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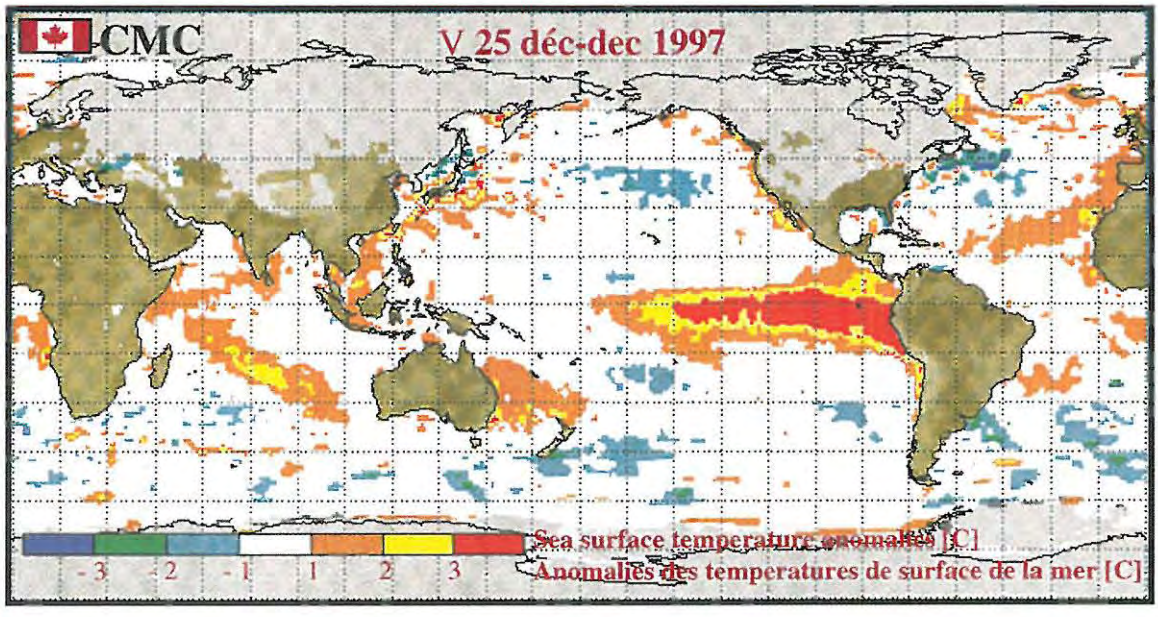
SCMO

Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

December / décembre 1998 Vol. 26 No. 6

International Year of the Ocean



Année Internationale des Océans

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

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Cover page: The image shown on cover page is made up of the geophysical fields for 25 December, 1997, analysed by the Canadian Meteorological Centre (CMC). Surface temperature anomalies are in colour. Regions with a snow cover of one centimetre or more are in grey. Regions with a sea ice concentration equal or greater than 50% are in dark grey if there is no snow, or in pale grey if there is one or more centimetre of snow on the ice.

These geophysical fields are analysed daily at CMC and are used as surface boundary conditions in numerical models. They can be viewed in the following Internet site: http://www.cmc.ec.gc.ca:80/~cmcdev/sst_glace_neige.html. Courtesy of Canadian Meteorological Centre, Atmospheric Environment Service, Dorval, Québec.

Page couverture: L'image en page couverture est composée des champs géophysiques du 25 décembre 1997 analysés par le Centre météorologique canadien (CMC). Les anomalies des températures de surface de la mer sont en couleur. Les régions où la couverture nivale est égale ou supérieure à un centimètre sont en gris. Les régions pour lesquelles la glace marine a une concentration égale ou supérieure à 50% sont en gris foncé s'il n'y a pas de neige, en gris pâle s'il y a un centrimètre ou plus de neige sur la glace.

Ces champs géophysiques sont analysés quotidiennement au CMC et utilisés comme conditions de surface dans les modèles numériques. On peut les visualiser sur le site Internet suivant : http://www.cmc.ec.gc.ca:80/~cmcdev/sst_glace_neige.html. Gracieuseté du Centre météorologique canadien, Service de l'environnement atmosphérique, Dorval, Québec.

Note - Avis

Please note the small change in CMOS electronic mail address. The same apply in the e-mail address of the *CMOS Bulletin SCMO* Editor.

Prière de noter le petit changement dans l'adresse électronique de la SCMO. Le même changement s'applique pour l'adresse du Rédacteur du *CMOS Bulletin SCMO*.

Canadian Meteorological and Oceanographic Society (CMOS)

Société canadienne de météorologie et d'océanographie (SCMO)

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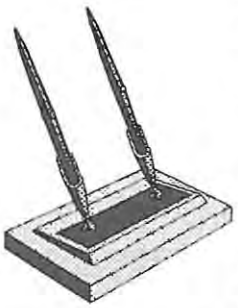
Adresses électroniques de la SCMO

....from the President's desk



A number of items are on my desk as we approach the end of the year and the first installment of our annual allotment of snow and cold.

First, as you will see in my membership renewal letter, is the need for your generosity in supporting the scholarship and our other charitable funds. Last year, thanks to Ambury Stuart (Weather Research House) and contributions from members, we successfully raised enough funds to support the awarding of the first CMOS/NSERC scholarship to a graduate student in meteorology. This year, as called for in our agreement with NSERC, a second scholarship award will be given in 1999 for a term of two years. However, this means we must redouble our efforts and funds. One of our long-standing supporters, Seimac Limited, will also be making a significant contribution over the next four years (see note on page 154 in this issue). Other corporate members are invited to meet this challenge. All members are asked to consider making a donation to this worthy cause. Now is the time to do it!

Second, a leading supporter of environmental causes in the USA (by profession a former journalist/broadcaster), Vice President Al Gore, recently published an editorial in an e-journal called Global Change, entitled "The Politics of Scientific Illiteracy" (for more information visit the web site at: http://www.globalchange.org/gc.htm). As Gore says "..too many Americans lack sufficient science literacy to tell the difference between sound science and sound bites". Judging from what one hears and sees in the media (and parliament), this literacy gap extends north of the US border! What can we in CMOS do about this? Perhaps part of the answer lies in educating the people who produce the information we read or hear i.e. the media and journalists.

CMOS has made some steps in this direction by:

- establishing an endorsement program for weathercasters;
- making submissions to the CRTC about the importance of prompt broadcast of weather warnings.

However, journalists sometimes find it difficult to locate nearby, accessible experts on whom to base their stories. Can CMOS improve this situation? Let's try! Share your ideas!

(Continued next page - Suite à la page suivante)

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INSIDE / EN BREF

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Troisièmement, je voudrais vous entretenir de la qualité du français sur le site Internet de la Société. Ceux et celles qui ont eu l'occasion de visiter notre site récemment auront constaté plusieurs améliorations tant sur le plan des actualités et des ajouts que sur le plan esthétique. Nous devons tous remercier Bob Jones pour cet effort. Bob, en plus d'être le responsable de notre site, est le Président du Centre d'Ottawa, un centre parmi les plus actifs de la Société. Ce que nous avons besoin présentement pour seconder Bob, c'est un réviseur bénévole qui pourrait vérifier l'orthographe et le bon usage du français au fur et à mesure que les informations sont mise à jour; en d'autres mots, un co-éditeur francophone. Soyez rassuré, la tâche n'est pas si onéreuse. La Société retient déjà les services d'un traducteur pour ses publications. Les documents de base, comme par exemple la constitution, sont en bon ordre. Il ne s'agirait d'éditer que les nouveaux textes apparaissant sur notre site Internet et de brèves introductions aux articles et liens postés. Il ne serait pas nécessaire de traduire les textes anglais au complet. Les articles soumis dans une langue seulement demeurerait disponible seulement dans la langue d'origine. Il n'est pas nécessaire non plus que ce volontaire habite la Capitale nationale, ou même le pays. Grâce au courrier électronique, ce travail pourrait ce faire n'importe où! Or si vous croyez avoir quelques heures par semaine à consacrer à relever la qualité du français sur notre site à un niveau d'excellence concordant davantage à l'image d'excellence de notre science, donnez-moi de vos nouvelles au plus vite.

Finally, the International Year of the Ocean draws to a close at the end of December. Both the Intergovernmental Oceanographic Commission and DFO (and Geoff Holland who is associated with both and the IYO) are to be congratulated for giving ocean science a much deserved higher profile during 1998 - we hope the various initiatives launched this year will continue and grow in the future.

All the best to every one at the beginning of the one before last year of this century!

Bonne année à tous, l'avant dernière année de ce siècle!

Bill Pugsley, President/ Président
CMOS/SCMO

Next Issue

Next issue of the *CMOS Bulletin SCMO* will be published in February 1999. Please send your articles, notes, reports or news items at the earliest to the address given above. Don't miss your chance!

Prochain numéro

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en février 1999. Prière de nous faire parvenir vos articles, notes, rapports ou nouvelles au plus tôt à l'adresse indiquée ci-dessus. Ne manquez pas votre coup!

Seimac Limited is pleased to support CMOS and Weather Research House in promoting meteorological education through the scholarship fund. Shown in the above picture - Susan Woodbury, Meteorology Division Manager of Seimac Limited, presenting Seimac's contribution of $2000 (first installment of a four year commitment) to Clive Mason, Chair of the CMOS Halifax Centre.

Seimac strongly believes that financial support for our meteorological youth will contribute to the growth and prosperity of the meteorological profession in Canada. We encourage all CMOS members and particularly private sector companies to take up the challenge begun by Ambury Stuart of Weather Research House by supporting the CMOS - Weather Research House Scholarship fund.

Note from the Editor

This special issue is CMOS' contribution to the International Year of the Ocean. It is our way to close this very special year dedicated to the oceans.

Note du Rédacteur

Ce numéro spécial se veut être la contribution de la SCMO à l'Année internationale des océans. C'est notre manière de clore cette année très spéciale consacrée aux océans.

The Changing Pacific

by Howard Freeland[1] and Dick Beamish[1]

A recent article in Science (McGowan et al 1998) generated considerable attention as it outlined declines in nutrient concentrations, chlorophyll and zooplankton in the CalCOFI region of the N. Pacific. The article suggested that profound changes were taking place. It is the opinion of the present authors that, if anything, the startling claims made in the Science article were understated. The purpose of this article is to outline the changes that are being observed in the North Pacific Ocean. The first part of the article will demonstrate that profound changes are occurring in the physical and chemical properties of the ocean with probable impacts on the plankton communities. The second part will review the condition of the North Pacific fisheries and demonstrate that changes are occurring that are Pacific-wide and probably determined by the changes in the physical and chemical environment. We cannot demonstrate unambiguously that these two sets of observations are linked, but we believe this to be the case.

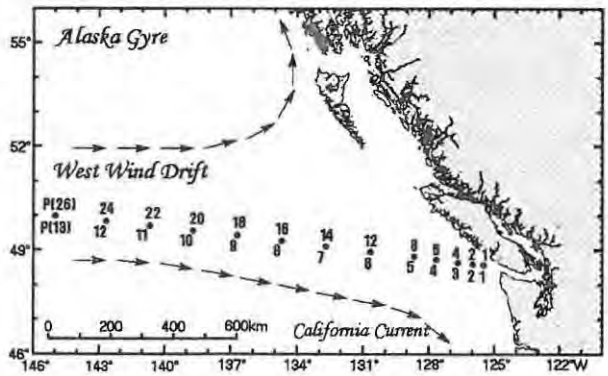

Figure 1: The stations comprising Line-P. Today Line-P is made up of 26 stations, here we plot just the original 13 stations started in 1956 with both the old and new numbering system.

It has been observed by Freeland et al (1988) that over a large part of the N.E. Pacific Ocean, sea surface temperature has steadily risen and surface salinity has declined over the last 60 years. Both of these trends conspire to reduce the density of the surface waters of the N.E. Pacific, which in its turn leads to an increase in the stability of water columns. Mixing is thereby reduced.

Since 1956 DFO Pacific Region has maintained sampling along a line of stations known as Line-P, extending from the mouth of the Juan de Fuca Strait to Ocean Station Papa (OSP) at 50°N and 145°W. Forty years ago deep winter mixing usually extended as deep as 130 m and supplied the nutrients needed to run the spring and summer primary production. Today, mixing penetrates more typically to a depth of 110 m and so supplies significantly less nutrients than previously. In the Freeland et al (1998) paper mid-winter mixed-layer depths are plotted. A trend-line plotted through these indicates a shallowing rate of 60 metres/century and has 95% confidence levels of about +30 m/cent. However, it is striking that an objective fit of a step change through these observations suggests that a trend may be an inappropriate interpretation of the observations, rather a step change taking place in 1976 may be a better explanation. This is an extremely interesting idea given the persistent suggestion from other observations that step changes routinely occur in the biological and physical properties of the N. Pacific. These changes have been dubbed "regime shifts".

The tendency towards shallower mixed layers and lower nutrients was accelerated in 1998 as the N. Pacific was dominated by El Niño effects. Through the winter of 1997/98 the surface layers of the N.E. Pacific were much warmer than ever before. This led to a significant increase in the stability of the water column.

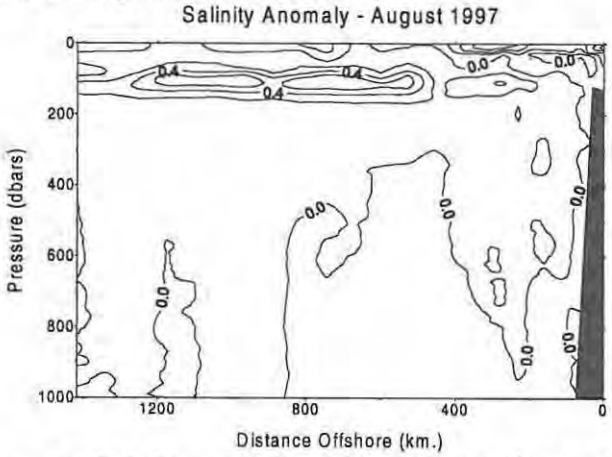

Figure 2: Salinity anomalies along Line-P observed in February 1998. (Courtesy M. Robert)

Figure 2 shows a plot of the salinity anomaly along Line-P during February 1998. At this time sea-level was extremely high along the B.C. coast, an event that may be associated with the passage of a Kelvin wave. Currents along the shelf and slope were anomalously strong resulting in the strong negative salinity anomalies close to the coast. However,

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an elongate feature representing high salinity anomalies over most of Line-P dominates the plot. This is due to the very shallow mixed layer that was a consequence of the 1997/98 El Niño.

In addition to the tendency in recent years towards shallow mixed layers, and so reduced nutrient supply, the stability of the water column in early 1998 was greater than in previous years and this had profound impacts on the nutrient supply.

Normally DFO Pacific Region acquires data along Line-P only 3 times per year, in February, May and September. However, observations were enhanced during 1997/98 to ensure a thorough view of the passage of the El Niño signal. Thus it was possible to create the picture shown in Figure 3, below. This diagram was computed by Frank Whitney and shows the near-surface nutrient concentrations through 1998 (triangle symbols) compared with a long term average. The change from normal is startling.

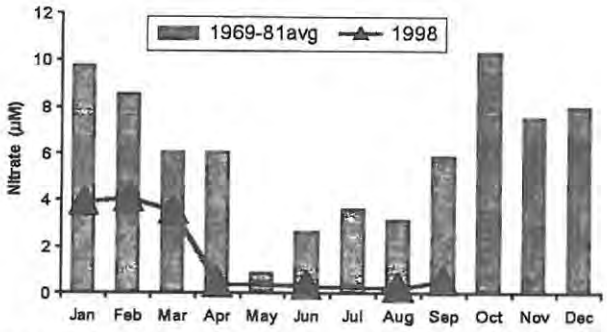

Figure 3: Nutrients at inshore stations along Line-P during 1998. (Courtesy F. Whitney)

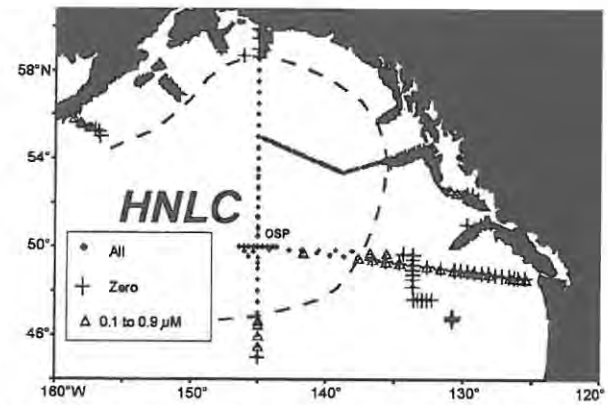

Figure 4: Regions of nitrate depletion in the N.E. Pacific during 1998. Courtesy F. Whitney

During 1998 there were other observations of the distribution of nitrate in the N. Pacific, and this has allowed the generation of the cartoon shown above in Figure 4. The figure shows a boundary (dashed line) between regions of nitrate depletion and the high nitrate and low chlorophyll region (HNLC) in the central Pacific. Recent work by Whitney et al, 1998, has demonstrated that the trend towards lower nutrients in the N.E. Pacific has led to lower chlorophyll levels and lower primary production in recent summers.

