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Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

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The scene above is reproduced from the front cover of "Historic Storms of the North Sea, British Isles and Northwest Europe" written by Hubert Lamb in collaboration with Knud Frydendahl and published by the Cambridge University Press. This new book is reviewed on page 14 by William R. Burrows. The picture is "Storm Warriors" painted by Thomas Rose Miles (1869-1888) and is reproduced here by kind permission of David Oliver May, Esq, FRINA of Leamington Marina, England, U.K.

EDITOR'S COLUMN

The next issue of the CMOS Newsletter 20(3), June 1992, will go to press on May 20th, 1992. Contributions are welcome and should be sent to me at:-

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I prefer receiving contributions submitted on floppy disk in a DOS format. At the present time I have no way of making any use of a Macintosh file.

Do you have an interesting photograph of a 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

There are a number of problems that occupy the minds of most active scientists. Perhaps the commonest is the problem of finding a secure source of funding that will last a lifetime. Another is where the next big party will be. There really are some major anniversaries coming up soon, and in this column I will outline a few options for some really big parties in the next few years.

The "hot topic" in the geophysical sciences today is without doubt the Greenhouse Effect. On the 11th of December 1895 a paper was presented at a meeting of the Royal Swedish Academy of Sciences that was subsequently translated and published in Phil. Mag. S. 5 Vol. 41 (251), April 1896. The paper was by Professor Svante Arrhenius and carried the title, "On the influence of carbonic acid in the air upon temperature of the ground". The paper is astonishing. Prof. Arrhenius in 1896 estimated that if $p[CO_2]$ were doubled in the atmosphere that the mean temperature of the atmosphere might rise by about 5°C. He points out that the increase would be somewhat larger in polar regions and somewhat less near the equator. In the final section of the paper he discusses the roles of oceanic plankton, forests, oceanic carbonate sedimentation etc etc. One might fairly consider, therefore, that the "Greenhouse Effect" in particular and the current fashion for "holistic earth sciences" are not new ideas but almost 100 years old. I think we owe Prof. Arrhenius a big bash on the 11th of December 1995.

The next big celebration will of course be the start of the third millennium, but when will that be? The guess that springs to mind is January 1st 2000. But (with some help from Allan H. Batten of Victoria, B.C.) we can think a little bit more carefully. Dionysius Exiguus (Little Dennis) lived in the 6th century and tried to calculate the actual birthdate of Jesus. He supposed that Jesus was born on Christmas day. However, that must be wrong, how many lambs do we see leaping around the green fields on December 25th? Anyway, he figured that Jesus was born Dec. 25th 753 AUC (from the founding of Rome) and called Jan 1st 754 AUC the year 1 AD. The problem is that if Dennis had been an Arab Jan 1st 754 AUC would have been called 0 AD in his new dating scheme, because the Arabs knew about zero, but western Europeans didn't. The Arabs brought us that concept during the great days of the Islamic empire but unfortunately Dennis knew nothing of Mohammed. Arab numerals and Dennis's dates came into general use in Europe about the same time, about 1200. Thus, the first century AD consists of the years 1 through 100, the first millennium is years 1 through 1000, and the second millennium consists of years 1001 through 2000. Thus the 21st century and the third millennium begin January 1st 2001. If only it were that simple! Dennis, of course, messed up his calculations. Well, you try and do it without Arab numerals! What he actually decided was that I AD = DCCLIV AUC. We know from the Bible (that was the text that Dennis used) that Herod was alive in what should have been I AD, and we now know, from records that Dennis didn't have, that Herod died in DCCL AUC so Dennis was at least IV out! So we have three options for celebrating the beginning of the third millennium, Jan 1st 2000, Jan 1st 2001 and Jan 1st 1997 (or possibly 1996 or 1995). Perhaps to be safe we should plan big bashes on each of these dates.

Finally, the big one! The famous Irish Divine (or infamous geophysicist) Archbishop Ussher of Armagh who flourished in the 17th century proved conclusively that the Earth was created at nine o'clock in the morning on October 23rd, 4004 BC. Thus we deduce that on October 23rd 1997 we can celebrate the 6000th birthday of the Earth itself. Incidentally, Oct 23rd 4004 BC was a Saturday.

If any of my faithful readers would like to contribute more suggestions for major geophysical celebrations I would be happy to carry descriptions.

McGILL UNIVERSITY
Department of Atmospheric and Oceanic Sciences.

The Department of Atmospheric and Oceanic Sciences of McGill University invites applications for a tenure-track position at the Assistant Professor level in global ocean circulation modelling. Applicants should have a Ph.D. in meteorology, oceanography or related discipline, with demonstrated expertise in global scale ocean modelling. The successful candidate will be expected to conduct an active program of research in ocean/climate modelling, supervise graduate students, and teach undergraduate and graduate courses. The appointee will also be expected to participate in the activities of CERCA, a research centre specializing in computational fluid dynamics that was recently established by four Montreal universities. Applicants should send a curriculum vitae, a list of publications, the names of three referees, and a statement of research interests to Professor H.G. Leighton, Chair, Department of Atmospheric and Oceanic Sciences, McGill University, 805 Sherbrooke St. W., Montreal, H3A 2K6, Canada. Telephone: 514-398-3760; Fax: 514-398-6115. Applications will be considered as they are received. The appointment is expected to begin in January 1993, but an earlier starting date is possible. Salary will be commensurate with qualifications. In accordance with Canadian immigration requirements, this advertisement is directed in the first instance to Canadian citizens and permanent residents of Canada. McGill University is committed to equity in employment.

March 16, 1992

Canadian Climate Research Network

Dr. John M.R. Stone, Director, Climate Research Division, Canadian Climate Centre

Background: The government, in its Green Plan, set out a major challenge to scientists: to significantly improve our ability to predict climate change, specifically its magnitude, rate and regional characteristics. This is an enormous scientific challenge in light of our present knowledge of climate processes, and our limited ability to simulate the global climate. However, it is a challenge which the government cannot realize on its own - it will need to mobilize all the expertise it can. One of the mechanisms that is being developed to foster climate research in Canada is a **Climate Research Network**. The government has recently announced a $85 million program to help achieve its goal, and a significant portion will be directed toward establishing the Network.

Approach: The Network will require the collaboration of scientists from different disciplines, sectors, and parts of the country, as well as enhanced Canadian participation in internationally coordinated programs. The Network will put in place mechanisms to stimulate and coordinate climate research, and to facilitate exchange of personnel and the transfer of information and data. A high speed electronic network is proposed to handle the later aspect, and access to supercomputer resources will be essential.

The Network will consist primarily of a series of "nodes" which address key components of the climate research agenda. Each node will have a critical mass of expertise focused on a particular theme, and will involve close collaboration with researchers from universities, government and the private sector. Individual nodes may not be organized identically. However, they will all serve the same function of focusing, coordinating and enhancing climate research. The nodes will not be geographically constrained as the communications network will enable scientists from across Canada to participate in the research activities of a given node. The communications network will also facilitate interchange between nodes.

The research partnerships required to address the scientific agenda cannot be imposed; they must be built from the ground-up. This process is being initiated by holding a series of Workshops across the country on important elements of the research agenda. Workshops have already been held on **Ocean Circulation Modelling** (Victoria, October 23-24, 1991) and **Land Surface Processes and Climate** (Saskatoon, December 11-13, 1991). Additional Workshops are planned in 1992 to cover themes such as Chemistry and Climate, Climate Variability, Clouds, and Paleoclimatology.

The management of the multi-sectorial Network and its nodes, and the securing of long-term funding partnerships are major challenges. A contract has been let to a management consulting firm to provide advice on these aspects of the Network. It is envisaged that a governing body, composed of the principal partners in the Network, will be established to set general directions, and that advice and scientific priorities will be obtained from a scientific panel. Long term, stable funding for the Network is a high priority considering the time scale required to develop a next generation global climate model, and the need to develop additional climate research expertise. This process assumes that Green Plan resources can be used to lever additional resources from other sectors.

The Network will also establish a **Climate Integration and Prediction Centre** to: (1) apply the results of the research gained from the Network and elsewhere; (2) simulate future climates of Canada and its regions under different emission scenarios; and (3) assist in the development of both limitation and adaptation policies. A feasibility study of the proposed Integration and Prediction Centre is currently being carried out.

The first two nodes are anticipated to be established by 1993/94. Remaining nodes will be established by 1995. A high speed electronic data network, most likely built upon existing networks and their successors, is planned to be in place in 1994. For further information on the Network please contact the Coordinator, Mr. Ross Brown, at (613) 996-4488.

Workshop on Land Surface Processes and Climate

Background: A workshop on land surface processes research was held at the National Hydrology Research Centre in Saskatoon on December 12-13, 1991. Over 40 Canadian researchers from universities, government (federal and provincial) and the private sector met to discuss issues in land surface climate process research, and to provide advice to AES on how research activities can be coordinated and enhanced within the proposed **Canadian Climate Research Network**. The workshop organizing committee was made up of representatives from the Canadian Climate Centre, National Hydrology Research Institute, Forestry Canada and Agriculture Canada. The specific objectives of the Workshop were: (1) to review the state of understanding of land surface processes, and the ability of modellers to incorporate these processes into atmospheric and hydrologic models; (2) to discuss future scientific requirements for land processes research; and (3) to discuss and make recommendations on mechanisms for facilitating land processes research.

Presentations: Over 20 scientific presentations were made at the workshop covering a diversity of material from vegetation-atmosphere feedbacks, to improved snowmelt models for areas with permafrost. A summary report describing key elements of the presentations can be obtained from Rick Lawford at (306) 975-5775. In addition to scientific presentations, Green Plan climate research initiatives were outlined for Environment Canada, Agriculture Canada and Forestry Canada. Special presentations were also made on GCM land surface schemes, the Canadian Climate Research Network, and Canadian activities in the BOREAS and GEWEX experiments.

Working Groups: On the afternoon of the second day, participants were formed into three working groups (two hydrological and one biogeochemical) to discuss a series of questions relating to land surface process research, and how land surface processes might be more effectively incorporated into GCMs. The responses of each working group were reported by K. King (U. Guelph), E. Soulis (U. Waterloo) and

M-K Woo (McMaster U.), and were subsequently synthesized by G. McBean (UBC):

Research Priorities: It was generally agreed that one of the major priorities in land surface process research was understanding the **scaling problem** i.e. how does one integrate processes taking place at the individual leaf up to the forest and ecosystem scales and *vice versa*? E. Soulis indicated that complex surface heterogeneity was able to be incorporated in the Waterloo distributed hydrological model by using a grouped response unit approach up to a resolution of 10 km. **This is only one order of magnitude lower than the resolution of current GCMs** and may represent an optimum resolution for integrating land surface processes into GCMs. **It was recommended that 10 km be a "target" resolution for land process modellers and GCM modellers to meet at.**

One of the working groups felt that research was needed on **natural systems** and **biogeochemical cycling.** Understanding the **fluxes of greenhouse gases** was considered to be very important, especially the **sources and sinks** for different biological systems. It was also agreed that research was needed on understanding the **linkages and feedbacks** operating in natural systems, and that **important feedbacks such as vegetation succession models must be included in GCMs to obtain better predictions of climate change.**

It was suggested that research priorities could only be established if one had some idea of the **sensitivity** of the climate to a particular land surface process. It was recommended **climate modellers could provide some of the direction through sensitivity analysis of GCMs and regional climate models** to different parameterizations of surface processes e.g. the comparison of GCM runs by D. Verseghy (CCC) to examine the effect of including a depression storage component for runoff.

It was also generally recognized that **a greater effort needed to be made in collecting data for validating process models** (e.g. snow and evapotranspiration) **and for monitoring key processes** such as wetland methane production. Significant shortcomings were noted for single summer data collection efforts which fail to measure seasonal or interannual variation in processes. There was also a need expressed for **better data for input to and validation of GCMs,** e.g. D. Verseghy noted major temperature anomalies in the CCC GCM over desert areas which are suspected to be caused by incorrect surface albedo values.

A summary of future needs for improving land surface models was presented by D. Verseghy which included:

Better understanding of the large-scale physical characteristics of global vegetation types:

- albedo (including diurnal and seasonal variations)
- snow masking characteristics
- precipitation interception characteristics
- dependence of stomatal resistance on environmental factors
- seasonal variation of canopy parameters (e.g. leaf area index)
- role in carbon and trace gas cycling
- effects causing irreversible changes in the biome

Better understanding of the hydrological characteristics (including spatial variability) of different soil/landscape types:

- soil permeability
- characteristic slope
- snow accumulation patterns
- terrain effect on surface soil moisture
- characteristics of groundwater flow
- runoff routing

Better global data sets of:

- evaporation
- surface temperature
- snow cover
- surface soil moisture
- runoff
- seasonal cropping patterns

Problems Facing Land Surface Process Research: The most commonly cited hindrance to a more integrated approach to land surface process research was the **heterogeneous nature of the subject.** It was generally felt that **Canada has the required expertise in land surface process research, but the expertise is spread very thinly.** The result is a wide distribution of researchers who are not naturally cohesive, and who rarely get the opportunity to collaborate. There were also few people working on integrating the results of research from all the different fields.

