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SCMO

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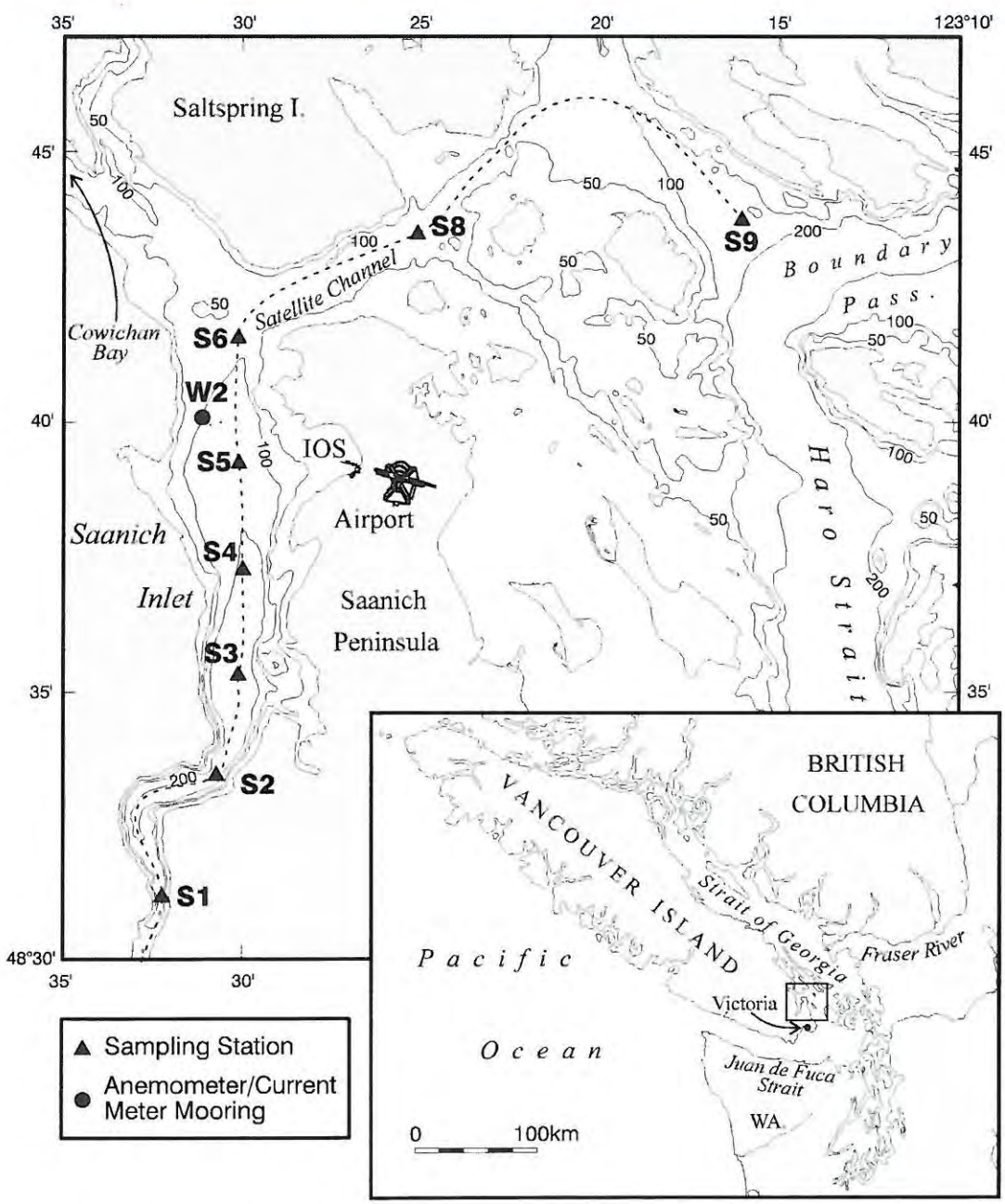

Figure 1. Site map of Saanich Inlet and the surrounding area

Carte de Saanich Inlet et de la région avoisinante

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

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Cover page: Part of the work of meteorologists and oceanographers is to carry out environmental studies to evaluate the impacts of human activity on different ecosystems. Here, the published article on page 39 presents such a study carried out by the Federal Department of Fisheries and Oceans on the oceanography of Saanich Inlet, on the west coast of Canada. This site is nowadays subjected to an intensive human activity which grows constantly, causing concerns about the deterioration of the inlet's environment and natural resources.

Page couverture: Les météorologues ainsi que les océanographes sont souvent appelés de par leur fonction à effectuer des études environnementales pour évaluer les impacts des activités humaines sur différents écosystèmes. Ici, l'article publié en page 39 présente une de ces études effectuées par le ministère fédéral des Pêches et des Océans sur l'océanographie de Saanich Inlet, sur la côte ouest du Canada. Cet endroit est l'objet d'une intense activité humaine qui croît à un rythme accéléré, causant ainsi des inquiétudes quant à la dégradation des ressources environnementales et naturelles.

Next Issue - Prochain numéro

The next issue of the ***Bulletin 25 (3)***, June 1997, will go to press by mid-June. We always need your contributions, short articles, notes, presentations, chronicles, etc. Forward them to me by early June. Don't miss your chance!

Le prochain numéro du ***Bulletin 25 (3)***, juin 1997 sera mis sous presse vers la mi-juin. Vos contributions sont toujours les bienvenues. Veuillez bien me les faire parvenir d'ici le début du mois de juin. Ne manquez surtout pas votre coup!

Canadian Meteorological and Oceanographic Society (CMOS)

Aim of the Society

The Canadian Meteorological and Oceanographic Society (CMOS) was formed in 1967 as the Canadian Meteorological Society and was joined in 1977 by the oceanographers. It is a national society of individuals and organizations dedicated to advancing all aspects of atmospheric sciences, oceanography and related environmental disciplines in Canada.

Membership

The Society is composed of about 1,100 members and subscribers, and is open to all who share an interest in atmospheric sciences, oceanography and related sciences and their many applications. Membership is broadly based and includes students, corporations, institutions and representatives in education and communications, industry, the private sector and government.

