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Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

FEBRUARY/FÉVRIER 1992 VOL. 20 NO. 1

Le 26e Congrès de la SCMO/The 26th CMOS Congress

Le 26e congès annuel de la Société canadienne de météorologie et d'océanographie (SCMO) se tiendra cette année dans la magnifique ville de Québec du 8 au 12 juin à l'Université Laval. Allons-y!

The 26th Annual Congress of the Canadian Meteorological and Oceanographic Society (CMOS) will be held from the 8th to the 12th of June at Laval University. Let's all plan on being there!

EDITOR'S COLUMN

The next issue of the CMOS Newsletter **20**(2), April 1992, will go to press on March 20th, 1992. Contributions are welcome and should be sent to me at:-

Institute of Ocean Sciences
P. O. Box 6000
Sidney, B.C. V8L 4B2
Tel. (604)-363-6590
FAX (604)-363-6746

I prefer receiving contributions submitted on floppy disk in DOS WordPerfect format, however, I do have a program that translates between MS Word and WordPerfect documents.

Do you have an interesting photograph, say, an interesting meteorological or oceanographic phenomenon? If so, write a caption and send it to me for publication in the CMOS Newsletter.

Howard J. Freeland, CMOS Newsletter Editor

WHAT'S GOING AROUND?
by Savonius Rotor

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

Canadian Supercomputing Challenge

Atmospheric Environment Service
Environment Canada

The 1992 Canadian Supercomputing Symposium presents the Canadian Supercomputing Challenge. The Dorval Computer Centre, Canada's largest scientific computing installation, housing the world's fastest vector supercomputer, is offering researchers a chance to test their mettle. Scientists and engineers are invited to produce the world's fastest scientific program to run on the world's fastest calculation engine.

The competition is to be a showcase for the researchers and the use of supercomputers in cutting-edge research and development. Each competitor will submit a proposal for a project in his or her field which could benefit from the use of the site's primary computing resource (the HNSX-NEC SX-3/44, the fastest vector supercomputer on Earth, rated at 22 GFLOPS (peak).) The use of supercomputer power should be of importance to the problem to be solved.

Ten finalists, selected from the submissions, will be given free time on the machine to carry out the proposed project. Finally, a panel of experts will select the project which made most effective use of the power of today's computing resources. The highest sustained rate of computation obtained will be an important criterion of evaluation.

The winner will be flown (all expenses paid, for two) to Montréal to present the winning project at the 1992 Supercomputing Symposium, a yearly conference sponsored by Supercomputing Canada (SUPERCAN). The paper presented will also be published in the conference proceedings. Lastly, there will be a grant of yet more computing resources for the winner's own use (100 hours of usage on the SX-3/44 to be spread over the following year with scheduling subject to the site's operational constraints).

Judgement Criteria: Submissions must be of scientific significance (worthy of submission to an appropriate refereed journal). That is a requirement that is intended to assure that the program in question accomplishes useful work.

In addition, the sustained rate of computation of programs will be an imporant criterion for judgement. The rate of computation will be determined by a method external to the code itself, based on NEC-specific software and hardware. The results will be given in GFLOPS.

The rate of computation should be for functional code and not to be boosted by unrealistic data, unrealistic elimination of input/output operations and the like.

For further information Write to:- ss92info@cid.aes.doe.CA or phone the contest organisers:-

Michel Dansereau	(514)-421-4696
Peter Silva	(514)-421-4692
FAX	(514)-421-4703

Eligibility: The contest is open to the world, but to avoid conflict of interest and to reduce the opportunity for bias employees of the following organisations or their affiliates are excluded:

Atmospheric Environment Service	(users of the SX3)
HNSX Supercomputers Inc	(the supplier of the SX3)
NEC	(the manufacturer of the SX3)

CMOS Position Statement on Atmospheric Change

A CMOS Position Statement on Atmospheric Change is currently being prepared by a sub-committee of the Scientific Committee. It is expected that the statement will be completed this winter. Comments are welcome and should be directed to:-

Dr. Ronald Stewart
CMOS Scientific Committee Chairman
4905 Dufferin Street
Downsview, Ontario M3H 5T4
Tel. (416)-739-4608
Fax. (416)-739-4211

Letters to the Editor

I would like to bring to the attention of members of CMOS a new WMO publication (WMO/TD-No.440) entitled "The History of the Commission for Agricultural Meteorology (CAgM)" which was introduced at the 10th Congress of the Commission at Florence, Italy early in December 1991.

This report was prepared by a CAgM Task Force consisting of Dr. W. Baier (Canada) (Co-ordinator); Dr. I.G. Gringof (USSR); and Dr. N.D. Strommen (USA). Much of the material for the report was compiled by myself with the assistance of members of the Task Force, the executive of CAgM, and the Secretariat of WMO.

The report consists of four chapters: 1. Introduction; 2. Pre-WMO; 3. Transition of IMO to WMO; and 4. Policy, Plans and Goals. This last chapter discusses the activities of the Commission under each of its six presidents. Annexes contain sections on Who's Who in CAgM; Commission resolutions and recommendations; WMO publications relative to the work of the Commission; seminars, training courses and technical conferences; consultancies and roving seminars; and a chronology of related events from 1853 to 1990.

The report is available from the WMO Secretariat in Geneva.

Respectfully, George W. Robertson. P.Ag.
Consulting Agrometeorologist.

As Chairman of the CMOS Accreditation Committee, I would like to take this opportunity to encourage members of CMOS to apply for accreditation in their field of specialty. Many CMOS members employed by government or academia may feel that, because their prime work is not consulting, they have no need to seek accreditation. However, in the true definition of the word 'consultant', "one who gives professional or expert advice", we are all consultants. Government employees give expert advice to the citizens and the government for which they work, as do academics in their research and other functions.

Today, the environment is on everyone's mind and, given the magnitude of the problems we face, will remain so for some time. Unfortunately many who speak for the environment have not had the credentials to judge fairly and impartially the issues at hand. I feel it is imperative that those with the knowledge be heard and that their experience be recognized. The attainment of a doctorate in one of the relevant sciences is often one such means of recognizing expertise. Unfortunately the title "Doctor" does not indicate field of specialization. In addition, many highly skilled specialists in the atmospheric and oceanic sciences have not sought this degree.

The CMOS accreditation program gives the applicant an opportunity to be recognized by his peers as having established him or herself in one or several areas of environmental expertise. The use of the letters ACM or ACO alone or in conjunction with other titles, such as P. Eng., gives quick recognition that the bearer has been recognized for his or her knowledge in the atmospheric or oceanic sciences. CMOS accreditation also indicates the specialty which the applicant feels is his or her strongest area.

At present 35 CMOS members are accredited with three currently pending. There are approximately 984 members of CMOS and a number of others who should be. Only with an increase in the number of Accredited Consultants can we begin to have a more powerful voice in shaping the future of the world. For example, the AMS certification program currently lists 490 holders of the CCM designation. In the past few years consideration has been given by several US states (e.g. California) to the licensing of meteorologists. There are many who feel strongly for or against government licensing. With a strong accreditation program by the recognized peer society, the user of environmental services will have the opportunity to seek out qualified consultants without the need for government intervention.

I urge each of you to consider applying for accreditation. We are not a restricted group nor an elite group. We are a group of concerned professionals who wish to further our voice in environmental affairs. Further information on the accreditation process may be obtained from CMOS Headquarters.

Keith C. Heidorn, Ph.D, ACM
Chairman, CMOS Accreditation Committee

It gives me great pleasure to inform you that the African meteorological community has created the African Meteorological Society (SMA) whose aim is to promote knowledge of meteorology and allied sciences and their application to various fields of socio-economic development.

The Executive Committee of the Society is as follows:-

President	Mr. E. Kayengeyenge (Burundi)
Vice President	Mr. A. Adejokun (Nigeria)
Chairman-Commission on Professional Affairs, Education and Manpower.	Mr. N. Njoroge (Kenya)
Chairman, Commission on Publications	Mr. H. Trabelsi (Tunisia)
Chairman, Commission on Scientific and Technical Activities	Mr. K. Konare (Mali)
Chairperson, Planning	Ms. G.K. Ramotwa (Botswana)
Exec. Secretary Mr.	S. Chacowry (Mauritius)
Auditor	Mr. L. Ndorimana (Burundi)

The Society is preparing the first issue of its Journal which will publish papers in their first language, English or French, with an abstract in the alternate language. The editor-in-chief is Prof. Luiz Ogallo, Chairman, Meteorological Department, University of Nairobi, P. O. Box 30259, Nairobi, Kenya.

26ième CONGRES ANNUEL DE LA SCMO
Québec, 8 au 12 juin 1992

Le 26e congrès annuel de la Société canadienne de météorologie et d'océanographie (SCMO) se tiendra cette année dans la magnifique ville de Québec du 8 au 12 juin à l'Université Laval. Le thème du congrès est : Météorologie et Océanographie à la mésoéchelle. L'Université Laval est l'hôte du Congrès.

Des conférenciers de prestige ont été invités à participer au congrès. Le comité du programme scientifique, sous la présidence de Ghislain Jacques du Ministère de l'environnement du Québec, a invité les personnes suivantes: Dr L.A. Codispoti (Monterey Bay Aquarium Institute), Dr T. Platt (Bedford Institute of Oceanography), Dr D.M. Checkley (North Carolina State University), DrR. A. Anthes (UCAR), Dr J. Testud (Centre d'études en télécommunications), Dr P. Yau (Université McGill), Dr F. Giorgi (NCAR), Dr S. Cohen (Centre climatologique canadien), Dr J.P. Blanchet (Université du Québec à Montréal) et Dr J. Mailhot (Environnement Canada). Diverses autres personnalités prendront la parole lors des cérémonies.

AUTRES SESSIONS

En plus du thème principal, le comité scientifique a planifié des sessions portant sur des thèmes tels la pollution atmosphérique, la prévision numérique, la physique des nuages, les changements climatiques, la télédétection, la productivité biologique à mésoéchelle, etc. L'Association de climatologie du Québec (ACLIQ) organisera aussi une session sur la climatologie.

TRANSPORT

Air Canada est le transporteur officiel du congrès. Cette compagnie offre des rabais très avantageux pour les congressistes. Le taux de réduction des billets peut varier entre 15% et 50%. Les exposants bénéficient aussi de 25% réduction sur le cargo. Pour vous prévaloir de ces importants rabais vous devez mentionner à votre agent de voyages le numéro de code CV920323.

HEBERGEMENT

Les participants doivent réserver eux-mêmes leur chambre. Des blocs de chambres sont réservés aux endroits suivants:

Holiday Inn Ste-Foy	418-653-4901
Hôtel Motel Universel	418-653-5250
Hilton Québec	418-647-6508
Université Laval	418-656-2921

Consultez la feuille d'information jointe à cette Lettre de Nouvelles pour les tarifs, la localisation des hôtels et les dates limite de réservation. Aucun autre arrangement ne sera effectué par le Comité organisateur en ce qui concerne l'hébergement.

L'Université Laval loue des espaces de stationnements pour la durée du Congrès; de même, ceux qui le désirent pourront acheter une passe pour accéder aux installations du centre sportif (PEPS) de l'Université. Les autobus et les taxis desservent l'Université.

ETUDIANTS

Des tarifs d'inscription spéciaux sont prévus pour les étudiants.

26th Annual CMOS Congress
Québec, 8th - 12th June, 1992

The 26th annual CMOS congress will be held in the historic city of Québec from the 8th to the 12th of June at the Université Laval. The theme of the congress is mesoscale meteorology and oceanography. The Université Laval is the host of the congress.

The scientific programme committee under the direction of Ghislain Jacques of the Ministry of the Environment of Québec has invited the following guest speakers: Dr. L.A. Codispoti (Monterey Bay Aquarium Institute), Dr. T. Platt (Bedford Institute of Oceanography), Dr. R.A. Anthes (UCAR), Dr. J. Testud (Centre d'études en télécommunications), Dr. P. Yau (McGill University), Dr. F. Giorgi (NCAR), Dr. S. Cohen (Canadian Climate Centre), Dr. J.P. Blanchet (Université de Québec à Montréal) et Dr. J. Mailhot (Environment Canada). Other honoured guests will speak at various ceremonies.

Other Sessions

Besides the principal theme the scientific committee plans sessions on subjects such as: atmospheric pollution, numerical forecasting, cloud physics, climatic change, remote sensing, biological productivity at the mesoscale, etc. A climatology session is being organized by the Association de climatologie du Québec (ACLIQ).

Transportation to Québec

Air Canada is the official airline of the Congress. Please indicate code CV920323 when you make your reservation. The company is offering very attractive reductions for conference participants. The reduction in ticket price varies between 15% and 50%. Exhibitors also benefit from a reduction of 25% on air cargo.

ACCOMMODATION

Participants should make their own room reservations. However, blocks of rooms have been set aside at the following locations:

Holiday Inn Ste-Foy	(418)-653-4901
Hôtel Motel Universel	(418)-653-5250
Hilton Québec	(418)-647-6508
Université Laval	(418)-656-2921

Check the information sheet found elsewhere in this Newsletter for rates, and locations of hotels and the reservation dates. No other arrangements concerning lodging have been made by the Organising Committee.

The Université Laval will rent parking spaces for the duration of the Congress; also those who wish to do so may purchase a pass to the University Sports Centre (PEPS). Buses and taxis operate to and from the University.

Students

Reduced registration rates for students have been approved.

PROGRAMME SOCIAL

Des évènements sociaux ont été planifiés pour occuper presque toutes les soirées et les conjoints sont invités. Les congressistes disposeront de moments libres pour profiter de l'hospitalité de la ville de Québec. Le programme planifié est le suivant:

lundi: soirée de bienvenue
mardi: réunion générale annuelle de la SCMO
mercredi: musique suivi d'un buffet
jeudi: banquet avec conférencier invité et discours

L'inscription comprend la participation à ces activités. D'autres billets sont aussi disponibles sur place. Le conférencier invité au banquet, M. Yves Tessier, historien réputé, fera une présentation sur l'histoire de la ville de Québec. Aucune visite touristique n'est organisée mais de l'information sera disponible sur place.

INSCRIPTION

Le formulaire d'inscription se retrouve dans la présente Lettre de Nouvelles. Profitez d'une réduction en faisant parvenir votre chèque avant le 1er mai 1992. Consultez le formulaire pour tous les détails des coûts.

EXPOSANTS COMMERCIAUX

Le coût pour la location d'un emplacement est de 650$ (ceci inclus toutes les activités pour 2 personnes). Les réservations doivent être faites avant le 1er avril. Contactez Roger Gagné au 418-644-2970 pour tous les détails (FAX: 418-643-9591).

COMMANDITES

Les entreprises ou organismes intéressés à commanditer une activité (pause-café par exemple) ou à publier de la publicité dans le programme doivent contacter Gilles Boulet au 418-646-1258 (FAX: 418-643-9591) pour les détails de la tarification.

REUNIONS D'AFFAIRES

Tous les comités, groupes à intérêts spéciaux et autres tiendront leur réunion d'affaire le lundi 8 juin dans des locaux qui leurs ont été réservés. L'heure et le lieu des réunions seront diffusés avant le congrès et seront affichés sur place.