In addition to insufficient research funding, the point was raised that the **non-prioritized nature of NSERC funding** was a hindrance to meeting major research objectives such as better understanding of climate change. E. Soulis argued that there should be clear priorities attached to funding so researchers knew where to concentrate their efforts. This led to some debate whether science needed to be more focused, or whether it should be left to organize itself from the bottom-up.

It was noted that while remotely-sensed data is often seen as the panacea for land surface science, **significant work still needs to be done for remotely-sensed data to be effectively incorporated into models** (e.g. groundtruthing and data assimilation). There were also concerns expressed regarding the accessibility, transmission, storage and cost of remotely-sensed data.

Research Coordination: It was agreed **the research agenda should be developed from the bottom-up,** but the need for science-directed research was also recognized. The challenge was to find the right mix. **Regional or systems themes were proposed as effective ways to promote collaboration and multi-disciplinary research, which dictates a distributed organization rather than a centralized one.** It was noted that the small number of researchers in the Canadian land surface process research community meant that large research experiments must be carefully coordinated to avoid spreading the available talent too thinly. It was proposed that the Royal Society might undertake this role through its Global Change Program.

It was recognized **there was a real need for better communication** through workshops and possibly an electronic mail network. **It was suggested that a core group of people be identified to form a Working Group on Land Surface Process Research** modelled after the National Wetlands Working Group. This group would be responsible for further developing the issues and ideas presented at the workshop, and for holding another workshop to develop a more definite concept of how land surface process research would fit into the proposed Climate Research Network.

Up-Coming Climate-Related Research Meetings in Canada

Whitehorse, May 12-14, 1992: Workshop on the Impacts of Climate Change on Resource Management of the North. The main purpose is to promote dialogue between federal agencies, the scientific research community and local groups about various aspects of climate change. Contact: Al Malinauskas (416) 739-4431.

Montréal, May 12-15, 1992: Joint spring meeting of the American and Canadian Geophysical Unions and the Mineralogical Society of America. Special sessions are planned on: Interactions between Synoptic and Mesoscale Weather Systems (Dr. Ron Stewart 416-739-4608), and Arctic Physical Oceanography (Dr. Lawrence Mysak 514-398-3759). The latter session will have a special emphasis on northern Atlantic-Arctic ocean/ice interactions.

Québec City, June 8-12, 1992: 26th Annual CMOS Congress. The theme of the congress is mesoscale meteorology and oceanography. Direct all enquiries by FAX to (418) 643-9591.

Edmonton, June 15-18, 1992: Wave Phenomena II: Modern Theory and Applications. Organized by the Canadian Applied Mathematics Society; theme topics include waves in the ocean and atmosphere. Contact: Dr. Gordon Swaters FAX (403) 492-6826.

Toronto, June 22-26, 1992: Fifth International Meeting on Statistical Climatology; 12th Conference on Probability and Statistics in the Atmospheric Sciences. The joint theme of the collocated meetings is detection of the enhanced greenhouse effect. Contact: Dr. Francis Zwiers (416) 739-4415.

Victoria, July, 1992: International Workshop on the Cox-Bryan Modular Ocean Model (MOM). Final date to be announced. Contacts: Dr. Greg Holloway EMAIL ZOUNDS@IOS.BC.CA or Warren Lee EMAIL WARREN@OCGY.UBC.CA.

Toronto, Aug. 10-14, 1992: Workshop on Cloud Microphysics and Applications to Global Change. This workshop, held in conjunction with the Third International Cloud Modelling Workshop, will focus on the relationship between cloud microphysics and global change using measurements taken from around the world. Contact: Dr. George Isaac (416) 739-4605.

Toronto, Aug. 10-14, 1992: Third International Cloud Modelling Workshop. The primary focus will be on the simulation of precipitation processes in cloud-scale and mesoscale systems. Contact: Dr. Harold Orville (605) 394-2291.

Montréal, Aug. 17-21, 1992: 11th International Conference on Clouds and Precipitation. The conference will cover a broad range of subject matter including the radiative effects of clouds, the effects of clouds on global climate, and clouds and precipitation in relation to the hydrological cycle. Contact: Conference Office (514) 398-3770.

Victoria, Oct. 13-16, 1992: International Symposium on Climate Change and Northern Fish Populations. Topics will include evidence for changes in climate and the resulting effects in freshwater and marine environments. Contact: Symposium Secretary (604) 756-7260.

Correction

Readers please note that a change should have been made to the report in the last CMOS newsletter on the **Workshop on Ocean Circulation Modelling** held at Victoria. In the second paragraph of the report, the third sentence should have read "Richard Greatbatch discussed modelling of the Labrador Current and interannual circulation changes in the North Atlantic". My sincere apologies to Richard for not including this change.

New CMOS Members

The following new members were approved at the CMOS Executive meeting 14th February, 1992:

Daniel Caya	Montréal, Qc.	(student)
Hélène Côté	Montréal, Qc.	(student)
David Daugharty	Fredericton, N.B.	(regular)
Adrian Dolling	Victoria, B.C.	(regular)
Anna Deptuch-Stapf	Dowsnview, Ont.	(regular)
Ann Godin	Vancouver, B.C.	(regular)
Stephane Goyette	Montréal, Qc.	(student)
Luc Fillion	Dorval, Qc.	(regular)
Thomas King	Halifax, N.S.	(student)
Anna Koziol	Montréal, Qc.	(student)
Muriel Lavoie	Sillery, Qc	(student)
Dimitris Menemenlis	Victoria, B.C.	(student)
Keith Moore	Toronto, Ont.	(regular)
John O'Reilly	Georgetown, Ont.	(retired)
William Parker	Dunster, B.C.	(regular)
Chantal Rivest	Dorval, Qc	(regular)

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.

Statement on Atmospheric Change

The following Position Statement was prepared by the C.M.O.S. Scientific Committee and was approved for distribution by the C.M.O.S. Council on February 14th, 1992.

The atmosphere is a thin blanket of air that makes life on Earth possible. Unlike our neighbouring planets, the Earth has an atmosphere that is predominantly nitrogen and oxygen but with many trace chemical species of highly variable concentration. The atmosphere provides us with life-giving oxygen and precipitation, shields us from harmful solar radiation and keeps our planet's temperature at a habitable level due to a natural greenhouse effect caused by water vapour and carbon dioxide. The atmosphere is an integral part of the total Earth system and, through the global wind systems, provides global connectivity.

Recently, human activities have begun to alter significantly the composition of the atmosphere. Many of these activities, such as combustion of fossil fuels in automobiles and otherwise, occur on urban scales yet yield impacts on regional and global scales, increasing carbon dioxide concentrations. Regional activities, such as increased use of artificial fertilizers, biomass burning and deforestation, also give rise to increased emissions of gases, such as nitrous oxide, methane and oxides of carbon. These emissions are sufficiently important that they lead to global increases in the concentrations of these gases. Some of the gases have relatively short lifetimes, for example, days for nitric oxide, but others have lifetimes of a decade, methane to a century, chlorofluorocarbons, nitrous oxide and carbon dioxide. The lifetime is a measure of the length of time that typical molecules remain in the atmosphere. Clearly, gases with such long lifetimes are a cause for concern since the response time for remedial action is so long. Environmental change is not limited to the atmosphere: however, here atmospheric change is emphasized.

Urban environments have long been among the first regions to suffer from human alteration of the atmosphere. The congestion of people, transportation systems and industries has led to substantial air pollution. Although ambient sulphur dioxide and particulate concentrations have been reduced in most Canadian cities (unlike the situation in many urban areas of the developing world) through the imposition of strict emission standards, problems with oxidants and their precursors remain. The use of cleaner fuels and the development of more stringent control strategies are still required.

Concentrations of ozone and other photochemical oxidants in the lower atmosphere have been increasing within and downwind of urban areas and throughout the Northern Hemisphere. Smog and reduced visibility are the most obvious results of these pollutants. Increasing anthropogenic emissions of nitrogen oxides and non-methane hydrocarbons are the cause, but natural volatile organic compounds also play a role. These oxidants can cause damage to both humans and to vegetation. Elevated concentrations of ozone are common in parts of Atlantic Canada, in the Lower Great Lakes - St. Lawrence valley region, and in the greater Vancouver region. A Federal program has recently been established to address this problem in Canada, but the study of related changes in the oxidising capacity of the background atmosphere is still at the research stage.

Concern about damage to Canadian ecosystems due to the acidification of precipitation was first raised in the 1970s. Extensive evidence of long range transport of sulphur and nitrogen pollutants, of resulting acidification of precipitation, and of damage to aquatic and terrestrial ecosystems and to materials in canada has been documented. However, only in the last few years have agreements been reached in North America to reduce emissions of acid forming pollutants. Severe acidification damage to Canadian soils, forests and lakes still exists, and it will be some time before the overall impact of current emission reductions on the recovery of ecosystems becomes known.

Toxic chemicals, such as synthetic organics (e.g., pesticides) and trace metals (e.g., mercury and cadmium), continue to be released into the environment. These chemicals may be transported long distances through the atmosphere to the Canadian Arctic, for example, where they accumulate in sensitive biological systems and may be toxic to plants, animals and humans. At present the emissions inventory of toxic chemicals to the atmosphere is poorly known, but their impacts in the Great Lakes Basin and the Canadian Arctic are a significant concern.

A recent dramatic discovery of anthropogenic impact on the atmosphere has been the identification of the hole in the Antarctic stratospheric ozone layer, in 1985. Halogenated compounds released from air conditioning systems, foam blowing, and other industrial uses are believed to be the cause. The ozone layer in the Arctic is showing evidence of similar perturbations, but to a lesser degree; as well, stratospheric ozone levels are decreasing in other regions. Destruction of the stratospheric ozone leads to increases in the amount of solar ultraviolet radiation (UV-B) reaching the Earth's surface. Excess UV-B can induce skin cancers, eye damage and suppression of immune systems in humans, and can affect the productivity of aquatic and terrestrial plants. If stratospheric ozone depletion continues, it will pose severe problems for the whole biosphere. The Vienna Convention, Montreal Protocol and the London Amendment on the protection of the ozone layer require phasing out of certain chlorofluorocarbons and related substances. However, even if the emission of chlorofluorocarbons was to stop immediately, the atmosphere would not recover for 50-60 years.

The natural greenhouse effect has maintained the Earth's temperature more than 30°C warmer than it would otherwise be. Human activities are now adding to the atmospheric

Statement on Atmospheric Change (continued)

greenhouse gas concentrations. Atmospheric carbon dioxide has increased by 25% since the beginning of industrialization and the concentrations of methane, nitrous oxide, tropospheric ozone and particularly chlorofluorocarbons have increased at even greater rates. If these rates of increase continue through the next century, current predictions arethat the global average temperature will increase by about3°C by 2100. However, there is considerable uncertainty in this prediction. Natural cycles of greenhouse gases are very complex and it is not clear how they will respond to continued loading by human activities. Processes in the climate system, mostly involving interactions of atmospheric radiation and water, serve to amplify climate warming and the magnitude of these amplifiers is uncertain. The great thermal capacity of the oceans will delay climate warming. Over the past century, the average global surface temperature has increased by about ½°C and the 1980s was the warmest decade on record. Whether this warming is due to the increased atmospheric concentrations of greenhouse gases, how much has been delayed by the oceans, or whether other factors, such as aerosols, have partially counterbalanced greenhouse warming is not known. It is clear, however, that climate change of the predicted magnitude would have significant impacts on the environment and human activities. If steps are taken to reduce net emissions of greenhouse gases to the atmosphere, the rate of climate change will be reduced. Within the United Nations International Negotiating Committee, discussions have already started for a Framework Convention on Climate Change.

It is important to realise the time and space scales of these issues. Urban air pollution is largely locally generated and can be countered on a regional basis. If the decision were made today to stop polluting the urban environment, noticeable improvement would quickly be evident since most urban pollutants have lifetimes of days. However, carbon dioxide accumulates in the atmosphere with a lifetime of about a century. Hence, the benefits of a decision made today to reduce emissions would not be apparent for a long time. Since these emissions accumulate in the atmosphere, the sooner action is taken, the less drastic will later action need to be.

In conclusion, our planet, through interactions of the atmosphere, oceans, cryosphere and biosphere, has maintained a climate and an atmosphere sufficient to sustain life for millions of years. Many natural stresses have been placed on the atmosphere over this period and variations in the composition of the atmosphere and in the climate have occurred. Recently, however, human activity has placed additional stresses on the system which have unquestionably altered the composition of the atmosphere and which may significantly influence our climate. Some of these anthropogenic stresses are being relieved through regional (for example, the Canada-USA Air Quality Accord) and global (the Montreal Protocol) remedial measures; such actions must continue. Simultaneously, however, we must strive to improve our understanding of the effects that these stresses have already had on our atmosphere and will have in the future.