One consequence of a thinner mixed layer, outlined in Freeland et al 1998, is an apparent increase in the availability of light in early spring. This could advance early spring growth and create a spring demand for nutrients earlier in spring than previously. This could in its turn stimulate an tendency towards the earlier development of zooplankton. In fact, such a shift in the timing of zooplankton growth has been observed by Mackas, 1998.

In October 1998 oceanographers from sites around the rim of the N. Pacific met in Fairbanks at the 7th PICES Conference. On the final day there was a symposium on the effects of the 1997/98 El Niño event. It was striking that throughout the day the same story of increased stability of the water-column, decreased nutrients, decreased chlorophyll and decreased zooplankton, emerged repeatedly in El Niño Watch observations from California, Oregon, B.C. and Alaska.

Changes such as these can have a profound impact on the relationships among all elements of the food web in the N.E. Pacific, and probably are doing so. In particular it is interesting to speculate on how a reduction in food supply will impact the Pacific Salmon.

The association of ocean dynamics and decadal-scale changes in the marine habitat of commercially-important fishes has recently become an important issue in fisheries management. In the 1970s and 1980s there was a tendency to assume that the impact of marine habitat changes could be considered to be random and it was fishing that most affected the long-term stability of fish populations. Assessment models generally considered that the dynamics of a population could be defined using data obtained from a fishery. The impacts of the environment and associated species was seldom incorporated into the assessment. This was particularly true for Pacific salmon which were thought to be strongly influenced by the fishery, the numbers that escaped the fishery to spawn, and the quality of the freshwater habitat. Harvest rates for the various species of salmon were high, frequently exceeding 50% and sometimes exceeding 70% (Groot and Margolis 1991). With such high fishing mortality it appeared logical that the abundance in the ocean would not reach a level in which there was some degree of self regulation or to use fisheries terminology, there was density-dependent mortality. Consequently, the limits of abundance were believed to be related directly to the number of juveniles entering the ocean. Because the fishery removed potential spawning females, there was a trade-off in the management of salmon between having the number of juveniles that would produce the maximum return possible and having a sustainable fishery that provided food and employment.

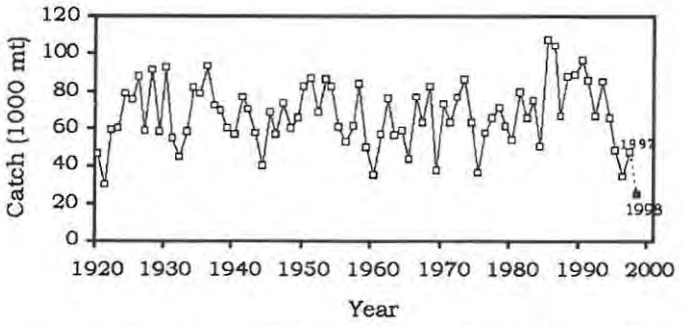

Figure 5: Canadian catch of Pacific salmon from 1921 to 1998. The 1998 estimate is preliminary.

In British Columbia, the total catch of all species of Pacific salmon declined in the early 1970s (Fig. 5). Because abundance was considered to be directly related to the production of juveniles, there was little choice but to believe that the decline could be reversed by producing more young salmon in fresh water. Consequently in the mid-1970s artificial rearing of eggs and fry was used to produce more juveniles and rebuild stocks to levels considered to be consistent with the productivity of the particular species and particular stocks (Perry 1995). A key, but unstated, assumption was that the ocean habitat or carrying capacity for salmon was not restricting production in any way. The issue of carrying capacity remains as a fundamental problem in fisheries management science. It is difficult for many biologists and non-biologists to conceive how a relatively small number of individuals compared to all other organisms in the ocean could in some way be regulated by an ocean that is so vast.

How could individuals be so crowded that their own density results in death? There are, however, some fundamental biological principles that highlight the importance of considering marine carrying capacity when managing Pacific salmon. Most of us remember that somewhere in university we were taught and accepted that the abundance of plants and animals that produce large numbers of seeds or babies is not regulated by the number of seeds or babies but by their habitat (Colinveaux 1978). Pacific salmon produce a large number of eggs or babies and would be expected, therefore, to be regulated by their habitat. The large numbers of smolt or fry that enter the ocean suffer high ocean mortality (Groot and Margolis 1991) which indicates that there is a marine habitat effect. Another basic biological principle is that distinct species that appear to be in a common habitat utilize the habitat differently. A number of species of Darwin's finches may be observed in the same tree, but they feed on different things (Weiner 1995). This is relevant because in the absence of fishing there were intrinsic factors within the populations of the various species of salmon that regulated their abundance. These factors resulted in a relative abundance among species that was approximately stable. Thus, in the absence of fishing, there were natural processes in the ocean that regulated the abundance of the various species of salmon. It is important to know if these processes still affect abundance in the ocean even though fishing has greatly reduced the number of adults that produce fertilized eggs in fresh water. The existence of self-regulation through a carrying capacity or density-related mortality is important for all commercial fish species, but can be studied in Pacific salmon because they have high harvest rates, catch is a good measure of productivity, and they are actively managed resulting in good records. Pacific salmon are short-lived, and widely distributed throughout the surface waters of the subarctic Pacific, facilitating studies of ocean impacts on year class strengths. A test of the assumption that catch is a good indicator of production (Beamish and Bouillon 1993, Mantua et al. 1997) can be made by examining stocks that have been managed for a long time (Beamish et al.1997). One of the best series of salmon production data is for sockeye salmon (Oncorhynchus nerka) in the Fraser River. Because these stocks are fished by Canada and the United States, an independent commission (International Pacific Salmon Fishery Commission) was responsible for a sophisticated accounting of stock specific information.

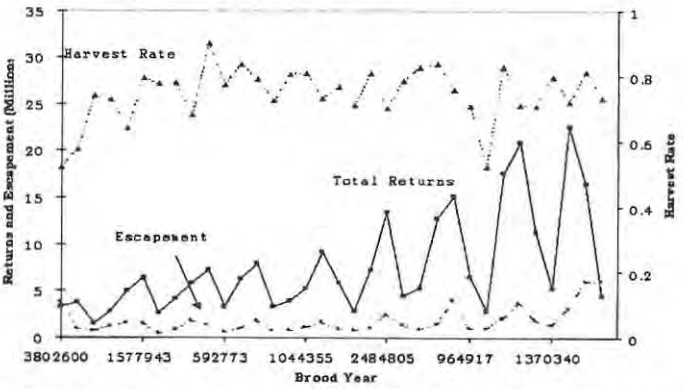

Figure 6: The harvest rate, total returns, and escapement for the combined Fraser River stocks in relation to the brood year that produced the return. The brood year is identified, and the total returns are lagged back to the brood year that produced the return. For any brood year, the total return is for ages 4 and 5. The harvest rates for each brood year are for age-4 fish only. The escapement is not lagged and indicates the year of spawning. The data are separated at the 1974 brood year to identify the regimes before and after the 1976-1977 climate event.

As a consequence it is possible to show that the measured catch (total returns minus escapement in Fig. 6) is a good indicator of total production and represents a large percentage of this production because of the high harvest rates (Fig. 2, Beamish et al. 1997). An indication that an ocean carrying capacity currently exists for Pacific salmon can be seen in the catch trends of Pacific salmon. There is a synchrony in the catch trends of Asian and North American stocks during this century (Fig. 7A, 7B). The synchrony is not exact, but in general there were high catches in the 1930s that declined in the late 1940s reaching very low levels in the early 1970s (Fig. 7A). Catches increased in the late 1970s as seen in the all-nation catch of pink, chum and sockeye salmon from 1926 to 1998 through to the early 1990s (Fig. 7A). In the mid-

1990s, catches declined and preliminary estimates for 1998 indicate that the drop in the total catch since 1995 may be close to 50% below the maximum catches in 1995. The trend was similar on both sides of the North Pacific Ocean (Fig. 7B) indicating that a common factor or factors affected the abundance trends.

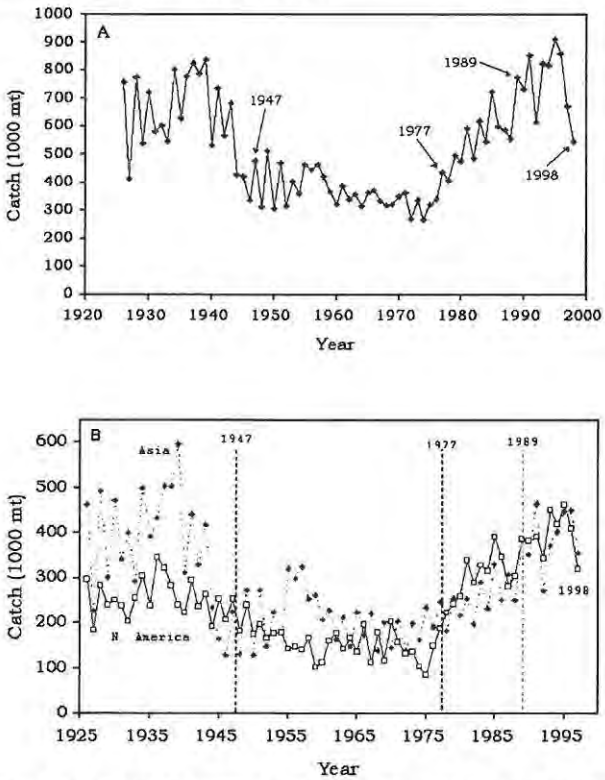

Figure 7: A. The all-nation catch of pink, chum and sockeye salmon from 1928 to 1998. The 1998 value is preliminary. B. A comparison of the combined pink, chum and sockeye catches between N. America and Asia.

The declines in Canada started about 1991 (Fig. 5), and in 1996 and 1997 in Alaska and in Asia. The largest all-nation catches on record occurred in 1995 (Fig. 7A). There were historic high catches of pink salmon (O. gorbuscha) in 1991 and sockeye salmon in 1993, synchronously throughout the subarctic Pacific. The increases in abundance of Pacific salmon beginning in the late 1970s coincided with large increases in the production of hatchery-reared salmon of all species (Beamish et al. 1997). By the mid-1990s, the total hatchery production in Canada, United States, Russia, and Japan was slightly over 6 billion juveniles. Beamish et al. (1997) estimated that the hatchery-produced salmon accounted for approximately 84% of the total catch of chum salmon (O. keta), 23% of the total catch of pink salmon, and 5% of the total catch of sockeye salmon.

Despite the different amounts of hatchery fish in the catch, the rates of increase in catch of these three species were very similar (Fig. 8). A possible explanation could be that the ocean habitat or carrying capacity for these three species became more favourable in the late 1970s through to the early 1990s and that the rate of return of salmon to the fishery was more a function of marine habitat than the number of juveniles the ocean. This simple explanation remains as speculation until more is known about the natural mechanisms that regulate the abundances of these species in the ocean but the general response does indicate that there is a strong ocean habitat effect on production.

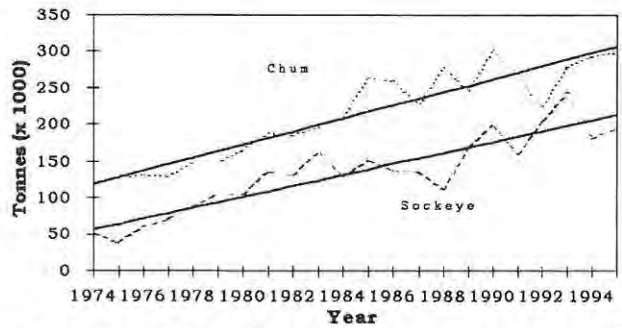

Fig. 8 The rate of increase of the sockeye salmon catch compared to chum salmon and pink salmon from 1974 to 1995.

We do know that the general trend in catches during this century follows a general trend in climate (Beamish and Bouillon, 1993) and in the ocean environment (Mantua et al. 1997). The Aleutian Low is the climate system in the winter in the northern North Pacific. It develops late in the year and persists until April or May. It is an accepted index of climate variability (Trenberth and Hurrell 1995) and one of the most persistent climate systems on the Earth. The changing intensity of the low has been associated with changes in the productivity of the subarctic Pacific (Venrick et al. 1987, Nitta and Yamada 1989, Brodeur and Ware 1992, Sugimoto and Tadokoro 1997, Minobe 1997). An index of the intensity of the Aleutian Low (ALPI, Fig. 9, Beamish et al. 1999a) corresponds to the general trend in Pacific salmon catches of all nations. The intensity of the Aleutian Low increased from the late 1970s until about 1989. Since 1989 the lows have been about average except in 1998 when an intense low reappeared. Because the various species of Pacific salmon remain in the ocean for different periods, recent changes in total catch resulting from changes in ocean productivity or salmon-carrying capacity would be expected to occur in the early to mid-1990s.

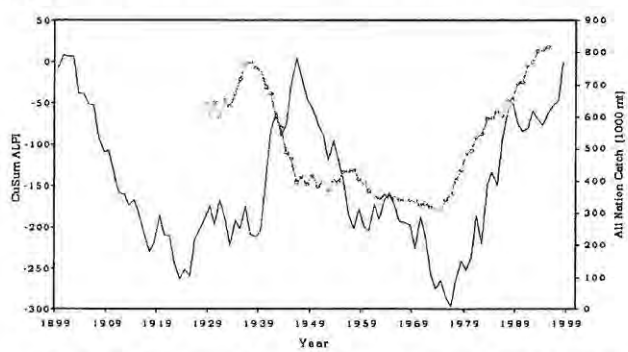

Figure 9: The Aleutian Low Pressure Index (solid line) and the all-nation catch of pink, chum and sockeye salmon (5 year running average) (open diamonds).

Catches of pink salmon, which spend only one winter in the ocean, were at historic high levels in 1991, indicating that marine survival was high in 1990. Thus, the weakening of the Aleutian Low in the 1990s appears to be associated with a reduction in productivity of salmon beginning after 1990. The Pacific decadal oscillation (PDO) is a composite index of ocean conditions that uses principal component analysis to identify dominant patterns. The resulting index is strongly influenced by sea surface temperatures (Mantua et al. 1997). Both the PDO and the ALPI follow similar trends, changing in the mid-1920s, late 1940s, late 1970s, and late 1980s. The synchrony of the trends in all-nation Pacific salmon catches with these indices of climate and the ocean environment has been identified as evidence of a linkage between salmon production and their marine habitat (Beamish and Bouillon, 1993). The regulation of abundance from marine survival rather than freshwater juvenile salmon production has now been recognized in a number of studies (i.e. Adkinson et al. 1996, Coronado and Hilborn 1998).

Off the west coast of Canada, Pacific salmon catches have declined dramatically in the 1990s. The 1998 catch total has not been finalized but it could be the lowest in history (Fig. 5). The low catches in 1998 are a consequence of both low abundance and management action, and therefore may not be directly comparable to past catches. However, they do show quite clearly that a dramatic change in abundance has occurred.

Evidence that the decline in abundance is related to the ocean environment is strongest for coho salmon (O. kisutch). Large numbers of coho salmon are released from hatcheries in Oregon, Washington, and British Columbia. Despite a rather constant release in recent years (Beamish and Mahnken 1998), the total returns of coho have declined. Because hatchery-reared coho may represent about 70% of the total production (Beamish et al. 1998), it is clear that a reduction in juveniles entering the ocean is an unlikely explanation for the declines in catch. The release of large numbers of hatchery-reared coho also allows an estimate of marine mortality to be made (Beamish et al. 1999b, Coronado and Hilborn 1998). In the 1970s and 1980s, marine mortality could be characterized as being about 85%. In the mid-1990s, marine mortality is approximately 98% for these southern coho stocks. Moreover, the dramatic increase in marine mortality occurred almost synchronously in all these stocks beginning about 1989 (Beamish et al 1999). A similar response has also been reported for steelhead (O. mykiss) that clearly demonstrates that total returns are associated with ocean conditions more than the number of juveniles produced in fresh water (Welch et al. 1999).