Société canadienne de météorologie et d'océanographie (SCMO)

But de la Société

La Société canadienne de météorologie et d'océanographie (SCMO) a été formée en 1967 comme la Société canadienne de météorologie à laquelle se joignirent en 1977 les océanographes. C'est une organisation nationale regroupant des individus et des organismes voués à la promotion de la météorologie et de l'océanographie ainsi que des disciplines environnementales connexes sous tous leurs aspects au Canada.

Membres

La Société compte environ 1 100 membres et abonnés et accueille toute personne intéressée par les sciences atmosphériques, océanographiques ou les sciences connexes et leurs multiples applications. L'éventail des membres est vaste et inclut des étudiants, des corporations, des instituts, des responsables en éducation et communications, des représentants industriels du secteur privé ou public.

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ACCREDITED CONSULTANTS
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Remote Vessel Detection on the Grand Banks Using Radarsat Imagery: Early Results

by Roc Larivière[1] and Howard Edel[2]

Résumé

Le 4 novembre 1995, le Canada lançait RADARSAT, satellite-radar muni d'un système d'images à ouverture synthétique. Il est possible de régler le système d'observation de la terre en fonction de faisceaux, d'angles d'incidence et de résolutions différents et, ainsi, d'obtenir toute la souplesse voulue pour la surveillance des navires. Grâce aux crédits et à l'appui technique du ministère des Pêches et des Océans (MPO), du Centre canadien de télédétection (CCT) et du ministère de la Défense nationale (MDN), on a pu mettre au point une station de travail RADARSAT sur les particularités océanique (STRPO) qui transforme les images de RADARSAT en «données-produits» comme la détection et la position des navires, le spectre des vagues océaniques et les conditions océaniques. Les données-produits sur la détection des bâtiments au large des côtes sont comparées aux données obtenues par vérification au sol de l'information recueillie par avion et à partir de bâtiments. Les données reçues au relais-satellite sont téléchargées dans la STRPO et traitées en trois heures. Les données-produits sur la détection des navires sont alors retransmises par FTP au Service des données sur le milieu marin (SDMM). Le SDMM archive ensuite ces données et les retransmet aux utilisateurs régionaux du ministère des Pêches et des Océans et du ministère de la Défense nationale.

On prévoit que l'information obtenue par RADARSAT jouera un rôle important dans la surveillance continue exercée par la direction de la Conservation et de la protection du ministère des Pêches et des Océans. À l'heure actuelle, on utilise des aéronefs et des navires pour les tournées d'observation hebdomadaires. RADARSAT pourrait s'avérer particulièrement utile quand les conditions atmosphériques empêchent la surveillance aérienne ou pendant les périodes où les ressources habituellement réservées à la surveillance servent à d'autres fins (pendant les périodes de pêche alimentaire). RADARSAT pourrait aussi être utilisé pour étendre la portée de la surveillance au-delà de la zone économique des 200 milles.

Introduction

On November 4 1995, Canada launched Radarsat equipped with a Synthetic Aperture Radar (SAR) imaging system (See CMOS Bulletin SCMO, Vol.24, No.1, February 1996). This Earth observation satellite has selectable beam modes, incidence angles and resolutions which provide the flexibility needed in vessel surveillance. A project with funds and technical support from Fisheries and Oceans Canada (DFO), the Canada Centre for Remote Sensing (CCRS) and the Department of National Defence (DND) has developed an Ocean Feature Workstation (OFW) which ingests and processes Radarsat SAR images into a number of products, including ship detection and position, ocean wave spectra and ocean features. The OFW vessel detection products for offshore areas are validated with ground truthing information collected by aircraft and vessel observations. Data received at the Gatineau Satellite Station is transferred to the OFW and is processed within 3 hours. Then the vessel detection products are electronically transferred to the automated FTP site at the Marine Environmental Data Services (MEDS). MEDS then archive the products and distribute them to regional users at DFO and DND.

It is expected that Radarsat vessel detection information can play a role in supporting the ongoing surveillance efforts by the Conservation and Protection Branch of DFO. Currently, a combination of aircraft flights and vessel missions are used for weekly fisheries enforcement. The support from Radarsat would be most useful under severe weather conditions when regular surveillance flights are grounded, or during periods when available surveillance resources are otherwise occupied (i.e. during food fisheries). Radarsat could also be used to extend the range into ocean basin monitoring beyond the 200 mile economic zone.

Although it was anticipated that Radarsat could provide operational data beginning in May 1996, it experienced an operational anomaly associated with attitude control during a solar eclipse at summer solstice. This anomaly resulted in Radarsat being removed from operation during most of June and July 1996. DFO collected its first good quality Radarsat image on August 2, 1996 under the Application Development and Research Opportunity (ADRO) agreement managed by the Canadian Space Agency (CSA). This marked the start of a six month DFO operational evaluation of Radarsat performance in vessel surveillance. The objective of the evaluation is to document and report all operational experiences

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[2]Marine Technology & Remote Sensing Coordinator, Fisheries & Oceans Science Directorate, DFO.

UTC	SHIP NAME	NATIONALITY	LENGTH	TYPE	LAT (N)	LON (W)
10:27	Adelia Maria	POR	80	Groundfish	46 45.030	46 37.520
10:37	Andvari	ICE		Shrimp	46 46.790	46 29.230
10:38	Seduva	LIT		Shrimp	46 46.770	46 27.520
10:39	Ocean Castle	FAR		Shrimp	46 47.270	46 30.030
11:53	Brimer	ICE		Shrimp	46 32.390	45 37.350
11:56	Jose Cacao	POR	66	Groundfish	46 24.940	45 46.020
11:59	Pallihja Mariannu	FAR	56	Shrimp	46 30.110	45 52.450
11:59	Solbakur	ICE		Shrimp	46 31.010	45 52.640
12:02	Kolbeinsky	ICE		Shrimp	46 27.040	45 56.130
12:02	South Island	FAR		Shrimp	46 25.640	45 56.700
12:04	Thorunn Havsteen	ICE		Shrimp	46 29.270	45 59.720
12:06	Takhurand	EST		Shrimp	46 32.220	46 04.480
10:33		FRA			46 39.180	46 33.250
11:47		UNK			46 01.850	45 43.060

Table 1: DFO Conservation and Protection aerial vessel report for August 2 1996.

associated with acquisition planning, data analysis and vessel detection results.

