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La Société canadienne de météorologie et d'océanographie

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CMOS Bulletin SCMO
"at the service of its members
au service de ses membres"
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Cover page: The December 2002 issue of the *CMOS Bulletin SCMO* (Vol.30, No.6) has raised a debate among members of our Society. Following new directives given by Ron Bianchi (Past-president), the Scientific Committee has drafted a new policy statement on the Kyoto Protocol. Please read **page 119** to find out the new CMOS official policy statement on the Kyoto Protocol. The Scientific Committee must be thanked for having pulled together many different opinions on this controversial issue. The photograph is the same as the one used in the December 2002 issue.

Page couverture: Le numéro de décembre 2002 du *CMOS Bulletin SCMO* (Vol.30, No.6) a suscité un débat au sein de notre Société. Suivant les nouvelles directives de Ron Bianchi, (président sortant de la SCMO), le Comité scientifique a rédigé une nouvelle politique sur le protocole de Kyoto. Prière de consulter la **page 118** pour connaître la nouvelle politique officielle de la Société sur le protocole de Kyoto. Le Comité scientifique doit être félicité pour avoir réussi à rallier aussi rapidement les différentes opinions sur ce sujet fort controversé. La photographie est la même que celle présentée lors du numéro de décembre 2002.

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....from the President's Desk

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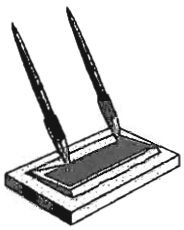

It was exciting to start my term as President at the Ottawa Annual Congress among the nearly 700 delegates. The usual mix of old friends and colleagues from both the operational and research sides was joined by students, post-docs and research associates who are being brought into our community through the research projects and the research networks funded by NSERC and CFCAS. A major order of business during this transition time among executives has been to finalize the new agreement between the government, CMOS and CFCAS in order to receive a further 50 million dollars to extend the Foundation for an additional 5 years.

I am writing this column in early July. Over the past two weeks, the farmers of Eastern Ontario have complained that an unforecast afternoon rain had ruined their first hay crop. The media commentary on the severe storm that hit the town of Grimshaw, Alberta contained an expectation that such events should be predicted or detected and the appropriate warnings issued. The ocean science community is expected to be able to predict not only the ocean physical parameters but the numbers and distributions of the fish as well. The last issue of the Bulletin had a number of items - letters, articles and book reviews – which discussed different aspects of communicating the uncertainties associated with our analyses and predictions to the public and policy-makers. Since our membership includes broadcasters, operational meteorologists and oceanographers and researchers, we are a unique organization to nourish this discussion.

The CMOS business office has completed the first phase of modernizing our administrative systems within our own office. We have transferred our membership records to a membership database system designed for societies and we are running our own electronic accounting systems. I hope that you will indicate corrections to your personal information when you renew your memberships this coming year so that this information becomes more current and accurate.

Over the past year, Ron Stewart led the Executive in the creation of a vision paper for CMOS. This paper was presented but not discussed during the AGM. We are seeking feedback from members by putting this Vision Paper onto the web site along with a series of questions. I hope that you will visit this site and help the Executive and the Council plan for a strong and vibrant Society for the future.

Allyn Clarke
President / Président
CMOS / SCMO

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August 2003 - août 2003

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Letters to the Editor

25 may 2003

CMOS may be a learned society, but we do not need peer review of letters to the Editor (Weaver, Vol. 31, No. 3). The *CMOS Bulletin SCMO* renders a service to its members by exposing the wide range of views that we variously hold.

I invite Dr. Weaver to consider Mr. Hengeveld's thoughtful article in the same issue about communicating complex science. If CMOS members were to be allowed to communicate in letters to the Bulletin only what some peers decide is scientifically correct, we would certainly fail to rise to the challenge set by Mr. Hengeveld to play our part in fostering better understanding between science and policy.

John Hollins, Gloucester, Ontario

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27 may 2003

I got my copy of the *CMOS Bulletin SCMO*, June 2003, yesterday.

I would like to once again congratulate you for a very interesting issue, with a number of items of interest to someone with my present passion (or hobby) on global warming and related areas.

I was glad to see Dr Vincent Gray's Letter to Editor. I had suggested that he write to you, in view of his expertise and in view of the fact that he has been an Expert Reviewer for the IPCC for several years.

Talking about Letters to the Editor, I also noted with some disapproval, a letter from Andrew Weaver re: "peer-review process" for letters to the Editor. I think Andrew has missed the point re Letters to the Editor. These letters are meant to create a dialogue and if there are some contentious issues, they should be debated through an exchange of letters. Andrew's suggestion is totally baseless as it would discourage readers to send any letters expressing their opinions on some scientific issues. Letters to Editors are not peer-reviewed articles. The only thing that should be scrutinized is that there is no deliberate slander or bad language or some undue political/social propaganda or something like that. Letters to Editors must be encouraged by the *CMOS Bulletin SCMO* to be published as they are received without the need to subject these letters to a peer-review process.

Keep up the good work. In my opinion, the *CMOS Bulletin SCMO* readership has increased far ahead of our Journal, Atmosphere-Ocean. There is a need to find out why.

Madhav Khandekar

24 June 2003

After my book 'Taken By Storm' (co-authored with Chris Essex) was reviewed in these pages (CMOS Bulletin SCMO, Vol.31, No.3, p.85-86) I had occasion to read some recent CMOS Bulletin SCMO issues. I appreciate the constructively critical attention to our book. I hope CMOS members will take the time to find out what Chris Essex and I are actually arguing, and that they will feel free to contact us directly with their feedback.

I was taken by surprise to read about the decision of CMOS to issue an official statement on the Kyoto Protocol. I have been a member of the Canadian Economics Association for many years. Its members regularly research important policy issues. But the CEA does not issue policy statements on behalf of its members, and if it did so, I would probably quit, even if I agreed with the statement. Economists who speak on policy issues do so as individuals, taking responsibility for their own positions. The CEA itself stays neutral so as not to limit the scope of debate among its members nor imply that its members endorse the views of an executive committee. The CEA web site states "The Association has for its object the advancement of economic knowledge through the encouragement of study and research, the issuing of publications, and the furtherance of free and informed discussion of economic questions. The Association as such will not assume a partisan position upon any question of practical politics nor commit its members to any position thereupon." I think this stance is wise.

The rationale for CMOS issuing a statement was, in part, Mr. Bianchi's argument that "In the absence of scientific information on the Kyoto protocol, only politics will be involved in making long-term decisions." It is not exactly correct to say that the absence of a CMOS statement constitutes the absence of scientific information. In fact there are other panels that have studied climate change and issued reports too. Mr Bianchi may feel that the reports of these other panels do not qualify as scientific information. That's possibly too harsh a judgment. And to suggest that in the absence of a CMOS statement "only politics will be involved" ignores the fact that there are other aspects, including economics, involved. Even people who believe in anthropogenic global warming can still legitimately conclude that Kyoto is an economically unsound policy response. In that respect it is no more the place of CMOS to "weigh in" on behalf of Kyoto than it is to weigh in on behalf of bank mergers or dividend tax credits. You're welcome to do so, to be sure, but it might strike some observers as being as presumptuous as, say, an economist weighing in on climate science issues.

Ross McKitrick
Associate Professor, Department of Economics
The University of Guelph

The MSC/COMET Partnership: Building a Training Infrastructure for Canada[1]

Due to severe cuts in its operating budget, the 1990s were a difficult decade for the Meteorological Service of Canada (MSC). In 2000, some progressive MSC managers decided that the time had come to build the foundations for a program of ongoing professional meteorological training for Canadian operational forecasters. How could this best be accomplished? It was clear that building the necessary infrastructure from scratch would be impossible in the funding climate of the times. However, one very interesting option was available: the Cooperative Program for Operational Meteorology, Education and Training, or COMET.

Based in Boulder, Colorado, COMET has been in the meteorological training business for years. Its mission is *"to promote and enhance the science of weather forecasting through the education and training of weather forecasters, forecast users, University faculty and students"*. COMET's team of meteorologists, instructional designers and computer personnel is second to none in the production of computer-based distance learning meteorological training modules. The same team also conducts numerous classroom-based residence courses in its modern classroom in Boulder.

Under the aegis of the University Corporation for Atmospheric Research (UCAR), COMET follows the sponsorship model, with funding provided by various agencies including the NWS (National Weather Service), AFWC (Air Force Weather Agency) and NMOC (Naval Meteorology and Oceanography Command). In the past, work done for any sponsoring agency became available to all the others through laser disks or CD-ROMs. Recently, though, COMET has turned to the Internet, where more and more of its work is published and freely available. It was clear that the sponsorship approach would be a highly cost-effective one for the MSC, which became COMET's first international sponsor in 2001.

Benefits from the Partnership began flowing to the MSC immediately. One of these was a special winter weather classroom course. First presented early in 2001, this course brought together 14 forecasters from all Canadian regions for two weeks of intensive course and lab work. Several American forecasters from Alaska and the northern regions of the continental US were also present. Two more winter weather courses have taken place since then, and the fourth will be held in early December, 2003.

Two Canadian operational meteorologists have been assigned on a part-time basis as liaison between the MSC and COMET. In addition to an important role in organizing the winter weather courses, these meteorologists are also heavily involved in the design and development of new COMET training modules. Furthermore, they are expected to make recommendations to MSC managers about the future course of professional meteorological training in Canada.

Without doubt the centrepiece of the Partnership's distance learning activities is the NorLatMet (Northern Latitude Meteorology) Website, at http://www.meted.ucar.edu/norlat (Fig 1). This site is designed to provide a single location for a wide variety of meteorological training materials, including Webcasts, multiple special training modules, a case study library, a meteorological research forum, and forums on special topics. It has been decided to place particular emphasis on winter weather (*"mon pays, ce n'est pas un pays, c'est l'hiver"* according to Gilles Vigneault) in the NorLatMet site. Winter weather is of great interest and importance not only to Canadians, but also to Alaskans and those Americans who live in the northern part of the "Lower 48". To this end, much of the Partnership's activity is focused on the so-called "Snow Initiative", which will identify cases illustrating various categories of significant or severe winter weather. These cases will then serve as the basis for new training modules for operational forecasters, as described in the following paragraph. Attempts will always be made to include mesoscale considerations in each of these new modules.

In a new approach to training, a "Snow Initiative" case serves as the core of the distance learning training module. The design allows the student to play the role of forecaster for the case. In this format, the case progresses through time and the student answers a series of questions about the meteorological situation and the forecasts. Datasets for the case are supplied as part of the module. In addition, at any time the student can refer to "learning objects" composed of supplementary material on meteorological theory and practice relevant to the case. The MSC/COMET Partnership reached a major milestone with the publication in June, 2003 of the first such training module, "Ocean Effect Snow: New England Snow Storm, 14 January, 1999" (Fig 2). This module is of course available through the NorLatMet Website.

Another Partnership milestone was the addition of the Canadian GEM regional model to COMET's Web page "Characteristics of Operational NWP Models". Until recently, this page, located at http://www.meted.ucar.edu/nwp/pcu2/launpcu2.htm ,

[1] Submitted by Bruce Muller and Doug Wesley

Figure 1

contained only American NWP models. The addition of the GEM regional means that inter-comparisons between the American models and GEM regional are now easier to make. In addition, for any individual model including GEM regional, this site is an extremely useful clearing-house of information about all aspects of that model.

The Partnership has been the source of at least one new forecast chart. Following lectures in the winter weather courses on banded heavy snowfall related to CSI (Conditional Symmetric Instability), it became clear that the tools to diagnose and forecast such episodes were not available in Canada. This led to the design of a new forecast chart at the Canadian Meteorological Centre, the CMC EPV (Equivalent Potential Vorticity) chart (Fig 3). Links to this chart, along with a description in either French or English, are available through the NorLatMet Website.

All these and many more activities are ongoing as part of the MSC/COMET Training Partnership. We are building for the future of professional meteorological training in Canada.

What is the source of the Partnership's success? Part of it comes from following COMET's formula for success:

> High Quality Instruction = Sound Science + Effective Instructional Practices + Outstanding Graphics + Operational Focus.

In addition, the dedication and professionalism of operational meteorologists are a sine qua non of the Training Partnership. Canadian forecasters are ready and willing to upgrade their skills, but they need the tools, the time, and a favourable organizational structure in order to accomplish this task. The Partnership hopes to contribute to a learning environment within the MSC so that we all can move into a future in which Canadian weather forecasting is more solidly anchored in the science of meteorology.

For more information on COMET, please contact: Bruce Muller - COMET, University Corporation for Atmospheric Research, P.O. Box 3000, Boulder, CO, 80307-3000 USA.

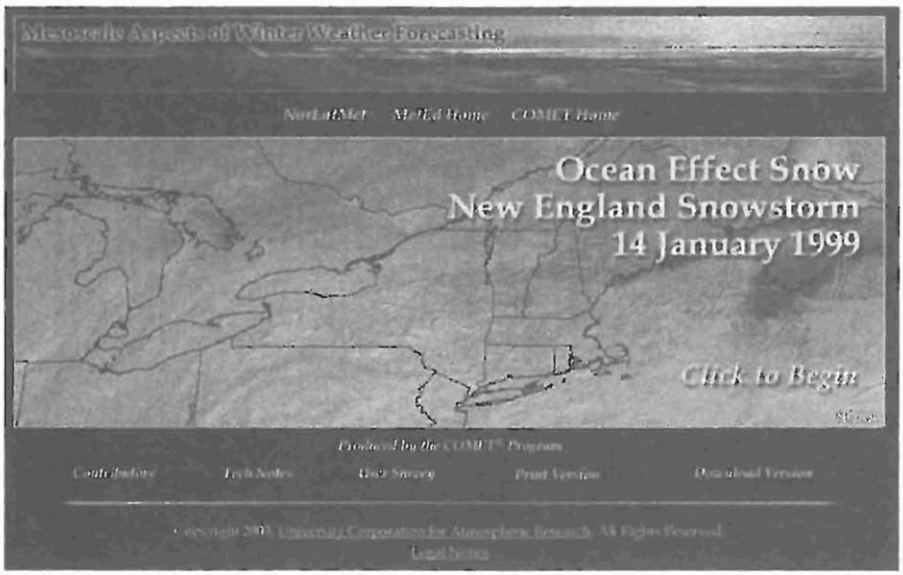


Figure 2

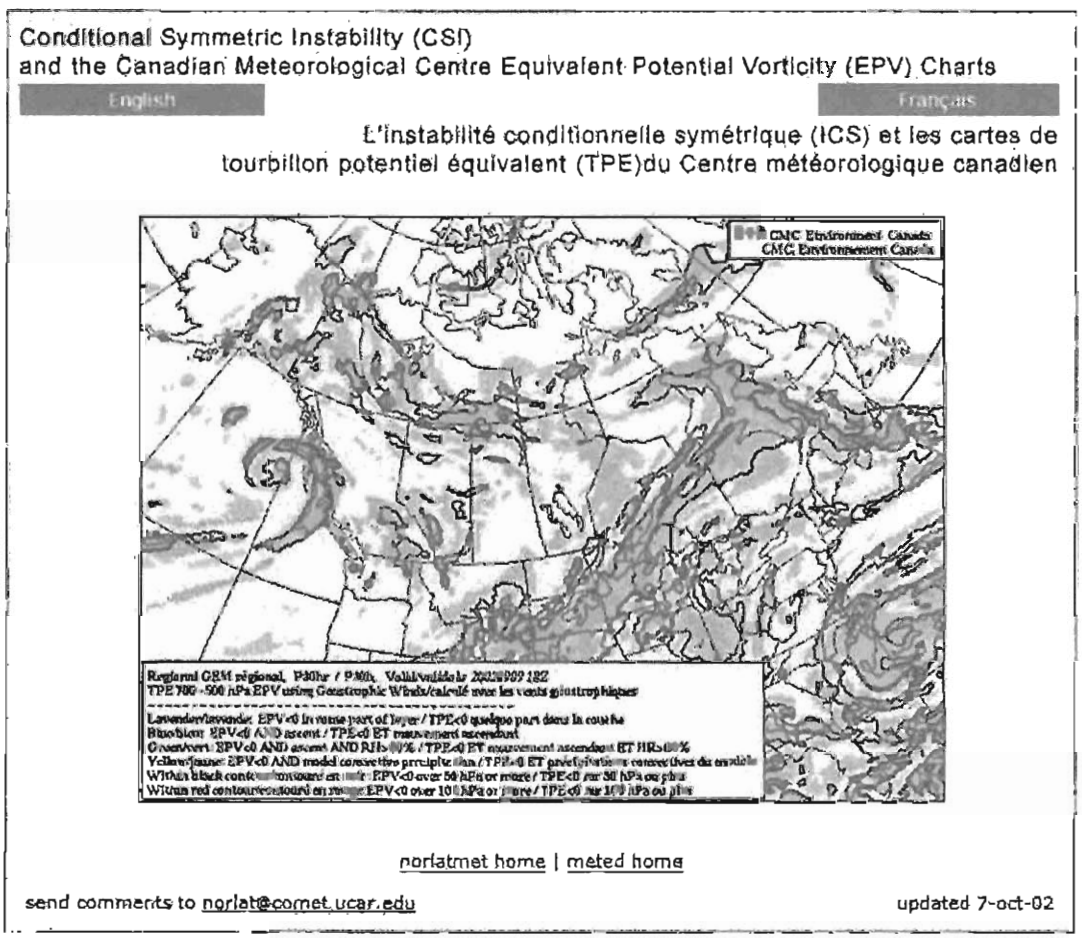


Figure 3

CMOS Toronto Centre's Education Program

by Sarah Wong[2]