It can be argued that an increase in marine mortality may only indicate an increasing impact of the agent or agents causing the mortality rather than an inability of the marine habitat to support more individuals. In other words, the increased mortality is not related to the density of the individuals but to some factor such as disease. Separating density-dependent marine mortality and density-independent mortality has always been a tough exercise. It has been difficult because we have been forced to study the problem from the wrong end. We traditionally looked at returns of salmon and tried to relate the returns to density related and unrelated factors using catch data (Ricker 1975). A lot of good work was accomplished using this approach, but it continued to be difficult to address the issue of carrying capacity resulting in the assumption that carrying capacity in the ocean was not limiting. The solution to understanding carrying capacity may be to study it directly in the ocean. One approach to studying carrying capacity directly is to develop and test hypotheses relating to the natural regulation of abundance. If we understand how a species did it naturally, we could focus our research on specific factors rather than attempting to measure a variety of possible factors. Recently, Beamish and Mahnken (1999) proposed that coho in particular and Pacific salmon in general, regulate their abundance in the ocean in two principal stages. The first stage is primarily predation- based and as many investigators have proposed (Pearcy 1992), occurs early in the marine phase of the life history of salmon. The second stage, which is the new concept, is a growth-based mortality. According to this hypothesis, salmon must consume a sufficient amount of food over the summer to be able to survive the first marine fall and winter period. If salmon do not reach a critical size by a critical period, they enter into a trajectory that results in death. This second mortality is a physiological-based mortality that may be terminated through predation, but its cause is food and growth based. This hypothesis links ocean production to carrying capacity for a species. If the climate and ocean are favourable, more food is available and more individuals grow to a critical size. However, even in favourable conditions, the density of a species could be sufficiently high that growth rates are reduced and the population stops expanding. When the climate and ocean conditions are less favourable, there would be less food or more competition or both, resulting in a reduced carrying capacity. This is only an hypothesis, but it can be studied directly by estimating abundances late in the first marine residence and measuring growth and condition. If late summer abundances of ocean age 0 juveniles are considerably higher than the subsequent returns, then fall and winter mortalities are important. If the growth rates and conditions of the fish that survive are significantly better than those that do not, then summer growth rates are important.

The issue of marine carrying capacity is an important issue in fisheries management because we have frequently structured our management on the assumption that it is not limiting particularly for fished populations of Pacific salmon. As a consequence we have assumed, for Pacific salmon, that adding more juveniles to the ocean can increase abundance. We also implicitly assume that the addition of more juveniles would not in any way reduce marine survival. The new information about the changing ocean conditions and the impact of climate and ocean on Pacific salmon indicates it is time to evaluate any

management action that is based on an assumption that the current carrying capacities are unlimited.

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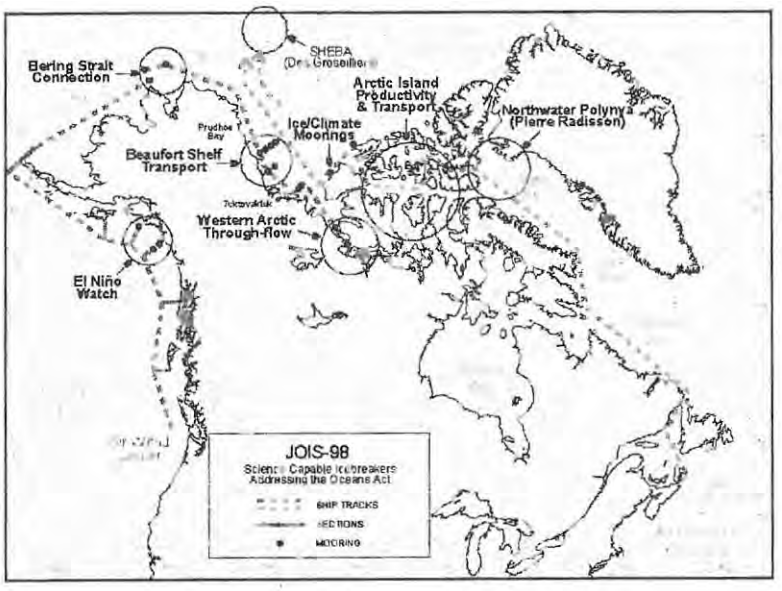
Fact on Salmon (from IYO web site)

28 December

The overall size of North Pacific salmon stocks is linked to and the strength of winter winds in the North Pacific. Alaska and northern British Columbia stocks increase when stocks in southern British Columbia, Washington and Oregon decrease and vice versa. One explanation is that the stronger winds bring more precipitation, increasing the fresh water entering coastal waters and making the water more stable and harder to mix. Northern plankton stay in the sunlit upper layer increasing their productivity while southern plankton get less nutrients from deep water.

Arctic Oceanographic Programs during the International Year of the Ocean

by Marty Bergmann[1]



The North American Arctic marine program has been very active over the past year as has been demonstrated by the large amount of national and international attention. The programs have evolved through cooperative activities of many researchers and nations involved with Arctic research.

The international **SHEBA** (**S**urface **H**eat **B**udget of the **A**rctic **O**cean) is a 5-year program collecting data on how clouds, ice, snow and the ocean interact and exchange energy over the course of a year. This intensive research program was mostly funded by the U.S. National Science Foundation but also involved DFO and other Federal Govemment Deaprtments. In 1998, a major field program was undertaken, which relied on the use of the DFO Canadian Coast Guard icebreaker (***CCGS Des Groseilliers***) and its expert crew to carry out the operational aspects of work on the Arctic sea ice.

The information, collected over a 13-month field season, was needed in order to improve the existing Arctic climate prediction models. These models are required for better forecasts of global climate change, leading to better forecasts to allow for better decisions and contributions to the world debate on climate issues. A total of about 170 scientists worked at the station at one time or another, and included principal investigators, technicians and graduate students. Preliminary information from the study showed that the ice is thinner, the surface water fresher, and the summer melt was greater than was expected. In addition, the productivity in the area was higher than previous data had shown and the surface nutrients lower than had been predicted.

The **JOIS** (Joint **O**cean **I**ce **S**tudies) program is predominantly a Canadian effort, with participation from the U.S. to build ancillary science programs in climate, contaminant transport and biology making effective use of **SHEBA** platform logistics.

The overall JOIS program in Canada represents a world-class science initiative within DFO and includes major participation by the CCG and Science Sectors from all regions within the department. The Science programs are coordinated by DFO and includes participation from DFO scientists (including Canadian Hydrographic Services) from across Canada, scientists from other federal departments including Environment Canada, and Natural Resource Canada, and researchers from Canadian and U.S. universities.

In 1998, this research program took advantage of the scheduling of the ***CCGS Louis S. St-Laurent***, identified as the vessel to provide logistic support for the ***CCGS Des Groseilliers*** locked in the ice at the SHEBA drift site in the Beaufort Sea. Due to the unusually low amount of ice in the Archipelago, the research activities included the collection of data from areas near the Magnetic North Pole and a longitudinal transect through M'Clure Strait. Physical oceanographic work, contaminant information, fish studies and sediment information were collected in these areas of low productivity. Data show that areas typically dominated by multi-year ice respond rapidly to incoming radiation, independent of season.

[1] Department of Fisheries and Oceans, Freshwater Institute, Winnipeg, Manitoba, Canada.

Research programs being carried out in 1997/98 and 1998/99 are closely tied to the objectives of the new Canada Oceans Act, and are strongly supported by northerners and Arctic organizations such as national and international panels: the **A**rctic **C**limate **SY**stems **S**tudy (**ACSYS**), the **A**rctic **M**arine **A**ssessment Program (**AMAP**) and the **C**ommittee on **A**rctic **F**auna and **F**lora (**CAFF**).

As a result of DFO's support for projects approved as part of SHEBA and JOIS, tremendous interest has been generated within the national and international scientific community (Germany, Sweden, Russia, Japan) for the work being planned as part of DFO's initiative in conducting oceans research in Canadian waters.

In 1998, DFO was involved with the Arctic North Water Polynya (**NOW**) research program and was funded primarily by the Natural Sciences and Engineering Research Council of Canada (NSERC). This program brought together Canadian and international expertise in Arctic oceanography; in excess of 60 scientists from Canada, U.S., Japan, Denmark, Belgium, Great Britain and Mexico.

Polynyas are large areas (10-90,000 km^2) of open water in the midst of the thick ice pack that covers the Arctic Ocean and adjacent seas during 10 of the 12 months of the year. They are suspected to be focal points for the intense production with the transfer of the solar energy fixed by planktonic microalgae to Arctic cod, seals, polar bears and northern inhabitants.

The North Water polynya, located in northern Baffin Bay between Ellesmere Island and Greenland, is among the most productive areas north of the Arctic Circle; the functioning of this ecosystem, its role in the overall Arctic biota and its potential response to global warming are poorly understood. Based on the information collected from the sediment traps, researchers were surprised to note that the period of highest productivity is in late fall and not spring/summer.

Fin de la mission SHEBA

C'est en présence de Son Excellence le Gouverneur Général du Canada, de hauts dignitaires du gouvernement, d'invités de marque, des familles de l'équipage et d'employés du MPO que le NGCC Des Groseillers a été accueilli à Québec le 6 novembre dernier, après plus d'un an d'absence. En effet, le 4 juillet 1997, ce brise-glace lourd du ministère canadien des Pêches et Océans appeillait à destination de la banquise arctique pour réaliser l'importante mission scientifique internationale SHEBA (Surface Heat Budget of the Arctic Ocean). Suite à un périple de plusieurs semaines, le navire s'est immobilisé dans les glaces de l'océan Arctique, au nord de l'Alaska, afin de conduire une série de mesures et d'expériences en relation avec les échanges océan-atmosphère et les changements climatiques.

Cette cérémonie a été l'occasion de souligner le retour récent à Québec du NGCC Pierre-Radisson, navire jumeau du Des Groseillers, affecté durant plusieurs mois à une mission d'étude de la polynie des Eaux du Nord, zone libre de glace entre le Canada et le Groenland, dans le cadre du projet international NOW (North Water). Plusieurs chercheurs de l'IML et des universités québécoises participent à ce dernier projet qui doit se poursuivre en 1999. Pour plus de renseignements, visitez les sites internet de SHEBA (http://sheba.apl.washington.edu) et de NOW (http://kestrel.fsg.ulaval,ca/giroq/now).

Source: Nouvelles des Sciences, Institut Maurice-Lamontagne, Vol.9, No.18, Novembre 1998.

Canada and the Oceans

Three vast and magnificent oceans and one of the longest coastlines in the world;

Fishing, aquaculture, tourism, shipping, ship-building, offshore oil and gas exploration and mining, recreation, etc;

Conflict in our oceans: competing users, destruction of habitat, sewage and waste disposal;

Need to work together, nationally and internationally, to conserve and protect our oceans.

Le Canada et les océans

Trois vastes et magnifiques océans et une des côtes les plus longues au monde;

Pêcherie, aquaculture, tourisme, navigation, construction de navires, exploration et exploitation minière offshore du pétrole et du gaz, récréation, etc;

Situation conflictuelle à propos de nos océans: usagers concurrentiels, destruction de l'habitat, évacuation des déchets et des ordures;

Nécessité de travailler ensemble, tant au niveau national qu'international, pour conserver et protéger nos océans.

Oceanographic Computer Atlas of the Northwest Atlantic

by Igor M. Yashayaev[1]

1. Motivation and Origin

In the 1980s and early 1990s research vessels of the former Soviet Union, working under the SECTIONS program, made thousands of measurements in the Newfoundland Basin. The SECTIONS program was designed to study the seasonal to interannual variability of water masses, currents, fronts, and their impact on the atmosphere in certain key areas of the global ocean with the objective of improving seasonal to interannual forecasts of meteorological conditions over the Soviet Union. These key regions were named Energy Active Zones of the Ocean (EAZO). The Newfoundland Basin was considered as one of these key regions, and assigned the highest priority in the observational part of the program. Sections can be viewed as a precursor to a number of elements of CLIVAR.

Other programs have collected extensive physical oceanographic datasets in the Newfoundland Basin. The International Ice Patrol has until the 1980's annually occupied a series of oceanographic sections crossing the continental slope from northeast Newfoundland to the Tail of the Banks during the spring and early summer. There have also been regular annual sections occupied by fisheries scientists as well as a number of large multi-institutional surveys lead by the Bedford Institute of Oceanography. The region also straddles the main shipping route between Europe and North America so there is a wealth of bathythermograph data from North Atlantic VOS programs.

Unlike most areas of the world ocean, climate studies of the Newfoundland Basin required the creation of a tool which would allow the analysis of a rich and large data set. We were inspired to create a system:

- capable of storing and accessing large volumes of both historical and recent observations;
- data quality control,;
- creating subsets of selected data types in any specified spatial and temporal domain (including user-defined section and surface); and
- performing various statistic and oceanographic analyses, girding and visualizing data and results.

These features were embedded in a computer product originally named Computer Atlas of the Newfoundland Basin (CANB). The choice of this region was motivated by:

- its importance in circulation and heat transport in the entire Atlantic;
- the presence of various water masses and sharp fronts;
- indications of temporal and spatial changes in the water mass properties;
- intense air-sea interaction; and by
- dense coverage with oceanographic data.

The Present Atlas

The development of the Atlas began in the early 1990's within a collaborative project between the State Oceanographic Institute in Moscow and the Ocean Sciences Division, BIO. The project originally was directed toward the examination of the variability within the Newfoundland Basin region of the Northwest Atlantic as part of a WOCE Control Volume Study as well as PERD funded research on the coupling of the atmosphere and ocean in the vicinity of Hibernia. In order that this system would be available to a wide variety of users in both locations, it was developed as a PC based application.

As we developed the system, we broadened our area of interest to include all of the Northwest Atlantic. The system can be applied to any region of the ocean; however, the user will need to quality control the historical hydrographic data for that region before importing the new data into the system. The current system, The *Computer Atlas of the Northwest Atlantic,* consists of an oceanographic data base, analysis and visualization software.

Distribution of the System

Over the years we have thought about distributing the system; however, we were constantly adding features. The system is now complete and robust enough to release it to a larger user group. While other groups have also developed PC and MAC based oceanographic analysis and visualization systems, we believe that this computer atlas

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offers a unique range of features and abilities. These include:

1) storing and accessing large volumes of data;

2) creating subsets in any specified spatial and temporal domain (on an arbitrary vertical section or an iso-surface);

3) performing oceanographic analyses (time series, *T-S*, section plots, distributions on surfaces); and

4) girding and visualizing data and results.

The Atlas is a MS-DOS based program; however, it runs without complications in a *Windows 95* DOS window. (We have not tested it broadly under NT). *The Atlas* is being contributed to the CD-ROM that is being assembled by the *WOCE Hydrographic Program Office* at Scripps under the direction of Jim Swift. This CD-ROM will contain a selection of software packages designed to view and/or explore hydrographic station data.

The software is available as downloadable files from the Ocean Sciences Division's web site.

http://www.mar.dfo-mpo.gc.ca/science/ocean/software/canwa.htm

The downloadable files are 14 Mbytes (21 Mbytes with complete data) and when expanded will need 23 (34) Mbytes on your PC to run. You can download the data separately. Even the "complete" download has only a limited XBT data set (though all Bottles and CTDs). To make it ultimately complete you'll need to get the XBT data (line 5 in the options of downloading on the page). You'll find out about other software requirements by visiting the page.

We are also considering publishing the system as a stand alone CD-ROM package. We would like to know whether you would be more interested in a CD version than the downloadable version from our web site.

Examples of products

The easiest way to see the capabilities of this Atlas is to view the posters which were produced for the WOCE Conference by the group at BIO. The climatology of the Labrador Sea is presented at:

http://www.mar.dfo-mpo.gc.ca/science/ocean/woce/labsea/labsea_poster.html

and the climatology of the Newfoundland basin is at:

http://www.mar.dfo-mpo.gc.ca/science/ocean/woce/newfbas/nwa_poster_frame.html

We hope that a number of readers will download this software and explore the Northwest Atlantic. Please tell us what you don't like about the software so that we can continue to develop it in ways that will be useful to the community.

Acknowledgments

Special thanks to the scientific coordinators: R. Allyn Clarke (BIO) and Sergei K. Gulev (PPS), for encouraging the creation of the Atlas, Sergei Grigoriev, PPS, for help in designing the user interface, John Lazier, Anthony Isenor and other BIO scientists for testing the Atlas and commenting on this document. The work on this project was supported by the Ministry of Science and Technology (Russian Federation) and the Department of Fisheries and Oceans (Canada).

Coming in our next issues

"Weekend / Weekday Effect for Tropospheric Ozone Episodes in Ontario, Canada" by A. Kumar (University of Toronto), W. Gough (University of Toronto at Scarborough) and D. Yap (Ontario Ministry of the Environment);

"A Western Boundary Current Meter Array in the North Atlantic near 42°N" by A. Clarke, R. Hendry, I. Yashayaev (DFO/Bedford Institute of Oceanography) and D. Watts (University of Rhode Island);

"High UVB radiation episode in eastern Canada in March 1993" by H. Krzeminska (University of Western Ontario), P. Jackson (University of Northern British Columbia) and R. Lowe (University of Western Ontario).

Bientôt dans nos prochains numéros

"Weekend / Weekday Effect for Tropospheric Ozone Episodes in Ontario, Canada" par A. Kumar (Université de Toronto), W. Gough (Université de Toronto à Scarborough) et D. Yap (Ministère de l'Environnement de l'Ontario);

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The International Year of the Ocean – Did it work?
Thoughts and Reflections of the IOC Chair
Geoff Holland

1998 was indeed a special year for the oceans. Expectations can always run higher than achievements, but there have been enough successes during the year to temper the disappointment of the failures. From the outset, one of the prime objectives was to leave a legacy of the **International Year of the Ocean** (IYO) that would persist for many years to come. Within Canada, it may yet be too early to judge the results. The program can be described in three parts, Canada's international contribution, the promotion of Canadian ocean programs and the public awareness campaign.

