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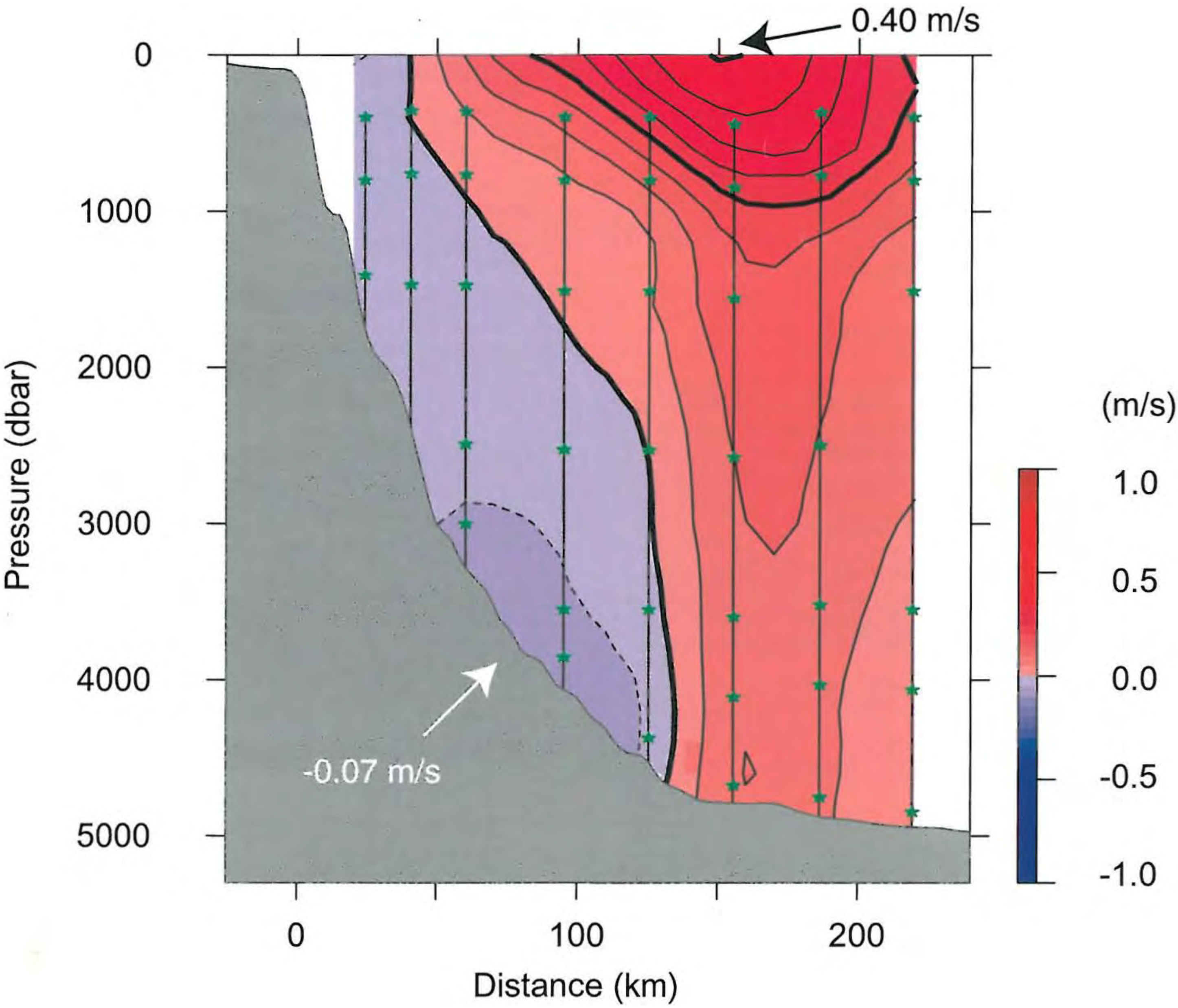

CMOS Bulletin SCMO

"at the service of its members
au service de ses membres"

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Cover page: Mean transverse flow from August 1993 to April 1995 for Current Meter Array ACM6. Distance scale has its origin at the 200 metre isobath on the Tail of the Grand Banks. Contour intervals are 0.05 m/s, red shading represents flow to the northeast, blue to the southwest. For more complete details don't miss reading the full article at page 42.

Page couverture: Courant transversal moyen (août 1993 à avril 1995) pour l'ensemble des courantomètres ACM6. L'origine de l'échelle de distance est l'isobathe de 200 mètres sur la queue des Grands Bancs. L'intervalle des contours est de 0,05 m/s, le courant vers le nord-est est illustré en rouge, le courant vers le sud-ouest est en bleu. Pour plus de renseignements, ne manquez pas de lire l'article au complet en page 42.

Next Issue

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

Prochain numéro

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en juin 1999. Prière de nous faire parvenir vos articles, notes, rapports ou nouvelles au plus tôt à l'adresse indiquée ci-dessus. Nous avons un urgent besoin d'articles. Ne ratez surtout pas votre chance!

CMOS - SCMO - CMOS - SCMO

New electronic address ➔➔➔➔➔
Nouvelles adresses électroniques➔➔➔➔➔

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Adresses électroniques de la SCMO

....from the President's desk

My thoughts were influenced this month by World Meteorological Day which came (as it always does) in the third week of March. This year, the theme was "Weather, Climate and Health", drawing attention to the impact of weather and climate on human health - usually the preserve of another UN agency in Geneva, the World Health Organization. Although weather/health usually refers to the effect of air pollution on the respiratory system, or the threat of skin cancer from UV-B radiation, some quite different impacts on health from climate change are now being identified. For example, EPA's Global Warming web site (see *http://www.epa.gov/globalwarming/reports/slides/cc&i/b-diseas.html*) provides examples of infectious diseases that may become bigger threats to the United States (and Canada) as the climate warms, in response to an ever-increasing concentration of greenhouse gases: malaria, hantavirus, encephalitis and increased potential transmission of many vector-borne diseases such as the dengue virus/fever. It is no wonder that, as impacts become "personal" through threats to health, as well as to property from climatic variability, more of the public might start to take climate change seriously. This in turn might provide the kind of public support that forces governments to address the causes of the problem, through early and effective action that is becoming long overdue.

On a different front, members at CMOS Centres in eastern Canada have turned out in record numbers to hear this year's Tour Speaker, Dr Greg Flato, give his outstanding presentation on the cryosphere. Those in the West will have a chance to hear and see him during April - you won't be sorry if you make plans to be there!

Meanwhile, the news about the Montreal Congress is very encouraging! Jean-Guy Cantin a réuni une équipe imposante pour voir aux préparatifs locaux et Hal Ritchie a mis en place un programme scientifique étoffé sous le thème de la Prévision environnementale. En plus d'écouter de nombreuses conférences scientifiques, vous êtes cordialement invités à participer à d'autres événements annuels très importants qui auront lieu au cours du congrès de la SCMO. Almost 300 papers have been submitted. Excellent accommodation at very reasonable prices is available, if you reserve NOW with the UQAM residence. The Congress web site has more details: *http://www.cmc.ec.gc.ca/cmos99/*. See you all in Montreal! Venez tous me rencontrer à Montréal!!

Bill Pugsley
President/Président
CMOS/SCMO

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April 1999 - avril 1999

Inside / En Bref

Articles

Our regular sections / Nos chroniques régulières

CMOS Annual Congress / Congrès annuel de la SCMO

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Lou Shenfeld

Not too long ago we received an e-mail from Lou that he was going to retire from CMOS after being a member for forty years. We followed up with Lou and asked for some more information on his career and association with meteorology and here is his story.

Lou graduated in 1951 with an MA and was assigned to the Montreal weather office. Soon after his appointment there he joined the Canadian Branch of the Royal Meteorological Society and the Canadian Meteorological Society when it was formed. Lou served as a weather forecaster in Montreal for three years and in Toronto for nine years. He joined Ontario Hydro as a hydro-meteorologist forecasting water flows. During the drought period in the mid-sixties Hydro was forced to operate their fossil fueled generating stations on a continuous basis. Air pollution problems brought about a change in Lou's career as he was sent to the United States for courses in air pollution meteorology and modeling. In 1968 he left Ontario Hydro and joined the provincial government in the Air Pollution Control Service in charge of their air monitoring and modeling program. He was involved in the design and implementation of the first Air Pollution Index and Alert System which formed the basis of Regulations in North America. Lou retired from this service in 1969 and joined the M.E.P. Company as an air pollution consultant.

Lou remained active in the field of meteorology long after normal retirement age and has been a loyal member of the Society for even longer.

Many thanks for letting us know of your long association with the Society, Lou. I hope it inspires others to let us know about their long service and association with CMOS.

P.S. Subsequent to the communications with Lou, Council has approved the creation of a twenty-five year membership pin which is now in the design stage. Lou, we will send you one despite the fact you are "over-qualified".
Neil J. Campbell, Exctutive Director

Climate Change Forum in Kelowna

On Thursday evening, February 4, 1999, Bill Taylor, Paul Whitfield and Peter Schwarzhoff of Environment Canada teamed with Dr. Melinda Brugman of the Columbia Mountain Institute of Applied Ecology to present a public forum on climate change. The audience of 230 citizens traveled to Kelowna from as far away as Penticton and Salmon Arm to hear the latest information about the science of climate change and how it could impact the Okanagan Valley.

This forum was hosted by the Kelowna Chapter of the Canadian Meteorological and Oceanographic Society and the Canadian Federation of University Women. Several corporate sponsors helped with finances, with Environment Canada providing invaluable assistance by providing three of the four speakers. Additional support was given by the Regional District of the Okanagan, with the Mayor of Kelowna and several councillors in attendance.

On Wednesday, Peter Schwarzhoff presented a seminar on the topic to 60 student teachers in their final days before graduation from Okanagan University College. The number of excellent questions put forward by this group would suggest that they gained a good knowledge of the subject and are motivated to share that knowledge with the elementary school children of the region.

Media attention was high in the days leading up to the forum, with all local papers running stories provided by the speakers. Dr. Brugman and Mr. Taylor were guests on a local CBC radio program the morning of the event while Mr. Whitfield and Mr. Schwarzhoff were given the opportunity to speak for an hour on the Barrie Clark Show - a call-in format. CHBC, the local CBC television affiliate carried a news item and promoted the forum on the weathercast.

While there were many challenging questions raised, all were easily handled by the speakers. A positive feeling was left in all cases with seemingly no negative issues left. By all accounts, a complete success.

Ken Little
CMOS Chapter in Kelowna

Notice to Members

If you are a member in good standing and have twenty-five years or more of membership in CMOS or its predecessors, please let us know by post, fax or e-mail at your earliest convenience.

Neil J. Campbell
Executive Director

ELBOW: An Experiment to Study the Effects of Lake Breezes On Weather in Southern Ontario

by P. King[1], D. Sills[2], D. Hudak[1], P. Joe[1], N. Donaldson[1], P. Taylor[2], X. Qiu[2], P. Rodriguez[1], M. Leduc[3], R. Synergy[4], and P. Stalker[5]

Abstract

The Effects of Lake Breezes On Weather (ELBOW) was carried out during the summer of 1997. It was a pilot project to study the role of lake breezes in triggering convection on the southwestern Ontario peninsula. The standard surface data network was supplemented by 3 ELBOW sites recording data and by early afternoon radiosonde launches. As well, boundary layer conditions were monitored by serial ascents of a kiteborne radiosonde. Mobile teams documented storm structures using photography and made limited surface measurements. Two cases are described briefly. In one a quasistationary multicellular cluster appeared to form at the intersection of two lake breeze lines and gave a radar estimated 200 mm of rain to a small area over a period of about 5 hours. The MC2 model was used to study the three dimensional structure of this event.

Résumé

Le projet "Les Effets de Brises de Lac sur le Temps" (ELBOW) fut complété durant l'été de 1997. Ce projet pilote avait pour but d'étudier le rôle des brises de lac sur le déclenchement de la convection le long de la péninsule du sud-ouest ontarien. Le réseau standard d'observation de surface fut complémenté par 3 stations ELBOW pouvant enregistrer des données en plus d'effectuer des lancements de radiosonde en début d'après-midi. De plus, les conditions de la couche limite furent mesurées à l'aide d'ascensions en série de radiosondes accrochées à des cerf-volants. Des équipes mobiles prirent des photos ainsi que certaines mesures de quantités de surface afin de documenter la structure des tempêtes. Deux études de cas sont ici brièvement décrites. Dans un cas en particulier, un amas multi-cellulaire quasi-stationnaire semble avoir pris forme à l'intersection de deux lignes de brises de lac, produisant environ 200 mm de pluie sur une région relativement petite pendant près de 5 heures. Le modèle MC2 a été utilisé afin d'étudier la structure tri-dimentionelle de cet évènement.

1. Introduction

Over the past few years, a study (principally by the lead author) of animated satellite imagery has indicated that lake breezes may play a larger role than previously thought in summertime convection, including summer severe weather, in southern Ontario. For example, Figure 1 shows a GOES-8 visible satellite image for 21 July 1994 at 18:02 EDT (2202 UTC). Cloud lines parallel to the coastlines of Lakes Erie and Huron extend inland and merge into a common line extending northeastward. Surface observations from London Airport suggest that the Erie line was associated with a lake breeze front. On this occasion, thunderstorms on the merged line were stationary for nearly 4 hours resulting in upwards of 60 mm of rain.

On another occasion, deep convection on merging cloud lines resulted in nearly 9 consecutive hours of thunder at London airport, 100 mm of rain and golf ball sized hail in surrounding districts (King and Leduc, 1996). The cloud lines again appeared to be associated with lake breeze fronts. These events suggest that lake breezes may be important to the generation of summer severe weather in southern Ontario.

There are also hints in the tornado climatology of southern Ontario suggesting lake breeze effects. King (1997) pointed out an apparent maximum in tornado occurrence coincident with the stationary line in Figure 1. Sills (1998) described several cases in which tornadoes formed on lake breezes in otherwise benign synoptic conditions.

