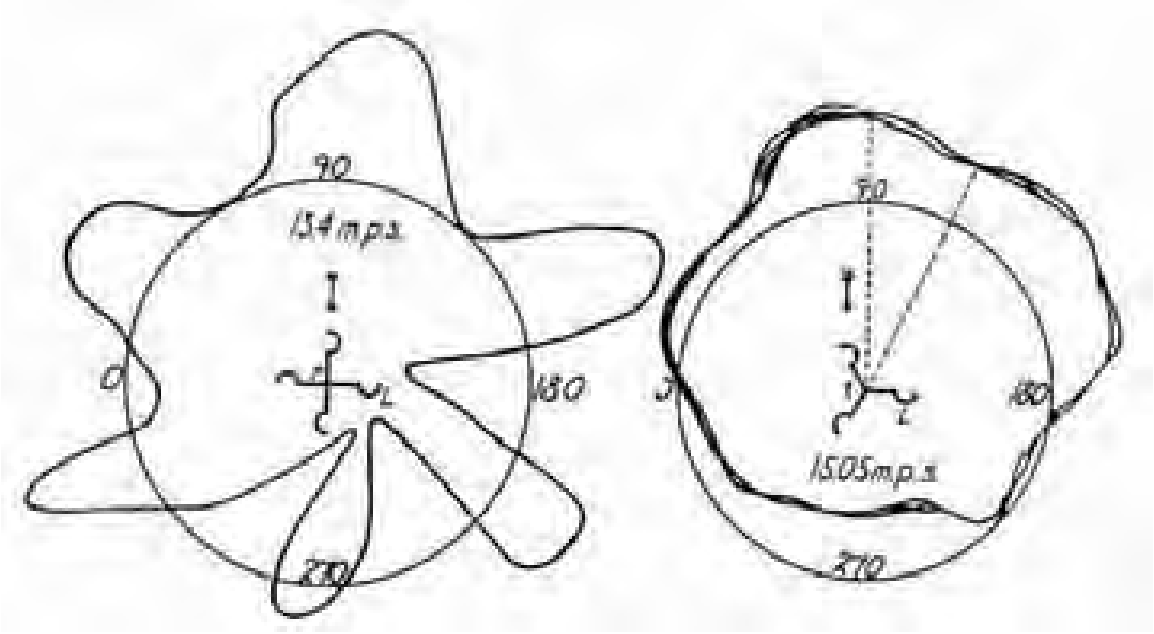

Figure 6. Dynamic Torque on the Four and Three-cup Anemometers

The anemometer test equipment for the wind tunnel was designed so that many different cupwheel variations could be tested. Cupwheels with 3,4,5 or 6 hemispherical cups, cylindrical surfaces with tops open or closed, and dimpled hemispherical cups were all tested. The cup diameters varied from 5.1 to 20.3 cm. and the arms lengths varied from 7.0 to 35.6 cm. The latter was limited by the size of the tunnel. Two test jigs were used in the tunnel. The first measured the static torque on a single arm (Fig.4) while the entire cupwheel in the wind tunnel was held in fixed positions, usually every ten degrees, around the circle. The second instrument displayed the dynamic torque on a single arm while the entire cupwheel rotated at speed in the wind tunnel.

The maximum static torque was produced on the 4-cup wheel when a cup was inclined at 45 degrees with respect to the wind (Fig.5). The most dramatic result during these static tests was the sudden reduction in torque of 19% in only one degree when the cup being measured was moved from the peak torque. Eighty years before, Dr. Robinson had used a whirling machine rather than a wind tunnel and while he could measure the maximum force, he could not measure the angle at which it occurred. He had assumed that the maximum force occurred at a cup inclination of 90 degrees to the wind and that the force on the cup varied directly with the cup's inclination. Thus when the torque exerted by four-cup wheel was calculated it appeared to be more constant during rotation than the three-cup wheel. The force of this argument (Glazebrook, 1923) continued into the 1930's, as Patterson had to overcome the prejudice toward the new cupwheel. The director of one national weather service commented at that time: "Who ever heard of a 3-cylinder automobile engine?" Patterson's detailed research had found that the force on a cup varied much more severely and did not agree with the previous formulations. At critical velocities the torque variation on individual cups led to significant vibration (Fig.6), which were not manifest in the three-cup design.

Further tested indicated that shorter arms though producing less torque, resulted in the anemometer factor remaining nearly constant with wind speed. Larger cups also produced less variation in the anemometer factor. When the different numbers of cups were tested, the three-cup system produced the most uniform torque. The result of the static tests was that three large cups mounted on short arms appeared to be the best combination for an anemometer cupwheel. Little noticed theoretical work in 1914 by C.E. Brazier in France (Middleton, 1953) indicated that the cup diameter should be equal to the radius of rotation to minimize error in the anemometer factor. The final result of Patterson's research was a cupwheel with three 12.6 cm (5") cups which were one inch larger than the previous cups. The arms were of medium length to provide sufficient torque and at 16 cm were shorter than the previous four-cup wheel. The British Meteorological Office (BMO, 1939) later adopted a similar cupwheel. In addition the lighter three-cup design reduced bearing wear and improved response to sudden changes in wind speed. This new cupwheel with hemispherical cups had an anemometer factor of 2.5 and rotated 640 times for each mile of wind. Along with the eight-point direction contacts, the MSC Anemovane provided a contact for each mile of wind.

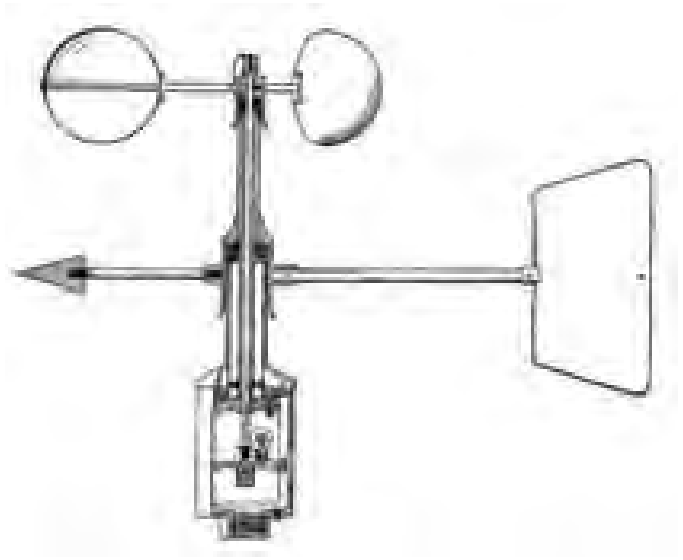

Figure 7. John Patterson's Anemovane of 1924

Even before Patterson's research work was published, the design of a concentric anemometer called the Anemovane was finished in 1924 (Fig.7). The Anemovane included an aerodynamic vane, which dated from development work in the UK to improve the low speed response of the Dines pressure-tube anemometer. The original flat-plate vane used on the Dines anemometer did not produce sufficient torque at low wind speeds to turn the pressure-tube into the wind. This degraded the already poor low speed response. A new vane was designed by Professor G.I. Taylor and was tested in the wind tunnel at the Royal Aircraft Establishment, Farnborough, in 1918. The vane was an aerofoil shape with a restoring torque which was eight times that of the flat-plate vane and four times that of the splayed vane (CSTM 870504) as used by MSC with the four-cup anemometer (Patterson, 1930). The hemispherical cups and aerodynamic wind vane remained unchanged until after 1944 (MSC drawing 11007) when the vane became rectangular when viewed from the side. An aerodynamic vane has been used on all MSC designed anemometers since Patterson's development of the Anemovane. More recently researchers (Wieringa, 1967) have questioned the aerofoil-based vane since it is under damped when used in conjunction with the almost friction-free modern transducers. At the present time a flat-plate vane combined with suitable position sampling may be a better choice for operational anemometers. A much smaller anemograph (CSTM 870502) was also produced in 1924 (Fig.8) for the Anemovane to replace the heavy recorder of the 1870's, which had been developed by Lt. Gibbon of the U.S. Signal Corp.

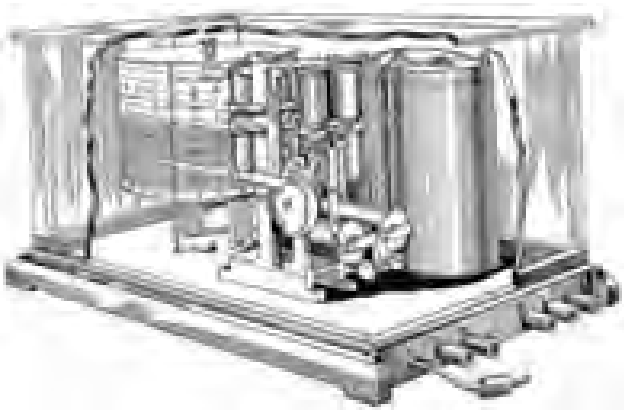

Figure 8. Canadian Anemograph of 1924

Further anemometer studies by Brevoort and Joyner (1934) in the USA examined the shape of the cups. A conical shaped cup produced a more linear anemometer factor than the hemispherical cups had. Also in effort to strengthen the cup with a beaded edge they found that it improved airflow over the cups and allowed for lighter cups with lower inertia. This conical shaped cup with beaded edges was found to have an error of less than three percent (Fergusson, 1939). As well as the USA, this cupwheel design was also introduced into the UK (Sheppard, 1940). Further studies by the National Research Council in Ottawa led to a cupwheel with these characteristics, as well as an updated anemometer, the 45B, in 1945 (Fig.9).

Figure 9. 45B Anemometer of 1945

The cupwheel on the 45B anemometer (CSTM 890100) had an anemometer factor of 3.1 so that one-mile of wind resulted in 600 turns of the cupwheel. While these conical cups had the same 5" diameter as the hemispherical cups, the arms were an inch shorter than previously making the radius of rotation almost equal to the cup diameter as suggested by Brazier's work. The arms and hub of this cupwheel were made from a single machined aluminum casting to which the cups were riveted. A second contact (MSC, 1942) for each 1/120th mile (13 m) of wind was introduced in the 1938 design along with the flashing light readout to provide winds in a near instantaneous 30 second period.

Figure 10. 78D Anemometer of 1978 on U Arm with lightning rod.

The 45B three-cup wheel with the conical cups and beaded edges is still used on the latest Canadian digital anemometers (Fig.10). Studies in the early 1970's indicated that this cupwheel had errors of less than three percent (Koren, 1972) up to 60 mph (26.8 m/s). The cups are 12.9 cm in diameter, the radius of rotation is 13.8 cm, and entire cupwheel weighs 350 gm or only 43% of the weight of the 1914 four-cup wheel. Both the USA four and three cup cupwheels of the pre1930 period were identical to the Canadian cupwheels (Covert, 1925). While all of the MSC anemometers were designed to have a minimal error at 10 mph (4.5 m/s), the 1914 four-cup anemometer had an error of +15% at 30 mph (13.4 m/s). The 1924 cupwheel with three hemispherical cups had an error (Fergusson, 1934) of about +7%, and the 1945 cupwheel with conical shaped cups and beaded edges was –3% or better at 30 mph.

John Patterson continued his work on instrument design even after he became Director of the Meteorological Service in 1929. Of note is his work on the Kew-Patterson mercury barometer (Middleton, 1964), an easily portable barometer, which became the standard station barometer until replaced by the Vaisala PTB220 digital barometer after 2000. He also worked with W.E. Knowles Middleton on a recording weighing barometer. The first original observing manual complete with instrumentation descriptions in 52 years was written by Patterson in 1930. His interest in aviation led him to write the Pilot Balloon manual of 1922 and to advance aviation requirements within the service (Thomas, 1996). Despite the economic effects of the depression, as Director he expanded the professional ranks within the service. By the time he retired in 1946 he left a meteorological service with the capacity to meet the needs of the modern world.