Although Canada supported the IYO through holding International Conferences, such as the WOCE Conference in Halifax, linking its national efforts to the international network over InterNet, participating in Ocean Expo '98 in Lisbon and sending a floating industrial exhibit to Europe on the Louis St. Laurent, the largest contribution was definitely the Canadian sponsorship of The Ocean Charter project. The charter is a non-legal document of principle, stating the importance of preserving the marine environment and sustaining its resources. Canada prepared and distributed the charter, using its Embassy and Mission network, to countries all around the world. Eventually the charter was available in over twenty languages. The target for signings by senior officials remains at 100 countries and may yet be achieved. As of the beginning of October, formal indications of signing by 30 countries have been received. The legacy from this activity will be to use its success as a statement of support and standard for action at the UN on ocean issues.

Within Canada the IYO has given the government an opportunity to publicize its new Ocean Act, the Ocean Strategy hearings, the work of the National Round Table, announcements on Marine Protected Areas and other departmental initiatives. The federal and provincial governments combined to improve the ocean curriculum in schools. The continued progress on these efforts will carry on into the next millennium.

Public awareness projects have been undertaken by federal departments, led by the IYO Secretariat in DFO, and several NGOs. In particular, schools have been targeted with the assistance of the Canadian Association of Principals and the Canadian Wildlife Federation. Both of these organizations have used an individual form of **The Ocean Charter**, called My Ocean Charter, to encourage commitments by schoolchildren and the general public. A **"Youth for the Ocean"** Foundation has been set up to promote youth leadership and education in the oceans in future years. The original target for 1 million signatures in Canada for the My Ocean Charter and $1,000,000 for the Foundation may not be met, but many volunteers have worked hard toward those goals. Publicity has progressed through Open Houses, media releases, advertisements, Public Service Announcements and with the willing help of ocean-related organizations, such as CMOS. The Governor General agreed to be the Canadian Patron for the IYO and participated in many activities. At the time of writing, a **"Wave Across the Country"** is being organized for November 13, as a "grande finale".

For myself, I approach the end of the International Year of the Ocean with mixed feelings. On the one hand, I am proud of the efforts in Canada and indeed in many of the IOC Member States for the achievements they have made throughout the year. On the other hand, I realize even more strongly, the distance that governments and the public have to travel before an adequate level of attention is paid to the essential ocean element of the planet's life support system.

A major disappointment has been the overall lack of attention paid to the oceans by the media. Unfortunately we understand that the media base their success on their attention to the sensations of the hour and not of the long-term. The global issues that are being faced by society are, by nature, long-term and too often we pay attention to the urgent and forget the important. A second disappointment is that governments, in general, did not take advantage of the opportunity of the IYO to initiate substantial new national and international efforts to address ocean issues. To a large extent, governments also focus on the shorter term, with elected officials having an attention horizon that is optimized by their term of office, usually around four years. It is probably our intergovernmental machinery that must start paying more attention to the issues that will affect us profoundly in a time frame of 25–50 years. Unfortunately, the United Nations system was set up to resolve intergovernmental differences rather than global environmental issues and will need some infusion of wisdom and foresight in any reorganization.

For the IOC, which is the most prominent UN organization dealing with ocean science and services, the way ahead in the short-term will be difficult. It is unlikely that any great injection of resources will occur in the next few years and the present mismatch of expectations and capability is expected to continue. It is obvious that critical programs in ocean science, observation and data management must continue to be pursued. A priority must be maintained for the application of knowledge and information into the necessary services for operations and decision-making in

coastal and ocean management. Concurrently, research into ocean processes and environmental and anthropogenic global changes must be promoted.

Sooner or later the intergovernmental situation will be resolved to address the increasing importance of the oceans over the next millennium. Advances in the use and development of marine living and non-living resources, as well as in the expanded use of ocean space and a more evident appreciation of the need to preserve and protect the ocean environment, will ensure the future strengthening of the IOC. Until then, the IOC must continue to work on attracting government support and other donors, to enable its important work to continue. The International Year of the Ocean has assisted to some extent to raise the governmental and public awareness in the ocean, but it is only a first step in what has to be done.

G.L. Holland
Chairman,
Intergovernmental Oceanographic Commission
UNESCO.

Meanwhile in DFO...

1998, the International Year of the Ocean (IYO), was an important year for the Department of Fisheries and Oceans, the federal department dealing on ocean issues and most closely related to the IYO.

Stemming from the passage of the Oceans Act in January 1997, **1998** saw:

① From the Oceans Policy Secretariat, the release of a public discussion paper called Toward Canada's Oceans Strategy on January 14. The public was encouraged to let their concerns about the state of the oceans, and their visions for oceans, be known! In the near future, a national panel of oceans experts will be established to consult with Canadians on the discussion paper and on what Canadians would like to see in an oceans strategy. The Oceans Policy Secretariat has met with all federal agencies/departments with oceans responsibilities, with provincial and territorial government representatives, and with representatives of Aboriginal groups.

② The launch of a web site at www.OceansCanada.com.

③ The release of two "roles" documents: The Role of the Federal Government in the Oceans Sector, and The Role of the Provincial and Territorial Governments in the Oceans Sector; the oceans strategy has been communicated to the public through press releases, in a special insert on IYO in the Ottawa Citizen, in a special insert in the Halifax Daily News, on the web site, etc.

④ Formation of the Oceans Sector on June 8, on Oceans Day.

⑤ With regard to the Marine Protected Areas (MPAs), public consultations were held with the oceans community; resulting from this a policy has been written and a framework drafted. Announcement of five pilot MPA sites, including (in the Pacific Ocean) Gabriola Passage, Race Rocks, Bowie Seamount, and Endeavour Hot Vents, and (in the Atlantic Ocean) the Gully. Others are expected to be announced in 1999, including the possibility of one in the Arctic Ocean.

⑥ Real progress was being made in developing integrated management plans.

⑦ Marine ecosystem health guidelines, standards and objectives will be developed.

⑧ With regard to the International Year of the Ocean (IYO), Minister Anderson kicked it off officially in September 1997 at the Summit of the Sea conference in St. John's, Newfoundland, by launching The Ocean Charter, an international program, sponsored by Canada, for highly-placed representatives to sign The Ocean Charter.

⑨ IYO Secretariat was set up at DFO; Governor General Roméo Leblanc was the Canadian Patron for the IYO; IYO material was delivered to over 15,000 canadian schools this fall through a partnership between DFO and the Canadian Association of Principals (CAP); a grade 11 science curriculum called "Oceans 11" was being piloted in Nova Scotia. The curriculum was developed in a partnership between DFO and the Nova Scotia Department of Education and Culture -- international interest has been expressed in the curriculum; a Youth for the Ocean Foundation was established -- it is a non-profit organization. Other completed significant projects were: "My Ocean Charter" signing campaign at the world exposition on the ocean, Expo '98, in Lisbon, Portugal and a CD-Rom on Oceans.

⑩ Public awareness and education was seen as an important component of the newly formed Oceans Sector. Sector employees have held interactive presentations with school children (within schools and at day camps), and have educated children and adults alike at open houses and through a presence or participation in various community-level activities.

Andrea Skillen,
Department of Fisheries and Oceans

CMOS Tribute to Tertia Hughes

Upon hearing the news of Tertia's death, the response from scientists around the world was overwhelming. Tertia clearly touched the lives of many scientists and will be sadly missed. Tertia's memory will live on through three initiatives that Tertia's friends in Canada, the US and elsewhere in the world have started.

Tertia Mary Clemency Hughes
July 24, 1967 - November 23, 1998

The first initiative is a web page (http://wikyonos.seos.uvic.ca/people/hughes/hughes.html) which we invite you to contribute to (please email: afanning@mer.seos.uvic.ca). The Department of Atmospheric and Oceanic Science and the Centre for Climate and Global Change Research at McGill University will be holding a special symposium in her honour on November 23, 1999. Finally, the friends of Tertia Hughes have put a resolution before the CMOS Council requesting that the Graduate Student Prize be re-named in her honour. CMOS Council have agreed to put forward a motion at the next Annual Congress in Montréal, in June 1999 to amend the CMOS Constitution, changing the name of the CMOS Graduate Student Prize from "Graduate Student Prize" to the "Tertia MC Hughes Memorial Graduate Student Prize". This prize would carry with it a financial award whose amount will be determined by the contributions received. The goal is to award $500 each to two recipients of this annual prize. The intention is to make the first awards at the CMOS Congress in Victoria in 2000. As such, donations are being sought for the "CMOS-Tertia Hughes Memorial Fund" which will be used to build a principal base to fund these awards in perpetuity. If members of CMOS, or any other friends of Tertia are able to contribute to this fund, tax-deductible donations (payable to 'CMOS-Tertia Hughes Memorial Fund') should be addressed to:

"CMOS - Tertia Hughes Memorial Fund"
CMOS-SCMO
Suite 112, McDonald Building
University of Ottawa
150 Louis-Pasteur Ave.
Ottawa. ON
K1N 6N5

P.S. More information can be read at page 170

Hommage de la SCMO à Tertia Hughes

Les scientifiques du monde entier ont répondu en masse par courrier électronique à l'annonce de la mort de Tertia. Sa vie a définitivement touché de nombreuses personnes. Le souvenir de Tertia continuera à vivre à perpétuité grâce à trois projets que ses amis au Canada, aux Etats-Unis et ailleurs au monde ont initiés.

Le premier projet consiste en un site Web (http://wikyonos.seos.uvic.ca/people/hughes/hughes.html) pour lequel nous invitons les contributions (expédier par courriel à: afanning@mer.seos.uvic.ca). Le Département des sciences atmosphériques et océaniques et le Centre sur le climat et les changements à l'échelle du globe de l'université McGill tiendra un symposium spécial en son honneur le 23 novembre 1999. Et en dernier lieu, les amis de Tertia Hughes ont proposé une résolution au conseil de la SCMO. Celui-ci a accepté de présenter une motion à la prochaine Assemblée générale annuelle à Montréal en juin 1999 afin de modifier la constitution de la SCMO pour changer le nom du "Prix de l'étudiant diplômé" en "Prix de l'étudiant diplômé en mémoire de Tertia MC Hughes". Ce prix comprendrait une bourse dont le montant sera déterminé d'après les contributions reçues. Notre but est de décerné deux prix de 500 $ annuellement. Nous espérons pouvoir allouer les premiers prix au congrès de la SCMO à Victoria en l'an 2000. À ce titre, nous invitons les dons pour le "Fonds commémoratif SCMO-Tertia Hughes", qui formeront une base de capitaux pour financer ces prix dans le futur. Si les membres de la SCMO, ou tout ami de Tertia, veulent contribuer à ce fonds, les dons déductibles d'impôts (libellé au "Fonds commémoratif SCMO-Tertia Hughes ") doivent être expédiés à :

"Fonds commémoratif SCMO - Tertia Hughes"
CMOS-SCMO
Bureau 112, Immeuble McDonald
Université d'Ottawa
150, rue Louis-Pasteur
Ottawa, Ontario
K1N 6N5

P.S. Pour en savoir plus, voir à la page 170

1998 - International Year of the Ocean - 1998

Facts for the Year (Some extracts only)

1 January

The International Year of the Ocean started first at the International Date Line, established by international agreement. The Date Line mainly follows the 180° meridian of longitude which lies almost entirely over the Pacific and Arctic Oceans. Every new day starts over the ocean.

7 - 9 February

The length of the world's coastlines is about 504,000 km, enough to circle the Equator 12 times. The apparent length of a coastline depends on the scale (length of ruler) at which it is measured. The coastline appears longer as shorter rulers are used because more small features are included. Canada has the longest coastline of any country. The 1996 Canadian Encyclopedia gives the length as 243,797 km, including major island coastlines while the 1997 Guiness Book of Records gives a figure of 244,800 km, including islands.

4 - 6 April

The Shell Oil Company 'Mars' tension leg offshore oil production platform, installed in April 1996, stands in 896 m of water in the Gulf of Mexico. This is the tallest production platform. The first offshore oil well was drilled in 1896 off the coast of California. Every day more than 10 billion barrels of oil and gas, about 20% of the world's supply, is taken from seabed wells. This represents more than 90% of the mineral value presently taken from the sea.

3 - 7 May

Until recent improvements in electronic thermometers, the most reliable way of measuring deep ocean temperatures was to lower special mercury thermometers into the ocean attached to a wire. A weight is slid down the wire, causing the thermometer to flip over, and thus locking the temperature reading by isolating the column of mercury from the mercury reservoir. When the thermometer is returned to the ship the temperature can be read to an accuracy of 0.01°C. The effect of water pressure will cause false temperature readings in mercury thermometers. Oceanographers determine the pressure, and hence the depth, at which a temperature reading was taken by measuring the difference between the temperature from a thermometer protected from water pressure and the apparent temperature from an unprotected thermometer. In 1751, Henry Ellis, captain of the British slavetrader '*Earl of Halifax*' made the first recorded measurements of the temperature profile of the open ocean. He used a thermometer in a bucket fitted with flaps which trapped water when it was being raised, which he lowered to depths as great as 1,650 m. 50% of the water in the oceans is colder than 3.0°C, and has between 34.5 and 35.0 grams of salt per kilogram of water. Only 1.6% of the water in the world's ocean is warmer than 19°C. The deep water in the world's ocean is all cold, and must come from polar regions. The cold water under the warm surface layers in temperate and tropical latitudes is brought there by subsurface currents. This was recognized as early as 1797 by British scientist Count Rumford.

4 June

On June 4, 1793, Captain George Vancouver anchored in Echo Bay in Dean Channel, on the Canadian Pacific coast. The following month, July 22, Alexander Mackenzie reached the coast at the same spot, completing the first overland crossing of Canada.

10 - 12 July

About 97% of all the water on Earth is found in its oceans or as sea-ice. Icecaps and glaciers contain about 2%, groundwater about 0.6%, with soil moisture, rivers, lakes and the atmosphere containing the rest. About 334,000 cubic kilometres of water are evaporated from the ocean each year, to return as precipitation on land and sea. At this rate it would take about 37,000 years for all the water in the oceans to evaporate, pass through the atmosphere and return to the ocean as precipitation or via rivers. Aristotle (384-322 B.C) recognized that the process of evaporation and precipitation is a cycle in which the sea and its sources, the rivers, are continually renewed. In the second book of his *Meteorologica* he wrote: "we always plainly see the water that has been carried up coming down again. Even if the same amount does not come back in a year or in a given country, yet in a certain period all that has been carried up is returned".

1 - 4 August

It is possible to define, and measure, mean sea-level and to measure changes in sea-level as small as 1 mm per year. Sea-level is subject to numerous short-term changes, including tides, wind-generated waves, tsunamis, weather-induced storm surges and freshwater floods. Most of these pass within a few days, or are closely related to astronomic forces and thus predictable. World-wide changes in sea level can be caused by changes in the volume of water in the oceans or by changes in the size and shapes of the ocean basins. The most significant changes over periods less than a few million years are in the volume of water, due to the amount of water stored in ice caps. There were several 'ice ages' in the last 2 million years, with sea level changes of 100 m or more. Sea levels world-wide have risen about 90 metres in the last 18,000 years, as a result of the melting of the glaciers formed during the last ice age. 7,000 years ago sea level was about 15 metres lower than at present. If the remaining polar ice caps were to melt, sea level would increase by about 60 m. By the year 2100 sea level is expected to be between 31 cm and 110 cm higher than at present. The change is small compared to the changes over geological time, but the rate of change is high. A rate of sea level rise greater than 0.5 cm/year would exceed the rate at which river delta wetlands grow. A rate faster than about 1 cm/year would be faster than the upward growth of tropical coral reefs.

15 December

From 350 to 225 million years ago there was only one ocean and one continent. The present continents were all clustered together into a single land mass, Pangea, surrounded by a single ocean, Panthalassa. Pangea began to break up about 200 million years ago.

31 December

Nearly half the world's population lives on or near coasts. Their activities affect the ocean in many ways, altering the amount and timing of fresh water inflows, introducing contaminants deliberately and accidentally, and changing the ecosystem through fishing and destruction of fish habitat. They are also vulnerable to the effects of these and other changes in the ocean: storm surges, tsunamis, sea level rise, contaminated marine organisms, loss of potential for tourism, depletion of marine resources.

1998 - Année internationale des Océeans - 1998

Capsules pour l'année (quelques extraits seulement)

1er janvier

L'Année internationale des océans débuta à la ligne internationale de changement de date établie par accord international. La ligne correspond approximativement au méridien de longitude 180 degrés, qui traverse presque entièrement les océans Arctique et Pacifique. Chaque nouveau jour se lève donc en mer.

7 - 9 février

Les côtes du monde s'étirent sur environ 504 000 km, une distance qui suffirait à encercler l'équateur 12 fois. La longueur apparente d'une côte dépend de l'échelle utilisée pour la mesurer. Une côte semblera plus longue si l'échelle est petite parce qu'un plus grand nombre de petits éléments sont inclus. Le Canada possède le plus long littoral du monde. D'après l'édition 1996 de *l'Encyclopédie du Canada*, il s'étend sur 243 797 km, y compris le littoral des grandes îles, tandis que l'édition 1997 du *Livre Guinness des records* le situe à 244 800 km, y compris les îles.