What can we in Canada do? Canada must continue and enhance a national program of long-term monitoring of climate and atmospheric composition, research for understanding the processes and consequences of human alteration of the atmosphere, and limiting their adverse effects. We must also contribute to related international activities because these issues transcend national boundaries. As a country with a vast environment, fragile ecosystems extending into the Arctic, a resource-based economy and a national pride in our environmental awareness and conscience, Canada must move to the forefront of nations. All Canadians have a stake in the changes occurring in our atmosphere and climate system and in their consequences. Humans are a part, a major part, or the problem and we must all, as individuals and collectively, play our role in providing solutions.

HydroGIS-93

International Conference on
Application of Geographic Information Systems
in Hydrology and Water Resources Management
Baden (Vienna), Austria, 19-22 April 1993

Objectives and Scope: The objective of this conference is to exchange experience in the application of GIS and to identify research needs with respect to specific requirements of hydrology and water resources. The conference will provide a forum for identifying the benefits and needs in application of GIS in the water-related research and decision-making field. Contributions are solicited from the fields of groundwater hydrology, surface water hydrology, agrohydrology, ecohydrology, etc.

Contributions should address the software aspects, applications, hardware requirements, standardization and research requirements. Especially welcome is work on the hydrological modelling aspects in relation to GIS, both relating to the development of the simulation software and application of models in practice.

Call for Papers: Participants intending to present a paper are requested to send a 1 to 2 page abstract in English to the Conference Secretariat.

HydroGIS 93
c/o Interconvention
Austria Center Vienna
A-1450 Vienna, Austria
Tel. +43-(222)-23-69-2641
Fax. +43-(222)-23-69-648

JGOFS NEWS

The Joint Global Ocean Flux Study (JGOFS) is an international research project organized by the Scientific Committee on Oceanic Research (SCOR) under the auspices of the International Council of Scientific Unions (ICSU), whose aim is to realize a basic understanding of the fluxes of carbon and related nutrient elements through the oceans and across their boundaries in order to provide some of the knowledge required for understanding the role of the ocean in the global carbon cycle and climate change.

The Canadian JGOFS Project, which is designed to contribute to this effort, has recently received funding from NSERC for an initial three-year period. The project grew out of a workshop held at McGill University in October, 1988; a National Plan was published in January, 1989, and a collaborative proposal was submitted to NSERC in November, 1990.

The Canadian JGOFS Project is a collaborative research venture involving scientists from the universities, DFO, AES and EMR. The NSERC funding is for the support of the university activities, while the work in government laboratories is supported by internal funding, together with monies from the Green Plan. A total of 58 individual researchers will work on 25 projects organized around three major themes. These are (with the names and affiliations of the Project Leaders):

Theme I: GAS EXCHANGE AT THE SEA SURFACE

1. Re-evaluation of the eddy flux correlation method (Owen Hertzman, Dalhousie)
2. Exchange of major atmospheric gases (Bruce Johnson, Dalhousie)
3. Bubble measurements and gas exchange (David Farmer, IOS, Sidney)
4. Study of white caps (Bryan Kerman, AES, Downsview)
5. CO2 system in the ocean (Peter Jones, BIO, Dartmouth and C.S. Wong, IOS, Sidney)

Theme II: TRANSFORMATIONS AND TRANSPORTS OF CARBON IN THE OCEAN

6. Spectral irradiance at the sea surface and the interior of the ocean (Trevor Platt, BIO, Dartmouth and Shubha Sathyendranath, Dalhousie)
7. New and regenerated primary production in coastal and open ocean waters (Paul Harrison, UBC)
8. Stable isotope tracers of particulate transport and cycling (Steve Calvert, UBC)
9. Abundance, distribution and growth of ultraphytoplankton and bacterioplankton (William Li, BIO, Dartmouth)
10. Biological-mediated export of carbon from the euphotic zone (Louis Legendre, Laval)
11. Herbivory and bacterivory by microzooplankton, mesozooplankton and pelagic tunicates; influence on the vertical flux of organic matter (Don Deibel, Memorial)
12. The microbial food web and carbon export from the euphotic zone (Louis Legendre, Laval)
13. Biological stratification in the ocean and global carbon flux (Alan Longhurst, BIO, Dartmouth)
14. Transport of CO_2 from the atmosphere to the deep ocean (Peter Jones, BIO, Dartmouth)
15. Net ocean carbon flux and the biological pump in the North Pacific Ocean (C.S. Wong, IOS, Sidney)
16. Processes controlling carbon fluxes in the equatorial Pacific (Marlon Lewis, Dalhousie)
17. Processes controlling vertical exchanges in the Subarctic Pacific and the eastern Pacific continental margin (Kenneth Denman, IOS, Sidney)
18. Horizontal flux of nutrients and organisms across the British Columbia shelf break (David Mackas, IOS, Sidney)
19. A three-dimensional plankton model for the North Atlantic (Geoffrey Evans, DFO, Newfoundland)
20. Modelling of physical and biological processes in the global oceanic carbon cycle (Charles Lin, McGill)
21. Ocean carbon cycle dynamics (C.S. Wong, IOS, Sidney)
22. Application of inverse theory to the study of biological transformations of carbon in the ocean (Alain Vézina, IML, Mont Joli)

Theme III: THE BURIAL OF CARBON IN THE OCEAN

23. Factors and processes controlling carbon burial and regeneration in modern sediments (Bernard Boudreau, Dalhousie)
24. Carbon burial on century time-scales (Verena Tunnicliffe, Victoria)
25. Oceanographic controls of carbon burial on glacial-interglacial time-scales in the equatorial Pacific (Larry Mayer, UNB and Thomas Pedersen, UBC)

The JGOFS Committee, originally appointed by CNC-SCOR to develop the project, is now working, with two additional members, as an Interim Steering Committee to establish the permanent Steering and Scientific Advisory Committees and the Secretariat. The latter will be based in the Oceanography Department at Dalhousie University.

Field work will begin during the Spring and Summer months, and a workshop to review initial results and proposed work for the second year will be held in October, 1992.

Submitted by the Canadian JGOFS Interim Steering Committee:

Bernard Boudreau (Dalhousie)
Steve Calvert (UBC)
Louis Legendre (Laval)
Marlon Lewis (Dalhousie)
Trevor Platt (BIO)
Ken Denman (IOS)
Ken Mann (BIO)
Alain Vézina (IML)
C.S. Wong (IOS)

Canadian Participation in the World Ocean Circulation Experiment Call for Proposals

Proposals are invited from researchers in Canadian universities for funding of research activities in support of the objectives of the World Ocean Circulation Experiment (WOCE) through NSERC's Collaborative Research Initiatives program. Funding to start Jul 1, 1993.

Proposals may consist of requests for continuation of research supported during the first round of funding (starting in 1990), or of new investigations.

All submissions must explain in detail how the work proposed will contribute to WOCE objectives and network with international WOCE activities. Detailed milestones of work to be performed must be provided. Budgets for up to three years may be submitted. Evidence must be provided of ship availability for any work to be done at sea. Proposals must be written on appropriate NSERC CSPP Grant forms (these will ba available from the WOCE Secretariat) and be accompanied by a NSERC personal data form.

Investigators funded under the first round of WOCE funding must submit, whether for continuation of previous research or for new initiatives, a separate (not on NSERC forms), extensive report of progress against milestones, evidence of contributions to and networking within WOCE, publications arising, and a financial report.

Information about WOCE and about previously funded Canadian projects may be requested from the Canadian WOCE Secretariat, c/o Ms Elsa Traczynski, Dept. Oceanography, University of B.C. Vancouver, B.C. V6T 1Z4; fax = 604-822-6091; OMNET: P.LEBLOND.

Proposals must reach the Canadian WOCE Secretariat by May 10, 1992; they will first be reviewed internally by the Canadian National Committee for WOCE, allowing some feedback to proponents, before going out for international review. Selected proposals will be submitted to NSERC in late Sept. 1992 for possible decision in May 1993.

Canadian WOCE Secretariat Moves

As of July 1st, 1992, the Canadian WOCE Secretariat will move to Dalhousie University where Dr. Barry Ruddick will take over as Chairman of the Canadian National Committee for WOCE. Correspondance sent to the present Secretariat will be forwarded starting on that date to the new address:

Canadian WOCE Secretariat
c/o Dr. Barry Ruddick
Department of Oceanography
Dalhousie University
Halifax, N.S. B3H 4J1
Canada.

OMNET DALHOUSIE.OCEAN
Tel: (902)-494-2505
Fax: (902)-494-3877

Modelling Efforts at UBC

William Hsieh

Open boundary conditions, in particular radiating boundary conditions, have been applied to regional circulation models with mixed success. The adjoint assimilation method enables optimal open-boundary control by assimilating data inside the model domain. The present availability of altimetry data prompted us to investigate the feasibility of using altimetry data to control an open-boundary ocean model optimally. To begin this exploration Dr Jieping Zou assimilated data from a 2-gyre closed-domain barotropic quasi-geostrophic model into a smaller regional open-boundary QG model of the northern gyre. Preliminary numerical experiments with our new scheme for optimal boundary control appear promising. The long-term goal will be to develop an open-boundary adjoint assimilation model of the North pacific sub-Arctic domain.

Numerical global ocean models tend to resolve many smaller scale phenomena poorly. Equatorial Kelvin waves, which are responsible for the onset of El Niño, have a longitudinal e-folding scale of only 250 km, and their resolvability in conventional coarse-resolution global models is, therefore, questionable. Max Ng has studied the behaviour of equatorial Kelvin waves in finite difference models with the Arakawa B or C grids first by considering the inviscid case, and then the Rayleigh damping case. Exact analytical solutions for these finite-differenced equatorial Kelvin waves are found in terms of modified Bessel functions. Potential applications of this theory include estimating the accuracy of zonal heat transport in numerical models by the kelvin wave during an El Niño, and generalizing the finite-difference effects to the equatorial current system.

Tracer Experiment Planned for the N. Atlantic

Scientists participating in the North Atlantic Tracer Release Experiment (NATRE) met at the Woods Hole Oceanographic Institution (WHOI) in January to finalize plans for the field program, to begin in March 1992. NATRE, as part of WOCE Core Project 3 (Gyre Dynamics), will obtain the first direct measurements of "diapycnal" mixing rate in the main thermocline of any ocean basin. Diapycnal mixing is mixing between parcels of water having different densities, such as occur in a thermocline.

The experiment involves the release of a chemically inert,easily measurable tracer and a set of neutrally buoyant drifters on a target isopycnal water mass, and measurement of the subsequent tracer dispersion. Details of the program description are to be found in reports of Core Project 3 discussions.

An estimate of the strength of diapycnal mixing is of crucial importance to understanding the dynamics of ocean circulation and the temperature and salinity structure of water masses.

In March, the first cruise of the experiment on RV Oceanus (WHOI) will identify the best site, in the vicinity of the central mooring of the planned Subduction Experiment array, in the eastern North Atlantic (near 27°N, 28°E), . In April the same

vessel will inject the tracer precisely at 300 metres over an area of about 1 square kilometre. At the same time, ten neutrally buoyant floats will be deployed in the patch of the tracer for tracking the dye. In addition, two "Richardson Number" (RiNo for short) floats will be delpoyed to measure current shear in the vicinity of the tracer. Following injection, the British research ship Darwin will conduct a detailed survey on the dye patch to determine its initial size and exact location. Oceanus will repeat the tracer survey in October. By this time the patch should be much thicker and spread out horizontally as it diffuses.

Observations of turbulent microstructure needed to understand local mixing processes during the experiment will be provided by Canadian scientists from the Bedford Institute (Neil Oakey) and Dalhousie University (Barry Ruddick) using the EPSONDE microstructure instrument. The first set of these measurements will be made on Oceanus over a three week period in November. A second survey will be made on the Hudson (Bedford Institute) in April 1993. The experiment will conclude with the recovery of floats in May 1993, using Hudson , and a final tracer sampling cruise on Darwin in May 1993, after the dye has diffused and mixed for over a year.

Nouvelles du quartier général de la SCMO du Conseil et de l'Exécutif National

Le Conseil de la SCMO s'est réuni le 14 février 1992 à Victoria, son point d'attache présentement, où les environs merveilleux du Collège militaire Royal Roads ont contribué au succès de la réunion. Parmi les items discutés à l'agenda, il faut mentionner l'item habituel des finances, qui promettent d'être satisfaisantes pour 1992, en dépit de certaines réductions des revenus comme par exemple les nouveaux taux réduits introduits pour les membres retraités. Tout dépend cependant du succès du renouvellement des membres et l'addition continue de nouveaux membres. Ainsi, s'il-vous-plaît, vérifier si vous avez renouvelé votre demande d'adhésion. Sinon, faites parvenir au bureau de la SCMO la demande d'adhésion qui se trouve à la dernière page du bulletin Nouvelles en écrivant RENOUVELLEMENT au dessus. Essayez de plus de convaincre un collègue ou un ami de joindre la Société.