The CMOS Toronto Centre's Education Program was originally set up after CMOS was involved with the 3rd International Conference on School and Popular Meteorological and Oceanographic Education in 1993. It was initiated to provide support to educators who required assistance to attend forthcoming conferences and other education activities related to meteorology and oceanography. While this is still one of the Toronto Centre's Education Program objectives, the program has steadily evolved to become more pro-active in the community, by setting up school talks and directly interacting with students.

The Toronto Centre has a small but dedicated group of professionals who volunteer their time to talk to students about the weather and oceanography. Besides myself, there is Robert Kuhn from the Meteorological Service of Canada Ontario Region, and Natasha Ramsahai from CBC Radio 99.1. Armed with defunct meteorological instruments, laptops, and overhead sheets for the less technologically supplied schools, students get to learn weather basics and how they are linked to oceanography. They also learn how to be prepared for severe weather events, including safety measures and how to inform others about them.

For the last several years, the Ontario teaching curriculum has made learning about meteorology mandatory for Grades 5 and 10. This has made it easier for the Education Program speakers to be invited to speak at schools, and foster awareness about the other CMOS Toronto Centre's initiatives. Furthermore, many teachers have often told me how it is very rewarding for them and their students to have a professional come in to talk about their work, and share their knowledge. It reinforces what the students learn in their classrooms. More importantly students learn how to apply what they are taught to real life situations.

It has been a grass-roots beginning for the Education Program. The Toronto Centre's outreach to schools initially started with word-of-mouth amongst friends who are teachers or talking at the schools where the speaker's children attend. As the program gained more awareness, we have been receiving more call-backs from schools where a speaker has previously presented. Furthermore, teachers have been informing their colleagues about the program. Natasha Ramsahai has also mentioned the CMOS Toronto Centre's Education Program on CBC Radio 99.1 several times. This has generated more requests from teachers across the GTA. In total, over the last three years there have been thirty-four lectures given at schools in the Toronto Centre Area.

The Education Program has received lots of encouragement from teachers to continue. The pupils are genuinely interested in learning about meteorology and oceanography as well as watching demonstrations with the instruments. I have personally always found it a pleasure to step into a classroom and meet with curious students. It is very rewarding when students ask questions and show interest in what I do as a meteorologist. I also see this as an opportunity to talk to students about potential careers in atmospheric science.

I would like to thank Natasha Ramsahai and Robert Kuhn for doing an excellent job, not only for giving up their own time to teach, but also for demonstrating their passion in educating others about science. A special mention goes to Charles Creese from the Meteorological Service of Canada who is also conducting a similar program in Thunder Bay.

[2] Education Coordinator, CMOS Toronto Centre

The Honourable David Anderson, P.C., M.P. Minister of the Environment to the 37th Annual Congress of the Canadian Meteorological and Oceanographic Society

Ottawa, Ontario June 2, 2003

Good morning. Welcome to Ottawa.

As I looked at the many session topics on your agenda, I was reminded of the long-standing debate about the gulf between those people who are in the sciences and those who are not. As scientific knowledge has grown and developed, it has necessarily become more complex and more specialized. The days of the gifted amateurs who made scientific breakthroughs in their home-made labs are now scarce.

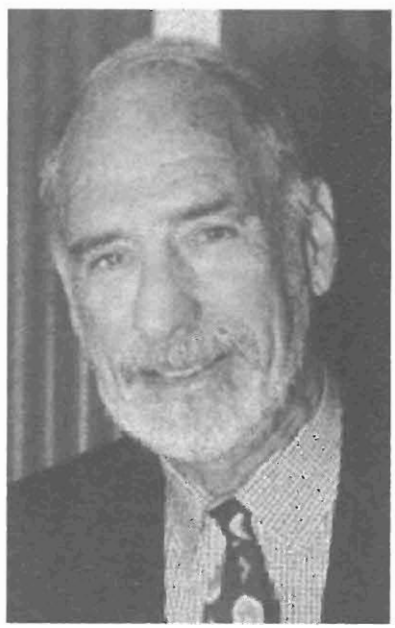
And yet, in some important ways, the gap between the scientific and non-scientific world is actually shrinking. Governments are increasingly addressing more and more issues where our choices depend on sound science. Canadians depend on good science to help them navigate the big issues of the day; it helps them make decisions about the kind of Canada they want to live in.

As scientists, you have both a heavy responsibility and a critical role to play in today's public debate. And as Minister of the Environment, I depend on good science to help me make policy decisions and explain them to my colleagues in Cabinet and indeed Canadians at large.

We recognize the significance of putting data into the hands of those that need it, for both research and business decisions, and we are supporting the science that we hope will lead to the best public policy decisions possible. Canada and the world face critical environmental challenges. And we are drawing on excellence in science to understand those challenges and to indeed resolve them.

As Canadians here know, our country went through a full and active public debate last year on the decision to ratify the Kyoto Protocol to the United Nations Framework Convention on Climate Change. To hear some of the people arguing against ratification, one would think there was no compelling reason to act. It was argued that climate change, if it existed at all, was of no real significance. Indeed, some people said this was really a smokescreen for an anti-business, anti-growth agenda. As a Minister, I can tell you that I have quite enough on my plate without making up new work for no reason.

Quite simply, our government moved on the climate change issue because we listened to the scientific consensus that there is a global warming trend and that reversing that trend is linked to controlling the concentrations of greenhouse gases in our atmosphere. Our government recognized that not every single scientist – even in climate-related fields – agrees with the consensus. As a Cabinet Minister, I know something about spirited professional disagreement. We determined that we could not stand aside and wait for a degree of unanimity that may never emerge – not in the face of the significant impacts of unchecked climate change.



We have added to our support climate science research to help humanity better understand the issues and how we can adapt to and address climate change. This scientific understanding will help us make the best-informed policy choices possible. Four main federal government departments are involved in Canadian climate science issues – Environment, Natural Resources, Fisheries and Oceans and Agriculture and Agri-Food. Together these departments invest roughly $70 million per year into research on the science of climate change and the ongoing systematic monitoring of our climate, weather, ice and hydrology.

While that monitoring has many other benefits, it has been essential to understanding climate change in Canada and the options for responding to it. Beyond that, we have invested $6 million per year for research into climate change impacts and adaptation. The Climate Change Action Fund includes $2.5 million for the current year for science, while Action Plan 2000 has earmarked a further $5 million per year.

Probably one of our most high-profile contributions to scientific knowledge has been our support for the Canadian Foundation for Climate and Atmospheric Sciences. In budget 2000, the Government of Canada allocated $60 million over six years to the Foundation. So far, about half the funds have gone to climate science, with the rest going to research into extreme weather and air quality. Our experience led to the decision to invest another $50 million in the Foundation in Budget 2003.

And I certainly could not get away without talking to this audience about the recent announcement of a $75 million investment for the Meteorological Service of Canada. This funding will allow the MSC to improve the quality of its forecasts and its service to Canadians in all regions. It will support the integration of MSC's forecast operations into five main centres and couple them with national research laboratories. The funding will also allow the Meteorological Service of Canada to develop new national research capacity.

> Today, I am pleased to announce that we will be taking an important step forward to improve access to data. Environment Canada's Meteorological Service will introduce a new Web-based service: online access to the Climate Data Archive in July 2003.
>
> *David Anderson, Minister of the Environment*

The increased emphasis on research will build on the existing network of specialized facilities and research programs, such as the ice service, supercomputing, air quality and climate modelling. The MSC will also expand its collaboration with Canada's academic and research community. Some of this will build on the important work of recent years. For example, a Coastal and Marine Meteorology research laboratory in Halifax will work hand in hand with the Canadian Hurricane Centre and the Atlantic forecasting production team. Together, they will improve our understanding of coastal and marine weather and develop forecasting tools to improve the quality of service to Canadians.

We are already at work to produce a better storm surge model with some exciting results, and while water surges cannot be stopped, they can be better predicted and understood. Once again our view is fairly clear – develop better science and that helps better decisions to be made. Our support for science extends beyond investments in research and basic data collection. Our government continues to increase access to the scientific information that we have gathered and managed over time. We look for new ways to make data more easily available to the people who can put it to work. Today, I am pleased to announce that we will be taking an important step forward to improve access to data. Environment Canada's Meteorological Service will introduce a new Web-based service: online access to the Climate Data Archive in July 2003.

As you no doubt know, the MSC operates the National Climate Data and Information Archive, which contains the official climate and weather observations for Canada. This archive contains more than 8 billion climate observations from 6,000 locations across the country and will go "live" this July on the MSC weather office Website. Its records go back as far as 1840 and cover elements as diverse as temperature, precipitation, cloud types, bright sunshine and occurrences of thunderstorms, hail and other weather phenomena. And with new sources of data from our lightning detection network, AMDAR and increased Doppler radars, this archive will only continue to grow.

The scientific research that we support and the data that we gather adds to what we know and what we understand. Making it accessible supports research even more. Canada has to look ahead to envision the Canada that we want to build for future generations. Excellence in science will help us define our choices and our answers. It will help us make an even more significant contribution to international thinking and decision-making.

These issues are too important to be guided by guesswork. They are too important for us to wait for a level of certainty that may never arrive. We have to make the best choices with the best scientific advice and guidance available and we must actively build on our knowledge. As you take part in the many sessions at this conference, I want to emphasize that I believe – and the Government of Canada believes – that people in the atmospheric and ocean sciences are engaged in some of the most important scientific research taking place in Canada today.

Especially as we face one of the greatest environmental challenges to come along – climate change. As a country where weather is more than a subject of conversation and where the water of three oceans is at our shores, your work matters, directly or indirectly, to all Canadians. Yes, I know we face many priorities for the funds that Canadians provide to us, and I have never heard a researcher say they have all the funding they could ever want. Even so, let me say that I am glad that we have been able to increase our support for science as much as we have.

We are adding to the base of knowledge that we will put to work into the best public policy choices possible.

Thank you and let me wish you all the best for the rest of your conference.

L'honorable David Anderson, c.p., député, Ministre de l'Environnement du Canada au 37e congrès annuel de la Société canadienne de météorologie et d'océanographie

Ottawa, Ontario, le 2 juin 2003

Bonjour. Bienvenue à Ottawa.

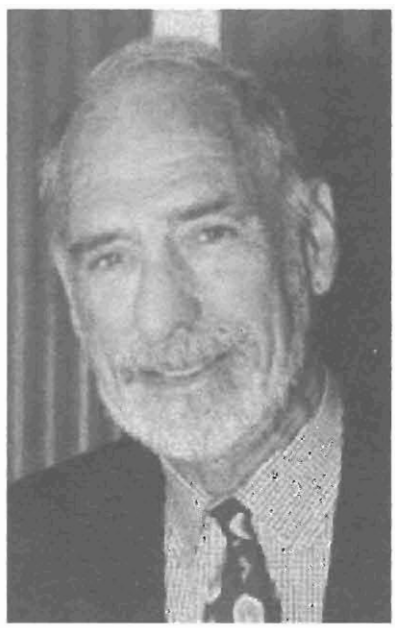
En prenant connaissance des thèmes des nombreuses séances inscrites à l'ordre du jour, je me suis rappelé ce débat de longue date sur le fossé qui sépare les personnes qui travaillent dans le domaine des sciences de celles qui appartiennent à d'autres secteurs. À mesure que les connaissances scientifiques progressent et prennent de l'expansion, elles gagnent forcément en complexité et en spécialisation. L'époque où des amateurs doués faisaient des découvertes scientifiques dans leurs laboratoires de fortune est désormais presque révolue.

Néanmoins, eu égard à certains aspects importants, le fossé entre l'univers des scientifiques et celui des non-scientifiques s'amenuise en fait. Les gouvernements interviennent de plus en plus dans les dossiers au sujet desquels les décisions que nous prenons reposent sur des principes scientifiques objectifs. Les Canadiens et les Canadiennes s'en remettent à des principes scientifiques objectifs quand vient le moment d'explorer les importantes questions d'actualité; ils s'en servent pour décider dans quel genre de pays ils veulent vivre.

En votre qualité d'hommes de science, vous avez à la fois une lourde responsabilité à assumer et un rôle critique à jouer dans le débat public d'aujourd'hui. En tant que ministre de l'Environnement, je me fonde sur des principes scientifiques objectifs pour prendre des décisions stratégiques et les expliquer à mes collègues du Cabinet et, bien sûr, à l'ensemble de la population canadienne.

Nous sommes conscients de l'importance de fournir des données aux personnes qui en ont besoin pour prendre des décisions, tant dans le domaine de la recherche que dans celui des affaires, et nous soutenons la recherche scientifique qui, nous l'espérons, nous permettra de prendre les meilleures décisions stratégiques possibles. À l'instar de tous les autres pays, le Canada fait face à des défis environnementaux. Et nous comptons sur le fait que nous excellons dans le domaine scientifique pour analyser ces défis et, en fait, pour les relever.

Comme le savent les Canadiens et Canadiennes ici présents, notre pays a été l'an dernier le théâtre d'un débat public exhaustif et mouvementé portant sur la décision de ratifier le Protocole de Kyoto dans le contexte de la Convention-cadre des Nations Unies sur les changements climatiques. Si l'on se fie aux propos tenus par certains des opposants à la ratification de ce protocole, on pourrait croire qu'il n'existe aucune raison valable de passer à l'action. On a fait valoir que le phénomène des changements climatiques, en admettant qu'il existe, n'avait aucune importance réelle. En fait, certaines personnes ont même déclaré qu'il ne s'agissait là que d'un prétexte pour que soit mis en place un programme allant à l'encontre des entreprises et de la croissance. En ma qualité de ministre, je peux vous dire que j'ai déjà bien assez à faire pour ne pas ajouter sans raison de nouvelles tâches à ma charge de travail.



