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Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

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A Water Spout off Southern Vancouver Island

The picture above was taken April 6th by Steve Cochrane, 3rd Engineer of the C.S.S. J. P. Tully. See the articles on page 6 of this Newsletter for a description of the spout and the weather conditions at the time.

EDITOR'S COLUMN

The next issue of the CMOS Newsletter **20**(5), October 1992, will go to press on September 20th, 1992. Contributions are welcome and should be sent to me at:-

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

I prefer receiving contributions submitted on floppy disk in a DOS format, however, I can now convert Macintosh files to DOS files. DFO contributors can send ASCII files to me over DFOnet to IOSCCS::HJFREE. Anyone with access to Omnet can send ASCII files to me at IOS.BC, attention Howard Freeland. ASCII files can also be sent to me via Internet to HJFREE@IOS.BC.CA. If you want to send graphics, then HPGL files can be sent as ASCII files over the networks, any other format will have to be sent on paper or on a floppy disc. It is recommended that whatever software prepares an HPGL file be configured for the HP7550 printer. If you have the option of selecting pen colours, please don't.

Do you have an interesting photograph, say, an interesting meteorological or oceanographic phenomenon? If so, write a caption and send me a high contrast black and white version for publication in the CMOS Newsletter. Savonius Rotor is also looking for assistance from anyone who has an unusual point to make.

Howard J. Freeland, CMOS Newsletter Editor

I received the following ditty. I do not know what the source is, perhaps it was written in response to comments made at the AGM at Université Laval in June. Ed.

Thoughts About Our Newsletter

Little doubt that the Newsletter
Contains these days a lot of matter:
News and views of many hues,
Some quite simple, some abstruse.
Many voiced their approbations
Although some have reservations:
They would like it if it had
Not less ocean, but more of Met.
Others have been heard to say,
Nous voudrons plus en français!
All this would be good to do
And it just depends on you.[1]
Any stuff you have not sent
The editor cannot invent.[2]
So please send him stuff today
Be it French or en anglais!

A friend of the Editor[3,4]

Editor's Notes:

[1] *Yes, the Newsletter contents reflect the contributions of the members of CMOS.*

[2] *Savonius Rotor disagrees with this line.*

[3] *a.k.a. Anon.*

[4] *I'm glad to see I still have one.*

WHAT'S GOING AROUND?
by Savonius Rotor

After reading my column on great geophysical celebrations in the offing, the following item was brought to my attention that originates from Applied Optics **11**(8), A14, 1972. The arguments are subtle, but the results are of enormous significance.

The temperature of heaven can be rather accurately computed from available data. Our authority is the Bible: Isaiah 30:26 reads, *Moreover the light of the moon shall be as the light of the sun and the light of the sun shall be sevenfold, as the light of seven days.* Thus, heaven receives from the moon as much radiation as we do from the sun, and in addition seven times seven (forty-nine) times as much as the Earth does from the sun, or fifty times in all. The light we receive from the moon is one ten-thousandth of the light we receive from the sun, so we can ignore that. With these data we can compute the temperature of heaven: The radiation falling on heaven will heat it to the point where the heat lost by radiation is just equal to the heat received by radiation. In other words, heaven loses fifty times as much heat as the Earth does by radiation. Using the Stefan-Boltzman law for radiation

$$(T_H/T_E)^4 = 50$$

where T_H and T_E are the absolute temperatures of Heaven and the Earth (300°K) respectively. This gives T_H as 798°K or 525°C.

The exact temperature of Hell cannot be computed but it must be less than 444.6°C, the temperature at which brimstone changes from a liquid to a gas. Revelations 21:8 reads: *But the fearful , and unbelieving.....shall have their part in the lake which burneth with fire and brimstone.* A lake of molten brimstone (sulphur) must be below the boiling point which is 444.6°C otherwise there would be no lake.

We have, then, the temperature of heaven, 525°C and the temperature of hell, less than 445°C. Therefore, heaven is hotter than hell.

Letters to the Editor

The History of the CMOS Journal

The June '92 CMOS Newsletter (Vol. 20 No.3) mentions that ".....the journal began as Atmosphere in 1963, published by the Canadian Branch of the Royal Meteorological Society." This is technically correct since the earlier Branch publication was not given a name.

Publication of the predecessor to Atmosphere began in January 1950, Vol. 1, No. 1. The first edition contained a single article "The Jet Stream - A resumé of scientific papers published on the jet stream and related phenomena up to November 1949", by P.D. McTaggart-Cowan. All issues contained a list of the Executive Committee, Councillors-at-Large, and a paper of general interest to the membership, very often scientific in nature. Many papers make interesting reading today, for example, "Meteorology - 2000 AD" by D.P. McIntyre (Vol.6 No.1), or the late Percy Saltzman's lighthearted account of "Operation Ice Capade", Vol. 1 No. 3, a report on reconnaissance flights to determine the freeze-up

of Hudson's Bay. The number of issues per volume varied from several to about nine.

A list of editors follows:

1950 - Not indicated probably F.W. Benum the Secretary.	
1951-54	P.P. Saltzman
1954	M.G. Hagglund
1955	W.T.R. Allen
1956-59	Morley Thomas

At the annual meeting of the Canadian Branch, Royal Meteorological Society, April 1960, the President reported, "We must admit to a lapse of the Publication of the Canadian Branch. This lapse need not be permanent." My records appear to indicate that the Publication next appeared in March 1963 as Atmosphere (Vol. 1, No. 1) under the editorship of Svenn Orvig, as noted in the Newsletter.

Yours sincerely,
Keith R. Greenaway
472 Wellesley Avenue
Ottawa, Ont. K2A 1B4

The 1992 Canada Wide Science Fair

Thank you for the two-hundred and fifty dollar award which I received at the Canada-Wide Science Fair in Sudbury. It is an honour to have my project recognized by your Society. The money is being saved towards my university education. I appreciate the support that your Society gives to students considering a scientific career. Thanks again.

Yours sincerely,
Andrew Hately.

The above picture shows Mr. Hately receiving the CMOS Award, presented by Mr. Gerhard Schinkel (Science North, Sudbury). Andrew Hately is a grade 11 student from Bowmanville, Ontario, and his project involved an assessment of the reliability of weather forecasts.

David Krauel
The New President of CMOS

Dr. David Krauel

After completing a Bachelor of Science in Physics at McMaster University in 1966, Dr. David P. Krauel was employed as a research assistant at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia for three years. During this period he completed his thesis on estuarine circulation and mixing and received a Master of Science in Physical Oceanography at Dalhousie University. In 1969 he took a leave of absence to study for a Doctorate in Oceanography at Liverpool University in England. In 1972, following the acceptance of his thesis on turbulent diffusion in the marine environment, he returned to Bedford Institute as a research scientist. In 1974 he accepted an offer to join the faculty at Royal Roads Military College in Victoria, British Columbia to assist in the planning and teaching of a new Bachelor of Science degree program in Physics and Oceanography. This, the first degree to be offered at Royal Roads, commenced in 1975. In 1981 Dr. Krauel was appointed Head of the Physics Department. During the ensuing years he developed a proposal for a masters degree in oceanography and acoustics which was approved and funded for first enrolments in 1987. In 1988 Dr. Krauel was appointed Dean of Graduate Studies and Director of Computing Services, positions which he continues to hold. Dr. Krauel's research is currently focused on satellite tracked drifter studies in the northeast Pacific, GIS applications in oceanography and acoustics, modelling turbulent diffusion in coastal waters and wind-wave hindcast modelling. Dr. Krauel was a member of Course XXXVIII at National Defence College in Kingston, Ontario in 1984-85. He is the Canadian member of the World Ocean Circulation Experiment Core Project 1 Working Group, Chairman of the Pacific Subcommittee on Oceanography, and a member of the Canadian National Committee for the Scientific Committee on Oceanic Research. He has been active in the CMOS Vancouver Island Centre as Chairman and on the organizing committees for the 13th and 24th Congresses.

Charles A. Lin
New Editor of Atmosphere-Ocean

Dr. Charles A. Lin took over from Roger Daley as meteorological co-editor of Atmosphere-Ocean. In the June issue of the Newsletter we carried a profile of Peter Smith, the new oceanographic co-editor, here we carry a profile of Charles Lin.

Dr. Charles Lin

Dr. Lin received his Ph.D. degree in meteorology from MIT in 1979. He worked in the Numerical Modelling Division of the Canadian Climate Centre during 1979-1980. In 1980 he joined the Department of Physics at the University of Toronto. His research in the subsequent few years centred on the stability of planetary waves in the troposphere, and energy balance climate models. In 1986 he joined the Department of Meteorology at McGill University as part of an AES/NSERC Industrial Research Program in climate research. At McGill his research interests have broadened to include the role of the oceans in climate variability.

In recent years Dr. Lin has examined the southern hemisphere planetary wave structure as an unstable baroclinic mode using a hierarchy of models. He, together with Dr. R. Stewart of the AES, have also examined the dynamical effects of melting in mesoscale circulations. His work in ocean-climate interaction has included the development of a geostrophic ocean circulation model which can be used for long-term climate studies; this work is done together with Dr. Richard Greatbatch of Memorial University.

During 1991-1992 Dr. Lin is on sabbatical leave at the Laboratoire de Météorologie Dynamique, École Normale Supérieure, in Paris, France. Upon his return to Canada he is happy to serve as the Atmospheric Co-Editor of *Atmosphere-Ocean* and looks forward to working with the Oceanic Co-Editor, Dr. Peter Smith of the Bedford Institute of Oceanography, to continue to promote the journal.

CMOS Prizes and Awards for 1991

Every year, in the dark days of November, December or early January, some of you put aside thoughts of year end festivities for a while to take the time to nominate your colleagues, peers or students for CMOS awards. The committee reviews the nominations, engages in a marathon conference call, and, by early March, makes its recommendation to Council. All these efforts bear fruit in June when the awards are announced at the annual congress banquet. This year in Quebec City the lucky, and highly deserving, awards recipients were:

Presidents Prize - Dan Wright of the Bedford Institute of Oceanography for his elegant and timely ocean and coupled atmosphere - ocean model development (conducted in collaboration with Tom Stocker) and related climate studies.

J.P. Tully Medal in Oceanography - Neil J. Campbell, retired (formerly with DFO in Ottawa), for his many and varied contributions to oceanography in Canada, and in international fora, both as a leader of arctic oceanographic expeditions and as a scientific administrator and diplomat.

Dr. Andrew Thomson Prize in Applied Meteorology - Peter Zwack of UQAM for his many innovative applications of theoretical research to operational meteorology.