Le Conseil a de plus fait des préparatifs pour la réunion annuelle de l'Assemblée générale. Quelques-uns des items sont déjà parus dans l'édition de février du bulletin Nouvelles, tel que la brochette de candidats mis en nomination pour le Conseil de 1992-93 et les suggestions de modifications des règlements (changement apporté aux fonctions du trésorier à la lumière des nouvelles procédures pour la tenue des livres financiers essayées avec succès au cours de l'exercice 1991-92). Le Conseil a également accepté avec reconnaissance l'invitation du Centre d'Ottawa de tenir le congrès de 1994 qui, avec la mise en nomination d'un membre à vie, seront soumises à l'Assemblée générale pour approbation.

Les autres activités du Conseil incluent l'approbation d'une première version d'un énoncé de politique de la SCMO sur le changement atmosphérique développé par le comité scientifique. Cet énoncé est inclus dans ce bulletin de Nouvelles. L'endossement des diffuseurs de la météo sera bientôt ratifié. Cependant, le Conseil a de plus mis sur pied un comité ad hoc pour acquérir ou développer du matériel pédagogique pour les diffuseurs de la météo tels que vidéos, livres, etc, pour aider ceux qui ont besoin d'améliorer leur connaissance en météorologie. La participation active de la SCMO dans l'exposition scientifique pan-canadienne pour les jeunes tenue à Sudbury, Ontario en mai 1992 a également été approuvée.

J'espère voir plusieurs d'entre vous au congèhs de 1992 de la SCMO à l'université Laval, du 8 au 12 juin 1992!

Uri Schwarz
Directeur Exécutif

NEWS FROM CMOS COUNCIL EXECUTIVE AND HEADQUARTERS

The CMOS Council met on February 14, 1992 in its present home town of Victoria, B.C. where the gracious surroundings of the Royal Roads Military College contributed to a fruitful meeting. Among the items dealt with were as usual finances, which promises to be satisfactory during 1992, despite certain income reductions such as the newly introduced lower rates for retired members. But it all depends on satisfactory membership renewals and the continuous addition of new members. So please, check whether you have renewed your membership. If not, send in the membership application form at the end of the Newsletter with the words RENEWAL on top. And try to get at least one colleague or friend to become a member.

The Council also made various preparations for the 1992 AGM. Some of those have appeared already in the February Newsletter, such as the Nominating Committee's slate of candidates for the 1992/93 Council and proposed amendments to the By-Laws (changes to the duties of the Treasurer in light of new accounting procedures tried successfully during 1991/92). The Council also gratefully accepted the Ottawa Centre's invitation to host the 1994 Congress which, together with a nomination for Life Membership, will be submitted to the AGM for approval.

Other Council actions included the approval of a first version of a CMOS position statement on atmospheric change developed by the Scientific Committee which is included in this Newsletter. The endorsement of Weather Broadcasters is to go ahead in the near future. However, Council also set up an ad hoc Committee to acquire or develop educational materials for weather broadcasters such as videos, work-books, etc. to help those requiring improvements in their meteorological knowledge. CMOS active participation in the 1992 Canada-wide Youth Science Fair (Sudbury, Ontario, May 1992) was also approved.

I look forward to seeing many of you at the 1992 CMOS Congress at Laval University, June 8-12, 1992!

Your Executive Director,
Uri Schwarz

The ERS-1 Calibration-Validation Experiment

CMOS 26, Special Session

The ERS-1 Calibration-Validation Experiment was carried out on the Grand Banks of Newfoundland from Nov 10-27 1991. It was organized primarily to provide *in situ*, aircraft and numerical forecast model validation of the Synthetic Aperture Radar (SAR) on the "ERS-1" satellite launched by the European Space Agency in July 1991. Other goals included the open-ocean determination of the relation between the wind stress and the sea state, validation of the algorithms used to invert SAR images and assimilate them in numerical wave models, testing of the wave-imaging capabilities of shipboard marine radars, intercalibration of the meteorological sensors on buoys and ships, and the relation of SAR image features to near-surface currents in the ocean.

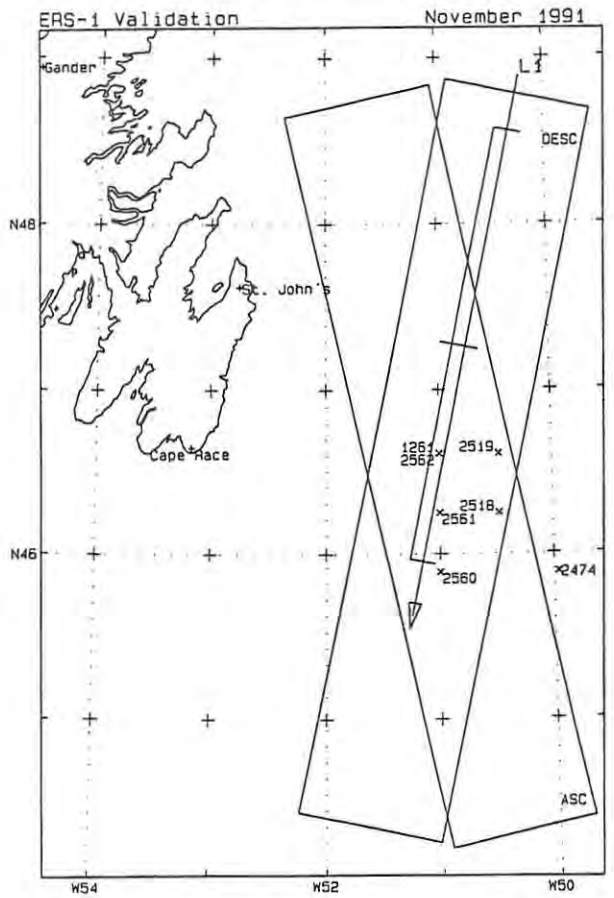

Figure 1. A map of the ERS-1 SAR swath crossover area where the Calibration-Validation Experiment was carried out. The ERS-1 ascending (ASC) and descending (DESC) swaths are shown; they occurred within 11 hours of each other once every 3 days (see Figures 2 & 3). The central validation site, where CSS "Hudson" and SRV "G. Ushakov" were located, is at the point marked "1261/2562"; the numbers are grid points in the AES "CSOWM" operational wave prediction model. The lines with arrows indicate the coverage by the CCRS Convair-580 SAR.

To achieve these goals a sharply focused cooperative experiment was organized and carried out. The ERS-1 "Commissioning phase" orbit produced a "crossover node" on the Grand Banks (see Figure 1) of SAR swaths from descending and ascending passes within 11 hours of each other every 3 days. An array of two ships: CSS "Hudson" and the Soviet RV "Georgi Ushakov", four meteorological buoys and three wave buoys, all deployed at grid points of the AES "CSOWM" operational wave forecast model, were overflown at ERS-1 overpass times by two aircraft: the CCRS Convair-580 with C-band SAR and the NASA P-3 with Radar Ocean Wave Spectrometer or Surface Contour Radar and Radar Altimeter. The crossover node lay within the swath of a high-frequency radar at Cape Race, which provided winds and waves at overpass times on a 1km grid. On Hudson were a bow-mounted wind stress measurement system, two X-band marine radars, and an acoustic Doppler current profiler (ADCP). On the Ushakov, at the site from Nov 19-21, were a radiosonde system and standard meteorological sensors.

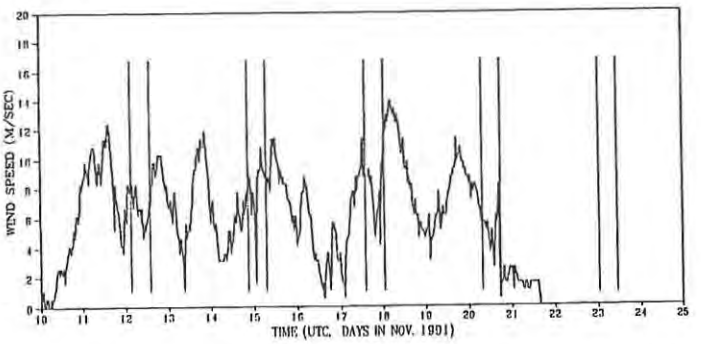

Figure 2. Time series of wind speed from the "Minimet" buoy located at CSOWM grid point 2562. The speeds are at 3m height. The vertical lines are the ERS-1 overpass times.

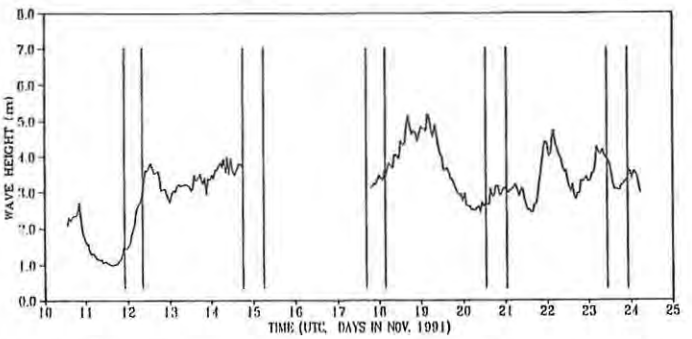

Figure 3. Time series of significant wave height from the MEDS Wavec buoy located at CSOWM grid point 2519. The vertical lines are the ERS-1 overpass times.

During the experiment an extensive data set was collected over a moderate range of winds and sea states. A sample wind time series is shown in Figure 2, and a sample wave height time series is given in Figure 3. The wind speed time series is from the "Minimet" buoy at CSOWM grid point 2562 (Figure 1): the location of both the Hudson and the Ushakov.The MEDS Wavec directional buoy which supplied the wave series was at grid point 2519, 37 km to the E. The wind-wave relationship is evident, but it is far from simple.

The CV-580 underflew ERS-1 7 times, and the P-3 underflew the satellite 4 times. The wind stress package on Hudson

gathered data in conjunction with both the meteorological buoys and with the meteorological sensors of the two ships. Two meteorological buoys deployed by AES at grid points 2560 and 2474 gave complete time series of winds, pressures, air and sea temperatures and waves. The two meteorological buoys and three wave buoys (two directional, one wave height only) deployed by Hudson gave partial time series. The ADCP on Hudson was used during non-daylight hours to make transects of the ocean current profiles in the crossover area.

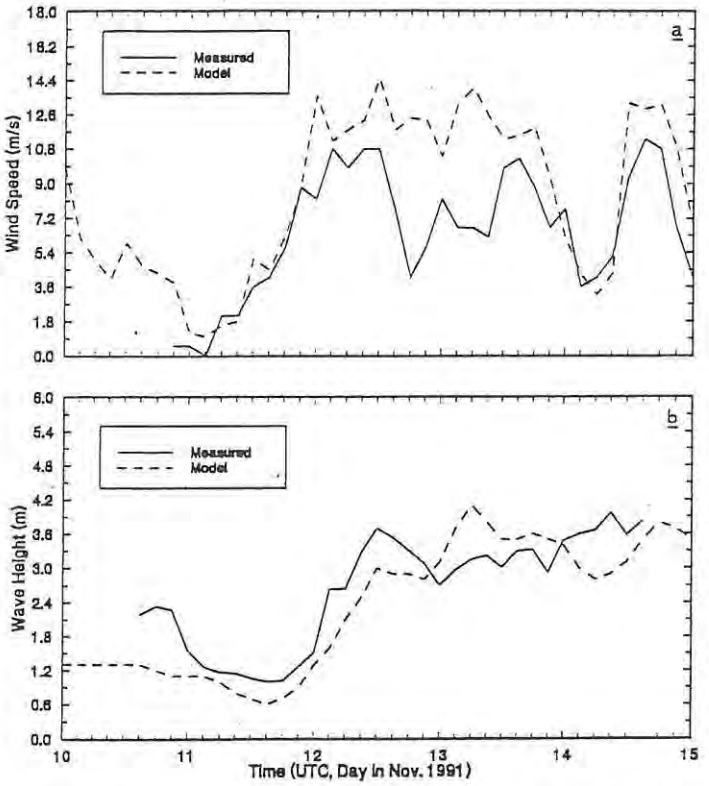

Figure 4. (Top) Time variation of model wind speed and the wind speed from the Minimet buoy at grid point 2562. The model wind speed is the 10 m wind generated by the Canadian Meteorological Centre at Montreal. (Bottom) Time variation of significant wave height from the operational version of the CSOWM together with the Wavec buoy wave heights at grid point 2519, located 37 km E of grid point 2562.

AES ran their "CSOWM" operational wave forecast model during the entire experiment. Figure 4 provides sample wave height time series at grid point 2519 (the location of the MEDS Wavec buoy) from the operational version of the CSOWM, together with the measured significant wave heights from the Wavec buoy. Also shown is the time variation of model wind speeds along with the measured wind speeds from the Minimet buoy.