3 - 7 mai

Avant le perfectionnement récent des thermomètres électroniques, le moyen le plus fiable de mesurer la température des eaux océaniques profondes était de faire descendre dans l'eau un thermomètre à mercure spécial attaché à un filin. On laissait alors glisser un poids le long du filin pour renverser le thermomètre, ce qui provoquait la séparation temporaire en deux parties de la colonne de mercure. Lorsque le thermomètre était remonté à la surface, la température pouvait être lue à une précision de 0,01 °C. L'effet de la pression de l'eau cause de fausses lectures de la température prise avec un thermomètre à mercure. Les océanographes déterminent la pression, et donc la profondeur d'immersion, à laquelle la température a été relevée en mesurant la différence entre la température prise avec un thermomètre protégé, indéformable à la pression, et la température apparente relevée avec un thermomètre non protégé. En 1751, Henry Ellis, capitaine du navire britannique *Earl of Halifax*, utilisé pour la traite des esclaves, effectua le premier profil enregistré de la température de la grande mer. Il utilisa un thermomètre installé dans un seau muni de volets, qui se remplissait d'eau lorsqu'il était remonté à la surface. Il a ainsi pu mesurer la température de l'eau jusqu'à une profondeur de 1 650 m. La température de 50 % de l'eau océanique, qui contient de 34,5 à 35,0 g de sels par kg, est inférieure à 3 °C. Seul 1,6 % de l'eau océanique est de température supérieure à 19 °C. Comme toutes les eaux profondes des océans sont froides, elles doivent donc venir des régions polaires. L'eau froide s'étendant sous les couches de surface chaudes aux latitudes tempérées et tropicales y est transportée par des courants sous-marins. Ce fait a été reconnu dès 1797 par le scientifique anglais Count Rumford.

10 - 12 juillet

Les océans et les glaces de mer contiennent environ 97 % de toute l'eau de la Terre. Les calottes polaires et les glaciers en contiennent environ 2 %, les eaux souterraines, environ 0,6 %, et l'eau du sol, les cours d'eau, les lacs et l'atmosphère, le reste. Environ 334 000 km^3 d'eau s'évaporent des océans chaque année, pour retomber sous forme de précipitations sur la terre et la mer. À ce taux, il faudrait à peu près 37 000 ans pour que toute l'eau des océans s'évapore dans l'atmosphère et revienne à sa source sous forme de précipitations ou via des cours d'eau. Aristote (384-322 av. J.-C.) reconnut que le processus de l'évaporation et des précipitations est un cycle permettant à la mer et à ses sources, les cours d'eau, de se renouveler continuellement.

1er- 4 août

Il est possible de définir, et donc de mesurer, le niveau moyen de la mer et de mesurer des changements du niveau de la mer aussi faibles que 1 mm par année. Le niveau de la mer est sujet à de nombreux changements à court terme, y compris les marées, les vagues de vent, les tsunamis, les marées de tempête et les inondations. La plupart de ces phénomènes disparaissent après quelques jours ou, parce qu'ils sont étroitement liés aux forces astronomiques, sont prévisibles. Les changements du niveau de la mer à l'échelle du globe peuvent être causés par des changements du volume d'eau dans les océans ou par des changements dans la taille et la forme des bassins océaniques. Le volume de l'eau accuse les changements les plus importants sur des périodes de moins de quelques millions d'années à cause de la quantité d'eau emmagasinée dans les calottes polaires. Il y a eu plusieurs époques glaciaires au cours des 2 derniers millions d'années, accompagnées de changements de 100 m ou plus du niveau de la mer. Les niveaux de la mer à l'échelle mondiale ont monté d'environ 90 m au cours des 18 000 dernières années suite à la fonte des glaciers formés au cours de la dernière période glaciaire. Si les calottes polaires restantes fondaient, le niveau de la mer monterait d'environ 60 m. On s'attend à ce que le niveau de la mer en 2100 soit de 31 à 110 cm plus élevé qu'à l'heure actuelle. Le changement est faible par rapport aux changements au cours des temps géologiques, mais le taux de changement est élevé. Un taux d'élévation du niveau de la mer plus élevé que 0,5 cm/année dépasserait le taux auquel les terres humides des deltas fluviaux s'agrandissent. Un taux supérieur à environ 1 cm/an serait plus élevé que le taux de croissance verticale des récifs coralliens tropicaux.

15 décembre

Il y a de 350 à 225 millions d'années, il n'y avait qu'un seul océan et un seul continent. Les continents actuels étaient tous regroupés en une masse continentale unique, dite la Pangée, entourée d'un océan unique, ou Panthalassa. La Pangée a commencé à se diviser il y a environ 200 millions d'année.

31 décembre

Presque la moitié de la population du monde vit en bordure des littoraux ou à proximité. Ses activités influent sur l'océan de bien des façons, modifiant le moment et la quantité des apports d'eau douce, y introduisant délibérément et accidentellement des contaminants et modifiant les écosystèmes par la pêche et la destruction de l'habitat du poisson. De plus, cette population est elle-même vulnérable face aux effets de ces modifications et d'autres changements qui se produisent dans l'océan : les ondes de tempête, les tsunamis, les hausses de niveau de la mer, les organismes marins contaminés, la perte de potentiel de tourisme, l'épuisement des ressources marines.

In Memoriam

George Henry Gilbert (1912-1998)[1]

George Gilbert was born and raised in a farming family in England, and the love of gardening stayed with him all his life. He studied mathematics at Exeter University, and later added an honours degree in Physics. In 1938, with the war looming on the horizon, he trained as a meteorologist and then taught air navigators, first in England and later at Port Albert, Ontario to where the school was moved under the Commonwealth Air Training Plan.

George continued to teach in Canada until the end of the war, having got married in 1942 and established his first Canadian garden in Goderich, Ontario. During that time the Canadian Meteorological Division published an article that he contributed, as an RAF meteorological officer, on the weather of south-western Ontario with special reference to the Port Alfred airfield. In 1945 he moved with his young family to London, England, working with the Meteorological Office and planting his garden at a bomb-damaged house. But in 1948 the difficult food and living conditions motivated them to emigrate to Canada where his wife's family lived.

Gander, Newfoundland, became George's work place (forecasting for aviation) and home for five years, and even there he kept gardening despite the thin rocky soil, introducing his neighbours to the hitherto unknown luxury of leaf lettuce. In 1953 he was seconded to the Defence Research Board in Ottawa where he stayed for 16 years, involved in studies of the influence of atmospheric conditions on blast damages caused by explosions, and of damages caused by sound-waves. A paper on the latter won him the best paper of the year award from the Royal Meteorological Society, Canadian Branch, in 1962.

In 1969 George moved to the Research and Training Division of the Meteorological Branch in Toronto, and while many of his research papers were classified, half a dozen or so were published. In addition to doing much important scientific work, he infected many of his colleagues with his love for gardens and gardening, which is so closely connected to weather and climate. He continued gardening even in the colder climate of Edmonton where he went to live after his retirement in 1973. On October 11, 1998, one of his grandchildren found him stretched on the grass, gardening in the only way he had energy for that morning.

Uri Schwarz,
CMOS Executive Director Emeritus

[1] Based on an obituary published in the Globe and Mail (9 November 1998) written by his daughter Barbara Ross, and material provided by Morley Thomas, the CMOS Archivist.

Tertia Hughes (1967-1998)

As the CMOS community has now probably heard, Tertia Hughes tragically died on Monday, November 23, 1998 in Woodstock, Ontario. Many of us knew Tertia as a friend and a colleague.

Tertia Hughes was born in Ottawa, Ontario, on July 24, 1967, the third of five children, to Donald and Pattice Hughes, now living in Stratford, Ontario. At the age of 6 weeks she moved with her family to Québec where she spent her childhood years and attended Secondary School at the Collège Jésus-Marie de Sillery in Sillery, Québec. She entered CÉGEP Champlain Regional College in Ste-Foy, Québec upon her graduation in 1983. While in CÉGEP it became clear to both Tertia and her instructors that she was a gifted scientist. She received her Diplôme d'études collégiales (DEC) in 1985 along with a prestigious graduation award for academic excellence, and a Université Laval entrance scholarship. It was at the Université Laval where she completed her first year of university studies. In 1986 Tertia moved back to Ottawa and completed her Honours BSc in Physics and Mathematics at the University of Ottawa. Her undergraduate awards, bursaries and fellowships at the University of Ottawa are too numerous to list here but one particular example summarizes her accomplishments. In 1989, upon graduation, she was awarded the Silver Medal for academic excellence from the Faculty of Science. This prestigious award is given to the student with the top graduating grade point average in all areas of Science. A quick browse through Tertia's University of Ottawa transcript clearly shows why she received this, having obtained 28/28 first class marks, with 22 of these being an A+.

Tertia was also a valuable member of several research groups during the summer months of her undergraduate years. In both 1987 and 1988 she worked with Dr. Michel Leclerc at the Institut national de la recherche scientifique - Eau, at the Université du Québec, partially supported by NSERC Summer Undergraduate Research Awards. In discussions with his colleague Peter Campbell at INRS, Dr. Leclerc recently reminisced about Tertia's work with enthusiasm, recalling her as a very gifted student: "the kind you try to attract to do graduate work". Tertia's work with Dr. Leclerc coincided with his decision to launch a new research project on the hydrodynamics of fish habitats in salmon rivers. Tertia participated in his first probings into what was then an unexplored area. Dr. Leclerc very recently was honoured by the INRS for his pioneering work in this area, and at the awards ceremony on November 28, 1998 he mentioned the exceptional support that he had enjoyed from the various students, including Tertia, who had worked with him over the past decade.

In the summer of 1989, immediately prior to undertaking graduate studies at McGill, Tertia worked with

Dr. K. Grønskei at the Norwegian Institute for Air Research, examining issues concerned with the dispersion of airborne pollutants. This overseas summer research position was sponsored by the International Association for the Exchange of Students for Technical Experience.

Tertia arrived at McGill University in September 1989 holding an NSERC postgraduate fellowship, having declined a McGill Women's Centennial fellowship. This was the same time as Andrew Weaver joined the Department of Meteorology (later renamed the Department of Atmospheric and Oceanic Sciences). It was in the second term of her first year at McGill that Andrew met Tertia as the instructor of Met 558B (Numerical Methods in Atmospheric and Oceanic Sciences). She received the top mark in this class, and a first class mark in every other class she took at McGill both during her MSc and PhD. Once her course work was completed Tertia chose to undertake her MSc research working under his supervision. She analysed some numerical results concerning the effects of Indonesian throughflow on the thermohaline circulation of the Indian Ocean and completed her thesis in record time (about 6 months). The external examiner for her MSc thesis, Mike Foreman at IOS, was so impressed with her research, and background review that he suggested the thesis be nominated for the CMOS Graduate Student Prize, which she was indeed awarded at the CMOS Congress Winnipeg, Manitoba in 1991.

Tertia started PhD research in the Department of Atmospheric and Oceanic Sciences, McGill University, immediately upon completing the requirements for the MSc. She began this by writing a literature review on the role of the ocean in climate. Andrew was so impressed by this review that he asked her to join him as a co-author for a review article he had agreed to write. In the first year of her PhD, it had become clear to him that Tertia was more like a colleague than a student. In 1992, Tertia along with Paul Myers and Andrew all moved out to the School of Earth and Ocean Sciences, University of Victoria, where Andrew had accepted a faculty position. Shortly afterward another friend from her McGill days, Daniel Robitaille, joined the group in Victoria.

She completed her PhD thesis in 1995 and remained at UVic as a Research Associate for a further 9 months. Her PhD research was once more supported by two major national fellowships: an NSERC Postgraduate Fellowship (1991-1993) followed by an Eco-Research Tri-Council (NSERC/SSHRC/ MRC) Doctoral Fellowship (1993-1994). During her PhD Tertia examined a number of questions concerning the stability and variability of the thermohaline circulation and atmosphere/ocean model coupling. She also struck up a collaboration with Dan Wright at BIO in order to compare her model output with theoretical analyses in order to develop improved closure parameterizations for zonally-averaged models. Rather suprisingly, as a PhD student, she was already starting to be asked to review numerous manuscripts for scientific journals. During her years at UVic Tertia developed many close and life long friends including Salil Das, Augustus Fanning, Warren Lee, Benyang Tang, Sophie Valcke, Trudy Wohlleben. She was an active organiser of social events within Andrew's group: never a birthday went by without Tertia bringing in a cake and a card for all to sign. She also organized going away parties for people, baby showers, and lab get togethers.

In January 1996, Tertia moved to Princeton University to work with Jorge Sarmiento and his group on modelling the carbon cycle and climate. She immediately immersed herself into her new job with the same enthusiasm, energy and dedication that she showed in her graduate and undergraduate days. She developed a deep understanding of the ocean carbon cycle and was the lead investigator in a collaborative project with Ron Stouffer and Suki Manabe to study the response of the ocean carbon cycle to anthropogenic climate warming in the GFDL coupled model. This included a major contribution towards the development of the next generation of the GFDL coupled model. She was also playing a key role in the development of a new ocean circulation model for carbon cycle and tracer studies. Her simulations of the ocean carbon cycle and tracer distributions were widely used by members of the Carbon Modeling Consortium, as well as for international model comparison studies being carried out by the International Geosphere-Biosphere Project. She leaves behind many close friends at Princeton and GFDL (all the members of Sarmiento's group, Ron Stouffer, Barbara Winter and many others).

Tertia will not only be remembered for her warmth and kindness, but will also be remembered through her scientific publications and theses. These can be viewed at http://wikyonos.seos.uvic.ca/people/hughes/pubs.html.

We would like to add that Tertia was one of the most remarkable people we have ever had the privilege of working with. She was extraordinarily bright and energetic, easily accomplishing the work of several people. We have seldom known anyone to be so cheerful and enthusiastic for everything that we worked on together. Her sense of humor was a real delight and her scientific contributions were truly outstanding.

Jorge's last review of her was so extraordinary that the Associate Dean of the Faculty told him that he wanted to raise her salary even more than the high level he had already recommended. This was an extremely rare event as normally the situation was the opposite - Jorge wanting to raise the salary, and the Dean wanting to lower it.

Prepared by Andrew J. Weaver and Jorge L. Sarmiento
University of Victoria

P.S. Read CMOS Tribute to Tertia Hughes at page 167.
Lisez l'Hommage de la SCMO à Tertia Hughes à la page 167.

Letters to the Editor

Edmonton Tornado and Hailstorm

My co-authors and I are thoroughly pleased with the Special August 1998 issue of the *CMOS Bulletin SCMO*. With your bold leadership and that of Tim Goos at Environment Canada, Prairie and Northern Region, our booklet on "The Edmonton Tornado and Hailstorm" might become the first in a series of memorable dissertations on important Meteorological and Oceanographic events. M.O.M. Printing in Ottawa should be congratulated for their essentially perfect production work.

The colour photographs on the cover and centre pages were submitted with very brief descriptions in the, perhaps vain, expectation that CMOS members would try reading the text to discover why each image was included within the manuscript. Nevertheless, all but one of the colour photographs had ever been published before. The Lee Mason Tools photograph was submitted to Macleans Magazine and subsequently published in their short article commemorating the tenth anniversary of the Edmonton tornado. The identities of the three people in that photograph are unknown. Drs. Myron Oleskiw and Lawrence Cheng, both successful meteorologists and U. of Alberta graduates, are seen in the Sterling Crane photo. Dr. Marianne English, a McGill graduate and local expert on severe weather and environmental meteorology, is seen with the far-flung V-8 engine. André LaChapelle, a local weather forecaster and U. of Alberta graduate, is seen commenting to the unidentified reporter. Finally, it is understandable that Paul-André Bolduc did not recognize that the places given on the front cover are suburbs of Edmonton. All of the photographs on the front cover depict the Edmonton tornado. After all, I could not name a single suburb of Ottawa with any degree of confidence.

The interdisciplinary aspects of our research led us into some fields in which we are certainly not experts, for instance, shingle engineering and corporate insurance, but we could not resist reporting our perceptions. Alan Wood of the Edmonton branch of the Insurance Bureau of Canada suggested recently that on page 40, we might have deleted the comment that hints at the difference between liability claims and property claims resulting from the Saguenay floods. We agree with him. He also pointed out that the insured loss due to the January 1998 ice storms actually exceeded one billion dollars and that, in addition to food spoilage, business income loss should be mentioned as a substantial part of that figure. These corrections also apply to page 40.