Prize in Applied Oceanography - R. Falconer Henry of IOS for his work on TRIGRID - an outstanding system of computer programmes for generating finite element grids for ocean modelling.

Rube Hornstein Prize in Operational Meteorology - Neil Ibey of the Canadian Forces Forecast Centre, Trenton for his work on the development of the Image Manager (IM) system for the display of meteorological data.

Graduate Student Prizes:

Yunbo Xie of UBC Oceanography for his PH.D. thesis on the acoustics of sea ice, and

Matthias Roth of UBC Geography for his doctoral thesis on suburban turbulence.

Reviewers of the Year - Lawrence Mysak of McGill and Diane Masson of IOS.

No nominations were received this year for the Environmental Citation or the Citation for Outstanding Radio and Television Weather Presentation. This year, as often happens, we had other deserving candidates, especially for the Graduate Student Prize(s), and the committee continues to be impressed by the strength and variety of the candidates.

It is a little early to be making nominations for 1992 but the call will go out towards the end of the year and we would encourage you to participate then in this recognition of excellent and outstanding achievements in Canadian meteorology and oceanography.

Peter Taylor
CMOS Prizes and Awards Committee

Canada/China Mesoscale Workshop June 8-11, 1991, Winnipeg

The following has been extracted from a report on the Canada-China Mesoscale Meteorology Workshop written by the organisers, Ken Fluto and Louis Legal. The Workshop was sponsored by CMOS and AES and took place during the week following the CMOS Congress in Winnipeg, 1991. The full report is available from Mr. Legal, AES Winnipeg.

Workshop Accomplishments

When the Canada-China workshop was first proposed, the organizing committee set out the following goals:

- provide a forum for information exchange
- make contact and establish a rapport with our Chinese colleagues
- explore the possibility and perhaps establish the nature of possible future meteorological collaboration

Presentations at the workshop consisted of invited speakers from AES research groups, McGill University and NOAA. The Chinese representative also made presentations at all sessions on the state of mesoscale meteorology in the PRC. Ample time was allowed during presentations to provide for discussion and questions. It was apparent from these discussions and questions that the participants became more informed on the Canadian and Chinese meteorological science and in the current activities of mesoscale research and development in their respective countries. The Chinese contingent appeared mostly interested in convective severe weather and, in particular, heavy rain events and hail. It was learned that tornadoes are relatively rare events in China, and hence were barely mentioned in their presentations.

The Chinese showed considerable interest in our processing and display technology. This was evident when they toured the Prairie Weather Centre and viewed our workstation development project and the operation of the Image Manager system. This was further brought out when we were discussing recommendations, in that they wanted an item relating to technology transfer initiative.

It was also felt that the NOAA participation was useful. It was interesting to note the resource availability comparison with the USA made by the Chinese. Their impression is that the Americans have a much higher resource base than either the Canadians or the PRC for mesoscale related research. The latter two countries have to use more initiative and look harder for opportunities to accomplish research. The Chinese also discussed their desire to invite Canadian participants to the USA/China Workshop which will be held in China in August 1992.

It was generally felt that the workshop proved useful in bringing together scientists from different areas of research related to mesoscale meteorology to talk about problems. It developed contacts and relationships between the operational community, AES researchers, McGill University and the scientists from the PRC.

The final session of the workshop dealt with future directions and joint initiatives. This session was to identify common areas of interest between Canada and China, possible joint research projects, joint initiatives and prepare recommendations for the next memorandum of understanding. The presentations and discussion of the previous couple of days provided a basis for this session.

Overall it is viewed that the three goals were met and that a positive contribution to mesoscale meteorology has been made in both countries. This was evident by the enthusiasm of the participants to further pursue cooperative initiatives.

Recommendations

The last session of the workshop was designed to identify future directions and possible joint initiatives. The following recommendations resulted from the session:

1. **Exchange Forecaster and Researcher Experts.**

   a) Two or three Canadian experts should participate in the Chinese mesoscale field experiment (SCREX) in China in 1993 and 1994. Similarly, two or three Chinese experts should participate in a Canadian thunderstorm field project such as the proposed Prairie Storms Experiment (PRASE) in 1993-94.

   b) One or two experts from China and Canada should participate in existing Canadian and Chinese programs. It was noted that this should include Chinese regional or provincial centres.

2. **Mesoscale Meteorology Workshops**

   a) The Chinese indicated that they would invite at least one Canadian observer to the China-USA mesoscale workshop to be held in China in 1992.

   b) The next Canada-China mesoscale workshop should be held in China after SCREX is completed. One or two American observers will be invited to participate.

   c) There should be a Canada-China mesoscale workshop in Canada during 1996 or 1997 tied to a Prairie Storms Experiment which should be designed for the period 1991-96. (See recommendation #5 on forecasting.)

3. **Joint Canada-Chinese Meteorology Publications**

   The following topics were suggested as possible joint publications which should be pursued:

   - Comparative Convective Climatology of China & Canada
   - Modelling
   - Convective Storm Structure Diagnosed from Radar

   It was suggested that a special issue of Atmosphere-Ocean could be devoted to a series of joint publications.

4. **Modelling**

   a) There should be cooperative work done by Canada and China on research mesoscale numerical models. The universities and RPN should be involved. The Community Model Plan proposed by Dr. Da-Lin Zhang of McGill University could be the structure to encourage this cooperation.

   b) There should be a joint effort by Canada and China to provide mesoscale models for the operational forecaster workstation.

   c) The two countries should exchange case studies to be run on the other country's mesoscale numerical models in order to compare performance.

5. Forecasting

The Prairie Storms Experiment (PRASE) should be pursued in the 1991-96 period. The mesoscale field experiment should be designed with an operational forecasting component and Chinese forecasters should be invited to participate. The experiment should also contain conceptual and modelling components.

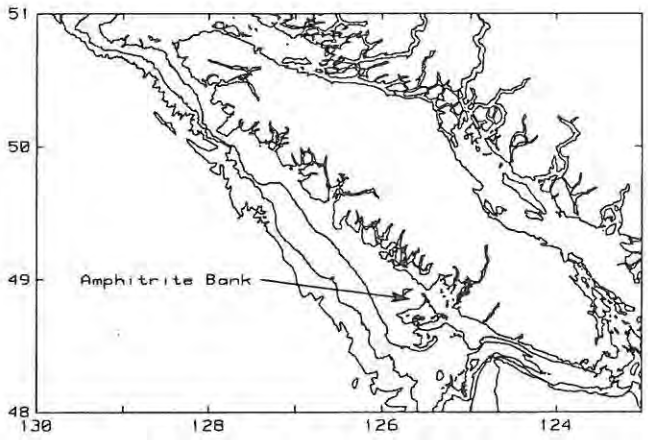
6. Canada-China Mesoscale Meteorology Advisory Group

It was recommended that all participants of the workshop should act as advisors for any future Canada-China joint initiatives in mesoscale meteorology. This representation should include researchers from AES and the university community as well as operational forecasters. It was suggested that one individual act as the focal point for interacting with the group.

A Water Spout off Vancouver Island

Steve Cochrane and Howard Freeland
Inst. of Ocean Sciences, Sidney, B.C.

On April 6th 1992 while the IOS vessel John P. Tully was engaged in routine mooring operations off the west coast of



Vancouver Island a water spout was observed. A video tape of the spout was made by Steve Cochrane, Third Engineer, and one photograph copied from the video tape is presented on the front page of this Newsletter. The spout was observed on Amphitrite Bank, about 3 km offshore from Vancouver Island. The Tully was about 400 metres away and trying to increase that distance. The spout appeared about 1130 am and lasted for about 10 minutes. During its development waves of some sort developed along the spout and propagated slowly downwards. Does anyone have an explanation for those waves? They are visible in the photograph. A water spout off the west coast of Vancouver Island is an unusual phenomenon. Sea surface temperatures were unusually high for this time of year with anomalies of 2 to 2½°C due to the current El Niño.

The Weather Situation on April 6th, 1992

Gerard Neault
Pacific Weather Centre, Vancouver

The weather situation on April 6, 1992 was not an exceptional one. A ridge of high pressure was building from the south. Showers that had been prevalent the day before over the Island and the adjacent waters had become less widespread and were confined mainly to the southern half of the island. In addition, the showers reported were all in the light category with the lowest visibility reported only 20km.

A look at the satellite pictures confirms that nothing very unusual was taking place. In fact, the satellite pictures showed the convective activity had decreased markedly from April 5. However, it is important to remember that waterspouts do not always form from thundershower clouds, but often begin when the cloud tops are only between 4-6000 metres. It has been found that mesoscale convergence, cyclonic vorticity and a superadiabatic lapse rate near the water surface are generally present when waterspouts occur.

There is no doubt, in this case, the lapse rate must have been close to superadiabatic near the water surface since the air aloft was very cold. Some cyclonic vorticity was likely present aloft, but probably on the weak side. There is too little information over the waters to assess the mesoscale convergence in the area where the waterspout occurred. It is likely in this case, as it is the case for summer severe weather, that mesoscale convergence played a major role in the occurrence of the waterspout on April 6, 1992.

For your information: According to Owen Lange, marine meteorologist at Pacific Weather Centre, the earliest reported waterspout sighting was made by Captain Cook, May 17, 1763, in Queen Charlotte Sound.

New CMOS Members

The following new members were approved at the CMOS Executive meeting 8th June, 1992:

Thurre Christian	UQAM, Québec	(étudient)
Anna Glazer	Montréal, Québec	(étudient)
Corinne Le Quéré	McGill Univ., Québec	(étudient)
Rosemary Tabory	Downsview, Ont.	(student)
Sheng Zhang	McGill Univ., Québec	(étudient)

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.

CMOS POSITION STATEMENTS

A CMOS Position Statement on Natural Hazards is currently being prepared by a subcommittee of the Scientific Committee. It is expected that the Statement will be completed later this year. Comments are welcome and should be directed to: Dr. Ronald Stewart, CMOS Scientific Committee Chairman, Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario M3H 5T4. Phone (416-739-4608) and FAX (416-739-4211).

If you have suggestions for future position statements, please also contact Dr. Stewart. Such suggestions will be considered at the next Scientific Committee meeting.

Contributions Requested

Please send climate research-related material to Ross Brown, Canadian Climate Centre, Phone: (613) 996-4488, Fax: (613) 563-8480.