Figure 5 shows sample comparisons of the wavenumber spectra from the CCRS C-band CV-580 SAR, the ERS-1 SAR, and the MEDS Wavec buoy. It should be noted that SAR, since it sees only an image of the longwave modulations of the wind-induced ripples, displays a 180 degree ambiguity in direction and so its spectrum is symmetrical (the slight

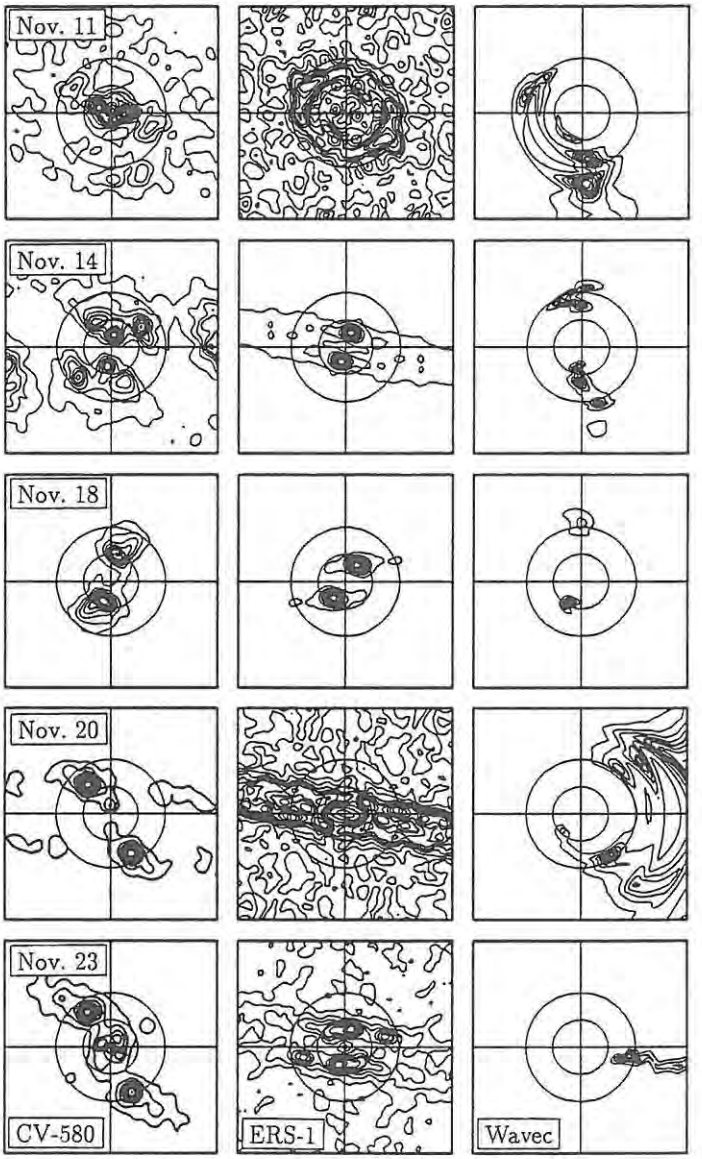

Figure 5. Comparison of directional (wavenumber) CV-580 and ERS-1 SAR image spectra with directional slope spectra from the MEDS Wavec buoy. All directions are "going towards"; the outer circles are at 100m wavelength and the inner circles are at 200m wavelength. North is up. The contours are at linear intervals relative to the spectral maximum. The SAR image spectra are symmetrical because the SAR technique cannot determine the wave direction unambiguously.

asymmetries in the aircraft SAR spectra are the result of scanning distortion corrections). This affects both the aircraft and the satellite SARs, and so the ambiguity can only be resolved by reference to the Wavec spectrum. Note the complexity of the wave fields: this will be one of the major challenges in the analysis of the various data sets, in particular in the SAR validation. This preliminary comparison indicates close correspondences between the SAR and Wavec swell spectra, i.e. the longer wavelength components of the wave field. It will also be a challenge to separate sea from

ERS-1 Cal-Val (cont)

swell: a necessary step in the process of estimating the relation between the wind stress and the sea state.

A special session on the Calibration-Validation experiment has been set up at the 26th Congress in Quebec at Laval, at which participants will review the data collected and analyzed to date. The session will begin to address the questions implied in the stated goals of the experiment and those arising from the data collected. It will provide a forum for the thoughts of the participants at a time when the initial screening has been carried out on the data sets but before final conclusions have been reached. Participants in similar ERS-1 calibrations in other locations have been invited.

Fred Dobson, BIO
Madhav Khandekar and
Roop Lalbeharry, AES Downsview
Paris Vachon, CCRS

Volume 26 No 1 April 1992 Avril

Climatological Bulletin
Bulletin climatologique

as of Mar. 20th 1992/en date du 1 Mars 1992

Soil erodibility and the frequency of freeze-thaw cycles, rainfall and snowmelt on frozen soil in Canada.
H. N. Hayhoe, D. R. Cooke and R. G. Pelletier.

Étude du bilan hydrique des sols au Québec méridional.
P. Rochette et P. A. Dubé

Climatic highlights of 1991 in Canada.
Canadian Climate Centre

Newsletter Advertising Rates

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Rates are based on black and white camera-ready copy. Sizes (inches) are full page (7.5 x 9.5), half-page single column (3.5 x 9.5), half-page two-column (7.5 x 4.5) and quarter page (3.5 x 4.5). Other charges will apply when typesetting, artwork or photography are required. Distribution is to CMOS members, and therefore is approximately 1000 for each issue. There are six issues per year and appear in February, April, June, August, October and December.

Advertisement type	Full Page	1/2 Page	1/4 Page
Commercial **	$300.00	$160.00	$100.00
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ACRONYM NEWS

Call For Research Grant Proposals Atmosphere/Cryosphere Research and Oceanography Need Your Money

Inspired by the recent plethora *Big Science* projects being sent to NSERC for consideration of funding, I have decided to seek interest within the scientific community for the multidisciplinary project ACRONYM. The goal of ACRONYM is to set up an intensive research network within Canada under the auspices of a seven-tier management structure. The ultimate goal of ACRONYM is to develop 10 regional Centres of Excellence (one in each province) specializing in fundamental research into designing new and ingenious acronyms for future *Big Science* projects. In British Columbia, for example, such a Centre (Western Administrative Structure on Toxic Emissions - WASTE) would focus on designing acronyms for seeking money for local environmental issues (such as the recent sewage disposal problem in Victoria). Here in Québec I foresee that the Centre (Scientific & Environmental Project on Acronym Research for Alternative Tidal Energy Sources - SEPARATES) will play a rôle in Hydro-Québec's future James Bay projects.

In order to disseminate recent results to the general public, who would ultimately fund, if not benefit, from this project, ACRONYM will open a special "In Touch with the research" number 1-800-ACRONYM. A series of 12 3-day "open-forum" meetings a year will be held to discuss recent developments within ACRONYM. These meetings will be held monthly in a different province (or territory) each time with invitations extended to the local media.

Proposals submitted to ACRONYM will not be reviewed externally, but rather will be judged for merit by an ACRONYM Privy Council made up of 10 provincial Members of Parliament (one from each province). These politicians will only fund those projects which are deemed to be of a most rigorous nature and in the best interest of the scientific community. Interested persons, tired of research, who wish to get involved with ACRONYM should contact:

ACRONYM
c/o Andrew Weaver
C^2GCR, McGill University
Montréal, Qc H3A 2K6

CAP CONGRESS/CONGRES ACP

The 1992 Congress of the Canadian Association of Physicists will take place during the week of June 15th in the newly refurbished and expanded Cleary International Centre on the Banks of the Detroit River, University of Windsor, Windsor, Ontario. The Centre affords a spectacular view of the downtown Detroit skyline. Special sessions are planned on Superconductivity; Technology Transfer; Atomic and Molecular Physics; Aeronomy and Space Physics; Industrial and Applied Physics; Nuclear Physics; Particle Physics; Physics Education; Plasma Physics; Positrons and Ion Beams in Semiconductors; Surface Sciences; Synchrotron Studies and Theoretical Physics.

Review/Critique

HISTORIC STORMS of the NORTH SEA, BRITISH ISLES and NORTHWEST EUROPE

Hubert H. Lamb in collaboration with Knud Frydendahl, Cambridge University Press, Cambridge, New York, Port Chester, Melbourne, and Sydney, 1991, xi + 204pp., ISBN 0-521-37522-3, hard cover.

This book is the fruit of several years' work. All the great storms with serious effects that could be identified within the last 500-600 years are catalogued and a few notable events dating back to antiquity are discussed. This is the only region for which there is sufficient information available in archives to make such a study feasible. The book discusses the impact of these great storms on seafarers, local populations and the landscape. Where possible, observations of weather and other circumstances reported during storms have been used to produce a modern meteorological analysis. A reasonably full meteorological analysis has been achieved in nearly every case since 1703 and has been done sketchily for earlier cases. There is extended analysis of several noteworthy storms and analysis of trends and variations in storm frequency and severity.

The book is divided into Part 1: Introduction and analysis, and Part 2: Catalogue and descriptions of great storms reported in the North Sea and neighbouring regions. The overall scientific level of the book is high. The narrative is written with an economy of words in a style that held my interest and was easy to follow. There are several very good quality photographic plates included. The scene on the cover gives a dramatic sense of the power of the sea in these storms. One can sense the terror that must have been felt by the men as they clung for their lives to the rigging of a sailing ship listing more than 45 degrees in windswept mountainous seas.

Four sections comprise Part 1: Introduction, Grading of Storms, Results, and Concluding Summary. In Section 1 the methodologies of dealing with the many problems associated with gathering, dating, and corroborating data, and producing analyses for a study of this magnitude are explained. Analysis of available data was done with careful testing and cross-checking to ensure the best possible meteorological reconstruction of each event. The discussion of the gradual evolution of instrumentation and recording of data was interesting. For the period up to the last few decades the most dependable measures of wind are from gradient winds derived from barometric pressure analysis. Modern Norwegian frontal analysis significantly improved the accuracy in interpretation of weather diaries and other related data and improved the possibilities of outlining barometric pressure patterns over sparsely covered parts of synoptic maps.

Section 2 of Part 1 deals with grading of storms. The subject is discussed from several viewpoints. There are several summary graphs and frequency tables. Professor Lamb proposes an overall storm severity index of the form maximum wind cubed times maximum area of damage times duration of damaging winds. This index is used as one method of ranking storms and helps to relate the storms discussed to modern events. For example, the recent storm of October 10 1987 was certainly a powerful event, yet there are 8 storms of higher Severity Index listed. I read with fascination the accounts of extensive changes of landscape and coast due to floods and shifting sands in several great storm events dating back to antiquity. The hardship inflicted on the local population in several of these storms is unmatched in modern tines. For example, two important townships on the east coast of Scotland were buried by sand in single storms in 1413 and 1694.

Section 3 of Part 1 is a summary of results. Of considerable interest here are secular variations and climate trends indicated by the Severity Index and other data summaries. The figures suggest a heightened frequency of the severest class of storms in times before about 1840. A number of signs point to increased storminess since 1950.

In Section 4 of Part 1 is a concluding summary of important findings throughout the book. Recorded data became more abundant during the period 1780-1850, the latter phase of the so-called Little Ice Age which lasted from the early fourteenth to mid nineteenth century . Great storm occurrences in these years suggest there was a greater frequency relative to this century of intense storm development during the entire Little Ice Age. The magnitude of sand-blow events in this period point to surface wind strengths probably unparalleled in the twentieth century. The Spanish Armada shipwreck disasters of 1588 suggest surface wind speeds from July to September likely unmatched in those months in any year of this century. The reason presented for the increased storminess seems well founded in evidence of a difference in sea surface temperature gradient likely related to secular variations of solar activity. As a final note Professor Lamb states that the greatest property damage has occurred as a result of floods and sand-blow events, but losses have been, and can be, notably reduced by sound construction of buildings and sea defence barriers.

Part 2 is a catalogue of great storm events since 1509. The analysis is impressive. Each storm is discussed with regard to area, observations, and meteorology. To as great a degree as possible, synoptic maps are included. There is enhanced discussion for storms of particular ferocity or historical importance. Four appendices deal with data analysis for storms in 1588, 1703, 1717, and 1791. Much good information is contained in these accounts, although I found the subject matter can seem repetitive after several pages of reading. Not being a native of northern Europe, I would have appreciated a map showing the location of places and countries named in the text.

I found this to be an outstanding book from which I learned much myself. The subject matter and discussion of analysis techniques make it a valuable acquisition for atmospheric scientists, climatologists, engineers, historians, economists, conservationists, and anyone else with an interest in great storm events.