CMOS members should be aware that The Institute for Catastrophic Loss Reduction (ICLR) was established this year with the mission to reduce the loss of life and property caused by severe weather and earthquakes. It was created under the leadership of the Insurance Bureau of Canada with offices in Toronto (Suite 1800, 151 Yonge Street, M5C 2W7. My contact is Alan Pang, (416) 362-2031, ext. 342, Fax: 362-2602, e-mail apang@ibc.ca. The ICLR, with Emergency Preparedness Canada, are co-hosting a series of regional workshops across the country during the autumn of 1998. Approximately sixty key individuals representing the major stakeholder groups (i.e., private sector, non-profit organizations, academia, and three levels of government) attend each workhop where the goal is to define a hazard mitigation framework for Canada. After reporting to the Federal and Provincial Ministers responsible for Emergency Preparedness, a National Conference with a broader audience will be held in Toronto in December 1998. It is hoped that in the future the ICLR will act as a national forum through which CMOS members can contribute toward reducing the loss of life and property caused by natural disasters in Canada.

Robert Charlton,
Edmonton, Alberta.

Update Digital Atmosphere

In the summer of 1946 one of my boyhood dreams came true: I saw a weather map being drawn. During a high-school excursion to the Koninklijk Nederlands Meteorologisch Instituut in the Dutch town of de Bilt, I looked over the shoulder of a forecaster entering station plots and fronts on a large map of Europe. The station plots alone took two hours, he said.

Surface plots and isobars were old hat even then: several appear in my German-language textbook *Meteorologie*, second edition 1890, by K. Mohn, then head of the Norwegian weather office. Computers already existed in 1946, but they did not draw pictures.

Today high-school students and airline pilots alike can get surface analyses and much more on the Internet, typically based on observations taken a little over an hour ago. However, all are based on somebody's idea of what's relevant. Many professional meteorologists and perhaps some hardy amateurs still like to perform their own analyses, but few relish the laborious interpolation needed for isopleths (lines that connect points of equal value, like isobars). To them I recommend Digital Atmosphere (DA), a program that collects observations from the Internet and draws what the user wants to see.

DA is the brainchild of Tim Vasquez, a former US Air Force meteorologist who lives in Norman, Oklahoma. His company, Weather Graphics Technologies of Garland, Texas, also sells other weather products. Myself, I find DA a diamond in the rough. Where you put the accent in that phrase depends on your computer literacy – mine being moderate. The package shines in its ability to customize and combine maps. Thus you can overlay your favourite

parameters, including but not limited to isobars, isodrosotherms (lines of equal dewpoint), and wind barbs for the region of your choice, based on the latest hourly METARs (aviation weather reports) and synoptical reports. That is as fresh as you can get, but wait until 30 minutes past the hour to give the stragglers a chance. Isopleth spacing and colouring are up to you, a great plus. For such tweaking you must edit the chart defaults, which appear in an ASCII file.

DA is a work in progress, with several irritants, or improvement opportunities for the politically-correct. It labels isopleths only at the edges of the screen. That leaves you wondering about "islands": are the values there higher or lower than those of the nearest edge-labelled ones? Adding insult to injury, the last digits of isobar labels overflow my screen in both millibar and inch mode. I mainly use DA's North American map, but you can also see other parts of the world. However, European weather patterns often look far too regular – suggesting a paucity of data there.

My greatest wish for DA is to see it store isopleths and then show their changes, movie-fashion, in looped displays. Then I would not need total recall to see that a deepening Alberta Clipper is coming my way. DA comes with an on-disk manual that lacks an index and fails to fill my knowledge gaps. In fairness, so does Microsoft's 1,400-page bound Windows 95 Resource Toolkit. Both otherwise overflow with answers to which I do not have the questions.

I have not found how to print DA maps on my Canon BJC-4000 bubblejet. Vasquez plans to improve his admittedly "quirky" driver. Meanwhile, DA has strong defenders. I first heard of it from an acquaintance at WSI Corporation, which supplies the excellent Intellicast weather maps on the Internet. A homepage of the American National Weather Service prominently mentioned DA last summer (no faint praise; I doubt the NWS takes advertisements). John O'Reilly, a former supervisor with Canada's Atmospheric Environment Service (AES) and now a meteorological consultant, has used DA since its early versions and found workarounds for most of its shortcomings. He adds that Vasquez has acted on most of his suggestions.

As a Canadian I missed the Humidex*, the marvellously-realistic summer-discomfort index by AES's Joan Masterton and Fred Richardson. Vasquez told me he plans to incorporate it. Besides do-it-yourself weather-mapping, DA has two other major functions. First, it offers a good suite of climatological data, frozen in time. Second, it lets you fetch many current weather charts from third-party Internet sources. Enough rich websites already serve the latter purpose, e.g. www.ontarioweather.com and www.dispatcher.org, the site of the Airline Dispatchers Federation. Besides, several of DA's imported pages overflow my screen. Perhaps I should get a 20-inch model.

You can download a free, fully-functional, time-limited demo of DA from Weather Graphics' website, www.weathergraphics.com. The undying version costs US$73 downloaded and $US78 plus shipping via mail.

Sander Schimmelpenninck, M.A.
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Volunteer observer for AES
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* Humidex, by J.M. Masterton and F.A. Richardson, AES Downsview, Ontario, 1979.

The humidex equals T + 5/9*(e-10), where T = temperature in degree Celsius and e = vapour pressure in millibars.

Job! Job! Job! Job!

I am working for a French TV production company, called Tele Images Nature, specialized in wild life documentaries. Right now, I am preparing our new serial on the Polar Region (Canada). For the filming, I need a young scientist (around 25-30 years old, good-looking) TV criteria for he or she would be one of the three heros of the documentary, specialized in glaciation. The filming will start in March 1999 and wil last 5 or 6 months. During that time, our hero will be able to carry on his own research. If you are interested in this project, please provide your name and address. I need this person very soon. He or she should send me a photograph and a reference paper with name, address, age and education.

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"Océans et changements globaux"[1]

Québec, Qué.
les 28 et 29 octobre 1998

avec la collaboration de
G.Cantin, M. Castonguay, M. Fréchette,
M, Levasseur, S. Michaud et A. Vézina

Cette conférence, tenue à l'Université Laval dans le cadre de la série annuelle des Forums québécois en sciences de la mer, se voulait l'événement majeur au Québec pour marquer l'Année internationale des océans et a été sans contredit un grand succès. Le Dr Louis Fortier, directeur général du GIROQ, a souhaité la bienvenue aux quelque 200 participants venus de diverses régions de la province, dont plusieurs de l'Institut Maurice-Lamontagne, pour entendre des conférenciers de haut calibre livrer des présentations d'une qualité exceptionnelle (voir le programme dans *Nouvelles des Sciences* 9 (16): 9-10). La session d'affichage, couplée à une réception le premier soir, a permis à tous d'échanger tout en se renseignant sur les travaux entrepris par les étudiants des différentes institutions représentées. Le concours d'affichage a permis de distribuer cinq bourses de 250$ aux auteurs des meilleures présentations. Le colloque était organisé par le GIROQ avec l'appui des partenaires suivants: GÉOTOP, IML, INRS-Océanologie, MAPAQ et UQAR. Un soutien financier important a été accordé par le Ministère de l'Industrie, du Commerce, de la Science et de la Technologie.

Le premier conférencier du Forum était le professeur **Daniel Pauly** du prestigieux "Fisheries Centre" de l'Université de la Colombie-Britannique. La conférence du Dr Pauly portait sur la comparaison de 1950 à 1994 des niveaux trophiques moyens des débarquements des pêches mondiales, tels que rapportés dans les statistiques de la FAO. La calcul des niveaux trophiques moyens provient de la modélisation trophique Ecopath, basée sur l'alimentation des espèces dans les différents écosystèmes de tous les océans. Le Dr Pauly nous a démontré que les niveaux trophiques moyens des prises mondiales ont graduellement diminué au cours des 50 dernières années, ce qui reflète une transition graduelle de prises dominées par les poissons de fond prédateurs à grande longévité vers des prises à faible longévité et à bas niveau trophique. La réorientation de l'industrie du poisson de fond de l'est canadien vers les pêches d'invertébrés comme la crevette a été cité comme exemple d'un tel phénomène. Cette baisse de niveau trophique des prises est particulièrement marquée dans l'hémisphère nord. Le Dr Pauly a fait ressortir que cette exploitation des ressources n'est pas soutenable et que des mesures énergiques devront être mises de l'avant pour éviter que les ressources halieutiques mondiales ne soient décimées. Pour les intéressés, cette étude a été récemmert publiée dans la revue Science (6 février 1998, pp. 860-861).

Le **Dr Maurice Héral** (CREMA-l'Houmeau, IFREMER) a, de son côté, brossé un tableau de la production aquicole mondiale des espèces animales. Son analyse fait ressortir que la part de la production aquicole à la production totale ne cesse d'augmenter. Les principales productions sont les crevettes panéidées, les mollusques et les salmonidés. Plusieurs de ces productions ont été développées avec succès pour remplacer des stocks naturels surpêchés ou décimés par des agents pathogènes. A ce titre, des exemples de succès éclatants sont l'élevage du pétoncle au Japon (un tiers de million de tonnes par an) ou la relance de la production d'huîtres dans la région de Marennes-Oléron (environ 40 000 tonnes produites annuellement).

Si un grand nombre de ces productions sont des succès commerciaux indiscutables, certaines posent des problèmes réels ou potentiels à l'environnement. Certains de ces problèmes sont dus au caractère exagérément intensif de certaines productions ou à des pratiques de gestion incorrectes, et ne sont pas en soi inhérents à l'aquaculture. Toutefois le Dr Héral a fait valoir que certaines productions exigeront des efforts de recherche extrêmement ciblés, si ce ne sont des réorientations majeures. Ainsi, on aurait tout intérêt à privilégier la production d'espèces de poissons herbivores plutôt que celles exigeant de grandes quantités de farine et d'huile produites à base de... poisson! Un autre aspect de la question est le transfert de technologies exigeantes du point de vue de l'environnement vers d'autres pays où la réglementation est moins stricte. Les axes de recherche à privilégier portent sur les diètes et l'efficacité de l'alimentation, la génétique des cheptels et les relations aquaculture-environnement.

Dans le contexte des changement climatiques liés à l'effet de serre, le **Dr Jean-Claude Duplessy** (Centre des faibles radioactivités, CNRS/CEA, France) a présenté en soirée une conférence fort intéressante mettant en relief les relations étroites entre la circulation océanique et le climat. Le conférencier nous a d'abord entretenus des variations passées de notre climat. La composition isotopique de l'oxygène des foraminifères présents dans les sédiments marins et la calotte glaciaire du Groenland permet de retracer l'évolution du climat de 900 000 ans à nos jours. On y détecte évidemment les grandes oscillations climatiques comme celles engendrées par la dernière glaciation, mais également de brusques changements à de très courtes échelles temporelles de l'ordre de la décennie. La petite ère glaciaire qui a frappé l'Europe au Moyen Âge

[1] Compte-rendu présenté dans Nouvelles des Sciences, Institut Maurice-Lamontagne, Vol.9, No.18, p.3-6. Publié avec la permission du Rédacteur.

est un bel exemple de ces variations brusques du climat. Le climat de notre planète est de toute évidence plus dynamique que ce que l'on croyait.

Selon le conférencier, les océans ne seraient pas étrangers à ces variations brusques du climat. Les océans accumulent la chaleur et les grands courants océaniques la redistribuent. Le golfe Stream, extension nord-atlantique de la grande circulation globale océanique ("convoyer belt"), illustre bien ce transport de chaleur des basses latitudes vers les hautes latitudes. L'analyse de la composition minérale et biologique des sédiments profonds de l'Atlantique a révélé l'existence de variations importantes de l'intensité de ce grand courant océanique, variations coïncidant avec des périodes de refroidissement du climat en Europe.

Dans ce contexte, comment l'effet de serre pourrait-il modifier le climat planétaire? Monsieur Duplessy nous a d'abord rappelé que l'effet de serre est un phénomène naturel. Sans l'effet de serre, la température moyenne du globe serait de -16°C, les océans seraient gelés et il n'y aurait probablement pas de vie sur terre. L'augmentation des concentrations en gaz à effet de serre depuis le début de l'ère industrielle a cependant altéré de façon significative le bilan radiatif de la terre. Un effort considérable a été consacré à la modélisation de l'influence de ces émissions sur notre climat. Malgré certaines divergences locales, tous les modèles prédisent un réchauffement. L'influence du réchauffement planétaire sur la circulation océanique peut cepandant moduler cette réponse. Ainsi, on prévoit que l'altération de la circulation des eaux de surface dans l'Atlantique nord résulterait en une augmentation plus faible des températures en Europe (8°C) qu'en Amérique du Nord (16°C) au cours des prochains 100 ans. Finalement, Monsieur Duplessy soulignait que malgré les diminutions prévues des émissions anthropiques, la hausse des températures semble irréversible pour le prochain siècle et que 100 000 ans devront s'écouler avant que toute trace du réchauffement actuel disparaisse!

Le lendemain, le **professeur David Barber** de l'Université du Manitoba. a traité de la cryosphère arctique en évolution, sujet d'intérêt certain pour le Canada. Il a décrit comment la couverture de neige sur la glace de mer joue un rôle primordial dans les échanges de masse et d'énergie à travers les interfaces océan - glace de mer - atmosphère (cryosphère). Les échanges de rayonnement à ondes courtes dominent le mécanisme de rétroaction "glace de mer - albedo" en raison du fort albedo de la neige. D'un point de vue écologique, cette dominance se manifeste dans une bande étroite de radiation photosynthétiquement active utilisable par les producteurs primaires vivant sous la glace. L'adaptation évolutive de ces organismes est donc dépendante de conditions géophysiques et énergétiques précises, du système physique de la cryosphère. Quand ce système physique sort de ces limites précises, toute la chaîne trophique en est pertubée. La neige joue un rôle déterminant d'un point de vue thermodynamique dans l'accrétion et l'ablation de la glace de mer à cause de sa conductivité relativement faible. Les variations spatio-temporelles des chutes de neige semblent avoir des conséquences significatives sur l'équilibre thermodynamique de la glace de mer.

Les propriétés radiatives et thermodynamiques de la neige deviennent importantes dans le contexte d'un changement climatique. Les simulations de réchauffement climatique montrent que les régions polaires seraient des indicateurs plus sensibles que les régions tempérées dans l'amplitude ou la détection du changement climatique. La compréhension du rôle fondamental que joue la couverture de neige dans le budget énergétique global de la cryosphère reste cependant à préciser puisque, par exemple, plusieurs modèles et études empiriques donnent des résultats contradictoires selon le signe et l'amplitude du mécanisme de rétroaction glace de mer - albedo considéré. Le professeur Barber a illustré sa présentation des résultats des travaux entrepris sur la polynie du Nord entre le Canada et le Groenland. L'animation qu'il a mise au point par ordinateur de la formation et de la fonte des glaces de mer sur un cycle annuel dans cette région fût très appréciée.

Le **Dr Jean-François Minster**, directeur du INSU/CNRS en France, a clôturé le Forum avec une présentation sur le satellite altimétrique TOPEX/POSEIDON et son utilisation dans la recherche sur le climat. TOPEX/POSEIDON a été lancé conjointemont par la France et les États-Unis en 1992 et mesure depuis l'élévation du niveau de la mer (à 4 cm près!) partout sur le globe. Ceci permet en retour de déterminer la vitesse et l'orientation des courants et de suivre le déplacement des grandes ondes océaniques à l'échelle du globe. Démontrant une rare maîtrise d'un sujet très complexe, le Dr Minster a clairement expliqué les principes de l'altimétrie et il a passé en revue les 20 ans de recherche qui ont été nécessaires pour arriver à obtenir des mesures aussi précises. Il a démontré comment les données fournies par TOPEX/POSEIDON, combinées à des modèles dynamiques de l'océan, permettent de prédire l'évolution des fronts et des tourbillons marins. Ces tourbillons sont l'équivalent océanique des systèmes atmosphériques qui nous sont familiers. Ils peuvent avoir des impacts importants sur la productivité marine entre autres. Le Dr Minster a ensuite montré comment TOPEX/POSEIDON permet de mieux comprendre le phénomène El Niño. Par exemple, les mesures altimétriques, en décrivant l'évolution de la surface de la mer sur tout un cycle El Niño, ont permis d'améliorer les modèles existants du phénomène. La démonstration d'ondes (dites de Rossby) qui sont produites par les El Niño et qui se propagent sur tous les océans pendant des décennies était particulièrement remarquable. Ainsi, un changement océanographique au large de nos côtes pourrait être dû à un El Niño qui ce serait passé 10-15 ans auparavant! Nul doute que l'altimétrie satellitaire jouera un rôle crucial dans la surveillance des océans et du climat, tant aux échelles locales qu'aux échelles globales.

Somme toute, un Forum qui a permis de prendre du recul et de discuter de la situation planétaire des océans à un moment où des changements importants du climat affectent la biosphère. Une occasion unique de rencontrer des conférenciers compétents et avides d'échanger avec collègues et étudiants.