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Arctic SOLAS:
A study of the impact of global warming on sea-air trace gas exchanges and climate in the Canadian Arctic

by Maurice Levasseur[1]

Arctic SOLAS is a new research project funded by the Canadian International Polar Year Program. The main objective of the project is to improve our knowledge of the interactions between sea ice, circulation and emission of climate-active trace gases and aerosols in the Arctic.

The Canadian Arctic is rapidly warming with important reductions of the extent, thickness and age of sea ice, as well as changes in water circulation. The influence of these major alterations of the Arctic on sea-air and ice-air flux of climate-active gases and aerosols (particles in the atmosphere), and on atmospheric chemistry and radiative properties are largely unknown. The Arctic is important in the production and cycling of climate-active gases, including dimethylsulfide (DMS), nitrous oxide (N_2O), and volatile organic compounds (VOCs). DMS and VOCs are precursors of aerosols and as such have a cooling effect on climate. On the other hand, N_2O is a powerful greenhouse gas which contributes to climate warming. The production of these gases is likely to be affected by changes in sea ice cover and their concentration and fate in the atmosphere will be altered by changing emissions from the ocean and by changing atmospheric dynamics in a warming Arctic. The processes involved are at present poorly characterized and it is impossible to specify the magnitude or direction (positive or negative) of their feedbacks on Arctic climate. Research activities include two expeditions on the Canadian research icebreaker *Amundsen* in the Canadian Arctic in the fall of 2007 and 2008. During these cruises, coordinated ocean and atmospheric measurements will be conducted along an East-West transect extending from the west coast of Greenland to the Beaufort Sea. These cruises are coordinated with those of ArcticNet and of the IPY-CFL project.

Arctic SOLAS involves applicants from eight Canadian universities, five governmental institutes and nine international collaborators. This is the Canadian contribution to the IGBP-SCOR program SOLAS (Surface Ocean – Lower Atmosphere Study) with the main objective of increasing our understanding of the complex interconnections between the ocean and the atmosphere and their impacts on climate.

Main Researchers and Affiliation

University

Maurice Levasseur	Université Laval (Québec Océan)
Jonathan Abbatt	University of Toronto
Michel Gosselin	UQAR / ISMER
Yves Gratton	INRS / ETE
Ann-Lise Norman	University of Calgary
Neil Price	McGill University
Richard Rivkin	Memorial University of Newfoundland
Philippe Tortell	University of British Columbia
Jean-Éric Tremblay	Université Laval (Québec Océan)
Huixiang Xie	UQAR / ISMER

Government

Robin Anderson	DFO - St-John
Peter Galbraith	DFO - IML
Sunling Gong	DOE - Science
Richard Leaitch	DOE - Science
William KW Li	DFO - BIO
Christine Michel	DFO - FWI
Michael Scarratt	DFO - IML
Alain Vézina	DFO - BIO

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[1] Université Laval, Québec.

The Temperature of Snow

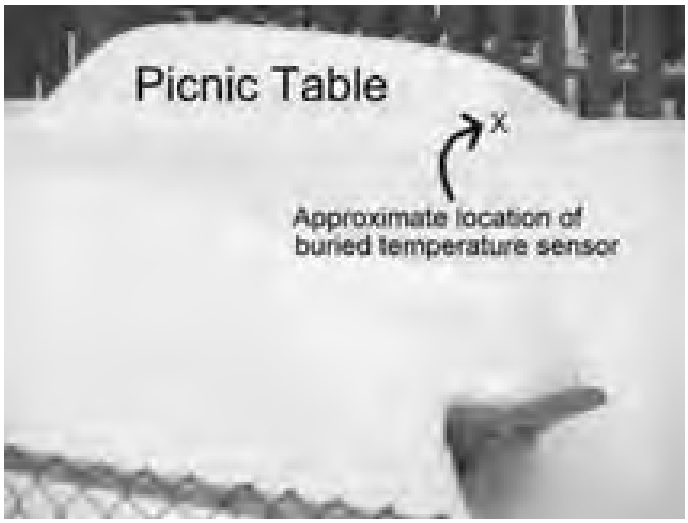
by Bob Jones[2]

Readers of the *CMOS Bulletin SCMO* include many researchers who may be able to fill in part of this puzzle. I am wondering, in the light of recent snowy events in eastern Canada, if anyone has ever written a paper on just what is the ambient temperature of the surrounding snow, should you unfortunately be buried in it. A quick search of the ATMOSPHERE-OCEAN articles, using the search techniques available on the A-O CDs, indicates that a 2006 paper by Ross Brown titled "*Evaluation of Snow Cover in CLASS for SnowMIP"* may partially address this problem, but my "research" provides possibly a much simpler answer.

We need to think back to the often-stated cliché, "snow is a great insulator" especially to keep perennial plants over a harsh winter, lawns and shrubs in good shape, etc. Everyone knows that a good winter snow cover helps the spring renewal and reduces winter kill on lawns. So, the question is: just how efficient is a snow blanket in providing this kind of protection. I don't propose to answer this question here of course, but the massive 2008 snow dumps in eastern Canada may have answered it partially.

As a retired meteorologist, my interest in meteorology continues from earlier days. Most of us, maybe even more so the met technicians, don't use simple window-mounted thermometers at home. We all know the sun shines on them; the house heat throws the readings off and the instrument is usually not well built. While most of us don't set up a Stevenson Screen in the back yard, we usually observe the ambient temperature in ways that improve on hardware store thermometers. I belong to that group and when the remote-reading wireless thermometer sensors came on the market a few years ago, I picked one up and looked for the best place to install it. We have a picnic table in the far corner of our back yard, so I decided that a mounting underneath this table (about three feet high) could be installed which would be well away from the house, protected from sun and in a nice breezy air circulation. This was certainly not Stevenson Screen standards, but was close. I mounted the sensor in an upside down plastic electrical box to waterproof it from rain dripping off the picnic table. Temperature readings from this setup have been remarkably accurate and are certainly satisfactory for the amateur weatherman.

Until the 2008 great eastern snow dump that is! In all the years I have used this location, snow amounts sitting on the ground around the picnic table, on the benches, on the top, etc., have never come close to impeding the line of sight transmissions from the remote temperature sensor. However, on the morning of March 9, following a 52 cm. snowfall, the picnic table became completely buried. The



Jones Backyard - March 15, 2008

remote thermometer continued to transmit through the snow – it is still transmitting as I write this in mid-March, and, as shown in the picture above, the table is still buried. The answer therefore is: the snow temperature is consistently about minus 5 degrees Celsius. On sunny days, because the table and thermometer are only covered by a foot or so of snow, this temperature rises to about minus 3, but on some very cold post-storm days, when air temperature was minus 15 or lower, the snow temperature stayed at minus 5.7. So this ends the research. It make me think that skiers buried in avalanches, given that they have enough air, will still be pretty cold if they aren't rescued soon. I am sure there have been studies using more controlled experiments, but without doing a thing, the results were suddenly flashing on my indoor remote temperature reader. Hopefully this article may generate a reply from a true snow researcher who can talk about deeper snow temperatures and confirm (or deny) that the minus 5 reading of deep snow is close.

---

[2] CMOS Member, Ottawa Centre, CMOS Webmaster

38th SCOR EXECUTIVE COMMITTEE MEETING

Bergen, Norway

26-28 August 2007

Meeting Report by Gordon McBean

Introduction and General Business
Professor Bjørn Sundby, the President of SCOR and from Canada opened the meeting. The meeting was attended by three Canadians: B. Sundby as President of SCOR; Professor Lawrence Mysak of McGill University as President of the International Association of the Physical Sciences of the Oceans (IAPSO); and Professor Gordon McBean of The University of Western Ontario as Chair of the CNC SCOR. A moment of silence was observed to recognize the deaths of Grant Ingram (Canada – The University of British Columbia) and Dale Krause (USA). This annual meeting was attended by about a dozen national members plus representatives from related programs and associations. This report will provide only selected highlights and details on many of these matters are available in meeting documents on the SCOR Web site.

The President noted that he had been asked to represent ICSU at the Intergovernmental Oceanographic Commission (IOC) annual meeting and had represented SCOR at the International Geosphere-Biosphere Programme (IGBP) Science Committee. SCOR had also held a summit on large-scale research projects in London, co-chaired by Sundby and Peter Burkill. SCOR has, like most similar international organizations, financial constraints on the activities it can undertake and all countries are encouraged to make their financial contributions. China (Beijing) Committee has increased its level of membership. The SCOR Secretariat has moved to the University of Delaware. As part of its ongoing assessment, the disciplinary balance of SCOR groups will be assessed through a group led by Laurent Labeyrie (France). The question of whether to undertake studies in the social sciences related to the oceans was discussed.

In 2008, the President (Bjørn Sundby) and all three Vice-Presidents are open for election. One Vice-President (Victor Akulichev) will have served his maximum term.

Discussion of Working Groups
SCOR has a large number of Working Groups, some of which are co-sponsored with other organizations. The meeting reviewed these and also considered proposals for new WGs (typically 2 new ones are established each year).

WG 78 on "**Determination of Photosynthetic Pigments in Seawater**" is now disbanded and the publication of its reports was discussed. The first volume was published by UNESCO Press. Publication of Volume 2 of Phytoplankton Pigments in Oceanography has a number of options which were discussed and the final approach will depend on an assessment and funding options.

WG 111 on **"Coupling Winds, Waves and Currents in Coastal Models"** is developing a book entitled *Coupled Coastal Wind-Wave-Current Dynamics*, which will be published by Cambridge University Press.

WG 115 on **"Standards for the Survey and Analysis of Plankton"** held its final meeting in May 2006 in Plymouth, UK at the Sir Alistar Hardy Foundation for Ocean Sciences and group members plan a series of papers for a special issue of the *Journal of the Marine Biological Association of the U.K*. Unfortunately, only one of the papers has been completed as planned and the timeline has slipped. It was agreed that they should be urged to get the job done within one year.

WG 116 on **"Sediment Traps and ^{234}Th Methods for Carbon Export Flux Determination"** completed its work with an article in the *Journal of Marine Research*. The meeting agreed to disband the group.

SCOR/IOC on **"WG 119 on "Quantitative Ecosystems Indicators for Fisheries Management"** will use its remaining funds to contribute to a workshop on "Coping with global change in marine social-ecological systems" which

will contribute to the objectives of both GLOBEC and IMBER. The meeting agreed to disband the group.

WG 120 on **"Marine Phytoplankton and Global Climate Regulation: The *Phaeocystis* Species Cluster As Model"** convened its symposium in September 2005 as their final meeting. The papers from the meeting were published in a special issue of the journal Biogeochemistry. Meeting participants agreed to disband the group.

SCOR/IAPSO WG 121 on **"Ocean Mixing"** held their symposium in 2004 and the final meeting of the group was held in conjunction with the 2007 IUGG General Assembly. The group will be disbanded with expectations of a final article.

SCOR/LOICZ/IAPSO WG 122 on **"Estuarine Sediment Dynamics"** will meet on September 23-27, 2007 with the publication of its findings expected for a special issue of *Coastal and Estuarine Science.*

SCOR/IMAGES WG 123 on **"Reconstruction of Past Ocean Circulation (PACE)"** produced a special theme section on Past Ocean Circulation for the AGU publication, *Geochemistry, Geophysics, Geosystems* and paper in Science. The group was disbanded noting that it had done very well.

SCOR/IMAGES WG 124 on **"Analyzing the Links Between Present Oceanic Processes and Paleo-records (LINKS)"** met for the final time on 20–24 November 2006 and is preparing a series of 5 manuscripts that mainly target understanding of the changes in ocean productivity and the connection to the recorded signal at the seafloor.

WG 125 on **"Global Comparisons of Zooplankton Time Series"** held a full meeting in Lima, Peru in association with the International Conference on the Humboldt Current System: Climate, ocean dynamics, ecosystem processes, and fisheries (27 Nov. 27-1 Dec. 2006) and an opportunistic meeting in May 2007. Papers will be collected for a special issue of *Progress in Oceanography*.