Acquisition Planning

The first acquisition was comprised of three images, off the Flemish Cap in fishing zone 3M, selected using the Radarsat Swath Planner (SPA 2.5) which enables the user to select its orbit and area coverage for various beam modes and resolutions. It was found that an image on August 2 at UTC 21:05 with a Standard beam mode (S7) at a 45-49° incidence angle, gave optimal coverage and resolution of the targeted area. Vessel information provided by DFO/Enforcement aircraft operating out of St-John's, Newfoundland were used to verify the OFW results (see Figure 1: DFO Flight Summary on page 38).

Vessel Detection Analysis on the OFW

The images were initially processed for ship detection using the 5 sigma algorithm on the OFW and later reprocessed using a beta version of the K-distribution algorithm at the CCRS image analysis facility (see Figure 2: OFW Targets Product on page 38). The K-distribution algorithm optimizes ship detection analysis while reducing the occurrence of false target detection.

For the purpose of this report, the vessel detection capability was evaluated using three consecutive Radarsat images taken on August 2, 1996. The 5 sigma algorithm detected 18 targets with significantly high probabilities (Prob $\geq$ 0.15) of actually being a ship; in addition 25 false targets were identified as possible targets. The improved K-distribution algorithm also reported 18 targets with significantly high probabilities (Prob $\geq$ 0.15) while only detecting 7 false targets. Meanwhile the number of high reflectance features, (likely vessels), visible in the hard copy image totalled 21. This would indicate that 86% of all targets were detected by both algorithms. Although both algorithms detected the same amount of highly probable targets, it is important to note that the K-distribution analysis reduced the number of false targets by 72%.

Early Results

Ground truthing data was obtained from DFO/Enforcement flight summaries of fishing vessels in the area prior to the Radarsat overpass. However, it was still possible to identify vessel groupings since fishing patterns are fairly constant and displacement at low fishing speeds can be minimal. The flight information reported 14 fishing vessels in the vicinity with the majority of these boats identified as ground fish trawlers and shrimping vessels which can range from 40-80 meters in length (See Table 1 shown above).

When observing data presented in Table 2 (Shown on following page), we notice that the number of potential detected vessels are identical for both the 5 sigma and K-distribution algorithms. However, the total number of false targets is much lower with the K-distribution where they contributed only 28% of the detections, while the 5 sigma algorithm had a 58% false target detection rate. The 18 fewer false targets represent a reduction of 72% in false target detection for the K-distribution.

VESSEL DETECTION METHOD	TOTAL TARGETS	HIGH PROBABILITY TARGETS	FALSE TARGETS	% FALSE TARGETS
5 Sigma	43	18	25	58%
K-distribution VS 1	25	18	7	28%
** K-distribution VS 2	21	21	0	0%
Visible on hard copy image	21			
Reported by aircraft	14			

** Updated with the new algorithm in December, 1996.

Table 2: Total numbers of detected Radarsat targets and possible vessels for the 5 sigma and K-distribution algorithm with the corresponding high reflectance points on the hard copy image and the aerial detection of actual ships.

Technically if the high reflectance points visible in the Radarsat image are truly ships, we would expect this number and that of the aerial report to match up (Table 2). However the image and ground truthing were not coincidental, so it is possible that 7 ships may have entered the area between the time of the aerial report and the time at which the Radarsat image was taken. Despite this lack of data synchrony and software configuration offsets, it is reassuring to note that there is a 78% agreement between potential vessels detected by Radarsat and the enforcement records which are not coincidental in this case.

Future OFW Processing

Based on these results, the K-distribution algorithm was chosen for operational vessel detection evaluation on the OFW. Radar analysis experts at CCRS and DND are leading a contract to implement and test a K-distribution algorithm for unattended operations on the OFW.

Continuing Test Plans

DFO has ordered 52 Radarsat images since August 2, under two major agreements. ADRO has contributed a total of 24 images taken in the months of August and September 1996. For its part, FOSD (Fisheries and Oceans Science Directorate) has ordered another 40 images taken by the end of October and November.

The November acquisitions include improved ancillary data collection by the surveillance aircraft. This exercise was distributed between the Scotian Shelf near Brown's Bank in the 4X fishing region and on the Flemish Cap in fishing region 3L & 3M. The results are expected to further the evaluation of detection and absolute ship positioning capabilities of Radarsat. These images will also be processed with the improved ship detection algorithm (K-distribution analysis) and with a functional land masking analysis, which became available for image processing in November 1996. The land masking reduces false targets in near shore areas.

Conclusions

The present study indicates that processing with the K-distribution is expected to provide improved results in vessel detection by improving the precision of ship location and reducing the occurrence of false target detection. The land masking will enable vessel detection at closer proximity to the coastline where the smaller fishing vessels operate.

It is also expected that enhancements to the OFW, improved synchrony with ancillary data and standardized Swath Planner configuration files will provide ocean users with a cost effective vessel detection product which can be delivered within 3 hours of the Radarsat pass.

Acknowledgement

The authors wish to acknowledge the valuable contribution of the following persons in obtaining these early and promising results.

From the Canada Centre for Remote Sensing:
Cathryn Bjerkelund and Paris Vachon.

From the Department of National Defence:
LCdr James Day and Maria Rey.