There have been a number of studies in other areas linking low-level convergence zones, such as sea breezes fronts, with severe convection. In Florida, there is a long history of studies linking sea breezes and convection (Byers and

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Roodebush, 1948; Pielke, 1974; Blanchard and Lopez, 1985; Wilson and Megenhardt, 1997). Lyons and his colleagues studied many aspects of the lake breeze in the Chicago area including effects on severe thunderstorms (Chandik and Lyons, 1971). They found that some thunderstorms intensified when they encountered the lake breeze while for others there was little effect. In one case, they noted a possible tornado that may have been related to the lake breeze. In Colorado, Wilson and Schreiber (1986) estimated that about 80% of all thunderstorms and 95% of strong thunderstorms formed near radar-observed boundary-layer convergence lines. The convergence lines were ascribed to several causes including topographically-induced flows, thunderstorm gust fronts and synoptic-scale fronts.

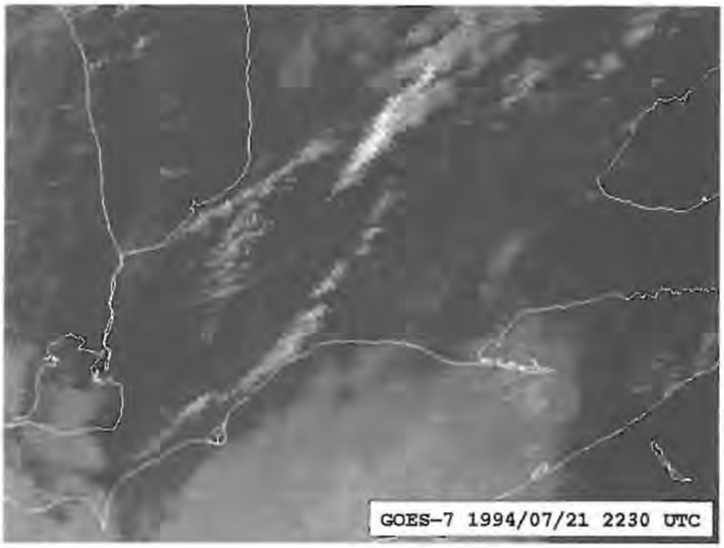


Figure 1: GOES-7 image at 2230 UTC on 21 July 1994 showing the merger of two apparent lake breeze induced convergence lines merging in a single line. The merged line was almost stationary for 4 hours.

Unfortunately, in the Ontario cases cited, sparsity of data makes it difficult to definitively link lake breezes and severe weather. A pilot field project was conducted in the summer of 1997 to gather supplementary observations and to test several observational technologies. The principal goals were to study cloud lines observed on satellite images and to determine their characteristics in terms of boundary-layer convergence and whether they could be identified as lake breeze fronts. Ultimately we wish to determine the role that such convergence lines play in generating severe weather. Because it was unlikely that we could achieve all of these goals with ELBOW, a secondary goal was to build a base of experience upon which we could design a more ambitious project for the future.

The experiment was sponsored by the Meteorological Research Branch (MRB) of Environment Canada in association with the Centre for Research in Earth and Space Science (CRESS) at York University. The University of Western Ontario (UWO) cooperated by assisting with rawinsonde launches from its research station 10 km northwest of London. The principal investigators were P. King of MRB and D. Sills of CRESS.

2. Description

The experiment was conducted in the flat to gently rolling countryside between Lakes Erie and Huron. Originally, two intensive observing periods (IOPs) were planned: one in May to coincide with the period of near maximum land-water temperature differences and a second in July when land-water temperature differences are less but when deep convection is statistically more frequent. The first IOP was cut short due to unseasonably cold and windy weather in May. It was partially replaced by a mini-IOP on 24-25 June. The July IOP took place largely as planned from 8 to 17 July.

The principal base of operations was the Atmospheric Environment Service (AES) radar site at Exeter. At this site, we had access via an Internet connection to radar and satellite information. In addition, the site is in an area where Lake Huron lake breezes occur frequently and is only about one hour's drive from Lake Erie. A secondary base of operations was the UWO research station northwest of London, which was used for rawinsonde launches.

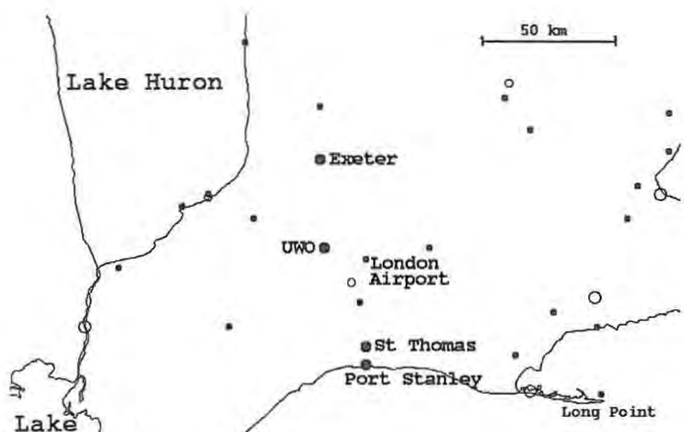


Figure 2: Availability of standard and special observations for ELBOW. Standard 10 m wind sites are indicated with black dots, stations with anemometers at non-standard heights are small open circles, and towers with anemometers at several levels are shown as large open circles. Special ELBOW sites and geographical reference points are also marked.

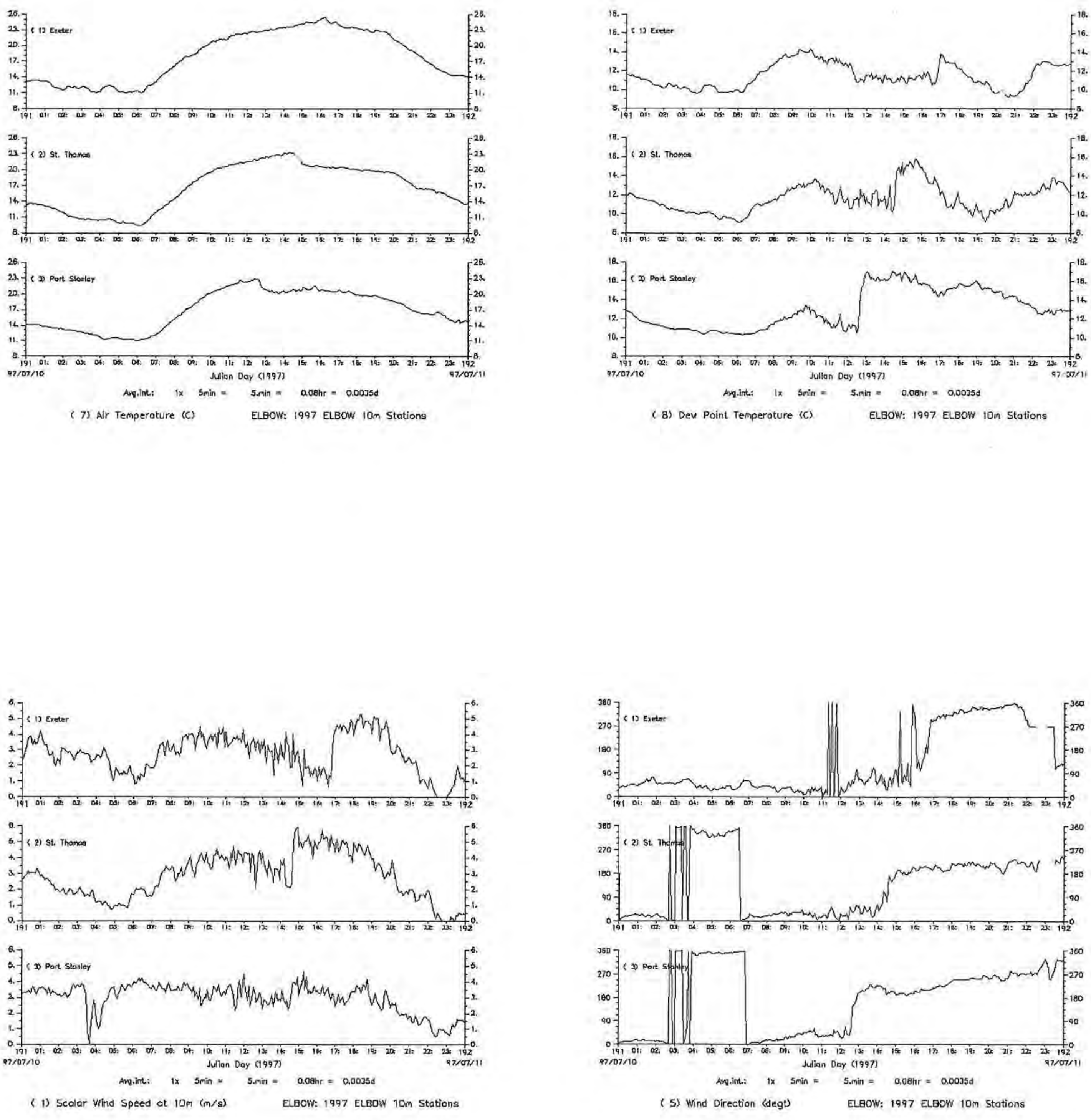


Figure 3:
Sample observations of 5-minute temperature, dewpoint, wind speed and wind direction from the 3 ELBOW stations for July 1997.

Figure 2 shows the surface data available for the experiment including standard weather observing stations reporting at one hour intervals, special ELBOW mesonet stations with five minute data, and stations belonging to other agencies such as Ontario Hydro and the Ontario Ministry of Environment and Energy. In addition to these data, regular rawinsondes were launched on most days during the IOPs from either the UWO site or the Exeter radar site and kite-borne radiosondes provided serial soundings from ground level to as high as 800 m AGL. An aircraft flight was made on 17 July to evaluate wind, temperature and humidity data from an instrument supplied by Aventech Inc. In addition, a time-lapse video recorder at the Exeter radar site was used to record sky conditions during most of the IOPs.

3. Data Collected

a) Special Surface Data

A 10 m portable meteorological tower was installed at the Exeter radar site on 12 May. Similar towers were installed at sites near St. Thomas and Port Stanley on 7 July. 10 m winds, 1.5 m temperature and humidity values, and 9.5 m to 1.5 m temperature differences were measured at each station. The Exeter site is located about 20 km inland from Lake Huron while the St. Thomas site is located about 8 km inland from Lake Erie. The Port Stanley site is situated on a 30 m bluff about 300 m from the Lake Erie shore.

Lake breeze frontal passages at coastal stations can usually be identified by a rapid decrease in temperature and increase in dew point temperature, and a change to a steady onshore surface wind. Locations further inland typically have a more muted response due to modification of the lake air as it moves inland. These signatures were identified in the Exeter site data only occasionally but were found much more frequently in the St. Thomas and Port Stanley data. This is largely due to the fact that Exeter is more than twice as far inland from Lake Huron as the southern stations are from Lake Erie. However, it was noted during the July IOP that the Lake Erie shore experienced noticeably more lake breeze activity. Thus, the higher frequency may be dependent upon the prevailing synoptic conditions or differences between the lakes themselves.

Figure 3 shows time series data from all three stations on 10 July. Lake breezes penetrated well inland on this day and lake breeze fronts can be easily identified in the temperature, dew point temperature, wind speed and wind direction time series. The Erie front passed the Port Stanley site near 12:40 EDT (1640 UTC) and the St. Thomas site near 14:35 EDT (1835 UTC). The Lake Huron front passed the Exeter site near 16:50 EDT (2050 UTC). Note the decreases in temperature and dramatic increases in dew point temperature with the passage of the lake breeze fronts. All three stations show the surface wind changing from northeast to an onshore flow. Wind speed increases are evident in all but the Port Stanley time series. This appears to indicate that surface winds behind the fronts grew stronger as the fronts progressed inland. Conversely, the dew point time series suggests that the moisture gradient decreased as the fronts progressed inland.

b) Rawinsonde Data

Rawinsonde data were collected on most of the IOP days using a NCAR 'CLASS' type ground station, a Vaisala sonde and a helium-filled balloon. Launches were made from either the Exeter site or the UWO site. Most flights resulted in data up to heights of 20 km or greater. A smaller than normal amount of helium was used with most launches to slow the ascent rate and obtain more detailed data in the boundary layer. Since these sites are located well inland from the lakes, data from within a lake breeze circulation were difficult to obtain. However, a lake breeze front did pass over the Exeter site on 16 July and rawinsondes were launched before and after the passage. Subtle differences in the basic meteorological parameters were observed across the front but a return circulation aloft was not detected on this occasion.

c) Mobile Observing Teams

Mobile spotter teams were equipped with basic meteorological instruments (sling psychrometer, hand-held anemometer and compass, and cameras). Their task was to supplement the fixed network by taking spot measurements in key locations. For example, they would take spot measurements on either side of a cloud line to determine if there were measurable differences in wind speed, wind direction, temperature and humidity. In the event that cumulus clouds began to develop vertically, the spotters tried to position themselves to take observations and photographs of the developing convection.

As it turned out, we had only one spotter team (D. Sills and X. Qiu) for the experiment supplemented occasionally by the project coordinator (P. King) and the kite team (P. Rodriguez and R. Synergy). However, due to problems with mobile communications, a larger number of spotter teams would likely have resulted in more confusion than useful data.

The spotter team did record significant differences in basic meteorological parameters across some cloud lines but occasionally differences were well below the accuracy thresholds of the instruments. The team also took valuable photographs of developing convection and storm damage.

We had considerable difficulties with communications. The greatest single problem was poor communications between team members in the field. We relied on cellular telephones for communication between team members but coverage was inadequate in the area of operations. In a future experiment, newer equipment and the use of signal boosters might improve coverage. Access to satellite and radar data was poor. The coordinator relied on a dial-up to an Internet server located at AES headquarters in Downsview for weather information. It was not reliable during regular business hours perhaps due to overloading of the server. In a future experiment, we would try to locate the coordinator at a site with full Internet access.

The experience gained here should make it easier to coordinate a greater number of spotter teams in a future experiment.

d) Kitesonde

A Vaisala radiosonde was flown on a kite on most days. The ground station was located at the Exeter radar site and the kite was flown from several different fields within about 3 km of the ground station. Flight duration was limited by a battery life of about two hours, during which period we attempted to make serial ascents using a manual winch. We attempted to do a morning flight and an afternoon flight each day.