INFORMATIONS

Un seul numéro de FAX pour toute demande: 418-643-9591

Programme scientifique: Date limite pour les résumés: 1 mars 1992. Ghislain Jacques: 418-644-3482

Exposants commerciaux: Date limite pour réservation: 1er avril 1992. Roger Gagné: 644-2970

Commandites et publicité: Grille de tarification sur demande Gilles Boulet: 418-646-1258

responsable du Comité organisateur
Richard Leduc: 418-643-7880

Transport aérien
Air Canada
numéro de congrès: CV920323

DEMANDEZ LE DEPLIANT DU CONGRES

Social Program

Social events have been planned for most evenings, and the spouses of participants are welcome. Congress participants should also spend some of their free time enjoying the hospitality of the City of Québec. The planned program is as follows:

Monday :	Ice breaker.
Tuesday:	CMOS Annual General Meeting.
Wednesday:	Music followed by a buffet.
Thursday:	Banquet with invited speaker.

The registration fees include these events. Extra tickets to these events may be purchased at the events. The banquet speaker is M. Yves Tessier, well known historian, who will speak on the history of the City of Québec.

No tours are being organised, but information for tourists will be made available. at the registration desk.

Registration

The registration form can be found elsewhere in this Newsletter. Get a reduction in registration rates by paying before May 1st, 1992. Check the registration form for rates.

Industrial Exhibitors

The cost of an exhibit booth is $650 (this includes registration for all events for 2 persons.) Reservations should be made by the 1st of April. Contact Roger Gagné at (418)-644-2970 for details (FAX: 418-643-9591).

Sponsorships

Businesses or organisations interested in sponsoring any activity (coffee break, for example) or publishing advertisements in the program should contact Gilles Boulet at (418)-646-1258 (FAX: 418-643-9591) for details on rates.

Business Meetings

All committees, special interest groups and others will have their business meetings on Monday 8th June in locations they have reserved. The times and locations of meetings will be posted and advertised at the congress.

FOR INFORMATION

A single FAX number serves for all queries (418)-643-9591.

Scientific Program: The closing date for abstracts is May 1st 1992, contact Ghislain Jacques: (418)-644-3482.

Commercial Exhibits: The closing date for reservations is April 1st 1992, contact Roger Gagné, (418)-644-2970.

Sponsorships and Publicity: List of rates available on request from Gilles Boulet (418)-646-1258.

The chairman of the organising committee is Richard Leduc (418)-643-7880.

Official Airline is Air Canada, congress number CV920323.

Ask for the congress prospectus.

Physical Oceanography at Memorial University

Located at the confluence of the cold, fresh Labrador Current coming from the north and the warm, saline Gulf Stream coming from the south, Newfoundland is one of the most exciting places in the world for the study of oceanography. It is at a pivotal point in the world climate system, being one of the most important regions for the exchange of heat between the tropical and polar regions. Newfoundland has some of the richest fishing grounds in the world as well as a growing offshore oil industry. These factors make the understanding of the oceans around Newfoundland a matter of great importance. To this end, a considerable expansion of ocean science has been taking place at Memorial University and is expected to continue. The growth of the Physical Oceanography Group to a position of international standing is an example of this. The group is now one of the largest in Canadian universities with 5 full-time faculty, 3 postdoctoral fellows, 12 graduate students, 1 Research Computing Specialist and a number of Research Assistants. We also have our own graduate program within the Department of Physics leading to the M.Sc. and PhD degrees in Physical Oceanography.

Experimental work is largely field oriented, but includes some laboratory experiments in acoustics and bio-fluid mechanics. The field studies involve acoustic and conventional physical oceanographic measurements. Theoretical studies include analytical and/or numerical techniques. These include modelling such things as horizontal eddy-diffusion, internal gravity wave phenomena and process orientated studies to look at the circulation in the North Atlantic and North Pacific Oceans. The university operates two small research vessels. Larger shelf and deep ocean research vessels are also available from government agencies.

Members of our group are involved in a variety of national and international research programs and collaborative efforts. These include the Ocean Production Enhancement Network of (OPEN), the World Ocean Circulation Experiment (WOCE), the Canadian Coastal Sediment Transport Program, as well as the Global Ocean Ecosystem Study.

The Physical Oceanography Group has its own computing facility and an excellent inventory of oceanographic equipment and instrumentation. The computing facility includes a multiprocessor Silicon Graphics Power Server, 2 Personal Irises and 6 other workstations.

Brad de Young (Observations and Ocean dynamics)

My research focuses on the circulation and wind forced response on the continental shelf, primarily the Newfoundland and Labrador shelf. I have also become interested in oceanic problems and have been working on some North Atlantic data sets looking at sea level. Analytical and numerical models are developed to interpret data collected during field programs, which involve mooring deployment and recovery, ADCP surveys, drifter deployments, CTD profiling, etc. Before going out to collect new data, historical data must first be analysed and this is one of the things that is being done now for the Northwest Atlantic, with an objective analysis of all of the temperature, salinity and density data for this region. The results will give us a good picture of the mean state and the seasonal signal. The gridded results will be used as input to numerical models of the circulation. This approach follows from work done in Conception Bay, Newfoundland where the physical data were usedto force different types of numerical models, diagnostic and reduced-gravity. The diagnostic model output plus wind forcing was used to force an advection-diffusion model of the Bay, an example of an application of physics to a biological problem, in this case the transport of fish larvae out of the Bay. A similar approach is planned for the study of cod eggs on the Newfoundland shelf as an application of the physical program there. The analysis of the North Atlantic sea level data is also coupled to modelling, using a barotropic model of the wind- and pressure-forced response of the North Atlantic.

Richard Greatbatch (Ocean dynamics & numerical modelling)

My research interests embrace both the large-scale ocean circulation and the dynamics of shallow sea and shelf regions. Using funding from OPEN (Ocean Production Enhancement Network) and the NSERC initiative in support of WOCE (World Ocean Circulation Experiment), we now have a Silicon Graphics Power Center computer we use for running models and 2 Personal Iris workstations we use to make "movies" of model output. For OPEN we are developing a density stratified model of the circulation on the Newfoundland Shelf and Slope. This project involves collaboration with Dr.B.deYoung and the use of observed data in conjunction with models. It is ultimately addressed to the question of managing the offshore cod fishery. WOCE, on the other, is focussed on climate and the role of the oceans in long term climate change and interannual variability. For this project, we are developing models of the North Atlantic. It also involves collaboration with Syd Levitus at the National Oceanographic Data Center in Washington, D.C., U.S.A.. A 2-density level model is being driven by observed wind stress from the period 1951-79. Output is being compared to measurements of transport through the Florida Straits and also the results of diagnostic calculations which attempt to infer the circulation from hydrographic data analysed by Levitus. These calculations suggest that the Gulf Stream was substantially weaker in the early 1970's than it had been in the late 1950's. Explaining this will be a focus of activity in future years. I also have collaborative projects with Drs. Lin and Weaver at McGill University that fall under the WOCE umbrella. The project with Dr.Lin is focussed on the dynamics of the thermohaline circulation in the ocean and models of climate variability. That with Dr.Weaver is focussed on analysing and modelling the circulation in the Labrador Sea.

Alex Hay (Ocean Acoustics, Benthic Boundary Layer)

The research program focusses on the interactions between the ocean and its bottom boundary, and on the development of acoustic remote sensing methods for investigating the physics of these interactions. The current emphasis is on sediment transport, and the development of multi-frequency, multi-beam acoustic systems to measure vertical profiles of the size and concentration of particles in suspension, and the time-evolution of a sandy seafloor, particularly the growth and migration of bedforms, during storms. The goal of this work is to characterize the response of mobile sediments to non-linear forcing by waves and currents. The work is being done in the nearshore zone and on the continental shelf. A fundamental component of the program is a suite of studies in the laboratory of sound

scattering in turbulent suspensions which are directed toward developing optimal methods for inverting multi-frequency backscatter to suspended particle concentration and size. These studies are also directed toward obtaining a better understanding of the dynamical behaviour of the solid particulate phase in turbulent two-phase flows, and particularly toward the role of fluctuations in particle concentration. Other interests include the dynamics of dense bottom currents, currently focussing on the dense inflow from the Labrador Current into Fortune Bay, the role in coastal environments of particles suspended in the pycnocline as a food source for shellfish, the development of bottom mixed layers, submarine spring plumes, and submarine landslides and turbidity currents.

Kevin Lamb (Internal Gravity Waves, Numerical Modelling)

Current work focusses on the generation of linear and nonlinear internal gravity waves resulting from the flow of a stratified fluid over topography. Two problems in particular are being investigated: uniform flow of a stratified fluid over a single obstacle, and tidal flow over a bank edge. The former problem provides the simplest case in which to investigate the roles of various parameters in determining, for example, the onset of wave breaking in the lee of the obstacle. The second problem was motivated by a series of measurements taken along the northeast edge of Georges Bank. The aim is to develop an understanding of the physical processes resulting from the tidal flow across the bank edge and their role in maintaining the high biological productivity of the area. These problems are being investigated numerically using a primitive equation model that I have developed. Use of sophisticated methods allows inviscid flows to be modelled and also realistically models sharp gradients. Because inviscid flow can be modelled the results can be compared with analytical results where they exist. Some model runs of the Georges Bank problem have shown the propagation of shocks into deep water. Such features have been observed off the North West Shelf of Australia. Dissipation will be necessary for better predictions of the flow at Georges Bank. This will be added to the model in the future. A related problem is the investigation of the propagation of internal gravity waves into waters of reduced stratification. This is also motivated by the Georges Bank observations, where large amplitude waves are seen propagating onto the bank where the water is well mixed.

Brian Sanderson

Research Interests: (1) The wind-driven Lagrangian circulation in Conception Bay. (2) Particle dispersion in shallow waters; in particular the effect of wind and bathymetry on the circulation and dispersion off the south shore of Puerto Rico. (3) Theoretical calculations of the zero-frequency interactions of waves and the resulting eddy-diffusion; particularly for internal waves and viscous surface waves. (4) The relative horizontal motion of fluid parcels. Fractal models, non-local diffusion equations, continuous-time random walk models are being studied and compared to other more common approaches to eddy diffusion. (5) Zooplankton feeding currents and turbulence-plankton interactions.

Oden 91 Expedition to the Arctic Ocean

ODEN 91 was part of an international expedition to the Arctic Ocean. The expedition initially comprised of three icebreaking ships, the Swedish *Oden*, the German *Polarstern*, and the U. S. *Polar Star*. Programs on *Oden* focused on studying water mass origin and circulation within the Arctic Ocean, radiation properties of sea ice, and processes involved in cloud formation in the Arctic. *Polarstern* and *Polar Star* programs were primarily geological and geophysical. The expedition left Tromso, Norway, in early August of 1991 and returned in mid-October. Unfortunately, *Polar Star* suffered problems with a propeller shaft that forced an early return.

Of the 40 scientists from several countries on board *Oden*, three were from Canada: Peter Jones, Mike Hingston and Frank Zemlyak, all from the Bedford Institute of Oceanography. A 4th Canadian, Ron Ritch, was part of a team studying the performance of *Oden*. His participation was especially appropriate since *Oden* was in large part based on a Canadian design; a new generation of icebreakers on designed by the oil industry for work in the Beaufort Sea.

Oden and *Polarstern* proceeded north and east past Svalbard into the Nansen and Amundsen Basins, across the Lomonsov Ridge into the Makarov Basin, then returned by way of the North Pole back across the Amundsen and Nansen Basins. *Oden* and *Polarstern* worked independently at first, Oden concentrating on oceanographic sections and *Polarstern* on cores from ridges. Shortly after reaching the Makarov Basin, the two ships proceeded together with *Polarstern* following *Oden*, partly to conserve fuel on *Polarstern*, but more significantly, to allow *Polarstern* to steam through a clear path while towing seismic equipment.

On September 7, both ships arrived at the North Pole. This event marked the first time a non-nuclear powered surface ship had reached the Pole and the first time ever that two surface ships were at the North Pole together. It was a cause for celebration on both ships!

Oden occupied four oceanographic sections in the Eurasian Basin and into the Makarov Basin. Previously, the only full depth, modern oceanographic data in central regions were from a very few ice camps (CESAR, LOREX) and from a single section across the Nansen Basin obtained in 1987 with *Polarstern*. The data from the *Oden* sections will take some time to analyze. Preliminary findings indicate that a considerable number of new ideas will emerge regarding circulation of Arctic waters. From a climatological point of view, the expedition revealed recirculating Atlantic Layer water in each of the Amundsen and Nansen Basins and from the Canadian Basin, indicating where this heat source for the region dissipates its heat. Preliminary results also indicate which of the water masses and regions are better ventilated. The atmospheric program observed the lowest particle concentrations ever encountered, about 1 cm^{-3}.

Oden arrived back in Sweden on October 14, welcomed by an escort of two icebreakers, a fire ship, and a fly-past by the Swedish Air Force. This welcome signified the pride of Sweden in the achievement of *Oden*, a pride we all felt for the results to which we had all contributed, and a pride that should be felt by Canadians for the design of *Oden* that permitted the expedition to succeed.

Peter Jones, Bedford Inst. of Oceanography.

Royal Roads Military College

Royal Roads Military College in Victoria, British Columbia, one of three Canadian military colleges, had its beginnings as a Naval Training Establishment in 1940. In 1975 Royal Roads received a university charter from the Province of British Columbia for the granting of degrees and began to offer a Bachelor of Science degree in Physics and Oceanography. In 1981 the College began to offer an annual three week course in Introductory Physical Oceanography, in 1986 began to offer a one year Diploma program in Oceanography and in 1987 began a Master of Science degree program in Oceanography and Acoustics.

The undergraduate B.Sc. degree program has evolved over the years into a joint concentration general program, a combined major program and a double honours program. The aim of the oceanography program is to combine a comprehensive study of oceanography at the undergraduate level with a solid background in the sciences which are a basis for oceanography. Students taking oceanography in the general program can combine their studies with courses in one of the following subject areas: space science, mathematics, physics, computer science or engineering sciences. Students in the combined major or honours programs combine their oceanography studies with either physics or space science. All degree programs involve a total of four years of study. The first two years consist of a common curriculum which includes the basic sciences and is followed by two years of study focusing on the selected subject areas.

The three week Introductory Physical Oceanography course evolved from the undergraduate program and was developed to cater to both civilian and military meteorologists and military officers who work in the maritime environment. The course brings together approximately two dozen individuals with different backgrounds and experience for an intensive three weeks of interaction and study involving lectures presented by College faculty and visiting scientists, films, laboratory exercises, tours of local oceanographic research facilities and an oceanographic cruise.

The one year Diploma in Oceanography was introduced for individuals who had already graduated with a degree in science or engineering with a strong background in mathematics and physics. Students are in residence for two sequential semesters and select a normal course load from amongst the undergraduate and graduate courses in oceanography, acoustics and mathematics. In addition, a year long experimental or theoretical oceanographic project is undertaken for which the student must submit and orally defend a project report.

The Master of Science program was developed for both maritime military officers and civilian meteorologists and involves course work and a thesis. Since the time period of educational leave for these students is limited, the program is structured so that it can be successfully completed in two calendar years. Students require a bachelors degree in science or engineering with a strong background in mathematics and physics for admission. Since most of the students have completed their undergraduate studies five to ten years prior to entering the graduate program, the first semester involves two undergraduate courses which are taken as a review and as an introduction to physical oceanography. The course work is heavy during the first year but is lighter during the second year so that the student can spend more time on thesis research, which is considered to be an important part of the degree program.