Notre gouvernement a pris des mesures eu égard au problème des changements climatiques tout simplement parce que nous avons ajouté foi au consensus des hommes de science, qui croient qu'il existe une tendance au réchauffement de la planète et que le renversement de celle-ci est lié au contrôle des concentrations de gaz à effet de serre dans l'atmosphère. Notre gouvernement reconnaît que tous les scientifiques, même parmi ceux qui travaillent dans les domaines liés au climat, ne sont pas du même avis. En tant que ministre du Cabinet, je suis familier avec les vives mésententes professionnelles. Nous avons décidé que nous ne pouvions pas attendre le moment où tous les hommes et femmes de science en viendraient à une certaine unanimité qui risque de ne jamais se produire – nous ne pouvions attendre compte tenu des importantes répercussions qu'auraient les changements climatiques s'ils n'étaient pas contrôlés.

Nous avons accru notre financement au titre de la recherche liée aux sciences du climat afin que l'humanité puisse mieux comprendre les enjeux et la manière dont nous pouvons nous adapter aux changements climatiques et lutter contre ce phénomène. Ces analyses scientifiques nous permettront de prendre les décisions les plus éclairées. Les quatre principaux ministères fédéraux intéressés par les questions relevant des sciences du climat au Canada sont Environnement, Ressources naturelles, Pêches et Océans et Agriculture et Agro-alimentaire. Ensemble, ces ministères consacrent environ 70 millions de dollars par année à la recherche scientifique sur les changements climatiques et à la surveillance systématique permanente du climat, des phénomènes météorologiques, des glaces et de l'hydrologie.

Cette surveillance, qui comporte un grand nombre d'autres

avantages, a joué un rôle crucial dans la compréhension des changements climatiques au Canada et des solutions à ce problème. Qui plus est, nous avons investi chaque année six millions de dollars dans la recherche sur les conséquences des changements climatiques et l'adaptation à ce phénomène. Le Fonds d'action pour le changement climatique prévoit affecter cette année 2,5 millions de dollars à la recherche scientifique. Le Plan d'action 2000 du gouvernement fédéral y consacre annuellement la somme additionnelle de cinq millions de dollars.

Notre appui à la Fondation canadienne pour les sciences du climat et de l'atmosphère est vraisemblablement l'une de nos contributions les plus en vue à l'avancement des connaissances scientifiques. Dans le budget de 2000, le gouvernement du Canada a accordé à cette fondation la somme de 60 millions de dollars répartie sur une période de six ans. Jusqu'à présent, environ la moitié des fonds ont été consacrés aux sciences du climat et le reste est allé à la recherche sur les conditions météorologiques extrêmes et la qualité de l'air. L'expérience acquise nous a amené à prendre la décision de consacrer à la fondation, dans le budget de 2003, la somme additionnelle de 50 millions de dollars.

Je ne peux évidemment pas, en l'occurrence, passer sous silence l'annonce récente de l'investissement de 75 millions de dollars dans le Service météorologique du Canada. Ces fonds permettront au SMC d'améliorer la qualité de ses prévisions et de son service aux Canadiens de toutes les régions. Ils seront consacrés à l'intégration dans cinq centres principaux des opérations prévisionnelles du SMC et à leur couplage avec les laboratoires de recherche nationaux. Ces fonds permettront en outre au Service météorologique du Canada d'élaborer une nouvelle capacité nationale de recherche.

L'importance accrue accordée à la recherche fera fructifier le réseau existant d'installations spécialisées et de programmes de recherche, comme les services des glaces, le super-ordinateur, la qualité de l'air et la modélisation climatique. Le SMC élargira sa collaboration avec les universitaires et les chercheurs canadiens. Dans une certaine mesure, l'important travail effectué au cours des dernières années sera mis à profit. Ainsi, le laboratoire de recherche sur la météorologie côtière et maritime à Halifax travaillera en étroite collaboration avec le Centre canadien des ouragans et l'équipe de production des prévisions de la région de l'Atlantique. Prises ensemble, ces initiatives nous permettront de mieux comprendre la météorologie côtière et maritime et d'élaborer des outils de prévision en vue d'améliorer la qualité du service aux Canadiens et aux Canadiennes.

Nous sommes déjà en voie de produire un modèle amélioré de prévisions des marées de tempête pour lequel nous avons obtenu des résultats intéressants. Si les marées de tempête ne peuvent être stoppées, nous pouvons toutefois les prévoir avec plus de précision et mieux les comprendre. Encore une fois, notre objectif est

Dans le budget de 2000, le gouvernement du Canada a accordé à cette fondation (Fondation canadienne pour les sciences du climat et de l'atmosphère) la somme de 60 millions de dollars répartie sur une période de six ans. Jusqu'à présent, environ la moitié des fonds ont été consacrés aux sciences du climat et le reste est allé à la recherche sur les conditions météorologiques extrêmes et la qualité de l'air. L'expérience acquise nous a amené à prendre la décision de consacrer à la fondation, dans le budget de 2003, la somme additionnelle de 50 millions de dollars.

David Anderson, ministre de l'Environnement

clair : nous voulons développer les connaissances scientifiques, ce qui favorise la prise de décisions plus éclairées. Notre appui à la science va plus loin que les investissements dans la recherche et la collecte de données de base. Notre gouvernement continue d'élargir l'accès aux données scientifiques que nous avons recueillies et exploitées au fil du temps. Nous cherchons de nouveaux moyens de faciliter l'accès aux données pour les personnes qui peuvent les mettre à profit. Je suis heureux aujourd'hui d'annoncer que nous franchirons une étape importante de l'amélioration de l'accès à ces données. Le Service météorologique d'Environnement Canada lancera un nouveau service virtuel : l'accès en direct aux Archives des données climatologiques en juillet 2003.

Comme vous le savez sans doute, le SMC exploite les Archives nationales des données climatologiques où sont versées les observations climatologiques et météorologiques officielles recueillies pour le Canada. Ces archives, qui contiennent plus de huit milliards d'observations climatologiques, provenant de 6 000 endroits un peu partout au pays, seront accessibles à compter de juillet sur le site Web du bureau météorologique du SMC. Dans ces archives, qui remontent jusqu'à 1840, on trouve des éléments aussi divers que la température, les précipitations, les genres de nuages, l'insolation effective et la fréquence des orages, la grêle et d'autres phénomènes météorologiques. En outre, grâce aux nouvelles données fournies par notre réseau de détection de la foudre, le logiciel AMDAR et le plus grand nombre de radars Doppler, ces archives continueront à prendre de l'expansion.

La recherche scientifique que nous finançons et les données que nous recueillons contribuent à enrichir notre savoir et notre compréhension. L'accessibilité aux données soutient encore plus la recherche. Nous devons donc penser à l'avenir et nous faire une idée du Canada que nous voulons construire pour le bénéfice des générations qui suivront. L'excellence dans le domaine scientifique nous aidera à cerner nos choix et nos réponses. Grâce à elle, notre contribution à la réflexion et à la prise de décisions à l'échelon international sera encore plus importante.

Ces questions sont trop importantes pour qu'on s'en remette à des conjectures à leur sujet. Elles sont trop importantes pour que nous attendions qu'on en arrive à un certain degré de certitude, ce qui ne se produira peut-être jamais. Nous devons faire les meilleurs choix en nous fondant sur les meilleurs avis et conseils scientifiques disponibles et nous devons tabler sur nos connaissances. Lorsque vous participerez aux nombreuses séances de la présente conférence, n'oubliez pas que le gouvernement du Canada et moi-même sommes d'avis que les personnes qui travaillent dans le domaine des sciences atmosphériques et de l'océanographie participent, dans certains cas, aux recherches scientifiques les plus importantes effectuées de nos jours au Canada.

Particulièrement, dans l'optique que nous faisons face à l'un des plus graves problèmes environnementaux : celui des changements climatiques. Dans un pays délimité par trois océans où la température est plus qu'un sujet de conservation, votre travail a, directement ou indirectement, de l'importance pour tous les Canadiens et les Canadiennes.

Je sais bien que la liste de priorités auxquelles nous pourrions consacrer l'argent que nous confient les Canadiens et les Canadiennes est fort longue. Qui plus est, jamais à ma connaissance un chercheur n'a affirmé qu'il avait reçu suffisamment d'argent pour combler tous ses besoins. Cependant, je tiens à vous dire que je suis heureux que nous ayons pu affecter des fonds additionnels aux activités scientifiques.

Nous enrichissons la base des connaissances dont nous tiendrons compte pour prendre les meilleures décisions possibles quant aux politiques publiques.

Je vous remercie et vous souhaite une excellente conférence.

Atmosphere-Ocean 41-3 Paper Order

OC-241

The Formation and Maintenance of the North Water Polynya by T. Yao and C. L. Tang

AO-502

Predictability as a Function of Scale by G.J. Boer

OC-238

Nonlinear Coupling between Modes in a Low-Dimensional Model of ENSO by Mark S. Roulston and J. David Neelin

AO-501

Trends in Winter Extreme Minimum Temperatures on the Canadian Prairies by Bevan D. Lawson

OC-237

Thermocline Oscillation and Warming Event in the Tropical Indian Ocean by Weihong Qian, Haoran Hu and Yafen Zhu

Next Issue CMOS Bulletin SCMO

Next issue of the *CMOS Bulletin SCMO* will be published in October 2003. Please send your articles, notes, workshop reports or news items at the earliest to the address given on page ii. We have an **URGENT** need for your articles.

Prochain numéro du CMOS Bulletin SCMO

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en octobre 2003. Prière de nous faire parvenir au plus tôt vos articles, notes, rapports d'atelier ou nouvelles à l'adresse indiquée à la page ii. Nous avons un besoin **URGENT** d'articles.

CMOS exists for the advancement of meteorology and oceanography in Canada.

Le but de la **SCMO** est de stimuler l'intérêt pour la météorologie et l'océanographie au Canada.

Climate Change Impacts and Adaptation

The Department of Fisheries and Oceans' (DFO) Response to the Challenge

by Estelle Couture[1] and Douglas Bancroft[1]

Originally presented by

Dr Wendy Watson-Wright

Assistant Deputy Minister of Science, Fisheries and Oceans Canada

at the Ottawa CMOS Congress 2003

Introduction

Our climate is changing. The rate of change and the characteristics of the resulting impacts will vary over time and across the country, affecting our health, our water resources, recreation and tourism, transportation, coastal zones, ecosystems, forestry and fisheries.

Climate change affects all Canadians. For example, in British Columbia there are concerns over forests and fish stocks, particularly salmon. In the prairies, extreme droughts and floods could both occur due to warming. In Québec and Ontario there is concern over extreme events such as flooding and droughts, causing an increase in forest fires and declining lake levels. Warmer climate may significantly reduce winter energy consumption and heating costs, but any gains are likely to be offset by increased summer cooling costs. In that region as elsewhere, the growing season may be extended, offering benefit to many farmers. In Atlantic Canada, coastal erosion and the potential decline of key fisheries, causes concern. The northern part of our country is likely to experience the most pronounced warming and it is the area where the people are most dependent on renewable resources. Climate change scientists have also predicted problems with infrastructures, pipelines, roads, and buildings associated with frozen ground. All areas of the country will be affected, but some more than others (1).

It has become evident that while we need to reduce greenhouse gas emissions, we will be required to adapt to the impacts of a changing climate. Understanding what climate change will mean for Canadians and elaborating sound adaptation strategies are very complex issues. There are no simple answers.

The Arctic

Global models (Figure 1) indicate that the change will be the greatest in the Arctic with much regional variation.

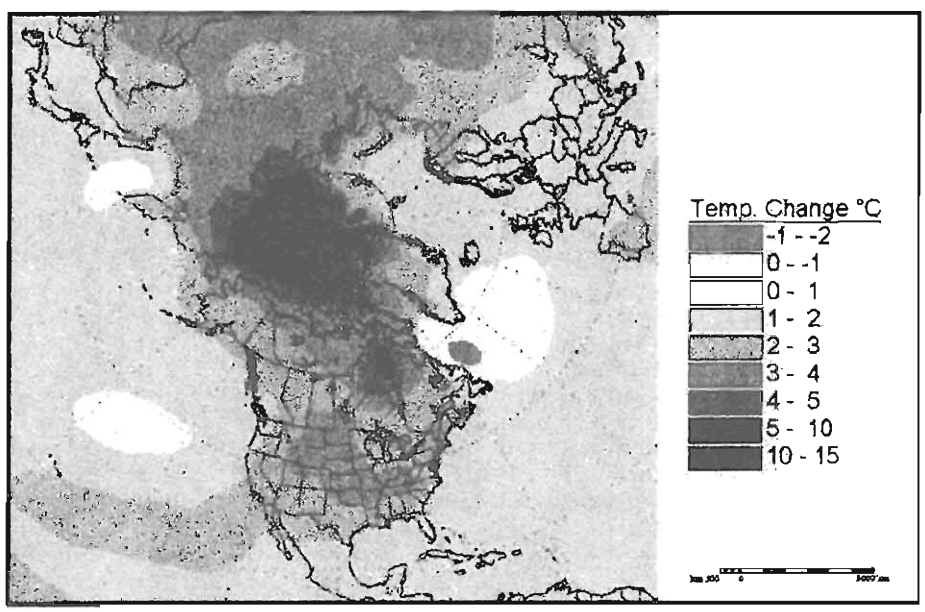


Figure 1. By about 2050, the warming projected by the CGCM1 experiment for Central North America and much of Asia exceeds 3°C, with ice covered waters in the Arctic Ocean warming by more than 5°C. Source: MSC Climate Research Branch.

[1] Oceanography and Climate, Fisheries and Oceans, Canada.

Although modellers say that they don't have sufficient confidence in these variations at such scales, the message we should take away from this figure is that we need to be alert for large, important regional differences that could have large impacts on ecosystems.

The Arctic is very important. It is characterized by one of the most extreme environments on the planet, with seasonally dependent sunlight, extreme temperatures, and a short growing season. Sea ice, snow cover, glaciers, tundra, permafrost and boreal forests are all sensitive indicators of change, susceptible to subtle variations in sunlight, surface temperature, ocean, heat transport and air and ocean chemistry (4). In addition, the Arctic plays a key role in many global processes such as atmosphere and ocean circulation and includes potentially important sources and sinks of trace gases. Because of the proximity and potential implications of changes in the Arctic, Canada is expected to play a leading role in Arctic climate change science.

Warming predicted by most climate models could potentially cause the opening of new shipping lanes. The Northwest Passage lies in the middle of the Canadian Arctic and is a significant shortcut between Europe and Asia. The opening of the Northwest Passage could have significant environmental, economic and political impact on Canada's claim of full sovereignty over the waters of the Arctic Archipelago.

The thinning of the ice would also threaten ecosystems. Animals who depend on ice as a platform such as ringed seals, walruses and polar bears would suffer by limiting access to their source of food (5).

Fish could be impacted as a result of decreased amounts of sub-ice and ice-edge phytoplankton, a key source of food for the copepods and fish, such as Arctic cod. On the other hand, a decrease in ice cover could enhance primary production in open water, and thereby increase food supply (3).