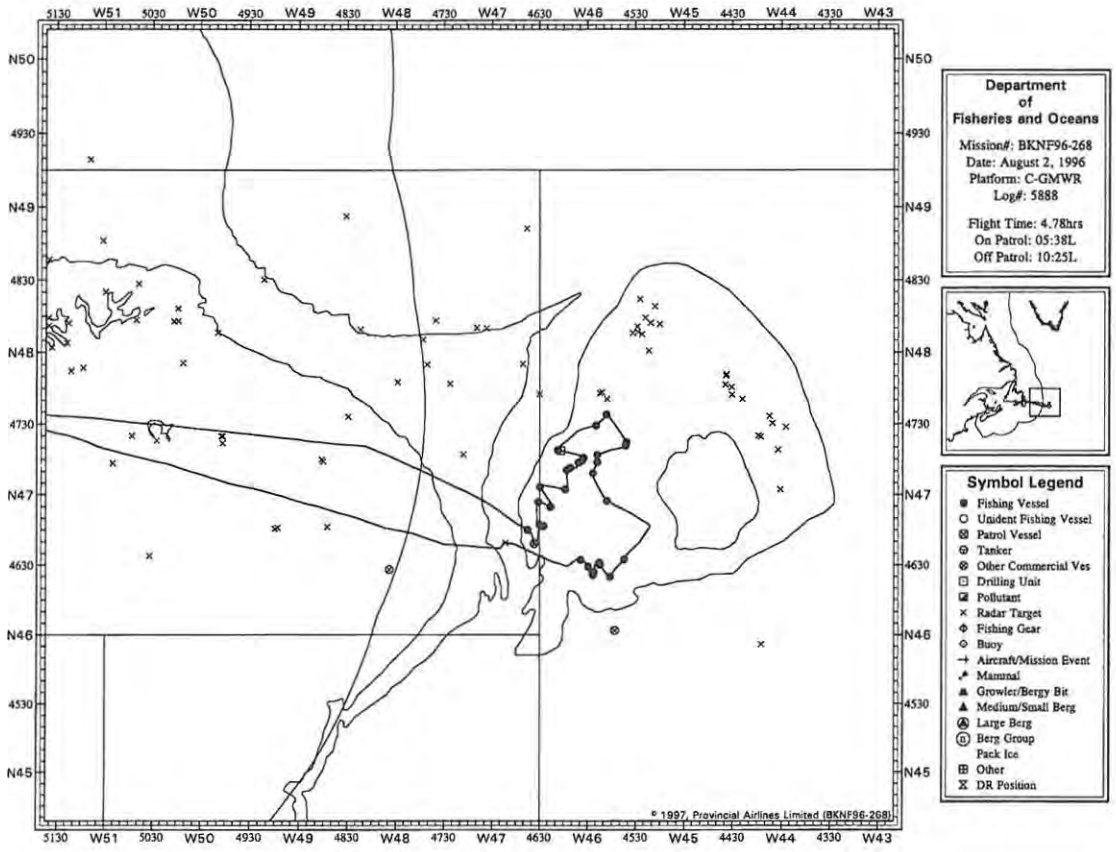

Figure 1: DFO Flight Summary

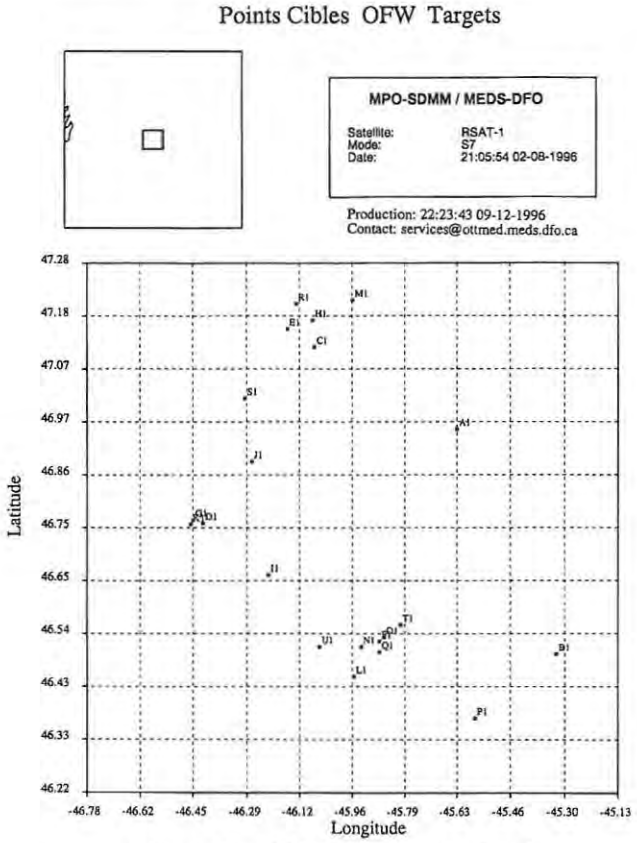

Figure 2: OFW Targets Product

Circulation and Nitrogen Transport in Saanich Inlet, B.C.

by Dario Stucchi[1] and Frank Whitney[1]

Résumé

Saanich Inlet est un fjord de 24 kilomètres de longueur situé juste au nord de la ville de Victoria à la pointe sud-est de l'île de Vancouver. Saanich Inlet se trouve au coeur de l'une des régions du Canada les plus recherchées par les retraités. En effet, la population y croît au rythme d'environ 2 % par année. La pression constante qu'exercent les nombreux projets domiciliaires de petite envergure et la construction envisagée d'une nouvelle ville de 12 500 habitants sur la rive ouest du bras de mer suscitent des inquiétudes quant à la dégradation des ressources environnementales et naturelles. En juillet 1994, sous l'égide du gouvernement provincial de la Colombie-Britannique, des organismes locaux et fédéraux ainsi que des regroupements de citoyens ont participé à une étude sur Saanich Inlet. L'étude avait pour objet d'évaluer l'état de l'environnement du fjord et d'établir la capacité de la crique d'absorber les déchets de projets domiciliaires futurs. L'étude s'attachait principalement aux eaux peu profondes, aux sédiments et aux ressources qui peuvent être affectés par la construction, l'agriculture et l'industrie. L'Institut des sciences de la mer (ISM) du ministère des Pêches et des Océans a mis en place un programme de mesures dans Saanich Inlet pour combler les lacunes au niveau des données océanographiques sur la circulation et le transport des éléments nutritifs au-dessus de la profondeur du seuil. L'article reprend les constatations d'une période d'échantillonnage intensif du 5 au 20 juillet 1995. Nous y décrivons la circulation calculée à partir des variations des propriétés de l'eau et des traces des bouées dérivantes et identifions les processus qui régissent la circulation dans le bras de mer. Nous présentons ensuite des mesures de l'azote biosynthétique dans le contexte de la circulation dans le fjord et traitons de l'importance du transport de l'azote pour la productivité primaire dans le bras. Mais nous présentons d'abord de l'information océanographique de base sur ce fjord singulier et sur la région adjacente, active sur le plan maréal.