Toronto Workshop on Climate System Research - May 4-5, 1992

Background:

This workshop represented the third in a series of workshops being held across Canada to define research priorities and foster collaboration within the context of a Climate Research Network. The workshop focused on three areas; (1) atmospheric chemistry and dynamics, (2) clouds and radiation, and (3) paleoclimate. The main objective of the workshop was to develop collaborative research proposals which would make a significant contribution to the next-generation Canadian general circulation model (GCM) being developed at the Canadian Climate Centre under the Green Plan Global Warming Science Initiative. There were 44 invited participants from the universities, federal government, Ontario provincial government and the private sector. The first day of the workshop consisted of invited overview papers on major issues in each of the three areas, followed by invited "straw proposals" to significantly increase climate research in priority areas. On the morning of the second day, participants formed into three working groups to discuss and refine the straw proposals. These were subsequently presented to the full group in the afternoon for general discussion.

Overview Presentations:

Jack McConnell (York. U.) presented the overview paper on Atmospheric Chemistry and Dynamics. The importance of understanding the transport and interactions of chemicals in the atmosphere for studies of climate/global change was clearly demonstrated in such areas as the role of aerosols on clouds and radiation, ozone depletion, and chemical signatures (tracers) of climate change. A strong case was made for extending the current CCC-GCM into a middle-atmosphere model because of the complex feedbacks that take place between the troposphere and stratosphere, and also to allow a predictive capability for the ozone change problem. A major proposal involving U. of T., York, McGill, UQAM and the Canadian Climate Centre has been submitted to NSERC to extend the CCC-GCM into a middle atmosphere model with fully interactive chemistry. This extension is critical for addressing policy-related questions concerning the global warming/cooling potential of anthropogenic gases and aerosols. The 3-D chemical transport model (CTM) being developed at York was described. It is a spectral model currently operating with 7 dynamical tracers and 29 chemical species. The York group is currently putting chemistry and convection into the CCC-GCM. The importance of maintaining a good measurement base of atmospheric constituents was stressed as was the need to monitor stratospheric and mesospheric temperatures for potential evidence of a climate warming signal.

George Isaac (AES) commented on how crudely clouds were treated in GCMs, and remarked on how sensitive climate change simulations are to different cloud parameterizations. A comparison of CCC-GCM output to station data from across Canada revealed it handled winter stratiform cloud regimes reasonably well, but did a much poorer job with summer convective cloud regimes. Problems were also noted in the ability of GCMs to simulate precipitation at high latitudes. Numerous cloud/climate-related issues were raised including; how to take variable cloud distributions into account (e.g. spatial inhomogeneity, different cloud types), cloud chemistry feedbacks (e.g. DMS), cloud transport, topographic effects, clouds and precipitation, and interaction with the lower stratosphere. The importance of field observations, data analysis and laboratory work was stressed.

The essence of Richard Peltier's (U. of T.) overview of paleoclimate was that significant internal feedback processes are required to explain the 100,000 year climate oscillation which turned on very dramatically about a million years ago. This oscillation does not correspond to any direct external forcing mechanism. Terrigenous dust is a possible feedback mechanism, but recent evidence seems to point more toward the thermohaline circulation as a likely candidate. The remaining issue is to explain how the thermohaline circulation interacts with other components of the climate system to cause 100,000 year oscillations in the global climate system. The overview highlighted the importance of paleoclimatic GCM simulations. For example, paleo-vegetation assemblages can give information on past precipitation regimes which can be used to evaluate the global hydrological cycle in GCMs (in essence a "paleo-GEWEX" experiment). Fully-coupled atmosphere-ocean GCM paleo-simulations have demonstrated the importance of the thermohaline circulation and have highlighted our inability to model high latitude precipitation processes e.g. the GCM was unable to sustain ice sheets during times when they were known to exist. The 6k BP warm period was noted as being a particularly useful simulation for GCMs in that it isolates the effect of different solar radiation input to the climate system. Significant advances in understanding the climate system were anticipated if more effort was made to mesh Canada's significant expertise in paleo-reconstruction with those of the climate modelling community.

Norman McFarlane (CCC) presented an overview of the CCC-GCM along with some of the preliminary results which are to be published shortly in *Journal of Climate*. Research is currently being carried out on a number of fronts to improve the GCM such as: increasing spatial resolution, fully coupling the GCM to an ocean circulation model, improving the treatment of land surface processes, extending the GCM into a middle atmosphere model, and improving cloud parameterizations. Norman highlighted some of the difficulties of evaluating GCM performance with surface data. For example, screen temperature is not carried in the model and the extraction of this information is a non-trivial process.

Straw Proposals:
The presentation and discussion of "straw proposals" were led by Len Barrie of AES (atmospheric chemistry and dynamics), Petr Chylek of Dalhousie University (clouds and radiation) and Anne de Vernal of UQAM (paleoclimate).

The atmospheric chemistry working group's recommendations were divided into several main themes: model development, model verification and synthesis/evaluation. Under model development, the main recommendation was for a community effort to focus on developing algorithms for chemical transportation and transformation (esp. in clouds). It was felt that a community CTM and GCM were necessary to enhance the participation of the atmospheric chemistry research community in these activities. An important activity highlighted during the discussion of atmospheric modelling was the addition to the GCM model of active simulations of ozone and aerosols which have a great potential to affect dynamics and are sufficiently well-known to model actively. It was stressed that one of the most basic requirements for modelling of chemical species is knowledge of the natural and anthropogenic input fluxes. Measurement programs were therefore seen as an essential component in model verification which need to be expanded. It was recommended that current baseline observations continue and that total column CO and CH_4 measurements be added. It was also recommended that suggestions for further expansion of the baseline observation program be the subject of a future workshop. A strong recommendation was made to better understand the Canadian contribution to global greenhouse gas emissions and cycles such as CO_2, CH_4, N_2O, S, Halogens, NOx and VOCs. Other concerns were the implications of ozone depletion for global/regional climate, and the relative contribution of radiatively important trace substances (RITS) to greenhouse forcing.

A major conclusion of the clouds and radiation working group was that both funding and the level of effort spent on cloud-climate related research in Canada were very low considering the importance of clouds in the global climate system. Three areas were proposed for cooperative projects:

(1) Use high resolution cloud or mesoscale models to develop better cloud parameterization schemes for GCMs;

(2) Analyze existing cloud data sets;

(3) Quantify the uncertainties in cloud models.

A number of suggestions were made on how to promote greater collaboration within the Canadian cloud research community. These included a workshop, a think tank, a community GCM, and the development of a cloud research institute (loose and small, but highly focused). The main problem facing cloud research in Canada was considered to be a lack of research personnel - Petr Chylek pointed out you could count the number of cloud-radiation researchers in Canada on one hand. Additional concerns were funding for observational systems, and the problem of insufficient interaction between the cloud research community and the GCM modellers.

The paleoclimate working group developed a proposal to carry out paleoclimatic simulations with the CCC-GCM, which would assist in GCM verification as well as stimulate the paleoclimate community to assemble a comprehensive paleoclimatic database. The group will continue to elaborate the proposal in the form of an NSERC collaborative research grant submission. It was proposed that this will serve as a discussion document for a workshop to be supported by EMR/GSC, the Royal Society and AES in October/November of this year. The proposal will first focus on the 6k BP period, and will look later at the 18k BP and 125k BP periods. The proposal will seek support from the GSC and NSERC and will request GSC to act as a repository for the paleoclimatic database.

General Discussion:
In the general discussions that followed the proposal presentations, there was a widespread request for a community GCM. John Stone pointed out there are major resource implications associated with providing the necessary model documentation and user training. The research community thought that this support should be made as part of the Green Plan commitment to enhance Canadian climate research capabilities. It was argued that the GCM development process would benefit greatly by being opened up to the wider scientific community.

There was also considerable discussion about how to best address the problem of a shortage of research expertise in the universities. Arguments were presented in favour of research chairs, particularly at the smaller universities, as there is the potential for these to become permanent university positions. The question of funding mechanisms for individual research was also discussed. John Stone indicated that there was no money in the Green Plan for grants and contributions, but that this was something he intended to look into, and that it may be an appropriate mechanism for funding well-defined collaborative projects.

Toronto Workshop on Climate and Statistics

The 5th International Meeting on Statistical Climatology and the 12th Conference on Probability and Statistics in Atmospheric Sciences were held jointly in Toronto from June 22-26. These meetings brought together world class experts in the fields of climatology, meteorology and statistics. The Canadian Climate Centre took advantage of this gathering to host a dinner-workshop on June 23 for invited participants from the conferences including leading international experts in the analysis and interpretation of climate data, as well as members of the Canadian statistics community. The discussions concluded there was a need to develop new statistical methods in three main areas: (1) data analysis (e.g. combination of diverse data types, homogeneity, optimal interpolation); (2) climate variability and change (e.g. signal detection); and (3) climate forecasting. It was evident from the discussions that greater collaboration between the two communities is particularly timely. A number of options for

fostering this collaboration were discussed. A full workshop report will appear in the next CMOS Newsletter. For further information contact Dr. Francis Zwiers at (416) 739-4415.

Summary of the 8th Session of the National Climate Research Committee, Vancouver, May 21-22, 1992

The National Climate Research Committee convened at the Pacific Region headquarters of the Atmospheric Environment Service (AES) on May 21-22, 1992. The Committee now has three main roles which include: (1) the Canadian National Committee for the World Climate Research Program; (2) the Research Committee for the Canadian Climate Program Board (CPB); and (3) the Scientific Advisory Panel for the Canadian Climate Research Network being established under the Green Plan Global Warming Science Program.

The main items discussed were: Arctic climate research, climate research data requirements, and the role of the Committee in the evolving Canadian Climate Research Network. Highlights of the discussions are presented below:

In recognition of the Arctic's crucial role in determining atmospheric circulation and the diffuse nature of Arctic research in Canada, the Committee will organize a Canadian Arctic workshop to develop a focused Arctic research strategy. The workshop will likely be held in Ottawa in mid-December 1992, hopefully in collaboration with the recently established Arctic Panel of the Canadian Global Change Program.

With respect to data requirements for climate research, discussion focused on the problem of the time-lag between collection of research data and its subsequent release to the research community at large. The Committee encouraged the CPB to urge granting councils to include provisions on this matter in grant documentation.

The Committee agreed to serve as the Scientific Advisory Panel for the Climate Research Network being established as part of the Green Plan Global Warming Science Initiative. At the same time, it recognized it would need access to a wider variety of expertise.

The Committee strongly endorsed a proposal for a Canadian Community Climate Modelling Project staffed by both AES and university researchers, which would facilitate the use of Canadian models by a much larger audience.

The Committee noted the generally poor response from the academic community to getting involved with the Global Water and Energy Cycle Experiment (GEWEX). It urged the sponsors to redouble their efforts to increase participation, including any logistic help they may be able to provide field researchers.