The department is located in the historic Hatley Castle which was built in 1908. Research facilities include an assortment of computing devices ranging from personal computers, through graphics workstations to mini-computers which are networked together and capable of communicating with off-campus computers; a Vax-based Gould image processor with specialized image processing software which can capture, display and manipulate a 2k by 2k image with 32 bits of information per pixel; a small research vessel; an acoustic Doppler current profiler; a Guildline CTD; and various recording current meters, thermistor chains and tide/wave gauges. The department is comprised of seven faculty members (Drs. J.R. Buckley, G.H. Fleming, D.P. Krauel, R.F. Marsden, M.J. Press, M.W. Stacey, and S.R. Waddell) plus eight other associate faculty members.

FREE Books Available FREE

The US National Science Foundation's Division of Ocean Sciences recently published two books of interest to physical oceanographers, meteorologists and graduate students.

----- Spectral Analysis of Physical Oceanographic Data by K. V. Konyaev. Translated from Russian into English 200 pp., original published in 1981.

This book presents a systematic description of multidimensional spectral analysis and its oceanographic applications. Traditional and some special data processing techniques, including recently developed high-resolution autoregressive methods are described. Errors of spectral estimates and some principal limitations of analysis are discussed. The book contains many examples of the analysis of oceanographic fields such as mesoscale eddies, internal and surface waves, and acoustic noise fields.

----- Special Research Project: The Ocean Characteristics and their Changes. Translated from Japanese into English.

This book contains translations of "The Ocean Characteristics and their Changes" Newsletter, Numbers 1 through 17, originally published by the Physical Oceanography Department at the institute of Oceanography, Tokyo University. Volumes span from September 1981 to March 1984.

Both translations were produced for NSF by the Amerind Publishing Company in New Delhi, India.

Ordering Information:

Charge:	FREE
Distribution:	Via U.S. Mail, while quantities last.
Write:	US WOCE Office Texas A&M University Dept of Oceanography College Station, TX 77843-3146, U.S.A. RE: Translation Books
Call:	(409)-845-1443 FAX: (409)-847-8879
T-Mail:	US.WOCE.OFFICE/Omnet

4TH AES/CMOS WORKSHOP
OPERATIONAL METEOROLOGY
SEPTEMBER 15-18,1992
WHISTLER, B.C.
"FORECASTING IN THE NINETIES"

The programme committee met in December to select the laboratories that will be presented at the workshop.

The deadline for submitting abstracts for the workshop was February 1, 1992. If you have not yet submitted your abstract and would like to make a presentation at the workshop, please contact Neil McLennan (Tel.(604) 664-9052, FAX (604) 664-9066).

The April issue of the Newsletter will contain a registration form for the workshop.

As the new chairman of the SIG on operational meteorology, I have been wondering what will be the best way to promote operational meteorology and put more life into the OPMET SIG. I believe that a regular contribution to the CMOS Newsletter might be a good first step.

The OPMET NEWS will be devoted to news, discussion, summaries of articles or conferences/ workshops, articles on forecasting techniques, articles explaining new concepts. It will promote a more scientific approach to weather forecasting.

In the short term, I would like the OPMET NEWS to be published four times per year and be at least 4 pages long so it could be published as an insert in the CMOS Newsletter. In the long run, I would like the OPMET group to produce a newsletter in a format similar to the National Weather Digest published by the National Weather Association in the U.S.

Suggestions for the SIG or the OPMET NEWS and contributions to the OPMET NEWS should be sent to:

Gerard Neault
7133 Camano St
Vancouver, B.C. V5S 4B8
TEL. (604) 437-5268

PAPER REVIEW

Synoptic Frontal Analysis: Time for a Reassessment?
The March 1991 issue of the Bulletin of the American Meteorological Society (Vol. 72, No.3, pp 348-363) featured this excellent paper by Clifford F. Mass on frontal analysis.

The paper reviews the history of the Norwegian frontal model, notes the deficiencies that have become apparent in over a half-century of research and operational forecasting, describes some attempts to rectify the situation, provides several examples of problematic and inconsistent application of the Norwegian analysis techniques, and discusses some potential approaches towards addressing these problems.
The topic is not new, but is still very actual. It is also very familiar to operational forecasters. Almost every day operational meteorologists try to interpret what they see on the satellite pictures using the Norwegian cyclone model and the analysis techniques that derive from it. Some days it works not too badly. On many days however it just doesn't work at all. It leads to inconsistent analyses (analyses changing with the person doing the analysis) and to improper use of the conceptual model (it is used for relatively shallow topographically-induced features such as damming and for shallow zones of temperature contrast produced by discontinuities in surface properties or cloudiness). It leads also, I believe, to poor diagnostic which in turn leads to poor forecasts. If ,at analysis time, the precipitation is tied to a front and that, in reality, the front does not exist and the precipitation is caused by another phenomenon, it is unlikely that the forecast based on such a diagnostic will be very good. In such a case any success will be due to chance rather than skill. It sounds very logical but such situations occur all the time. It occurs not because meteorologists are lazy and stupid but because they are analyzing and interpreting the atmospheric evolution using a conceptual model that is known to be deficient but for which there is no substitute.

What can be done? Clifford Mass suggests a two- pronged approach. First, the research and operational insights gained over the last half-century should be combined with more recent numerical modelling and observational studies (making use of new technologies such as Doppler radar, dropsondes, aircraft, and profilers) to establish an amended, and more general, conceptual model of cyclone evolution. Second, a clear and consistent methodology of analyzing synoptic charts should be devised.

The author suggests three approaches for devising a clear and consistent methodology of analyzing synoptic charts:

Approach 1: Present analysed fields (e.g. pressure, temperature) without frontal symbology.

Approach 2: Modify current analysis techniques to fit the improved paradigm by:

a) restricting the application of classic frontal symbols to surface-based fronts that extend through a considerable depth of the lower troposphere.

b) using frontal symbols only for features that fundamentally concern horizontal density (in reality, temperature) gradients.

c) using a modified form of these symbols (or new symbols) for shallow features, such as those associated with gust fronts, sea breezes, topographic damming, and boundary-layer processes.

d) making sure that analyses are consistent in time, i.e. temporal continuity should be upheld.

OPMET NEWS (cont)

Approach 3: Present automated analysed fields and use frontal(or other symbols) only for features that are unresolved or improperly positioned by the analyzed fields.

The best approach, I believe, is the second one. As noted by the author, despite its shortcomings, the classic Norwegian cyclone model and the analysis techniques that derive from it, do express some essential truths, one in particular being that many cyclones evolve in a rather similar way, i.e. as an amplifying wave in a region of substantial temperature gradient. Conceptual models also help organize a mountain of observations into a coherent picture and aid the visualization and interpretation of complex three-dimensional motions. Fronts are also useful tools for communicating weather information to non-meteorologists. It is probably the easier approach to implement since all that it is required is a strict application of the Norwegian cyclone model and the associated analysis techniques.

Which approach do you favour? Should the OPMET SIG promote such a change?

New CMOS Members

The following new member was approved at the CMOS Executive meeting 23rd September, 1991:

Susan Allen (regular)	UBC, Vancouver, B.C.

The following new members were approved at the CMOS Executive meeting 18th December, 1991:

Davis Barber (student)	Univ. Waterloo
Jing-Ming Cheng (student)	Vancouver, B.C.
John Dower (student)	Univ. Victoria, B.C.
Deborah Hanley (student)	Halifax, N.S.
Stephen Lamming (regular)	Burlington, Ont.
Paul Meyers (student)	Montréal, Qc.
Judy Nemeth (student)	Dorval, Qc.
Ted Packard (régulier)	Rimouski, Qc.
Sylvia Venegas (régulier)	Montréal, Qc.
Alsin A. Vian	Univ. Laval, Qc.
Hong Wang (student)	Memorial Univ., Nflnd.
Lee Xuhui (student)	UBC, Vancouver, B.C.

Note to Centres and Chapters:
It is important that you make contact as soon as possible with any new members in your area to verify their mailing address and to begin distribution of local Society material. National mailings and publications begin once approved new members are entered in the office computer. This follows the date of the executive or Council meeting shown in this notice.

Henry Melson Stommel 1920-1992

"Most human history has not afforded men much chance to pursue curiosity, except as a hobby of the rich or within the refuge of a monastery. We can count ouselves fortunate to live in a society and at a time when we are actually paid to explore the universe."

Henry Stommel, on receiving the Bigelow Medal, 1974.

The Woods Hole Oceanographic Institution announces with great sorrow the death of Henry Melson Stommel on January 17th in Boston. He was 71 years old.

Hank Stommel was the most prodigious and influential oceanographer who ever lived. He made contributions to nearly every area of physical oceanography, to some subjects returning several times during his long career with new ideas and new approaches to elaborate and deepen our understanding of them. He was a theorist of extraordinary creativity and an astute observer willing to spend weeks at sea. His work combined penetrating physical insight with the simplest possible mathematics, always embodying the same approach: to find the simplest model of the underlying physical process and to expose its essence. He was never satisfied until he understood the details of how things really worked. He was always on the forefront, grappling with observations until he could visualize the essential process and develop a simple model, and then moving on as others followed him into that field. His originality and the range and penetration of his own research have in major part generated the modern concepts of ocean circulation.

Hank shared his ideas and his enthusiasm with anyone who was interested; he was always a willing collaborator on something intriguing. His intellectual energy and exuberance for explaining to others what he had learned were tremendous. His deep physical insight, his broad scholarship and his zest for scientific research have been an inspiration to generations of oceanographers and students throughout the world.

Among the numerous awards Hank received are the Sverdrup Medal from the AMS, 1964; WHOI's Bigelow Medal, 1974; the Maurice Ewing Award from the AGU, 1977; the Rosenstiel Award from the AAAS, 1978; the Agassiz Medal from the NAS, 1979; the Huntsman Award from the Bedford Institute of Oceanography, 1980; the Grand prix d'Océanographie de Monaco, 1982; the Bowie Award from the AGU, 1982; the Crafoord Prize from the Royal Swedish Academy of Sciences, 1983; the Albert Defant Medal from the German Met. Soc., 1986; and the US National Medal of Science, 1989. He was also the recipient, in 1966, of oceanography's somewhat dubious Albatross Award.

Hank was a member of the Natl. Academy of Sciences; the American Academy of Arts & Sciences; Foreign Member of the Soviet Academy of Sciences; The Royal Society (London); Membre d'Honneur of the Société de Géographie de Paris; and a foreign associate of the French Académie des Sciences.

Hank's family requests that memorial gifts be directed to a fund that will be established in his honour at the MBL/WHOI Library for the purchase of scientific journals.

Dr. William (Bill) L. Ford
1913-1992

A Tribute to Bill Ford was held in the auditorium of the Bedford Institute of Oceanography on Monday Jan. 20th, 1992. Bill passed away peacefully on January 15th and many of his family, friends and colleagues gathered together to share memories of his life and career.

Born in Montreal, Bill received his Ph.D. from Northwestern University, Evanston, Ill. He held honorary degrees of D.Sc. from the University of New Brunswick and LL.D. from Dalhousie. He was also a graduate of the National Defence College, Kingston.

After a brief four year period in industry, Bill trained as an oceanographer at the Woods Hole Oceanographic Institute including participation in the study of the effects on the ocean of the first peacetime atomic bomb test, at Bikini Atoll, in 1946. From 1948 to 1965 he held positions in the Defence Research Board in Dartmouth, Esquimalt and Ottawa. In 1965 he was appointed Director of the Bedford Institute, a position held until his retirement in 1978.

After his retirement from federal service, Bill continued to contribute actively in marine matters. He served as Chairman of the Environmental Advisory Committee set up by the Royal Commission on the Ocean Ranger Disaster, and as oceanographic technical advisor to the Hibernia Environmental Assessment Panel.

Bill Ford loved the sea. He was an avid sailor and was highly respected for his organizational and managerial skills. He is survived by his wife Marjorie (née MacLean) and by daughters Stephanie and Arden. He was pre-deceased by his first wife, the former Hazel Stapleton.

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Climatological Bulletin
Bulletin climatologique

as of Oct 1st 1991/en date du 1 Oct. 1991

CLIMATE RESEARCH NEWS

The oceanographers have clearly taken a lead with **WOCE NEWS**, and the casual reader of the new-and-much-improved C.M.O.S. Newsletter (kudos to Howard Freeland) might be forgiven for thinking that the oceanographers have taken over! The intent of this column is to provide information on what is going on in the positive z-axis domain, with a focus on climate research activities.

Why do we need a climate research column? There are currently a number of major climate research initiatives in the planning or implementation stages in Canada. For example, Canadian participation in the Global Energy and Water Cycle Experiment (**GEWEX**) will include development of distributed hydrological models, improved precipitation measurement methodologies, process research on evaporation and evapotranspiration, and development and validation of satellite algorithms for inclusion of remotely sensed data in land surface process models. The Boreal Forest Experiment (**BOREAS**), a cooperative Canadian/NASA field and analysis study, is designed to achieve greater understanding of the interactions between the boreal forest biome and the atmosphere in order to clarify their roles in global/climate change. The federal Government has made a commitment under the Green Plan to improve the ability to understand climate processes, and to provide more accurate simulations of the magnitude, rate and regional characteristics of climate change. This commitment will result in increased funding for climate-related research. In addition, a Canadian Climate Research Network (**CCRNet**) is being implemented to foster the multi-disciplinary and multi-sectorial climate-related research required to meet the above objectives.

While these and other initiatives will enhance climate-related research activities in Canada, the multi-disciplinary nature of the problems requires that scientists become much more effective communicators. By acting as a focal point for Canadian climate research news, the aim of this column is to encourage communication across disciplines. **However, this effort will only succeed if it is supported by the climate research community.** The first item in the column is a report on an Ocean Circulation Modelling Workshop which was sponsored by the CCRNet as part of a process to identify research priorities and Canadian expertise in key areas of the climate change research agenda. Future items will include a description of the Climate Research Network by Dr. John Stone (Climate Research Division, Canadian Climate Centre), and a report on a Workshop on Land Surface Processes and Climate held in Saskatoon last December. It is my intention to include progress reports on the major land surface experiments, and general information such as workshop reports. So if you have any climate-related research news you would like to share with a very select audience, I will be very pleased to include it in the column.

Ross Brown
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Phone: (613) 996-4488
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Workshop on Ocean Circulation Modelling

IOS, Sidney, B.C., October 23-24, 1991

Background: The Workshop was held to discuss Canadian research in the field of ocean circulation modelling and to provide advice to AES on the development, within the proposed Canadian Climate Network, of an enhanced research capacity in this field. Top Canadian researchers from universities, government departments and the private sector were invited to the Workshop. AES, in organizing the Workshop, was inviting these scientists to join it in meeting the challenge, stated in the government's Green Plan, to improve our ability to understand and predict climate. The first day was taken up with scientific presentations. The majority of the second day was used for a general discussion on the development of a coupled ocean-atmosphere climate modelling node within the Network.

Report: There were several presentations on experience with existing ocean circulation models and of new models being developed in Canada. Andrew Weaver considered the effect of freshwater fluxes on the stability of the thermohaline circulation. Richard Greatbatch discussed modelling of the Labrador current and the circulation on the Newfoundland/Labrador shelf. Preliminary results with Oberhauser's isopycnal model were described by Josef Cherniawsky and William Hsieh discussed global ocean simulations with the MOM version of the Cox-Bryan model.

Lawrence Mysak made a presentation showing evidence for a 200 year oscillation in a randomly forced thermohaline circulation model. Ann Gargett's paper, presented by Greg Holloway, demonstrated the sensitivities of ocean models to the assumed diffusivity coefficients of salt and heat. A novel approach to the pole problem in ocean models was described by Michael Eby and Keith Thompson discussed a number of model related projects at Dalhousie University. Chris Garett advocated the use of the semi-closed Mediterranean basin as a means of estimating interannual variability and detecting climate change. Finally Allyn Clarke discussed the predictability of the interannual variability of the North Atlantic Ocean.