WG 126 on **"Role of Viruses in Marine Ecosystems"** had a very productive meeting in Bergen, Norway in May. The major outcome of the Bergen meeting was a multi-lab comparison of techniques. The group's book, tentatively entitled *Methods in Aquatic Viral Ecology*, is expected to be ready for publication in 2009. The final meeting will be in 2009.

SCOR/IAPSO WG 127 on **"Thermodynamics and Equation of State of Seawater"** held its second meeting on 7-11 May in Reggio Calabria, Italy and will meet next in Berlin on 4-10 September 2008 in conjunction with the International Association of the properties of water and seawater. It is moving along well.

WG 128 on **"Natural and Human-Induced Hypoxia and Consequences for Coastal Areas"** will meet for the second time on 20-23 September in Shanghai, China, in conjunction with the IMBER/LOICZ Continental Margins Open Science Meeting and most of the papers for their special issue (potentially for Biogeosciences) are underway and will be discussed at the Shanghai meeting.

SCOR/IAPSO WG 129 on **"Deep Ocean Exchanges with the Shelf"** met for the first time on 10-11 July in Perugia, Italy in conjunction with the IUGG meeting. They are planning a symposium for their final meeting at the IAPSO meeting in Montreal in 2009.

SCOR WG 130 on **"Automatic Plankton Visual Identification"** met for the first time on 2-3 June in Hiroshima, Japan in conjunction with the Fourth International Zooplankton Production Symposium there. The group developed an ambitious plan to fulfill its terms of reference. Its 2008 meeting will be partially or wholly funded by the Brazilian company Petrobras.

Generally, the last six or seven WGs have had very enthusiastic reports, but the earlier ones had more negative comments. Probably managing the WGs over a shorter period of time has improved and this approach should be continued.

New Working Group Proposals

Three proposals for new WGs were examined. After considerable debate it was recommended that WG on the Legacy of in situ Iron Enrichment: Data Compilation and Modeling be supported. The agreement was that the value of gathering together the data from the diverse set of previous experiments, especially given the new experiments, was important. The SCOR EC will issue a scientific statement regarding such experiments and the challenge of sequestering substantial amounts of carbon. Further work on modeling and analysis efforts will be considered based on subsequent inputs.

The proposal for a WG on Land-Based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems, another very important and timely topic, was recommended for strengthening the proposal so that it could be considered for funding either later this year (if funds are available) or in next year's competition.

The proposal for a WG on the Coral Triangle: The Centre of Marine Diversity also led to strong interest in this proposal. In the end, a number of refinements and linkages with other activities were suggested with encouragement to resubmit it for next year.

Large-Scale Scientific Programs

SCOR co-sponsors with a range of partners a number of large scale scientific programs. The meeting reviewed each of these.

SCOR/IGBP/IOC Global Ocean Ecosystems Dynamics (GLOBEC) Project
GLOBEC continues its integration and synthesis activities to work toward its completion at the end of 2009. GLOBEC and IMBER are working together on an activity on end-to-end food webs and will be developing a transition team in fall 2007 to identify aspects of GLOBEC that IMBER might take on after GLOBEC ends. Ian Perry (Canada) was endorsed as the new Chairman.

SCOR/IOC Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program
The research plan for the HABs in Eutrophied Systems was published in 2007 and NOAA is providing funding for this CRP, through IOC. The SSC is beginning a discussion about adding a CRP on benthic HAB species, such as those that cause ciguatera. A new Asian GEOHAB activity is under development and a second meeting will be held in Vietnam in January 2008. A new GEOHAB Web site has been launched (see http://www.obs-vlfr.fr/LOV/OMT/GEOHAB/). GEOHAB still needs an International Program Office.

SCOR/IGBP Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project
The IMBER SSC met in June 2007 in Victoria, B.C. to discuss implementation activities. The IMBER Data Management Committee met in conjunction with the SSC meeting and is making good progress in developing the IMBER data management system. IMBER will hold an open science meeting in late 2008.

GEOTRACES Project
The GEOTRACES Scientific Steering Committee held its first meeting in San Francisco, California, USA, on 16-18 December 2006. A standing GEOTRACES data management committee was created and initial planning undertaken for a GEOTRACES Data-Model Synergy Workshop and for GEOTRACES cruises in the Pacific, Atlantic and Indian oceans. GEOTRACES is in initial discussions regarding the placement of an international GEOTRACES data management office.

SCOR/IGBP/WCRP/CACGP Surface Ocean-Lower Atmosphere Study
SOLAS held its second open science meeting in Xiamen, China in March 2007 and also is planning its third summer school for 2007 (see http://www.solas-int.org/). SOLAS and IMBER have created a cooperative research activity related to ocean carbon and have formed a working group to guide the activity and to interact with IOCCP. The SCOR Executive Committee and other co-sponsors approved a new chair (Prof. Dr. Doug Wallace, Germany) and members of the SSC in May 2007.

Ocean Carbon and other activities

IOC/SCOR International Ocean Carbon Coordination Project (IOCCP)
IOCCP led planning for a Surface Ocean CO_2 Variability and Vulnerabilities Workshop on 11-14 April in Paris, France and is publishing a revised CO_2 methods handbook and will revise the WOCE/CLIVAR hydrography manual.

SCOR-IOC International Symposium on "The Ocean in a High-CO_2 World"
SCOR, IOC, IAEA and IGBP are planning a second symposium, in Sept./Oct 2008, at the Oceanography Museum in Monaco. Half of the speakers for the symposium have been selected and half will be chosen on the basis of abstracts submitted. The portal to international activities related to the science of ocean acidification is http://ocean-acidification.net/.

SCOR Summit of International Marine Research Projects
SCOR, with funding from the Alfred P. Sloan Foundation, convened a meeting on major large-scale ocean research projects in London, England on Dec. 7-9, 2006. A discussion was held on a 2008 meeting.

Panel on New Technologies for Observing Marine Life
The panel will meet next at the CoML All Program meeting in Auckland, New Zealand in November 2007.

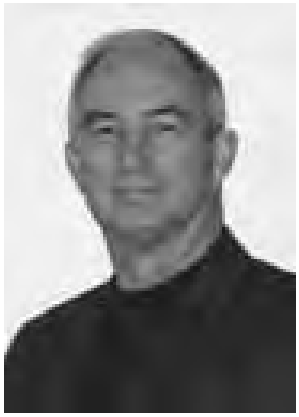
SOLAS/INI Workshop on Anthropogenic Nitrogen Impacts on the Open Ocean
A joint SOLAS-International Nitrogen Initiative (INI) workshop was held on 17-20 November 2006 in Norwich, UK, with a focus on the current understanding of the potential for changes in open ocean health due to human alteration of the marine nitrogen cycle, either directly or indirectly.

SCOR Committee on Capacity Building
Significant attention was devoted to the issue of enhancing SCOR's capacity-building activities. In response to a decision last year, a new SCOR Committee on Capacity Building has been formed, led by Venu Ittekkot of Germany, who was appointed to the SCOR EC as a co-opted member. The committee has been largely formed, a questionnaire was sent to national members, and discussion on many of the topics during the meeting considered the potential for enhancing capacity-building activities (e.g., one of the WGs expects to be meeting in South Africa and taking the opportunity to invite a number of African scientists to participate in their efforts). The committee will also be continuing the effort to promote regional graduate schools of oceanography and marine environmental sciences in developing country regions, to sustain the various fellowship programs for developing country scientists, to provide travel support grants, to send free copies of reports to developing nation libraries, etc. G. McBean, chair of the Canadian SCOR Committee and also of START, reported on START's outreach activities as well,

and encouraged cooperative activities.

Relations with Intergovernmental and Other Organizations.
SCOR interacts with the Intergovernmental Oceanographic Commission, Global Ocean Observing System (GOOS) and the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), with which there are promising areas of future interaction. The North Pacific Marine Science Organization (PICES) will hold its 2008 meeting in China. The International Council for Science has continued its development of regional offices in Africa, Southeast Asia, and South America. G. McBean described the new Integrated Research on Disaster Risk program. SCOR representatives have attended the International Geosphere-Biosphere Program (IGBP) which will hold its 2008 Congress in Cape Town, South Africa. World Climate Research Programme (WCRP) is co-sponsoring the SOLAS project and SCOR projects are working well with CLIVAR, the part of WCRP most relevant to SCOR. G. McBean described the Global Change START (System for Analysis, Research and Training) which is co-sponsored by IGBP, IHDP, WCRP and invited collaborations. Scientific Committee on Antarctic Research (SCAR) and SCOR are co-sponsoring a joint Expert Group on Oceanography. SCOR's major activity with Scientific Committee on Problems of the Environment (SCOPE) is the PACKMEDS project. The International Association for Meteorology and Atmospheric Sciences (IAMAS) was represented by M. MacCracken and the International Association for the Physical Sciences of the Oceans (IAPSO) by L. Mysak. The Partnership for Observation of the Global Ocean (POGO) 2008 meeting will be held in Bermuda in January 2008.

SCOR 50th Anniversary Celebration
SCOR's 50th anniversary celebration will be held in Woods Hole in October 2008. The primary focus will be on future directions and needs in the ocean sciences and SCOR's role. The program will be made up of a few plenary talks, a couple of panels, and a high quality poster session of papers to be submitted by young scientists competitively selected by SCOR member nations. For this event, especially to cover costs of bringing in speakers and the young scientists, member nations have been asked to make some additional contributions.



Report prepared by **G. McBean**, based on SCOR Meeting Report and the Joint IAMAS/IAPSO Liaison Report for the SCOR Annual Executive Committee Meeting, Bergen, Norway.

Global Ocean Ecosystem Dynamics (GLOBEC) Program activities in 2008

GLOBEC is now well-into its Integration and Synthesis phase, and a full calendar of activities is scheduled for 2008. These include:

ESSAS (Ecosystem Studies of Sub-Arctic Seas)
A series of ESSAS workshops is planned for 15-19 September 2008 in Halifax, Nova Scotia, in association with the 2008 ICES Annual Science Conference. The workshops will include sessions on predicting future climates in the ESSAS regions, advective processes, on assessing the best approaches to using models for comparing the ESSAS regions and their responses to climate change. Please see the GLOBEC web site www.globec.org for more information.

A special ESSAS session will be held at the 2008 Ocean Sciences Meeting in Orlando, Florida, USA, titled "Climate impacts on sub-polar seas: mechanisms of change and evidence of response" organised by George Hunt, Jr., Ken Drinkwater, Jeff Napp and Erica Head. The schedule is at: http://www.sgmeet.com/aslo/orlando2008/sessionschedule.asp?SessionID=034

A special issue of Deep-Sea Research II edited by George Hunt, Ken Drinkwater, Skip McKinnell and Dave Mackas has been published as a result of the ESSAS symposium on "Climate Variability of Sub-Arctic Marine Ecosystems" which was held in Victoria, Canada in May 2005. See the journal web site for the table of contents.

ICES-GLOBEC Cod and Climate Change Programme (CCC)
The CCC project will hold a Workshop on Cod and Future Climate Change from 24-26 May 2008 in Gijon, Spain, convened by K. Drinkwater (Norway), J. Dippner (Germany) and C. Schrum (Norway). For further information contact Keith Brander (keith@ices.dk). In addition, the ICES/GLOBEC Working Group on Cod and Climate Change will meet 22-23 May 2008, in Gijon, Spain, chaired by Geir Ottersen (Norway) and Kai Wieland (Denmark).

SO GLOBEC
A special Southern Ocean GLOBEC session will be held at the 2008 Ocean Sciences Meeting in Orlando, Florida, USA, 2-7 March 2008, titled "Synthesis of coupled

physical-ecosystem dynamics and linkages to environmental forcing on event to climate scales", and organised by Enrique Curchitser, Hal Batchelder, Eileen Hofmann and Cabell Davis. See the link below for the schedule:
http://www.sgmeet.com/aslo/orlando2008/sessionschedule.asp?SessionID=052

SPACC (Small Pelagics and Climate Change)
A synthesis book of the SPACC programme entitled "Climate change and small pelagic fish" and edited by Dave Checkley, Juergen Alheit, Claude Roy and Yoshioki Oozeki is due to be published in 2008 by Cambridge University Press. The book includes 16 chapters and has been authored by 88 scientists. If you are interested in purchasing a copy at a reduced cost please contact the GLOBEC IPO: (globec@pml.ac.uk).