William R. Burrows
Atmospheric Environment Service, Toronto, Ontario

ATMOSPHERIC SCIENCE
at the University of British Columbia

The Atmospheric Science Programme at the University of British Columbia was started with new Provincial Government funding in 1988, although studies of the atmosphere had been ongoing for many years before. The Programme is sponsored by the Departments of Geography and Oceanography which provides the opportunity for cross discipline links. The focus of the atmospheric science research is on processes of the atmosphere and its interactions with the ocean and land surfaces. Graduate and faculty research now covers a broad range of activities from microscale urban turbulence and energy transfers, through to interactions of the whole North Pacific Ocean with the global atmosphere. The Vancouver area provides easy access to a variety of surfaces and terrain (urban, water, ice, snow, forest, agricultural and alpine). The network of UNIX computer workstations provides good facilities for the analysis and display of data and some numerical modelling. Other facilities include a polar-orbiting satellite receiving station and connections to the Pacific Weather Centre's satellite and synoptic data systems.

With the formal establishment of the Atmospheric Science Programme, four new faculty were appointed. Other faculty, already at the University, teach courses and do research in areas essentially in or close to atmospheric science, so that number of faculty in the atmospheric science area is about 10. An M.Sc. in atmospheric science is now available and students can study towards the Ph.D. degree in either Geography or Oceanography. We presently have about 10 M.Sc. students (6 registered in M.Sc. atmospheric science and others in physical geography or oceanography) and 10 Ph.D. students. Students can also study for a B.Sc. with major or honours in Atmospheric Science or undertake a one year Diploma in Meteorology course (if they already have a B.Sc. or similar degree). In spring 1992, 6 students are expected to complete the B.Sc. degree and 4 others will complete the Diploma in Meteorology.

Faculty members are active in both national and international science programmes, including the World Climate Research Programme, World Ocean Circulation Experiment, Tropical Urban Climate Experiment, International Satellite Cloud Climatology Project and others. In the brief descriptions of research given below, the main themes have been emphasized. Much research is done in cooperation with colleagues at UBC or elsewhere and graduate students are active members of each research team. In additions to collaborations wit Geography and Oceanography colleagues, UBC has active research programs in Soil Science, Chemistry, Engineering, Forestry and Mathematics with areas of common interest to atmospheric scientists.

Susan Allen (mesoscale oceanography, topographic flows, waves and eddies) Susan Allen is primarily working on oceanic problems focusing on the effect of topography on rotationally dominated flow. However, in collaboration with Douw Steyn and Greg Lawrence (Civil Engineering), the problem of winter gap winds through Howe Sound is being investigated. Peter Jackson, a doctoral student of Douw Steyn, has written a four layer multi-grid numerical model to investigate the phenomena of cold winter gap winds flowing through Howe Sound. The model and field data suggest the presence of hydraulic jumps within the fjord. The necessarily-limited resolution of the numerical model means that the jump is barely resolved. A physical model has been constructed within a water flume to investigate the hydraulic control of flow through the fjord. Initial results indicate the jump suggested by the model is only one of several along the length of Howe Sound. Oceanographic problems being investigated include amplification of diurnal tides over a mid-ocean ridge (in collaboration with R.E. Thomson, Institute of Ocean Sciences), upwelling though a canyon and the effect of topography on rotating, surface, buoyancy currents. Work has begun on building a 1 m rotating table with completion expected by December, 1992. The table will allow modelling of rotationally dominated flow in both the ocean and the atmosphere.

Phil Austin (cloud physics, cloud-climate feedback, remote sensing) Phil Austin is working on models and observations of cloud microphysics, with an emphasis on the processes controlling cloud fraction and cloud reflectivity. One focus has been the retrieval of cloud properties from satellite measurements; data from the First ISCCP Regional Experiment (FIRE) has been used to compare cloud optical thickness estimates made by polar orbiting and geostationary satellites with in-situ measurements from aircraft. A recent upgrade to the UBC satellite laboratory has enabled us to begin archiving polar orbiter data for a 2000 km swath extending along the Pacific coast; we are applying the retrieval technique to observations of cloud formation and layer break-up, and will be monitoring cloud optical depth and cloud drop size variations in concert with continuous aerosol measurements underway at the NOAA aerosol observatory on Washington State's Olympic Peninsula. Drizzle is the principal sink for cloud aerosols and cloud water; its spatial inhomogeneity is a prominent feature of the layer cloud measurements made during FIRE. A stochastic model of drizzle growth is being used to test the sensitivity of water flux to cloud thickness, the dropsize distribution, the collection kernel and layer turbulence. The results are being used to improve the drizzle flux parametrization in a boundary layer model of the aerosol life cycle.

John Fyfe (atmospheric dynamics, variability and stability of global climate) John Fyfe is examining regional cyclogenesis and low frequency variability of the wintertime mid-tropospheric Northern Hemisphere midlatitude flow. Maps of high-frequency temporal variance have maxima, referred to as storm tracks, localized downstream of the major troughs. Data diagnoses and primitive equation modelling are being used to understand storm track dynamics. Another problem is low frequency current fluctuations in the Strait of Georgia, B.C. Aside from the effects of intense mixing primarily at the southern and northern ends, the circulation is strongly affected by a large early summer discharge of freshwater by the Fraser River and atmospheric forcing. The low-frequency current fluctuations are as energetic as the tides and have short horizontal correlation scales. Using several numerical models we have been attempting to extend our understanding of these important currents. In the study of Rossby wave breaking, we are employing a hierarchy of relatively simple models to study the propagation of planetary wave trains from the midlatitudes into the tropics. In a barotropic model a thorough analysis of the WKB limit, together with some high resolution numerical simulations, has revealed a new breaking mechanism. Generalizations of this theory to three dimensions are presently being made, while plans include very high resolution simulations employing the methods of contour dynamics. We

are also considering the growth of disturbances to large-scale nonparallel steady states in a model for forced and dissipated flow. A variant of the energy method has been developed to optimize the instantaneous disturbance energy growth rate. There are applications in analysis of global stability of steady states and investigation of the initially fastest-growing disturbances. Motivated by the large variety of wave motions present in geophysical systems we are attempting to elucidate the transport and mixing of passive tracers by large-scale eddies through numerical simulations. Lagrangian and Eulerian diffusivities are calculated for a wide range of initial tracer distributions, advecting wave forms and Peclet numbers.

William Hsieh (numerical ocean modelling and data assimilation, remote sensing) William Hsieh and his group have been examining global upwelling associated with El Niño and climate change using historical air pressure and wind data. El Nino related upwelling and downwelling have been observed in extratropical regions. Modelling work included the development (with J. Zou) of an adjoint regional open-boundary quasi-geostrophic ocean model suitable for data assimilation and the derivation (with M. Ng) of an exact analytic solution of equatorial Kelvin waves in finite-difference models. Warren Lee has recently developed a global primitive-equation 15-level ocean mode. The model simulates adequately the thermohaline circulation and the major current systems. This model will be used by the Canadian Climate Centre for coupling to their atmospheric general circulation model.

Gordon McBean (air-sea interaction, marine storms, heat and water cycles) Gordon McBean is examining how transfers of heat from the ocean influence the atmosphere and provide a mechanism for determining the long-term variations in atmospheric climate. Large, long-term heat transfer anomalies can cause significant perturbations to atmospheric circulation. Work with graduate students includes investigating how well global climate models simulate these linkages and their associated variability. A related topic is the study of marine storms which are important for both our weather and our climate. Studies are being made of mechanisms for heat exchange within storms and the impact on the storms resulting evolution. Both studies will contribute to better understanding and modelling large-scale atmosphere-ocean interactions and their role in climate. Another study area is temporal variations in North American precipitation regimes. Explanations are sought for the sudden shifts between wet and dry periods. A joint project with Graham Thomas is relating monthly river runoff anomalies for the British Columbia coast to the precipitation and atmospheric circulation anomalies that presumably cause them over the mountains of B. C. A second phase will examine how global climate models simulate these anomalies. Then, by studying the way the model's circulation anomalies change with doubled CO_2, changes of precipitation and runoff for B.C. for a warmer climate will be clarified.

Tim Oke (surface energy and water balances; heat islands and urban climate) Tim Oke is involved in research into the physical basis of urban climates. Work centres on the energy and water balances of cities. He maintains a 30 m micrometeorological tower in a suburban area of Vancouver which is the focus of work on the turbulent transfer characteristics of the urban atmosphere. Fast response measurements are used to study the spectra of the u,v,w components of wind, air temperature and humidity and the associated cospectra of momentum, heat and water vapour. The results are used to assess the existence of a constant flux layer and the applicability of "ideal" terrain theory to the urban system. Additional measurements from a mobile 30m tower are used to assess the spatial variability of fluxes and questions of representativeness of observations over an inhomogeneous surface. An evaporation model for cities has been developed and tested in Vancouver and its general applicability is being evaluated using field observations from drier cities (Tucson, AZ and Sacramento, CA). A study is underway to investigate how the three-dimensional form of the city surface affects the surface temperature distribution viewed by remote platforms. It utilizes field observations together with scale and numerical modelling. A similar mix of approaches are used in another study of the physical mechanisms underlying the thermal amelioration provided by city parks. Work is also underway to develop a simple, operational model of the urban heat island.

Douw Steyn (air pollution, modelling and observations of forced mesoscale flows) Douw Steyn's research focuses on meteorological factors that govern the dispersion of pollutants in the troposphere. This interest has led me to investigate topics as diverse as turbulent transfer in the atmospheric surface layer, the growth of the daytime mixed layer depth in coastal zones and the local wind fields responsible for redistributing pollutants. My work has led to the application of mesoscale flow models in complex terrain, and in particular to an investigation of sea breeze circulations as mechanisms for redistributing pollutants. This latter work which is ongoing, has involved both observational and modelling phases. I am at present engaged in a comprehensive meteorological and photochemical modelling study of ozone episodes in the Lower Fraser Valley, B.C. in collaboration with Drs Don Hastie and Hiromi Niki at York University. The research will involve observation of both the meteorology and photochemistry of the episodes, and will lead to the development of a combined meteorological and photochemical modelling system with which I plan to undertake studies of the effectiveness of various emissions reductions scenarios. Outstanding meteorological questions are the role of recirculation of pollutants in the sea breeze, and the importance of venting of pollutants by upslope flows. Among the many interesting questions regarding photochemistry are ones dealing with the species mix of emissions of volatile organic compounds from the coastal vegetative communities in the region.

Other members of the Department of Geography who are also involved in atmospheric-science related research include Graham Thomas who is examining terrestrial processes and their role in climate, the parametrization of hydrologic fluxes, land-surface remote sensing and biospheric processes and monitoring. Graham will be leaving the Department to return to the United Kingdom this summer. A replacement is being sought. Michael Church's research program focuses on interpretation of river channel changes while Chris Burn is interested in permafrost. Michael Bovis is involved in studies on large-scale landslides while David McClung studies snow avalanches. Other members of the Department of Oceanography involved in atmospheric science-related research include: Paul LeBlond who is undertaking observations and modelling of ocean waves and ocean circulations; and Stephen Pond who specializes in observations and numerical modelling of coastal circulations and studies of turbulence.

Meeting Announcements

BASE Meeting Announcement

In late 1994, a mesoscale field experiment (**BASE** - **B**eaufort and **A**rctic **S**torms **E**xperiment) is planned for the Beaufort Sea area. The objectives of BASE are to improve our understanding of the weather over the Beaufort Sea and surrounding areas of the Arctic. It is expected that several atmospheric phenomena will be studied during the field experiment. This includes the intense mesoscale vortices that develop along the baroclinic region associated with the edge of the sea ice. The development of these vortices and the weather associated with them have proven to be very difficult to forecast. Other important phenomena that will be investigated during BASE are: the orographic cyclones that develop in the lee of the nearby mountain ranges, the behaviour of extra-tropical cyclones that track into the region from the south and the development of snow squalls associated with the passage of cold northerly air over the relatively warm surface waters in the vicinity of the mouth of the Mackenzie River.

The primary observing platform that will be used during BASE is the NRC's Convair 580 aircraft. In addition to dropsonde and radar, it has a full complement of probes for the *in situ* measurement of all state parameters, turbulence and microphysical characteristics. It is expected that the aircraft data will be augmented by enhanced rawinsonde launches and other ground-based observing systems. It is anticipated that there will be a major involvement of Japanese scientists in the project.

The data collected during BASE will undoubtedly prove to be of the utmost importance in improving our understanding of mesoscale weather phenomena in the Arctic. The unique opportunity provided by BASE will also be of interest to those concerned with the hydrological cycle of the region. This aspect of BASE takes on special importance and relevance given that the Canadian contribution to GEWEX will be focused on the hydrological cycle in the Mackenzie River basin.

In order to begin the planning process for BASE, we are inviting all interested parties to a short meeting to be held during the upcoming Annual Congress of CMOS in Québec City. The exact time and location of the meeting will be available later and posted at the Congress site.

If you would like further information on BASE, please contact either Dr. R. E. Stewart at the Atmospheric Environment Service, Downsview, (phone: 416-739-4608, e-mail: R.Stewart/Omnet) or Prof. G.W.K. Moore at the University of Toronto (phone: 416-978-4686, e-mail: moore@rainbow.physics.utoronto.ca)

The International Society of Biometeorology Thirteenth International Congress of Biometeorology

Calgary, Alberta, Sept. 12-18, 1993.