Kite-borne sondes offer the tantalizing prospect of making frequent soundings in critical areas. In this case, we hoped to make frequent soundings through a lake breeze passage. Unfortunately, lake breezes tended to arrive late in the day at Exeter or else were highly-perturbed by the gradient flow.

We had difficulty flying the kite on light wind days when thermals carried the kite up and down capriciously. The kite flew very well on days with steady winds. In addition, the radiosonde station was not mobile restricting our launches to areas close to the ground station. To be useful in a lake breeze study, a kite system must be fully mobile.

e) Aircraft

A light aircraft (Cessna 172) was flown on 17 July with a wind, temperature and humidity measuring device built by Aventech Inc. of Concord, Ontario. It flew a low-level (150 m AGL) transect between the coasts of Lakes Erie and Huron. It also retrieved soundings during a number of ascents and descents.

There were fine details in the data that appeared to be qualitatively correct. Unfortunately, lake breezes were not well developed that day and we were unable to test the aircraft's ability to detect lake breeze fronts.

4. Case Studies

A number of cases occurred during the project in which significant convection developed at cloud lines or at the intersection of cloud lines. Continuing analysis of the observational data and subsequent numerical modelling simulations using MC2 (Benoit et al., 1997) at York University suggest that these cloud lines are indeed associated with lake breeze fronts. We will give a brief description of three of these events.

a) June 24 - Quasistationary Thunderstorm near London

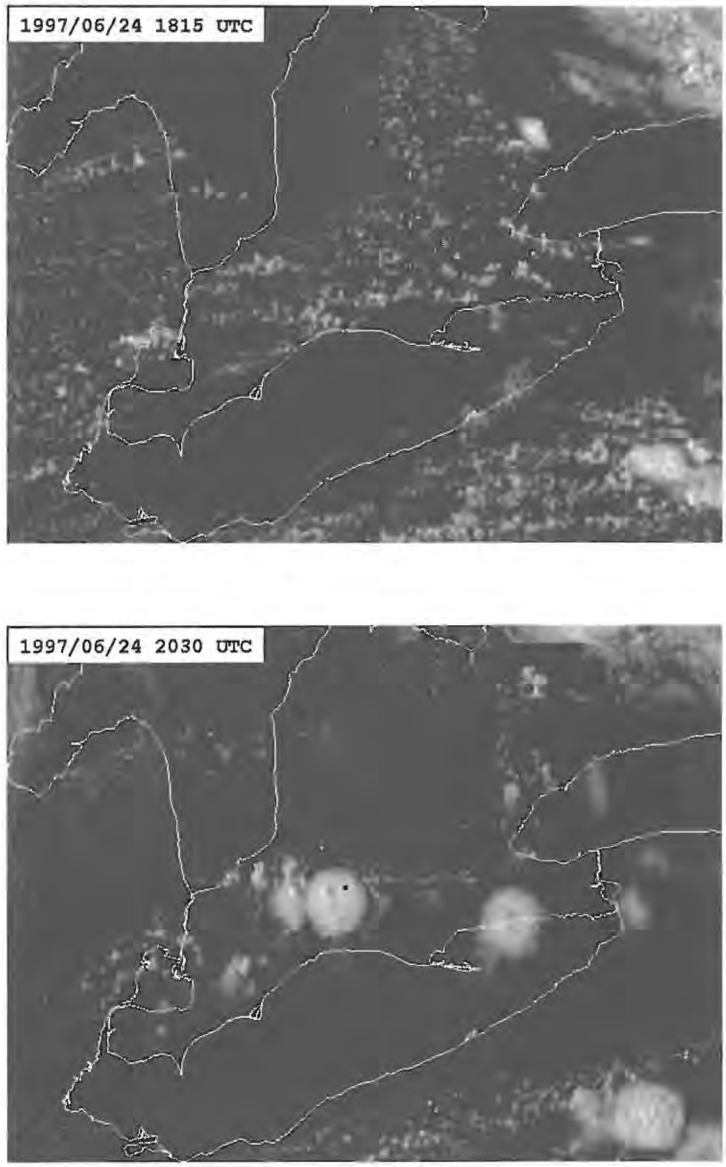


Figure 4a) at 1815 UTC and Figure 4b) at 2030 UTC: Development of a thunderstorm cluster at the merger point of multiple lines near London, Ontario on 24 June 1997.

The project coordinator and the principal spotter team decided at about 11:00 EDT (1500 UTC) on 24 June that conditions were favourable for lake breeze triggered thunderstorms in the London area. The spotter team deployed to the Exeter radar site arriving about 13:30 EDT (1730 UTC). From that position they could see convection developing to the west of London. By 14:15 EDT (1815 UTC), several cloud lines had formed, as shown in Figure

4a. One line extended from the north end of Lake St. Clair eastward to south of London (marked with a black square). A second line extended from the south end of Lake St. Clair east-northeastward to south of London. A third line, which appears to have more significant convection, extended from the southern end of Lake Huron to London.

The team proceeded toward the latter line and made several spot measurements while trying to position itself on the periphery of the thunderstorm, which quickly developed into a multicellular cluster. By 16:30 EDT (2030 UTC), a large cluster had developed just west of London apparently at the intersection of the three lines (Figure 4b). The complex continually redeveloped to the northwest effectively canceling the southeasterly storm motion. This resulted in an extended period of heavy rain over an area to the south of London. Damage from the storm consisted of localized flooding and some downed trees and power lines. There were also unconfirmed reports of golf ball sized hail and a funnel cloud with this storm.

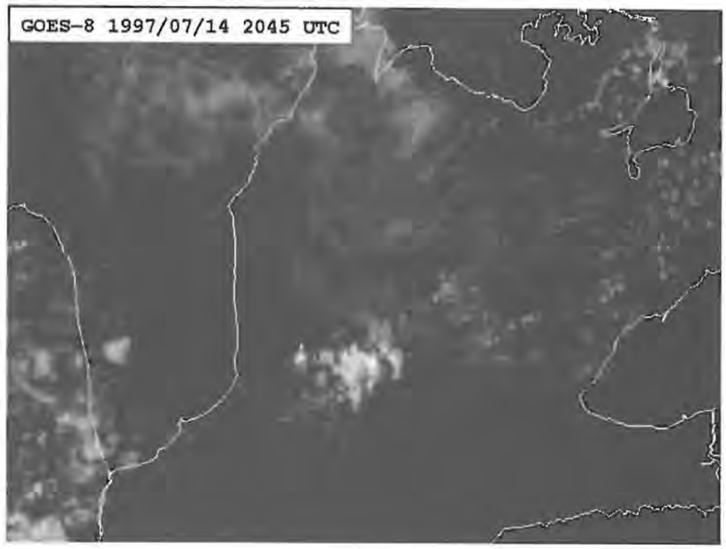
b) July 14 - Punkeydoodle's Flash Flood

Intense convection developed just to the north and east of the Exeter radar after 16:00 EDT (2000 UTC) on 14 July. The King City radar north of Toronto showed the echoes reaching 17 km in height within 20 minutes of the appearance of the first echo. A rawinsonde launch from Exeter radar at about 15:30 EDT (1930 UTC) showed Convective Available Potential Energy (CAPE) near 6200 Jkg^{-1}, a Lifted Index (LI) of -11°C and 0-3 km storm-relative helicity near 180 $m^2 s^{-2}$. The convection developed into a quasistationary multicellular cluster that gave about 200 mm of rain in the area around Punkeydoodle's Corners, southwest of Kitchener, according to radar estimates.

Figure 5a is a satellite image at 16:45 EDT (2045 UTC), about ten minutes after the first radar echo appeared. The strongest convection appears to occur where two cloud lines merge. Two and a half hours later, there is still an overshooting top near the original point of development with an extensive circular anvil to the northeast (Figure 5b).

For this event, the main spotter team spent the early afternoon hours searching for a lake breeze front inland from Lake Huron. After they launched a sonde from the Exeter site and the convection erupted, they stationed themselves on the southwest edge of the thunderstorm while the coordinator made observations on its western periphery. The coordinator photographed the cloud structure of the complex. The spotter team experienced heavy rain and noted downed trees, washed out roads and flooded fields.

This event clearly appears to be a case of converging lake breeze lines contributing to the development of a severe thunderstorm. Efforts to simulate this event with the MC2 mesoscale model are continuing. Some preliminary results were reported at the 19th Severe Local Storms Conference



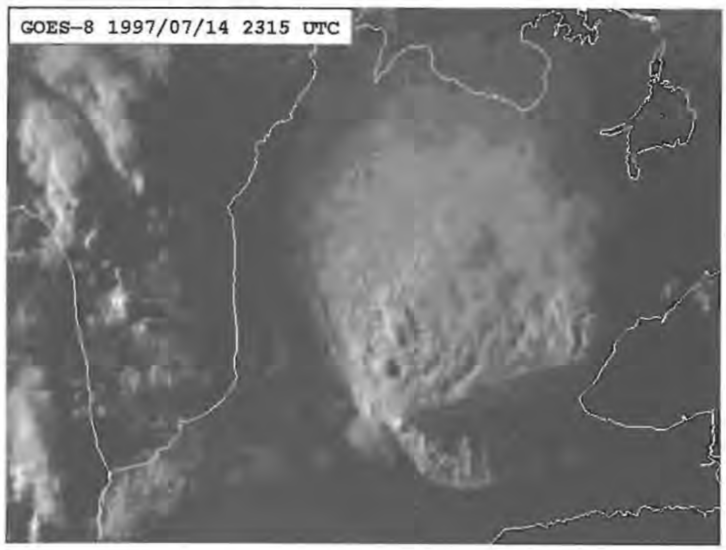


Figure 5a) at 2045 UTC and Figure 5b) at 2315 UTC: Development of a large, stationary multicelluar cluster at Punkeydoodle's Corners (near Stratford, Ontario) on 14 July 1997.

(Sills and King, 1998). More modelling results and some photographs for this event can be found at the following world wide web address: http://www.yorku.ca/research/blayer/dsills.html.

c) July 16 - Air Pollution Case

On this day the Lake Erie and Lake Huron lake breezes penetrated well inland, meeting in the late afternoon. The principal spotter team made spot measurements across the

Lake Huron and Lake Erie fronts as they moved inland, following the merging lines as far inland as Kitchener. Perhaps the most remarkable nature of this event was the contrast in visibilities in the different air masses. The air moving inland from Lake Erie was visible as a pall of air pollution with cumulus clouds poking out of the top. This case emphasizes the importance of lake breezes to air quality in southern Ontario.

6. Future Plans

With ELBOW, we believe that we have made significant progress toward the understanding of the relationship between lake-induced circulations and the development of severe weather. We are currently in the planning phase of a more comprehensive experiment (ELBOW 2000) which will build on the knowledge and experience we have gained.

The most important feature in this future experiment would be improved communications. Ideally, the coordinator would have full Internet capability to allow for immediate access to various satellite and radar products. Improved communications with mobile teams is also a necessity. We would also install more surface mesonet stations to better delineate the behaviour of lake-induced convergence lines. It can be seen from Figure 2 that there is a large hole in the network in the area between London and Kitchener where it appears that important interactions often take place (and certainly did on July 14). In addition, we think that the area just west of London is important when the gradient flow is more westerly. There is also a large hole in the network there.

There would be more and better-equipped spotter teams. Spotters might be equipped with mesonet stations that they could install in critical locations on a given day. By using towers with the anemometer at 7 m (instead of the standard 10 m), the spotter teams could quickly assemble the station and then disassemble it and move on to another location. This tactic would give better quality measurements than the hand-held instruments used in this project.

We were able to launch rawinsondes from two sites. Ideally, at least two fully mobile teams would launch balloons where and when appropriate.

Our limited experience with the light aircraft indicated that it might form a useful adjunct to a future experiment. A fully-equipped aircraft such as the NRC Twin Otter could obviously make more extensive and higher quality measurements.

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A Western Boundary Current Meter Array in the North Atlantic near 42°N

by R. A. Clarke[1], R.M. Hendry[1], I. Yashayaev[1] and D.R. Watts[2]

Résumé

Le Basin de Terre-Neuve est une part importante de la circulation océanique de l'Atlantique Nord. Le long de la partie supérieure du talus continental se trouvent le Courant du Labrador ainsi que le courant de la partie ouest du gyre sub-polaire de l'Atlantique nord. Par ailleurs, la partie plus profonde du talus continental est occupée par le courant profond occidental qui transporte vers l'équateur les différentes composantes des eaux profondes de l'Atlantique nord. Parmis celles-ci, on retrouve les eaux de la Mer du Labrador, les eaux profondes du nord-est de l'Atlantique, et les eaux superficielles du détroit de Denmark. Près de l'isobathe de 4 500 mètres, le courant de l'Atlantique nord (CAN) transporte vers le nord les eaux chaudes et salées provenant du gyre sub-tropical de l'Atlantique nord.

Cette région en est une de transition entre les gyres sub-tropical et sub-polaire de l'Atlantique nord, et est limitée au nord par la crête sud-est de Terre-Neuve et au sud par le Cap de Flemish. En cet endroit le talus continental change rapidement et subitement de pente et de direction, provoquant de nombreux méandres, tourbillons, bifurcations et rétroréflections des courants majeurs (Clarke et al, 1980, Rossby, 1995).

Vu la complexité des interactions entre les différents courants, on a conçu une étude contrôle de volume afin de déterminer les flux de chaleur, de sel et de masse à travers cette région, qui servirait à estimer la section A2 (nominalement à 48° N) du courant occidental. L'étude contrôle de volume couvrait une région qui fut divisée en quatre sections à partir de 50° W jusqu'au Cap Flemish, et dans lesquelles on pouvait effectuer des calculs d'inversion. Ces sections allaient être occupées trois fois sur une période de deux ans.