Warming in the Arctic will also cause sea level rise, increased wave activity and coastal erosion. This phenomenon extends to more than the Arctic. Sea level rise and coastal erosion are significant concerns in Atlantic Canada where most of the coast has been undergoing slow submergence for several thousand years (2). Global climate change would serve to accelerate the rate of sea level rise, which could inundate coastal lowlands and erode susceptible shorelines.

Changes have already started to occur

The ice coverage has decreased over the last few decades and there is also evidence that the thickness of the ice has also declined. Understanding and predicting change in sea ice is a major challenge for scientists. There are many variables such as cloud cover, precipitation, circulation in the basin, ice export, ice mechanics, heat from the ocean, polynyas, freshwater and the cold halocline that enter into the equation. Existing global models do a poor job of representing ice cover, as well as the snow on the ice. Although we have learned a lot, there is quite a bit left to learn.

Figure 2 shows recent events caused by warming in the Arctic. For example, Pacific salmon never used to be seen in Arctic waters but that changed in 1993. We are seeing shifts in species composition of ecosystems; the salmon population is shifting northward. Sockeye salmon's normal habitat is shrinking partly due to their sensitivity to water temperature, i.e. they are normally restricted to surface

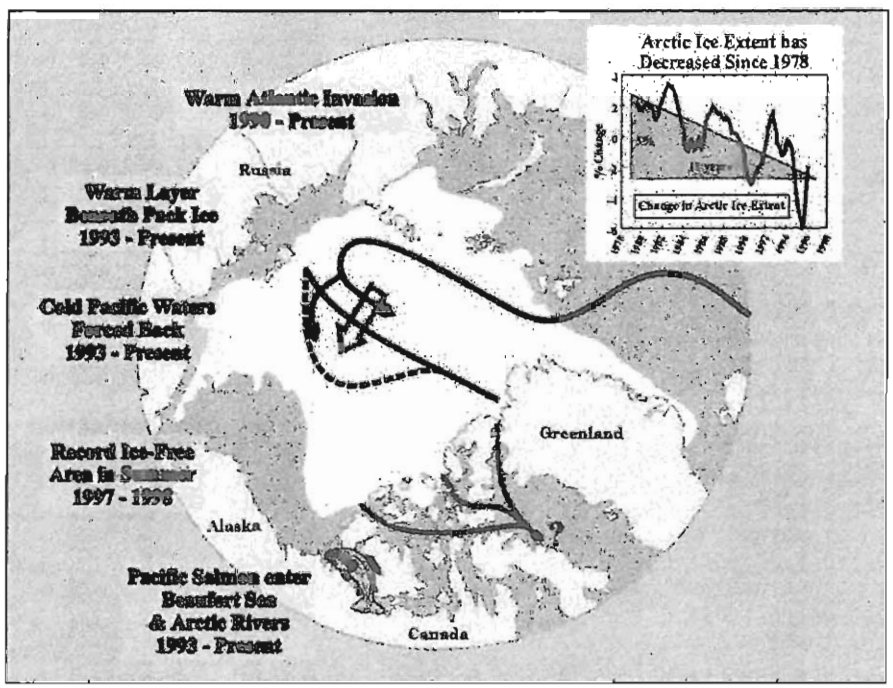


Figure 2. Events caused by warming in the Arctic. Courtesy Humfrey Melling of the Institute of Ocean Sciences, DFO.

waters colder than 8 degrees. If the trend continues, a suitable ocean habitat for sockeye salmon may not include any of the Pacific Ocean by the end of the century (6).

As conditions become too warm for salmon off the coast of BC, other species will move further north. In recent El Niño events, northward currents along the Pacific coast from California to BC became stronger. Hake and sardine catches increased significantly in Canadian waters as they followed their preferred temperature regime and food sources northward. El Niño events are predicted to become more frequent and more intense with global warming. Climate change will require that fishing communities remain flexible and be prepared to adapt (6).

Changes in the environment can occur suddenly, causing dramatic effects. The massive single year reduction of salmon catch in Figure 3 was possibly due to many factors, but most evidence points to an ocean climate regime shift. As well, in early April of 2003, thousands of cod were found dead in Smith Sound, Newfoundland. The early sense regarding the mass mortality was that the cod froze to death, but scientists have not yet figured out why some (not all) of the fish died. It appears to be associated with unusually cold water, but scientists are still uncertain about the mechanism.

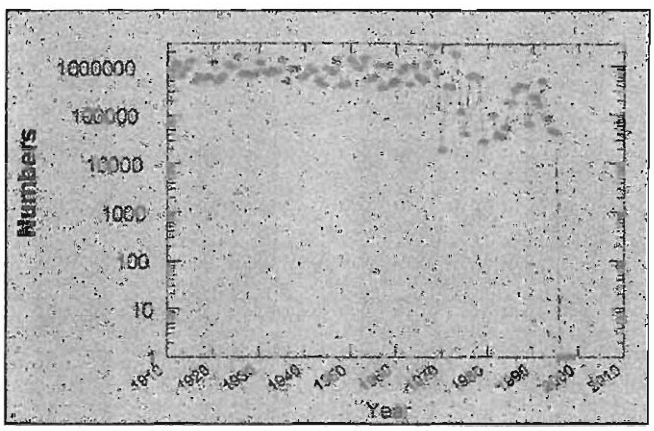


Figure 3. Rivers Inlet Sockeye Catch (1912-1999). In 2000, Salmon catches drop to almost zero. Source: McKinnell et al. 2000.

Fisheries management is most challenging when stocks are at the mercy of such environmentally-induced changes. We must understand the physical, chemical and biological environment and how it has affected fish stocks in the past, so we can begin to forecast the influence of these factors on fish populations into the future.

Partnerships

DFO recognizes that addressing climate change issues is a very complex task. All countries of the world are affected by climate change; it is a global and broad issue that requires partnerships and collaborations. Understanding and predicting climate is a task that cannot be undertaken by one country alone and even less by one department alone.

DFO focuses considerably on building partnerships and developing coordination and collaboration internationally as well as with other federal departments, Canadian universities and industry. Here are some examples:

1) Argo

Project Argo is an example of an international collaboration as part of an ocean observing system.

The goal of project Argo is to deploy profiling floats collecting subsurface temperature and salinity data in real time to gain a better understanding of the state of the ocean and ultimately to give us climate forecasting capability.

The first deployments began in 2000 with the objective to deploy 3000 floats in the global array by 2005. Canada is expected to contribute a total of 150 floats to the array in steady state. Currently, 59 Canadian floats are collecting data (Figure 4) in the world's ocean thanks to Howard Freeland and Allyn Clarke both from DFO.

Ultimately, these data will be assimilated into GODAE (Global Ocean Data Assimilation Experiment) to yield our first operational ability to forecast the ocean.

2) GLOSS

The Global Sea Level Observing System (GLOSS) is also part of the global observing system, a network of sea level gauges around the world. DFO's most recent contributions to the network are gauges in the Arctic funded partly by Climate Change Action Fund Action Plan 2000.

This year, DFO installed three stations (Nain, Alert and Holman) and next year, two (Tuktoyaktuk and Broughton Island) and possibly three more (Resolute) will be installed. Once completed, these five and possibly six stations will form the Canadian Arctic Permanent Gauging network, another contribution to the Global Ocean Observing System.

Monitoring

Monitoring the oceans for large-scale oceanographic events and general ocean circulation has become essential in the quest to detect, understand and eventually predict the state of the ocean.

On the Pacific Coast, datasets have been collected at Line-P (Figure 5) for several decades. On the Atlantic Coast, data has been collected at the Labrador Sea (Figure 6) line since 1928. These datasets are of the few time series data of sufficient quality and of suitable length to be useful in examining the variability of the oceans. More recently, DFO established a more geographically extensive programme on the Atlantic Coast; The Atlantic Zone Monitoring Programme (AZMP) (Figure 7). One key element of the AZMP is oceanographic sampling at fixed stations and along transects. The programme is a collaboration among scientists of DFO Institutes; Maurice Lamontagne Institute (IML), St-Andrews, Bedford Institute of Oceanography (BIO), the Northwest Atlantic Fisheries Centre (NAFC) and the Marine Environmental Data Service (MEDS). The data from these programmes are available on DFO web sites. (Line-P: http://www-sci.pac.dfo-mpo.gc.ca/osap/projects/linepdata/default_e.htm; Labrador Sea: http://www.mar.dfo-mpo.gc.ca/science/ocean/woce/labsea/labsea_poster.html, AZMP: http://www.meds-sdmm.dfo-mpo.gc.ca/zmp/main_zmp_e.htm).

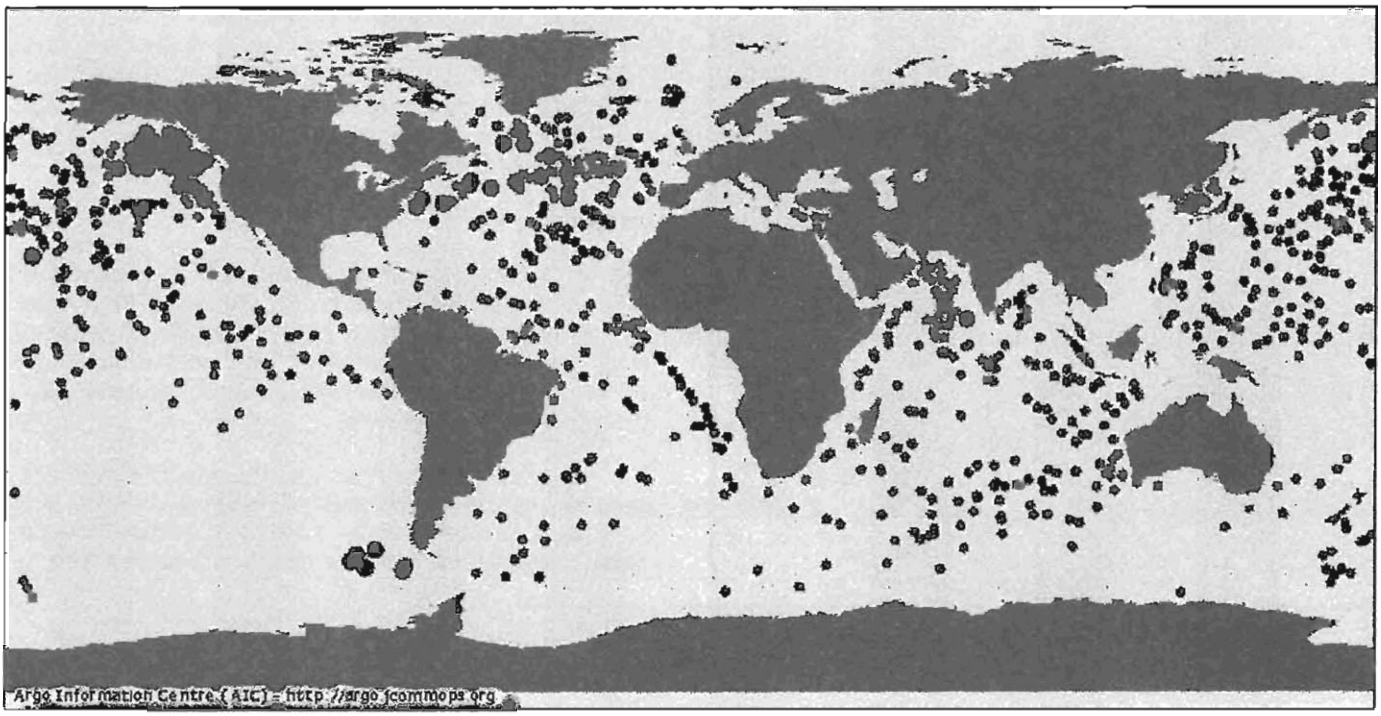


Figure 4. Global array of Argo floats. Large circles indicate the location of Canadian floats. Courtesy JCOMMOPS.

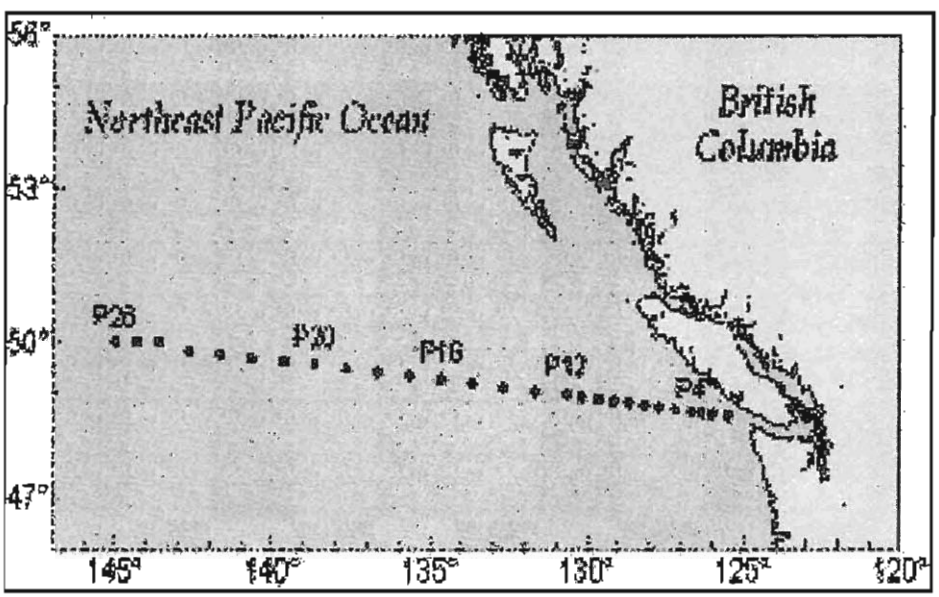


Figure 5. Location of oceanographic stations forming Line-P.

Data Management

The importance of good data management is increasingly being recognized as the foundation of all science programmes. DFO's Marine Environmental Data Service is Canada's national oceanographic data centre mandated to archive, quality control and disseminate data to anyone making a request. MEDS archives physical, biological and chemical oceanographic data including those from the programs described above. MEDS is recognised by the international community as a leader in data management.

Research

DFO also participates in numerous large, international climate research programmes. The Surface Ocean Lower Atmosphere Study (SOLAS) is an example of collaboration among international partners, Canadian Universities and DFO. Last summer's SOLAS SERIES experiment looked at the effects of iron enrichment on ocean plankton and related chemical cycles, in an effort to better forecast how the ocean and atmosphere could change in the future as a result of climate variability and change.

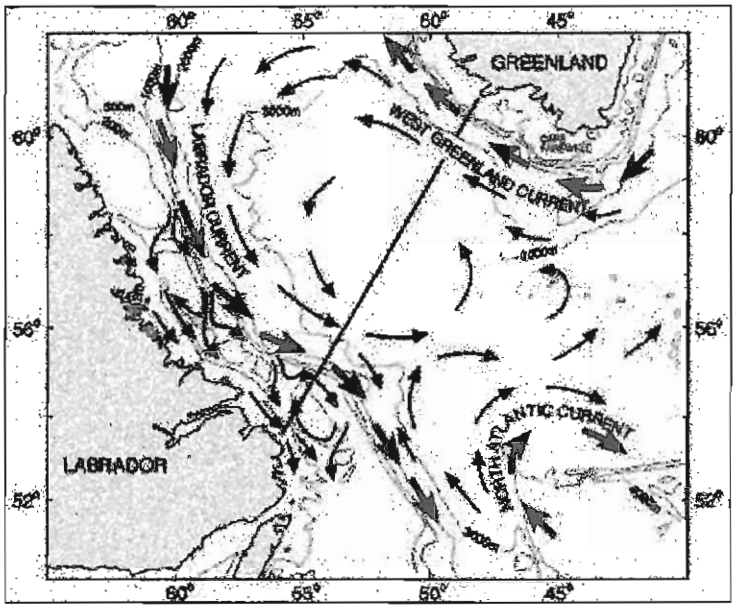


Figure 6 Location of the Labrador Sea Line.