It was generally agreed that we should not focus all our efforts on one model but rather **encourage the exploration of a wide range of models**. This will require the funding of several existing research groups across the country. The aim of these modelling efforts is to improve our climate simulation capability and not for operational predictions.

It is accepted that it will be essential, in order to improve our climate models, that **an ocean circulation model not only be developed but coupled to an atmospheric General Circulation Model (GCM)**. It was understood that developing a completely new ocean model does carry a certain risk and that this might best be done by freeing some researchers from the demands of the NSERC funding system so that they can carry out some careful studies which need to be done but which may not lead to any immediate publications. This is the approach taken in developing the Canadian Climate Centre's GCM.

CLIMATE RESEARCH NEWS (cont)

Ocean circulation models are not yet as advanced as atmospheric models and there are many important questions regarding model structure and parameterization that need to be solved. During the next few years it is essential that ocean climate model development proceed with maximum participation and interaction with oceanographers. For this reason, it would seem to make sense to **collocate a ocean circulation modelling activity with a major oceanographic research group.**

Several participants recognised that coupling ocean and atmospheric circulation models was an extremely difficult exercise and it would ultimately be necessary for **modellers from both fields be brought together in one place so that they can intimately work together.** Specifically, this means growing an ocean circulation modelling unit and co-locating it with the existing modelling group of the Climate Centre.

In addition, it is important that funds also be made available to support university modelling groups and to allow for regular visits and information and data exchange amongst the ocean modelling community.

It was recognised that it was equally important to facilitate the **inter-comparision of existing and new models with standard data sets and forcing functions.** This intercomparison would allow not only for model diagnostic studies but also a greater appreciation of each models' strengths and weaknesses. This has been the approach adopted by the ECMWF.

Many participants noted the lack of reliable data sets, particularly of sub-surface data. The existing Levitus monthly mean data set is not good enough for diagnosing seasonal changes in ocean transport. Also the data sets on surface wind stresses are unreliable, especially at high latitudes. On the other hand, it was recognised that collecting ocean data was extremely expensive and **Canada should cooperate in international programs such as WOCE, JGOFS and the new Global Ocean Observing System .**

Data assimilation for ocean data presents different problems than that experienced with atmospheric data - the data are much sparser but the time scale is much longer. New techniques would be necessary. It was agreed that this was an area in which Canada should put some effort, possibly by hosting a small international workshop. As in weather prediction, techniques for data assimilation will be closely linked to model development.

It has been the experience of modellers in the weather forecasting community that, before putting an enormous amount of effort into better parameterizations, it had been profitable to first **improve the numerical processes in the models.** As a general point, this suggests a closer interaction with modellers in the weather forecasting community (particularly within AES). Specifically, they could help, by applying the semi-Lagrangian technique, to overcome the singularity problems near the poles with the Cox-Bryan model.

Improved parameterization of ocean processes was recognized as being an important priority. Although this should focus first of all on physical processes, particularly, ocean mixing processes, it was understood that chemical and biological processes were also important. It is hoped that some of this improved understanding will come from such global experiments as TOGA, WOCE and JGOFS. Some noted that **Canada's particular strength was in understanding the continental shelves (on both the East and West coasts), and in the Arctic.**

There was a general appreciation of the large costs of developing and coupling ocean and atmospheric circulation models and that **Green Plan resources should be used to lever funds from other sources where possible.**

WOCE NEWS

Editor's Note:

The note immediately following was printed in the last CMOS Newsletter, however, due to an oversight by the editor 4 of the diagrams appeared without contours. It is being reprinted here in, I hope, correct form. Would contributors please help prevent the editor from messing up again by suppressing colour instructions when making HPGL files to include with Word Perfect documents. Word Perfect does not print coloured contours.

A Recent Canadian Contribution to the WOCE Hydrographic Program

by Ross Hendry
Bedford Institute of Oceanography, Dartmouth, N.S.

Physical and Chemical Sciences at the Bedford Institute of Oceanography continued the Canadian contribution to the WOCE Hydrographic Program (WHP) on recent April-June 1991 Cruises 91007 and 91015 of C.S.S. *Hudson*. An overview of the *Hudson* program was provided by LeBlond in WOCE News 19 (5). This note presents a rationale for the cruise plan and shows how the results can further our regional interests in addition to contributing to the international WOCE effort.

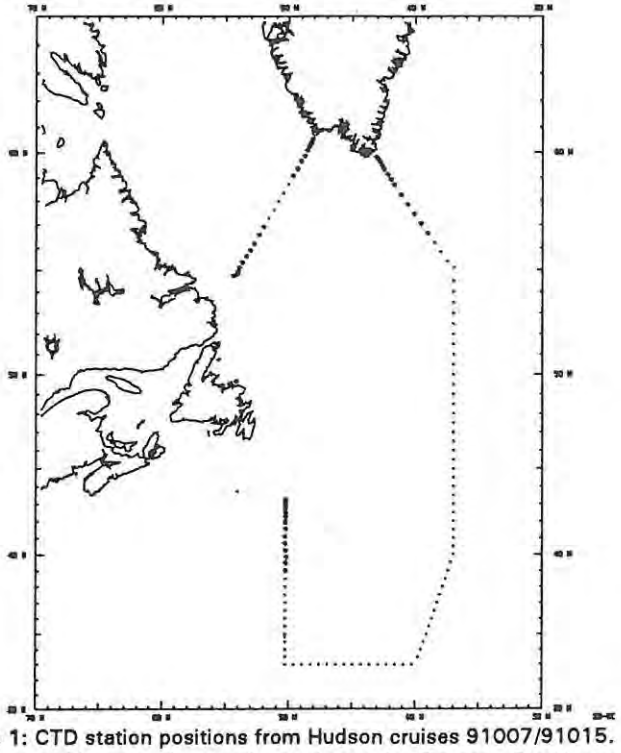


Figure 1: CTD station positions from Hudson cruises 91007/91015. Stations making up the sections shown in Figures. 2(a-d) are emphasized.

The station positions are shown in Figure 1. The CTD survey began in the shallow waters on the Grand Banks, and ended on the outer limits of Hamilton Bank off Labrador. The six survey segments and the coastal boundaries define a closed region in the western North Atlantic. All of the segments lie along WOCE lines. Since none of the lines provide ocean-wide zonal or meridional coverage, our contribution is officially classified as part of the WOCE repeat hydrography program rather then the one-time global survey. With the notable exception of the Labrador Sea line, there are no current Canadian plans to reoccupy the lines visited on the 1991 *Hudson* cruise.

The segment along the 50°W meridian is designated WHP A20N, or the northern part of one-time survey line A20. This line crossed the Labrador Current and the Gulf Stream, and at deeper depths sampled the westward flowing Deep Western Boundary Current (DWBC).

The zonal segment along 33°N at the southern extreme of the survey is deemed WHP line A4C, a central part of one-time WHP section A4.

The three segments running generally northward from 33°N to the southern tip of Greenland comprise WHP line AR5. This section crossed the North Atlantic Current near 51°N. It ended in 50 percent ice-covered waters on the Greenland shelf south of Cape Farewell after sampling the DWBC at the base of the continental rise and crossing the shallow East Greenland Current.

The final survey segment WHP line AR7W crossed the Labrador Sea from the Greenland continental shelf to Hamilton Bank off southern Labrador. AR7W was also occupied in 1990 [Lazier, WOCE News 19(1)], and we have a commitment to WOCE for further annual realizations of this Labrador Sea line. Fresh coastal currents characterize both ends of AR7W: the northward flowing West Greenland Current on the eastern side and the southward flowing Labrador Current on the western side. The DWBC that flows to the north along the west Greenland slope and returns to the south along the Labrador slope was also sampled on both ends of the line in the 1991 survey.

The hydrographic and tracer measurements obtained on the cruise will help initialize and constrain circulation models aimed at better understanding the oceanic transports and air-sea exchanges of heat and fresh water in the thermodynamically active region bounded by the cruise track. Because the segments completely enclose the region, a local inverse calculation should produce interesting results. The measurements of the Labrador Current will make a useful contribution to local studies seeking to understand the covariability between Canadian coastal ocean climate and biology. The DWBC that was sampled four times on the cruise provides a route for relatively fast communication between surface waters in the Norwegian-Greenland Seas and the deep interior of North Atlantic. This pathway is thought to be potentially important in the partitioning of the global store of carbon dioxide between the atmosphere and the ocean. The cruise data should contribute to a better understanding of this deep current system.

The data from the cruise are at an early stage and are being worked on by a number of investigators. We can use a provisional version of the discrete oxygen data set from rosette samples to highlight the four crossings of the DWBC and provide a semi-quantitative illustration of the interconnections suggested above. High values of dissolved

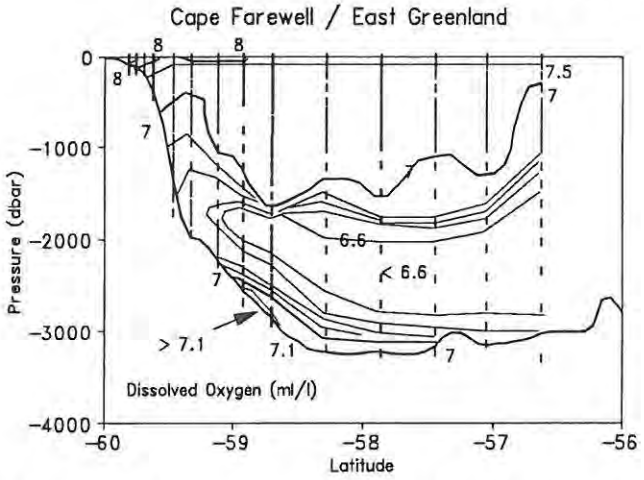


Fig 2a. Dissolved oxygen concentration (ml/l) along a transect of the east Greenland slop and rise, showing a deep maximum associated with the Deep Western Boundary Current (DWBC).

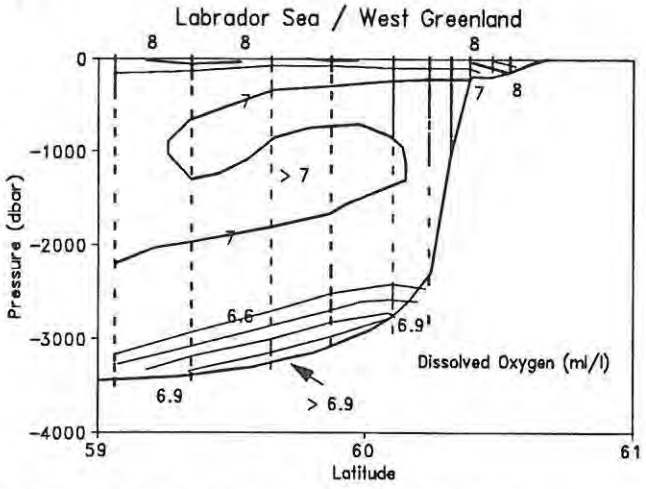


Figure 2b: Oxygen section from the west Greenland slope and rise.

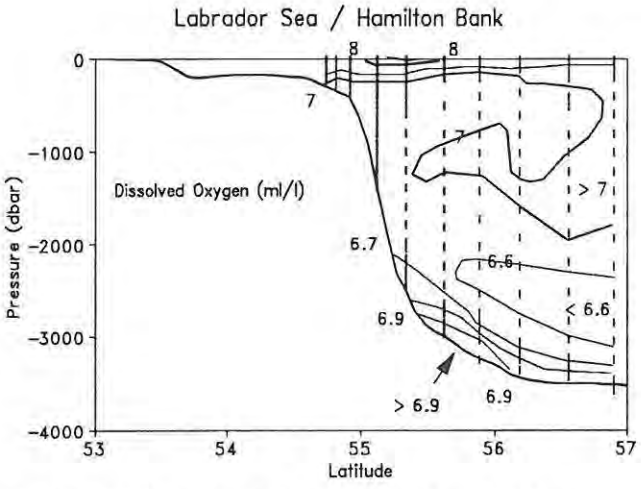


Figure 2c: Oxygen section from the Labrador slope and rise.

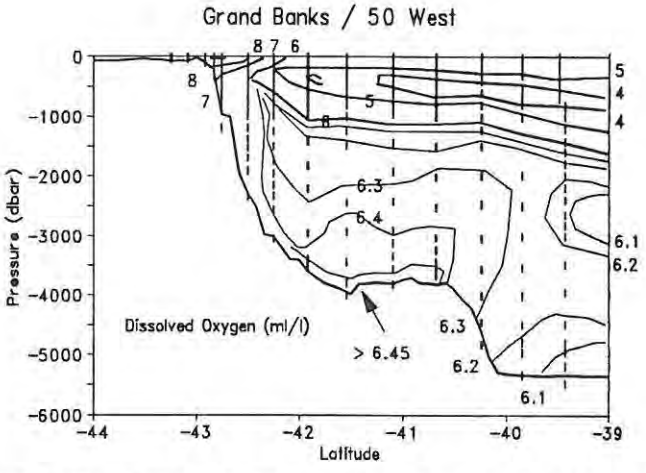


Figure 2d: Oxygen section along 50°W on the southeast Newfoundland Rise leading up to the Grand Banks.

oxygen provide a distinctive label for the waters cooled in contact with the atmosphere in the Norwegian-Greenland Seas and subsequently spilled over the sill at Denmark Strait to form the DWBC. Mixing and biological activity would both contribute to reduced DWBC oxygen concentrations further from its source region.

The Cape Farewell section is the most upstream section from the point of view of the DWBC. The DWBC is marked by oxygen readings greater than 7.1 ml/l near the 3000 m depth contour (Figure 2a). Moving approximately 450 km around the southern tip of Greenland to the Labrador Sea, a similar DWBC oxygen signature shows maximum deep readings of just over 6.9 ml/l (Figure 2b). The DWBC oxygen maximum is also seen on the western side of the Labrador Sea (Figure 2c) with deep oxygen concentrations greater than 6.9 ml/l. The deep oxygen maximum on the Labrador side is about 450 km away from the west Greenland maximum as the crow flies, but the DWBC has traversed approximately 2000 km around the northern perimeter of the Labrador Sea before reaching the section offshore of Hamilton Bank . Finally, the DWBC oxygen maximum is seen near 3500 m depth over the Southeast Newfoundland Ridge south of the Grand Banks on 50°W (Figure 2d). The DWBC has traversed approximately 1500 km from the western Labrador section, and the maximum concentrations are reduced to just over 6.4 ml/l. The net path length between the east Greenland crossing and the 50°W crossing is on the order of 4000 km. A nominal mean speed of 0.05 m/s gives a transit time of about 2.5 years.

The goal of the WHP is to create a data base of observations like those obtained on the *Hudson* cruise to verify models of ocean circulation that can contribute to an improved understanding of climate and climate variability. Regional studies in many parts of the world ocean will also benefit from the WHP efforts.

OBSERVATIONS AND MODELLING OF WIND-DRIVEN CURRENTS IN THE NE PACIFIC

Patrick F. Cummins and Howard J. Freeland
Institute of Ocean Sciences, Sidney, B.C.