La section la plus à l'ouest entourait la crête sud-est de Terre-Neuve, d'où le Gulf Stream bifurque pour faire place au CAN. La frontière nord de cette section fut choisie de sorte qu'elle coupe le talus continental à mi-chemin entre la crête sud-est de Terre-Neuve et les monts océaniques de Terre-Neuve. Les variations du niveau de la mer (d'après l'altimètre Geosat), ainsi que les levés hydrographiques suggéraient que cette région du CAN était moins sujette à former des méandres et des débris tourbillonaires, permettant ainsi à un réseau de mesures de courant à densité modérée (le ACM6) -- installé le long de cette section -- de capturer le transport dû au CAN. Cette section fait aussi partie de la partie ouest du WHP, section A2.

Introduction

The Newfoundland Basin contains many important parts of the circulation system of the North Atlantic. Along the upper continental slope is the Labrador Current and the western boundary current of the sub-polar gyre of the North Atlantic. Over the deeper continental slope, the deep western boundary current (DWBC) transports the various components of North Atlantic Deep Water equatorward. These include Labrador Sea Water, Northeast Atlantic Deep Water and Denmark Strait Overflow Water. Near the 4500 metre isobath, the North Atlantic Current (NAC) transports warm and salty waters poleward from the subtropical gyre of the North Atlantic.

This region is the transition region between the sub-tropical and sub-polar gyres of the North Atlantic. The region is bounded on the north and south by the Southeast Newfoundland ridge and Flemish Cap respectively. Here the continental slope undergoes sharp and rapid changes in direction and steepness, resulting in the formation of meanders, eddies, bifurcations and retroflections of the major current systems (Clarke *et al*, 1980, Rossby, 1995).

Because of the complex interactions between the current systems, a control volume study was designed to determine the heat, salt and mass flux through this region. This would serve as the western boundary estimate for the trans basin section A2 (nominally at 48° N). The control volume study consisted of a series of sections which divided the area from 50° W to Flemish Cap into four closed boxes in which inverse calculations could be performed. These sections would be occupied three times over a two-year period.

The most westerly box enclosed the Southeast Newfoundland ridge. Here the Gulf Stream bifurcates and the NAC begins. The northern boundary of this box was chosen to cross the continental slope halfway between the SE Newfoundland Ridge and the Newfoundland Seamounts. Sea level variability from the Geosat altimeter and hydrographic surveys suggested that this was a region where the NAC was less subject to meanders and eddy shedding. This would allow a moderate current meter array, ACM6, set along this section to capture the NAC transport.

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This section is also the western end of WHP section A2.

Mooring Array

The mooring array (Figure 1 shown on cover page) consisted of eight current meter moorings containing a total of 45 Aanderaa current meters. The array was set across the continental slope from the 1500 metre isobath (actual depth of 1493 metres) to the centre of the Newfoundland Basin at a depth of 4888 metres. The inshore limit for the mooring array was determined by the fact that there is active bottom trawling for redfish to depths of 1200 metres in this region. This means that the array will not span the core of the Labrador Current usually located on the 1000 metre isobath.

The length of the current meter array was 400 km, the separation between moorings varied between 33 and 70 km. The array was deployed in August 1993 and recovered in May 1995 (two moorings whose acoustic releases failed were recovered by dragging in July 1995). The full array provided approximately 640 days (~1.75 years) of data.

Nominal current meter depths of 400 m, 800 m, 1500 m, 2500 m, 3500 m, 4000 m, and 100 m off the bottom were chosen to sample the major water masses and current features. All meters measured speed, direction, and temperature. Those at 400 m and 800 m were equipped with pressure and conductivity sensors. Most meters at 1500 m as well as those at 2500 m most likely to be in the core of the NAC were equipped with pressure sensors to document the pull down of the moorings. The mooring lines from 800 m to 400 m on the moorings in the core of the current were faired to reduce drag and subsequent pull down.

In addition to the current meter moorings, six Inverted Echo Sounders were set from the 3300 metre isobath to 30 km beyond the most offshore mooring. Three of these IESs were set at current meter mooring locations, two were set between moorings and the sixth was set half a separation distance beyond the final mooring. Only four IESs were recovered and their data is discussed in a Ph.D. thesis from University of Rhode Island (Meinen, 1998).

Data Analysis

Most of the Aanderaa Current meters used in this array were the old style tape recording instruments and some of these failed towards the end of the record. Two of the moorings lost their main buoyancy packages during the last three months of their deployment. This loss caused the current meters to sink below the maximum pressure for their pressure sensors resulting in failure of the sensor and flooding of the instruments. The overall data return was 79% for temperature and 76% for velocity.

Due to an oversight, most of the current meters in this array were deployed with a rotor gear ratio that resulted in the rotor counter resetting if the current speed exceeded about 0.3 m/s. This was a serious problem in the upper levels where current speeds of more than 0.7 m/s were frequent. The number of wrap arounds for these upper current meters was estimated by comparison with the speeds measured at the deeper levels on the mooring and an analysis of the mooring pull-down.

In order to calculate the transport across the section, the temperature and transverse flow observations were low pass filtered and subsampled at 2 day intervals. These were then interpolated, using optimal linear interpolation, onto a regular grid with horizontal grid spacing 20 km and vertical grid spacing 200 dbar.

Total transport estimates require measurements throughout the water column, but no direct measurements were made at levels shallower than 400 dbar. We estimated temperature and flow in the 0 to 400 dbar levels using an indirect method based on climatology. This method assumes that the temperature at 400 dbar can serve as a measure of the location of a particular water column relative to the axis of the NAC. From our climatology of upper ocean sections in this region, we can estimate the geostrophic shear and the temperature structure within the upper 400 dbars as a function of month and 400 dbar temperature. Using these estimates, we can construct temperature and transverse velocity fields in the upper 400 dbars and add these estimates to the gridded fields.

Transports

The NAC is seen in the mean transverse current field as a surface intensified (northeastward) positive flow with maximum surface speed 0.40 m/s at distance 300 km offshore of the 200 metre isobath. The NAC extends to the ocean bottom; the maximum positive flow at the bottom is 0.10 m/s at distance 320 km.

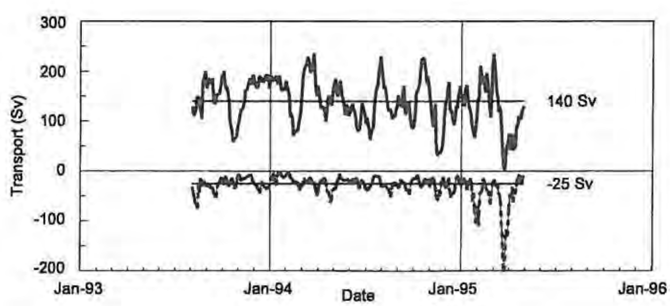

Figure 2: Transport through mooring array ACM6. Solid curve is poleward transport, dashed equatorward transport. The 'mean' value is the median of the individual 2 day estimates of these transports.

Inshore of the NAC is a region of bottom intensified negative (southwestward) flow. This intensification is associated with the DWBC, marked by a maximum bottom flow of 0.07 m/s at distance 220 km and 4200 dbar pressure.

The transport was decomposed into its poleward and equatorward components. Each elemental grid cell, 20 km x 200 dbar x 2 days, has associated with it a transport. The positive and negative transports were separately accumulated to provide the time series of synoptic transport as shown in Figure 2. The median values of positive and negative transport of 140 Sv and 25 Sv respectively are also shown in the figure.

The average transports can also be computed from the means of the 2 day estimates; these have values of 139 Sv and 30 Sv respectively for the poleward and equatorward transports. The difference in the equatorward transport between this estimate and the estimate based on the medians arises from the large equatorward flow observed at the end of the record. The median estimate will be relatively unaffected by this extreme event.

Mean transport can also be defined as the transport associated with the mean flow. This calculation results in much reduced estimates of positive and negative transports due to the smearing of the position of the NAC. Because the flows in the NAC are relatively strong compared to the inshore flows, the transport associated with the negative flow direction in the mean flow field is relatively more affected by this smearing.

Discussion

This preliminary analysis provides a gross estimate of the total volume transport of water poleward and equatorward within the western boundary region around 42° N. 140 Sv is larger than what has normally been considered the transport of the NAC; however, this figure also contains a substantial part of the recirculating flow within the Mann Eddy, a quasi-permanent anticyclonic circulation feature in the centre of the Newfoundland Basin. Reiniger and Clarke (1975) estimated the transport of the North Atlantic Current and Mann Eddy across this same section as 121 Sv by referencing a bottle section to current meter data a few 100 metres off the bottom.

The equatorward transport of 25 to 30 Sv is also large compared to the estimates of the DWBC transports of 10-15 Sv within the Labrador Sea. This new estimate includes less dense waters than are usually included within the DWBC. In the future, we will make estimates of the DWBC transport in temperature classes.

This note is based on material on the web page

http: //www.mar.dfo-mpo.gc.ca/science/ocean/ woce/acm/acm_poster_frame.html

which is based on a poster prepared and presented at the WOCE Scientific Conference in May, 1998.

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Did you know?

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.

Reference: International Year of the Ocean Web Site, 3-4 May 1998 facts.

WOCE, MEDS and the CDs

by J.R. Keeley[1] and P.A. Bolduc[1]

Résumé

Le World Ocean Circulation Experiment (WOCE) est la partie du programme mondial de recherche sur le climat (PRMC) qui a joué un rôle prépondérant dans l'amélioration des modèles de circulation océanique utilisés pour les prévisions climatiques. Les océans jouent un rôle central dans le système climatique quant à la façon dont ils transportent chaleur et eaux fraîches et participent à l'échange de ceux-ci avec l'atmosphère. Les océans provoquent également l'absorption de CO2 émis par la combustion de carburants fossiles. WOCE a utilisé les ressources de plus de 30 pays afin d'effectuer des observations *in-situ* et par satellite des océans entre 1990 et 1997, et ce à un niveau jamais atteint auparavant. Le programme a aussi entreprit l'étude de processus physiques importants, quoique mal compris. Parallèlement, des développements importants dans la capacité des modèles océaniques à reproduire des effets connus de la circulation des océans ont vu le jour durant le programme WOCE. Quoique l'analyse, l'interprétation, la modélisation et la synthèse des données WOCE (WOCE AIMS) vont se poursuivre jusqu'en 2002, la collecte continue de données WOCE ainsi que leur contrôle de qualité sont un prérequis pour le succès de cette entreprise. Les diverses banques de données WOCE distribuées sur CD en mai dernier à Halifax seront une ressource unique pour les chercheurs du climat et de l'environnement marin pour les décennies à venir.

Introduction

The World Ocean Circulation Experiment (WOCE) is a part of the World Climate Research Programme with the main objective to develop improved ocean circulation models. To achieve this, the project has two goals, model development and description of the global circulation based on a high quality and comprehensive data set. The oceans are a key element in the climate system in the way they transport heat and fresh water and exchange these with the atmosphere. The oceans also sequester CO_2 released by the burning of fossil fuels. WOCE has used resources from nearly 30 countries to make unprecedented in-situ and satellite observations of the global ocean between 1990 and 1997 and to observe poorly-understood but important physical processes. In parallel, great advances have been made during WOCE in the ability of ocean modelers to reproduce the known characteristics of the ocean and its circulation. Analysis, Interpretation, Modelling and Synthesis of WOCE data (WOCE AIMS) will continue to 2002 but a prerequisite for its success is the continuing assembly and quality control of WOCE data. The diverse WOCE data sets will serve as a unique resource for climate researchers and marine scientists for decades to come.

WOCE Data and Information System

WOCE data management structure has been designed as a distributed system which utilises the expertise of scientists and builds on existing data streams to attain a well documented and highest possible quality data resource. The system consists of several elements with the flow being from Principal Investigator to DAC to SAC to users and finally to the archive as shown in Figure 1.

Each measurement technique produces a different data "stream", and the data management system is working to bring them together to form a single data resource for numerous investigators and analysis groups.

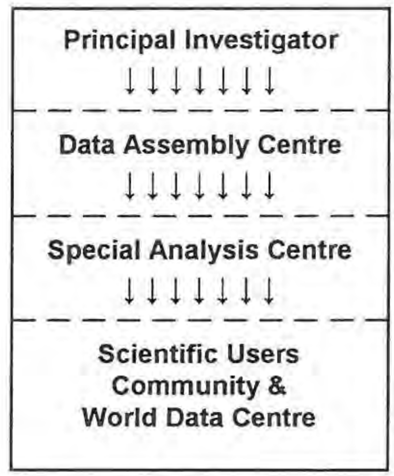

Fig. 1: Typical WOCE Data Stream

The structure of the Data Assembly Centres (DACs) is varied. Some are managed by scientists while others are a cooperative arrangement between scientific centres and existing national archive centres. All handle assembly and quality control of data sets, and generate data products.

Special Analysis Centres (SACs) perform data analysis and synthesis functions, including the generation of derived data sets. The WOCE archive is being developed at U.S. National Oceanographic Data Centre (NODC) and is distributed across the various data centres of the World Data Centre System. The Data

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Information Unit (DIU) is a central source of information on the status of WOCE, tracking all data collection, processing and archiving activities, and acting as the primary interface between the WOCE data system and all users. The DIU has been operational at the Graduate College of Marine Studies of the University of Delaware in Lewes, DE since 1986. It has followed the progress of the WOCE Field Programme since its beginning in January, 1990. Being a key player in managing WOCE data, the DIU has provided, in one place, information about all WOCE data sets by:

1) maintaining and distributing a directory of WOCE-related datasets and providing referrals to related inventories of the WOCE Data Assembly Centers, and National and World data centers;

2) gathering information needed to maintain the Unit's directories and summaries;

3) helping scientists use the WOCE Data System and the associated computer links.

Sharing WOCE Data

Early in the planning stage of the program, WOCE developed a data-sharing policy which strikes a balance between the requirements of the experiment as a whole and the intellectual rights of the individual investigators who contributed to the programme. The trade-off between these different interests has resulted in a policy which expects data to be made publicly available within 2 years of the data set being complete. Investigators are thus allowed a reasonable period to complete their own analysis and publications, while ensuring the global dataset is accumulated and made accessible for wider examination. Data cannot be released by the data centres without the consent of the originator. WOCE encouraged investigators to share data with others and to authorise general release as soon as possible. In cases where investigators had required exclusive rights to data more than 2 years old, WOCE encouraged peer pressure and funding agencies to persuade the originator to give consent to release.