Introduction

Saanich Inlet, is a 24 km long fjord located just north of the city of Victoria at the southeastern end of Vancouver Island (Figure 1 shown on front page). Saanich Inlet lies in the heart of one of Canada's most desired retirement locations, a region that is experiencing an annual population growth of about 2%. The continuing pressure from many small scale developments and the proposed construction of a new town of up to 12,500 people on the western shore of the inlet lead to concerns about the deterioration of the inlet's environment and natural resources. In July of 1994, led by the provincial government of British Columbia, local and federal government agencies together with organizations of concerned citizens, participated in the Saanich Inlet Study (SIS). The objectives of the study were to assess the state of the inlet's environment and determine the inlet's ability to assimilate wastes from future developments.

The focus of the SIS was on shallow waters, sediment and resources that can be influenced by construction, agriculture and industry. The Institute of Ocean Sciences (IOS) of the Department of Fisheries and Oceans (DFO) undertook a program of measurements in Saanich Inlet to address gaps in the oceanographic data relating to the circulation and nutrient transport above sill depth. In this article we report primarily on the findings from an intensive sampling period from July 5 to 20, 1995. We describe the circulation as deduced from water property variations and drifter tracks and identify the processes that drive the circulation in this inlet. We then present measurements of biogenic nitrogen in the context of the inlets' circulation and discuss the importance of nitrogen transport to primary productivity in the inlet. But first we provide some background oceanographic information about this unusual inlet and the adjacent tidally active region.

Background

Like many fjords, Saanich has a sill (75m deep) at its mouth which restricts the circulation of the deep basin waters (225m deep) behind it. Unlike most Pacific fjords, the waters of the deep basin are devoid of dissolved oxygen - anoxic - for most of the year. Saanich Inlet is unusual in another respect, namely, that the processes and factors which force the circulation in most fjords are either absent or weak in this inlet.

Tidal currents are weak throughout the fjord. Saanich Inlet does not have any severe topographic constrictions (sill or narrows) to amplify the ebb and flow of the tides. Since the sill is moderately deep, and the mouth of the inlet is rather wide (3.5 km), the energetic interactions of a stratified flow with topographic constrictions (Farmer and Freeland 1983) common in many other Pacific fjords are not prominent in this inlet.

There is no significant freshwater discharge along the shores of this inlet because the catchment basin for the inlet is rather small. Consequently the classical model of estuarine circulation is not appropriate. The closest major river is the Cowichan River, 10km to the NW, but the

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major source of freshwater to the region is the Fraser River (See Figure 1: Map of Saanich Inlet on front page).

Winds in the inlet are also generally not as energetic as in many of the mainland and west coast of Vancouver Island inlets. Saanich Inlet is not a favourite location for sailboat enthusiasts. There are no prominent diurnal sea-breezes during the summer months nor is the inlet subject to the strong katabatic outflows of cold arctic air during the winter months.

The extensive Saanich Inlet data set which spans more than four decades provides many clues about what drives the oceanography of this fjord. However, to understand the inlet's circulation we need to understand the oceanography of the adjacent tidally active region and in particular the importance of the fortnightly or neap-spring variation in the strength of the tides.

Although local runoff is negligible, within 50 km of Saanich Inlet the Fraser River - British Columbia's largest river- discharges into the southern end of the Strait of Georgia. The Fraser River contributes about half of the total freshwater supply to the Strait of Georgia (Griffin and LeBlond 1990). The discharge of the Fraser River peaks in June - the freshet - as snow pack in the interior of the province melts (Figure 2). The discharge of the Cowichan River and the local runoff into Saanich Inlet are also seasonal but they peak in the winter months. The Fraser River's June average discharge of about 8,000 $m^3 s^{-1}$ dwarfs that of the Cowichan River (20 $m^3 s^{-1}$) and the runoff from the Saanich Inlet watershed (estimated at 1 to 2 $m^3 s^{-1}$).

The freshwater in southern Strait of Georgia moves seaward through a complex region of tidal channels amongst the Gulf Islands to Juan de Fuca Strait and eventually out to the Pacific Ocean. Boundary Passage and Haro Strait are the main passages. Saanich Inlet connects with this region of complex tidal channels via Satellite Channel (Figure 1) one of the lesser passages through the Gulf Islands.

Tidal currents are weak in the inlet, but they are anything but weak in the adjacent channels and passages. The large tidal volume and freshwater moving through the contorted passages and over sills produces strong (up to 4 knots) tidal currents and intense mixing. The stabilizing effect of freshwater which varies seasonally is countered by the mixing actions of the tidal currents which vary on a 14 to 28 day lunar cycle. These counteracting processes result in large variations in the density stratification in the region, particularly during the summer when the Fraser River is at its peak flow. It is precisely this variability in stratification that strongly influences the oceanography of Saanich Inlet.