Invited presentations were made to the Committee by N. McFarlane from AES on "Canadian Climate Centre Modelling Activities", C.S. Wong from the Institute for Ocean Sciences (IOS) on "The Oceans as a Carbon Sink", and E. Carmack from IOS on "Salt Water Fluxes and Budget of the Arctic Ocean".

For additional information on the National Climate Research Committee or the Canadian Climate Program, please contact Mike Malone, Atmospheric Environment Service, at (416) 739-4433.

Up-Coming Climate-Related Research Meetings in Canada:

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.

Saskatoon, September 1-2, 1992: Regional Evaporation Study (RES) Workshop at National Hydrology Research Centre. The workshop will review the results of the RES-91 field program, discuss collaborative studies and operational concerns, and look at future RES plans. Contact: Dr. Geoff Strong (306) 975-5809.

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.

Fredericton, June 8-11, 1993: Twenty-Seventh Annual CMOS Congress. The Congress will feature a Theme Session on climate modelling. Contact: Dr. John Loder, Chairman, Scientific Program Committee, (902) 426-4960.

Calgary, Sept. 12-18, 1993: The International Society of Biometeorology Thirteenth International Congress of Biometeorology. The theme of this congress is adaptations to global atmospheric change and variability. The congress will address issues of human, animal, plant, invertebrates and microorganisms in relation to climate change and variability. Contact: Dr. N. Barthakur (514) 398-7938.

WOCE News

WOCE presence at Laval CMOS Congress

On June 8, 1992, CNC WOCE met, with Paul LeBlond in the chair, and with CNC members Greatbatch, Mysak, Ruddick and Wright present. Ms. Barbara Conway was present as NSERC representative. F. Dobson, D. Kelley, D. Brickman, and G. Swaters attended parts of the meeting. Some of the items of business acted upon were:

1. The chairman reported on activities since the last meeting in February.

2. The content and format of the annual report submitted to NSERC were discussed.

3. A sub-committee of CNC WOCE was formed with responsibility for organising the review of proposals for work beginning after July 1993. The committee chairman is Dr. R. Allyn Clarke, with members drawn from CNC members who are not applicants for funding.

4. As an amendment to management structure, The post of Scientific Coordinator was created, with Dr. R. Allyn Clarke nominated for that position.

5. Budgets for 1992-93 were approved for current projects.

6. New CNC members Andrew Weaver and Dan Kelley were nominated and approved for three years, replacing Drs. Greatbatch and LeBlond, whose terms ended in June.

7. The Secretariat will move to Dalhousie University on July 1, 1992, with Barry Ruddick the new CNC WOCE Chair.

On Tuesday, June 9, a special session entitled "Large Scale Oceanography: WOCE" occupied the entire afternoon, with Paul LeBlond chairing the first half and Richard Greatbatch chairing the second. The session was very well attended, and seems to have been well received. A list of titles and presenters follows:

La Circulation dans L'Océan Nord-Atlantique Ouest. T. H. Reynaud, A. J. Weaver, R. J. Greatbatch.

Interpentadal Changes in the North Atlantic Circulation. R. J. Greatbatch, A.F. Fanning, A. D. Goulding, J. Xu, S. Levitus.

Microstructure Measurements during the North Atlantic Tracer Release Experiment (WOCE Core-3). B. Ruddick, J. Burke, N. Oakey.

Summer Sea Surface Temperature Variability off Vancouver Island. W. Fang, W.W. Hsieh.

Optimal Control of Open-ocean Boundary by Assimilating Altimetry data into a Regional Circulation Model. J. Zou, W.W. Hsieh.

Deep Water Mass Properties in a 2½-D Model of the Global Ocean. D. Wright, T. Stocker.

On Equatorial Kelvin Waves in Numerical Ocean Models. M.K.F. Ng, W.W. Hsieh.

Intense Currents in the Deep North-East Pacific Ocean. H. Freeland (presented by P. Cummins)

Time-Dependent Convective Instability. D. Brickman.

Salinity Control over Deep Convection. D. Kelley.

Contact information for the CNC-WOCE Secretariat:

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Omnet: WOCE.CAN (This is still being set up; we are assuming this address is available.)

Phone (temporary) (902) 494-8834

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The next meeting of CNC-WOCE is planned for early September. If you have any items of business which you wish discussed (or maybe even dealt with!) please let us know.

Barry Ruddick (barry@papa.ocean.dal.ca)

WOCE Logo Competition

Design a logo for the Canadian WOCE community and win the grand prize of a free invitation to present a paper at the CMOS Congress in Fredericton in 1993!

The above logo was designed by Howard Freeland and Frank Whitney as an IOS WOCE logo and is printed here to stimulate discussion. It uses a projection that displays the whole world and is meant to be a local variant on the WOCE IPO logo. This one has placed Victoria in its natural place at the centre of all things. For a national WOCE logo a simple modification might place Ottawa at the centre.

JGOFS Canada: Sedimentary Record Studies in the Equatorial Pacific

Summarized by Tom Pedersen (UBC Oceanography) and Larry Mayer (Surveying Engineering, University of New Brunswick)

Publication of the high-resolution Vostok and Byrd Station ice core CO_2 records (Barnola et al., 1987, and Neftel et al., 1988, respectively) has confirmed that major changes in the CO_2 concentration of the atmosphere have accompanied glacial-interglacial climatic cycles during the Late Quaternary. How such variations occur is not yet clearly known, but a number of hypotheses to explain them have been advanced; all centre on changes in ocean chemistry (e.g. Boyle, 1988, and references therein; Broecker and Peng, 1989). Boyle (1988) suggested that moving the site of nutrient regeneration from shallow intermediate depths in the ocean to the deep sea could account for a major fraction of the atmospheric CO_2 decrease by increasing the alkalinity of deep waters. Boyle did not define a specific mechanism to accomplish the vertical shift in the distribution of nutrients, but suggested that increased primary production in low latitudes (and thus a greater export flux of organic carbon from the mixed layer) could play a significant role. Sarnthein et al. (1987, 1988) presented evidence from the Atlantic, Indian and Pacific oceans which showed that the accumulation rate of organic carbon indeed increased in marine sediments in regions of equatorial and coastal upwelling during the last glacial period. This enhanced deposition was attributed to increased meridional wind speeds, particularly at low latitudes, in response to sea ice formation at times of reduced high-latitude insolation. A similar mechanism was invoked by Pedersen (1983) and Lyle et al. (1988),who observed increased carbon accumulation in the eastern equatorial Pacific during Late Pleistocene glacial maxima. Pedersen et al. (1991) showed that in the Panama Basin area such an association appears to hold for the last 500 kyr. Because primary production in the broad equatorial Pacific is reckoned to account for as much as 50% of new production globally (Chavez and Barber, 1987), variations in productivity and carbon burial have the potential to alter climate on a global scale. Clearly, determination of spatial and temporal variations in the burial flux of organic carbon in the equatorial Pacific is critical to understanding the short and long-term dynamics of such variability and to interpretation of the CO_2 ice-core record.

High productivity in the equatorial Pacific is supported by upwelling primarily along the equatorial divergence within the South Equatorial Current (SEC), and by upwelling associated with Ekman transport and shear between the westward-flowing North Equatorial Current, north of about 10° N, and the eastward-flowing Equatorial Counter Current, centred on about 7° N. (Wyrtki, 1974). In the Panama Basin region, four factors govern the nutrient supply to surface waters. Nutrients are advected into surface waters in the southern reaches of the basin by the Peru Current which swings westward at or just south of the equator, where it becomes part of the SEC. The Equatorial Undercurrent delivers nutrients to the Galapagos Islands area, where it shoals substantially. Coastal upwelling along the Colombian coast is associated with a south-flowing current which originates in the northern part of the Panama Basin, and domal upwelling locally in the Panama Bight and regionally to the west (the Cocos Ridge area) supports high production in those areas (Wyrtki, 1974). Given the considerable evidence now in existence that global wind speeds were significantly higher during the last glacial period than they are today (Sarnthein et al., 1988 and references therein; Pisias and Rea, 1988), there can be little doubt that upwelling was enhanced in the eastern Pacific during glacials. However, extant evidence to support this association is restricted to a rather small number of cores. Thus, it is not yet known how areally extensive the enhanced upwelling was, nor whether or not there were loci of exceptional productivity which might have resulted from specific physical oceanographic responses to faster trade winds; for example, higher wind stress increases the dynamic height of the western Pacific which should be manifest by a larger or faster Equatorial Undercurrent. Strengthening of this flow during glacials should promote increased delivery of nutrients to the Galapagos platform, which would have been shallower at that time because of the lowered sea level. Relatively shallow, high sedimentation-rate cores now available from the area should record in some detail the history of such variations and their role in CO_2 dynamics.

The carbonate record is also intimately linked to the global geochemical CO_2 cycle for it is a function of both productivity (complicated by the fact that heterotrophs (foraminifera) as well as autotrophs (coccoliths) can contribute substantially to the settling flux), and dissolution (which through the production of metabolic CO_2 is related to the production and the settling flux of organic carbon (Emerson and Bender, 1981)). Despite these complications, the carbonate record provides critical information in the context of the JGOFS program because the preservational history of carbonate is a key parameter in a number of geochemical models of the ocean (Bender, 1984; Berger and Keir, 1984; Broecker and Peng, 1984; Berger and Spitzy, 1988) and because carbonate profiles record the response to the state of undersaturation of the oceans. Hence, it is a signal that is global rather than local. In addition, a number of techniques have been developed for separating the productivity and preservation signals (e.g. Berger and Diester-Haas, 1988), which, with careful verification have the potential to greatly improve the carbon budget information that can be extracted from the carbonate record. High-resolution records of carbonate accumulation in concert with organic carbon records can therefore provide important information on local and global changes in the carbon cycle.

The Equatorial Pacific program of the sedimentary Canadian contingent in JGOFS is designed to address the following questions:

(i) How have the accumulation of organic matter and calcium carbonate varied spatially across the eastern equatorial Pacific and as a function of water depth during the Late Quaternary, and are the variations consistent with circulation dynamics in the region? This question is also of considerable interest to Canadian JGOFS participant Marlon Lewis (Dalhousie University),

and the results obtained in this work will be used to constrain the models he intends to develop based on contemporary temporal and spatial observations of primary production.

(ii) What are the phase relationships in the eastern equatorial Pacific among the organic carbon and carbonate carbon accumulation rate records, the ice core CO_2 record, the ice volume record (as recorded by oxygen isotopes in foraminifera), and the gradient in dissolved inorganic carbon concentrations between surface and deep waters (which is recorded by carbon isotopes in planktonic and benthic foraminifera).