Data Management and Distribution

WOCE is different from all previous oceanographic experiments in the scope of its goals and the field work that is required to achieve them. It is also different in that several large and diverse data sets have to be combined and distributed. Early in the planning stage, the Scientific Steering Group has established a Data Management Committee (now renamed the Data Products Committee, DPC) to be responsible for the overall planning and oversight of operations ot the WOCE data management and exchange activities.

1	Data Information Unit
2	Hydrographic Programme Data
3	Hydrographic Programme Special Analysis Centre Products
4	Upper Ocean Thermal Data
5	Subsurface Float Data
6	Surface Velocity Programme Drifter Data
7	Moored Measurement Data
8	Acoustic Doppler Current Profiler Data
9	Fast and Delayed Mode Sea Level Data
10	Meteorology Volume 1 - Indian & Pacific Oceans
11	Meteorology Volume 2 - Atlantic & Southern Oceans
12	Flux Special Analysis Center Products
13	Related Satellite Altimeter and AVHRR Data
14	TOPEX/POSEIDON Sea Surface Height Anomaly
15	Mean Surface Wind Fields from ERS-AMI and ADEOS-NSCAT Microwave Scatterometers
16	Mean Surface Wind Fields -Vol. 1 (1990-1993)
17	Mean Surface Wind Fields -Vol. 2 (1994-1997)

Table 1. List of CDs distributed in Halifax

CD-Rom technology has been selected as the distribution medium by the DPC. The first phase was to make available on CD-Rom each WOCE data stream. It was the responsibility of each DAC manager to master a CD-Rom and decide on the content that best suits the community they were serving. The following guidelines were approved at the Tenth meeting of the WOCE DPC held in January 1997:

1) Each CD-Rom would be a stand-alone dataset and must contain browsers and other utilities required;

2) In formatting the CD-Rom, every effort should be made to make them platform-independent (PC/Mac/UNIX) and conform to ISO-9660 standard;

3) Each CD-Rom would be reviewed and, after minor revisions, the master copy was to be delivered to the U.S. NODC for final mass production.

The CD-Roms are not the archive system of WOCE data but they serve as a data and information distribution tool. While the CD-Rom technology offers a reliable way for data dissemination, it does not diminish the ongoing archival activity. The CDs were available at the Scientific Conference held in Halifax in May 1998 (Clarke, 1998).

The CDs found in the package distributed in Halifax are listed in Table 1 shown on previous page.

MEDS (Marine Environmental Data Service) has contributed directly in the production of two of those CDs, namely, the Upper Ocean Thermal Data CD and the Surface Velocity Programme Drifter Data CD.

Upper Ocean Thermal Data CD

The DAC for the Upper Ocean Thermal, UOT, is a consortium of agencies that takes maximum advantage of existing programmes and expertise. It combines management of both low resolution data streams (reduced vertical resolution data exchange less than one month after time of acquisition and transmitted through the IGOSS system) and high resolution streams (full vertical and variable resolution data). The main data centre participants were the U.S. NODC, MEDS, and IFREMER in Brest. Science expertise is provided by CSIRO, AOML and Scripps. A number of agencies in countries provide assistance including Australia, France, Germany and Japan.

The data flow from collector to users is handled by the Global Temperature Salinity Profile Project, an IOC/WMO-sponsored programme. MEDS manages the low resolution data, while the NODC and IFREMER manage the high resolution flow. Science centres provide review of data quality and generate products.

The data resource on the CD consists of all of the temperature and salinity profiles collected during the period from 1990 to the end of 1997. Low resolution data are provided (derived from the original high resolution measurements) when the high resolution data have not yet reached the archives. All data have undergone extensive quality assessment first by the data centres and then by the science centres.

The CD provides a variety of documents that describe the operation of the UOT DAC, the GTSPP, how the data were processed and data quality control manuals produced by participants. Summaries of the data show where and when the data were collected. A sampling of products generated by the science centres is also provided. The data (more than 680,000 stations) are provided divided by area and time-frame for manageable-size files. Included is sample software to show how to read the data.

Surface Velocity Programme Drifter Data CD

Within the framework of its role as a Responsible National Oceanographic Data Centre for Drifting Buoy Data, MEDS was, along with the NOAA / Atlantic Oceanographic and Meteorological Laboratory (AOML), the Data Assembly Centre (DAC) for Surface Velocity Profile (SVP) data collected by drifting buoys. SVP data were transferred on a six-month basis from AOML, Miami, to MEDS, Ottawa, for archiving and distribution to the scientific community. The types of data received by MEDS from AOML included:

1) "B" files (Raw data files). These files contain data received from Service ARGOS with engineering units changed to physical units. Multiple sensor readings were condensed to one value for each satellite pass; no other processing was done.

2) "P" files (Position files). These files came from editing the raw files and separating out the position-related fields. Values that violate acceleration criteria were edited from these series [Hansen and Poulain, 1996].

3) "S" files (Sensor files). These files came from editing the raw files and separating out the SST-related fields. The fields were edited according to Hansen and Poulain [1996].

4) "K" files (Interpolated files). These files contain data interpolated to uniform six-hour intervals using an optimum interpolation procedure called Kriging [Hansen and Poulain, 1996].

5) "Directory file". The directory file contains detailed information about each drifter.

MEDS merged the "P" and "S" files together allowing for a ±15-minute window to match the date/time entries from both data sets; the merged output files are archived by experiment number and are available to the users; the data from these files can be retrieved by area and time-frame from one or many experiments.

The Krigged data file constituted the output product of the WOCE Surface Velocity Program. The entire data set submitted by AOML was archived by MEDS and is contained on the CD. This file contains all associated information, such as drogue type, deployment date, date drogue lost, etc. The histogram shown below (Fig. 2) illustrates the statistics on volume of data transmitted to MEDS by AOML to 1997. The file contained the fields described in Table 2 shown on the following page.

1) Platform identifier (Argos #)
2) Observation year (UTC)
3) Observation month (UTC)
4) Observation day (UTC)
5) Observation hour and minute (UTC)
6) Latitude of observation (+ve North)
7) Longitude of observation (+/- 180 deg, +ve West)
8) Sea surface temperature (deg. C)
9) East component of current (+ve East) (m/s)
10) North component of current (+ve North) (m/s)
11) Error in latitude
12) Error in longitude
13) Originator's experiment number
14) WMO platform identifier number

Table 2: Fields contained in the Krig file

Also included on the SVP CD are various data products produced by AOML. For each part of the following ocean basin, (North and South Atlantic Ocean, Indian Ocean and Pacific Ocean), the CD illustrates the mean velocity estimates fields, the variance of these fields, the number of data points in 5-degree by 5-degree bins used in the calculation of mean velocities through August 1996 and finally the contour plots of the number of data points. MEDS has also produced a series of graphs illustrating the volumes of data by year by ocean basin.

Conclusion

Version 1.0 of the WOCE Global Data does not represent the final WOCE Data Resource. More data sets are within the data management system (as described above) but remain for the time being proprietary, or still with the Principal Investigator because they are incomplete or being processed and analysed. As more data become available and more derived products are generated, the WOCE data resource will expand further. Future versions intend to provide a greater integration of all data collected by WOCE into a single logical site that can be accessed and searched by individual researchers. The DPC will be meeting early in 1999 to discuss the evolution of the present resource towards this goal. MEDS will be contributing its resources and expertise in achieving this goal.

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2) Hansen, D.V. and P.-Marie Poulain, 1996, Quality control and interpolation of WOCE/TOGA drifter data, J. Atmos. Oceanic Tech., **13**, p.900-909.

3) WOCE Report No. 150/97, March 1997 WOCE International Project Office, Southampton. Updated by WOCE DIU, February 1998.

Acknowledgement: The authors wish to acknowledge the continuous and enthusiastic support of Dr. Savithri Narayanan, Director of MEDS, in the production of these two CDs and the initiative of Dr. J.R. Wilson who was at the origin of MEDS' participation in WOCE.

Note: A limited number of copies of the UOT and SVP CDs are available directly from MEDS. Copies of the WOCE package are available from NOAA.

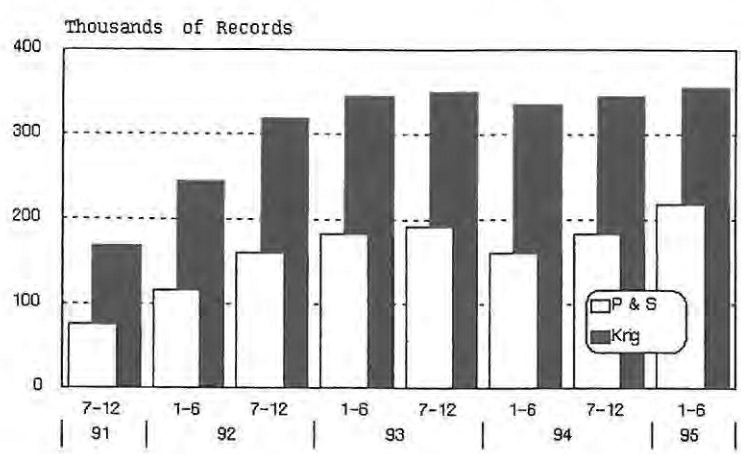

Figure 2: Histogram showing the volume of SVP data received at MEDS from AOML

Good reasons to publish in Atmosphere-Ocean

by Richard Asselin[1]

Introduction

Scientific publication has been one of the major and most manifest activities of CMOS and its predecessors, the Canadian Meteorological Society and the Canadian Chapter of the Royal Meteorological Society. This activity has progressed from the occasional publication of individual non-refereed papers (starting in 1950) to a quarterly publication Atmosphere (1967), containing a mixture of news and scientific papers, and finally to a full-fledged refereed journal in 1974. In 1977, the journal changed name to Atmosphere-Ocean. Since then, however, progress has been almost nil. The number of papers per year has remained about the same for 20 years (although the length of papers seems to have increased!). Considering the number of other international meteorological and oceanographic journals, and the wealth of papers they publish each year, A-O is in danger of becoming an insignificant journal, in spite of having an acceptable impact factor.

If CMOS members wish to maintain scientific publication as an important activity of their Society, then more papers have to be submitted in Atmosphere-Ocean.

Quality of publication

It is appropriate for scientists to develop their reputation by publishing in several international journals, but Canadian scientists should also contribute to the reputation of Canadian science by publishing some of their important findings in our own national journals, and specifically in Atmosphere-Ocean. A-O editors have a particular interest in presenting Canadian scientists and Canadian results in a favourable light. They will spend extra efforts to ensure that all reviewing, revising and technical editing are carried out in a timely and thorough manner.

Atmosphere-Ocean should be the journal of choice for publishing special issues to present the results of major Canadian projects. There have been several such issues in the past that have been very well received and now serve as a permanent record of the experiment. Ideally, A-O editors would like to have one special issue each year, and expect project leaders to come forward with proposals.

As detailed in a previous article (The Future of A-O, *CMOS Bulletin SCMO* Vol. 26 No. 4, August 1998), Atmosphere-Ocean enjoys an acceptable impact factor, with more than 400 citations per year. This record of achievement can be enhanced by the publication of more high-quality papers, and a larger readership.

Page charges

There is a cost to authors for publishing in Atmosphere-Ocean because CMOS has chosen to have low subscription costs, in order to encourage more readership. Approximately half of the publication costs are covered by page charges, the rest by subscription fees. Recently, steps have been taken to make access to the electronic version free of charge, with the hope that readership will be enhanced. A wider readership should also lead to more citations, and, therefore, to a greater impact factor.

There are journals without page charges, and these may have appeal for authors with limited budgets. However, these journals generally have a limit on the number of pages per article, or a penalizing fee for an excessive number of pages. In some cases the author has to produce a camera-ready copy that meets the standards of the journal, which may be very frustrating and may consume time that would be better spent doing research.

Furthermore, the subscription rates of these journals are higher, and they cannot offer free internet access as we do. CMOS even sends an electronic message to anyone who requests to be placed on the list, to announce the availability of the recent papers on the web.

Comparing Atmosphere-Ocean with other journals having page charges, we found that the A-O page charges are very comparable, taking into consideration both the value of the Canadian dollar and the number of words per page. Payment of page charges also entitles A-O authors to 50 free offprints, and more can be ordered at a modest cost.

A page of Atmosphere-Ocean contains about half or more the number of words in a 8.5in x 11in journal page, but the figures are often reproduced at a larger scale than in other journals. Since excessive figure size constitutes waste and results in higher costs, we intend to examine this problem and see if it can be resolved.

A typical article in A-O has 28 pages, resulting in page charges of about $2100. If unplanned, such an expense may be difficult to accommodate within a research budget at the last minute. However, is it excessive to set aside about $2000 to disseminate results from a research project that costs at least ten times that much, and often much more?

[1]Director of Publications, Canadian Meteorological and Oceanographic Society, Ottawa, Canada.

Costs and benefits to CMOS

CMOS is classified as a charitable organisation because it contributes to Canadian education by publishing scientific material. Furthermore, since we generally publish at a loss (i.e. at a small cost to all members), Revenue Canada has exempted CMOS members (including non-CMOS authors), from paying GST/HST on any good or service provided by the Society, including page charges. Thus, the publication of papers in A-O also results in a compensating benefit to all CMOS members.

There are some fixed costs involved in the publication of A-O, such as administrative fees and printing of booklet covers, and there are fixed revenues in the form of subscription fees. Variable costs result from the number of pages and the number of copies printed. Page charges constitute a page-dependent revenue, that serves to cover the fixed costs and the costs of additional pages printed. The current page charge($75 per page) and subscription rates ($35/$100 for individuals/institutions) are well balanced to cover the publishing costs. Furthermore, if the printed version were eventually to become obsolete, the current page charges would be sufficient to cover the costs of the electronic version.

Administrative flexibility

Being a small society, CMOS can offer more flexibility than bigger organisations. For example, it is possible to arrange for splitting the page charge invoice among several co-authors, or to accept partial advance payments to take advantage of funds subject to time lapse.