Effects of climate change on the world's oceans
This symposium, co-sponsored by GLOBEC, PICES, ICES and others will bring together results from observations, analyses and model simulations at a global scale, and will include discussion of climate change scenarios and the possibilities for mitigating and protecting the marine environment and living marine resources. The symposium web site is at:
http://www.pices.int/meetings/international_symposia/2008_symposia/Climate_change/climate_background_3.aspx

Eastern boundary upwelling ecosystems symposium
An international symposium on Eastern boundary upwelling ecosystems: integrative and comparative approaches, co-sponsored by

GLOBEC/IMBER/SOLAS/EUR-OCEANS/IRD,

will be held 2-6 June at Las Palmas, Gran Canaria, Spain. For further details see the webpage: http://www.upwelling-symposium.org/

Symposium on "Coping with global change in marine social-ecological systems"
An international symposium on "Coping with global change in marine social-ecological systems" will be held 8-11 July 2008 at FAO Headquarters in Rome, Italy, co-sponsored by

GLOBEC/FAO/EUR-OCEANS

and convened by Ian Perry, Rosemary Ommer and Philippe Cury. The central goals of the symposium are to build relationships across natural and social science disciplines in regards to marine ecosystem changes, and to identify key next steps and common elements and approaches that promote resilience of marine social-ecological systems in the face of global changes. Details on abstract submission (deadline 1 February 2008) and registration (early registration until 1 April 2007) are available from the conference website: http://www.peopleandfish.org/

Symposium on "Linking herring"
The linking herring conference, sponsored by GLOBEC, ICES and PICES and convened by Maurice Clarke, Mark Dickey-Collas and Aril Slotte will be held 26-29 August 2008, in Galway, Ireland. For further details see: http://www.linkingherring.com/

ASLO Summer Meeting 8-13 June 2008
There will be a special GLOBEC session at the 2008 ASLO Summer Meeting entitled "Basinscale effects of climate change on North Atlantic marine ecosystems" organised by Roger Harris, Peter Wiebe and Brad de Young. See the meeting website for further details: http://aslo.org/stjohns2008/program.html

Reported by Dick Stoddart,
CNC/SCOR Secretary

Les membres du Comité organisateur sont:

- Michel Béland, Environnement Canada, Président;
- Michèle Bourgeois-Doyle, Conseil national de recherches Canada
- Jacques Derome, Université McGill, Coordonnateur du programme scientifique;
- Pierre Dubreuil, Secrétaire exécutif;
- Laurier Forget, Conseil national de recherches Canada Directeur de l'assemblée;
- Michel Jean, Environnement Canada;
- Charles Lin, AIMSA, Environnement Canada;
- Scott Munro, AISC, University of Toronto;
- Lawrence Mysak, AISPO, Université McGill; and
- Helen Joseph, Pêches et Océans Canada.

Pour plus d'information, prière de visiter www. Iamas-iapso-iacs-2009-montreal.ca dès aujourd'hui. Pour plus de renseignements, veuillez communiquer avec le bureau de gestion de l'assemblée à montreal2009@nrc.gc.ca

AIMSA: Association internationale de météorologie et des sciences atmosphériques; **AISPO:** Association internationale des sciences physiques des océans; **AISC:** Association internationale des sciences cryosphériques.

Job Advertisement

The Centre for Earth Observation Science (CEOS), Clayton H. Riddell Faculty of Environment, Earth, and Resources, The University of Manitoba, is seeking qualified candidates for several full time research and student positions, focusing on investigations of oceanic and atmospheric forcing of sea ice in the northern hemisphere. These positions will become part of a collaborative team working with Dr. David G. Barber through his Canada Research Chair (http://www.chairs.gc.ca/web/home_e.asp), the International Polar year (www.ipy-cfl.ca) and ArcticNet (a Network of Centres of Excellence; www.arcticnet.ulaval.ca). Field work is supported by the Canadian Research Icebreaker, Amundsen (http://www.amundsen.quebec-ocean.ulaval.ca).

We seek several candidates to fill the following positions:

1) A full time (contingent term) appointment at a 'Research Associate' level to work in climate forcing of sea ice dynamic and thermodynamic processes. Candidates with a background in remote sensing, numerical modelling field observations, and or statistical approaches to understanding sea ice processes are encouraged to apply. A Ph.D. or masters in meteorology, oceanography, physical geography or related field is desirable.

2) A full time (contingent term) appointment at a 'Research Associate' level to work on ocean-sea ice-atmosphere (OSA) processes relating to how changes in sea ice dynamic and thermodynamic processes affect biogeochemical, ecological, and climate processes operating across the OSA. Candidates with a background in Arctic marine ecology, remote sensing, numerical modelling, field observations and or statistical approaches to understanding sea ice processes are encouraged to apply. A Ph.D. or masters in biology, meteorology, oceanography, physical geography or related field is desirable.

3) A three-year term position (with possibility of extension) as a data manager for the Centre for Earth Observation Science. Duties will include coordination, management, and expediting of data warehousing from various Arctic research programs. The candidate will coordinate management of data through a computerized data warehousing system known as the Canadian Cryospheric Information Network (CCIN). The candidate should have a bachelors or masters degree in physical or computer science and experience with computer database programs (e.g., MySQL and or Unix based systems).

4) Graduate studentships (Ph.D. or masters level) to work on atmospheric forcing of sea ice dynamic processes at the local or hemispheric scale using in situ data from ocean buoys and ship based observations. A background in remote sensing, meteorology, oceanography, Geographic Information Systems, limnology or related field is desirable.

5) Graduate studentships (Ph.D. or masters level) to work on Freshwater-marine coupling in Hudson Bay. These projects will examine the role of freshwater in ocean surface mixed layer processes (both physical and biological) and the role freshwater plumes play in moderating the ocean surface under sea ice in winter. A background in remote sensing, meteorology, oceanography, limnology, Geographic Information Systems or related field is desirable.

Candidates should send a CV and letter of intent via email to Prof. David Barber, c/o Ms. Denise Whynot (dwhynot@cc.umanitoba.ca). Pay and benefits are competitive internationally and commensurate with qualifications. The University of Manitoba is an equal opportunity employer. Reviews will begin April 1 and continue until filled.

www.umanitoba.ca/ceos

Statistical Analysis of Environmental Space-Time Processes

by Nhu D. Le and James V. Zidek

Springer Science + Business Media, Inc., 2006 US$ 79.95, Hardback Cover, 341 pages ISBN 0-387-26209-1

Book reviewed by Iain Russell[1]

The book is logically separated into four sections; Environmental Processes, Modeling, Design and Risk: Assessment and Implementation.

The Environmental Processes section provides a good grounding in the fundamentals including Measurement challenges and inherent Uncertainty, as well as an insightful case study using recent BC Ozone data. Statistical modeling is introduced as a contemporary means to enhance and support data analysis in general and, in particular, this chapter provides insights into various alternative ways of extracting more information from the observed data by using modeling techniques. A particularly insightful aspect of this is the notion of combining statistical models with physical models in order to describe the inevitable role that uncertainty plays in science.

The second section of the book provides more detailed insights and descriptions of the covariance and kriging approaches to statistical modeling of environmental fields; and particular attention is given to the well-known, ubiquitous kriging approach and some of it's variants. Chapter 7, in particular, provides good background information on the various predictive kriging interpolation approaches, from the classical kriging linear method which assumes data (field) homogeneity and a normal distribution to cokriging where additional information from other measured variables can add value to the analysis. The application of Bayesian statistical methods to kriging, resulting in the use of data distributions which are likely more realistic based on prior knowledge of the data, are described in Chapters 8 and 9. Both of these latter chapters describe the fundamental theory behind Bayesian Kriging, with Chapter 9 providing the theoretical grounding for the main methodology put forth by the authors in this book, Hierarchical Bayesian Kriging.

Parts 3 and 4 of the book mainly focus on Environmental network design and risk assessment, and the practical Implementation of techniques to mapping and modeling environmental fields. Chapter 10 provides a very technical, theoretical look at multivariate modeling approaches; the notion of inferring information from a variety of simultaneously observed variables in a network in order to provide more precision in the final analysis. Environmental Network Design is the subject of Chapter 11, and here the authors provide quite a bit of theory but as well there is a discussion on incorporating cost into the design and a useful case study highlighting some of the considerations used to extend the gauged sites in an existing network, such as finding those ungauged areas where field variance is predicted by the statistical model to be large and hence those sites are then prime targets for installation of additional monitoring equipment. An important point is made that the designs predicted by the various methods are optimal, but that in actuality good designs are needed which address practical considerations such as cost and computation. In Chapter 12 the book discusses the challenges presented by fields of extreme values, i.e. those that contribute most to environmental risk; in particular the difficulty of quantifying risk when the data (i.e. the extreme values) lie in the tails of a probability distribution; i.e. the extreme values are rare and so it is difficult to sample this data sufficiently. The same network design in Chapter 11 is used in order to test this design for sufficient monitoring of extremes.

Environmental risk assessment and risk analysis is discussed in Chapter 13, and emphasis is again placed on the reality that uncertainty abounds in environmental processes. Postnormal Science is discussed in this chapter, with the key message that this approach to science is associated with the complexity and uncertainty inherent in environmental processes, and that its role is to bridge the gap between theses processes and policy-makers; the example of Global climate change is used to illustrate. To complete this section of the book, there is a particularly useful chapter on the use of the statistical programming language “R”, in the form of a tutorial, for the analysis of data and prediction (estimation) of values at ungauged locations. Software programs and packages written in “R” by the authors are available from the website maintained by the authors, http://enviRo.stat.ubc.ca

Overall, I liked the style that the authors adopted for this book, in particular the liberal use of real-World examples to illustrate the subject matter. The book is technical in nature, and very mathematical at times; the authors recognise this and for those mathematically-intensive sections they highlight them and point out that the reader can alternatively use the R Tutorial in chapter 14 to gain access to these very technical sections. The book is quite concise given its technical subject matter; at times I felt that more explanation of the more complex concepts would be useful.

[1] CMOS Member, Toronto, Ontario

In the Preface the authors state that a diverse range of professional scientists, students, researchers and government policy-makers have directly or indirectly provided input; I would expect that an equally broad range of people would benefit from reading this book. In particular it will raise questions for those engaged in the understanding and analysis of environmental fields and provide an appreciation of the inevitable uncertainty inherent within those fields.

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

Nonlinear Dynamics and Statistical Theories for Basic Geophysical Flows, by Andrew J. Majda and Xiaoming Wang, Cambridge University Press, 2006, pp.551, ISBN 0-521-83441-4, Hardback, US$90.

The Equations of Oceanic Motions, by Peter Müller, Cambridge University Press, ISBN # 0-521-85513-6, 2006, pp.291, Hardback, US$80.

The Chronologers' Quest: The Search for the Age of the Earth, by Patrick Wyse Jackson, Cambridge University Press, ISBN # 0-521-81332-8, 2006, pp.291, Hardback, US$30.

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

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

Inter-Basin Water Transfer, Case Studies from Australia, United States, Canada, China and India, Fereidoun Ghassemi and Ian White, International Hydrology Series, Cambridge Universtiy Press, ISBN 978-0-521-86969-0, Hardback, pp.435, US$165.

Numerical Modeling of Ocean Circulation, Robert B. Miller, Cambridge University Press, ISBN 978-0-521-78182-4, Hardback, pp.242, US$65.

Radiation in the Atmosphere: A Course in Theoretical Meteorology, by Wilford Zdunkowski, Thomas Trautmann and Andreas Bott, Cambridge University Press, ISBN 978-0-521-87017-5, Hardback, 2007, pp.482, US$135.