We have examined velocity observations from the interior of the Alaskan Gyre from a current meter mooring deployed in 4000 m of water at 49° 33'N, 138° 38'W, in the vicinity of Ocean Weather Station "Papa". The mooring held five current meters which spanned the depth of the water column. The data reveal surface-intensified motions with flow fluctuations in the upper layers of the water column characterized by long period, O(100 d), time scales of variability. At abyssal depths, the flow displays shorter, O(20 d), time scales of variability. These data have been compared with observations from one of the NEPAC moorings in the northeast Pacific* 42°N, 152°W) which were graciously provided for our use by Dr. Pearn P. Niiler. Similar characteristics in kinetic energy levels, in the vertical structure of the flow and in the vertical variation of eddy time scales are found at this location. Modal decomposition shows that at both sites flows are dominated by the first internal wave mode and the barotropic mode, with very little energy in higher modes.

The current measurements are considered in terms of the linear theory of directly wind driven variability of Müller and Frankignoul (1981). An intercomparison with simulated currents from a quasi-geostrophic numerical model demonstrates that stochastic forcing of the ocean by the wind stress curl can account for the observed variability. Numerical experiments and a simple extension of the linear theory suggest that the presence of bottom topography is an important factor for the partition of energy between vertical modes and the vertical variation of the time scales of the flow.

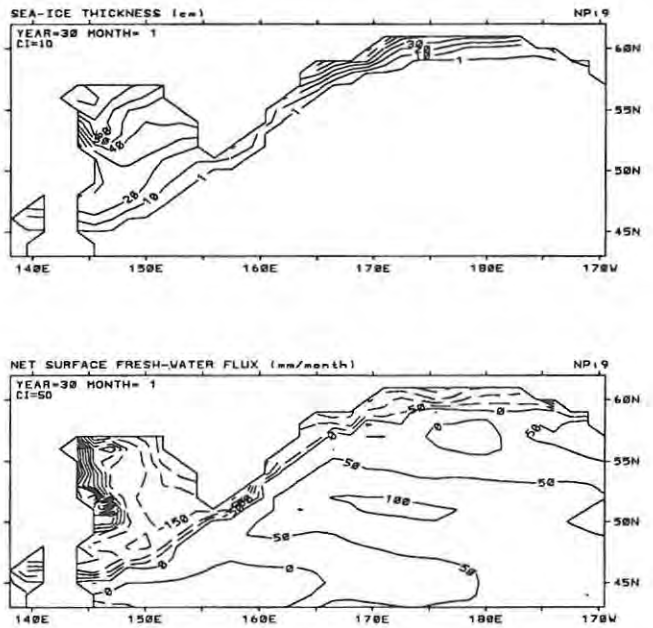
* Hu, J.H. and P.P. Niiler, 1987: NEPAC current meter and XBT data for the circulation on the northeast Pacific thermocline: 42°N and 28°N, 152°W; July, 1982 - October, 1985. SIO Ref. No. 87-4 (Tech. Rep.).

Simulation of sea-ice in an upper ocean GCM of the North Pacific

Josef Cherniawsky and Greg Holloway
Institute of Ocean Sciences, Sidney, B.C.

We have recently introduced an advective (as in Thorndike and Colony, 1982) and thermodynamic (as in Yuen et al., 1991) sea ice model into the upper ocean general circulation model (GCM) of the North Pacific (Cherniawsky and Holloway, 1991). The mixed layer was subjected to (i) monthly mean climatological wind stress from Harrison (1989), (ii) monthly climatological heat fluxes from Oberhuber (1988), and (iii) fresh water fluxes derived by relaxing the model mixed-layer salinity to annual mean climatological (Levitus, 1982) salinity values in ice-free areas, or due to melting/freezing under the ice.

The uncertainties in climatological forcing data for the Sea of Okhotsk and in the western Bering Sea make model/data intercomparison difficult, though "reasonable" simulation of sea-ice thickness in the NW Pacific is possible (Fig. 1 shows an example) by creative extrapolation of surface forcing (air temperatures, etc) from adjoining ocean areas. Evidently, a more objective preparation of surface forcing fields is required, especially given the new datasets that may become



available from our colleagues in Russia (Carmack, private communication). Fig. 2 (lower panel) shows an example of ice generation/melting areas in January, in terms of significant negative (dashed) and positive fresh-water fluxes under ice, from which one can learn on a relative role of sea-ice in cycling fresh-water anomalies around the subarctic gyre.

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Cherniawsky, J., and G. Holloway, 1991. An upper-ocean general circulation model for the North Pacific: Preliminary experiments. Atmosphere-Ocean 29(4), 737-784.

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Thorndike, A.S., and R. Colony, 1982. Sea ice motion in response to geostrophic winds. J. Geophys. Res. 87: 5845-5852.

Yuen, C.W., J.Y. Cherniawsky, C.A. Lin and L.A. Mysak, 1991. An upper ocean general circulation model for climate studies: Global simulation with seasonal cycle. Clim. Dyn. (in press).

WOCE AT THE BIRTH OF PICES

PICES is the short name for the North Pacific Marine Science Organization, an international body devoted to collaboration in marine sciences in the North Pacific, mainly northward of 30°N. As its name indicates, PICES owes its inspiration to the International Council for the Exploration of the Sea (ICES), one of the oldest international cooperative bodies in ocean sciences, established to foster scientific research and fisheries coordination in the North Atlantic.

Prof. Warren Wooster, currently with the Institute of Marine Studies at the University of Washington, in Seattle, has been promoting the creation of PICES for many years. With strong support from Canada, the USA, China, Japan and Russia, the organization is now coming into being. A formal treaty establishing PICES will come into force in 1992.

As defined in the treaty, the purpose of PICES shall be:

a) to promote and coordinate marine scientific research in order to advance scientific knowledge of the area concerned and of its living resources, including but not necessary limited to research with respect to the ocean environment and its interactions with land and atmosphere, its role in and response to global weather and climate change, its flora, fauna and ecosystems, its uses and resources, and impacts upon it from human activities; and

b) to promote the collection and exchange of information and data related to marine scientific research in the area concerned.

This is a very broad mandate, and existing programs, such as WOCE, concerned with the oceanography of the North Pacific, may well wonder how PICES will affect the realization of their objectives in that area.

Early signs indicate that WOCE may well benefit from the increased cross-Pacific ties created within the framework of PICES. A scientific workshop was held in Seattle, 9-14 Dec, 1992 to discuss possible areas of collaboration. Topics explored included The Bering Sea, Climate Change, Fishery Oceanography and Environmental Quality. Participants from the five countries listed above were present. Some of the participants were members of the WOCE community. Paul LeBlond and Howard Freeland, from the Canadian National Committee for WOCE were present; Bruce Taft, recently returned to Seattle after serving with the WOCE IPO in Wormley was there; Prof. Y. Nagata, Chairman of the Japan WOCE Committee, and Prof D. Hu from the Chinese WOCE Committee were also present.

It was generally recognized that PICES should support rather than replace or supplant existing programs. Recommendations arising from the discussions of the Climate Change panel stressed the importance of supporting the work of WOCE and other international programs on a regional basis.

The WOCE community should welcome the birth of PICES and view the new organization as a means of assisting in the coordination of its programs in the North Pacific.

DURABILITY OF CANADIAN WOCE DRIFTERS
CANADIAN WOCE SVP TEAM

The durability of satellite-tracked drifters used in the WOCE Surface Velocity Program has been a concern in assessing the cost effectiveness of this component of the WOCE program. This concern has also been shared by the Canadian WOCE SVP team.

At a recent meeting in Vancouver, Canadian WOCE SVP participants (see list below) reviewed the results of the five deployments effected since Aug. 1990. Of the 49 deep and shallow drifters deployed, 30 were still functioning as of late November 1991. The rest had either run aground (10) or stopped transmitting. Details of each deployment may be requested from P. LeBlond. An update of drifter trajectories will be presented in a later issue of this newsletter.

All drogues deployed have been of the "holey sock" type and have had drag ratios better than 1:40, confirming to the standard WOCE design. Drifters have been procured from TechnOcean, Drifter Labs (via Aanderaa Instruments, Victoria), and OceanRoutes-Seimac. We present here an analysis of the durability of the drifters deployed. Because of the small number or short deployment period of some instruments it has not been possible to present performance statistics for each type. A more detailed analysis will be presented when more data are available.

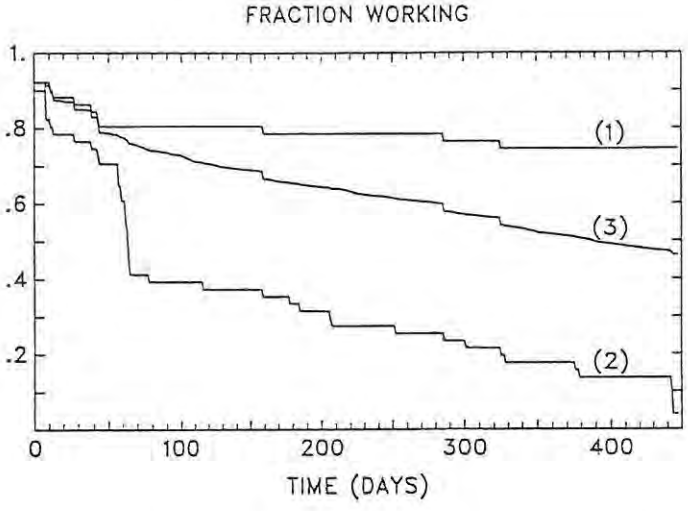

Figure 1: Performance of Canadian drifting buoys in the N. Pacific through November 1991. Curve (1) is an unrealistic maximum estimate while curve (2) is an even more unrealistic minimum estimate. Curve (3) is an attempt to find an unbiased estimate.

We wish to estimate the fraction of drifters F(t) still operating at some time t after launch, which may be expressed in terms of the number of drifters lost (i.e. not operating at time t) $N_L(T)$, and the total number of drifters deployed N_D:

$$F(t) = 1 - N_L/N_D$$

Drifters may no longer be in operation at a given time because they may have run aground, been recovered, or stopped functioning at sea. Here, we assume that all drifters were deployed at the same time, so that N_D is a constant. To account for later deployments, we assume that drifters deployed at a later date and still functioning are equivalent to drifters deployed at the earliest time and recovered after a period equal to that spent at sea.

We can obtain a maximum estimate $F_1(t)$ of durability by assuming that all drifters recovered or grounded (N_R) would otherwise have continued to function to time t. In this case, $N_L = N_F$, the number of buoys which actually failed at sea. This unrealistic upper bound is shown as curve 1 in Figure 1.

A minimum estimate $F_2(t)$ is obtained by assuming that all drifters recovered (or equivalently so, as defined above) or grounded would have failed at the time of recovery or grounding. Then, $N_L = N_F + N_R$. This lower bound is even more unrealistic since it assumes that all late-deployed drifters still functioning at time t also fail at that time. $F_2(t)$ is shown as curve 2 in Figure 1.

A more realistic estimate $F_3(t)$ is obtained by assuming that only a fraction p(dt) of buoys recovered or grounded would have failed a time dt after recovery or grounding. Then,

$$N_L(t) = N_F(t) + \sum_{n=1}^{N_R} p(t-t_n)$$

where t_n is the time at which an N_R buoy n was recovered.

We assume that $p(dt) = 1 - F_3(t)$, so that

$$F_3(t) = 1 - \left(\frac{N_F(t) + N_R - \sum_{n=1}^{N_R} F_3(dt)}{N_T} \right)$$

Since F_3 can be computed sequentially starting at $t = 0$, and t_n is always > 0, for $t\text{-}t_n < t$, $F_3(t\text{-}tn)$ is always computed before it is needed in the equation above. This bootstrap estimate of $F_3(t)$ would seem to be relatively unbiased. It may be too large because the failure rate may increase with time at sea, but there is no evidence so far to indicate this behaviour. Indeed many failures occur soon after deployment, and $F_3(t)$ may be an underestimate. $F_3(t)$ is shown as curve 3 in Figure 1.

On the basis of information available on day 325, 1991, we find a half-life $F_3(t) = 0.5$ of about 400 days for the Canadian WOCE SVP drifters.

The Canadian WOCE SVP team consists of David Krauel (Royal Roads Military College, Victoria, B.C.), Bill Large (NCAR, Boulder, Colorado, USA), Paul LeBlond (University of British Columbia, Vancouver, B.C.), Rick Thomson (Institute of Ocean Sciences, Sidney, B.C.) and Gordon Swaters (University of Alberta, Edmonton, Alta).

Fixing 'wrong way' ocean models

by JPOD*

Goal One for WOCE is to develop understanding adequate to model the role of oceans in climate change. Achieving the WOCE goal will require an ocean model of sufficient skill to be coupled to an atmosphere model without degrading the performance of that atmospheric model. How are we doing? On seasonal to (perhaps) interannual timescales, such coupling is possible with (arguably) modest skill. On WOCE timescales of a decade or more, ocean model skill is dangerously lacking and coupling with an atmosphere is a haphazard proposition.

Why do ocean models go wrong? There are many reasons. From a view of climate modelling, important errors appear to arise due to poor representation of mid-depth to abyssal flows, as seen in geochemical transports and affecting model heat transports. In many cases, significant ocean currents are either missing or go the wrong way! Among the sources for these errors, one often cites inadequate resolution which either omits entirely -- or admits but with suspect fidelity -- the oceanic eddy field.

At JPOD*, we are exploring a possible alternative to the demand for very high resolution. We borrow from statistical mechanical theory of eddies, combining this with coarse resolution numerical models. In particular we have

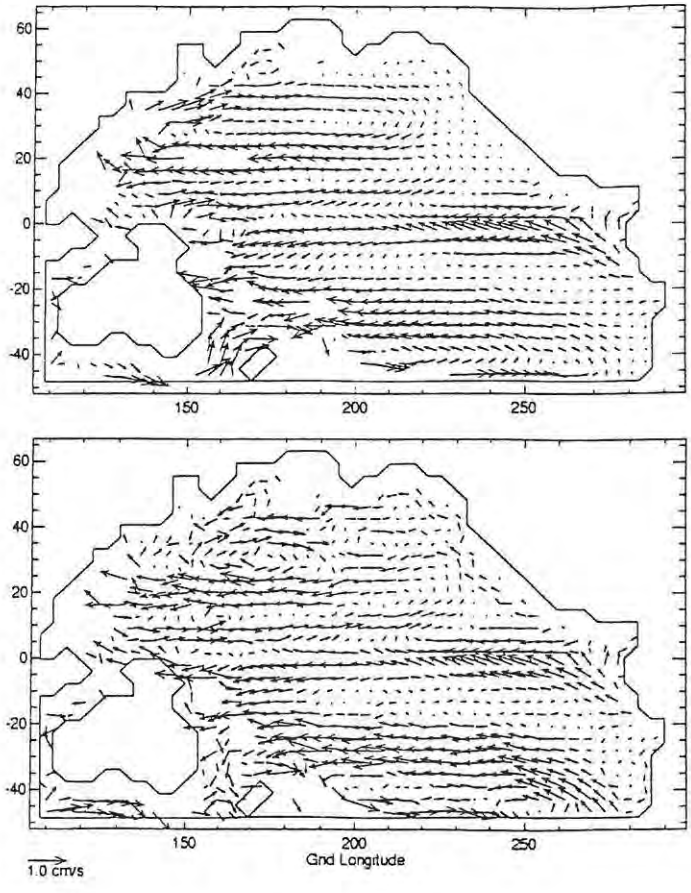

Figure 1

considered the influence of seafloor topography, testing a suggestion of Holloway (1992) that a simplest 'fix' for numerical models may be to cause the transport streamfunction to tend toward a streamfunction given by $\psi^* = -LfH^2$, where L is a lateral length scale, f is Coriolis and H is total depth. Our tests have been performed in a 15 level, 4°, global version of the GFDL "Modular Ocean Model" (MOM). Choice of model and resolution are motivated in part by cooperation with research at the Canada Climate Centre (Downsview, Ont.) toward a coupled model.