Conclusion

Atmosphere-Ocean has managed to maintain a good reputation for more than 20 years, but it is still a small journal, publishing a decreasing proportion of all the papers published internationally each year. There are many papers published by Canadian authors in other international journals, that could be redirected to A-O and enjoy a good distribution, thanks to free access via the internet. CMOS members are, therefore, invited to place A-O higher in their list of favoured journals.

Death of Professor Mohammed El-Sabh

Professor Mohammed El-Sabh passed away from cardiac arrest in Rimouski on February 8, 1999, at the age of 59. The Université du Québec à Rimouski (UQAR) and the entire province of Quebec have lost a respected member who contributed to the worldwide recognition of Rimouski in the field of marine sciences.

The funeral service was held at the Bic Church on Saturday, February 13, and he was buried at the Saint-Germain cemetery of Rimouski.

Born in Egypt, Mohammed El-Sabh received a Ph.D. in physical oceanography from McGill University in Montreal. He arrived at UQAR in 1972 where he became part of the first team of researchers to develop oceanography in Rimouski. Throughout the years, his classes, work and numerous publications and interventions benefited enormously the national and global reputation of UQAR.

At UQAR, he supervised about twenty master's theses and doctorate dissertations in oceanography. His competence was called upon by a number of universities to evaluate university writings.

His research led him to write several scientific works, such as: Natural and Man-Made Hazards (Netherlands, 1986), Oceanography of the St.Lawrence Estuary (Germany, 1990) and Integrated Management and Sustainable Development in Coastal Zones (U.S.A., 1998).

The researcher from Rimouski actively participated in the organisation of numerous seminars and meetings of specialists from around the world, in order to better understand our coastal environment and to contribute to the prevention of catastrophes caused by nature and minimise their damage. He had developed throughout the world an impressive network of professional relationships in the field of marine sciences.

Mohammed El-Sabh won several awards, such as: the Merit Award of the International Tsunami Society (for having organised in 1986 the International Symposium Périls et Catastrophes held in Rimouski), the Applied Meteorology Prize from the Canadian Meteorological and Oceanographic Society (1989), the Michel-Jurdant Award (Environmental Sciences, ACFAS, 1991), the Alcide-C.-Horth Distinction (for his contribution to the advancement of research, 1991), the Recognition Prize of the UQAR (1997) and the Scientific Prize of the Société internationale des catastrophes naturelles (1998).

He was twice chairman of the Department of Oceanography. Last fall, he accepted the position of Administrative and Scientific Supervisor of the PRICAT Project to develop links between Canada and Tunisia in the field of maritime resources. He was also a Council member of the Fondation de l'UQAR.

A great man has just left us. Many people will remember fondly his friendliness and enthusiasm and the way he had so well integrated into Quebec society.

He is survived by his spouse, Mrs. Pauline Côté, Professor of Education Sciences at UQAR and two children, Youssef and Nadia.

Mario Bélanger
Communication Services
UQAR

Décès du professeur Mohammed El-Sabh

Le professeur Mohammed El-Sabh est décédé, à l'âge de 59 ans, à Rimouski, le 8 février 1999, suite à un malaise cardiaque. L'UQAR et tout le Québec perdent ainsi une personnalité de premier plan qui a contribué à faire connaître Rimouski à travers le monde, dans le domaine des sciences de la mer.

Le funérailles se sont déroulées à l'église du Bic, le samedi 13 février, et il a été inhumé au cimetière Saint-Germain de Rimouski.

Né en Égypte, Mohammed El-Sabh a obtenu un Ph.D. en océanographie physique de l'Université McGill, à Montréal. Il est arrivé à l'UQAR en 1972, pour faire partie de la première équipe de chercheurs qui se sont lancés dans la mission de développer l'océanographie à Rimouski. Ses cours, ses travaux, ses nombreuses publications et interventions, ont aidé grandement à la réputation de l'UQAR au fil des années, tant au niveau national que mondial.

À l'UQAR, il a supervisé une vingtaine de mémoires de maîtrise ou de thèses de doctorat en océanographie. On a fait appel à ses compétences dans plusieurs universités pour l'évaluation de travaux universitaires.

En recherche, il est à l'origine de plusieurs publications scientifiques majeures, notamment: *Natural and Man-Made Hazards* (Pays-Bas, 1986), *Oceanography of the St.Lawrence Estuary* (Allemagne, 1990) et *Integrated Management and Sustainable Development in Coastal Zones* (États-Unis, 1998).

Le chercheur rimouskois a participé activement à l'organisation de divers colloques et rencontres de spécialistes, à travers le monde, dans le but de mieux connaître nos environnements côtiers et aussi, pour contribuer à prévenir les catastophes causées par la nature, et à limiter leurs dégâts. Il avait développé, à travers le monde, un impressionnant réseau de relations professionnelles dans le domaine des sciences de la mer.

Mohammed El-Sabh a mérité de nombreux prix, notamment: le Mérite de la International Tsunami Society (pour l'organisation du Symposium international *Périls et Catastrophes* tenu à Rimouski en 1986), le Prix d'océanographie appliquée de la Société canadienne de météorologie et d'océanographie (1989), le Prix Michel-Jurdant (Sciences de l'environnement, ACFAS, 1991), la Distinction Alcide-C.-Horth (contribution à l'avancement de la recherche, 1991), le Prix de reconnaissance de l'UQAR (1997) et le Prix scientifique de la Société internationale des catastrophes naturelles (1998).

À l'Université il a occupé à deux reprises les fonctions de directeur du Département d'océanographie. Il avait accepté l'automne dernier de devenir le responsable administratif et scientifique du projet PRICAT pour développer des liens entre le Canada et la Tunisie dans le domaine des ressources maritimes. Il était aussi membre du Conseil d'adminstration de la Fondation de l'UQAR.

C'est une personnalité forte qui vient de disparaître. Plusieurs gardent un bon souvenir de cet homme sympathique, enthousiaste, bien intégré à la société québécoise.

Il était le compagnon de Mme Pauline Côté, professeure à l'UQAR en sciences de l'éducation. Il était le père de deux enfants, Youssef et Nadia.

Mario Bélanger,
Services des communications
UQAR.

Reminiscences with Mohammed El-Sabh

by T. S. Murty[1]

I first met Mohammed El-Sabh in 1969 while he was a Ph.D student at McGill University and later at the Université du Québec à Rimouski where he and a number of colleagues pioneered the development of the Department of Oceanography. Mohammed became best known nationally and internationally for his work on natural hazards. He, along with like-minded scientists in Canada and the United States, founded the International Natural Hazards Society in 1988 and served as its first president for eight years. He was also chairman of the IAPSO Committee on Natural Hazards.

Beside his dedication to the mitigation of natural hazards he was a generous man and very much a people person as illustrated by some of our travels together. One such trip was to a conference in Novosibirsk, Siberia, where on a hot Sunday afternoon we tried to buy an ice cream cone from a street vendor. Unfortunately, the ice cream and cones were all frozen together and despite the efforts of the young girl, she could not separate the cones without crushing and breaking them. After several failed attempts and broken cones she burst into tears because she had lost so much money in trying to serve us. Mohammed, seeing the despair on the young girl's face, promptly pulled out $50 US dollars from his pocket and gave it to her with a hug. This particular trip was not without its other moments. Mohammed fell while out walking and broke his leg. Despite the remoteness of this part of Russia he managed to get a cast on his leg and we left for Moscow a few days later with him barely able to walk on crutches. I had to leave him standing on the sidewalk of the airport terminal while I searched for a wheelchair minutes before my departure time. Both our visas were expiring and without flights home we were not sure what would become of us. With help, he managed to get baggage and all on a flight out of Russia and myself on another aircraft to London. We laughed about it afterwards but it was scary and rather lonely at the time.

On another occasion while we were attending one of the Indian Science Conferences, we took some time off for sightseeing. While stopping en route we were entertained by a man with a performing bear which could do incredible acrobatic tricks. Mohammed noticed how well-fed the man was in comparison to the poor bear and immediately took 200 Rupees out of his pocket and told the bear's master to feed it and look after it properly.

His generosity and love of animals led to a near-tragic accident on the same trip when we were visiting a temple in Jaipur. He took the time to feed a monkey and in so doing he turned and fed another, at which time the first attacked him in a jealous rage and tore at his face. Before any of us in the party could react, the second monkey jumped and knocked Mohammed to the ground thus saving him from serious injury. We departed from there much shaken by the event.

Mohammed was well-respected and cultivated many good friends around the world. He was a true friend of mine and I know he will be missed by many others.

1: Bill Baird & Associates, Ottawa, Canada.

Avis aux membres

Si vous êtes membre en règle de la SCMO ou de son prédécesseur depuis vingt-cinq ans, prière de nous le laisser savoir le plus tôt possible par retour du courrier, par facsimilé ou par courriel.

Neil J. Campbell
Directeur exécutif

Getting Into the Swim of Things at DFO!

by Kelly Ash

Fisheries and Oceans Canada (DFO) and universities across the country are literally 'putting education to work'. In partnership with DFO, the co-operative education program is providing Canadian students, such as myself, the opportunity to combine classroom learning with hands-on experience that can only be found in the workplace.

This work-study option is typically structured to alternate traditional study terms with related work terms during which time students are placed on a four-month contract according to their field of study. At DFO these disciplines range from oceanography and natural sciences, to computer science, mathematics, geography, languages and administration, to name a few.

As a student working on her Bachelor of Science Degree in Marine Biology at Dalhousie University in Halifax, my present position has brought me inland to DFO headquarters in Ottawa. It is here that I have been working within the Oceans Sector as a writer/editor of Ministerial Correspondence under the supervision of Mrs. Judith Lyons. The majority of my work responsibilities involve processing and drafting responses to ministerial letters, e-mails and petitions that deal with issues involving habitat, environmental science, and protection and conservation of Canada's freshwater and marine environments. The sources of such correspondence include politicians at all three levels of government, constituents, scientists, teachers, first nations, public interest groups, companies in the private sector, and Canadian citizens at large.

Handling such a wide range of correspondence addressed to the Minister of Fisheries and Oceans, and to DFO in general, has provided me with a new insight into the broad scope of issues that the Oceans Sector is involved with, and has opened my eyes to the concerns and challenges facing Canadians today.

Working for Fisheries and Oceans Canada in the Public Service has given me an opportunity to witness the administration efforts behind DFO's vision to be a world leader in oceans and aquatic resources management. At Dalhousie University, I have seen the results of many DFO projects in action through the work of the many government scientists that work within the university. Here at Headquarters (in Ottawa), I will soon be ending my four-month contract and returning to school with a better understanding of how departmental policies are implemented and what kind of impacts they have on the community, both locally and globally.

The co-op experience can be rewarding and beneficial for both employers and students. Students bring new perspectives to the workplace and offer employers a chance to assess their skills and potential before they are ready to enter the workforce on a full-time basis. For students, the experience offers them a chance to develop their skills, look at career options and then decide where they best fit into today's job market.

Having studied Marine Biology for the last three years, I am excited that I can now apply my scholastic and personal interests to my work responsibilities here at DFO. It is encouraging to see that the knowledge I am acquiring in university is still relevant to the modern workplace. I am especially proud to be Canadian when I see that the concerns of the Canadian public are being addressed promptly and am grateful for the opportunity I've had to be a part of that process.

Note from the Editor: Kelly Ash has just completed a 4-month work-term with DFO in the Ocean Sector, Habitat Management and has attended most of the CMOS Ottawa Centre lunches during her stay in Ottawa.

WANTED

Articles, short notes, news items, workshop reports, trip reports, book reviews. We need to hear from you!!!!!!

RECHERCHÉ

Articles, notes brèves, nouvelles, rapports d'ateliers, rapports de voyages, revues de livres. Nous avons besoin de votre contribution!!!!!!

Just Published / Vient de paraître

A HISTORY OF AGROMETEOROLOGY IN CANADA

by George W. Robertson
Atmospheric Environment Program,
Environment Canada, 1998.
Pages xii + 258 (in English only)

FOREWORD

(Note: Limited number of copies are available from CMOS)

The World Meteorological Organization is a specialized agency of the United Nations. Its Commission for Agricultural Meteorology, to which most of the world's countries belong, promotes the application of meteorology to enhance world food production. At the Ninth Session, in 1986, the Commission "encouraged members to prepare for individual countries a 'History of Agricultural Meteorology' that was linked to international work and the work of the Commission." (WMO, 1987.)

In response to this request, and in recognition of the valuable contributions of a substantial number of Canadians to the discipline, Agriculture Canada and Environment Canada agreed to produce "A History of Agrometeorology in Canada". A joint project was developed by the two Departments, and George Robertson was commissioned to prepare the manuscript.

Robertson is a well-known, well-respected agrometeorologist, both in Canada and internationally. He headed Agriculture Canada's Agrometeorological Section for 18 years, served two years as a consultant in a WMO assignment in the Philippines, then returned for another two years to the Swift Current Research Station as Head of the Soil Science Section. After his retirement in 1973 he undertook a variety of consulting jobs, including missions sponsored by WMO and the Food and Agriculture Organization to strengthen agrometeorology in developing countries. His more than 30 years of experience as a researcher, teacher, manager, consultant and coordinator give him a perspective that few others could match.

Dr. Wolfgang Baier, retired Director of Agriculture Canada's Plant Research Centre, provided leadership and support for the preparation of the manuscript, in cooperation with Mal Berry, former Chief of the Analysis and Impact Division of Environment Canada. Environment Canada's Joan Masterton managed manuscript completion and publication. Ed Truhlar and Mal Berry edited the document.

Call for papers
Western Canada Weather Workshop

The third annual "Western Canada Weather Workshop" (WCWW) will be held June 24th and 25th 1999 at the University of British Columbia (UBC) in Vancouver, Canada. The workshop is jointly organized by the Pacific Weather Centre (PWC) of Environment Canada and the University of British Columbia (UBC) Atmospheric Science Programme with sponsorship from the local chapter of the Canadian Meteorological and Oceanographic Society (CMOS).