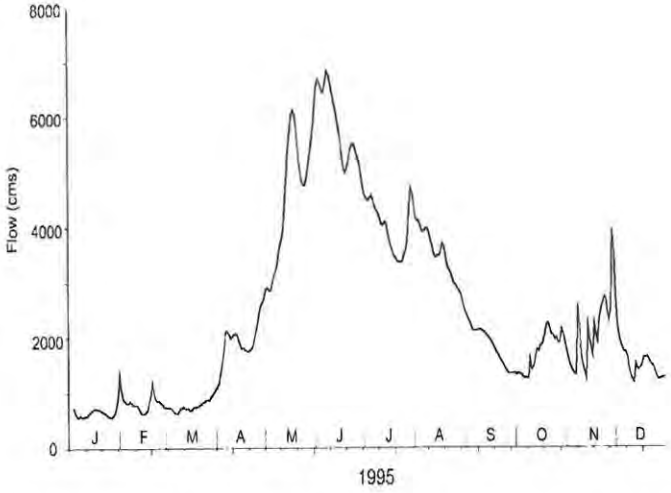

Figure 2. Fraser River discharge (at Hope) curve for 1995

Water Properties and Circulation

Detailed surveys of Saanich Inlet in 1995 clearly demonstrate the effect of the neap-spring tidal cycle. Over the time span of a couple of weeks in the summer, salinity conditions near the surface (Figure 3) significantly changed throughout the inlet. Our first complete survey of the inlet on July 6th, a time of neap tides, shows that waters less than 29 PSU (Practical Salinity Unit) occupied the top 20m of most of the inlet. The next survey one week later, a time of spring tides, shows only a vestige of waters less than 29 PSU. The salinity layer between 29.5 and 30 PSU thickened as the 29.5 PSU isohaline moved upward in the water column. The following neap tide survey (July 20) shows that the waters of salinity less than 29 PSU had reoccupied the entire length of the inlet, and the thickness of the salinity layer between 29.5 and 30.0 PSU had shrunk.

Local runoff cannot account for this change in salinity because only 10.3 mm of rain fell at the Victoria Airport from the last week in June to the last week in July. Most of this rain fell on July 9 and 10th just before the low salinity water leaves the inlet. Evidently there has been a large scale movement of the low salinity water occupying the top 20m of surface waters out of the inlet and then back into the inlet in the span of two weeks. The water temperature and dissolved oxygen show similar large scale changes in the three surveys.

There is also a change in stratification over the neap-spring cycle. Stratification in the inlet is weaker during the spring tides than either the week before or after when there were neap tides. However, the change in stratification is most pronounced outside the inlet in Satellite Channel and Haro Strait. The intense mixing during the spring tides almost completely destroys the stratification in Haro Strait, but the weaker tidal currents during neap tides are unable to completely mix the water column. These data show that the degree of mixing is modulated by the neap-spring tidal cycle.

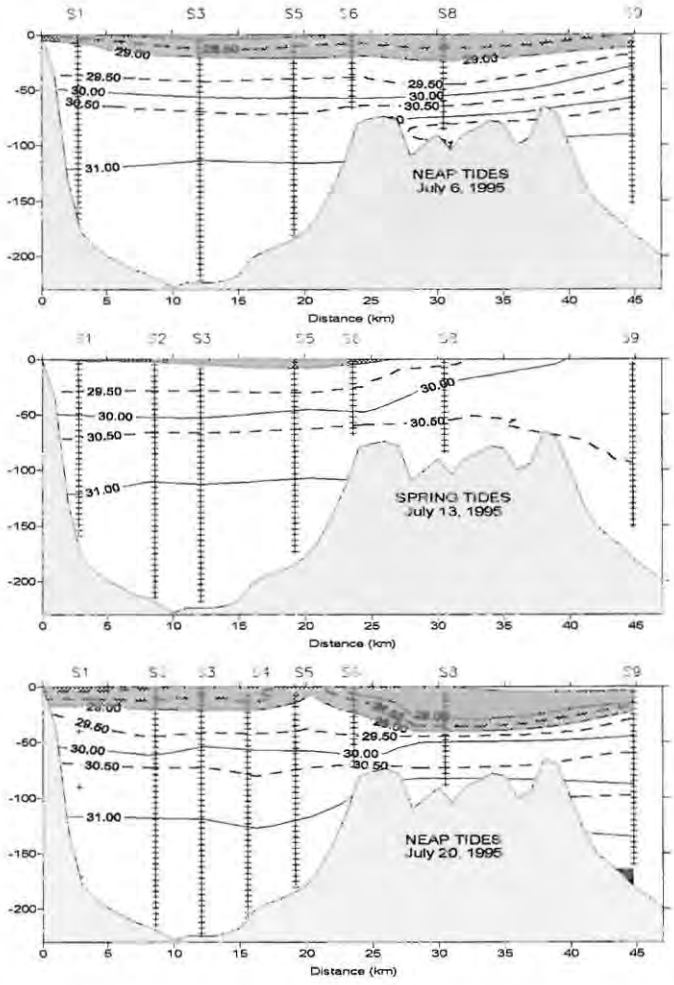

Figure 3. Along-channel transects of salinity from the head of Saanich inlet to Haro Strait. The contours of waters having a salinity less than 29 PSU are shaded.

From Monday to Friday of the weeks of July 10th and 17th, we deployed and tracked several drifters that were drogued to follow the top 2m of the water column. During the week of spring tides, July 10 to 14, most of the drifters moved northward out of the inlet (Figure 4). Several which escaped the inlet were recovered and redeployed. Of the drifters deployed in the lower reaches of the inlet, most grounded immediately. One drifter in Finlayson Arm moved back and forth for a couple of days and then proceeded northward the entire length of the inlet. Winds were not a factor as they were generally weak and there was no single noteworthy event.

During the week of neap tides, July 17 to 20, the drifter tracks are quite different from the week previous. In Finlayson Arm, the drifters show a tendency for up-inlet or southerly, movement albeit with a lot of back and forth motion. At the northern end of the inlet, the drifters appear to be locked in a CCW rotating eddy off Patricia Bay. No drifters left the inlet though several grounded on the eastern shore. There was a southerly flow along the western shore and a northerly flow along the eastern shore. Current meter data collected concurrently at mooring W2 (Figure 1) also show the surface outflow in the top 15m followed by an inflow the following week.

Nitrogen Cycle

To this point our data and discussions have dealt with the circulation and water property changes in the inlet as they respond to the changing density and stratification outside in Haro Strait and Boundary Passage. We now turn our attention to the implications that this circulation has for transport and cycling of nitrogen and the biological productivity of this fjord.