We find that near-surface circulation is little affected, responding mainly to direct wind forcing. Mid-thermocline depths around 500 m are transitional, as tendency toward ψ^* competes with "usual" model currents. At greater depths, the tendency toward ψ^* may dominate, even reversing the sense of "usual" model currents. These are the "usual" model currents which, historically, have often had the wrong sign! Thus, we are encouraged that introducing an effect of statistical mechanics appears to help. We are cautioned though that these results are preliminary.

Figure 1 is from the Pacific portion of the global model, showing flow at a model depth of 850 m. Windstress is from Hellerman-Rosenstein while surface T and S relax to Levitus. The top panel shows a flow from "control", i.e. MOM run in a "usual" way. The lower panel shows the same run with 50 day relaxation to ψ^*, where L varies linearly from 30 km at the equator to 3 km at the pole. In the control case, one observes that the Kuroshio carries subtropical water to high latitude across the N Pacific, cutting off any Alaska Stream and weakening the Alaska Gyre to near stagnation, as has been typical of previous model studies in the N Pacific. Eastern boundary currents are quiet except near the Equator. In the case with ψ^*, a strong Alaska Stream flows southwestward, while a strengthened deep Oyashio flows along the western boundary to force a more realistic Kuroshio separation. A California Undercurrent flows north to feed a renewed Alaska Gyre, while a Chilean Undercurrent flows poleward in the eastern S Pacific.

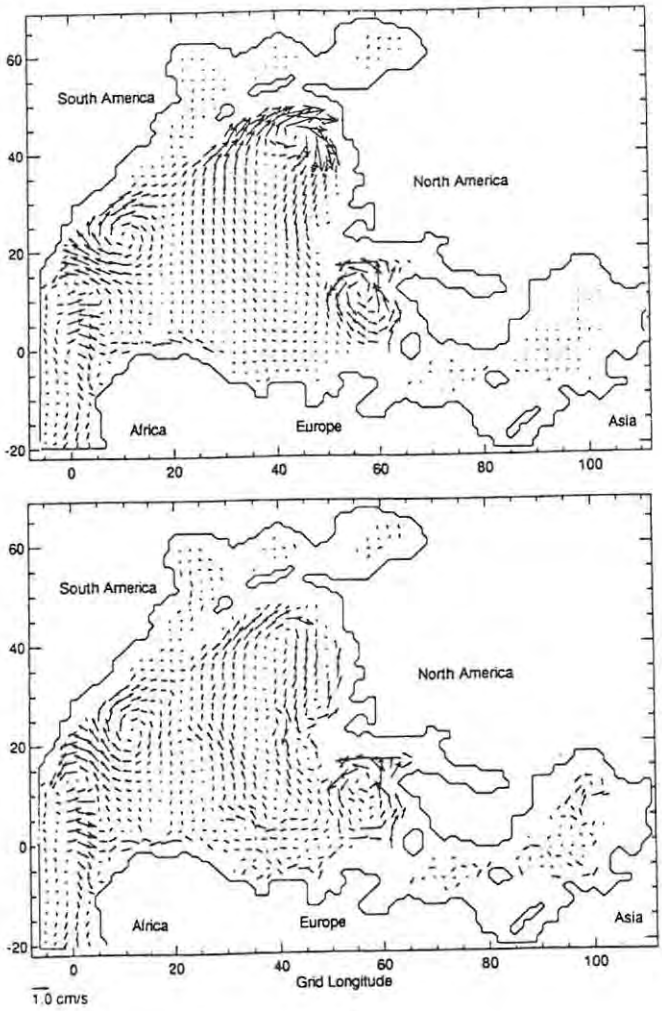

Figure 2

Figure 2 is from a higher resolution (1°) run in a N Atlantic-Arctic domain in which the coordinate grid has been turned 90° to avoid convergence of meridians at the Pole. (For this special case, the Atlantic Equator has been replaced by a wall. In coarser resolution, global runs, the two model domains are smoothly coupled across the Atlantic Equator.) A "usual" control case is shown in the top panel. The lower panel has 50 day relaxation to ψ^*, while L was given a constant value of 10 km. In the control case, the Gulf Stream carries subtropical water all along the Atlantic seaboard, contacting a tight cyclonic gyre eastward from the Grand Banks. When ψ^* is introduced, the deeper Gulf Stream is displaced seaward near C. Hatteras while "Slope Water" penetrates southward from the Grand Banks along the Mid-Atlantic Bight. Poleward flow is seen off the Iberian Peninsula. An Arctic circulation is seen as Atlantic water flows along the Barents Slope, returning in a Transpolar Current along the Lomonosov Ridge. Cyclonic circulation is seen around the periphery of the Canada Basin. (However, flows in the Arctic are too strong due to the simple choice of constant L = 10 km for this case.)

Below 850 m (not shown), effects of ψ^* are expressed even more clearly. In particular, a strong undercurrent sweeps equatorward along the western N Atlantic continental margin. It seems that some of the grossest defects of "usual" models are (perhaps) being overcome. Further effort will refine the representation of statistical mechanical effects, hopefully leading toward ocean models that can be faithfully coupled to atmosphere models.

Holloway, G., 1992, "Representing topographic stress for large scale ocean models", J. Phys. Oceanogr., to appear.

*JPOD, the Joint Program in Ocean Dynamics, is a cooperative effort between the Institute of Ocean Sciences, D. F. O., and the Centre for Earth and Ocean Research, Univ. of Victoria. Contributors to research in this article are Kelly Choo, Michael Eby and Greg Holloway.

WOCE NEWS (cont)

The Marine Environmental Data Service and WOCE

Ron Wilson, DFO (MEDS) Ottawa

Most data for the World Ocean Circulation Experiment (WOCE) is managed by Data Assembly Centres or DACs. DACs are formed by twinning data and scientific centres to provide a fertile mix of scientific and data management expertise. This arrangement also helps WOCE participants to share work and reduce the load on any one centre.

Typically the scientific side of a DAC will provide advice to the data centre on algorithms and standards for data analysis, and for quality control procedures to be carried out at the data centre. At some point in the assembly of the data sets, the scientific centre will examine the data using their own procedures and pass final judgement on the quality of the data. The data centre side of the DAC will provide the data processing and database management, the initial quality control, data flow monitoring, and distribution of the data to users inside and outside WOCE according to the data sharing arrangements.

The Marine Environmental Data Service (MEDS) is participating as the data centre in WOCE DACs for the Surface Velocity Program (SVP) and the Upper Ocean Thermal Program (UOT). MEDS has undertaken these commitments because we already had software systems and expertise for drifting buoy and real time BATHY and TESAC data.

Data Management for the Surface Velocity Program

The WOCE SVP is a large drifting buoy program that will provide information on the movement of the surface layer of the ocean. Over a 5 year period, which began in 1991, SVP will operate a global network of 1000 plus drifting buoys designed and drogued to follow the water rather than the wind. These buoys report through Service ARGOS and the data are distributed in real time on the Global Telecommunications System (GTS). The data are also distributed in delayed mode through the SVP Drifter Center in the Atlantic Oceanographic and Meteorological Laboratory (AOML) of the National Oceanic and Atmospheric Administration (NOAA) in Miami.

The data flow for this program begins with processing of the real time data from the GTS in MEDS. MEDS receives of the order of 45,500 reports per month from 400 drifting buoys. The data are processed, quality control is applied and maps are produced on a monthly basis with distribution by mail and, soon, through the WOCE Data Information Unit at the University of Delaware. The maps can be used for identifying data of interest and for management of the array during the experiment. The data are also acquired from Service ARGOS on a monthly basis and are fully processed and quality assessed by AOML. These data along with a data set that has the positions interpolated to six hourly values are submitted to MEDS after six months to replace and augment the WOCE real time data and for further distribution and final archival.

Data Management for the Upper Ocean Thermal Program

The WOCE UOT is collecting a global temperature and salinity data set based on available BATHY and TESAC data from the Integrated Global Ocean Service System (IGOSS) and from ship of opportunity programs. All other sources of reliable upper ocean temperature data are also being sought.

The data flow for this program begins with MEDS copying and analyzing over 100 BATHY and TESAC reports from the GTS each day in our role as the real time data assembly centre for the Global Temperature-Salinity Pilot Project (GTSPP). The accumulated data are passed to the US National Oceanographic Data Center (NODC) three times per week where they are immediately made available to the TOGA modelling program in the US National Weather Service and soon to the NOAA Ocean Applications Group in Monterey. At the end of the month the accumulated data are passed to the AOML, Scripps Institute of Oceanography, and CSIRO in Australia (the other elements of the WOCE UOT DAC in addition to MEDS and NODC) for scientific quality control. The quality controlled and flagged data are returned to NODC on a regular basis to replace the real time data that have only had data centre quality control. After about one year the fully processed, and controlled and calibrated, delayed mode data from the shipboard recorders are received and replace the less reliable real time data in the GTSPP database.

The software systems developed for processing and quality controlling the WOCE UOT data are used in MEDS for all Canadian data. Some or all of these systems have been or will be installed at the Bedford Institute of Oceanography, NODC, AOML and Scripps. Thus the benefits of this work are being realized by a community much larger than WOCE. In addition, a better quality and more complete data set for the Canadian area of interest can and is being provided to Canadian users in both real time and delayed mode.

METEOROLOGY AND OCEANOGRAPHY A VIEW FROM THE PERSIAN GULF

INTRODUCTION

The gulf war is long over, the oil well fires are out, and the long term environmental and political consequences are just beginning to be objectively evaluated. As a break from the media headlines, it may interest some to know how meteorology and oceanography were used operationally by the Canadian Forces (CF) in the gulf theatre.

Overall CF participation in the war centred around two squadrons of fighter aircraft, various small unit land forces including a mobile field hospital, and a naval Task Group (TG). The latter consisted of a destroyer, a smaller destroyer escort, a large replenishment vessel, and their associated helicopters.

Canadian naval activity in the early stages of the war was intensive. Our ships carried out 25% of the boarding and hailings during the allied naval blockade. This was due to their area of operation in the central are of the Gulf; "in harms way". This forward position necessitated the around the clock overhead fighter aircraft coverage.

Our ships carry meteorological and oceanographic trained personnel, augmented as required to meet various specific tasks. Interestingly, there was no shortage of volunteers for augmentation.

METEOROLOGY

The ships sent to the gulf carried the best equipment available in our inventories, and meteorology was no exception. Their suites included state-of-the-art radiosonde upper air balloon sounding systems; satellite imagery receivers and processors; and various computers. Back home, a special Middle East window was configured on the Canadian Meteorological Centre's spectral model.

Satellite imagery at sea was new for Canadian ships, and the capability proved most useful. At times it was the only source of real time information, and received praise from all concerned including the TG Commodore.

At sea, weather conditions were dominated by the Shamil, strong northwest winds flowing down the gulf. Otherwise, during the blockade phase, there was little significant weather. Indeed, the climatological conditions provided during the pre sail briefings were substantially correct.

During the air war phase, the weather dictated to a large extent the timing of coalition strikes. It is interesting to note that winter mid latitude systems, with associated low ceilings and poor visibilites in rain, still significantly hamper high performance "high tech" aircraft.

Throughout the war, a different problem was anomalous electromagnetic (EM) propagation prediction, i.e. how well will your radars and radios work today? This was a relatively new challenge for the navy. In the past, efforts were largely concentrated in anti submarine warfare (ASW) support; whereas in the gulf, the main threats were from aircraft, missiles and mines. The anomalous EM effects in the gulf are the worst in the world, due to the strong vertical gradients of temperature and moisture. "Nowcasting" was accomplished by balloon launches to obtain vertical profiles, and computer modelling of the EM refractive effects.

After the war, our sailors were able to observe closely the oil well fires whose plumes they had seen overhead throughout the gulf at sea, and on satellite imagery. The skies darkened as the ships moved further north west, so that in the vicinity of Kuwait City condition were totally blacked out. On a tour through Kuwait City, one sailor reported the bus passing through low level smoke plumes from the still distant fires that reduced visibility to less than 3 meters for 15 minutes at a time. Breathing was reported as difficult.

OCEANOGRAPHY

In the past, the navy's interest in oceanography was largely driven by a desire for optimising ASW effectiveness, In the gulf, mine threats and mine countermeasures (MCM) dominated oceanographic support requirements. Current and bottom types were the two major information requirements.

Canadian ships carried small mine avoidance sonars, and used oceanographic information for sonar performance predictions. The actual mine clearance work was done by French, US, UK, Belgium, Dutch and Italian ships and divers. Mine hunting was carried out with high resolution sonars, and was made difficult by continual seabed changes due to silt and current from the Tigris and Euphrates rivers. Temperature/salinity profiles had to be measured frequently and sonar performance checked against standard targets.

As a final note for biological oceanographers, the ships companies observed a great wealth of marine life in the gulf, including sea snakes, sharks, small fish, shrimp and jelly fish. "Even during the slicks, one observed a much greater variety of life than one sees in the Halifax or Esquimalt approaches", said one sailor. As a speculative note, perhaps life is adapting to a periodic oil pollution? Are we seeing "evolution in action"?

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Proposed Amendments to CMOS By-Laws

Introduction

The administration of CMOS financial affairs has been becoming increasingly difficult for the CMOS Treasurer to manage unaided. Among the main reasons for this development are the growing complexities of National and Provincial tax laws and of CMOS banking and investment activities. Also, there are the periodic moves of the National Executive which require new Treasurers to deal with unfamiliar and complex tasks, and with auditors and banks in different parts of the country.

During 1990 it became clear that the demands of GST accounting could not be met with our existing financial procedures. The Council, therefore, approved new procedures (Council Meeting #4 1990/91, June 9, 1991) which entrusted the day-to-day financial administration to the CMOS Business Office, which was already carrying out some financial activities. The Treasurer's role would henceforth mainly be to supervise the relevant payments or request Executive approval for them if they exceeded what he was authorized to approve, and carry out detailed budgetary planning for the Society.

The new procedures were approved in the form of Guidelines on a trial basis for one year. As they worked well the Council, during its second meeting (1991/92) on February 14th, 1992, approved permanent Guidelines as well as proposals for changes to the By-Laws which had become necessary in view of the revised duties of the Treasurer. In accordance with Article 5a) of the CMOS Constitution, these proposals for a revision are published on the next page; they are to be considered by the 26th Annual General Meeting.

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as of January 1992/en date de janvier 1992

Suggestions de modifications des règlements de la SCMO

Introduction

La gestion financière de la SCMO est devenue de plus en plus difficile pour le Trésorier de la Société pour une seule personne. Parmi les raisons principales justifiant ce développement on peut mentionner la complexité croissante des lois de taxation nationale et provinciale et la gestion du compte de banque et des investissements de la SCMO. De plus, il y a les déménagements périodiques de l'Exécutif national, qui exige du nouveau Trésorier de s'occuper de tâches non familières et complexes et de faire affaire avec des auditeurs et des banques dans différentes parties du pays.