Sessions on major weather events of 1998 and early 1999, coastal meteorology, mountain meteorology, severe weather and aviation meteorology are planned.

Papers will be accepted until May 21st, 1999. Please send via e-mail a one-paragraph abstract with title, author(s), affiliation, phone, and e-mail address to Gerard Neault (e-mail: gerard.neault@ec.gc.ca).

For additional information, contact Gerard Neault:

e-mail: gerard.neault@ec.gc.ca;
tel: (604) 664-9358; fax: (604) 664-9004.

Demande de présentations
Atelier de travail sur la météorologie de l'ouest du Canada

Le troisième atelier de travail sur la météorologie de l'ouest du Canada aura lieu les 24 et 25 juin, 1999 à l' Université de la Colombie-Britannique à Vancouver. L'atelier de travail est organisé conjointment par le Centre météorologique du Pacifique d' Environnement Canada et du Programme des Sciences de l' Atmosphère de l'Université de la Colombie-Britannique avec support du chapitre local de la Société canadienne de météorologie et d'océanographie (SCMO).

Des sessions sur les évènements météorologiques d'importance de l'année 1998 et du début de l'année 1999, sur la météorologie côtière, sur la météorologie des montagnes, le temps violent et la météorologie aéronautique sont prévues.

Les communications seront acceptés jusqu'au 21 mai 1999. Veuillez envoyer par courrier électronique un résumé d'un paragraphe avec titre, auteur(s), affiliation, numéro de téléphone et addresse de courrier électronique à Gérard Neault: (courriel: gerard.neault@ec.gc.ca).

Pour plus d' information, veuillez rejoindre Gérard Neault:

courriel:gerard.neault@ec.gc.ca;
tél: (604) 664-9358; facsimilé: (604) 664-9004.

Polar Aspects of Atmospheric re-analyses

Special session at the Second International Conference of re-analyses

Wokefield Park, Mortimer
Reading, U.K.

23-27 August 1999

It is hoped to include an afternoon session on polar aspects of re-analyses at the Second International Conference on Re-Analyses (information on which will be found below and at the ECMWF Web Site - address shown below also). Those wishing to contribute to the session are encourages to respond to the following call for papers to the conference.

The Conference has been sponsored by the World Climate Research Programme, the European Centre for Medium-range Weather Forecasts, Fujitsu Systems (Europe) Ltd, the National Aeronautics and Space Administration and the American Meteorological Society.

Delegate registration, including the submission of abstracts, is now invited. Full conference details and on-ligne registration form can be found at:

http://www.ecmwf.int/conf/index.html

For queries please contact the chair of the Local Organizing Committee:

Dr. D. Burridge
ECMWF, Shinfield Park
Reading, RG2 9AX U.K.
Tel: +44 118 949 9000; Fax: +44 118 986 9450
reanalyses2@ecmwf.int

CLIMAR 99 (Second Notice)

Sheraton Wall Centre
Vancouver, B.C. Canada
8 - 15 September 1999

WMO Workshop on Advances in Marine Climatology

Background

The WMO Commission for Marine Meteorology (CMM) at its ninth session (Geneva, October 1984) agreed on the value of preparing a publication which would provide comprehensive documentation of the knowledge and techniques already in use by a number of Meteorological Services in the processing of marine meteorological data and, at the same time, describe in detail the diverse applications of such data in the service of the marine user community. The Commission's recommendation resulted in the publication, in 1995, of the WMO *Guide to the Applications of Marine Climatology*.

During its last session (Havana, March 1997), the Commission agreed with the proposal of its Working Group on Marine Climatology to update the Guide which should have now two parts: a static part expected to remain valid over a long time-frame, and a dynamic part covering issues such as new technologies and climate change. It further agreed that a workshop, to be held in 1999, should provide the input for the dynamic part.

During the same period, there has been a significant amount of research carried out by national agencies in a number of Member countries. Initiatives such as the Comprehensive Ocean-Atmosphere Data Set (COADS) under which two specialized events have been held, the "COADS Wind Workshop" (Kiel, Germany, May 1994) and the workshop on "Historical Marine Surface Data and Metadata" (Toledo, Spain, September 1997), are thought to be of particular importance as a contribution to the preparation of the new version of the Guide.

The Workshop is being held as a merged effort and will therefore also include contributions for COADS, particularly to cover "search for marine data on the Southern Hemisphere sparse data areas", "quality control and homogeneity" and "winds".

Objectives

The objectives of the Workshop are:

1) To receive appropriate input for the dynamic part of the new version of the WMO *Guide to the Applications of Marine Climatology*, with particular emphasis on new technologies;

2) To review the requirements of users for new marine climate products and enhanced climate information;

3) To provide guidance and technical support for those national Meteorological Services with responsibilities under the Marine Climatological Scheme (MCSS);

4) To make a further contribution to the data and metadata of COADS.

Participation

Participation is invited and anticipated from a wide range of professionals involved in the fields of applications of climatology, particularly marine climatology, climatological data archival and retrieval, climatological modelling, climate researchers, experts with responsibilities in the MCSS and marine climatic data users.

Organization

The Workshop is being organized jointly by the World Meteorological Organization, Environment Canada and the COADS programme of the National Oceanic and Atmospheric Administration (NOAA). The Workshop is also being co-sponsored by NOAA's Office of Global Programs (OGP) and its Environment Services Data and Information Management (ESDIM) program.

Venue

The Workshop will take place at the Sheraton Wall Centre Hotel, Vancouver, Canada. The hotel is located about three blocks away from the action of Robson Street. Vancouver is a world-class gateway city set amidst a majestic backdrop of mountains and sea. A block of rooms has been reserved for participants and the rate very conveniently negotiated to C$ 170 (approximately US$ 110) single or double occupancy. A hotel reservation form for the Sheraton is available upon demand.

Structure

The Workshop, which will take place in English only, is structured with an opening ceremony and session, followed by ten sessions (from the afternoon of Wednesday, 8 September 1999 to the morning of Wednesday, 15 September 1999), and ending with a discussion and closing session. The sessions will include both invited and contributed papers. Poster sessions will be organized if required. A Workshop Preprint volume of extended abstracts will be available. Invited papers as well as selected contributed papers will be considered for publication as the dynamic part of the WMO *Guide to the Applications of Marine Climatology*.

Workshop Programme

1. Characteristics of data from in situ observing platforms. Winds, waves and sea-surface temperature (SST) data are of primary interest.
   Buoys;
   Voluntary Observing Ships (including oil rigs);
   Fishing fleet; Intercomparisons.

2. Development of blended satellite and in situ databases
   Winds and waves; Precipitation;
   SST; Humidity (flux).

3. Metadata and data quality
   COADS quality control issues;
   Analysis of WMO-47 data;
   Use of WMO-47 data in climatological analysis;
   Buoy metadata.

4. Bias adjustment in climate data
   Winds; SST; Other parameters.

5. Reanalysis
   Data assimilation techniques in reanalysis;
   Intercomparison or evaluation of reanalysis fields (marine); Impact of satellite information on reanalysis data quality; potential bias.

6. Use of new marine climate products
   Reanalysis databases; Satellite databases;
   World Ocean Circulation Experiment (WOCE) and Global Ocean Observing System (GOOS) data sets.

7. User requirements for (enhanced, improved) climate information
   Offshore, e.g. oil and gas industry; Fisheries;
   Coastal zone management; Insurance.

8. Climate variability and change
   Interannual - decadal; Teleconnections;
   Century scale - climate change detection.

9. Database enhancements
   COADS/United Kingdom Met Office blended database; Adding new historical data sets.

10. Climate predictions

Workshop papers: invited and contributed

Invited speakers are being identified for each session. All invited speakers will be notified in April 1999. Contributed presentations will be accepted subject to approval of the one-page abstract submitted to the Organizing Committee (see below). A maximum of about 30 contributed papers can be accommodated in the programme: papers in excess of this number may be placed in poster sessions. Authors of contributed presentations are totally responsible for their own travel costs.

All authors should submit an informal one-page abstract by 31 March 1999, preferably by e-mail, but alternatively by fax or paper mail. The purpose of these abstracts' submission is the selection of the papers that will comprise the final programme, the determination of those who will be designated as invited speakers, the size of the programme and whether a poster session will be required. The second Workshop submission will be an extended abstract, due on 1 August 1999. Its length should be 5-15 pages for invited papers and 5-10 pages for contributed papers. Extended abstracts will be printed in a Preprint volume, to be available at the beginning of the Workshop and authors should provide them in the format used by the American Meteorological Society (AMS) for its Conference Preprint volumes. Graphics, figures and photographs, if included, should be made available in electronic form (JPEG format). Authors will be responsible for adhering to these formats. Extended abstracts, combined with the summaries prepared by the session rapporteurs, will also be published in WMO Marine Meteorology and Related Oceanographic Activities (MMROA) reports series and placed on the WMO Web page.

A third level of submission's usage is also planned and would be mandatory for invited speakers and optional for contributed papers. These papers would be subject to peer review. Following peer review, the authors would submit a final version, in electronic form, to the Organizing Committee. This would then undergo technical editing, and be later published by WMO as the dynamic part of the *Guide to the Applications of Marine Climatology* (about 31 March 2000). Selected papers would also be available on a number of relevant Web pages (e.g. Environment Canada, COADS, NCDC).

Authors of invited papers may apply for reimbursement of their travel costs (APEX airfare) and other expenses such as hotel, lump sum for meals and incidentals. However, no honorariums will be paid for their attendance.

Organizing Committee

■ Mr. Val Swail, Chairman
Environment Canada; Downsview, Ontario, Canada
Fax: (416) 739-5700; e-mail: Val.Swail@ec.gc.ca

■ Dr. Henry F. Diaz
Climate Diagnostic Center; Boulder, CO, USA
Fax: (303) 497-7013; e-mail: hfd@cdc.noaa.gov

■ Mr. Joe D. Elms
National Climatic Data Center
Asheville, NC, USA
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■ Mr. Fernando Guzmán
Ocean Affairs Division
WMO, Geneva, Switzerland
Fax: 4122 733 02 42; e-mail: fguzman@www.wmo.ch

33^e CONGRÈS SCMO - MONTRÉAL 1999

PROGRAMME (sujet à changement)

INSCRIPTION

Hôtel Gouverneur, Place Dupuis, 1415, rue Saint-Hubert, Montréal
(coin Sainte-Catherine et Saint-Hubert):

- Dimanche le 30 mai: de 16:00 à 21:00

Université du Québec à Montréal, Pavillon Judith-Jasmin, 405, rue Sainte-Catherine
(on peut y accéder par le métro, à la station Berri-UQAM):

- Lundi le 31 mai: de 07:30 à 17:00
- Mardi le 1er juin: de 08:00 à 17:00
- Mercredi le 2 juin: de 08:00 à 16:00
- Jeudi le 3 juin: de 08:00 à 16:00

REPAS - MÉDAILLE PATTERSON - FACULTY CLUB, UNIVERSITÉ McGILL:

Endroit: FACULTY CLUB, Université McGill, 3450 rue McTavish, Montréal
(une rue à l'ouest de McGill College et au nord de Sherbrooke - à environ 10 minutes de marche du Métro McGill)

- Jeudi le 3 juin 1999 de 12:00 à 13:30

Transport (autobus): Départ pour le Faculty Club à 11:30;
Retour vers l'Hôtel Gouverneur à 13:30

Prix de billets: 25 $ (taxes et services inclus). Possibilité d'un repas végétarien pour ceux et celles qui en feront la demande. Nombre de places est limité à **80** personnes.

COCKTAIL DE BIENVENUE NEC-HNSX - LA BIOSPHÈRE:

Endroit: La BIOSPHÈRE, 160, chemin Tour-de-L'Isle, Île Sainte-Hélène, Montréal
(à 3 minutes de marche du Métro Île Sainte-Hélène)

- Lundi le 31 mai 1999: de 18:00 à 19:30

Transport (Métro): Nous donnerons avec chaque inscription deux billets de métro (aller - retour)

Le cocktail inclus nourriture, 2 consommations, 2 billets de métro et visite guidée de la Biosphère)

Aller: Se rendre au Métro Berri-UQAM à quelques pas où se tient les sessions et les kiosques des exposants. Ensuite se diriger vers l'enseigne Métro Longueuil (LIGNE JAUNE). Une fois en route, vous arrêtez à la prochaine station : Métro Île Sainte-Hélène. À la sortie de la station, il faut se diriger vers l'immense SPHÈRE , très visible.

Retour: Faire le trajet inverse vers la station Métro Île Sainte-Hélène. Ensuite se diriger vers l'enseigne Métro Berri-UQAM. Note: Possibilité de stationnement limité à proximité de la Biosphère en fin d'après-midi.

VISITE DE LA BIOSPHÈRE :

- Lundi le 31 mai 1999 Heure: 19:00

ASSEMBLÉE GÉNÉRALE ANNUELLE DE LA SCMO - LA BIOSPHÈRE:

Endroit : La BIOSPHÈRE, 160, chemin Tour-de-L'Isle, Île Sainte-Hélène, Montréal
(à 3 minutes de marche du Métro Île Sainte-Hélène)

- Lundi le 31 mai 1999: Heure: 20:00

Transport (Métro): Nous donnerons avec chaque inscription deux billets de métro (aller - retour);

Aller: Comme pour le cocktail de bienvenue.

Retour: Comme pour le cocktail de bienvenue.

Note: Possibilité de stationnement limité à proximité de la Biosphère en fin d'après-midi.

BANQUET - HÔTEL GOUVERNEUR, PLACE DUPUIS :

Endroit: Salle LA CAPITALE (4e étage),
HÔTEL GOUVERNEUR, PLACE DUPUIS, 1415, rue Saint-Hubert, Montréal
(Coin Sainte-Catherine et Saint-Hubert - à environ 5 minutes de marche des sessions et kiosques des exposants)

Mercredi le 2 juin 1999: Heure: 19:00 (Bar payant de 18:00 à 19:00)

Possibilité d'un repas végétarien pour ceux et celles qui en feront la demande.