Human Impacts on Weather and Climate, by William R. Cotton and Roger A. Pielke Sr., Second Edition, Cambridge University Press, ISBN 978-0-521-60056-9, Paperback, US$55, pp.308 + 12 colour plates.

Fishers' Knowledge in Fisheries Science and Management, Edited by Nigel Haggan, Barbara Neis and Ian G. Baird, Coastal Management Sourcebooks 4, UNESCO Publishing, ISBN 978-92-3-104029-0, 2007, Hardback, pp.437.

Marine Habitat and Cover, Their Importance for Productive Coastal Fishery Resources, John F. Caddy, Oceanographic Methodology Series, UNESCO Publishing, ISBN 978-92-3-104035-1, 2007, Hardback, pp.253.

The Geomorphology of the Great Barrier Reef, by David Hopley, Scott G. Smithers and Kevin E. Parnell, Cambridge University Press, ISBN 978-0-521-85302-6, 2007, pp.532, US$150.

Lagrangian Analysis and Prediction of Coastal and Ocean Dymanics, Edited by Annalisa Griffa, A.D. Kirman, Jr,, Arthur J. Mariano, Tamay Özgökmen, and Thomas Rossby, Cambridge University Press, ISBN # 978-0-521-87018-4, 2007, Hardback, US$160.

An Introduction to Atmospheric Thermodynamics, by Anastasios A., Tsonis, Cambridge University Press, ISBN 978-0-521-69628-9, 2007, pp.187, US$55.

Ebb and Flow: Tides and Life on our Once and Future Planet, by Tom Koppel, The Dundurn Group, Toronto, Canada, ISBN 978-1-55002-726-6, Paperback, pp.292, CDN$26.99.

Canadian Hydrographic Conference

The next Canadian Hydrographic Conference will be run jointly with the National Surveyors Conference. The Conference will take place in Victoria, B.C., May 5th - 8th 2008 at the Victoria Conference Centre. This international event will unite delegates from both land and sea surveying and mapping disciplines to discuss the challenges and opportunities for their profession in the 21st century. The theme, "*Bringing Land and Sea Together*" will promote the transfer of ideas, knowledge and technology within the greater geomatics community. Keynote speaker at the Victoria Conference will be Roberta Bondar, who flew the Space Shuttle Discovery, January 22-30, 1992. For more information, please visit their website at:

http://chc2008.ca

A-O Abstracts Preview

Avant Première des résumés de A-O

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

Les résumés suivants paraîtront sous peu dans votre revue ATMOSPHERE-OCEAN.

Satellite-Derived Aerosol Radiative Forcing from the 2004 British Columbia Wildfires

SONG GUO and HENRY LEIGHTON

Abstract
The British Columbia wildfires of 2004 was one of the largest wildfire events in the last ten years in Canada. Both the shortwave and longwave smoke aerosol radiative forcing at the top-of-atmosphere (TOA) are investigated using data from the Moderate Resolution Imaging Spectroradiometer (MODIS) and the Clouds and the Earth's Radiant Energy System (CERES) instruments. Relationships between the radiative forcing fluxes (ΔF) and wildfire aerosol optical thickness (AOT) at 0.55μm ($t_{0.55}$) are deduced for both noontime instantaneous forcing and diurnally averaged forcing. The noontime averaged instantaneous shortwave and longwave smoke aerosol radiative forcing at the TOA are 45.8±27.5 W m^{-2} and –12.6±6.9 W m^{-2}, respectively for a selected study area between 62°N and 68°N in latitude and 125°W and 145°W in longitude over three mainly clear-sky days (23 – 25June). The derived diurnally averaged smoke aerosol shortwave radiative forcing is 19.9±12.1 Wm^{-2} for a mean $t_{0.55}$ of 1.88±0.71 over the same time period. The derived ΔF-t relationship can be implemented in the radiation scheme used in regional climate models to assess the effect of wildfire aerosols.

Résumé
Les feux de forêt de 2004 en Colombie-Britannique ont été l'un des événements de feu de forêt les plus importants au cours des dix dernières années au Canada. Nous étudions le forçage radiatif des aérosols de fumée sur les rayonnements de grandes et de courtes longueurs d'onde au sommet de l'atmosphère à l'aide des données du MODIS (spectroradiomètre imageur à résolution moyenne) et des instruments CERES (Nuages et Système d'énergie radiative de la Terre). Les relations entre les flux radiatifs forçants (ΔF) et l'épaisseur optique des aérosols de feux de forêt à 0,55 μm ($t_{0,55}$) sont déduites à la fois pour le forçage instantané à la mi-journée et pour le forçage moyenné sur la journée. Les forçages radiatifs moyennés à la mi-journée des aérosols de fumée sur le rayonnement de courtes et de grandes longueurs d'onde au sommet de l'atmosphère sont respectivement de 45,8±27,5 W m^{-2} et -12,6±6,9 W m^{-2} pour une aire d'étude sélectionnée entre les latitudes 62°N et 68°N et les longitudes 125°O et 145°O pendant trois journées au cours desquelles le ciel était principalement clair (du 23 au 25 juin). Moyenné sur la journée, le forçage radiatif sur le rayonnement de courtes longueurs d'onde par les aérosols de fumée est de 19,9±12,1 W m^{-2} pour un $t_{0,55}$ moyen de 1,88±0,71 pendant la même période. La relation ΔF-t dérivée peut être appliquée dans le schéma de rayonnement utilisé dans les modèles climatiques régionaux pour évaluer l'effet des aérosols de feux de forêt.

Connections between Stratospheric Ozone and Climate: Radiative Forcing, Climate Variability, and Change

N. MCFARLANE

Abstract
Quantifying the combined effects of ozone depletion and changes in other greenhouse gases and radiatively and chemically active atmospheric constituents is of great importance for human welfare. Achieving this goal requires evaluating the impact of stratospheric ozone depletion and its recovery on the tropospheric climate as well as elucidating the effects of climate change on the evolution of ozone itself. This, in turn, requires the understanding and quantification of the long-term sensitivity of the climate system to significant perturbations in the radiation budget of the atmosphere associated with human activities. Detecting and quantifying such effects also requires a quantitative understanding of the role of natural events, such as volcanoes and solar variability, on the composition and evolution of the atmosphere and ultimately of the effects of such events on the climate change signal throughout the active atmosphere and at the surface.

With the advent of climate modelling as a key tool for studying and predicting the evolution of the climate system, the linked concepts of radiative forcing and climate sensitivity have come into wide use as a means to understand and quantify key aspects of modelling results. These concepts are reviewed and their relevance to understanding and quantifying the radiative impact of ozone and ozone depleting substances on the radiative forcing of the climate system are discussed.

Recent observational, theoretical, and modelling studies have revealed many new features of stratosphere-troposphere coupling that are relevant to understanding the role of stratospheric processes in climate variability and change. Aspects of these studies are reviewed briefly.

Résumé [traduit par la rédaction]
Il est très important pour le bien-être des humains de quantifier les effets combinés de l'appauvrissement de l'ozone et des changements dans les autres gaz à effet de serre et dans les constituants atmosphériques radiativement et chimiquement actifs. Pour atteindre cet objectif, il est nécessaire d'évaluer les conséquences de l'appauvrissement de l'ozone stratosphérique et de son rétablissement sur le climat troposphérique ainsi que d'élucider les effets du changement climatique sur l'évolution de l'ozone même. Ceci exige de comprendre et de quantifier la sensibilité à long terme du système climatique aux perturbations importantes du bilan radiatif de l'atmosphère associées aux activités humaines. La détection et la quantification de tels effets exigent aussi une compréhension quantitative du rôle des événements naturels, comme la variabilité de l'activité volcanique et solaire, sur la composition et l'évolution de l'atmosphère et, en fin de compte, des effets de tels événements sur le signal de changement climatique dans toute l'atmosphère active et à la surface.

Depuis que la modélisation climatique est devenue un outil clé pour l'étude et la prévision de l'évolution du système climatique, les notions interdépendantes de forçage radiatif et de sensibilité du climat se sont généralisées en tant que moyen de comprendre et de quantifier les aspects importants des résultats des modélisations. Nous examinons ces notions et nous discutons de leur pertinence pour la compréhension et la quantification de l'effet de l'ozone et des substances qui appauvrissent d'ozone sur le forçage radiatif du système climatique. De récentes études par observation, de modélisation et théoriques ont mis en évidence plusieurs nouvelles caractéristiques du couplage stratosphère-troposphère utiles pour comprendre le rôle des processus stratosphériques dans la variabilité et le changement climatique. Nous examinons brièvement différents aspects de ces études.

Stratospheric Ozone Chemistry

JOHN C. MCCONNELL and JIAN JUN JIN

Abstract
Stratospheric ozone is important in shielding the planet from harmful solar radiation and tropospheric ozone while harmful to plants and humans in large amounts is also, in combination with water vapour, a major source of OH radicals which act as a detergent for many chemical species emitted into the troposphere by natural and anthropogenic emissions. This paper presents the chemistry affecting both tropospheric and stratospheric ozone with an emphasis on the stratosphere. In the decade since the last Environment Canada report on stratospheric ozone (Wardle et al., 1997) there have been many advances in our understanding. Recent studies have shown that inorganic chlorine, which is the main contributor to polar ozone depletion and middle stratospheric ozone reduction, has started to decrease as a result of the implementation of the Montreal Protocol. During this period, Canada launched a small satellite, SCISAT-1. We discuss the chemical processes related to polar ozone loss, such as chlorine activation and denitrification, using data from SCISAT-1. These measurements and those from the Microwave Limb Sounder (MLS) instrument on the Aura satellite confirm that the chlorine deactivation in the Arctic is distinct from that in the Antarctic. Recent studies show that our understanding of the middle atmosphere bromine budget needs improvement. Using measured constraints reproduces the polar and extra-polar ozone loss better. In addition, recent studies have addressed the variation of middle atmosphere ozone with solar variability. These studies have investigated the variation of solar radiation and related energetic particle precipitation (EPP) such as auroral precipitation, solar proton events (SPEs) as well as cosmic rays. Although there was some appreciation of these effects in the past, current three-dimensional (3-D) models suggest that the EPP may have a greater effect on middle atmospheric ozone than was previously realized. Stratospheric ozone loss allows the penetration of more ultraviolet (UV) radiation into the lower atmosphere, and thus may result in an increase in the oxidation state of the troposphere and affect tropospheric chemistry. Quantitative assessment of the effect of lightning on the ozone budget of the upper troposphere and lower stratosphere (UTLS) is a current challenge, while increases in the size of commercial aviation fleets have a positive radiative forcing in this region. To include the feedbacks between radiation, chemistry and dynamics associated with atmospheric change, coupled chemistry-climate models (CCMs) have been developed during the past decade. While these models still require improvement in transport and physical processes they generally predict that the Antarctic ozone layer will recover to the levels prior to 1980 in the middle of this century as a result of decreasing atmospheric chlorine and a cooling stratosphere. According to a recent semi-empirical relationship between ozone loss and Arctic meteorological conditions (Rex et al., 2004), a colder Arctic stratosphere may result in more severe ozone loss in the boreal springtime in the near future.