WOCE Scientific Conference

Halifax, N.S.
May 24-29, 1998

Report by Allyn Clarke

The Department of Fisheries and Oceans (DFO) and the Canadian Meteorological and Oceanographic Society (CMOS) sponsored the World Ocean Circulation Experiment's scientific conference on Ocean Circulation and Climate at the World Trade and Convention Centre in Halifax, May 24-29, 1998. This conference marked the first time that the scientific community that undertook the WOCE Field program (1990-1997) has met to display and discuss the global data sets. Over 380 scientists from 30 nations attended the conference which was sponsored internationally by the World Climate Research Programme (WCRP), the Intergovernmental Oceanographic Commission (IOC) and the Scientific Committee on Ocean Research (SCOR). Wayne Easter, the Parliamentary Secretary to the Minister of Fisheries and Oceans welcomed the participants to Canada and the conference on behalf of DFO.

The Conference adopted the format developed by WOCE Society. The first and the last day as well as the mornings of Tuesday through Thursday were devoted to plenary talks designed to review the progress achieved (and not achieved) in the various areas of the WOCE scientific agenda. Tuesday to Thursday afternoons were devoted to posters. Because of the large space available in the Conference Centre, all 300 posters remained on display throughout the conference and particular posters became community blackboards as groups of scientists in debate on some issue of the global circulation would gather around a poster that had a particular relevant diagram. In spite of the beautiful weather outside, discussions continued in the poster area each evening well beyond 1800. Because of the quality and usefulness of the posters, International WOCE requested all authors to consider putting these up on their web sites and to provide the URLs to the WOCE project Office. Seventy-eight posters are available under the WOCE Conference through:

http://www.soc.soton.ac.uk/OTHERS/woceipo/ipo.html

The Conference was a very successful scientific meeting and marked a milestone for WOCE:

- The Conference celebrated WOCE's achievement of accomplishing so much of what was planned in the late 80s.

- The Conference brought observationalists and modellers in contact with each other's ideas, data products and capabilities as a step to encourage stronger collaborative studies during WOCE's analysis and interpretation phase (1998-2003).

- The Conference demonstrated the value of continuing some of the WOCE observations within the new programs, CLIVAR, GCOS and GOOS.

- The Conference highlighted the new space-based and in situ instrumentation that will be the foundation of future global ocean programs.

- The Conference highlighted advances (and deficiencies) in ocean modelling through the WOCE period.

All participants were provided with a set of 17 CD ROMs which contain the WOCE global data sets as received and quality controlled by the WOCE data management system up to early 1998. It is intended that an updated set of CDs will be issued in several years' time.

The overall progress of WOCE was reviewed by a series of plenary talks and commentators; however, the real breadth of the WOCE data set was displayed in nearly 300 posters. Scientists remained in the poster display discussing and sharing their ideas and results until well into the early evening. Many young scientists, post doctoral fellows and graduate students attended the conference suggesting that the next generation of scientists has already taken up the challenge of analyzing, interpreting and modelling this new data set.

The WOCE Scientific Conference demonstrated to the participants in WOCE how much was really accomplished by working together. It also provided a spur to continue and strengthen these collaborations to ensure that the WOCE datasets are fully exploited in analysis and models to improve our understanding of ocean circulation for the modelling and prediction of climate.

Call for Laboratory Sessions and Papers Sixth Workshop on Operational Meteorology

The Sixth Workshop on Operational Meteorology, sponsored by Environment Canada, will be held November 29 to December 3, 1999 in Halifax, Nova Scotia. The format of the workshop will be divided between presented papers and hands-on laboratory sessions to meet the following objectives:

- to share knowledge and experiences on the advances of operational meteorology;
- to promote research and development among operational forecasters;
- to provide an opportunity for interaction between the research and the forecast communities.

Papers

The Program Committee wishes to solicit papers on all aspects of operational meteorology, with a focus on knowledge, skills and techniques that assist the forecaster in preparing accurate and useful products. Papers will also be solicited from invited speakers. Due to the importance of hands-on laboratories, and the desire to limit concurrent sessions, the number of oral presentations will be kept to a minimum. Poster session(s) will be held, with an opportunity for authors to introduce their papers to the audience.

Laboratories

In addition, the Program Committee would like proposals for hands-on laboratory sessions. The laboratory sessions can vary in length from 1.5 to 3.0 hours in duration. Normally, the number of participants will be limited (25 or less), which may require more popular labs to be repeated. **Note:** Five grants of $2,000 (Cdn) will be given to support the preparation of high-quality lab sessions. (Preference may be given to non-Environment Canada and non-government agencies). In addition, five more grants will be made available for aviation-related laboratories to improve quality and service to NavCanada and its clients. Recipients of all grants will be notified shortly after the January 07 1999 deadline and will be expected to deliver a detailed outline and copy of materials being used before 30 March 1999.

Deadlines

Papers: Titles and abstracts of 250 to 500 words should be sent by 15 April 1999. Authors should indicate if they wish their submission to be considered for an oral presentation (a reminder that these will be limited). Abstracts will be evaluated according to their quality and relevance to operational meteorology. Authors will be notified by 1 June, 1999 of acceptance of their papers, and furnished with instructions regarding presentation and publication of their papers. Proceedings will be published and distributed subsequent to the workshop, with papers due at the time of the workshop in November 1999.

Laboratories: Proposals should be sent before 7 January 1999 to be considered for one of the $2,000 grants, and should detail the objectives and activities, along with the intended participant size. Proposals should also include a brief resumé to assure the committee of your track record in lab delivery. Proposals not being considered for the grants, are expected no later than 30 March 1999.

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Demande de communications et de séances en laboratoire Sixième atelier de météorologie d'exploitation

Le Sixième atelier de météorologie d'exploitation, parrainé par Environnement Canada, aura lieu du 29 novembre au 3 décembre 1999 à Halifax (Nouvelle-Écosse). On y présentera des communications et des séances pratiques en laboratoire, dans les buts suivants:

- partager les connaissances et expériences concernant les progrès de la météorologie d'exploitation;
- promouvoir la recherche et le développement parmi les météorologues d'exploitation;
- permettre l'interaction entre les milieux de la recherche et de la prévision d'exploitation.

Communications

Le Comité du programme sollicite des communications sur tous les aspects de la météorologie opérationnelle, l'accent étant mis sur les connaissances, les techniques et les compétences qui aident les météorologues à fournir un produit exact et utile. Des communications seront aussi sollicitées auprès des conférenciers invités. Compte tenu de l'importance des séances pratiques en laboratoire et du souci de réduire le nombre de séances simultanées, le nombre d'exposés oraux sera limité au minimum. Il y aura également des séances de communications affichées, dans lesquelles les auteurs pourront présenter leurs communications à l'auditoire.

Laboratoires

Par ailleurs, le Comité du programme sollicite aussi des propositions de séances pratiques en laboratoire. Celles-ci peuvent varier de une heure et demie à trois heures. Normalement, le nombre de participants à ces séances sera limité (maximum de 25), ce qui signifie qu'il faudra peut-être donner en reprise les séances les plus achalandées.

Remarque : Cinq subventions de 2 000 $ (can) seront allouées à la préparation de séances de laboratoire de haute qualité (la préférence pourra être accordée aux organisations qui ne relèvent pas d'Environnement Canada et aux organisations non gouvernementales). De plus, cinq autres subventions seront réservées à des séances de laboratoire axées sur l'aviation et visant à améliorer la qualité des produits et services destinés à NavCanada et à ses clients. Les personnes auxquelles des subventions auront été accordées en seront informées peu après l'échéance du 7 janvier 1999. Elles devront fournir, au plus tard le 30 mars 1999, une description détaillée de leur séance et des exemplaires des documents qui y seront utilisés.

Dates-limites

Communications: Les titres et des résumés de 250 à 500 mots doivent être envoyés d'ici le 15 avril 1999. Les auteurs doivent indiquer s'ils désirent que leur communication soit prise en considération pour une présentation orale (à noter que le nombre de celles-ci sera limité). Les résumés seront évalués en fonction de leur qualité et de leur pertinence par rapport à la météorologie d'exploitation. Les auteurs dont les communications auront été acceptées en seront informés d'ici le 1er juin 1999 et recevront des instructions sur la présentation et la publication de ces communications. Des comptes rendus seront publiés et diffusés après les ateliers, les communications à y figurer devant être fournies au moment de l'atelier, en novembre 1999.

Laboratoires: Les propositions doivent être envoyées avant le 7 janvier 1999 si leurs auteurs désirent être pris en considération pour l'octroi d'une des subventions de 2 000 $. Elles devront exposer les objectifs visés et les activités prévues, ainsi que le nombre de participants visé. Chacune de ces propositions devra également comprendre un bref curriculum vitae destiné à faire connaître au Comité les antécédents de l'auteur en matière d'exécution de séances de laboratoire. Les auteurs qui n'entendent pas solliciter de subvention sont priés de faire parvenir leurs propositions au plus tard le 30 mars 1999.

Adresse: Jim Abraham,
Président du Comité du programme
Environnement Canada
45 promenade Alderney
Dartmouth (N.-É.)
Canada B2Y 2N6
tél.: (902) 426-9134; fax: (902)426-9158
Courriel: jim.abraham@ec.gc.ca

Third WMO International Symposium on Assimilation of Observations in Meteorology and Oceanography

Québec City, Québec, Canada

7-11 June 1999

The Third WMO International Symposium on Assimilation of Observations in Meteorology and Oceanography will take place in Québec City, Canada from 7 June to 11 June 1999. Contributions to the symposium are sought on research in data assimilation related to operational applications, the use of satellite observations, and methodological aspects. The different components of the climate system will be covered, in particular the ocean/atmosphere circulation, atmospheric chemistry (stratosphere and troposphere), ocean biogeochemistry, and the continental biosphere. The symposium is organized by the World Meteorological Organization (WMO) with the co-sponsorship of various national and international scientific organizations. The working language will be English.

The symposium will be held at the Hotel Québec Hilton in the heart of Québec City. Accommodations will be available at the conference hotel, at smaller hotels within a few minutes walk, and at the residences of Laval University. Information on the scientific program, accommodations, travel to Québec City, and other topics will be posted on the symposium web site at the following address:

http://www.tor.ec.gc.ca/wmosymposium

Provisional registration is requested by ***5 January 1999*** and the deadline for submission of short abstracts is ***1 February 1999.*** Electronic registration and abstract submission is strongly encouraged; instructions can be found on the symposium web site. Information about registration and abstract submission by mail can be obtained at the following address:

Third WMO Symposium on Assimilation of Observations in Meteorology and Oceanography
c/o Data Assimilation and Satellite Meteorology Division
Atmospheric Environment Service
4905 Dufferin Street
Downsview, Ontario M3H 5T4 CANADA

Fax: (416) 739-4221
e-mail: wmosymposium.info@ec.gc.ca

Call for Papers
33RD Annual CMOS Congress

The Montréal Centre of the Canadian Meteorological and Oceanographic Society (CMOS) and l'Université du Québec à Montréal (UQÀM) will host the 33rd Annual CMOS Congress at UQÀM from 31 May to 4 June, 1999. The theme is "Environmental Prediction", to reflect emerging major national and international initiatives in this domain. Contributions are particularly sought on theoretical and practical aspects in the following areas: coupled atmosphere-ocean modelling, waves in the atmosphere or oceans, atmospheric and oceanographic circulations, data assimilation, operational meteorology, transient climate change, climate predictability, cloud physics, transport and diffusion of pollutants, environmental emergency response, and environmental decision support systems. In addition to invited and contributed papers relating to the general theme, sessions will be held on other aspects of meteorology and oceanography, depending on contributions. Presentations are also solicited for a special session on education in meteorology and oceanography.

Abstracts on any topic in meteorology and oceanography will be received until **February 5, 1999**. Since both oral and poster sessions will be organized, authors should indicate their preference. Authors are strongly encouraged to submit abstracts, not to exceed 300 words, interactively through the conference web site at the following address:

www.cmc.ec.gc.ca/rpn/cmos99

A template for sending an electronic abstract can also be obtained from this web site. The Scientific Program Committee will greatly appreciate all efforts to submit abstracts electronically, as this will facilitate the approval and printing process, and produce a faster response to the authors. Hard- (paper) and soft-copy (diskette) submissions can also be sent by mail to:

Harold Ritchie, Chair
CMOS Congress '99 Scientific Program Committee
Recherche en prévision numérique
Atmospheric Environment Service
2121 Trans-Canada Highway, 5th Floor
Dorval, QC, H9P 1J3
Canada

Commercial exhibits will be on display during the Congress. For further information contact Harold Ritchie - Scientific Program Committee (Harold.Ritchie@ec.gc.ca, 514-421-4739), Jean-Guy Cantin - Local Arrangements Committee (jean-guy.cantin@sympatico.ca, 514-748-9480) or Robert Mailhot - Commercial Exhibits (Robert.Mailhot@ec.gc.ca, 514-421-7200).

Following the CMOS Congress, the World Meteorological Organization (WMO) will hold the Third WMO Symposium on Data Assimilation in Meteorology and Oceanography from 7 to 11 June 1999 in Québec City, QC. Those interested in receiving information about this symposium can subscribe to its mailing list by sending the following one line message

subscribe-omm your_email_address
to "majordomo@ec.gc.ca".

Invitation à présenter des Communications
33e Congrès annuel de la SCMO

Le Centre de Montréal de la Société canadienne de météorologie et d'océanographie (SCMO) et l'Université du Québec à Montréal (UQÀM) seront les hôtes du 33e Congrès annuel, qui se tiendra à l'UQÀM du 31 mai au 4 juin 1999. Le thème choisi, "La prévision environnementale", reflète les importantes initiatives de recherches qui émergent dans ce domaine aux niveaux national et international. On recherche particulièrement des contributions, couvrant les aspects tant théoriques que pratiques, dans les domaines suivants: modélisation atmosphère-océan, ondes dans l'atmosphère ou l'océan, circulations atmosphérique et océanique, assimilation des données, météorologie opérationnelle, changement transitoire du climat, prédictibilité du climat, physique des nuages, transport et diffusion des polluants, réponse aux urgences environnementales et systèmes d'appui aux décisions environnementales. Outre les communications présentées par les conférenciers invités et les autres participants reliées au thème général, des séances additionnelles sur d'autres aspects de la météorologie et de l'océanographie seront organisées, selon les contributions reçues. On recherche aussi des contributions pour une séance spéciale sur l'éducation en météorologie et en océanographie.

On peut faire parvenir des résumés sur des sujets liés à la météorologie ou à l'océanographie jusqu'au **5 février 1999.** Puisque nous organiserons des séances orales et d'affichage, nous prions les auteurs d'indiquer leur préférence. Les résumés ne doivent pas dépasser 300 mots. Nous encourageons fortement les auteurs à nous les soumettre interactivement en utilisant le site WEB du congrès à l'adresse suivante :

www.cmc.ec.gc.ca/rpn/scmo99

On peut obtenir un formulaire pour nous faire parvenir un résumé par voie électronique au même site WEB. Le Comité du programme scientifique vous serait grandement reconnaissant de soumettre les résumés par voie électronique puisque cela facilitera les processus d'approbation et d'édition tout en accélérant la réponse aux

auteurs. On peut également nous les soumettre sous forme papier ou sur disquette, par courrier, à :

Harold Ritchie, président
Comité du programme scientifique
Congrès de la SCMO '99
Recherche en prévision numérique
Service de l'environnement atmosphérique
2121 Route Trans-canadienne, 5e étage
Dorval QC, H9P 1J3
Canada

Une exposition commerciale aura lieu pendant le Congrès. On peut obtenir plus de renseignements auprès de Harold Ritchie - Comité du programme scientifique (Harold.Ritchie@ec.gc.ca, 514-421-4739), Jean-Guy Cantin - Comité local d'organisation (jean-guy.cantin@sympatico.ca, 514-748-9480) ou Robert Mailhot - Exposition commerciale (Robert.Mailhot@ec.gc.ca, 514-421-7200).

À la suite du Congrès de la SCMO, l'Organisation Météorologique Mondiale (OMM) tiendra son Troisième Symposium sur l'Assimilation des données en météorologie et océanographie du 7 au 11 juin 1999 à Québec, QC. Ceux qui sont intéressés à recevoir de l'information concernant ce symposium peuvent s'inscrire à sa liste d'envoi électronique en envoyant le message suivant sur une seule ligne

subscribe symposium-omm votre_adresse_électronique
à "majordomo@ec.gc.ca".

CALL FOR PAPERS

IUGG-99 XXII General Assembly
Inter-Association Symposium
(IAPSO, IASPEI, IAVCEA, IAHS, IAMAS, IAG, IAGA, IUGG Tsunami Commission, ILP)
on
GEOPHYSICAL HAZARDS, RISK ASSESSEMENT, MITIGATION AND WARNING SYSTEMS
Birmingham,U.K. 22-27 July, 1999

Geophysical hazards, such as earthquakes, volcanic eruptions, avalanche, landslides, floods, droughts,tsunamis,storm surges, wildfire, tropical cyclones and extreme weather events constitute major problems in many developing and developed countries. With the growth in world population, the increasing pressure on natural resources in newly developing areas, and the increasing cost and sophistication of engineering structures and technical installations, there is an urgent need to seek to understand the potential threats posed by natural hazards and to ascertain increasing preparedness and appropriate ways of mitigating the damaging effects.