(iii) How has the utilization of nutrients (recorded by the nitrogen isotope composition of organic matter) responded to climate forcing during the Late Quaternary, and what has been the history of the partial pressure of CO_2 (recorded by the carbon isotopic composition of plankton) in the surface waters during this time.

(iv) How closely coupled are variations in the organic carbon and $CaCO_3$ accumulation rates both spatially and temporally during the Late Quaternary? This question relates directly to the invocation of changes in mean ocean alkalinity as the first-order control on atmospheric CO_2 as postulated by Broecker and Peng (1989) and Boyle (1988).

The pursuit of answers to these questions will shed light not only on the proposed link between CO_2 extraction from the atmosphere, increased low latitude upwelling, and onset of glacial periods, but also the mechanistic relationships between nutrient fluxes (upwelling), export fluxes of organic matter, and influxes or effluxes of CO_2 to or from surface waters. The close interrelationship between such variables and the saturation state of deep waters will be assessed through use of the carbonate data. Detailed Corg and $CaCO_3$ profiles will be used in conjunction with high-resolution chronostratigraphy (to be provided by d18O measurements over long time scales plus AMS ^{14}C measurements on forams for the last 30 kyr) and foram and organic matter stable isotope data as forensic tools in this project . Carbonate records will be provided not only by direct measurement of $CaCO_3$, but also by "remote-sensing" using gamma-ray porosity-attenuation-evaluator data (Mayer, 1991).

By studying carefully chosen cores, we intend to assemble a synoptic overview of carbon and carbonate accumulation and associated biological and physical phenomena for various times in the Late Quaternary. The ultimate goal of the project is to provide high-quality records of both the directions and magnitudes of carbon fluxes in this very important region over a period of time which has embraced extremes in the earth's geologically-recent climatic evolution.

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JGOFS CANADA AIRBORNE

Dalhousie oceanographers Marlon Lewis, Scott McLean and colleagues will be providing airborne remote sensing observations during the current international Joint Global Ocean Flux Study's (JGOFS) Equatorial Pacific (EqPac) process study. The National Aeronautical and Space Administration (NASA) will be providing the research aircraft, a long-range P-3B (Orion) aircraft on a series of flights over the central equatorial Pacific in late August during the U.S. JGOFS fall survey cruises. Lewis and McLean will instrument the aircraft with a nadir-looking, multichannel, visible radiometer (Airborne SeaWiFS Simulator) with band characteristics identical to the visible bands on the upcoming SeaWiFS ocean colour satellite sensor. In addition, they will be deploying two airlaunched ocean colour drifting buoy systems in the equatorial region. These buoys will make near surface measurements of upwelling radiances, again at SeaWiFS bands. Both the airborne sensor and the buoy systems will provide both local and large scale measurements of the optical properties of the upper ocean which in turn can be used in the estimation of surface pigment concentrations, primary production, and local heating rates.

The Equatorial Pacific is a key region for JGOFS. The steady zonal winds drive a near-surface divergence which in turn results in a shallow mixed layer and upwelling of deep water rich in both nitrate and inorganic carbon. The high rates of vertical nitrate transport drive increased primary production and a relatively high rate of "new" production of organic carbon, much of which is lost to the local surface layer as sedimenting material. On the other hand, the Equatorial Pacific is the largest ocean source for atmospheric carbon dioxide; as the upwelled water warms, carbon dioxide is released to the atmosphere. The oscillations in upwelling associated with the interannual El Nino/Southern Oscillations are clearly seen in the atmospheric carbon dioxide record. Finally, from a climate perspective, variations in the air-sea exchanges of heat, moisture, and momentum in the Equatorial Pacific explain to large degree interannual variations in higher latitude climate.

Within Canada, Lewis is joined by other Canadian JGOFS scientists in their interest in this dynamic region. University of New Brunswick's Larry Mayer, and University of British Columbia's Tom Pedersen will be investigating the burial processes along the Equator in an effort to reconstruct paleoclimatic variations. Institute of Ocean Science's C.S. Wong has a long-standing interest in the air-sea exchange of carbon dioxide in the Equatorial Pacific.

Other measurements from the P-3 include those taken with NASA scientist Frank Hoge's Airborne Oceanographic Lidar (AOL) system, a high power laser probe of the sea-surface which can also estimate surface pigment concentrations. NASA's Goddard Space Flight Center will provide, in addition to the aircraft and avionics, the Ocean Data Acquisition System (ODAS), a three channel visible radiometer, and a thermal infrared sensor for sea-surface temperature observations. University of Rhode Island scientists Jim Yoder and Petra Stegmann will coordinate observations and near-to-real time communication of data to the seagoing component of the experiment. At sea will be a team led by chief scientist Richard Barber from Duke University. Observations will include high precision measurement of surface pigments, nutrients, carbon dioxide, primary production, meteorology and surface physical oceanographic processes. Finally, satellite observations of sea-surface temperature will be supplied by Pierre Flament at the University of Hawaii.

The P-3 will leave from San Francisco, California and transect to Hawaii on a data flight pattern at 150 m altitude. Four low-altitude zig-zag flights over the Equator are planned from Hawaii and Christmas Island located on the equator at 157 degrees west. The return trip over the Pacific is also designated as a data flight.

All data from the Dalhousie group will be made available to interested Canadian JGOFS participants through the JGOFS Canada Data and Information Network. Dalhousie's participation is funded by the Natural Sciences and Engineering Research Council, NASA, and the U.S. Navy.

PROCESSES CONTROLLING VERTICAL AND HORIZONTAL EXCHANGES OF CARBON ALONG THE CANADIAN PACIFIC CONTINENTAL MARGIN

Ken Denman, Rod Forbes, Ann Gargett, Dave Mackas & Rick Thomson (all at Institute of Ocean Sciences, Sidney, B.C.) and Steve Calvert (University of British Columbia)

Knowledge of the biological, physical and chemical processes that control the downward removal of carbon, both particulate and dissolved, from the surface layer of the ocean must be studied in a JGOFS. Per unit area, continental margins are biologically more productive than the open ocean (e.g. Walsh, 1989). If the proportion of total production that is "new" or available for export from the surface layer increases with total production according to the relationship of Eppley and Peterson, 1979) then the carbon removed from the surface layer per unit area is proportionately even greater over continental margins, and exchange processes there merit even greater attention. Of the organic carbon produced by the marine ecosystem over continental margins, some sinks and is deposited in shelf sediments, some is advected into deep waters, and some is mixed horizontally and vertically at the edge of the continental shelf. The same dynamical processes are operative over continental margins as in the deep ocean, but in addition horizontal advection, eddy and cross-frontal mixing, surface and internal tidal mixing, and benthic resuspension into the water column must be considered. In upwelling areas, or eastern boundary currents, much of the photosynthetic production of carbon is exported offshore in the surface currents. Evidence that shelf-deep ocean coupling is important to the ocean carbon cycle also comes from benthic respiration studies: Smith (1987) found that the sinking flux of particulate organic carbon was insufficient to meet the organic carbon demand of the sediment community in the deep ocean, and that the demand/supply excess increased in stations approaching the

continental shelf. Not only must we refine our knowledge of sinking fluxes in the deep ocean, but we must determine whether export from continental margins can satisfy the increased demand surplus near the continental shelf. In this study we are investigating the dynamics controlling material and dissolved fluxes, vertical and horizontal, between the surface layer and deeper layers and between the continental shelf, slope and the open ocean. The sediment trap studies over the shelf and slope are being done in conjunction with other CJGOFS studies by C.S. Wong (some analyses from our traps + station P traps) and P.J. Harrison (^{15}N uptake studies to determine proportion of "new" to total production).

Specific objectives of this project are:
1. Along the British Columbia shelf break, to determine whether the sinking flux of particles in areas of persistent upwelling jets is greater than in areas where upwelling jets rarely occur. Determine whether the upwelling jets transport significant carbon and nutrients from the shelf to the open ocean, and how those fluxes are partitioned into sinking particles and vertical and horizontal advection and mixing.
2. To determine whether vertical and horizontal mixing processes are greater over the continental slope than in deeper or shallower waters?
3. To determine, for both onshore and offshore fluxes, the partitioning of the flux among dissolved nutrients (potential, but not yet realized new production), phytoplankton biomass (realized primary production), and consumer biomass (realized secondary production).

We are deploying sequencing sediment traps from moorings on the continental slope, at sites under the path of repeated offshore flowing upwelling jets and at sites where upwelling jets are rare, to obtain the seasonal cycle and relative amounts between the sites of vertical fluxes of particulate C, N and pigments. The traps will be at a depth of 150-200 m, below the photic zone and between the near surface southward flowing shelf edge current and the deeper northward flowing California Undercurrent. A current meter/beam transmissometer will be mounted at depths of 50 m and just below the sediment trap. Traps will be deployed in mid summer 1993, and retrieved in mid summer 1994 with a sequence time of 1 week. In a subsequent deployment, we plan to deploy moorings at the shelf edge, over the slope and in deep water to obtain the shelf-slope-deep water gradient in sinking fluxes. For the shelf moorings, the sediment trap will have to be below the photic zone and above the benthic boundary layer, say at 75 m in 100 m of water. Beam transmissometers and current meters will be included on the moorings.

During the periods of deployment, we will attempt to determine the position- and time-dependent cross-shore transport of three pools of biogenic elements: dissolved nutrients, phytoplankton, and zooplankton. The first step will be to obtain a number of "snapshot" estimates of current and concentration fields along the B.C. shelf break. The product of detailed scalar and vector fields gives trophically-partitioned flux as a function of depth and alongshore location. Observations to estimate the fluxes will be obtained by shipboard survey 1-3 times per year. The velocity field will be measured using a ship-mounted Acoustic Doppler Current Profiler (ADCP), closely spaced CTD profiles (for calculation of geostrophic currents, or more complicated diagnostic flow fields by methods being developed by Mike Foreman of IOS), position-reporting drifting buoys, and possibly feature displacement trajectories from sequences of satellite images. Nutrient and plankton distributions will be estimated from a combination of surface underway sampling, CTD/Rosette profiles, stratified and vertically-integrated net tows (BIONESS and Bongo nets), and bioacoustics (single frequency echo integration).

In 1990, from April until October, a pilot study was carried out with two sediment trap moorings in about 600 m of water, one in the path of a recurring upwelling jet (Denman, Freeland, and Mackas, 1989) and one upstream from the jet. From 24 one-week sediment samples, the seasonal cycle in phytoplankton exported production was clearly resolved. However, the prior hypothesis, that more organic particles would sediment out at a site under a recurring offshore flowing upwelling jet than at a site where upwelling jets seldom occur, was not confirmed for that period: the total sedimented flux at the two sites was equal within a few percent. Biogenic silicate comprised a high, and consistent, proportion of the total mass flux, indicating that diatom remains, probably largely packaged in fecal pellets, contribute the bulk of material entering the traps throughout the study period.