En 1990, il est devenu évident que les exigences de comptabilité pour la TPS ne pouvaient pas être rencontrées avec nos procédures financières existantes. Par conséquent, le Conseil a approuvé des nouvelles procédures (minutes de la réunion du Conseil #4 1990/91, 9 Juin 1991) qui chargent la gestion financière journalière au bureau d'affaires de la SCMO qui s'occupaient déjà de quelques responsabilités financières. Désormais, le rôle du Trésorier consiste principalement dans la supervision des activités pertinentes du bureau d'affaires, dans l'approbation des paiements ou la demande à l'Exécutif de les approuver et enfin dans la planification budgétaire détaillée de la Société.

Les nouvelles procédures furent approuvées sous forme de lignes directrices à titre d'essai pour une année. Comme tout a bien fonctionné, le Conseil, lors de sa seconde réunion (1991/92), tenue le 14 février 1992, a approuvé à titre permanent les lignes directrices de même que les propositions de changements aux règlements qui sont devenus nécessaires étant donné le nouveau rôle du Trésorier. En conformité avec l'article 5 a) de la constitution de la SCMO les propositions de révision des règlements sont publiées ici-bas; ils doivent être discutées par la 26 ième réunion générale annuelle.

PROPOSALS BY THE COUNCIL TO THE 26TH ANNUAL GENERAL MEETING FOR AMENDMENTS TO THE CMOS BY-LAWS

Proposed Amendments	Present Text
BY-LAW 17 - FINANCE	
Amend the first sentence of paragraph b) to read: "The treasurer shall make arrangements for the preparation of the accounts of the Society for external audit at the end of the fiscal year."	b) The treasurer shall prepare the accounts of the Society for external audit at the end of the fiscal year. The accounts, the budget and the auditor's report shall be presented at each Annual General Meeting.
APPENDIX II TO THE BY-LAWS	
Amend the duties of the treasurer outlined in Section c), paragraphs 1-8 as follows:	
1. (Unchanged)	1. The Treasurer shall, on behalf of the Society, open and maintain such bank accounts as may be necessary for the investment and day-to-day handling of the Society funds.
2. Amend to read: "The Treasurer shall supervise the book keeping by the Society's Business Office of the books of accounts of the Society and ensure that they are maintained in accordance with the financial guidelines approved from time to time by the Council and in a manner agreeable to the Auditor."	2. The Treasurer shall maintain books of accounts of all financial transactions of the Society in a manner agreeable to the Auditor and approved by Council.
3. (Unchanged)	3. The Treasurer shall have the authority to disburse the funds of the Society up to a limit for single payments specified by Council from time to time. Disbursements exceeding this limit shall require a decision of the Executive duly recorded at a meeting of the Executive.
4. Delete and replace by the following: "The Treasurer shall manage the investments of the Society in accordance with Council directives."	4. The Treasurer shall be responsible for the collection of all accounts due to the Society.
5. Amend to read: "The Treasurer shall supervise the collection of all accounts due to the Society by the Business Office and that Office's preparation of the accounts of the Society for audit. The Treasurer shall ensure that the Business Office makes available to the auditor all such books and documents relating to the Society as the Auditor may require in accordance with By-Law 17 (b)."	5. The Treasurer shall prepare the accounts of the Society for audit, and shall make available to the auditor such books and documents relating to the Society as the latter may require in accordance with By-Law 17 (b).
6. Amend to read: "The Treasurer shall provide periodic financial reports to the Executive and the Council and shall prepare the annual budget for consideration by the Council."	6. The Treasurer shall prepare the annual budget for consideration by Council.
7. Amend to read: "The Treasurer shall supervise the preparation of, and sign all financial statements and other Provincial as well as Revenue Canada information returns for the Society."	7. The Treasurer shall prepare the necessary financial statements and revenue Canada information returns for the Society.
8. (Unchanged.)	8. The Treasurer shall recommend an auditor to Council.
9. Add the following new paragraph: "9. The Treasurer shall carry out other financial functions for the Society, such as originating subventions for Centres, drawing up contracts, and such other functions as may become necessary from time to time."	

PROPOSITIONS DU CONSEIL A LA 26ième ASSEMBLÉE GENERALE ANNUELLE DE CHANGEMENTS AUX REGLEMENTS DE LA SCMO

Changements proposés	Texte actuel
REGLEMENT 17 - FINANCES	
Changez la première phrase du paragraphe b) comme suit: "Le trésorier doit faire des arrangements pour la préparation des comptes de la Société pour examen par un vérificateur externe à la fin de l'année fiscale."	b) La comptabilité est mise à jour par le trésorier jusqu'à la fin de l'année fiscale et est soumise à l'examen d'un vérificateur externe. La comptabilité, le budget et le rapport du (des) vérificateur(s) sont déposés devant chaque assemblée générale annuelle.
APPENDICE II aux REGLEMENTS	
Changez les fonctions du trésorier détaillées à la Section c), paragraphe 1-8 comme suit:	
1. (Inchangé)	1. Le trésorier ouvre et maintient au nom de la Société, des comptes en banque jugés nécessaires pour l'investissement des fonds de la Société et pour les transactions quotidiennes.
2. Changez comme suit: "Le trésorier doit surveiller la tenue des livres comptables par le bureau d'affaires de la Société et s'assurer qu'ils sont tenus d'une manière en accord avec les lignes directrices approuvées de temps à autre par le conseil d'administration et jugée acceptable par le vérificateur."	2. Le trésorier maintient la comptabilité de toutes les transactions financières de la Société d'une manière jugée acceptable par le vérificateur et approuvée par le conseil d'administration.
3. (Inchangé)	3. Le trésorier a le pouvoir de débourser des fonds de la Société par montants ne dépassant pas une certaine limite spécifiée et revue de temps à autre par le conseil d'administration. Les déboursements dépassant cette limite, nécessitent une résolution dûment inscrite au compte rendu d'une des réunions de l'Exécutif.
4. Enlevez et remplacez par ce qui suit: "Le trésorier doit gérer les investissements de la Société en accord avec les directives du conseil d'administration."	4. Le trésorier est responsable de la perception de toutes les sommes dues à la Société.
5. Changez comme suit: "Le trésorier doit surveiller la préparation du journal comptable de la Société par son bureau d'affaires pour vérification. Le trésorier doit s'assurer que le bureau d'affaires fournit à la demande du vérificateur les livres et documents de la Société conformément au règlement 17(b)."	5. Le trésorier doit préparer le journal comptable de la Société pour vérification, et fournir, à la demande du vérificateur les livres et documents de la Société conformément au règlement 17(b).
6. Changez comme suit: "Le trésorier doit préparer à l'intention de l'Exécutif et du conseil d'administration des rapports financiers périodiques et doit préparer le budget annuel pour examen par le conseil d'administration."	6. Le trésorier prépare à l'intention du conseil d'administration le budget annuel.
7. Changez comme suit: "Le trésorier doit surveiller la préparation des états financiers nécessaires de la Société et autres renseignements requis par la province et par Revenue Canada."	7. Le trésorier prépare les états financiers nécessaires de la Société et les renseignements requis par Revenue Canada.
8. (Inchangé).	8. Le trésorier doit recommander un vérificateur au conseil d'administration.
9. Ajoutez le nouveau paragraphe suivant: "9. Le trésorier doit effectuer les autres fonctions financières au nom de la Société comme l'initiation d'octroi de subventions aux Centres, la rédaction de contrats et autres fonctions telles que requises de temps à autres."	

INVITATION A PRESENTER UNE COMMUNICATION AU

26ième CONGRES ANNUEL

SOCIETE CANADIENNE DE METEOROLOGIE ET D'OCEANOGRAPHIE

UNIVERSITE LAVAL, QUEBEC, 8-12 JUIN 1992

Vous êtes invités à présenter une communication au 26ième Congrès annuel de la Société canadienne de météorologie et d'océanographie qui se tiendra à Québec du 8 au 12 juin 1992. L'Université Laval est l'hôte du Congrès; les activités du Congrès auront lieu à l'Université Laval.

Le thème du Congrès est "LA METEOROLOGIE ET L'OCEANOGRAPHIE A LA MESO-ECHELLE"; les communications ou présentations sous forme d'affichage sont les bienvenues. D'autres sessions reliées à la météorologie, à l'océanographie et à la climatologie seront aussi organisées lors du Congrès et toute communication sur ces sujets est aussi la bienvenue.

La date limite pour la réception des résumés est le 1 mars 1992. Les auteurs sont priés de remettre une copie imprimée de leur résumé de même qu'une copie sur disquette sur un fichier format ASCII.

POUR INFORMATIONS:

Dr Richard Leduc
Comité organisateur
MENVIQ
2360 chemin Ste-Foy, 2ième étage
Ste-Foy, QC G1V 4H2
tél: 418-643-7880
fax: 418-643-9591

Ghyslain Jacques
Programme scientifique
MENVIQ
2360 chemin Ste-Foy, 2ième étage
Ste-Foy, QC G1V 4H2
tél: 418-644-3482
fax: 418-643-9591

CALL FOR PAPERS

26th ANNUAL CONGRESS OF THE

CANADIAN METEOROLOGICAL AND OCEANOGRAPHIC SOCIETY

LAVAL UNIVERSITY, QUEBEC CITY, JUNE 8-12 1992

You are invited to submit a paper for the 26th Annual Congress of the CMOS which will be held in Québec City June 8 to 12 1992. Laval University is the official host of the Congress where all the activities will be held.

Congress theme is "MESO-SCALE METEOROLOGY AND OCEANOGRAPHY". Papers or posters related to this theme are most welcome. Other sessions related to the various fields of meteorology, oceanography and climatology will also be held and papers or posters are also invited.

The deadline for abstracts is March 1st 1992. Authors are requested to submit a hardcopy of their abstract as well as on a diskette in an ASCII format file.

FOR INFORMATION:

Dr Richard Leduc
Organising committee
MENVIQ
2360 chemin Ste-Foy, 2ième étage
Ste-Foy, QC G1V 4H2
tél: 418-643-7880
fax: 418-643-9591

Ghyslain Jacques
Scientific programme
MENVIQ
2360 chemin Ste-Foy, 2ième étage
Ste-Foy, QC G1V 4H2
tél: 418-644-3482
fax: 418-643-9591

SCMO 26e congrès annuel
UNIVERSITÉ LAVAL, QUÉBEC
8 au 12 juin 1992
MÉTÉOROLOGIE ET OCÉANOGRAPHIE À LA MÉSOÉCHELLE
INFORMATIONS POUR L'HEBERGEMENT

Les participants doivent prendre eux-mêmes tous les arrangements nécessaires pour réserver leur chambre.

Lieu	Taux	Téléphone	Date limite
Université *	32$	418-656-2921	1 mai
Motel Universel	58$	418-653-5250	1 mars
Holiday Inn	90$	418-653-4901	1 mai
Hilton	110$	418-647-6508	17 mai

* comprend le petit déjeuner

Le nombre de chambres est limité. Les participants ont donc avantage à réserver le plus tôt possible.

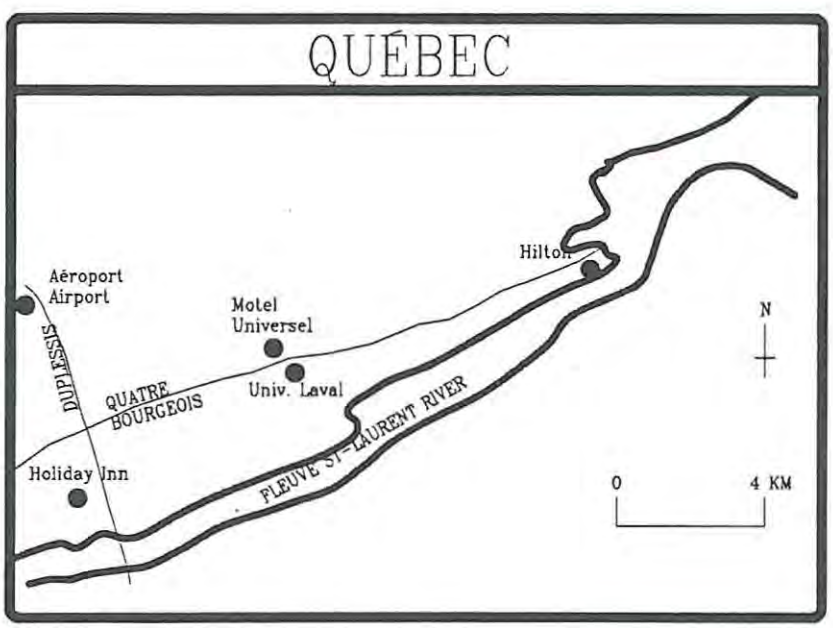
CMOS 26th Annual Congress
UNIVERSITÉ LAVAL, QUÉBEC
June 8-12, 1992
MESOSCALE METEOROLOGY AND OCEANOGRAPHY
INFORMATION FOR ACCOMODATION

All participants must make their own arrangements and reservations.

Place	Rate	Telephone	Deadline
University*	32$	418-656-2921	1 May
Motel Universel	58$	418-653-5250	1 March
Holiday Inn	90$	418-653-4901	1 May
Hilton	110$	418-647-6508	17 May

* includes breakfast

At each place the number of rooms is limited. Reservations must thus be made as soon as possible.



SCMO

26e congrès annuel

UNIVERSITÉ LAVAL, QUÉBEC

8 au 12 juin 1992

MÉTÉOROLOGIE ET OCÉANOGRAPHIE À LA MÉSOÉCHELLE

FORMULAIRE D'INSCRIPTION AU CONGRÈS

TARIFS

Membre de la SCMO		
avant le 1er mai 1992	120,00$	
après le 1er mai 1992	140,00$	
Non membre	160,00$	
Membre honoraire	50,00$	
Membre en retraite		50,00$
Etudiant	50,00$	

Nom ..... Prénom .....

Adresse .....

.....

Code postal .....

Tél: .....

		TOTAL
Catégorie:	membre SCMO avant le 1er mai	.....$
	membre SCMO après le 1er mai	.....$
	non membre de la SCMO	.....$
	membre honoraire	.....$
	membre en retraite	.....$
	étudiant	.....$
	TOTAL	.....$

COMPLÉTER ET FAITES PARVENIR À L'ADRESSE CI-DESSOUS EN INCLUANT UN CHÈQUE FAIT À L'ORDRE DU **CONGRÈS SCMO 1992**

CONGRÈS SCMO 1992
a/s M. Paul Lamb
2360 chemin Ste-Foy, 2e étage
Ste-Foy, QC, Canada
G1V 4H2

téléphone: (418) 643-7880
télécopieur: (418) 643-9591

CMOS

26th Annual Congress

UNIVERSITÉ LAVAL, QUÉBEC

June 8-12, 1992

MESOSCALE METEOROLOGY AND OCEANOGRAPHY

REGISTRATION FORM

RATES

CMOS member

before May 1 1992	120,00$
after May 1 1992	140,00$
Non member	160,00$
Honorary member	50,00$
Retired member	50,00$
Student	50,00$

Name ..... First Name .....

Address .....

.....

.....

Postal Code .....

Phone .....

		TOTAL
Category :	CMOS member before May 1 1992	.....$
	CMOS member after May 1 1992	.....$
	non member	.....$
	honorary member	.....$
	retired member	.....$
	student	.....$
	TOTAL	.....$

FILL IN AND SEND WITH CHEQUE PAYABLE TO: **CMOS CONGRESS 1992**

CONGRÈS SCMO 1992
a/s M. Paul Lamb
2360 chemin Ste-Foy, 2e étage
Ste-Foy, QC, Canada
G1V 4H2

tel: 418-643-7880
FAX: 418-643-9591

ACCREDITED CONSULTANTS/EXPERTS-CONSEIL ACCRÉDITÉS

Entries on the following pages are restricted to CMOS Accredited Consultants. The accreditation process started in December, 1986. A complete list of CMOS accredited consultants can be obtained from the CMOS Business Office. Individuals interested in applying for accreditation may contact the CMOS Business Office at the Society's Newmarket address for a copy of the guidelines, and an application form.