Because nitrate supply periodically limits summer phytoplankton growth in Saanich Inlet (Takahashi *et al.*, 1977) it is necessary to understand the mechanisms by which nutrients are transported into the euphotic zone before we can describe plankton dynamics. Consequently, over a complete neap-spring cycle, we conducted a sampling program aimed at resolving nitrogen transport in its biologically active forms.

Between July 5 and 20, 1995 we sampled every 2 to 3 days at three stations; S3, S5 and S6 (Figure 1). At these stations we collected discrete water samples and continuous profiles of temperature, salinity and light transmission from the surface to the bottom. The water samples were analyzed for nitrate (NO_3), ammonium (NH_4) and dissolved organic nitrogen (DON). Sea water samples from S3 and S6 were filtered to determine the concentrations of particulate organic carbon and nitrogen (POC/N). In addition to the water sampling program, we moored a sediment trap near S3 at a depth of 50 m, and sampled it every two or three days to measure vertical transport of particles.

A convenient way to measure fluxes in a water column is to integrate nitrogen data to a depth that shows little change with time. We selected 50 m as the integration depth because we observed only slight variations at this depth.

Of the several sources of nitrogen available to plankton, NO_3 and DON form the largest pools and have the greatest fluxes (See Table 1). Together NO_3 and DON account for 80% to 90% of the biologically active nitrogen. Concentrations vary through the neap-spring cycle in July by 320 mmol NO_3 m^{-2} and 200 mmol DON m^{-2}. Sedimentation to 50 m depth at S3 equalled 41.6 mmol N m^{-2}, 348 mmol C m^{-2} and 31.3 g dry weight m^{-2} over the 14 day period.

Table 1: Biogenic nitrogen in the upper 50 m at S3.

Date	NO_3	NH_4	DON	PON	Total N	Sed N mmol $m^{-2}d^{-1}$
July 5	675	15.9	540	86.0	1317	
July 7	684	10.7	662	96.1	1453	5.93
July 10	738	78.9	731	70.6	1619	2.04
July 12	888	87.7	740	45.4	1761	2.46
July 12	964	74.2	568	46.4	1653	2.31
July 17	866	33.3	538	63.3	1501	1.63
July 19	644	24.5	599	233	1501	4.80

Concentrations for NO_3, NH_4, DON, PON and Total N are expressed in mmol N m^{-2} betwen 0 to 50 m.

The spring tides of July 10-14 brought both salt and nutrients towards the surface, as total nitrogen (most in the form of NO_3) increased by 444 mmol m^{-2} between July 5 to 12. While we did not make any measurements outside the inlet Parsons *et al* (1983) found high nitrate values in the well mixed waters outside Saanich Inlet. Of the three inlet stations where we sampled for nitrogen, station S6 near the mouth had the highest near surface nitrate values. As the surface waters of salinity less than 29 PSU were flushed out of the inlet, nutrients upwelled into the euphotic zone, increasing nitrate in the top 5 m from less than 1 to over 5 µmol/L (Figure 5). Only on July 5 and 17 was NO_3 completely depleted in the upper 5 m at S3, and was always detected at S5 and S6. Nitrate fluxes at S3 were largest in the 15-30 m layer where salt exchange was most evident. During the spring tide inflow between July 10 and 14, all layers showed an increase in NO_3.

Following the upwelling of nutrients into the euphotic zone, particulate material accumulated rapidly, so that between July 14 and 19 at S3, PON increased from 2 to 3 µmol/L in the upper 10 m to over 10 µmol/L. PON is dispersed throughout the upper 50 m at S6 and except for July 19, is more abundant than at S3. Depth integrated concentrations vary from 85 to 180 µmol m^{-2} at S6 and 45 to 96 µmol m^{-2} at S3 (except 233 µmol m^{-2} on July 19). S6 lies in the frontal zone between stratified and mixed waters that Parsons *et al.* (1983) have described as highly productive.

Sedimentation rates change over the neap-spring cycle; highs occur during neap tides and lows during spring tides (Table 1). Rates varied from 1.6 to 5.9 mmol N m^{-2} d^{-1} through this 2 week period which constitutes on average 4.1 ± 1.5 % of the suspended PON load. POC fluxes equalled 13.8 mmol m^{-2} d^{-1} at spring tide and 42.6-44.0 mmol m^{-2} d^{-1} in the two neap periods, equivalent to 5.2 ± 1.6 % of the suspended POC. Past studies have noted that sedimenting particles are mostly fecal pellets, that sink about 200 m d^{-1}, excreted by grazing zooplankton. Thus, periods of increased algal growth produce elevated fluxes of organic material from surface waters to sediments.

Within this framework, we can assess the relative importance of nitrogen sources and sinks over a neap-spring tidal cycle. From the observations we estimate the daily rates of input and loss from the upper layer (See Table 2).