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REVIEWS/CRITIQUES

ATMOSPHERIC TRANSMISSION, EMISSION AND SCATTERING
By Thomas G. Kyle.
Pergamon Press, 1991, ISBN 0 08 040287 9.

Thomas Kyle takes on an enormous undertaking when he attempts to provide a concise and understandable view of atmospheric optics for the generalist. *Atmospheric Transmission, Emission and Scattering* attempts to steer the difficult course between being overly mathematical for the operational practitioner and being too vague to be of interest to those specializing in the fields related to atmospheric optics. The general contents can be summarized in three categories. Chapters one and two are concerned with the atmosphere in which the optical phenomena occur. Chapters three through seven consider atmospheric scattering processes by aerosols and droplets. Within this section the author also considers the optics of rainbows and the effects of turbulence on optics. The last third of the book, chapters eight to thirteen are concerned with absorption processes within molecules. Chapter thirteen discusses several common models developed by the Air Force Geophysical Laboratory that can be used to model absorption and emission.

The book takes some unusual approaches to presenting the information that the author believes is important. He unifies his approach by treating all wavelengths of the electromagnetic radiation implicitly, from ultraviolet to microwave. This unification provides us with a good basis to better understand the general physics of scattering, absorption and emission. Unfortunately, the application of this technique is uneven in the information presented. This will disappoint readers who are interested in a better understanding of research areas within a particular wavelength region. As an example, in the chapter dealing with aerosols the Deirmendjiian size distribution is discussed in some detail, but the Junge and lognormal distributions are not mentioned. If one can overlook the shortcomings within areas of individual expertise, this unification of process can be instructive. One always wonders though, what other important information may be missing in areas in which one is not familiar. This unevenness in the level of writing finds its way into other areas as well. In the second the third chapters large sections are written in the detail and language suitable for senior secondary students. The chapters on absorption and emission require a significantly greater understanding in the area of quantum physics.

There are two other approaches which the author has selected to follow which are unusual. These are at least partially justified, however, on the basis of his desire to integrate a vast area of information into a concise book. The first is that very few references have been written into the text. This does provide easier reading, particularly when the information has come into the public domain or when the explanations in the text are clear. To those who do not understand part of the text though, there is little chance of finding help through the brief reference list at the end of the book. My bias is for a book to provide references at the end of each chapter. The second approach which requires noting is the lack of references to the diagrams found in the text. Kyle has done this on purpose, wanting the diagrams to illustrate the general case instead of being an addendum to lengthy prose in the main body of the text. Again, this has certain merits, but often one does not really know what the diagram is illustrating 'in general'. At the end of chapter 12 fourteen diagrams generated from AFGL models are placed beyond the text. These are not described within the chapter and therefore lose much of the impact that they may have had. I suspect that many readers will never bother studying these diagrams in the context of what the book was attempting to depict.

Finally, I believe it is important to comment on the general quality of the publication in that this book again breaks new ground. Although camera-ready copy has been used for conference proceedings this is the first book that I have seen to make use of this method. It was prepared using WordPerfect, Ezplot and Framework. The typeface and most of the diagrams, while maybe less exciting than drafted work, are more than adequate. If this is a means of keeping prices at reasonable levels this book is a good example of what the future should hold. Unfortunately, even the publishing aspects are not without problems. In many places the symbols are defined poorly, sometimes remaining undefined. The quality of the spelling and grammar is poor. In a few cases sentences have not even been completed and references to equations are incorrect. It seems as if a final proofreading was omitted before the manuscript went to press. As an example of the writing style found in much of the book, a paragraph from the first chapter on emission follows,

"*The rules governing which energy levels are involved in transitions with which other levels are called selection rules. A molecule in a particular state can only make transitions to a few other states. Many transitions are forbidden. Molecules cannot just jump from any state to any other state. Selection rules are primarily determined by the symmetry of the molecule, and symmetry is very important in quantum considerations. Even something that seems insignificant can be vitally important, such as the spin of one oxygen nucleus in carbon dioxide causing half the rotational lines in certain vibrational transitions to disappear*"

I suppose the ultimate question to be asked is, "Would I buy the book?" I am afraid the answer is, "No." There are too many shortfalls for a book of this nature; these vary from bothersome spelling mistakes to gaps in information. The book comes close to being a good general overview of atmospheric optics, but unfortunately the drawbacks far outweigh the benefits. In its present form, this book could not be used as a textbook for atmospheric optics. These drawbacks are unfortunate because the aim of the book is excellent. Many atmospheric scientists have become too specialized and a book that attempts to unify such a large and important subfield within the discipline is needed. Hopefully, a second edition that overcomes the shortfalls of the present book will be published soon. When this happens I believe it will be a text that one would want to place on an office bookshelf.

Bruce McArthur
Atmospheric Environment Service
Toronto, Ontario

TideView (Software Review)
Published by Channel Consulting, Victoria, B.C.

At most places on the earth, the tides are relatively uniform, rising and falling to approximately the same heights twice a day with the phase changing by about half an hour in each cycle. But this is not the case in the Straits of Juan de Fuca and Georgia which separate Vancouver Island from the state of Washington to the south and British Columbia to the east. Here, due to unique geophysical features, in a typical cycle one of the high tides, called the high high, may be much higher than the other, the low high, and there is a low low which may be much lower than the high low. Also during the winter months the high high is always in the day and the low low at night, and these extremes are reversed in the summer.

For many users of the sea, either for business or pleasure, the currents produced by the tides are of more importance than the changes in sea level. This is particularly for the region close to Victoria which, because it is at a node in the open-closed channel formed by the Straits of Juan de Fuca and Georgia, there are modest changes in sea level of less than three metres, but considerable tidal currents with maximum rates over six knots. To add to the complexity, this flowing body of water which is typically 30 km wide and 200 metres deep must change direction by over 90 degrees and force its way through the network of
channels formed by the Gulf and San Juan Islands. For a marine pilot, a ferry captain, the master of a tug, a racing or cruising sailor, a commercial or sports fisherman, a kayaker or any of the majority of people in this region who go down to the sea in boats, activity is controlled by the tidal currents. For this reason, TideView, a computer program which predicts the tidal currents and heights from Sheringham Point near the western entrance of the Strait of Juan de Fuca to Texada Island, 60 km northwest of Vancouver in the Strait of Georgia, is a valuable tool.

TideView, marketed by Channel Consulting of Victoria, was developed in conjunction with the Federal Department of Fisheries and Oceans and the Department of Geography at the University of Victoria. TideView is designed to run on an IBM PC or compatible computer, and the outputs may be printed on a dot matrix or HP laserjet printer.

There is a small but adequate instruction manual and the program is easy to install. Once installed the program can only be run on that computer. To move it to another machine an "uninstall" program must first be run. This is an inconvenience to the user, and a feature which a good "hacker" could probably by-pass with little effort, but the desire to protect the copyright of a potentially popular program is understandable.

For the first-time user there is a demonstration program which illustrates the primary features of the software using the time and date of the 1991 Swiftsure Classic yacht race for the vicinity of Race Rocks. The program is entirely menu-driven and the menus can be accessed by a mouse or by the cursor keys. Keyboard access using a letter for each menu button is something the authors might consider in a future edition as this may be the preferred method of interaction for an experienced user.

I installed and used the program on a 386 laptop computer as this would be a popular vehicle for people using TideView on their boats. The manual warns that LCD screens of some laptops may introduce image distortions which could lead to slight incorrect indications of current direction, but I did not find this to be a problem.

On entering the program the user first sets the beginning and ending dates and times, in standard or daylight time, of the period of interest, and the interval at which outputs are required during that period. Pressing the "GO" button, generates a chart of the whole straits system covered by the program. The "IN" button then permits zooming into an area of interest. A field of view scanning a few kilometres is probably of most interest to the average user. At this scale some of the finer features of the coast line are inevitably lost.

Arrows indicating the magnitude and direction of the currents are then plotted at a grid spacing as close as 100 m when zoomed into a small area and up to 1,200 m for large fields of view. The user can select the way in which the magnitude of the current is expressed, either as a series of bars each representing 0.25 knots, or by area or length of the arrow. Except when needing to know the exact magnitude of the current, I found the area representation to be the most pleasing to work with. In all cases, a legend is given which equates the arrow size to the current speed. The charts can be made to cycle at the chosen interval times over the selected period, or the charts can be created one by one at that interval and then each can be printed.

Each printout includes one third of a page of copyright information which soon becomes very annoying. I would suggest that in future versions a single-line copyright statement is all that is needed with each printout. There seems to be a small bug in the system which from time to time, but not consistently, causes the printer to advance an extra half-page, thus destroying correct paging. If this can be corrected, a facility which would cycle through the selected period automatically printing the tide chart at each interval would be a very useful feature.

The program can also be used in "POINT" mode. In this case a single location is identified and the output consists of two plots spanning a two-day period containing the selected date and time. One plot is of the current vectors at 30 minute intervals, and the other of the tidal height. As I became accustomed to using the program I found it normally more efficient to use this mode first to identify the times at which the currents reverse, and then plot the charts of tide vectors at closer intervals around that time. A comparison of the vector and height plots clearly demonstrates that it is not possible to use the table of tide heights to predict times of current reversals.

How reliable are the results provided by TideView? The times of high and low tides and of current reversals agree with the values in the Canadian Tide and Current tables. The magnitudes do not always agree exactly, but which is correct? TideView does not accurately predict the eddy which forms off Discovery Island. As a result of this eddy the tidal current along the east side of Discovery Island almost always runs north to south, whether the tide is ebbing or flooding. TideView does not show this.

REVIEWS/CRITIQUES (Cont.)

Current reversal begins in the boundary layer close to the shore and gradually moves out, over a period of an hour or so, into the mainstream which, because of its momentum, does not reverse at the tide change but continues to drive water against the incline in the water surface. TideView predicts this pattern but on two of the three occasions which I checked, the time of reversal close to the shore was almost an hour before the prediction. On another occasion the time of reversal was well-predicted but a counter current shown by TideView did not exist. Nevertheless the current was significantly reduced at this point and by using that information I was able to overtake three boats in a one-design racing fleet – and that alone was worth $95, the purchase price of TideView.