Résumé
L'ozone stratosphérique joue un rôle important en protégeant la planète contre le rayonnement solaire dommageable et l'ozone troposphérique, bien que nocif pour les plantes et les humains en concentration élevée, est aussi, en combinaison avec la vapeur d'eau, une source importante de radicaux OH qui servent de détergent pour plusieurs espèces chimiques introduites dans la troposphère par les émissions naturelles et anthropiques. Cet article porte sur les processus chimiques affectant l'ozone troposphérique et l'ozone stratosphérique, en plaçant la stratosphère au premier plan. Au cours de la décennie, depuis le dernier rapport d'Environnement Canada sur l'ozone stratosphérique (Wardle et coll., 1997), notre compréhension du sujet a progressé à de nombreux égards. Des études récentes ont montré que le chlore inorganique, qui est le principal agent d'appauvrissement de

l'ozone polaire et de réduction de l'ozone dans la stratosphère moyenne, a commencé à diminuer par suite de l'application du protocole de Montréal. Durant cette période, le Canada a lancé un petit satellite, le SCISAT-1. Nous discutons des processus chimiques liés à la perte d'ozone polaire, comme l'activation du chlore et la dénitrification, en nous servant des données du SCISAT-1. Ces mesures et celles du sondeur au limbe en hyperfréquence (MLS) du satellite Aura confirment que la désactivation du chlore dans l'Arctique est différente de celle de l'Antarctique. Des études récentes montrent qu'il nous faut améliorer notre compréhension du bilan du brome dans l'atmosphère moyenne. L'emploi de contraintes mesurées reproduit mieux les pertes d'ozone polaire et extrapolaire. De plus, des études récentes ont porté sur la variation de l'ozone dans l'atmosphère moyenne en fonction de la variabilité de l'activité solaire. Ces études ont analysé la variation du rayonnement solaire et des précipitations de particules énergétiques (PPE) correspondantes, comme les précipitations aurorales, les épisodes de protons solaires de même que les rayons cosmiques. Bien qu'il y ait eu certaines évaluations de ces effets dans le passé, les modèles tridimensionnels actuels indiquent que les PPE pourraient avoir plus d'effet sur l'ozone de l'atmosphère moyenne qu'on l'avait d'abord cru. La perte d'ozone stratosphérique permet la pénétration de plus de rayonnement ultraviolet (UV) dans la basse atmosphère et peut donc entraîner une augmentation de l'état d'oxydation de la troposphère et modifier la chimie troposphérique. L'évaluation quantitative de l'effet des éclairs sur le bilan de l'ozone dans la haute troposphère et la basse stratosphère (HTBS) est actuellement un sujet d'étude, au moment où l'accroissement de la taille de la flotte d'avions commerciaux exerce un forçage radiatif positif dans cette région. Pour inclure les rétroactions entre le rayonnement, la chimie et la dynamique liées au changement atmosphérique, on a mis au point des modèles couplés chimie-climat au cours de la dernière décennie. Même si ces modèles nécessitent encore des améliorations en ce qui a trait au transport et aux processus physiques, ils prévoient de manière générale que la couche d'ozone dans l'Antarctique se rétablira aux niveaux d'avant 1980 au milieu du présent siècle par suite de la baisse du chlore atmosphérique et du refroidissement de la stratosphère. Selon une relation semi-empirique proposée récemment entre la perte d'ozone et les conditions météorologiques arctiques (Rex et coll., 2004), une stratosphère arctique plus froide pourra entraîner une perte d'ozone plus importante durant le printemps boréal dans un avenir prochain.

Field Accuracy of Canadian Rain Measurements

KENNETH A. DEVINE and ÉVA MEKIS

Abstract

Daily historical rain-gauge data from several Canadian sources and field experiments were compared to the World Meteorological Organization (WMO) pit gauge rainfall measurements in order to determine the accuracies for different operational rain gauges. The detailed technical description of the main Canadian precipitation gauges assisted in understanding the associated accuracies and the need for adjustments for rain-gauge errors. All gauges, including the pit gauge, reported less than the actual rainfall. The corrections for wind, funnel wetting, evaporation and receiver retention improved the overall accuracy of the manual gauges. The range of rainfall measurements from different manual gauges was greatly reduced after applying the correction factors which were determined through a series of precision measurements. The recently introduced Hydrological Services TB3 tipping bucket rain gauge and the Geonor T-200B precipitation gauge improved rainfall catch efficiencies compared to the older Meteorological Service of Canada (MSC) tipping bucket and F&P/Belfort gauges with error values of –3.5% for the TB3 and -4.7% for the Geonor. The manual Type B gauge, in service for more than thirty years, was found to be the best rain gauge and provided the most accurate values based on all the reported rainfall field experiments with an average bias of only -0.6% compared to the raw pit gauge data.

Résumé

Nous avons comparé les données quotidiennes historiques de pluviomètres de plusieurs sources et expériences sur le terrain canadiennes avec les mesures de chutes de pluie par pluviomètres enterrés de l'OMM afin de déterminer la précision de différents pluviomètres opérationnels. La fiche technique détaillée des principaux capteurs de précipitations canadiens a aidé à comprendre les degrés de précision associés et le besoin d'ajustements en fonction des erreurs des pluviomètres. Tous les capteurs, y compris, le pluviomètre enterré, ont fourni des mesures inférieures à la chute de pluie réelle. Les corrections pour le vent, pour le mouillage de l'entonnoir, l'évaporation et la rétention dans le collecteur ont amélioré la précision générale des capteurs manuels. L'intervalle des mesures des différents capteurs manuels a été grandement réduit après l'application de facteurs de correction déterminés d'après une série de mesures de précision. Le pluviomètre à auget basculeur TB3 nouvellement exploité par les Services hydrologiques et le capteur de précipitations Geonor T-200B ont amélioré l'efficacité du captage de la pluie comparativement aux plus anciens pluviomètre à auget basculeur du Service météorologique du Canada et pluviomètre F&P/Belfort, avec des erreurs de -3,5 % pour le TB3 et de -4,7 % pour le Geonor. Le pluviomètre manuel de type B, employé depuis plus de trente ans, s'est avéré le meilleur pluviomètre et a donné les valeurs les plus précises d'après toutes les expériences sur le terrain de mesure de chute de

pluie, avec un biais moyen de seulement -0,6 % comparativement aux données du pluviomètre enterré.

Observed Changes in Daily Temperature and Precipitation Indices for Southern Québec, 1960-2005

ABDERRAHMANE YAGOUTI, GILLES BOULET, LUCIE VINCENT, LUC VESCOVI and ÉVA MEKIS

Abstract
Trends and variations in daily temperature and precipitation indices in southern Québec are examined for the period 1960-2005. The indices are based on daily temperature and daily precipitation which have been recently adjusted at 53 climatological stations. The adjustments were made for site relocation, changes in observing programs, known instrument changes and measurement program deficiencies. The results show that the surface air temperature has increased in southern Québec over 1960-2005. Significant warming is evident in the western, southern and central parts of the province but the increasing trends become smaller toward the east. The warming is greater during the winter although many significant increasing trends are found in the summer. The analysis of the temperature extremes strongly indicates the occurrence of more nights with extreme high temperatures in all seasons. The temperature indices also suggest an increase in the number of thaw/frost days during the winter (days with maximum temperature above 0°C and minimum temperature below 0°C), a decrease in the length of the frost season, an increase in the length of the growing season, a decrease in heating degree days and an increase in cooling degree days. The precipitation indices show an increase in the annual total rainfall although many stations indicate decreasing trends during the summer. The number of days with rain has increased over the region whereas the number of days with snow and the total snow amounts have decreased over the past 46 years.

Résumé
Nous examinons les tendances et les variations dans les indices de températures et de précipitations quotidiennes dans le sud du Québec pendant la période 1960-2005. Les indices sont basés sur les températures quotidiennes et les précipitations quotidiennes qui ont été récemment ajustées à 53 stations climatologiques. Les ajustements ont été faits pour tenir compte de la relocalisation de sites, de changements dans les programmes d'observation, de changements connus d'instruments et de lacunes dans les programmes de mesure. Les résultats montrent que la température de l'air en surface a augmenté dans le sud du Québec entre 1960 et 2005. On observe un réchauffement appréciable dans les parties ouest, sud et centre de la province mais la tendance à la hausse devient plus faible vers l'est. Le réchauffement est plus fort en hiver, même si l'on observe plusieurs tendances appréciables à la hausse durant l'été. L'analyse des extrêmes de température indique clairement qu'il y a plus de nuits avec des températures élevées extrêmes dans toutes les saisons. Les indices de températures suggèrent aussi une augmentation dans le nombre de jours de gel/dégel en hiver (jours avec une température maximale au-dessus de 0 °C et une température minimale au-dessous de 0 °C), une diminution de la durée de la saison de gel, une augmentation de la durée de la saison de croissance, une diminution des degrés-jours de chauffage et une augmentation des degrés-jours de réfrigération. Les indices de précipitations montrent une augmentation de la hauteur annuelle des précipitations, bien que plusieurs stations indiquent une tendance à la baisse en été. Le nombre de jours avec pluie a augmenté dans la région alors que le nombre de jour avec neige ainsi que les hauteurs totales de neige ont diminué au cours des 46 dernières années.

Multi-Year Sea-Ice Conditions in the Western Canadian Arctic Archipelago Region of the Northwest Passage: 1968-2006

STEPHEN E.L. HOWELL, ADRIENNE TIVY, JOHN J. YACKEL and STEVE MCCOURT

Abstract
Numerous studies have reported decreases in Arctic sea-ice cover over the past several decades and General Circulation Model (GCM) simulations continue to predict future decreases. These decreases — particularly in thick perennial or multi-year ice (MYI) — have led to considerable speculation about a more accessible Northwest Passage (NWP) as a transit route through the Canadian Arctic Archipelago (CAA). The Canadian Ice Service Digital Archive (CISDA) is used to investigate dynamic import/export and in situ growth of MYI within the western CAA regions of the NWP from 1968 to 2006. This analysis finds that MYI conditions in the western CAA regions of the NWP have remained relatively stable because the M'Clintock Channel and Franklin regions continuously operate as a drain trap mechanism for MYI. Results also find that in addition to the Queen Elizabeth Islands (QEI) region, Western Parry Channel and M'Clintock Channel are also regions where a considerable amount of MYI forms in situ and combined with dynamic imports contribute to heavy MYI conditions. There is also evidence to suggest that more frequent dynamic import of MYI appears to have occurred since 1999 compared to the formation of more MYI in situ before 1999. As a result, the drain-trap mechanism that has historically maintained heavy MYI conditions in the NWP is perhaps operating faster now than it was in the past. Based on the 38-year MYI record examined in this study, it is likely that the mechanisms operating within the western CAA regions of the NWP will facilitate the continued presence of MYI for quite some time.

Résumé
De nombreuses études ont signalé des diminutions dans la couverture de glace de mer arctique au cours des dernières décennies et les simulations des modèles de circulation générale (MCG) continuent de prévoir d'autres diminutions. Ces diminutions — en particulier dans la glace de plusieurs années épaisse et pérenne — ont vivement laissé miroiter la possibilité d'un passage du Nord-Ouest (PNO) plus accessible en tant que route pour traverser l'archipel Arctique canadien (AAC). Les archives numériques du Service canadien des glaces (ANSCG) permettent d'étudier l'importation/exportation et la croissance sur place de la glace de plusieurs années dans les segments du PNO situés dans l'ouest de l'AAC de 1968 à 2006. Cette analyse montre que les conditions de glace de plusieurs années dans les segments du PNO situés dans l'ouest de l'AAC sont restées assez stables parce que les régions de Franklin et du détroit de M'Clintock agissent continuellement comme un mécanisme de drain à siphon pour la glace de plusieurs années. Les résultats montrent aussi qu'en plus de la région des îles de la Reine-Élisabeth, l'ouest du détroit de Parry et le détroit de M'Clintock sont aussi des régions où se forme sur place une quantité considérable de glace de plusieurs années qui, combinée avec l'importation dynamique, contribue à créer de difficiles conditions de glace de plusieurs années. Certains indices donnent également à penser que la fréquence des importations dynamiques de glace de plusieurs années a augmenté depuis 1999 alors qu'avant 1999, il se formait davantage de glace de plusieurs années sur place. Par conséquent, le mécanisme de drain à siphon qui, historiquement, a maintenu des conditions difficiles de glace de plusieurs années dans le PNO opère peut-être plus rapidement maintenant qu'il ne le faisait dans le passé. D'après les 38 ans de données sur la glace de plusieurs années examinées dans cette étude, il apparaît probable que les mécanismes en action dans les segments du PNO situés dans l'ouest de l'AAC continueront d'y favoriser la présence continuelle de glace de plusieurs années pendant un bon bout de temps.