The iron fertilization experiment took place 1000km offshore British Columbia at Station Papa in the Gulf of Alaska on an area about 100 square km. The fertilised patch, clearly visible from space, has resulted in unprecedented data sets that will improve not only global climate models, but regional eco-system models.

Additionally, DFO is conducting research on the Arctic to understand ice dynamics and the changes of ice-cover related to coastal erosion and impacts on fish habitat in the Arctic. The Canada-Japan Joint Western Arctic Climate Study (JWACS) began in 2002. In its first year, JWACS bridged disciplines in a climate change context, with the three ship cruise tracks of the CCG ships Louis St. Laurent and Sir Wilfrid Laurier and the RV Mirai, a recently outfitted research vessel working under the authority of Japan and considered by many as the premiere marine research vessel in the world. The work accomplished on these three ships utilized a variety of tools to collect data in many different disciplines. This work is ongoing until 2006 and represents a major international initiative with Japan.

Combined with the Canadian Arctic Shelf Exchange Study (CASES) work, initiated in 2002 and led by the university community, DFO has the elements of an extremely successful multi-year climate research program underway in the Western Arctic.

Ships

DFO is playing an integral role in the organization and planning for the refit of a Canadian Coast Guard (CCG) icebreaker, viz. the CCGS Franklin (Figure 8), for Arctic research. More than 2 years ago, DFO staff and members of the Arctic research university community, led by Université Laval, joined forces to pursue this major initiative. Funded in large part by a grant from the Canadian Foundation for Innovation, a refitted and science-ready vessel is expected to set sail for the Arctic in September of this year, to begin the over-wintering component of CASES.

Modelling

In order to properly conduct ecosystem management, DFO will also need prediction capabilities of the future state of the ocean which will require a variety of models. They range from global coupled ice-ocean atmosphere models to regional inshore physical geo-chemical biological models (Figure 9).

The Department of Fisheries and Oceans, Environment Canada and the Department of National Defence are planning a collaborative initiative for a global coupled model complete will real time ocean data assimilation.

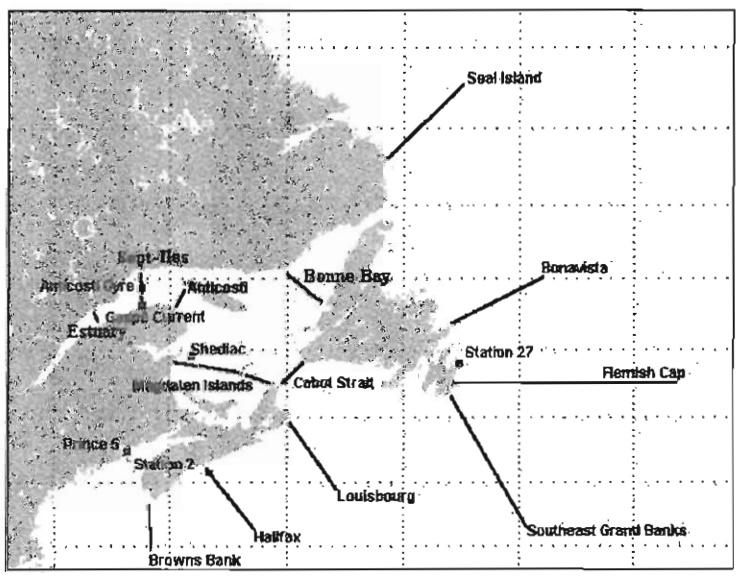


Figure 7. Location of the 6 fixed stations and 13 sections of the Atlantic Zone Monitoring Programme (AZMP).

Furthermore, DFO regional laboratories are collaborating on a variety of different coupled models to meet numerous marine safety and ecosystem management requirements. For example, the Institut Maurice Lamontagne (IML) in Mont-Joli, Québec is currently collaborating on regional climate modelling with federal, provincial and industrial partners. Coupled ice-ocean models of Hudson Bay and the Gulf of St. Lawrence are being developed by François Saucier of IML to study the impacts of climate change. The Hudson Bay model uses grids at 10 km resolution for the ocean and 40 km resolution for atmospheric forcing. Figure 10 shows an example of Hudson Bay coupled ice-

ocean model results of sea ice concentration, thickness, and velocity averaged over seasons. These results were averaged from a high-resolution seasonal simulation resolving physical processes over time steps of 5 minutes including tidal circulation.

Figure 8. CCGS Franklin. DFO and Université Laval are jointly working toward the refit of the "*Franklin*" in support of Canadian-led Arctic Science.

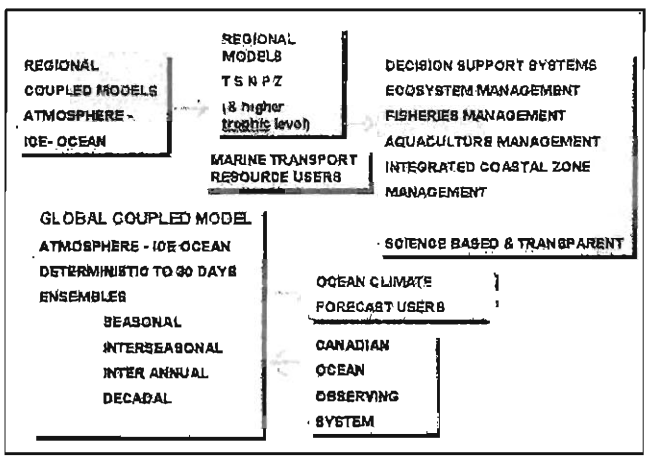


Figure 9. Ecosystem management will require a variety of models ranging from global coupled ice-ocean atmosphere models to regional inshore physical geo-chemical biological models.

In Summary

What must Canada do to improve to address the complex issues of climate change?

- We must reduce uncertainties in climate scenarios and in climate change predictions. Since climate varies on a regional scale, we must be able to generate models to help us predict potential changes on such scales.

- We must all address the need for sustained, systematic monitoring for climate detection and prediction.

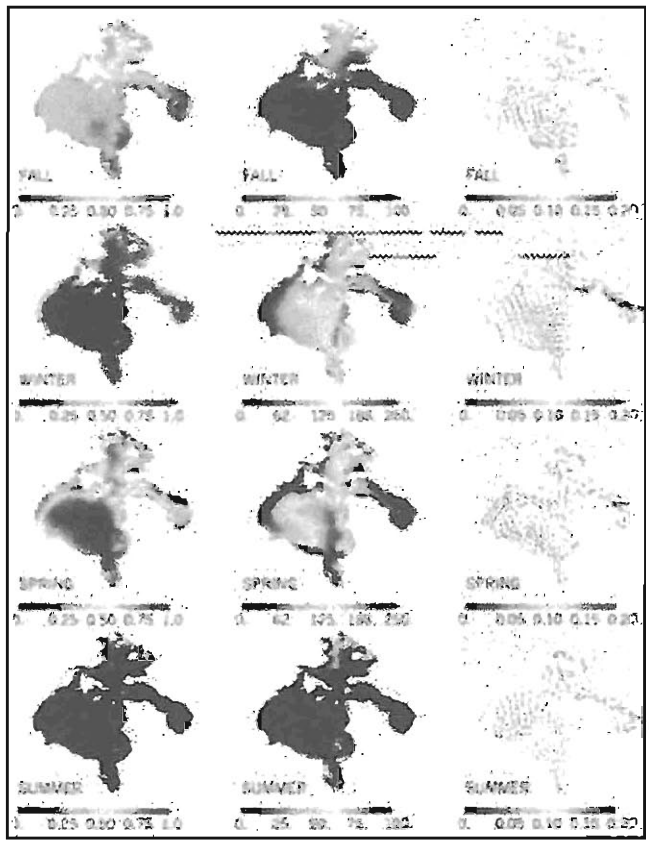


Figure 10. Seasonally averaged sea ice conditions. The first column represents ice concentration; the second column represents thickness (cm) and the third column represents velocity (ms^{-1}). These results are the work of François Saucier of Institut Maurice-Lamontagne, DFO.

- DFO must integrate climate science into the end-to-end operational programmes for ecosystem management.

- Since the Arctic plays such an important role in global climate, we must continue to support partnerships aimed at understanding the Arctic climate.

Adaptation

Adaptation is a bigger challenge, especially since there are so many uncertainties as to what we are adapting to, especially at the regional scale.

Fisheries

The adaptive capacity of the Canadian fisheries sector with respect to climate change is generally poorly understood. DFO needs to anticipate and prepare for potential changes, and take into consideration the fact that present-day decisions will affect future vulnerabilities. A major challenge will be adjusting policies and practices in an appropriate and timely manner to deal with shifts in fish species distribution and relative abundance.

Fisheries managers and others can help enhance the adaptive capacity of both fish species and the fisheries sector by reducing non-climatic stresses on fish populations, such as pollution, fishing pressures and habitat degradation. Maintaining genetic and age diversity in fish sub-populations is also important. These are considered 'no-regrets' adaptation options, which will benefit fisheries irrespective of climate change (3).

Regulatory regimes can also significantly affect the ability of fishers to adapt to changing conditions and may need to be re-evaluated and adjusted accordingly. DFO is currently developing policy frameworks such as the Atlantic Fisheries Policy Review based on a conservation-oriented approach that considers biological and environmental factors, as well as social and economic values.

Aquaculture

Aquaculture is generally considered to be relatively adaptable to climate change, and is recognized as a potential adaptation to help fisheries cope with the impacts of climate change. On a global basis, aquaculture production has been steadily increasing since 1990 and is expected to surpass capture harvests by 2030 (3).

The aquaculture industry may be able to benefit from longer growing seasons and increased harvest areas. There are, however, environmental and social considerations that may limit the ability of the aquaculture industry to respond to climate change. For example, some environmentalists have suggested that salmon farming may be partly to blame for the recent declines in wild harvest numbers on the west coast. Thus, scientific studies on aquaculture and environmental interactions must be carefully planned and executed.

Ice-breaking and increased shipping activity

Climate scenarios are predicting the opening of shipping channels in the Arctic which would have several implications for DFO. Warmer summers in the Arctic imply that ice would start breaking up earlier. The released pieces of ice could potentially accumulate and block narrow passageways, increasing the need for ice-breaking.

Multi-year pieces of ice could also be released into regions of a "North West Passage". These pieces of ice are capable of ripping holes in the hull of ships, thus risking human safety, cargoes and the environment. There could then be an increased demand for search and rescue from the Canadian Coastguard. DFO may have to increase its Coastguard fleet to respond to emergency situations.

Warmer winters could imply less ice-breaking in the St-Lawrence seaway or it could simply mean a longer shipping season to Montréal.

Unfortunately, there are, as yet, no accurate regional scenarios for either the Arctic or the St-Lawrence Seaway to use for planning.

The Real Challenges for DFO

Climate change poses major challenges for all scientists and for DFO. We know much of what needs to be done, although nature undoubtedly has a few surprises left in store for us. More understanding of climate processes is still required to reduce model prediction uncertainties.

"End-to-end" monitoring, data management, modelling and prediction, necessary for policy and decision support, require substantial resource allocation. DFO is involved in many productive, exciting climate programmes but the reality is that funding comes from many different sources, some of which are "sun setting".

DFO, like many departments, is in the midst of a priority assessment and allocation alignment process. The challenge for all of us will be to ensure that climate science priorities are fully understood by senior management and that investments continue to be made in climate programs of the future.

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Acknowledgment

The authors of this article wish to thank Mr. Robin Brown, Head of the Ocean Science and Productivity Division at the Institute of Ocean Sciences, Sidney, BC and Dr. Allyn Clarke, Manager of the Ocean Sciences Division at the Bedford Institute of Oceanography in Dartmouth, NS for their invaluable input in producing this article.

CMOS Prizes and Awards / Prix et récompenses de la SCMO

President's Prize

To **Dr. Charles Lin** for his record of important contributions to several areas of atmospheric and oceanic science, including atmospheric dynamics, mesoscale meteorology, ocean modeling, and specifically for his development and use of coupled atmospheric-hydrologic models as highlighted by his paper, co-authored with Wen, Béland and Chaumont, *"A Coupled Atmosphere-Hydrological Modeling Study of the 1996 Ha! Ha! River Basin Flash Flood in Québec, Canada"* published in 2002 in Geophysical Research Letters, 29 (2).

Dr. Andrew Thomson Prize in Applied Meteorology

To Dr. Clément Chouinard and Mr. Jacques Hallé for their outstanding contribution to the research, development and operational Implementation at the Canadian Meteorological Centre of the direct assimilation of radiance measurements from satellite temperature and moisture sounding instruments. Chouinard and Hallé were also key contributors to R&D activities that led to significant changes in the methodology of data assimilation and that made possible the use of these new datasets. As a result of their contribution to data assimilation, the improved performance of the short-term NWP forecasts issued operationally puts CMC among the best NWP Centres in the world.

Prix du Dr. Andrew Thomson en météorologie appliquée

À **Clément Chouinard et Jacques Hallé** pour leur contribution marquante à la recherche et à l'Implantation au Centre météorologique canadien de l'assimilation des mesures d'irradiance tirées des télémesures satellitaires de température et d'humidité. Chouinard et Hallé ont aussi été de contributeurs clés aux activités de R&D qui ont conduit à des changements importants des méthodes d'assimilation des données et qui ont rendu possible l'utilisation des ces nouveaux ensembles de données. Par suite de leur apport à l'assimilation des données, la performance améliorée des previsions numériques opérationelles à court terme place le CMC parmi les meilleurs centres de prévision numérique au monde.

J.P. Tully Medal in Oceanography

This year's award goes to **Mr. Stephen Pond** for his widely recognized, meticulous observational studies in air-sea interactions and coastal oceanography, and for his prominent role in supervising many graduate students in physical oceanography.

Prize in Applied Oceanography

To **François Saucier and Denis Lefaivre** for their pioneering development and careful validation of models of the Gulf of St. Lawrence and the St Lawrence Estuary and their application to the operational forecasting of tides, surges, currents and oil spill trajectories.

Le Prix en océanographie appliquée

À **François Saucier et Denis Lefaivre** pour le développement d'avant garde et la validation attentive de modèles du Golfe et de l'Estuaire du Saint-Laurent ainsi que leur application à la prévision opérationnelle des marées, vagues libres, courants et trajectoires de déversements d'hydrocarbures.

Rube Hornstein Medal in Operational Meteorology

This year's award goes to **Mr. William Purcell** for his instrumental work in promoting and developing software, such as the Weather Analysis Display System and the Phoenix project, which allow meteorologists to place more emphasis on real time data to improve weather forecasts of all kinds.

The Tertia M.C. Hughes Memorial Graduate Student Prize

To **Dr. Yongsheng Chen** for his groundbreaking Ph. D. thesis work at McGill University: *"On the dynamics of the inner spiral rainbands in a simulated hurricane."* This work represents important advancements in the area of hurricane dynamics research.

The CMOS/Weather Research House Scholarship Supplement

Ambury Stuart announced that this year's prestigious scholarship is awarded to **Morris Flynn**, University of Alberta. Also, **Amanda Cole**, last year's recipient of this award, will continue to hold her scholarship for another year at UC Berkeley.