In summary, TideView is a powerful program which will be invaluable to those who use the sea in the Straits of Juan de Fuca and Georgia, professionally or for pleasure. It is not yet perfect in either its usability or its predictive power, but it is far better than any other system available to the public for obtaining predictions of the tidal currents. The boater in these waters will still need to take every opportunity to check the currents by looking at the kelp vectors, the bow waves around mooring buoys and the surface wave patterns, but TideView tells you what to expect and when to expect it. The program is easy to use and runs well on a laptop computer which therefore can be taken on board for longer journeys. The price of $95 for a program with a limited market is reasonable when one considers the work that is required to develop and maintain such a product.

John Dewey
Dept. of Physics, University of Victoria

Newsletter Advertising Rates

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
Position vacancy	$200.00	$120.00	$80.00
Employment wanted	----- Free to members only -----		

** Corporate and sustaining members are charged at the position vacancy rate.

Fellows and Academicians.

Chris Garrett was one of 28 distinguished scientists selected to be new AGU fellows in 1992. Meanwhile, Paul LeBlond has been elected to the Russian Academy of Sciences.

In Canada Steve Calvert (UBC Oceanography and compiler of the JGOFS News section of this Newsletter) and Verena Tunnicliffe (U. Vic. Biology and Secretary/Treasurer Vancouver Island Centre of CMOS) have both been elected Fellows of the Royal Society of Canada.

A New Job for Gordon McBean

Gordon McBean has given up his position as Chairman of the Atmospheric Sciences Programme at UBC to take up a new position as Head of the Department of Oceanography also at UBC. Gordon will, however, remain a member of the Atmospheric Sciences Program. Gordon's links with UBC extend far back. He received his B.Sc. in Physics at UBC, his M.Sc. in Meteorology from McGill University and his Ph.D, in Physics and Oceanography from what was then the Institute of Oceanography at UBC. Gordon is a member of a wide variety of national and international committees. He was awarded the 1975 President's Prize of CMOS and has been elected a Fellow of the American Meteorological Society. Gordon has served as the meteorological editor of Atmosphere-Ocean and presently is the Vice-President of CMOS.

43rd Arctic Science Conference

Valdez, Alaska Sept. 8th-12th 1992

The American Association for the Advancement of Science (AAAS) 43rd Arctic Science Conference is scheduled for September 8-12th in the Valdez Civic and Convention Center in Valdez, Alaska.

Environmental Change: Natural and Man-Made is the theme for the 1992 annual conference. Valdez was chosen as the conference site because it is a microcosmic example of the effects of both natural and man-made environmental change, exemplified by the Exxon Valdez oil spill.

Receding tidewater glaciers, record snow falls, unusually warm winters, warming permafrost, northward migrating tree lines, and increasing atmospheric CO_2 are some of the natural environmental changes that have been observed in the Arctic over the past few decades.

The causes of these changes may be natural or they may be man-induced, and may have positive or negative repercussions. At the conference, physical and biological scientists, teachers, students, economists, sociologists and others with an interest in polar and sub-polar regions will discuss the consequences of environmental change with colleagues and take the opportunity to examine the spectacular local scenery and wildlife in Valdez.

The abstract deadline for submission to the conference was June 15th, but registration for the conference will be accepted at the door. Anyone planning to attend should write or call Cindy Wilson at (907)-474-7954 as soon as possible for more information.

4th AES/CMOS Workshop on Operational Meteorology Whistler, B.C.

September 15th-18th, 1992
Preliminary Program

Monday - September 14th

1800-2100	Registration (For the registration form, please see page 23 of the CMOS Newsletter, April 1992.)

Tuesday - September 15th

0700-1000	Registration
0830-0900	Welcome and Introductory Remarks Neil McLennan, Program Chairman Pat Pender, Director General, Pacific Region Gordon McBean, Vice President, CMOS
0900-1000	Opening Session
1010-1020	Coffee Break
1020-1200	Introduction to the Poster Session, Laboratory sessions and demonstrations.
1200-1300	Lunch
1300-1440	Session 1 - Isentropic Analysis
1440-1500	Coffee Break
1500-1600	Session 2 - The Meteorological Data Explosion
1600-1800	Poster Session and Icebreaker

Wednesday - September 16th

0800-1000	Session 3 - Quasi-Geostrophic Theory
1000-1020	Coffee Break
1020-1220	Laboratory Session 1
1220-1320	Lunch
1320-1440	Session 4 - Verification
1440-1540	Session 5 - Surface Analysis
1540-1600	Coffee Break
1600-1730	Session 6A - Numerical Weather Prediction Session 6B - Radar
1930-2230	Banquet

Thursday - September 17th

0800-1000	Laboratory Session 2
1000-1300	Free
1300-1440	Session 7A - Integrated Forecast Systems Session 7B - Convection
1440-1500	Coffee Break
1500-1640	Session 8A - Computer Worded Forecasts Session 8B - Delivery Systems
1930-2100	Session 9 - Case Studies and Videos

Friday - September 18th

0800-1000	Laboratory Session 3
1000-1020	Coffee Break
1020-1200	Session 10 - Forecast Techniques
1200-1215	Closing Remarks

4è Atelier SEA/SCMO de Météorologie Opérationnelle Whistler, C.-B.

15-18 septembre, 1992
Programme préliminaire

Lundi - 14 septembre

1800-2100	Inscription (Pour le formulaire d'inscription voir s.v.p. page 23 de Nouvelles SCMO, Avril 1992.)

Mardi - 15 septembre

0700-1000	Inscription
0830-0900	Mots de bienvenue Neil McLennan, Program Chairman Pat Pender, Director General, Pacific Region Gordon McBean, Vice Président, SCMO
0900-1000	Session d'ouverture
1010-1020	Pause-café
1020-1200	Introduction à la session d'affichage, aux sessions de laboratoire et aux démonstrations.
1200-1300	Déjeuner
1300-1440	Session 1 - Analyse isentropique
1440-1500	Pause-café
1500-1600	Session 2 - Explosion des données météorologiques
1600-1800	Session d'affichage et réception de bienvenue

Mercredi, 16 septembre

0800-1000	Session 3-Théorie quasi-géostrophique
1000-1020	Pause-café
1020-1220	Session de laboratoire 1
1220-1320	Déjeuner
1320-1440	Session 4 - Vérification
1440-1540	Session 5 - Analyse de surface
1540-1600	Pause-café
1600-1730	Session 6A - Prévisions numérique Session 6B - Radar
1930-2230	Banquet

Jeudi - 17 septembre

0800-1000	Session de laboratoire 2
1000-1300	Libre
1300-1440	Session 7A - Systèmes intégrés de prévision Session 7B - Convection
1440-1500	Pause-café
1500-1640	Session 8A - Prévisions rédigées par l'ordinateur Session 8B - Systèmes de distribution
1930-2100	Session 9 - Études en cas et vidéos

Vendredi - 18 septembre

0800-1000	Session de laboratoire 3
1000-1020	Pause-café
1020-1200	Session 10 - Techniques de prévision
1200-1215	Mots de fin

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: $73.45/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 (604-662-8051) 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: $14.00 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: 73.45$ (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 (604-662-8051) 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: 14.00$ 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

Volume 30 No 3 September 1992 Septembre

ATMOSPHERE-OCEAN

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 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.

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

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

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

On the growth rate of wind-generated waves. D. Schwab and S. Venkatesh.

Measurements of bubble plumes and turbulence from a submarine. T. Osborn, D.M. Farmer, S. Vagle, S.A. Thorpe, and M. Cure.

Using measured variances to compute surface fluxes and dry deposition velocities: A comparison with measurements from three surface types. J. Padro, J. den Hartog, H. Neumann and J. Woolridge.

Volume 26 No 1 April 1992 Avril

Climatological Bulletin
Bulletin climatologique

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.

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

Climatic highlights of 1991 in Canada. Canadian Climate Centre

Air-Sea Interface
Announcement and Call for Papers

radio and acoustic sensing, turbulence and wave dynamics
Marseilles, June 24-30, 1993

Announcement

A symposium on the Air-Sea Interface will be held in Marseilles, France, 24th-30th June 1993. This meeting will be along the lines of the very successful meetings in Miami (1981) and Sendai (1984), which dealt with the mechanics of the air-sea interface and the application of remote sensing techniques in this field. The symposium will be convened by Mark Donelan, of the National Water Research Institute, Canada Centre for Inland Waters, Dr. Alfred Ramomonjiarisoa of the Institut de Mécanique Statistique de la Turbulence, Université d'Aix-Marseilles and Prof. Kristina Katsaros of the University of Washington and the Institut Français de la Récherche pour l'Exploitation de la Mer.

Objectives

The causes and evolution of climatic change are among the principal scientific issues today. The interaction between oceans and atmosphere is a vital link in the dynamics of climate variation. From the very small scales of near-surface boundary layers, to the global variation of ocean surface properties, to wind and wave distributions, there is much to be explored via theory and observations. Today the advanced development of radio and acoustic remote sensing techniques complements the more traditional *in situ* methods and greatly increases the excitement of, and possibilities for, learning more about the boundary layers that join atmosphere and ocean and that are vital in the regulation of our weather and climate.

This symposium is the third in a series dealing with the mechanics of the boundary layers on both sides of the air-sea interface and with the application of remote sensing techniques in this field. The previous symposia were directed primarily at wave dynamics and the upper ocean mixed layer and the related use of electromagnetic remote sensing methods. This symposium widens the scope to acknowledge the coupling of air and water boundary layers and the increasing prominence of acoustic methods for observing the interface and probing the boundary layers from above and below.

Abstracts

A 500 word (maximum) camera-ready abstract, including title, author's name(s) and affiliation(s), must be sent by mail (not fax), before the end of November, 1992, to:

Dr. Michael Skafel
National Water Research Institute
Canada Centre for Inland Waters
Box 5050
Burlington, Ont. L7R 4A6 Canada

TWENTY-SEVENTH ANNUAL CMOS CONGRESS

The 27th Annual Congress of the Canadian Meteorological and Oceanographic Society will be held at the University of New Brunswick, Fredericton, N.B., Canada from June 8-11, 1993.

The Congress will feature Theme Sessions on:
- Forest and Agricultural Meteorology;
- Biological-Physical Interactions in the Ocean;
- Climate Modelling; and
- Remote Sensing.

Special sessions are also being planned on CASP II, circulation over abrupt topography, modernized weather services, ozone depletion, and tracers in the ocean. In addition, there will be sessions based on contributed papers in other areas of meteorology and oceanography.

Oral and poster papers, and exhibits will be invited in a later announcement with an Abstract Deadline of 29 January 1993.