As set out in the document, "CMOS Guidelines for Accreditation", the criteria are:

(1) The applicant must possess an appropriate undergraduate degree from a recognized university.

(2) The applicant must possess at least one of the following types of specialised training:

   (i) post-graduate degree from a recognised university in meteorology or oceanography.

   (ii) post-graduate degree from a recognised university in the natural or applied sciences or mathematics specializing in one or more branches of meteorology or oceanography; or

   (iii) three years of on-the-job meteorological or oceanographic experience.

3) Upon completion of the above educational and training requirements, the applicant must have spent at least two years of satisfactory performance at the working level in the field of specialisation included in this document. This should include at least some consulting experience.

Les entrées sur les pages suivantes sont réservées aux experts-conseil accrédités de la SCMO. Le processus d'accréditation a débuté en décembre 1986. Une liste complète des experts-conseil accrédités de la SCMO peut être obtenue du bureau d'affaires. Les personnes désirant l'accréditation doivent entrer en contact avec la Société à Newmarket afin de recevoir une copie de règlements et un formulaire d'application.

Le document "Règlements de la SCMO pour l'accréditation" liste les critères suivants:

(1) L'applicant doit possèder un degré universitaire de premier cycle approprié d'une institution reconnue.

(2) L'applicant doit posséder au moins un des types suivants de formation spécialisée.

   (i) degré de deuxième ou troisième cycle d'une universitaire reconnue en météorologie ou océanographie;

   (ii) dégré de deuxième ou troisième cycle d'une universitaire reconnue en sciences naturelles ou appliquées ou en mathématiques avec spécialisation dans une des branches de la météorologie ou de l'océanographie; ou

   (iii) trois années d'expérience de travail en météorologie ou en océanographie.

(3) Une fois les exigences d'éducation et formation complétées, l'applicant doit avoir au moins deux années de travail, avec performance satisfaisante, dans un champ de spécialisation mentionné dans ce document. Une certaine expérience d'expert-conseil est nécessaire.

ACCREDITED CONSULTANTS/EXPERTS-CONSEILS ACCRÉDITÉS

Mory Hirt
CMOS Accredited Consultant
Applied Aviation & Operational Meteorology

Meteorology and Environmental Planning
401 Bently Street, Unit 4
Markham, Ontario, L3R 9T2 Canada
Tel: (416) 477-4120 Telex: 06-966599 (MEP MKHM)

Tom B. Low, Ph.D., P. Eng.
CMOS Accredited Consultant
Research and Development Meteorology

KelResearch Corporation
850-A Alness Street, Suite 9
Downsview, Ontario M3J 2H5 Canada
Tel: (416) 736-0521

Ian J. Miller, M.Sc.
CMOS Accredited Consultant
Marine Meteorology and Climatology, Applied Meteorology and Climatology, Storms, Waves, Operational Meteorology

MacLaren Plansearch Limited
Suite 701, Purdy's Wharf Tower
1959 Upper Water Street
Halifax, Nova Scotia B3J 3N2 Canada
Tel: (902) 421-3200 Telex 019-22718

T.W. (Terry) Krauss, Ph.D.
CMOS Accredited Consultant
Cloud Physics, Radar, Weather Modification, Storms, Research & Development

Intera Technologies Ltd.
2500, 101-6th Avenue S.W.
Calgary, Alberta T2P 3P4 Canada
Tel: (403) 266-0900

Douw G. Steyn
CMOS Accredited Consultant
Air Pollution Meteorology, Boundary Layer Meteorology, Meso-Scale Meteorology

3650 Carnarvon Street
Vancouver, British Columbia V6L 3E4 Canada
Tel: (604) 228-6407 Home: (604) 733-1255

Brian Wannamaker
CMOS Accredited Consultant
Remote Sensing, Instrumentation (oceanography) Physical Oceanography, Sea Ice/Icebergs

Sea Scan
R. R. #3,
Caledon East, Ontario L0N 1E0 Canada
Tel: (416) 880-0528

R.B.B. Dickison
CMOS Accredited Consultant
Boundary Layer Meteorology, Synoptic Meteorology Agrometeorology, Hydrometeorology, Forest Meteorology

Atlantic Weather & Environmental Consultants Ltd.
112 Bloor Street
Fredericton, New Brunswick E3A 2K4 Canada
Tel: (506) 450-8802

Mike Lepage, M.S.
CMOS Accredited Consultant
Wind Engineering, Climate Data Management Air Pollution Meteorology, Climate Research

Rowan Williams Davies & Irwin Inc.
650 Woodlawn Road West
Guelph, Ontario N1K 1B8 Canada
Tel: (519) 823-1311 Fax: (519) 823-1316

1992 MEMBERSHIP APPLICATION FORM-DEMANDE D'ADHÉSION 1992

(Please print in block letters - Lettres moulées s.v.p.)

Title: Dr___ Mr___ Mrs___ Miss___ Ms___
M ___ Mme___ Mlle___

Name/Nom _____

Address/Adresse _____

_____

_____

_____

Telephone/Téléphone res./maison _____ bus./travail _____

Occupation/Emploi _____

For records only: if student, please indicate institution and year studies will be completed.

Pour dossiers seulement: l'étudiant(e) doit inscrire le nom de son institution et l'année où il (elle) finira ses études.

MEMBERSHIP CATEGORY-CATÉGOIRE DE MEMBRE
ANNUAL FEES - COTISATION ANNUELLES
(Please check one - cochez un s.v.p.)

Regular Régulier	☐	$40.00
Student Étudiant	☐	$20.00
Retired En retraite	☐	$25.00
Sustaining Soutien	☐	$150.00 (minimum)
Corporate Corporation	☐	$200.00 (minimum)

PUBLICATION SUBSCRIPTIONS - ABONNEMENT AUX PERIODIQUES

ANNUAL RATES - ABONNEMENTS ANNUELS

		Members Membres	Non-members Non-membres	Institutions Institutions
ATMOSPHERE-OCEAN ATMOSPHERE-OCEAN	☐	$25.00	$35.00	$65.00
Climatological Bulletin Bulletin-Climatologique	☐	$15.00	$20.00	$25.00
Annual Congress Program and Abstracts Congrès Annuel Programme et Résumés	☐	$ 0.00	$15.00	$15.00

NOTE: Students receive one society publication in their annual fee and must indicate free publication desired. All regular Society publications are sent to Corporate and Sustaining Members. Members resident in Canada please add 7% GST to annual rates

NOTE: Les membres étudiant reçoivent une des publications SCMO et doivent indiquer la publication gratuite désirée. Tous les périodiques sont envoyés aux membres corporatifs et soutiens. Les membres qui résident au Canada veuillez ajouter 7% (TPS) à l'abonnement annuel.

PRIMARY FIELD OF INTEREST - SPHERE D'INTÉRÊT PRINCIPAL

Meteorology / Météorologie ☐ Oceanography / Océanographie ☐

SPECIAL INTEREST GROUP - GROUPE D'INTÉRÊT SPÉCIAL

(Indicate group if interested - Indiquez si vous avez des intérêts dans une groupe.)

Hydrology / Hydrologie ☐ Air pollution / Pollution de l'air ☐ Agriculture and Forest / Agricole et Forêt ☐

Operational Meteorology / Météorologie d'exploitation ☐ Floating Ice / Glace dérivant ☐ Mesoscale Meteorology / Météorologie de l'échelle meso ☐

Fisheries Oceanography / Océanographie des pêches ☐ Other (specify) / Autre (stipulez)_____ ☐

See over/au verso

CMOS-SCMO
P.O.Box/C.P. 334
Newmarket, Ontario
L3Y 4X7
Canada

Canada Post / Postes Canada
Postage paid / Port payé
FIRST CLASS / PREMIÈRE CLASSE
S15487
TORONTO

Please enroll me as a member of the Society. I attach a cheque for $_____ payable to the Canadian Meteorological and Oceanographic Society for membership fee and/or publication subscriptions. I also include a tax-deductible donation of $_____ for (indicate):

☐ The Society's Development Fund

☐ Other (specify) _____

_____ _____
(Signature) (Date)

If applying for student membership, please obtain signature of one of your professors.

_____ _____
(Signature) (Date)

Mail completed form to CMOS at the address above.

Je désire devenir membre de la Société. J'inclus un chéque au montant de $ _____ payable à la Société Canadienne de Météorologie et d'Océanographie pour la cotisation de membre et/ou des abonnements aux périodiques. J'inclus aussi un don déductible d'impôts de $ _____ pour (indiquez):

☐ Le fonds de développement de la Société

☐ Autre (stipulez) _____

_____ _____
(Signature) (Date)

Si vous désirez devenir membre-étudiant, veuillez obtenir la signature d'un de vos professeurs.

_____ _____
(Signature) (Date)

Faire parvenir à la SCMO la demande d'adhésion complétée à l'addresse au dessus.

Special Symposium in honour of Dr. Warren Godson's 50 years of service in Atmospheric Science in Canada. June 17th 1992, Downsview, Canada

When an individual dedicates 50 years of his or her life to a given discipline it is a singular achievement. When the work includes pioneering contributions in a wide spectrum of atmospheric research covering thermodynamics, radiation, dynamic meteorology, cloud physics, weather modification, NWP, air quality and climate change, the effort is truly extraordinary. Such is the work of Dr. Warren Godson, recently appointed Scientist Emeritus of Environment Canada.

Warren Godson is truly a unique figure in Canadian meteorological research. He was the first to earn a Ph.D. in meteorology in Canada, achieving this at the University of Toronto in 1948. His career has defined the profile of research in the Atmospheric Environment Service and its predecessor organisations. He has published some 120 papers. He was long-time Director General or Research for AES and Science Advisor to three heads of the Service. He has made significant contributions to international science and has long been active in WMO, ICSU, IUGG, IAMAP, and other science organisations. He was awarded the IMO prize in 1975. In Canada he has been honoured widely. He is a three-time winner of CMOS's President's Prize, the AES Patterson Medal, three-time winner of the RMS's Canadian Darton Prize, and is a Fellow of the Royal Society. He was elected Fellow of the American Meteorological Society and winner of the Buchen Prize of the RMS.

To honour Dr. Godson, AES has planned a special symposium on Wednesday, June 17th, 1992 at the Service's Downsview Headquarters. The Symposium will survey the broad areas of research in atmospheric science with which Dr. Godson has been associated. In a general way, the Symposium will be an historic retrospective of atmospheric research in canada over the past half century. An outstanding roster of Dr. Godson's former and current colleagues will participate in this unique Symposium.

CMOS members are invited to attend this one day event on June 17th, 1992. For further information contact either:-

Dr. Gordon Shimizu (416)-226-6320 or
Dr. Ted Turner (416)-739-4229

Notice to SIGS and Centres

Please send reports on activities of SIGS and Centres, for inclusion in the CMOS Annual Report for 1991, as soon as possible to:-

Mr. Douglas Bancroft
CMOS Corresponding Secretary
SSO METOC
MARPAC HQ
FMO Victoria
B.C. V0S 1B0

or FAX directly to (604)-363-2132.

See over/au verso

Notice to all Members

In accordance with By-Law 7(b), I am giving notice that the Annual General Meeting of the Society will be held on Tuesday June 9th, 1992 at the CMOS Congress. The meeting room and exact time will be posted at the registration desk. This meeting will include these items listed under By-Law 7(c):

1. To receive and consider the reports of the council, the Auditor, the ballot counters, the Committees, the Centres, the Chapters, the Editorial boards, and the Special Interest Groups;
2. To approve the annual budget of the Society;
3. To establish the membership fees for the next calendar year;
4. To discuss and determine such other questions as may be proposed relating to the affairs Society; and
5. To install new officers for the ensuing year.

The agenda for the Annual General Meeting will be published in the Annual Review which will be mailed to all members before the Annual General Meeting. In accordance with By-Law 10 (e) of the Canadian Meteorological and Oceanographic Society, I am providing you with:

1. The list of members of the current Council;
2. A list of nominations for 1992/93 made by the nominating committee; and
3. Notification that nominations for Council will be received in accordance with By-Law 10(d).

The Council for 1991/92 consists of:

President	Dr. L.A. Hobson
Vice-President	Dr. D. Krauel
Treasurer	Dr. S. Tabata
Recording Secretary	Dr. H. Melling
Corresponding Secretary	Mr. D. Bancroft
Past President	Ms. N. Cutler
Councillor-at-large:	Dr. R. Leduc
	Dr. K. Tai-Tee
	Mr. B. Lawson

The Council nominations for 1992/93 consist of:

President	Dr. D. Krauel
Vice-President	Dr. G. McBean
Treasurer	Dr. S. Tabata
Recording Secretary	Dr. H. Melling
Corresponding Secretary	Mr. D. Bancroft
Past President	Dr. L.A. Hobson
Councillor-at-large	Dr. R. Leduc
	Dr. G.K. Sato
	Dr. D. Daugharty

Douglas Bancroft
Corresponding Secretary

see over

Avis a tous les membres

Conformément au Règlement 7(b), je donne l'avis que l'Assemblée générale annuelle de la Société aura lieu mardi le 9 juin 9, 1992. La Salle de l'Assemblée sera affichée au kiosque d'inscription. Cette assemblée examinera les pointes contenus dans l'Article 7(c), qui sont:

1. L'acception et la prise de connaissance des rapports du conseil, des vérificateurs, des préposés au dénombrement des votes, des comités, des centres, des sections, des conseils de rédaction, et des groupes d'intérêts spéciaux;
2. L'acceptation du budget annuel de la Société;
3. La détermination des montants de la cotisation pour la prochaine année en cours;
4. La discussion et la résolution de questions soulevées se rapportant aux affaires de la Société; et
5. L'investiture des administrateurs pour la prochaine année.

L'ordre du jour pour la générale annuelle sera publiée dans la revue Annuelle qui sera envoyée a tous les membres avant la recentré annuelle. Selon les termes de l'Article 10(e) des Règlements de la Société canadienne de météorologie et d'océanographie, je vous fais parvenir:

1. La liste des membres du Conseil en cours;
2. La liste des mises en candidature pour 1992/93 telle que rédigée par le Comité des mises en Candidature; et
3. Notification que les mises en candidature pour le conseil seront recues salon les termes de l'Article 10(d).

La Conseil pour 1991/92 se compose comme suit:

Président	Dr. L.A. Hobson
Vice-président	Dr. D. Krauel
Trésorier	Dr. S. Tabata
Secrétaire d'assemblée	Dr. H. Melling
Secrétaire correspondant	Mr. D. Bancroft
Président Sortant	Ms. N. Cutler
Conseillers	Dr. R. Leduc
	Dr. K. Tai-Tee
	Mr. B. Lawson

Misses en candidature pour le Conseil pour 1992/93:

Président	Dr. D. Krauel
Vice-président	Dr. G. McBean
Trésorier	Dr. S. Tabata
Secrétaire d'assemblée	Dr. H. Melling
Secrétaire correspondant	Mr. D. Bancroft
Président Sortant	Dr. L.A. Hobson
Conseillers	Dr. R. Leduc
	Dr. G.K. Sato
	Dr. D. Daugharty

Douglas Bancroft
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au verso