Citations

1) To **Mr Gary Saunders** for his book: *"So Much Weather: Facts, Phenomena and Weather Lore from Atlantic Canada"* a fun and informative book which brings the subject of East Coast weather to the general public.

2) To **Mr Bob Jones** for his tireless volunteer work over the years in a variety of CMOS endeavours and in particular his role in recent years as "webmaster" for the CMOS and the Canadian Foundation for Climate and Atmospheric Sciences web sites.

Certificate of Appreciation

To **Francine Ford** in recognition of ten years of association with CMOS as Business Manager.

Special Tribute to Susan Woodbury

Special tribute to **Susan Woodbury** for her dedication and work on behalf of the meteorological and oceanographic private sector in Canada.

Appointments of Fellows to the Society

The Council of CMOS has endorsed the appointment of three new Fellows to the Society in 2003:

1) **Tim Oke** for his outstanding contributions to urban climatology and meteorology, and for his longstanding contributions to Canadian meteorology and the Society.

2) **Nancy Cutler** for her outstanding contributions to Canadian and global meteorology, for her strong advocacy for women in science, and for her extensive and sustained contributions to the Society.

3) **John Maybank** for his lifelong contributions to agricultural and physical meteorology and for his outstanding organizational and scientific leadership in the founding and organization of the Society.

First Argo Science Workshop

Tokyo, Japan, November 12-14 2003

When fully implemented in 2006 the Argo global array of 3000 floats will provide 100,000 temperature and salinity profiles each year from the upper ocean. Over a quarter of the array, contributed by 15 countries, is already delivering data that are freely available to all researchers and agencies.

The workshop will highlight the uses that are being made of profiling float data to address regional and global oceanographic and climate issues. It will consist of invited talks, submitted science presentations, poster sessions, data demonstrations and displays by equipment manufacturers.

Since attendance is limited to about 200, early registration by scientists and program managers is encouraged. The workshop timetable, registration and abstract submission details are at *www.argo.ucsd.edu*

Please address any queries to argo@ucsd.edu
Further Argo information is available at argo.jcommops.org

Worksop sponsored by
Japan Marine Science and Technology Centre (JAMSTEC)
US National Oceanic and Atmospheric Administration (NOAA)

Climate Change Impacts on the United States

Edited by J. Melillo, A. Janetos, and T. Karl

2001, Cambridge University Press
612pp. ISBN 0-521-00075-0, US$39.95 Soft Cover

Book reviewed by William A. Gough[1]

Structure

Climate Change Impacts on the United States is divided into eighteen chapters with two appendices. The Chapters follow three thematic groupings. The first three chapters serve to introduce climate change and variability including an overview of historical and projected climate change, associated biospherical scenarios and the socioeconomic context. This is followed by a regional analysis of climate impacts focusing on the Northeast, Southeast, Midwest, Great Plains, West, Pacific Northwest, Alaska and the Islands in successive chapters. At this point the framework abruptly changes to a topic-based analysis of the impacts of climate change examining the following areas: Native Peoples, Agriculture, Water, Human Health, Coastal Areas and Marine Resources, and Forests. The final chapter reviews directions for further research.

Critique

The science and impacts studies in this work were competently and thoroughly explained. In many respects it is similar to the Intergovernmental Panel on Climate Change (IPCC) documents which have been produced at five year intervals since 1990. For those readers, much of the first three chapters can be skimmed or omitted. Climate change science is essentially the same in all these documents. The remainder of the book examines impacts on a regional basis or from a sectoral basis, all of which should be of great interest to Americans and of some interest to Canadians.

Regional climate change assessment, however, is fraught with difficulty. The main tool of choice is the coupled climate model. Although there are a number of institutions in the US which have produced projected climates as part of the IPCC process (GFDL, NCAR, GISS to name three), this assessment primarily used the output from the Canadian model (CCCma) and the British Hadley Centre climate model. Although the choice of such models was not made clear, I think it is an indication of the high esteem the Canadian model is held by climate change researchers worldwide. However, in spite of the relative high quality of the two models selected, there is still low confidence in regional projections for all such climate models. This issue came up time and time again in this assessment. In the simple comparison of just two models there was strikingly different projected behaviour. Using two models is a minimum requirement for a climate change impact assessment and this work would have benefited by using more coupled model results.

Although the Kyoto Protocol has been a prominent issue in the Canadian and international media it was not mentioned once in this report. There was a fleeting reference to on-going negotiations for emission reductions as part of the Framework Convention on Climate Change, but no discussion of the intransigent US role in these negotiations. An almost apologetic section was inserted in the first chapter, entitled, "The climatic effects of stabilizing the carbon dioxide concentration" indicating (correctly) that current reduction strategies would have only a small impact on mitigating temperature increases. However, stripped of the larger context of an on-going process of further increases in emission reduction (post Kyoto), this section seems to excuse involvement in the current reduction efforts. Also, peppered throughout the document were references to how some of the vulnerabilities could be offset by adaptation I do not quibble with this as these observations appear for the most part to be reasonable, but it was party to an apparent overall bias that adaptation rather than mitigation is the way to go. Perhaps this is not surprising from a document funded by and under the auspices of the US government.

Style

The book is accessible on many levels. For those who lack a strong science background or the time to plough through all 612 pages of material, most chapters provide an overview summarizing the chapter and provide a list of key findings. For those with more time or specific interest, more details follow. However, this does not mean the text is accessible only to the experts in the field. An effort has been made to harmonize the writing style which is largely free from specialized jargon. There is a liberal use of references for follow up if consulting the original literature is desired. Each chapter comes with its own comprehensive list of cited literature. This should prove quite valuable to those new to a specific field.

Overall Assessment and Recommendations

This document provides a comprehensive, relatively even-handed overview of potential impacts of climate change on

[1] Department of Physical and Environmental Sciences, University of Toronto at Scarborough

the United States. It provides a potentially useful guide to the regional and sectoral vulnerabilities in the US. For those looking solely for mitigation or adaptation strategies, this is not for you.

Methodological and Technological Issues in Technology Transfer

Edited by B. Metz, O.R. Davidson, J.W. Martens, S.N.M. van Rooijen, L. van Wie-McGrory

Published for Intergovernmental Panel on Climate Change (IPCC).

Published by Cambridge University Press, 2000.
Paper Cover ISBN 0-521-80493-9, 466 pages, $35.95.

Book reviewed by Paula Coutts, M.Eng., P.Eng.[2]

Article 4 of the United Nations Framework Convention on Climate Change (UNFCCC) calls for the transfer of environmentally sound technologies, from developed to developing countries, both for adapting to climate change as well as for mitigating the effects of greenhouse gas emissions. *"Methodological and Technological Issues in Technology Transfer"* is a Special Report that has been prepared by IPCC Working Group III, in response to a request by the Subsidiary Body for Scientific and Technological Advice (SBSTA), that will contribute to the widespread use of environmentally sound technologies and assist in achieving the objectives of the UNFCCC. The writing team consisted of 8 Section Coordinators, 24 Coordinating Lead Authors, 120 Lead Authors and 53 Contributing Authors, with 20 Review Editors overseeing the review process.

Technology transfer is defined as the broad set of processes covering the flows of know-how, experience and equipment. Social, economic, political, legal and technological factors influence the flow and quality of technology transfer. Environmentally Sound Technologies (ESTs) are those which protect the environment; are less polluting; use resources in a more sustainable manner; recycle more of their wastes and products; handle residual wastes in a more acceptable manner than the technologies they are substituting; and are compatible with nationally determined socioeconomic, cultural and environmental priorities.

This report is written for a wide audience, including policy-makers, scientists, managers, professionals and academics, and is organized into various sections, based on topics aimed at those key players. With the exception of researchers and academics, most readers will only be interested in specific chapters.

The Summary for Policy Makers is a stand-alone introduction on what governments can do to facilitate and enhance the transfer of environmentally sound technologies. The main report is divided into three sections.

Section I provides a framework for analysis of the intricate nature of the technology transfer process. It examines broad trends of technology transfer in recent years, the international political context, policy tools for overcoming key barriers and creating enabling environments, and provides an overview of financing and partnerships.

Section II provides a sectoral perspective on the transfer of adaptation and mitigation technologies. Every chapter discusses relevant climate mitigation and adaptation technologies, the magnitude of current and future transfers, technology transfer issues within and among countries and the lessons learned in the following sectors:

- Residential, Commercial and Institutional Buildings Sector;
- Transportation;
- Industry;
- Energy Supply;
- Agricultural Sector;
- Forestry Sector;
- Solid Waste Management and Wastewater Treatment;
- Human Health; and
- Coastal Adaptation.

Section III includes a variety of case studies (thirty in total) to illustrate the issues discussed in Sections I and II, and demonstrates the distinctive problems and special opportunities that stakeholders are likely to encounter in dealing with the transfer of technology. Case studies in mitigating climate change include initiatives to foster de-materialization, de-carbonisation of energy sources, industrial ecology, dissemination and commercialization of renewable energy technologies, energy efficiency programs, and household biomass energy usage. Case studies on adapting to climate change focus primarily on practices in the agriculture and forestry sectors, mitigation of health impacts, and tools and strategies for coastal management.

A description of acronyms, abbreviations and a glossary are included in the Appendices. However, the report does not have an Index of subjects cross-referenced to relevant chapters in the report, which would be very useful due to its size and contents. A comprehensive list of primary references is provided at the end of each chapter.

This report addresses the following questions, which are of interest to key players in the process of technology transfer

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[2] Paula Coutts Consulting, Toronto, Ontario

(private firms, financiers, state-owned enterprises, government, non-governmental organizations, community groups, international institutions, information providers, R&D organizations, business consultants):

- How can the private sector play an additional role in facilitating technology transfer and how can enabling environments for private investment be created?

- What areas should be the focus of capacity building and how should it be undertaken?

- How can transfers and access to emerging technologies and publicly owned technologies be facilitated?

- Are existing mechanisms sufficient? Are new mechanisms needed? What can multilateral institutions do?

- How can progress on technology transfer be better monitored?

- What are the main barriers to technology transfer?

- What areas should be the focus of capacity building and how should it be undertaken?

- What additional activities need priority attention? (adapted from presentation by B. Metz, co-chair IPCC WGIII)

In determining how the management of technological change (technology transfer) can encourage development that is climate friendly (mitigation) and climate responsive (adaptation), this report is the most comprehensive assessment available to date for policymakers, industry and environmental organizations, and researchers in global change, technology, engineering, and economics.

Notwithstanding this positive conclusion, the reviewer was surprised to find numerous typos and formatting inconsistencies throughout the report, which detracted from the wealth of information presented.

Air Pollution X

Editors: C.A. Brebbia, C.A. and J.F. Martin-Duque

Wessex Institute of Technology, 2002
Hardback Cover, 1-85312-916-X, 820 pp. US$385.00

Book reviewed by: Warren McCormick[3]

This book contains most of the papers presented at the 10th International Conference on Modelling and Management of Air Pollution held in the City of Segovia, Spain in July 2002. This conference was organized by the Wessex Institute of Technology in collaboration with the Department of Geodynamics of the Complutense University of Madrid. This series of meetings has been mostly held in European centres and had presenters from Europe, South America and Asia.

The conference covered topics such as: air pollution modelling, air quality management, monitoring and laboratory studies, global and regional studies, emission inventories, remote sensing, and urban issues. Many of the contributions placed emphasis on the development of experimental and computational techniques. Below is a detailed listing of each section and the topics presented in that section.

Section 1 is titled Air Pollution Modelling and has 13 papers covering empirical ozone models, specialized Gaussian models, AERMOD, puff models, CFD and economic/pollution models. Section 2 is titled Air Quality Management and has 9 papers covering the UK air quality management schemes, use of MM5-CMAQ in Spain and analysis of economic instruments and environmental risk. Section 3 is titled Global and Regional Studies and has 7 papers covering GHG/CO2 issues and measurement of long range pollutants. Section 4 is titled Emission Inventories and has 4 papers covering methodologies used in Europe and the Caribbean for common air pollutants and GHGs. Section 5 is titled Monitoring and Laboratory Studies and has 8 papers covering ecological monitoring, passive samplers, remote sensing, flux chamber and vehicle testing. Section 6 is titled Usability of Remote Sensing and contains 7 papers covering the monitoring of common air pollutants and particles from space. Section 7 is titled Comparison of Modelling with Experiments and contains 5 papers covering air pollution control equipment, water tank experiments and MM5 modelling. Section 8 is titled Aerosols and Particles and contains 8 papers covering measuring and analysis of particles in subways and urban areas. Section 9 is titled Urban Air Pollution and

[3] Air Quality Meteorologist, Ministry of Water, Land and Air Protection, Nanaimo, BC

contains 13 papers covering pollutant analysis, wind studies and modelling in the urban setting. Section 10 is titled Urban Transport Emissions and contains 6 papers covering the emission characteristics from vehicles.

Overall Impression: The information in most of the papers is highly technical and directed at experts in the respective fields, although others can get a flavour for the work. The papers are well written and the only draw-back in the book is that a few, more complicated graphs and figures did not copy well in black and white. It would be a good reference book for those interested in aspects of the air pollution field from the viewpoint outside of North America, very few authors presented work from North America. The book has an index of authors but not a subject index.

COASTAL ENVIRONMENT - ENVIRONMENTAL PROBLEMS IN COASTAL REGIONS IV

Editor: C.A. Brebbia

WIT Press, Southampton, Boston
September, 2002, ISBN # 1-85312-921-6, USD$247.00

Book reviewed by Charles T. Schafer[4]

This 16 cm x 24 cm 456 page publication has a colourful hard cover depicting a suite of coastal settings. In its Preface, the editor notes that the work is "a compilation of most of the papers presented at the *International Conference on Environment Problems in Coastal Environment* which was reconvened in Rhodes in 2002." Its content is subdivided into seven sections and one special session representing the contributions of a total of 120 (11 Canadian) authors and co-authors. Each section contains between two and 11 papers for a total of 40 and there are two additional special session reports. Collectively, these 42 presentations cover a wide range of Northern Hemisphere coastal settings and issues. The resource requirements for many of the studies point indirectly to the relative levels of support currently available for coastal zone science in various industrialized nations.

Section 1 (Environmental Management and Impact) is a collection of 11 papers that consider a range of issues. The first several reports present ideas on project management (planning and funding), conservation/tourism conflicts, marsh hydrology patterns, marsh flora repopulation of a "reflooded" (previously drained) marsh, a risk management study of endangered species living near remote Canadian light stations, and a contribution on effluent toxicity reduction using a biodegradation method. The remaining papers in this section describe the development of a six stage geomorphologic evolution model for some lake environments, the classification and interpretation of dynamic atmospheric processes that provoke the development of severe sea storms, and one contribution on the importance of seasonal variation of currents in relation to seawater exchange based on a 2-D numerical simulation. Section 2 (Oil Slicks and Spills) includes a contribution from Canadian scientists on the recovery of a crude oil-contaminated salt marsh following *in situ* remediation. Sections 3 and 4 comprise a suite of papers that treat erosion, drift and transport issues. They demonstrate that coastal erosion continues to be a significant problem especially in areas characterized by loose or semiconsolidated sediment. Other papers in these two sections treat regional rainfall runoff patterns (annual to decadal) and surface "erodibility", the precautionary use of data from a continuous turbidity measurement instrument, monitoring the transport processes associated with natural versus nourished beaches, and a revealing numerical model study of nutrient transport in Spain's Elbro Estuary. The final contribution of Section 4 offers a good example of how benthic macroinvertebrate community distributions are controlled by sediment texture patterns.