Theme: Adaptations to Global Atmospheric Change and Variability.

The 13th Congress will address issues of human, animal, plant, invertebrates, and microorganisms in relation to climatic change and variability. Interactions related to health and disease, production and performance, dwelling, architecture, clothing, energy and transport will all be within the scope of the Congress.

We invite you to attend and participate in this timely and important international Congress. Plans are underway to make the Congress a scientifically and socially rewarding experience. It is not too early to make your plans now for the 13th International Congress of Biometeorology in 1993.

For further information please contact:

Dr. N. N. Barthakur
Dept. of Renewable Resources
McGill University-Macdonald Campus
21,111 Lakeshore Road
Ste.-Anne de Bellevue
Québec, H9X 1C0, Canada
Tel: (514)-398-7938
FAX: (514)-398-7983

First International Conference of the African Meteorological Society

7-11 December, 1992 Nairobi, Kenya

Theme: Recent Climate anomalies and prediction in Africa.

Congress Topics:

- Diagnostic Studies. (systems which control African climate such as monsoons, interactions of mid-latitude and tropical systems.)
- Interannual Variability and Recent Climate Anomalies. (extreme events, floods, cyclones, strong winds, etc.)
- Medium and Long-Range Forecasting.
- Monitoring and Forecasting of Extreme Weather Events. (tropical cyclones, droughts, floods, dust storms, etc.)
- Applications of Meteorology. (agrometeorology, hydrometeorology, energy resources, etc.)
- Climate Change Issues. (environmental pollution, land use, desertification, etc.)
- Impacts of the Extreme Climate Anomalies.

Submission deadline for abstracts is June 1992.
For further information contact:

Prof. Laban Ogallo, Principal
Inst. for Meteorological Training and Research
First Intl. Conference of the African Met. Soc.
P. O. Box 30259
Nairobi, Kenya

JOHN STEWART MARSHALL
1911-1992

J. Stewart Marshall, physicist, teacher, and one of the pioneers of radar meteorology, died on March 20, 1992, at the age of 80. He had been in declining health for the past year.

Stewart Marshall was born in Welland, Ontario, on July 18, 1911. He attended Queen's University, earning a BA with Honours in Physics and Mathematics in 1931 and an M.Sc. in 1933, with a thesis on the scattering of electrons by metallic coils. Delayed for a while by tuberculosis, he then went to Cambridge University as an 1851 Exhibition Scholar, graduating in 1940 with a Ph.D. in nuclear physics. It was at Cambridge where he met Beth Scott, who was later to become Mrs. Marshall.

World War II brought Marshall to the Canadian Army Operational Research Group in Ottawa, where he worked first on problems in ballistics, then on experiments with the new invention of radar. He was among the first to recognize that a kind of radar interference that sometimes obscured ships and airplanes was caused by rain and snow. To cope with the interference required understanding the scattering properties of the precipitation. This was one of the goals of Project Stormy Weather, organized under Dr. Marshall in Ottawa in 1943. It soon became evident to Marshall and his group that the unwanted weather interference was actually providing an entirely new way of observing the atmosphere.

When the war was over Marshall moved to the physics department at McGill and brought Stormy Weather research with him. Three of his early graduate students were Walter Palmer, Kenrick Gunn, and Walter Hitschfeld - all destined to make their mark. By the mid-1950s the contributions of Marshall and his students had included definitive work on the scattering properties of clouds and precipitation, the character of the radar echoes they produce, and the application of radar to the study of storms, rain and snow development, and weather forecasting. The Stormy Weather Group had done much to establish radar meteorology as a discipline.

It was mainly the strength of this work and the momentum it created that led to the formation of the Department of Meteorology at McGill in 1959. As the first chairman of Canada's first department of meteorology, Stewart Marshall had a profound influence on the teaching of meteorology in this country.

His later research included studies of hail and lightning and the use of radar in investigations of atmospheric effects on radio propagation. Teaching also continued to occupy its share of his attention. His textbook on introductory physics went through several editions and was widely used in Canada for a generation. An innovative teacher, he was an enthusiastic proponent of closed-circuit television as means of communicating with large classes. He was also an effective popularizer of science, collaborating with the CBC on a series of radio talks on meteorology and, in the earliest days of television, explaining approaching rainstorms to the Montreal audience using polaroid photographs from the McGill radar.

Stewart Marshall received many honours and awards over the years. To name a few, these include the Patterson Medal of the Atmospheric Environment Service, the Hugh Robert Mill Medal of the Royal Meteorological Society, and the Prizes in Applied Meteorology of the Canadian and the American Meteorological Societies. The AMS award bears the citation, "for his pioneering contributions to the development and application of radar as a standard tool of applied meteorology," which nicely describes the work for which he is best known. He was elected a Fellow of the Royal Society of Canada and a Fellow of the American Meteorological Society. In 1990 he was elected an Honourary Member of the American Meteorological Society.

Stewart Marshall will be remembered by scores of ex-students and colleagues in Canada and throughout the world for his intellectual stamina, the rigour of his thought, the brilliance of his scientific intuition. He is survived by his wife Beth, daughters Heather Marshall and Claire Rapp, granddaughter Marnie, and sister Marion Gales.

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ATMOSPHERE-OCEAN

Labrador Ice Margin Expt. - Special Issue

Oceanographic features in the Newfoundland marginal ice, March-April, 1990. C. L. Tang.

Automated sea-ice tracking for LIMEX 1987 and 1989. Thomas Hirose, Lyn McNutt and Michael Manore.

Wave attenuation in the marginal ice zone during LIMEX. Antony Liu, Paris W. Vachon, Chih Y. Peng & A. S. Bhogal.

Sea ice properties off Labrador and Newfoundland during LIMEX 1989. S. J. Prinsenberg & I. K. Peterson.

Detection of the Labrador Current using ice flow movement in synthetic aperture radar imagery and ice beacon trajectories. M. Ikeda and C. L. Tang.

Ice flow collision interpreted from acceleration data during LIMEX 1989. R. F. McKenna and G. B. Crocker.

A simulation of sea-ice motion and distribution off Newfoundland during LIMEX, March 1987. C. Tang & T. Yao.

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ATMOSPHERE-OCEAN

as of March 20 1992/en date de 20 mars 1992

A comparison of satellite winds and surface buoy winds in the Northeast Pacific. N. Bepple and P. Austin.

On the climatology of persistent circulation anomalies in the atmosphere and in a general circulation model. B. Dugas and J. Derome.

A numerical model of the internal tide in Knight Inlet, British Columbia. M. W. Stacey and S. Pond.

An estimation of several ice control parameters in a coupled ice-ocean model of the Arctic. Gordon H. Fleming.

A diagnostic study of the southern hemisphere summer circulation of the CCC general circulation model.
Charles Lin, Lin Su and Steven Lambert.

Implicit normal mode initialization for a global finite-element semi-Lagrangian shallow water model. Luc Fillion, Jean Côté and Michel Roch.

Frequency distribution and directional evaluation of the Ocean Data Gathering Program (ODGP) wave spectra at Hibernia. Barbara-Ann Juszko and Ross Graham.

Meetings Co-Sponsored by CMOS 1992-1993

Third International Cloud Modelling Workshop and Cloud Microphysics, Applications to Global Change.
Toronto, Aug. 10th-14th, 1992.
Contact: Dr. George Isaacs, AES, Tel (416)-739-4605

Eleventh International Conference on Clouds and Precipitation.
Montréal, Aug. 17th-21st, 1992.
Contact: Dr. Henry Leighton, McGill University
Tel: (514)-398-3766

Third International Conference on Popular Education and Training in Meteorology and Oceanography.
Toronto, July 14th-18th, 1993.
Contact: Oscar Koren, AES, Tel. (416)-739-4705.

Thirteenth International Congress on Biometeorology.
Calgary, Sept. 12th-18th, 1993.

3RD INTERNATIONAL WORKSHOP ON WAVE HINDCASTING AND FORECASTING MONTREAL, QUEBEC, MAY 19-22, 1992

An international workshop on wave hindcasting and forecasting, sponsored by the federal Panel on Energy Research and Development (PERD) and the Atmospheric Environment Service, will be held in Montréal, Québec from May 19-22, 1992.

For additional information contact the program chairman, or consult the C.M.O.S. Newsletter **29**(4), August 1991.

Those wishing to present a paper should submit a title and abstract (100-300 words) to the address shown below. Each abstract should contain the author's name, mailing address and telephone number. The deadline for receipt of abstracts is November 30, 1991. Full papers will be required by April 1, 1992.

To receive further notices contact:

V. R. Swail
Atmospheric Environment Service
4905 Dufferin Street
Downsview, Ontario M3H 5T4 Canada
Telephone (416)-739-4347 FAX: (416)-739-4297

The Impacts of Climate Change on Resource Management of the North

Whitehorse, Yukon Territory
May 12-14th, 1992

VENUE: Goldrush Inn, Whitehorse.

PRINCIPAL SPONSORS:

Atmospheric Environment Service, Environment Canada.
National Oceanic and Atmospheric Administration, U.S.A.
Indian and Northern Affairs, Canada.

PURPOSE:

- To provide information to the people of the Arctic regions of N. America about current issues in climate and climate change.
- To promote dialogue between the Federal Governments, scientific research community and local groups about various aspects of the climate problem important to northern people.
- To discuss and formulate recommendations regarding the management of northern resources that might be affected by global warming and associated regional climate change.

FORUM:

A combination of plenary sessions for information exchange and working groups to address terrestrial, freshwater and marine resource management issues in the context of climate change. There will also be two evening sessions organized for the general public.

CONTACTS:

Canada -	United States -
Al Maninauskas	William Bolhofer
Canadian Climate Centre	NCPO/NOAA
Environment Canada	Universal Building, Suite 518
4905 Dufferin Street	1825 Connecticut Avenue
Downsview, Ont. M3H 5T4	Washington, D.C. 20235
Tel. (416)-739-4431	Tel. (202)-606-4360
Fax (416)-739-4380	Fax (202)-606-4355

Canadian Applied Mathematics Society

Wave Phenomena II: Modern Theory and Applications

June 15-18, 1992
The University of Alberta
Edmonton, Alberta

Theme topics and principal speakers include:-

WAVES AND STABILITY
D. Benney (MIT), A. Craik (St. Andrews), P. Drazin (Bristol) J. Marsden (Berkeley), S. Maslowe (McGill)

WAVES IN THE OCEAN AND ATMOSPHERE
R. Grimshaw (New S. Wales), W.R. Peltier (Toronto)

HYPERBOLIC WAVES AND SHOCKS
D. Crighton (Cantab), J. Hunter (Davis), A. Jeffrey (Newc.) J. Keller (Stanford), A. Majda (Princeton), B. Seymour (UBC) F.T. Smith (U.C. London), J. Smoller (Michigan).

SOLITONS AND COHERENT STRUCTURES
M. Ablowitz (Boulder), T.B. Benjamin (Oxon.), J. Bona (Penn. State), J.C. Eilbeck (Heriot-Watt), Y. Kodama (Ohio State), A.C. Newell (Tucson), C. Rogers (Loughborough)

WAVES IN SOLIDS
M. McCarthy (Galway), D. Parker (Edin.), A. Pipkin (Brown)

Organizers: T. Bryant Moodie and Gordon Swaters.

Information: CAMS Conference
Applied Mathematics Institute
University of Alberta
Edmonton, Alberta
Canada T6G 2G1
FAX: (403)-492-6826

International Symposium on CLIMATE CHANGE AND NORTHERN FISH POPULATIONS

October 13-16, 1992, Victoria B.C., Canada

OBJECTIVE:
This symposium will promote an exchange of information relating to the effect of climate change on fisheries in aquatic ecosystems in northern latitudes.

TOPICS:
- Evidence for changes in climate and the resulting effects in freshwater and marine environments.
- Effects of climate on fish populations.
- Economic impacts of climate change on fisheries
- Preparing for climate change.

PUBLICATION:
Proceedings will be published in the Special Publication series of the Canadian Journal of Fisheries and Aquatic Sciences.

CALL FOR PAPERS:
All interested persons are invited to provide summaries of their papers, not to exceed 250 words, to the Symposium Secretary (address below) by **January 15, 1992.** The Organizing Committee will select papers for oral presentation and for a poster session.

For additional information, please contact the Symposium Secretary, Department of Fisheries and Oceans, Pacific Biological Station, Nanaimo, B.C., Canada V9R 5K6 or members of the Coordinating Committee.

Telephone: (604)-756-7260
Rapidfax : (604)-756-7053

Third International Cloud Modelling Workshop

Toronto 10th-14th August, 1992

The International Commission on Clouds and Precipitation of the IUGG is planning to conduct the Third International Cloud Modelling Workshop in Toronto, Canada during 10th-14th August, 1992. The workshop is being cosponsored by the WMO, the AMS and CMOS.