REPAS - MÉDAILLE TULLY - RESTAURANT (à venir):

Endroit: (à venir)

- Mardi le 1er juin 1999 Heure : de 12:00 à 13:30

RENCONTRE DES ANCIENS DE LA MÉTÉOROLOGIE DE L'UQAM:

Endroit : (à venir)

- Mardi le 1er juin 1999 Heure : de 17:00 à 20:00

VISITES GUIDÉES EN FRANÇAIS OU EN ANGLAIS :

Vendredi le 4 juin

Visite guidée en français : du Radar McGill, du Bureau des services météorologiques environnementaux (BSME) de Montréal et de MétéoMédia

- Heure: départ à 09:00 et fin de la visite à 15:00

Visite guidée en anglais : de MétéoMédia, du Radar McGill et du Centre météorologique canadien

- Heure: débute à MétéoMédia à 10:30 et se termine à 16:15

AU MUSÉE STEWART AU FORT DE L'ÎLE SAINTE-HÉLÈNE :

Ne manquer pas de visiter l'exposition : NAPOLÉON BONAPARTE...À L'ÎLE SAINTE-HÉLÈNE

Du 5 mai au 11 octobre 1999 ; Ouvert 7 jours par semaine de 10:00 à 18:00

Droits d'entrée: 10,00 $

33rd CMOS ANNUAL CONGRESS - MONTREAL 1999

PROGRAM (subject to modification)

REGISTRATION

Hôtel Gouverneur, Place Dupuis, 1415 Saint-Hubert Street, Montreal
(at the corner of Sainte-Catherine and Saint-Hubert):

- Sunday 30 May: from 16:00 to 21:00

Université du Québec à Montréal, Judith-Jasmin Pavilion, 405 Sainte-Catherine Street
(accessible by the subway, at Berri-UQAM Station):

- Monday 31 May: from 07:30 to 17:00;
- Tuesday 1 June: from 08:00 to 17:00
- Wednesday 2 June: from 08:00 to 16:00
- Thursday 3 June: from 08:00 to 16:00

PATTERSON MEDAL LUNCH - FACULTY CLUB, McGILL UNIVERSITY:

Location: FACULTY CLUB, McGill University, 3450 McTavish Street, Montreal
(one block west of McGill College, north of Sherbrooke - about 10 minutes from McGill Métro)

- Thursday 3 June: from 12:00 to 13:30

Transportation (bus): Departure for the Faculty Club at 11:30
Return to Hôtel Gouverneur at 13:30

Tickets: $ 25 (taxes and services included). Possibility of vegetarian meal for those who require it.
Please note that the number of seats limited to **80** persons.

NEC-HNSX ICE BREAKER - LA BIOSPHÈRE:

Location: La BIOSPHÈRE, 160, chemin Tour-de-L'Isle, Île Sainte-Hélène, Montréal
(at 3 minutes walking distance from Île Sainte-Hélène Métro)

- Monday 31 May: from 18:00 to 19:30

Transportation (Métro): With each registration, we will provide two subway tickets (return fare)

Ice breaker includes food, 2 drinks, 2 subway tickets and the guided tour of the Biosphère)

Way to go: From the session rooms and exhibitors' site, walk to Berri-UQAM Métro which is very close. Then look for the sign Longueuil Métro (YELLOW LINE). Once in the wagon, you get off at the next station: Île Sainte-Hélène Métro. When you get out of the station, take the direction towards the big SPHERE; you cannot miss it.

Way back: Just do the reverse way towards the station: Île Sainte-Hélène Métro. Then look for the sign Berri-UQAM Métro. Note: Possibility of limited parking near the Biosphère.

GUIDED TOUR OF THE BIOSPHÈRE:

- Monday 31 May: Time: 19:00

CMOS ANNUAL GENERAL MEETING - LA BIOSPHÈRE:

Location: La BIOSPHÈRE, 160, chemin Tour-de-L'Isle, Île Sainte-Hélène, Montréal
(at 3 minutes walking distance from Île Sainte-Hélène Métro)

■ Monday 31 May: Time: 20:00

Transportation (Métro): With each registration, we will provide two subway tickets (return fare)

Way to go: Same as the Ice Breaker activity.

Way back : Same as the Ice Breaker activity.

Note: Possibility of limited parking near the Biosphère.

CMOS ANNUAL BANQUET - HÔTEL GOUVERNEUR, PLACE DUPUIS:

Location : Room LA CAPITALE (4th floor),
HÔTEL GOUVERNEUR, PLACE DUPUIS, 1415 Saint-Hubert Street, Montreal
(at the corner of Sainte-Catherine and Saint-Hubert - about 5 minutes walking distance from the session rooms and exhibitors' site)

■ Wednesday 2 June: Time: 19:00 (Cash Bar from 18:00 to 19:00)

Possibility of vegetarian meal for those who require it.

TULLY MEDAL LUNCH - RESTAURANT (to come):

Location: (to come)

■ Tuesday 1 June: Time: from 12:00 to 13:00

MEETING OF THE UQAM GRADUATES:

Location : (to come)

Tuesday 1 June: Time: from 17:00 to 20:00

GUIDED TOURS IN FRENCH OR IN ENGLISH:

Friday 4 June

Guided tour in French: of McGill Radar, of the Montreal Environmental and Weather Service Centre, and of the WeatherNetwork

■ Time: departure at 09:00 and the tour ends at 15:00

Guided tour in English : of WeatherNetwork, of McGill Radar and of the Canadian Meteorological Centre

■ Time: starts at the WeatherNetwork at 10:30 and ends at 16:15

AT THE STEWART MUSEUM AT THE FORT ON ÎLE SAINTE-HÉLÈNE :

Don't miss the exhibition: NAPOLÉON BONAPARTE...AT ÎLE SAINTE-HÉLÈNE

From May 5th to October 11th, 1999; Open 7 days a week from 10:00 to 18:00;

Admission fee: $10.00

33e CONGRÈS SCMO - MONTRÉAL 1999

PROGRAMME (sujet à changement)

	Dimanche 30 mai	**Lundi 31 mai**	**Mardi 1 juin**	**Mercredi 2 juin**	**Jeudi 3 juin**	**Vendredi 4 juin**
Matin	Réunion des comités	Sessions scientifiques	Sessions scientifiques	Sessions scientifiques	Sessions scientifiques	Visites guidées
Midi	Réunion des comités		**12:00 - 13:30** Repas **Tully** (informel) Restaurant (endroit : à venir)		**12:00 - 13:30** Repas Médaille **Patterson** Faculty Club Université McGill	Visites guidées
Après-midi	Réunion des comités	Sessions scientifiques	Sessions scientifiques	Sessions scientifiques	Sessions scientifiques	Visites guidées
Soir		**18:00 - 19:30** Cocktail de bienvenue **NEC-HNSX** Biosphère (Île Ste-Hélène) **19:00** Visite de la Biosphère **20:00** Assemblée annuelle de la SCMO Biosphère (Île Ste-Hélène)	**17:00 - 20:00** Rencontre des anciens de la météorologie de l'UQAM (endroit : à venir)	**18:00 - 19:00** Bar payant **19:00** **Banquet** Hôtel Gouverneur (Place Dupuis)		
Horaire des inscriptions	**16:00 - 21:00** Inscription Hôtel Gouverneur (Place Dupuis)	**07:30 - 17:00** UQAM - Pavillon Judith - Jasmin	**08:00 - 17:00** UQAM - Pavillon Judith - Jasmin	**08:00 - 16:00** UQAM - Pavillon Judith - Jasmin	**08:00 - 16:00** UQAM - Pavillon Judith - Jasmin	

33rd CMOS CONGRESS - MONTREAL 1999

PROGRAM (subject to modification)

	Sunday 30 May	**Monday 31 May**	**Tuesday 1 June**	**Wednesday 2 June**	**Thursday 3 June**	**Friday 4 June**
Morning	Committee Meetings	Scientific Sessions	Scientific Sessions	Scientific Sessions	Scientific Sessions	Guided Tours
Noon	Committee Meetings		**12:00 - 13:30** **Tully** Lunch(informal) Restaurant (Location : to come)		**12:00 - 13:30** **Patterson** Medal Lunch Faculty Club McGill University	Guided Tours
Afternoon	Committee Meetings	Scientific Sessions	Scientific Sessions	Scientific Sessions	Scientific Sessions	Guided Tours
Evening		**18:00 - 19:30** **NEC-HNSX** Ice Breaker Biosphère (Ste-Hélène Island) **19:00** Tour of the Biosphère **20:00** CMOS Annual General Meeting Biosphère (Ste-Hélène Island)	**17:00 - 20:00** Meeting of the UQAM Graduates (Location : to come)	**18:00 - 19:00** Cash Bar **19:00** **Banquet** Hôtel Gouverneur (Place Dupuis)		
Registration Schedule	**16:00 - 21:00** Registration Hôtel Gouverneur (Place Dupuis)	**07:30 - 17:00** UQAM Judith-Jasmin Pavilion	**08:00 - 17:00** UQAM Judith-Jasmin Pavilion	**08:00 - 16:00** UQAM Judith-Jasmin Pavilion	**08:00 - 17:00** UQAM Judith-Jasmin Pavilion	

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EXPERTS-CONSEILS ACCRÉDITÉS de la SCMO

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
E-mail - Couriel: cap@physics.uottawa.ca
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MAIN INTEREST / INTÉRÊT PRINCIPAL ☐ METEOROLOGY / MÉTÉOROLOGIE ☐ OCEANOGRAPHY / OCÉANOGRAPHIE

SPECIAL INTEREST / INTÉRÊTS SPÉCIAUX
☐ HYDROLOGY / HYDROLOGIE ☐ FISHERIES OCEANOGRAPHY / OCÉANOGRAPHIE DES PÊCHES
☐ AGRICULTURE & FOREST / AGRICULTURE ET FORÊT ☐ MESOSCALE METEOROLOGY / MÉTÉTOROLOGIE DE L'ECHELLE MÉSO
☐ FLOATING ICE / GLACES FLOTTANTES ☐ GLOBAL CHANGE / CHANGEMENT GLOBAL
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		REGULAR - RÉGULIER	45.00	
		STUDENT - ÉTUDIANT *	20.00	
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		SUSTAINING - DE SOUTIEN *	170.00	
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		RETIRED - RETRAITÉ	30.00	
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		CMOS BULLETIN SCMO (INCL.)	GRATIS	
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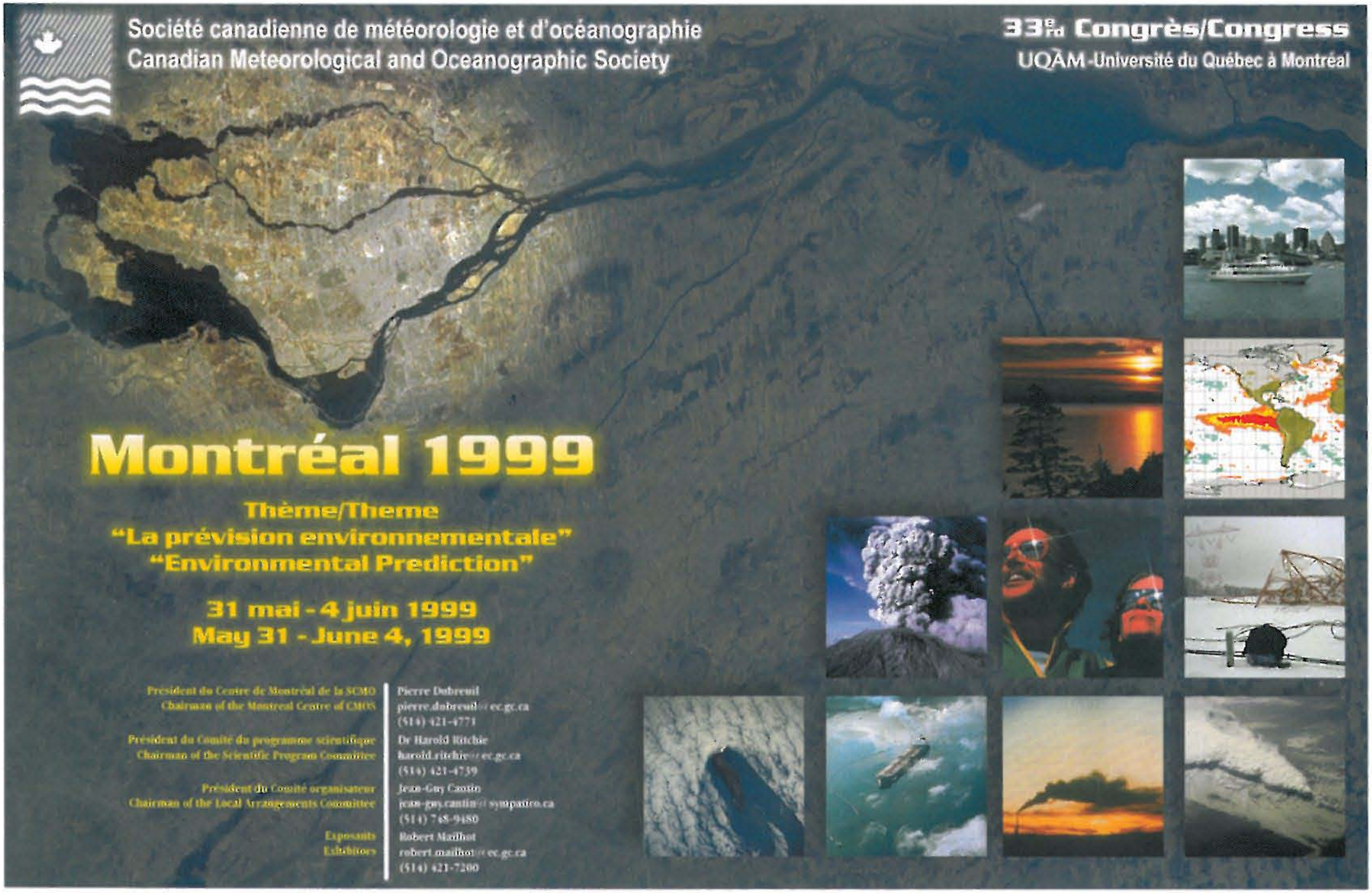

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