Vingt-Septième Congrès de la SCMO

Le 27ième Congrès annuel de la Société Canadienne de Météorologie et d'Océanographie se tiendra à l'Université du Nouveau Brunswick, Frédéricton, N.B. Canada, du 8 au 11 juin, 1993.

Le Congrès présentera des sessions thématiques portant sur les sujets suivants:
- Météorologie forestière et agricole;
- Interactions biologiques-physiques dans l'océan.
- Modélisation climatique; et
- Télédétection.

Sont également prévues des sessions spéciales portant sur: PCETA II, la circulation au-dessus de topographies très accidentées, les services météorologiques modernes, l'amincissement de la couche d'ozone et les traceurs dans l'océan. De plus, des sessions sur divers autres domaines de la météorologie et de l'océanographie seront organisées.

Un appel de communications orales, de sessions d'affichage ou de présentation d'exhibits sera lancé ultérieurement. La date limite pour la soumission des résumés sera fixé au 29 janvier, 1993.

For further information, contact:/Pour plus d'information, contacter:

Mr. Dave Daugharty
Chairman, Local Arrangements Committee
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Dr. John Loder
Chairman, Scientific Program Committee
Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, N.S. B2Y 4A2
Tel: 902/426-4960; FAX: 902/426-7827
INTERNET: jloder@sable.bio.dfo.ca

Volume 30 No 4 December 1992 Décembre

ATMOSPHERE-OCEAN

as of July 20 1992/en date de 20 juillet 1992

Measurements of drifter cluster dispersion. Badal K. Pal and Brian G. Sanderson.

Propagation of coastal trapped waves under an ice cover in Hudson Bay. T. Reynaud, R.G. Ingram, H.J. Freeland and A.J. Weaver.

On the interannual variability of Arctic sea-level pressure and sea ice. S. Power and L. Mysak.

Tropospheric low-level temperature inversions in the Canadian Arctic. J. Kahl.

Tropospheric variations in the turbidity of the Arctic atmosphere in Russia. V. Radionov and M. Marshunova.

Sea-ice and wind: Effects on primary production in the Barents Sea. E. Sakshaug and D. Slagstad.

Volume 26 No 2 August 1992 Août

Climatological Bulletin
Bulletin climatologique

as of July 20 1992/en date de 20 juillet 1992

Moisture risk assessment for spring wheat on the eastern prairies. G.H.B Ash, C.F. Shaykewich and R.L. Raddatz.

Potential impacts of CO_2-induced climate change using the GISS, GFDL and CCC scenarios on corn yields in the Essex County region. A. Viau and C. Mitic.

Etude comparative d'approches utilisées pour l'estimation de l'évapotranspiration en régions tropicales.
A. Viau, J. Boivin and B. Singh.

Development of an historical climate database for temperature and other climate elements.
D. Gullett, W. Skinner and L. Vincent.
Canadian Climate Centre

Announcement and Call for Papers
Okhotsk Sea/ISY/PIE '93
Joint International Symposium

January 31-February 5, 1993, Mombetsu, Hokkaido, Japan

The Okhotsk Sea & Cold Ocean Research Association (OSCORA) and the National Space Development Agency of Japan (NASDA) have agreed that the next year's 8th International Symposium on Okhotsk Sea and Sea Ice is to be combined with the 7th International Space Year/Polar Ice Extent (ISY/PIE) Workshop. On behalf of the organising committee we would like to announce that the Okhotsk Sea/ISY/PIE '93 will be held from January 31st through February 5th in Mombetsu, Hokkaido, Japan.

The objectives of the Joint International Symposium are to promote the advancement of all ice-related studies such as oceanography, meteorology, glaciology, biology, fisheries, engineering, satellite remote sensing technology and especially to discuss applications of satellite remote sensing to those ice-related studies.

Special Sessions

- Japan-Canada Workshop on the Saroma-Resolute Study (SARES)
-ISY/PIE Workshop:
Remote Sensing Technology on Snow & Ice Studies
- Real time ice monitoring & possibility of forecasting
- Global arctic & antarctic brightness temperature data sets.
- Ice transport & sea ice thermodynamics
- Sea ice modelling
- Assimilation and/or integration of data sets
- Oceanography & sea ice in the Sea of Okhotsk

Call For Papers

Abstracts stating the purpose, results and conclusions of research on symposium topics are invited. The abstract in 200-300 words in English or Japanese for review should be received by October 1, 1992, at the Secretariat of the Okhotsk Sea & Cold Ocean Research Association. Original and one copy of final camera-ready manuscripts in English or in Japanese with English summary (up to 6 pages including figures and tables) should be received by December 1st, 1992. A volume of proceedings will be made available to the participants prior to the Symposium.

The Secretariat

The Okhotsk Sea & Cold Ocean Research Association
c/o Department of Planning and Adjustment
Mombetsu Municipal Office
Saiwai-2, Mombetsu, Hokkaido 094, Japan.
Tel: +81-1582-4-2111 Ext. 221
Fax: +81-1582-3-1833

Further Information

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Hokkaido University of Education
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Fax: +81-154-43-0855

GLOBAL WARMING
A Call for International Coordination

4th International Conference on the Scientific and Policy Issues Facing all Governments
April 5th-8th, Chicago, Ill., U.S.A.

SUPCON International and the World Resource Review will convene the 4th Annual International Conference GLOBAL WARMING - A Call for International Coordination. to be held April 5-8, 1993 in Chicago, USA. The objective of the conference is to report on the impacts of the UNCED convention in Rio and provide an international forum on scientific and policy issues facing governments with regard to the greenhouse effect and similar trans-national environmental problems including water shortage, floods, and acid rain. Participating agencies include the U.S. Forest Service, USDA, NASA, EPA, DOE, EPRI, TVA, GRI, environmental ministries, energy ministries, education ministries, forestry and agricultural ministries and meteorological authorities from five continents. Natural resource specialists, energy specialists, atmospheric scientists, policy analysts, environmental specialists, biotechnologists, and energy, environmental and education officials from around the world participate at this inter-disciplinary conference. Papers and panel discussions are invited under a variety of subject headings.

Send 400-word abstracts as soon as possible to the program Committee, Global Warming International Conference, P.O. Box 5275, Woodridge IL 60517-0275, USA.
Tel: 708-910-1551 Fax: 708-910-1561.
Presentation space is limited.

Abstract deadline:	November 16, 1992 (Postmark)
Paper deadline:	February 15, 1993
Advanced registration:	February 18, 1993
Registration deadline:	March 31, 1993.

For further information regarding the Global Warming Science and Policy International Conference, and global warming publications contact:

The Global Warming International Center
P. O. Box 5275
Woodridge, IL 60517-0275, U.S.A.

Atmosphere-Ocean
Back Issues

There are a large number of boxes at the Institute of Ocean Sciences containing back issues of Atmosphere-Ocean. Howard Freeland and Bill Crawford propose sending these sometime in the near future either to Ed Truhlar at AES Downsview or to the CMOS Business Office in Newmarket. Until we do that, however, we would like to make a special limited-time offer. If you are missing any copies of Atmosphere-Ocean, or if you would like to backdate your valuable collection, then please contact either Bill or Howard at IOS for free service to CMOS members.

Bill Crawford	Howard Freeland
Tel (604)-363-6369	Tel (604)-363-6590
Fax (604)-363-6323	Fax (604)-363-6746

OCEAN SCIENCES

Postdoctoral Fellow. Department of Oceanography, The University of British Columbia. To participate in a fisheries oceanography research program on Biophysical Controls of Salmon Migration, linking the effects of ocean currents and property distributions to bioenergetic models in a team of oceanographers and fisheries biologists.

Recent Ph.D. in Ocean or Atmospheric Sciences, experience with analysis of large datasets, objective analysis, EOFs and familiarity with UNIX. The successful applicant will lead the analysis and interpretation of the oceanographic information and work with fisheries biologists and other oceanographers towards development and testing of numerical models.

Appointment subject to success of funding application, to be announced November 1, 1992. Starting date: January 1, 1993. Term is one year with possibility of renewal for an additional year.

Interested candidates should send a letter of application, a c.v., reprints (or preprints) of recent (or future) publications, and names of three referees to Paul H. LeBlond, Department of Oceanography, The University of British Columbia, Vancouver, B.C., Canada V6T 1Z4. Deadline for application is October 1, 1992. The University of British Columbia encourages applications from qualified women and minority applicants.

ACCREDITED CONSULTANTS/EXPERTS-CONSEIL ACCREDITES

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.

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.

ACCREDITED CONSULTANTS/EXPERTS-CONSEILS ACCRÉDITÉS

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401 Bently Street, Unit 4
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Tel: (416) 736-0521

Ian J. Miller, M.Sc.
CMOS Accredited Consultant
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MacLaren Plansearch Limited
Suite 701, Purdy's Wharf Tower
1959 Upper Water Street
Halifax, Nova Scotia B3J 3N2 Canada
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T.W. (Terry) Krauss, Ph.D.
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75 Woodfern Drive, S.W.
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3650 Carnarvon Street
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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
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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'ADHESION 1992

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

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

MEMBERSHIP CATEGORY-CATEGORIE DE MEMBRE
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Regular Régulier	☐	$40.00/40,00$
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		Members Membres	Non-members Non-membres	Institutions Institutions
ATMOSPHERE-OCEAN ATMOSPHERE-OCEAN	☐	$25.00 25,00$	$35.00 35,00$	$65.00 65,00$
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Annual Congress Program and Abstracts Programme et résumés du congrès annuel	☐	$ 0.00 0,00$	$15.00 15,00$	$15.00 15,00$

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 étudiants reçoivent une publication gratuite de la SCMO et doivent indiquer celle désirée. Tous les périodiques réguliers de la Société sont envoyés aux membres moraux et de soutiens. Les membres résidant au Canada, veuillez SVP ajouter 7% (TPS) aux frais d'abonnement annuel.

PRIMARY FIELD OF INTEREST - SPHERE D'INTERET PRINCIPALE

Meteorology / Météorologie ☐ Oceanography / Océanographie ☐

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(Indicate group if interested - Indiquez si vous avez des intérêts dans un des groupes.)

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Floating Ice / Glace flottant ☐
Mesoscale Meteorology / Météorologie à la mésoéchelle ☐
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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):

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

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Mail completed form to CMOS at the address above.

Je désire devenir membre de la Société. J'inclus un chèque au montant de $ _____ payable à la Société canadienne de météorologie et d'océanographie pour la cotisation de membre et/ou les frais d'abonnement aux périodiques. J'inclus aussi un don déductible d'impôts de $ _____ pour (indiquez):

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(Signature) (Date)

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