The purpose of the workshop is to stimulate co-operative efforts among theoreticians and observers who seek to understand the mechanisms of cloud and precipitation evolution in both natural and cloud seeded situations. The broad goal of the workshop is to promote work that will increase the utility of numerical models in cloud physics, weather modification, cloud chemistry, climate, forecasting and other areas of meteorology that require accurate representation of cloud processes. The primary focus of the Third International Cloud Modelling Workshop will be on the simulation of precipitation processes in cloud scale and mesoscale systems.

Those interested in participating in the workshop are invited to contact:- Dr. Harold Orville, Institute of Atmospheric Sciences, South Dakota School of Mines and Technology, 501 E. St. Joseph Street, Rapid City, South Dakota 57701-3995, U.S.A., Tel. (605)-394-2291, FAX (605)-394-6061, Omnet: H.ORVILLE.

All expenses incurred in connection with the workshop (travel and computer costs) will have to be borne by the participants. The Cloud Microphysics and Applications to Global Change Workshop, and the 11th International Conference on Clouds and Precipitation Physics, held one week later in Montréal.

Atmospheric Environment Service of Canada McGill University, Aug 17-21, 1992.

The 11th International Conference on Clouds and Precipitation, organized by the International Commission on Clouds and Precipitation (ICCP) of the International Association of Meteorology and Atmospheric Physics, will be held on the campus of McGill University in Montreal, Canada, on August 17-21, 1992.

The ICCP has recently broadened its mandate to include all aspects of clouds and precipitation. Accordingly, papers are invited in the following technical areas: cloud microphysics, precipitation physics, instrumentation, the remote sensing of clouds and precipitation (including satellite observations), the mesoscale structure of precipitation systems, radiative effects of clouds, cloud and precipitation chemistry, the effects of clouds on global climate and air quality, and clouds and precipitation in relation to the hydrological cycle.

For further information about the conference, please contact 11th ICCP, Conference Office, McGill University, 3450 University Street, Montreal, Canada H3A 2A7 (Tel: (514) 398-3770; Fax (514) 398-4854). Questions about the scientific program should be directed to Professor Peter V. Hobbs, Atmospheric Sciences AK-40, University of Washington, Seattle, WA 98195, USA (Tel: (206) 543-6027; Fax (206) 543-0308).

SYMPOSIUM ON THE SURFACE CLIMATES OF CANADA

HELD IN CONJUNCTION WITH THE FORTY FIRST ANNUAL MEETING OF THE CANADIAN ASSOCIATION OF GEOGRAPHERS

UNIVERSITY OF BRITISH COLUMBIA
VANCOUVER, BRITISH COLUMBIA

MAY 20 AND 21, 1992

Wednesday, May 20, 1992

1:30 - 3:30 Session 1 (Chair: W. R. Rouse, McMaster University)
1. Introduction - W. G. Bailey, Simon Fraser University
2. Canada's Climate: An Overall Perspective - F. K. Hare, Professor Emeritus, University of Toronto
3. Oceans and the Coastal Zone - O. Hertzman, Dalhousie University

3:30 - 4:00 Coffee

4:00 - 5:00 Session 2 (Chair: J. A. Davies, McMaster University)
4. Lakes - W. M. Schertzer , Canada Centre for Inland Waters
5. Wetlands - D. S. Munro, University of Toronto **Thursday, May 21, 1992**

8:30 - 10:00 Session 3 (Chair: J. A. Davies, McMaster University)
6. High Arctic - M. K. Woo, McMaster University
7. The Boreal - W. R. Rouse, McMaster University
8. Alpine Environments - I. R. Saunders, Simon Fraser University

10:00 - 10:30 Coffee

10:30 - 12:00 Session 4 (Chair: W. R. Rouse, McMaster University)
9. Forests - J. H. McCaughey, Queen's University
10. Agricultural Environments - T. Gillespie, University of Guelph
11. Urban Environments - T. R. Oke, University of British Columbia

12:00 - 1:30 Lunch

1:30 - 3:30 Session 5 (Chair: T. R. Oke, University of British Columbia)
12. Spatial Variability of Surface Climates - D. G. Steyn, University of British Columbia
13. Climate Change and Variability - to be read on behalf of D. Harvey, University of Toronto
14. Future Research Directions - J. A. Davies, McMaster University

3:30 - 4:00 Coffee

4:00 - 5:30 Session 6 (Chair: Editors (W.G. Bailey, W.R. Rouse, T.R. Oke and J.A. Davies))
Final session for authors to prepare summary statement

FOR ADDITIONAL INFORMATION CONTACT:

Dr. T. R. Oke Department of Geography
The University of British Columbia
#217 - 1984 West Mall
Vancouver, British Columbia, V6T 1Z2
Tel. (604) 822-2900
Fax. (604) 822-6150

4TH AES/CMOS WORKSHOP ON OPERATIONAL METEOROLOGY

SEPTEMBER 15-18, 1992 WHISTLER, B.C

FORECASTING IN THE NINETIES

The 4th AES/CMOS workshop on operational meteorology will be held September 15-18, 1992 in Whistler, B.C.. The theme of the workshop is: Forecasting in the nineties.

The workshop will be three and a half day long. Sessions on isentropic analysis, data explosion, quasi-geostrophic theory, verification, surface analysis, numerical models, radar systems, forecasting and analysis systems, convection, computer worded forecasts, delivery systems, case studies and forecasting techniques have been scheduled. Laboratories, poster sessions and demonstrations will also be part of the workshop.

ACCOMMODATION

The workshop hotel is:

The Whistler Fairways Hotel and Resort
4005 Whistler Way,Whistler,B.C.
Canada, V0N 1B0

Tel. 1-800- 663- 5644 (Toll free in Canada and U.S.)
Fax: (604) 932-6711 Telex: 04-507575

Cost: $87.75/night (including resort tax and GST)

Participants must make their own room reservations. Reservations must be made before August 14, 1992.

TRANSPORTATION

AIRLINE: No official airline

BUS: Maverick Coach Lines (604-255-1171) offer six convenient departures daily from Vancouver Bus Depot in downtown Vancouver. There are seven departures daily from Whistler. **Cost: $13.00 one way.**

Perimeter Transportation Ltd. operates a shuttle service between Vancouver International Airport and Vancouver Bus Depot for connections to Maverick Coach to Whistler.

Bus service will also be offered by the organizing committee. Participants interested in the bus service must pay for their reservation when they register. It is only available to participants registering before August 1, 1992. **Cost: $15.00 one way.**

Schedule September 14, 1992

Departs Vancouver Airport	14.30
Arrives Whistler	17.00

Schedule September 18, 1992

Departs Whistler	12.45
Arrives Vancouver Airport	15.15

TRAIN: B.C. Rail (604-984-5246) offers daily train service between North Vancouver and Whistler.
Cost: $13.50 one way

Schedule

Departs N. Vancouver	7.30	Arrives Whistler	10.04
Departs Whistler	18.10	Arrives N. Van.	20.35

CAR RENTALS: Most major car rental companies offer car rental service at the Vancouver Airport.

4e ATELIER SEA/SCMO DE METEOROLOGIE OPERATIONNELLE

15-18 SEPTEMBRE, 1992 WHISTLER, C.-B.

LA PREVISION DU TEMPS DANS LES ANNEES 90

Le 4e atelier SEA/SCMO de météorologie opérationnelle se tiendra à Whistler, C.-B. du 15 au 18 septembre 1992. Le thème de l'atelier sera: la prévision du temps dans les années 90.

La durée de l'atelier sera trois jours et demi. Des sessions traitant d'analyse isentropique, de l'explosion des données, de la théorie quasi-géostrophique, de vérification, de l'analyse des cartes de surface, de modèles numériques, de systèmes de radar, de convection, de prévisions écrites par ordinateur, de systèmes de distribution des données et prévisions, d' études de cas et de techniques de prévision sont à l'horaire. Il y aura aussi des laboratoires, des sessions d'affichage et des démonstrations.

HEBERGEMENT

L'hôtel de l'atelier est:

The Whistler Fairways Hotel and Resort
4005 Whistler Way, Whistler, B.C.
Canada, V0N 1B0

Tél. 1-800-663-5644 (sans frais au Canada et aux Etats-Unis) Télécopieur: (604) 932-6711 Telex: 04-507575

Coût: $87.75 (taxes incluses)

Les participants doivent réserver eux-mêmes leur chambre. Les réservations doivent être faites avant le 14 août 1992.

TRANSPORT

AVION: Il n'y a pas de transporteur officiel.

AUTOBUS: Maverick Coach Lines (604-255-1171) offre un service d'autobus entre le terminus d'autobus, situé au centre-ville, et Whistler. Il y a six autobus par jour entre Vancouver et Whistler et sept autobus par jour entre Whistler et Vancouver. **Coût: $13.00 aller ou retour.**

Perimeter Transportation Ltd. (604-261-2299) a des autobus qui font la navette entre l'aéroport et le terminus d'autobus de Vancouver, situé au centre-ville.

Un service d'autobus sera offert par le comité organisateur. Les participants qui sont intéressés par ce service doivent réserver et payer pour leur places lorsqu'ils s'inscrivent. Ce service n'est disponible qu'aux participants qui s'inscrivent avant le 1er août, 1992. **Coût: $15.00 aller ou retour.**

HORAIRE 14 septembre 1992

Départ de l'aéroport de Vancouver	14.30
Arrivée à Whistler	17.00

Horaire 18 septembre 1992

Départ de Whistler	12.45
Arrivée à l'aéroport de Vancouver	15.15

TRAIN: B.C. Rail (604-984-5246) offre un service journalier de train entre Vancouver Nord et Whistler.
Coût: $13.50 aller ou retour.
HORAIRE

Départ de Vancouver Nord	7.30	Arrivée à Whistler	10.04
Départ de Whistler	18.10	Arrivée à Van. N.	20.35

LOCATION D'AUTO: La majorité des companies de location d'auto offre un service de location d'auto à l'aéroport de Vancouver.

4TH AES/CMOS WORKSHOP
ON
OPERATIONAL METEOROLOGY

SEPTEMBER 15-18, 1992
WHISTLER, B.C.

FORECASTING IN THE NINETIES

REGISTRATION FORM

RATE

AES employee	$ 25.00
CMOS member	$110.00
Students	$ 50.00
Others	$150.00
Late registration fee (after Aug.1)	$ 25.00

Bus: $15.00/person one-way (must be paid before Aug. 1)
(For details see information sheet elsewhere in the Newsletter)
Extra banquet ticket: $40.00/person

Name: _____

Address: _____

City: _____ Province/State: _____

Country: _____

Home phone: _____ Business phone: _____ Fax phone: _____

Affiliation: _____

CATEGORY:

AES employee	$.....
CMOS member	$.....
Student	$.....
Others	$.....
Late registration	$.....
Extra banquet tickets	$.....
Bus	$.....
TOTAL	$.....

MAKE CHEQUE PAYABLE TO: **4TH AES/CMOS WORKSHOP ON OPERATIONAL METEOROLOGY**

SEND FORM TO:

4TH AES/CMOS WORKSHOP ON OPERATIONAL METEOROLOGY
C/O Gerard Neault, Pacific Weather Centre
200- 1200 W 73rd Avenue
Vancouver, B.C.
V6P 6H9

Tel. (604) 664-9052 Fax (604) 664-9005

4e ATELIER SEA/SCMO
DE
METEOROLOGIE OPERATIONNELLE

15-18 SEPTEMBRE, 1992

WHISTLER, C.-B.

LA PREVISION DU TEMPS DANS LES ANNEES 90

FORMULAIRE D'INSCRIPTION

TARIFS

Employé(e) du SEA	$ 25.00	Autobus: $15.00/personne aller ou retour
Membre de la SCMO	$110.00	(Pour plus d'information, consultez la feuille
Etudiant	$ 50.00	d'information jointe à cette lettre de Nouvelles)
Autres	$150.00	
Inscription après	Billet de banquet additionnel:	
1er août	$ 25.00	$40.00/personne

Nom: _____

Adresse: _____

Ville: _____ Province: _____ Pays: _____

Téléphone: maison _____ bureau _____ télécopieur _____

Affiliation: _____

CATEGORIE:

Employé(e) du SEA	$.....
Membre de la SCMO	$.....
Etudiant	$.....
Autres	$.....
Inscription après 1er août	$.....
Billet(s) de banquet additionnel(s)	$.....
Autobus	$.....
Total	$.....

COMPLETER ET FAITES PARVENIR A L'ADRESSE CI-DESSOUS EN INCLUANT UN CHEQUE FAIT A L'ORDRE DE **4TH AES/CMOS WORKSHOP ON OPERATIONAL METEOROLOGY**

4TH AES/CMOS WORKSHOP ON OPERATIONAL METEOROLOGY
C/O Gérard Neault, Pacific Weather Centre
200- 1200 W 73rd Avenue
Vancouver, B.C.
V6P 6H9

Téléphone: (604) 664-9052 Télécopieur: (604) 664-9005

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___

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

Name/Nom _____

Address/Adresse _____

_____

_____

_____

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

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.

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 Postage paid / Postes Canada 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.