CORRECTION - CORRECTION

In the February issue (Vol.36, No.1, page 30), it should be read that Denis Gilbert has been appointed as Co-editor (oceanography) in replacement of Patrick Cummins, who had served for the previous four years. Denis' e-mail address is denis.gilbert@dfo-mpo.gc.ca

Dans le numéro de février (Vol.36, No.1, page 30), il faudrait lire que Denis Gilbert a été nommé co-directeur scientifique (océanographie), en remplacement de Patrick Cummins, qui a servi durant les quatre années précédentes. L'adresse courriel de Denis est denis.gilbert@dfo-mpo.gc.ca

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Third Annual CMOS Photo Contest

We are pleased to announce that CMOS Members are invited to participate in the CMOS Photo Contest. Details can be found now on the CMOS Web Page at http://www.cmos.ca/photocontest.html. The photos should be submitted directly to Bob Jones, webmaster@cmos.ca The deadline for submissions is **May 15, 2008.** Awards and certificates will be presented to the first, second and third place winners.

Troisième concours annuel de photographies de la SCMO

Nous invitons les membres de la SCMO à participer au concours de photographies de la société. Les détails du concours sont présentement indiqués sur la page web de la SCMO à http://www.cmos.ca/photocontest.html. Les photos doivent être envoyées directement à notre webmestre Bob Jones à webmestre@scmo.ca. La date limite pour soumettre vos photos est **le 15 mai 2008.** Des prix et des certificats seront décernés au premier, second et troisième gagnant.

ATMOSPHERE-OCEAN 46-1 Paper Order

Ozone: From Discovery to Protection,
by C.T. MCELROY and P.F. FOGAL

Understanding Ozone Depletion: Measurements and Models, by C.T. MCELROY and P.F.FOGAL

Ozone Climatology, Trends, and Substances that Control Ozone, by V.E. FIOLETOV

Stratospheric Ozone Chemistry,
by JOHN C. MCCONNELL and JIAN JUN JIN

Ozone in the Troposphere: Measurements, Climatology, Budget, and Trends, by D.W. TARASICK and R. SLATER

Dynamics, Stratospheric Ozone, and Climate Change,
by THEODORE G. SHEPHERD

Connections between Stratospheric Ozone and Climate: Radiative Forcing, Climate Variability, and Change
by N. MCFARLANE

Surface Ultraviolet Radiation,
by J.B. KERR and V.E. FIOLETOV

Effects of Ozone Depletion and UV-B on Humans and the Environment, by KEITH R SOLOMON

Revised proposed changes to the CMOS membership fees and benefits for 2009

Proposed changes to the CMOS membership fees and benefits for 2009 were discussed by Council on 18 December 2007 and on 25 March 2008 and approved for presentation to the CMOS membership at the AGM on 26 May 2008 for final approval. Only Canadian fees are discussed here but the usual supplements to cover postage to non-Canadian destinations would continue to apply.

1- Lower fees for students:

a) The current student fee of $40 compares with $15 charged by AGU, CGU and AMS, however in addition to the Bulletin it includes a subscription to paper and electronic editions of A-O.

b) It is proposed to reduce the student fee to $20 and drop the paper subscription to A-O.

2- Separate fees for Corporate and Library members:

a) Currently, commercial corporations and libraries pay the same corporate fee ($333) and both receive all publications. Most corporations don't really want all the publications and libraries don't really want membership but do want a bundle of publications. It is proposed to separate corporate memberships and library memberships as follows.

b) It is proposed that corporate members would be charged two times the rate for individual members or $160 but would receive only the Bulletin. Other publications could be ordered at the institutional rate.

c) Library members would continue to pay the current fee of $333 and receive all CMOS paper publications. If ordered separately these cost: Bulletin $80, A-O $125, CD $50, Congress P&A $60, for a total of $315. Electronic access to A-O (separately $110) is included for one site or range of IP addresses. Additional sites or ranges cost $110 each.

3- Require membership for Accredited Consultants:

a) Currently accredited consultants (unlike endorsed weathercasters) do not have to be CMOS members. Non-members pay an additional annual fee of $75.

b) It is proposed to simply require that all accredited consultants be CMOS members.

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Modifications proposées aux cotisations et aux avantages des membres de la SCMO pour 2009

Les modifications suivantes proposées aux cotisations et aux avantages des membres de la SCMO pour 2009 ont été discutées par le Conseil le 18 décembre 2007 et le 25 mars 2008 et approuvées pour être présentées aux membres de la SCMO lors de la AGA du 26 mai 2008 pour une approbation finale. Seules les cotisations canadiennes sont abordées ici, mais les compléments usuels pour couvrir les frais d'envoi vers des destinations non-canadiennes restent pertinents.

1. Cotisations moins élevées pour les étudiants :

a. La cotisation étudiant actuelle de 40 $ se compare aux 15 $ demandés par l'UGA, l'UGC et l'AMS; cependant en plus du bulletin, elle inclut un abonnement aux éditions imprimées et électroniques de A-O.

b. Il est proposé de réduire la cotisation étudiant à 20 $ et de ne pas offrir l'abonnement à l'édition imprimée de A-O.

2- Cotisations séparées pour les membres corporatifs et les bibliothèques :

a) Actuellement, les entreprises commerciales et les bibliothèques payent la même cotisation corporative (333 $) et les deux reçoivent toutes les publications. La plupart des entreprises ne veulent pas vraiment toutes les publications et les bibliothèques ne veulent pas vraiment être membres mais veulent recevoir un ensemble de publications. Il est proposé de séparer l'adhésion des corporations et des bibliothèques de la façon suivante.

b) Il est proposé que la cotisation pour les membres corporatifs sera deux fois la cotisation pour des membres individuels, soit 160 $, mais qu'ils ne recevront que le Bulletin. Les autres publications pourront être commandées au tarif institutionnel.

c) Les bibliothèques membres continueront à payer la cotisation actuelle de 333 $ et recevront toutes les éditions papier des publications de la SCMO. Commandées séparément, celles-ci coûtent : 80 $ pour le Bulletin, 125 $ pour A-O, 50 $ pour le CD-ROM A-O, 60 $ pour le Programme et résumés du Congrès, soit un total de 315 $. L'accès électronique à A-O (110 $ séparément) est inclus pour un site ou une gamme d'adresses IP. Chaque site ou gamme d'adresses supplémentaire coûte 110 $.

3- Adhésion requise pour les consultants accrédités :

a) Les consultants accrédités actuels (au contraire des présentateurs météo agréés) n'ont pas besoin de devenir des membres de la SCMO. Les non-membres payent des frais annuels supplémentaires de 75 $.

b) Il est proposé de simplement exiger que tous les consultants accrédités soient membres de la SCMO.

Canadian Contributors to the IPCC

CMOS would like to acknowledge the participation of all those Canadians who contributed to some aspect of one or more of the four reports of the Intergovernmental Panel on Climate Change, as review editor, reviewer, lead author, or contributing author. Readers of the *CMOS Bulletin SCMO* will know that the IPCC shared, along with Al Gore, The 2007 Nobel Peace Prize "***for their efforts to build up and disseminate greater knowledge about man–made climate change and to lay the foundations for the measures that are needed to counteract such change***".

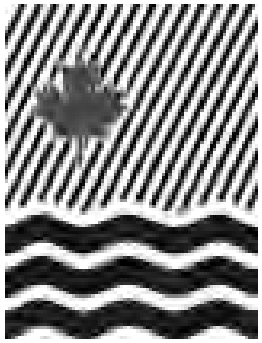
More than two hundred Canadian scientists have taken part in the IPCC reviews since the Panel was created in 1988 and many more contributed scientific articles to the refereed journals that the IPCC reviewed. The list that follows is as complete as we can make it at the time of writing, but if we have missed some contributors, as we almost certainly have, we apologise now and promise to publish any missing names in a subsequent article.

Andrey, J.; Apps, M.; Arnott, S.; Arora, V.; Auclair, A.; Austin, P.; Bachu, S.; Baker, H.; Bardecki, M.; Barnett, D. M.; Barrie, L.; Bhatti, J.; Beamish, R.; Beukema, S.; Blain, D.; Blanchet, J.-P.; Boehm, M.; Boer, G.; Bond, D.; Boyd, H.; Brklacich, M.; Brown, R. D.; Bruce, J.; Brugman, M.; Burch, S.; Burton, I.; Calvert, S.; Campbell, C.A.; Caya, D.; Chen, W.; Christian, J.; Clarke, R. A.; Clarke, G. ; Cogley, J.G.; Cohen, S.; Collas, P.; Côté, Isabelle; Crabbe, P.; D'Amours, D.; de Elfa, R.; Demuth, M.; Denman, K.; Desjardins, R.L.; Diamond, A. W.; Drexhage, John; Duchemin, E.; Duinker, P. N.; Dumanski, J.; Duncan, K.; Dyke, L.; Eby, M.; Enright, Brenna; Etkin, D. A.; Findlay, B. F.; Fioletov, V. E.; Fisher, D.; Flato, G.; Fleming, R.; Forbes, D. L.; Ford, James; Fung, I.; Furgal, C.; Fyfe, J.; Gauthier, S.; Gibb, D.; Gillison, R.E.; Goetze, D.; Gong, S.L.; Gregorich, E. G.; Gullet, D.; Gunn, A.; Gunter, Bill; Ha, C.; Haites, E.; Hall, P.J.; Harvey, D.; Harvey, E.; Harvey, L.L.D.; Heckey, R.; Heginbottom, J. A.; Herbert, D.; Higuchi, K.; Hogg, W.; Huffman, Ted; Jaccard, M.; Janzen, H.; Jaques, A.; Jefferies, R.; Jetté-Nantel, S.; Jones, C.; Judge, A. S.; Khandekar, M.; Keith, D.; Kharin, V.; Kidwell, M. R.; Knox, J.; Koener, R.; Koshida, G.; Kovacs, P.; Kur, W.; Kurz, W.; Kushner, P.; Lalonde, M. ; Lambert, S.; Laprise, Renée; Lawford, R.; Le Quéré, C.; Leaitch, R.; Lee, T.C.K.; Legg, J.; Lewis, T.; Lewkowicz, A.G.; Lohmann, U.; Lopoukhine, N.; Loulou, Richard; Lunn, N. J.; Maarouf, A.; MacIver, D. C.; Majorowicz, J.A.; Malcolm, J.; Malone, L.; Martell, D. L.; Matthews, H.D.; Matulla, C.; Maunder, W. J.; Maxwell, B.; McAllister, T.; McBean, Gordon; McBoyle, G.; McConkey, B.; McConnell, J.; McElroy, C.T.; McFarlane, N.; McKibbon, R. S.; Mekis, E.; Melling, H.; Meyn, S.; Minns, Ch. K.; Monahan, A.; Monirul M. Qader Mirza; Monreal, C.; Mortsch, L.; Mutton, J.; Mysak, L.; Neitzert, F.; Nuttall, M.; Patenaude, G.; Pagnan, J.; Pahlow, M.; Palmer, C.; Pearce, T. D.; Pedersen, T.; Peltier, W. R.; Peña, M.; Pentland, R.; Picard, D.; Pinter, L.; Platt, T.; Plummer, D.; Pollard, D. F. W.; Prowse, T.; Regier, H. A.; Reist, J. D.; Riseborough, D.; Robinson, J.; Rochette, P.; Rochon, R.; Rogner, Hans-Holger; Roots, F.; Rose, G. A.; Roulet, N.; Sanderson, M.; Scinocca, J.; Scott, D.; Shepherd, T. G.; Skinner, M.; Skinner, W. R.; Smit, B.; Smith, M.; Smith, S.; Stewart, J. W.; Stewart, R.; Stocks, B.; Stone, D.A.; Stone, J.M.R.; Street, R. B.; Swail, V.; Tarnocai, C.; Taylor, A. E.; Thambinuthu, K.; Thomas, G.; Tiessen, H.; Tremblay, A.; Van Kooten, C.; Vaughan, H.; Wall, G.; Waltner-Towes, D.; Wandel, J.; Wang, K.; Weaver, A.; Wein, R.; Welch, D.; Wheaton, E.; Whittaker, S.; Wiebe, W. R.; Williams, D.; Williamson, T.; Wilson, M.; Woo, M. K.; Wrona, F. J.; Yashayaev, I.; Zhang, X.; Zwiers, F. W.