Much has been accomplished since the onset of the UN International Decade for Natural Disaster Reduction (IDNDR), which challenged all members of the international community to take a proactive stance to reduce threats before disasters strike. In parallel with these developments, the international scientific community has been engaged in global risk management through the Inter-governmental Panel on Climate Change (IPCC). The possible hazards associated with climate change have been examined, their impacts assessed, and options for mitigation and adaptation have been considered.

The aim of this Inter-Association Symposium is to stimulate synergistic interactions between all geophysicists on common interests in the field of natural hazards, especially across disciplinary boundaries. The scope seeks through contributed presentations to recognize the technical and scientific progress made during the last ten years in research related to any aspects of geophysical hazards to accomplishing the goals set forth for the Decade, including risk assessment; the application of known preparedness and mitigation approaches; and the development and use of scientific and engineering knowledge to improve warning systems, the disaster preparedness and mitigation in practice.

In order to set the stage for this symposium, a series of invited keynote lectures will be presented on July 22 to evaluate the state-of-the-Science in geophysical hazards and risks.

ABSTRACT SUBMISSION:

The deadline for submission of abstracts (English or French) is **15 January 1999.** Instructions for abstract submission and format can be found at the IUGG website:

http://www.bham.ac.uk/IUGG99/

or by writing to any of the co-convenors listed below. Please specify the symposium code as 'JSP23' and the symposium title as shown above.

CONVENOR (IAPSO):

Mohammed El-Sabh
Centre Océanographique de Rimouski
Département d'océanographie
Université du Québec à Rimouski
310 Allée des Ursulines
Rimouski (Québec)
G5L 3A1 CANADA

CO-CONVENORS:

for IASPEI

Juan Manuel Espinosa-Aranda (Mexico)
maranda@servidor.unam.mx
and Yong Chen (P.R. China)
chenyong@sun.ihep.ac.cn

for IAVCEI

Brad Scott (New Zealand)
B.Scott@gns.cri.nz

for IAHS

Lars Gottschalk (Norway)
Lars.Gottschalk@geofysikk.uio.no

for IAG

Yehuda Bock (U.S.A.)
bock@pgga.ucsd.edu

for IAGA

Susan McLean (U.S.A.)
smclean@ngdc.noaa.gov

for IAMAS

Tom Beer (Australia)
tom.beer@dar.csiro.au

for IUGG Tsunami Commission

V. K. Gusiakov (Russia)
gvk@omzg.sscc.ru

for ILP

Friedemann Wenzel (Rumania)
fwenzel@riskinc.com
or fwenzel@ibm.com

For further information, please contact:

Mohammed El-Sabh, Professeur
Tel: (418) 723-1986 extension 1707
Fax: (418) 724-1842
E-mail: mohammed_el-sabh@jafar.uqar.uquebec.ca
or nayom@quebectel.com
Website: http://www.uqar.uquebec.ca/oceano/accueil.htm

Troisième Symposium International de l'OMM sur l'Assimilation des Observations en Météorologie et en Océanographie

Ville de Québec, Québec, Canada

7-11 Juin 1999

Le troisième Symposium international de l'OMM sur l'assimilation des observations en météorologie et en océanographie se tiendra à Québec, du 7 au 11 juin 1999. On recherche des contributions au colloque portant sur la recherche en assimilation des données liée aux applications opérationnelles, sur l'utilisation des observations par satellite et sur les aspects méthodologiques. Les différentes composantes du système climatique seront abordées, en particulier la circulation océan/atmosphère, la chimie atmosphérique (stratosphère et troposphère) et la biochimie des océans. Le symposium est organisé par l'Organisation Météorologique Mondiale (OMM) avec le parrainage de diverses organisations scientifiques nationales et internationales. Le langage de travail sera l'anglais.

Le colloque se tiendra à l'hôtel Québec Hilton au coeur de la ville de Québec. Des chambres seront offertes à l'hôtel de la conférence, à de plus petits hôtels situés à quelques minutes de marche ainsi qu'aux résidences de l'Université Laval. Des informations sur le programme scientifique, l'hébergement, le transport à la ville de Québec et d'autres sujets seront disponibles sur le site Internet du Symposium à l'adresse suivante:

http://www.tor.ec.gc.ca/wmosymposium

Une inscription préliminaire est demandée pour le 5 janvier 1999 et l'échéancier pour la soumission de courts résumés est le **1er février 1999**. Il est fortement suggéré de s'inscrire et de soumettre les résumés par voie électronique; des instructions sont disponibles sur le site internet du Symposium. Des informations concernant l'inscription et la soumission des résumés par courrier sont disponibles à l'adresse suivante:

Third WMO Symposium on Assimilation of Observations in Meteorology and Oceanography
c/o Data Assimilation and Satellite Meteorology Division
Atmospheric Environment Service
4905 Dufferin Street
Downsview, Ontario M3H 5T4
CANADA

facsimilé: (416) 739-4221
courriel: wmosymposium.info@ec.gc.ca

First Announcement
Seventh Workshop on
Regional Climate Modelling

The 7th Annual Canadian Workshop on Regional Climate Modelling, entitled "Atmospheric and Ocean Processes in the context of Regional Climate Modelling" will be held in Ste-Marguerite-du-Lac-Masson (Montréal area) from May 23-May 27, 1999.

Regional Climate Models (RCMs) have been developed in a number of countries over recent years. These fine-scale models were designed to "downscale" General Circulation Model simulations to spatial scales over which climate impact and adaptation studies can be best performed. Beyond this climate scenario function, RCMs may also be used to perform simulations to study mesoscale processes. RCMs serve as "intelligent interpolators" in regions where the data is sparse, generating a set of internally consistent environmental fields that are difficult and sometimes impossible to observe. It has become increasingly recognized that RCMs may be used as valuable tools in a variety of environmental applications when coupled with other modules such as hydrological, lake, ocean, ice, air quality, and biological models. They produce scenario simulations of land use, for example, under current as well as altered climate conditions.

Previous Canadian workshops on Regional Climate Modelling were mostly intended to summarize the progress in developing a Canadian Regional Climate Modelling system, with co-investigators, collaborators, and students of the RCM collaborative group presenting results of their work. During last year's workshop, scientists from Canada and abroad in the field of regional climate modelling and impact assessment studies met for the first time to exchange information on the global climate change problem. The workshop attracted some 75 scientists, including international keynote speakers.

The objective for the planned 1999 workshop, organised jointly by the Regional Climate Modelling Group of the Université du Québec à Montréal, the Department of Fisheries and Oceans, and the Department of Environment, is again to gather scientists from different research areas and to emphasize the links between the atmospheric and oceanographic research communities. Climate simulations from GCMs with fully interactive dynamical ocean models are now routinely performed around the world. However, the same is not true for climate simulations with RCMs. The coupling of dynamical regional ocean models within RCMs is far behind what is found in global models. For instance, the Canadian RCM could never be applied to Eastern Canada because of the lack of an interactive ice-ocean-lake model. We are now close to having a version of the model that includes a thermodynamic ocean-lake model. However, it is not clear that such a simple model can account for the complex processes taking place in the Gulf of St.-Lawrence or in Hudson Bay. The need for high quality regional climate simulations over Eastern Canada is rapidly growing, and better understanding of the complex interactions between the climate and the ocean is a key element for obtaining these required climate scenarios.

As the size of the meeting is limited (number of attendees should be around 100), we would appreciate it if those interested in attending or participating in the workshop were to indicate their intention as soon as possible. There will be a limited number of invited speakers to facilitate the exchange between the two research communities. In addition, researchers are encouraged to submit presentations on the following subjects of particular interest:

- Recent developments in regional climate and ocean modelling;
- Atmosphere-ocean-ice processes in the context of regional climate modelling; and,
- Explore avenues for coupling regional ocean models and regional climate models.

Those wishing to give a presentation (typically 15-30 minutes have been allotted for each) should provide their coordinates and title of their presentation to Daniel Caya (climate modelling), François Saucier (ocean modelling), or Gérald Vigeant (air sea interactions).

Please feel free to distribute this announcement to other interested parties. For more information, please contact Daniel Caya (climate modelling), François Saucier (ocean modelling),- or Gerald Vigeant (air sea interactions).

Daniel Caya, Project Manager
Regional Climate Modelling Group
Department of Earth Sciences
UQAM
PO Box 8888, Station Downtown
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caya@sca.uqam.ca

Francois Saucier
Division of Ocean Sciences
Maurice Lamontagne Institute
850, Route de la Mer,
Mont-Joli (Québec) Canada G5H 3Z4
SaucierF@dfo-mpo.gc.ca

Gérald Vigeant
Chef / Chief
Division - Sciences Atmosphériques & Enjeux environnementaux
Direction de l'Environnement atmosphérique
Environnement Canada / Environment Canada
100 boul. Alexis-Nihon, 3e étage
Ville Saint-Laurent, Québec, Canada H4M 2N8
gerald.vigeant@ec.gc.ca

***** Reminder *****

1999 CMOS PRIZES AND AWARDS

Just to remind everyone that the deadline for the submission of nominations is 11 January 1999. The list of prizes and awards is available on the CMOS Web Site:

http://www.meds.dfo.ca/cmos/

Please submit your nominations to :

Mr. Mike Leduc, Secretary
CMOS Prizes and Awards Committee
Atmospheric Environment Service
Toronto Regional Centre
4905 Dufferin Street
Downsview, Ontario
M3H 5T4

Telephone : (416) 739-4474
Fax : (416) 739-4603

We are counting on you!

***** *Rappel* *****

PRIX ET MENTIONS DE LA SCMO - 1999

Juste pour vous faire le rappel que la date limite pour la soumission de mises en nominations est le 11 janvier 1999. Toutes les informations sur les prix et mentions de la SCMO sont disponibles au site Internet suivant :

http://www.meds.dfo.ca/cmos

Veuillez svp faire parvenir vos nominations à:

M. Mike Leduc, Secrétaire
Comité SCMO pour les prix et mentions
Service de l'environnement atmosphérique
Centre régional de Toronto
4905 rue Dufferin
Downsview, Ontario
M3H 5T4

Téléphone : (416) 739-4474
Facsimilé : (416) 739-4603

On compte sur vous!

Reminder to Members

An opportunity now exists for members or non-members to nominate Fellows to the Society, keeping in mind that nominees must be members in good standing. In considering the nominations of Fellows , consideration should be given to the following general criteria:

Research, Teaching, Technology, Professional Services, Administration in academia, industry, government or other institutions, Communication and interpretation of atmospheric and oceanographic phenomena, Weathercasting International meteorological and/or other oceanographic affairs.

Each nomination should be signed by the primary sponsor and supported by two others, at least one of whom must be from an establishment other than that of the nominee.

Application forms are available from the Office of the Executive Director. Nominations are to be postmarked no later than **April 15, 1999.** The insert in *CMOS Bulletin SCMO* (Vol.26, No.1, p.25) refers.

Neil J. Campbell,
Executive Director

Rappel aux membres

Les nominations pour les Fellows de la Société sont maintenant acceptées. Les personnes mises en cadidature doivent être des membres en règle de la Société. Les critères suivants devraient être pris en considération lorsqu'une candidature est soumise:

Recherche, enseignement, technologie, services professionnels, administration dans les universités, l'industrie, le gouvernement et dans les autres institutions, communication et interprétation des phénomènes atmosphériques et océaniques, la prédiction de la météo, les affaires internationales en météorologie et/ou océanographie, autres.

Chaque candidature doit être signée par le commanditaire principal et doit être endossée par deux autres, dont au moins une personne venant d'un établissement autre que celle de la personne mise en nomination.

Les formulaires d'application sont disponibles au bureau du directeur exécutif. La date butoir du **15 avril 1999** devra être respectée. Vous trouverez plus de détails dans le numéro de février du *CMOS Bulletin SCMO* (Vol.26, No.1, p.25).

Neil J. Campbell,
Executive Director

CMOS-ACCREDITED CONSULTANTS
EXPERTS-CONSEILS ACCRÉDITÉS de la SCMO

MEMBERSHIP APPLICATION FORM / DEMANDE D'ADHÉSION

☐ NEW APPLICATION / NOUVELLE DEMANDE
☐ RENEWAL / RENOUVELLEMENT

CANADIAN METEOROLOGICAL AND OCEANOGRAPHIC SOCIETY
LA SOCIÉTÉ CANADIENNE DE MÉTÉOROLOGIE ET D'OCÉANOGRAPHIE
112-150 Louis Pasteur, Ottawa, ON K1N 6N5
Tel/Tél: 613-562-5616 Fax/Téléc: 613-562-5615
email/couriel: cap@physics.uottawa.ca
http://www.meds.dfo.ca/cmos

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SPECIAL INTEREST / INTÉRÊTS SPÉCIAUX

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☐ OPERATIONAL METEOROLOGY / MÉTÉOROLOGIE D'EXPLOITATION
☐ FISHERIES OCEANOGRAPHY / OCÉANOGRAPHIE DES PÊCHES
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IF THIS IS A STUDENT APPLICATION PLEASE PROVIDE THE NAME AND SIGNATURE OF ONE OF YOUR PROFESSORS.
FOR RECORDS ONLY; PLEASE INDICATE THE INSTITUTION AND YEAR STUDIES WILL BE COMPLETED AND DEGREE ANTICIPATED.

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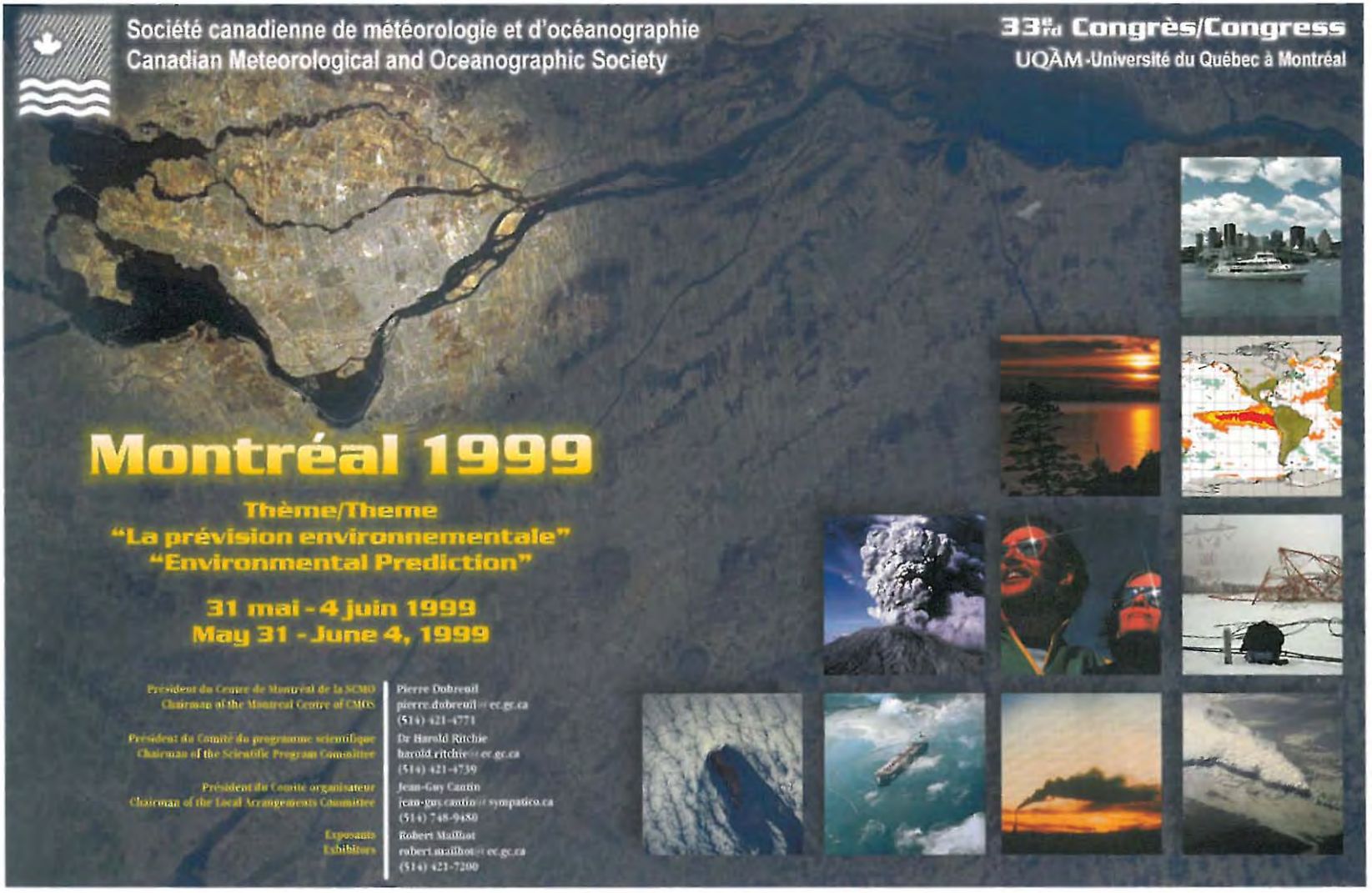

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