In Section 5 (Hydrodynamics and Transport Modelling), readers will discover a paper that details a connection between the water mass characteristics of an inland sea in relation to sea level variations, a study that explores variation in river water level with respect to local river mouth morphology, and a numerical simulation that is proclaimed by its creators as capable of doing a better job at predicting surface winds over a bay than can be ascertained from shore-based wind and pressure measurements. The last paper in this section makes a persuasive case for using the Hartley Transform function as an alternative to the Fourier Transform in oceanographic time series analysis. A range of water quality issues is addressed in Section 6. According to one paper, water quality can be expected to be relatively "patchy" in some Mexican lagoons during the summer season because of the pattern of freshwater discharge. Another contribution describes "SAM" (Advanced System for Automatic Monitoring) which comprises a combination of fixed monitoring platforms and small boats equipped for continuous water quality monitoring. The last three reports of Section 6 consider the trophic structure of several Mexican bays, ports and lagoons, the nature of sediments transported to the sea during the snowmelt season near Japan's Mukawa Estuary, and the output of a steady-state model that explains the fate and transport of faecal indicator bacteria in the surf zone.

Section 7 of the proceedings takes us out of the water and into the realm of atmospheric pollution and its control. Its reports highlight the development of air quality dispersion models that utilize continuous variables, management of the carbon cycle in relation to air pollution, a contribution

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[4] Geological Survey of Canada - Atlantic
Bedford Institute of Oceanography
Dartmouth, Nova Scotia.

that describes a neural network method for testing the importance of meteorology in determining surface ozone concentrations, and a paper on ozone deposition modelling that describes a "Critical Load Map" output. The concluding report in Section 7 is an evaluation of two air quality models. The TAPM model is shown to be useful as a generator of meteorological data for locations where there are no suitable direct observations. The book's Special Session consists of two reports that deal respectively with beach and highway erosion issues and a laboratory study of the effect of seepage flow on bedload transport rates. Both of these papers could have been included respectively in Sections 3 and 4.

The utility of this book stands on its value as an example of the diverse range of topics that comprise the dynamic field of integrated coastal zone science at the start of the 21st century. In that context, its purchase by a library is certainly appropriate as part of a four-volume reference set that follows the change in scope of coastal environment research between 1995 and 2001. However, I would not be inclined to add it to a personal collection because its content has not achieved the synthesis of ideas that I have come to expect in a classic style of textbook. Also, it is likely that the key ideas in many of the book's contributions have been republished in other widely available international scientific journals. EPP (editorial, publisher, printer) problems include at least one misplaced page, papers lacking conclusions or at least a discussion section, repetition of sentences, words left out, improper word usage, poor choice of words, poorly written abstracts lacking key results, spelling errors, and several irksome printing errors (e.g., fuzzy figures and faded print). These irritating features are not what I expect to find in a book that would be purchased in Canada at a before tax price of CAD $340.

Robert G. Fleagle: **Eyewitness: Evolution of the Atmospheric Sciences**

Boston: American Meteorological Society, 2001, 129p.

Sverre Petterssen: **Weathering the Storm**; Sverre Petterssen: **The D-Day Forecast, and the Rise of Modern Meteorology**

Boston: American Meteorological Society, 2001, 329p.

Books reviewed by Morley Thomas

The Fleagle and Petterssen books are recommended to anyone interested in the evolution and rise of modern meteorology. Although both cover the World War II and postwar years it would be difficult to find two more dissimilar meteorological autobiographies. Fleagle, a top-flight American academic, has written a straightforward, chronological story of his professional life, which included participation in international meteorology. His book is a good read but not exciting. Petterssen, a Norwegian by birth, also became an academic and had become an internationally recognized meteorologist by wartime. He writes of a most exceptional meteorological life in which his advice was sought and used by senior American and British decision-makers during and after the war. His autobiography, which includes many delightful anecdotes of his dealings with famous people, is a "page turner" and very hard to put down.

Robert Fleagle, with a bachelor degree in physics from The Johns Hopkins University, was one of 400 aviation cadets in the "5th war course" at New York University in 1942. After nine months of training Fleagle was assigned as an instructor for subsequent wartime training courses and thus began a long and distinguished career in teaching and research meteorology. Discharged from the Army Air Forces in April 1946, he enrolled in a new Ph.D. program at NYU and, with his doctorate, accepted a position at the University of Washington in 1948.

Fleagle remained based at that university until his retirement in 1989 when he was appointed Professor Emeritus, Atmospheric Sciences. Besides teaching, he helped develop graduate programs, did consulting work, published research papers and became chairman of his department in 1967. But, he was by no means parochial in his interests and activities. Robert Fleagle was not only an eyewitness to the evolution of the atmospheric sciences in the United States, but also internationally, as he attended several International Union of Geodesy and Geophysics General Assemblies. But he was primarily active in American meteorology; he worked with, in one way or another, just about all the leaders of American meteorology in the last half of the twentieth century - Robert White, Tom Malone, George Benton, Richard Reed, Joe Smagorinsky, Hans Panofsky, Walter Orr Roberts, David Atlas, and so

on.

Dr. Fleagle, president of the American Meteorological Society in 1981, also served the Society for more than forty years as an editor, councilor, commissioner and committee member. He spent his sabbatical in 1958-59 at Imperial College in London and was privileged to serve in the Office of Science and Technology during the Kennedy Administration in 1963-64. Very active in UCAR-NCAR and National Academy of Sciences affairs he became interested late in his career in climate change as it expanded into global environmental change. Despite an extremely busy life teaching and serving on national committees he found time to publish, with J.A. Businger, *An Introduction to Atmospheric Physics* in 1963 and a revised edition in 1980.

Sverre Petterssen grew up in northern Norway, became an apprentice in meteorology at the famous Bjerknes' "Bergen School" and graduated with a B.Sc. in 1924 from Oslo University. With the national meteorological service he was posted in 1928 to the Bergen regional meteorological centre where he began his research on the movement and rate of development of storms. He became head of the centre in 1931, obtained his Ph.D. in 1933 and in 1935 was invited to North America to give a series of lectures for the US Navy, the US Weather Bureau, the California Institute of Technology and the Canadian Meteorological Service in Toronto. Representing Norway over the next few years he became involved in International Meteorological Organization technical commissions and participated in conferences on forecasting, applications and the upper atmosphere held in several European cities.

In 1939 Petterssen was invited to the Massachusetts Institute of Technology to succeed Carl-Gustav Rossby as chair of the Department of Meteorology. There he found time to complete manuscripts for his *Weather Analysis and Forecasting* (1940) and *Introduction to Meteorology* (1941). He organized special courses for US Army Air Corps "meteorological cadets" at MIT but in August 1941 he was asked by the Norwegian Air Force to come to England and forecast for air missions to Norway. However, the British, well aware of his abilities, asked the Norwegians to loan him to the Meteorological Office where he became head of the Upper Air Branch at the main forecast centre at Dunstable. There, the prime tasks were wind forecasting for Bomber Command's night bombing of Germany and forecasting of night and early morning fog at airfields in England.

In the summer of 1942 he was in the United States and Canada to advise on the properties of snow in connection the development of a tracked vehicle for a proposed invasion of Norway. Back at Dunstable Petterssen resumed his upper air responsibilities, forecasted for low-level bombing missions to Norway and for a short period went as a meteorological advisor to the Allied forces in Algeria and Italy. Then, in preparation for the invasion of Europe in 1944, he and C.K.M. Douglas spoke for the Met Office in the daily analysis and forecast telephone conferences chaired by J.M. Stagg, the Chief Meteorological Officer at Eisenhower's Supreme Headquarters. Also involved were spokesmen for the UK Navy and US Air Force weather offices. Petterssen's accounts of those days are often at odds with the Overlord weather forecasting accounts published by Stagg and Irving Krick.

After the invasion of Europe, Petterssen was invited to the United States to lecture on his upper air forecasting methods and their possible use in the Pacific for the bombing of Japan. He was back in Dunstable when the Nazi regime collapsed in May 1945 and was given a seat on one of the first aircraft to fly from England to Norway. He became head of the Norwegian Meteorological Service and, the next year, at an organizing meeting in Montreal for the International Civil Aviation Organization, he declined an offer to take charge of its meteorological program. In 1947 he attended the meetings of technical commissions of IMO at Toronto and was elected president of the aerological commission.

In 1948, after several weeks as an advisor to the Indian Meteorological Service, Petterssen accepted a position as director of scientific services with the US Air Force Weather Service. But, when that position became too administrative for him, he accepted an invitation to establish a forecast research center at the University of Chicago in 1952. He later became chairman of the Chicago departments of meteorology and geophysical sciences before retiring to England in 1963. In 1965 he was awarded the IMO Medal. Dr. Petterssen died in 1974.

Sky and Ocean Joined: The U.S. Naval Observatory, 1830-2000

by Steven J. Dick

2002, 609 pp. Cambridge University Press, Hardback Cover ISBN 0-521-81599-1 $130.00US.

Book reviewed by Paul LeBlond[5]

Today, we think of telescopes as tools for discovering the universe, finding other solar systems, probing for cosmological mysteries. We readily forget that astronomical instruments were originally designed for calendrical calculations, and that optical telescopes first found use as the servants of marine navigation. Accurate chronometers, developed in the late 1700s, remained rare and unreliable until the middle of the next century, and astronomical observations continued for many decades to be the preferred means of determining longitude. Mariners continued to require accurate maps of the sky to determine their position and to navigate by the stars. Chronometers also had to be calibrated against accepted time intervals - measured against the passage of stars and planets overhead. The great observatories in Greenwich and Paris were established as aids to the English and French navies, but it took some decades after the creation of the United States for Congress to fund an observatory. Petty political considerations delayed the creation of a Naval Observatory until 1830, and then only under the guise of a Depot of Charts and Instruments. The officer in charge, at first Lt. Louis Goldsborough, was to "take care of all the nautical instruments not on board of ship..." and "...attend particularly to the time-pieces, or chronometers, to ascertain precisely their character such as their rate of deviation from true time...". There lay the seed of the Naval Observatory, as the Depot was formally renamed in 1844.

Astronomer and historian of science Steven Dick, a member of the staff of the Naval Observatory, has carefully documented the emergence and growth of that institution from a modest chart depot and chronometer calibration facility, to an internationally respected national observatory and time-keeper for the nation. The book reviews the main activities of the observatory and its evolution within the political realm of the Department of the Navy and US science. The careers and lives of its most active leaders and scientists are described and illustrated. There is a list of selected personnel, a bibliographical essay as well as numerous references in footnotes and a detailed index.

Readers interested in the history of astronomy will appreciate the account of how technological developments in positional accuracy, primarily motivated by the need to generate ephemerides for the Nautical Almanac, led to unexpected discoveries. In 1877, Asaph Hall, a "Professor of Mathematics" (so were the astronomers classified by the Navy administration) at the Observatory, discovered that contrary to then held belief, Mars had two moons. Drawing from the Iliad, Hall named the satellites Phobos (Flight) and Deimos (Fear), for the horses that drew the chariot of Mars. The announcement was hailed as an "extraordinary discovery" by the journal Nature, and as "one of the most important discoveries of modern astronomy" by famous French astronomer Leverrier. The Naval Observatory, basking in its newly acquired international fame, forged on, under the vigorous leadership of Simon Newcomb, to explore the heavens while refining its navigational products. A larger, 61-inch astrometric reflector telescope in Flagstaff, AZ led to hitherto unachieved accuracy in parallax measurements of stellar distances. In 1978, a century after Hall, James Christy analysed measurements made at Flagstaff and discovered that Pluto also had a moon, which he named Charon ("ch" as in Loch) after the ferryman who conveyed the souls of the dead to Pluto's underworld realm.

Oceanographers will be particularly interested by the role of Matthew Fontaine Maury, the fourth Officer-in-Charge of the Depot of Charts and Instruments, and the first Superintendent of the newly named Naval Observatory. Maury is better known for his charting of ocean currents and for his book "The Physical Geography of the Sea", published in 1855. However, he was also a strongly pro-active superintendent. He launched a "systematic review and exploration of the whole heavens" motivated as much by scientific interest as navigational necessity. The fame later brought to the observatory by Hall and Newcomb rested firmly on the direction set by the first superintendent. Maury also sought to free the US Navy from its dependence on charts and pilot books produced by the French and English admiralties. He compiled wind and current charts from log books as adjuncts to the compilations of the Nautical Almanac. Maury's tenure at the Naval Observatory was a period of turmoil, partly by his favour of hydrographic studies as opposed to strict positional astronomy, and partly because of his difficulty in managing civilian scientists in a naval establishment. At the beginning of the Civil War, Maury, a Virginian, left Washington in a hurry and joined the Confederate Navy. He spent some years in England and Mexico after the confederate defeat and returned to the US in 1868 to teach meteorology in Virginia until his death in 1873.

Today, the US Naval Observatory has for its primary mission "to determine the positions and motions of celestial bodies, motions of the Earth and precise time." It compiles and publishes detailed digital star catalogs and maps (the USNO-A 2.0 version has over 500 million stars) and provides precise time for the US Global Positioning System as well as for LORAN-C and Omega navigation systems. It can be found on the web at http://www.usno.navy.mil.

"Sky and Ocean Joined" will be of greatest interest to people interested in the history of astronomy, astronomical

[5] Galiano Island, BC

navigation, including GPS, and the role played by American astronomers in defining universal time reference systems.

Books being reviewed / Livres en circulation pour critique

Radiative Transfer in the Atmosphere and Ocean, by Gary R. Thomas and Knut Stamnes, March 2002, Cambridge University Press, Paperback Cover, 0-521-89061-6, $45.00US. Reviewer: Chris McLinden, ARQX, Air Quality Research Branch, MSC, Toronto, ON.

Land Use, Land-Use Change and Forestry, Intergovernmental Panel on Climate Change, Cambridge University Press, Paper Cover, 0-521-80495-7, 2000, $29.95. Reviewer: Richard Fleming, Great Lakes Forestry Centre, Sault-Ste Marie, ON.

Ecological Climatology, Concepts and Applications, by Gordon Bonan, August 2002, Cambridge University Press, Paperback Cover, 0-521-80476-0, $150.00US. Reviewer: Brad deYoung, Physics and Physical Oceanography, Memorial University, St. John's, NL.

Inverse Problems in Atmospheric Constituent Transport, by Ian G. Enting, August 2002, Cambridge University Press, Hardback Cover, 0-521-81210-0, $100.00US. Reviewer: Dr. Irene Rubinstein, Toronto, ON.

Inverse Modeling of the Ocean and Atmosphere, by Andrew F. Bennett, July 2002, Cambridge University Press, Hardback Cover, 0-521-81373-5, $80.10US. Reviewer: Dr. Irene Rubinstein, Toronto, ON.

Environmental Change, Climate and Health: Issues and Research Methods, edited by Pim Martens and Anthony J. McMichael, Cambridge University Press, Hardback Cover, 0-521-78236-8, $90.00US. Reviewer: Sharon Jeffers, Service Météorologique du Canada, Montréal, QC.

Atmospheric Pollution: History, Science and Regulation, by Mark Z. Jacobson, Cambridge University Press, Hardback Cover, 0-521-81171-6, $110.00US. Reviewer: Claude Lellèvre, Enviromet International Inc., Montréal, QC.

Ecohydrology: Darwinian Expression of Vegetation Form and Function, Peter S. Eagleson, Cambridge University Press, Hardback Cover, 0-521-77245-1, $110.00US. Reviewer: Nigel Roulet, Department of Geography, McGill University, Montréal, QC.