Contributeurs canadiens au GIEC

La SCMO désire reconnaître la participation de tous les Canadiens qui ont contribué de quelque façon à un ou plusieurs des quatre rapports du Groupe d'experts intergouvernemental sur l'évolution du climat, à titre d'éditeur, réviseur, auteur principal ou associé. Les lecteurs du *CMOS Bulletin SCMO* sauront déjà que le GIEC s'est partagé en 2007 avec Al Gore le prix Nobel de la paix "***pour leurs efforts de collecte et de diffusion des connaissances sur les changements climatiques provoqués par l'Homme et pour avoir posé les fondements pour les mesures nécessaires à la lutte contre ces changements***."

Plus de deux cents scientifiques canadiens ont participé aux revues du GIEC depuis que le groupe a été créé en 1988, et beaucoup plus ont contribué aux articles scientifiques que le GIEC a consultés. Le liste suivante est aussi complète qu'on peut le faire en ce moment ; si nous avons oublié certaines personnes, ce qui est certain, nous nous en excusons et promettons de publier tout nom manquant dans un article subséquent.



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

2008 Congress - Kelowna, British Columbia
Congrès 2008 - Kelowna, Colombie Britannique

May 25 - 29, 2008 / 25 au 29 mai 2008

Grand Okanagan Lakefront Resort and Conference Centre

http://cmos2008.ca

The Canadian Meteorological and Oceanographic Society (CMOS) Congress 2008 will be held in Kelowna, British Columbia, Canada, at the Grand Okanagan Lakefront Resort from 25 to 29 May, 2008. The Congress theme is "***Water, Weather and Climate: Science Informing Decisions***".

On top of regular sessions, the Congress will feature plenary presentations by leading researchers including:

- Humfrey Melling, Research Oceanographer, DFO;
- Dr. David W. Schindler, Professor, University of Alberta;
- Dr. Michael Glantz, Director, Centre for Capacity Building;
- Dr. Roland Stull, Professor, University of British Columbia;
- Dr. David Hughes, Leader, National Coal Resource Inventory;
- Kathryn A.Kelly, Physicial Oceanographer, University of Washington;
- Dr. Pierre-Yves Le Traon, French Institute for the Exploitation of the Sea.

David Phillips, MSC Senior Climatologist, Environment Canada, also known in the media as "Canada's weather guru", will be the public speaker on Tuesday night, May 27.

The Teachers' Day will be held on Wednesday, May 28. Andrew Weaver, University of Victoria, will speak on his micro network of weather stations in Victoria (*CMOS Bulletin SCMO*, Vol.34, No.6, pp.184-190). Dale Gregory, retired teacher from Port Coquitlam, will speak on global warming.

Be part of the Congress. Register right now !

Le congrès 2008 de la Société canadienne de météorologie et d'océanographie aura lieu du 25 au 28 mai 2008 à Kelowna en Colombie Britannique, Canada, au Grand Okenagan Lakefront Resort and Conference Centre. Le thème du congrès est: "***Eau, météo et climat: la science comme outil de décision***".

Durant le congrès, en plus des sessions régulières, plusieurs conférenciers pléniers feront une présentation:

- Humfrey Melling, Océanographe, DFO;
- Dr. David W. Schindler, Professeur, Université de l'Alberta;
- Dr. Michael Glantz, Directeur, Centre pour le renforcement des capacités;
- Dr. Roland Stull, Professeur, Université de la Colombie Britannique;
- Dr. David Hughes, Chef, Inventaire national de ressource en houille;
- Kathryn A.Kelly, Océanographie physique, University of Washington;
- Dr. Pierre-Yves Le Traon, Institut français pour l'exploitation de la mer.

David Phillips, Climatologue principal de la SCM, Environnement Canada, connu dans les média comme "le gourou de la météo canadienne", sera l'orateur public mardi soir, le 27 mai.

La journée des enseignants se tiendra mercredi, le 28 mai. Andrew Weaver, Université de Victoria, décrira le micro réseau de stations météorologiques à Victoria (*CMOS Bulletin SCMO*, Vol.34, No.6, pp.184-190). Dale Gregory, professeur à la retraite de Port Coquitlam, nous entretiendra sur le réchauffement planétaire.

Soyez des nôtres ! Enregistrez-vous dès maintenant !

lac2008@cmos.ca

2007 A.G. Huntsman award presented to Dr. Thomas Kiørboe

Drs. Andrew Miall and Thomas Kiørboe

The A.G. Huntsman Foundation is pleased to announce that the winner of the 2007 A.G. Huntsman Award is Dr. Thomas Kiørboe from the Danish Institute of Fisheries Research, Charlottelund Castle, Denmark. The medal was presented by Dr. Andrew Miall, President of the Academy of Sciences of the Royal Society of Canada, during a special ceremony held at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia on Wednesday 21 November 2007. Dr. Kiørboe holds a Ph.D and a Dr. Scient from the University of Copenhagen. He is a member of the Royal Danish Society of Science and Letters, the Danish Academy of Natural Sciences and the European Union Network of Excellence in Climate and Marine Research. He is listed as "Highly Cited Author" by the Institute of Scientific Information and is on the editorial board of 5 international scientific journals. Dr. Kiørboe, the thirty-first recipient of the A.G Huntsman Award, is recognized world-wide for his original and provocative thinking that has led to pioneering contributions in many areas of marine ecology. He developed innovative approaches for field, laboratory and modelling studies of how micro-scale physical processes interact with the responses of individual marine organisms to generate observed patterns in populations and food webs. He is a major intellectual force in the difficult but essential business of linking processes from the small to large scales. His work in other areas, such as larval fish metabolism and the impact of food quality on consumers, has had major and lasting impacts, in some cases helping to spur the development of new research areas such as ecological stoichiometry. Overall, Thomas Kiørboe has played a major role in changing the way scientists view the field of plankton ecology.

Le Prix A.G. Huntsman 2007 présenté au Dr. Thomas Kiørboe

La Fondation A.G. Huntsman est heureuse d'annoncer que le lauréat 2007 de la médaille Huntsman est le Dr. Dr. Thomas Kiørboe de l'Institut danois de recherche sur les pêches, Charlottelund Castle, Danemark. La médaille a été présentée par le Dr. Andrew Miall, Président de l'académie des sciences de la société royale du Canada, lors d'une cérémonie spéciale tenue à l'institut océanographique de Bedford à Dartmouth, N-É., mercredi, le 21 novembre 2007. Le Dr. Kiørboe détient un Ph.D et un Dr. Scient de l'université de Copenhagen. Il est membre de la société royale danoise des sciences et lettres, de l'académie danoise des sciences naturelles et du réseau d'excellence en recherche sur la climat et les sciences marines de l'union européenne. Il est sur la liste des auteurs très cités par le 'Institute of Scientific Information' et est sur le comité éditorial de cinq journaux scientifiques internationaux. Le Dr. Kiørboe, le 31^{e} lauréat de la médaille Huntsman, est reconnu mondialement pour son originalité qui a mené à des contributions originales dans plusieurs domaines de l'écologie marine. Il a développé des approches novatrices sur le terrain, en laboratoire et via la modélisation pour étudier les interactions à l'échelle microscopique entre les processus physiques et les réponses des organismes individuels marins, et montrer comment ces interactions génèrent des patrons observés au niveau des populations et des réseaux trophiques. Il est une force intellectuelle majeure dans un domaine difficile mais essentiel : lier les processus des petites aux grandes échelles. Ses travaux dans d'autres domaines, tel que le métabolisme des larves de poisson et l'impact de la qualité de la nourriture sur les consommateurs, ont eu des impacts scientifiques majeurs et durables, dans certains cas participant au développement de nouveaux domaines de recherche tel que la stoichiométrie écologique. En résumé, les travaux du Dr. Thomas Kiørboe ont changé la perception qu'ont les scientifiques de l'écologie du plancton.

Ian Perry becomes new Chair of the International GLOBEC Program

Dr. Ian Perry has become the new Chair of the GLOBEC Scientific Steering Committee, replacing Dr. Francisco Werner whose six year term had come to an end. Ian will serve as the Chair of the IGBP/SCOR/IOC Global Ocean Ecosystem Dynamics (GLOBEC) program from now until its completion in early 2010. Please read the article in the Report section of this issue (pp. 62-63) for a brief update of on-going GLOBEC activities.

Ian obtained his B.Sc. in Zoology and Ph.D. in Zoology and Oceanography with Dr. Timothy Parsons at the University of British Columbia in Vancouver. Upon completion, he worked as a Fisheries Oceanographer with Canada's Department of Fisheries and Oceans in the Marine Fish Division at the Biological Station in St. Andrews, New Brunswick. He spent

seven years in St. Andrews, working and building collaborative programs between fisheries scientists and oceanographers, focussing on the Scotian Shelf, the Gulf of Maine, and Georges Bank. Work in these regions brought Ian into joint programs with the U.S. National Marine Fisheries Service and other scientists at Woods Hole, MA, which led to his involvement in the circulation and biological modelling studies funded in the first U.S. GLOBEC program, on Georges Bank.


Dr. Ian Perry

Ian moved to the Pacific Biological Station (PBS), Nanaimo, B.C., in 1991. He currently conducts research on the influence of the environment on fish distributions and recruitment in the Pacific, and research on the structure, function, and processes of fish production in marine ecosystems. He developed a framework to provide stock assessment advice for new and developing fisheries, and presently conducts the stock assessments for green sea urchins along the B.C. coast. Recently, he has begun exploring ecosystem-based approaches to the study and management of marine systems in B.C.

Ian's collaborative projects among fisheries scientists and oceanographers brought increasing involvement with international programs such as GLOBEC and the North Pacific Marine Science Organisation (PICES). He served on the Scientific Steering Committee for the Canada GLOBEC program, and was a member of the Executive Committee of the PICES Climate Change and Carrying Capacity (CCCC) program. He was also the Vice-Chair of the IGBP/SCOR/IOC GLOBEC program during its first six years, served as the first chair of its Focus 1 Working Group on retrospective analyses and time series studies, and presently serves as co-chair of GLOBEC's Focus 4 Working Group on the human dimensions of marine ecosystem changes. Ian has just completed a six year term as a Regional Editor for the journal *Fisheries Oceanography*, and has taught courses on fisheries oceanography at universities in Canada, Chile and Portugal. He is looking forward to the opportunities and challenges of guiding the IGBP/SCOR/IOC GLOBEC program through its final years to its completion in 2009/2010.

Dick Hallgren Symposium on International Cooperation

Report from Geoff Holland


Geoff Holland

The American Meteorological Society held its 88th Annual Conference in New Orleans, January 20 - 24, 2008. One of the special events was the Dick Hallgren Symposium on International Cooperation, which took the form of several themes, each with invited panelists and a moderator. Amongst the invitees were Canadians Gordon McBean, moderating the Panel on "*Future of International Cooperation in Observing Systems*", and Geoff Holland who was the ocean panellist for the theme "*History and Current Status of International Cooperation in Atmospheric and Ocean Sciences*". The special symposium was split over the first two days of the AMS Conference.

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

Chemical Oceanography,
Pollution Control and Water Technology

211-100 High Park Avenue
Toronto, Ontario M6P 2S2 Canada
Tel: 416-604-9165 (Home)
Email; omer86@can.rogers.com

Douw G. Steyn

Air Pollution Meteorology
Boundary Layer & Meso-Scale Meteorology

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

2008 Congress Congrès 2008

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

May 25-29, 2008 Kelowna, B.C.
25-29 mai, 2008 Kelowna, C.-B.

Water, Weather, and Climate:
Science Informing Decisions

Eau, météo, et climat:
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