Meteors in the Earth's Atmosphere: Meteoroids, and Cosmic Dust and their Interactions with the Earth's Upper Atmosphere, Edited by Edmond Murad and Iwan P. Williams, Cambridge University Press, Hardback Cover, -0521-80431-0, $80.00US. Reviewer: Chris Wielki, Winnipeg, MB.

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

Emissions Scenarios, Intergovernmental Panel on Climate Change, Cambridge University Press, Paper Cover, 0-521-80493-0, 2000, $44.95.

Climate Change 2001, Synthesis Report, Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change, by Robert T. Watson, Editor, April 2002, Cambridge University Press, Paperback Cover, 0-521-01507-3, $40.00US

Scattering, Absorption and Emission of Light by Small Particles, by Michael I. Mishchenko, Larry D. Travis and Andrew A. Lacis, June 2002, Cambridge University Press, Hardback Cover, 0-521-78252-x, $90.00US.

The State of The Nations's Ecosystems, Measuring the Lands, Waters and Living Resources of the United States, The H. Heinz III Center for Science, Economics and the Environment, Cambridge University Press, Paperback Cover, 0-521-52572-1, $25.00US.

Oil and Hydrocarbon Spills III: Modelling, Analysis and Control, Editor: C.A. Brebbia, Wessex Institute of Technology, Hardback Cover, 1-85312-922-4, $245.00US.

The High-Latitude Ionosphere and its Effects on Radio Propagation, by Robert Hunsucker and John Hargreaves, Cambridge University Press, Hardback Cover, 0-521-33083-1, $140.00US.

Innovative Energy Strategies for CO_2 Stabilization, by Robert G. Watts, Cambridge University Press, Hardback Cover, 0-521-80725-5, $80.00US.

Exploration of the Solar System by Infrared Remote Sensing, by R.A. Hanel, B.J. Conrath, D.E. Jennings, R.E. Samuelson, Cambridge University Press, Hardback Cover, 0-521-81897-4, $120.00US.

Handbook of Atmospheric Science, Principles and Applications, Edited by C.N. Hewitt and Andrea Jackson, Blackwell Publishing Ltd, Hardback Cover, 0-632-05286-4, $300.00US.

Polar Lows: Mesoscale Weather Systems in the Polar Regions, Edited by Erik A. Rasmussen and John Turner, Cambridge University Press, Hardback Cover, 0-521-62430-4, $120.00US.

Dynamics of the Atmosphere, A course in theoretical meteorology, Wilford Zdunkowski and Andreas Bott, Cambridge University Press, Paperback Cover, March 2003, 0-521-00666-8, $60.00US.

Coasts: Form, Process and Evolution, Colin D. Woodroffe, Cambridge University Press, Paperback Cover, May 2003, 0-521-01183-3, $50.00US.

If you are interested in reviewing one of these books for the *CMOS Bulletin SCMO*, please contact the Editor at the e-mail address provided below. Of course, when completed, the book is yours. The instructions to be followed when reviewing a book for the *CMOS Bulletin SCMO* will be provided with the book. Thank you for your collaboration.

Si vous êtes intéressés à faire la critique d'un de ces livres pour le *CMOS Bulletin SCMO*, prière de contacter le rédacteur-en-chef à l'adresse électronique mentionnée ci-bas. Bien entendu, le livre vous appartient lorsque vous avez terminé la critique. Les instructions qui doivent être suivies lors de la critique d'un livre dans le *CMOS Bulletin SCMO* vous parviendront avec le livre. Merci pour votre collaboration.

Paul-André Bolduc, Editor / Rédacteur-en-chef
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paulandre.bolduc@sympatico.ca

Advance Book Information: "The Sea's Enthrall": Memoirs of an Oceanographer

By Timothy Parsons (PhD)

ISBN 0-9731648-7-5 | 200 pages | Paperback | US$19.95 or ISBN 0-9731648-8-3 | 200 pages | Hardcover | US$39.95; Publication Date: 2004 (Feb/Mar)

With early memories of women selling peppers in the streets of Ceylon, where the author lived as a child, the southern English town of Bude during WWII, where he grew up, and emigration to Canada, where his formal education as an ocean scientist would take place, *The Sea's Enthrall* is more than a tale of an oceanographer.

It is a witty, at times philosophical, sometimes even poignant exposition on Life, as seen from the perspective of a man whose scientific training is wonderfully complemented by a curiosity for less empirical matters, such as poetry and religion.

Oceanographers in training can learn from Dr. Parsons' many insights into topical research; retired professors in the sciences will find many parallels in thought and experience; those who enjoy anecdotal storytelling, or travelogues, or simply appreciate learning about fascinating people who have managed to make a mark in the world - all these will enjoy "*The Sea's Enthrall.*"

"Timothy Parsons is an unknown national treasure--possibly because he's always dared to say what nobody wants to hear. But if you love our ocean planet, you'll need to read this book." - Paul Kennedy, Host/Producer, IDEAS (CBC Radio One).

"I knew Tim Parsons well as a fellow student during his time at Christ's Hospital and have met him in Canada on numerous occasions since then. I have always thought of him as an independent thinker who likes to challenge conventional views, whatever the subject. He is a scientist who appears to have discovered there is a poetry to life which illuminates his thinking. I look forward to his memoirs, they will make great reading." - Brigadier General Ron Bell (rtd).

About the Author

Dr, Timothy Parsons is a Professor Emeritus of the Department of Earth and Ocean Sciences, at the University of British Columbia, Vancouver, Canada. He is also an Honorary Research Scientist Emeritus of the Institute of Ocean Sciences in Sidney, BC.

With a PhD from McGill University, Montréal, and over forty years in the field of oceanography, Dr. Parsons is a distinguished and highly acclaimed authority in his field. He has been the recipient of several prestigious awards, including the Japan Prize from the Science and Technology Foundation of Japan, in 2001, of which he was the first Canadian recipient.

For further information, or to place prepublication orders, please contact: Alex Allen, EcceNova Editions, P.O. Box 50001, 15-1594 Fairfield Road, Victoria, BC V8S 5L8, Canada, sales@eccenova.com, www.eccenova.com

ÉNONCÉ de POLITIQUE

Le Protocole de Kyoto: gérer les biens publics mondiaux

La Société canadienne de météorologie et d'océanographie (SCMO) est un organisme scientifique à but non lucratif qui représente les professionnels et scientifiques atmosphériques et océaniques canadiens. Depuis 1963, l'objectif de la SCMO est l'avancement de la météorologie et de l'océanographie au Canada. La SCMO possède un comité spécial chargé d'examiner les questions scientifiques en temps opportun.

1. La SCMO appuie les conclusions du Troisième rapport d'évaluation du Groupe d'experts intergouvernemental sur l'évolution du climat (GIEC) publié en 2001[1]. Ce rapport indique les connaissances scientifiques de plus de 1 000 des plus éminents scientifiques climatiques au monde – tant comme contributeurs que réviseurs. Certaines des conclusions du rapport sont:

- Les concentrations de gaz à effet de serre dans l'atmosphère et leur forçage radiatif ont continué d'augmenter en raison des activités humaines;
- depuis le Second rapport d'évaluation (1995), il existe de nouvelles preuves solides que la plupart du réchauffement au cours des 50 dernières années est attribuable aux activités humaines;
- le changement du climat au cours du dernier siècle (en particulier la hausse de la température de la surface du globe) ne peut être justifié que par la variabilité naturelle (variabilité solaire et interne);
- il est projeté que la température de l'air et le niveau de mer augmenteront sous tous les scénarios d'émission de gaz à effet de serre étudiés par le GIEC;
- la stabilisation des concentrations de CO2 dans l'atmosphère au plus tard en 2100 (même à 550 ppm – deux fois la concentration préindustrielle) nécessiterait la baisse des émissions globales de CO2 provenant des activités humaines sous les niveaux de 1990,et ce avant 2050, et la continuation de la réduction jusqu'en 2100, et au-delà. En se basant sur cette étude et sur la documentation scientifique qui la soutient, la SCMO réitère qu'il existe suffisamment de preuves scientifiques pour justifier une action internationale afin de freiner l'augmentation des gaz à effet de serre dans l'atmosphère.

2. La SCMO accepte que l'implantation totale du Protocole de Kyoto devrait réduire le taux d'augmentation de la concentration de gaz carbonique et autres gaz à effet de serre dans l'atmosphère.

- La SCMO reconnaît que le Protocole de Kyoto est une première étape et que des réductions supplémentaires seront nécessaires pour arrêter la progression des concentrations des gaz à effet de serre dans l'atmosphère. L'implantation du Protocole de Kyoto permettrait de mettre en place des instruments de politique afin de négocier les réductions futures par le biais d'une multitude de mécanismes, dont la conservation et une fiabilité accrue des sources d'énergie sans carbone.

3. La SCMO encourage le développement approfondi des projections économiques, basé sur des scénarios scientifiquement plausibles de futurs changements climatiques, de distributions de la population et de développement économique/énergétique, qui sont assujettis au même niveau d'examen scientifique que lors du processus d'évaluation scientifique du GIEC.

4. La SCMO appuie le besoin identifié par la Convention Cadre des Nations Unies sur les Changements Climatiques (CCNUCC), et de son article 5 sur la recherche et l'observation systématique, et par le Protocole de Kyoto envers le CCNUCC, selon lequel les gouvernements se sont engagés à soutenir l'observation systématique du système climatique et la recherche sur les changements climatiques.

5. La SCMO prend la position que le succès du Canada, ainsi que celui du monde entier, relativement au changement climatique ne peut être atteint que par le biais d'une population informée. La SCMO affirme son propre engagement à faire la promotion et la diffusion des connaissances bien fondées en science du changement climatique. Le public doit comprendre les raisons des changements climatiques, ainsi que leurs conséquences, avant que l'on ne puisse s'attendre de leur part une acception de la nécessité des mesures proactives, ainsi que leur pleine participation à son implantation. La SCMO encourage les autres agences et organisations à se joindre à cet objectif.

[1] Sommaire des évaluations disponible au public au http://www.ipcc.ch

9 juin 2003

The Kyoto Protocol: About Managing the Global Commons

The Canadian Meteorological and Oceanographic Society (CMOS) is the non-profit scientific organization representing Canadian atmospheric and oceanic scientists and professionals. Since 1963, the goal of CMOS has been the advancement of meteorology and oceanography in Canada. CMOS has a special committee charged with the examination of timely scientific issues.

1. CMOS endorses the conclusions of the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) published in 2001[1]. This report draws on the scientific knowledge of over 1000 of the world's leading climate scientists - both as contributors and as reviewers. Some of the conclusions from the report were:

- Concentrations of atmospheric greenhouse gases and their radiative forcing have continued to increase as a result of human activities;
- Since the Second Assessment Report (1995), there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities;
- The change in climate of the past century (in particular the rise in global surface temperature) cannot be accounted for by natural variability (solar and internal variability) alone;
- Global average air temperature and sea level are projected to rise under all greenhouse gas emission scenarios considered by the IPCC;
- Stabilizing atmospheric concentrations of CO2 by 2100 (even at 550 ppm - twice the preindustrial concentration) would require global CO2 emissions from human activities to drop below 1990 levels by 2050 and to continue to decrease until and beyond 2100. Based on this assessment and the scientific literature that underlies it, CMOS reiterates that there is sufficient scientific evidence to warrant international action to curb the increase in atmospheric greenhouse gases.

2. CMOS agrees that full implementation of the Kyoto Protocol should reduce the rate of increase in the atmospheric concentration of carbon dioxide and other greenhouse gases.

- CMOS recognizes that Kyoto is a first step, and that further reductions will be needed to stop the increase in atmospheric greenhouse gas concentrations. Implementation of the Kyoto Protocol would establish policy instruments to negotiate future reductions through a variety of mechanisms including conservation, and increased reliance on non-carbon-based energy sources.

3. CMOS encourages the further development of economic projections, based on scientifically plausible scenarios of future climate change, population distributions, and economic/energy development, that are subject to the same level of intense international review and scrutiny that is built into the IPCC scientific assessment process.

4. CMOS supports the need identified by The United Nations Framework Convention on Climate Change (UNFCCC), and its Article 5 on Research and Systematic Observation, and the Kyoto Protocol to the UNFCCC, which provides that governments must undertake enhanced climate research and report on observations of the climate system.

5. CMOS takes the position that Canada's, and indeed the world's, success in dealing with climate change can only be achieved through an informed population. CMOS affirms its own commitment to the promotion and dissemination of well-founded knowledge on the science of climate change. The public must understand the reasons for and consequences of climate change before they can be expected to accept the need for proactive measures and to participate fully in their implementation.

CMOS encourages other agencies and organizations to join in this goal.

[1] Summary assessments publicly available at http://www.ipcc.ch

9 June 2003

Canadian National Committee for SCOR
Comité national canadien pour SCOR
Scientific Committee on Oceanic Research

Ocean Science Theses

The Canadian National Committee (CNC) for SCOR is undertaking an initiative to gather and publish the titles of completed Masters and PhD theses in oceanographic sciences. Several compilations from Canadian universities have already been posted on the CNC/SCOR web site at www.cncscor.ca. Additional summaries from other universities are welcome and should be sent to dick.stoddart@sympatico.ca.

Call for Abstracts
OMRN National Conference

The Ocean Management Research Network 2003 National Conference is scheduled for 13-15 November 2003 in Ottawa, Ontario. The Conference theme is "Canada's Oceans: Research, Management and the Human Dimension". The deadline for submitting abstracts for both papers and posters is 30 September 2003. For information, please access http://www.omrn.ca/eng_con03.html

The Role of Coastal GIS

The background paper was prepared for CoastGIS, the 5th International Symposium on GIS and Computer Cartography for Coastal Zone Management, scheduled for 16-18 October 2003 in Geneva, Italy. The paper discusses the role of coastal GIS vis-à-vis: the UN 2001 Millennium Declaration and the 2002 Plan of Implementation adopted by the World Summit of Sustainable Development, together with some associated materials from inter-governmental organisations; the changing approach to integrated coastal management, and the use of indicators. To download the paper, access http://www.gisig.it/coastgis/ and click on 'Hints for discussion'.

Over a Century and a Half of Canada's Weather Data Now Online

Canada's past weather records are now available through a new website featuring a collection of over 200 million observations from over 7,000 sites, some dating as far back as 1840. The archive consists of a database of hourly weather observations, including temperature, precipitation, air pressure, wind speed, and cloud types, as well as notes on the occurrence of thunderstorms, hail, fog and other types of weather. For information, access http://www.ec.gc.ca/Press/2003/030731_n_e.htm

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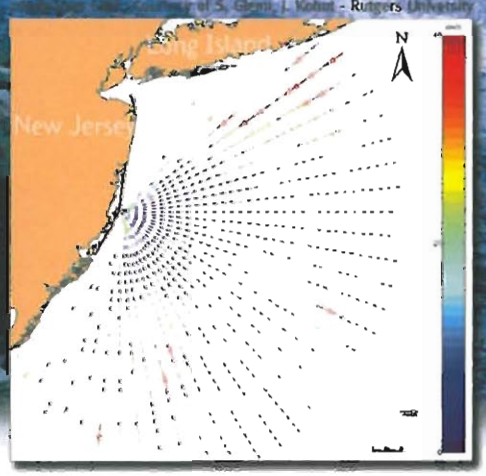
Map Surface Currents to 200 km with the Long Range SeaSonde



Data set showing surface current radial vectors averaged from 6pm to 8pm, [illegible] courtesy of S. Glenn, J. Kohut - Rutgers University

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