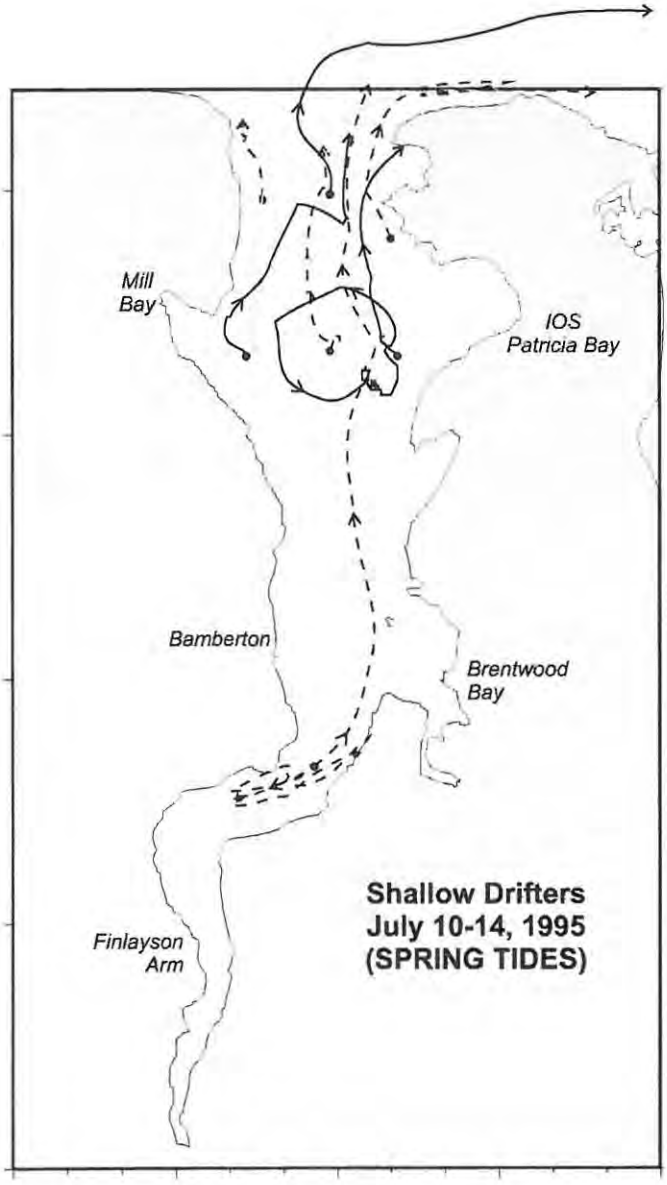

Figure 4. Tracks of shallow drogue (0 to 2m) drifters in Saanich Inlet during a period of spring tides.

Table 2: Fluxes of N and C in the upper 50 m at S3

Parameter	Maximum Input (mmol $m^{-2}d^{-1}$)	Maximum Loss (mmol $m^{-2}d^{-1}$)
Nitrate	75	110
Ammonium	23	14
DON	61	40
PON	85	13
POC	450	88
	Minimum (mmol $m^{-2}d^{-1}$)	Maximum (mmol $m^{-2}d^{-1}$)
Sedimented N	1.6	5.9
Sedimented C	14.0	44.0

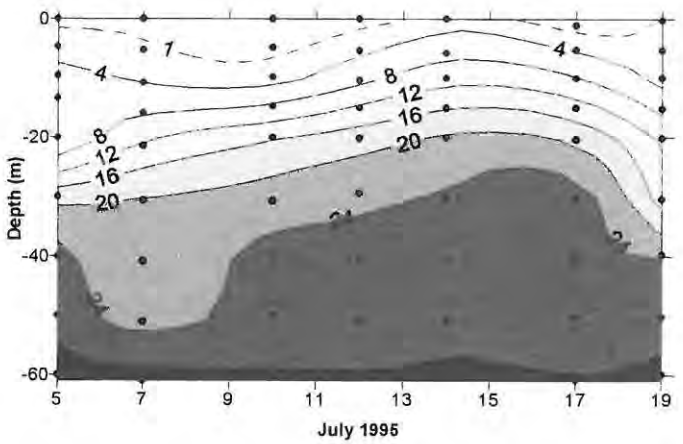

Figure 5. Plot of nitrate (µmol/L) at station S3.

Nitrate is both the largest N pool and has highest transport rates. Influx varies between 5 and 75 mmol m^{-2} d^{-1} as higher salinity water upwells into the euphotic zone during spring tides. The removal of 110 mmol m^{-2} d^{-1} NO_3 late in the study period coincides both with a fresh water intrusion and an increase in PON of 85 mmol m^{-2} $d^{-1}$and DON of 30 mmol m^{-2} d^{-1}. It may be argued that this NO_3/PON change is due to advection or *in situ* growth. Regardless of the processes, these are dramatic flux rates which must affect all other plankton activities in the inlet.

Primary Productivity

There have been several investigations of the primary productivity of Saanich Inlet waters. Takahashi *et al.* (1975) found primary production rates of from 50 to 600 mg C m^{-2} h^{-1} for a May bloom, which over a 12 hour period would equal 0.6 to 7.2 g C m^{-2} d^{-1}. Takahashi *et al.* (1977) noted in their time series of weekly productivity measurements from May to September 1974, several lesser blooms or "summer blooms" after the large May bloom. Parsons *et al.* (1983) analyses of the Takahashi *et al.* (1977) time series demonstrated that there was a relationship between chlorophyll *a* (a measure of phytoplankton material) and the tides at a period of 14 days. The phase of the relationship was such that phytoplankton abundance coincided with a minimum in the velocity of tidal currents - neap tides.

We estimated the primary productivity rate from our nitrogen and dissolved oxygen measurements over a neap-spring cycle in July 1995. During algal growth in coastal and estuarine waters, 25% of assimilated N may be excreted as DON (Bronk *et al.* 1994). Observed increases of 5 to 60 mmol DON m^{-2} d^{-1} requires a gross assimilation of 20 to 240 mmol N m^{-2} d^{-1} which (employing a C:N ratio of 106:16 for marine planktonic matter) would in turn require primary production rates of 1.6 to 19.2 g C m^{-2} d^{-1}. DON production rates in neap tide periods appear high since they exceed what would be expected during an intense spring bloom.

Oxygen is a product of photosynthesis and supersaturated concentrations are often observed near the surface during algal blooms. Using the increases in the supersaturated dissolved oxygen concentrations in the surface water and the O:C atomic ratio of 276:106 we converted the oxygen fluxes to carbon production rates. During the neap tides, we calculated an average primary productivity rate of about 5 g C m^{-2} d^{-1} ranging from 1 to 9 g C m^{-2} d^{-1}. These rates are comparable to those calculated by Takahashi *et al.* (1975) for the May bloom but smaller than those calculated using DON.

Sediments

The anoxic bottom waters of Saanich Inlet prevent the usual macro-fauna from colonizing its basin sediments. As a result sediments remain undisturbed by burrowing and digging animals. Preserved in the sediments are the seasonal strata or varves of particulate matter. The annual cycle of deposition is distinctly seen as a sequence of dark and light varves in the sediments (Figure 6). One dark and one light band define an annual cycle. The light coloured varves correspond to the deposition of diatom shells during the summer productive season and the dark bands are composed of terrigenous material washed into the inlet by the winter rains.

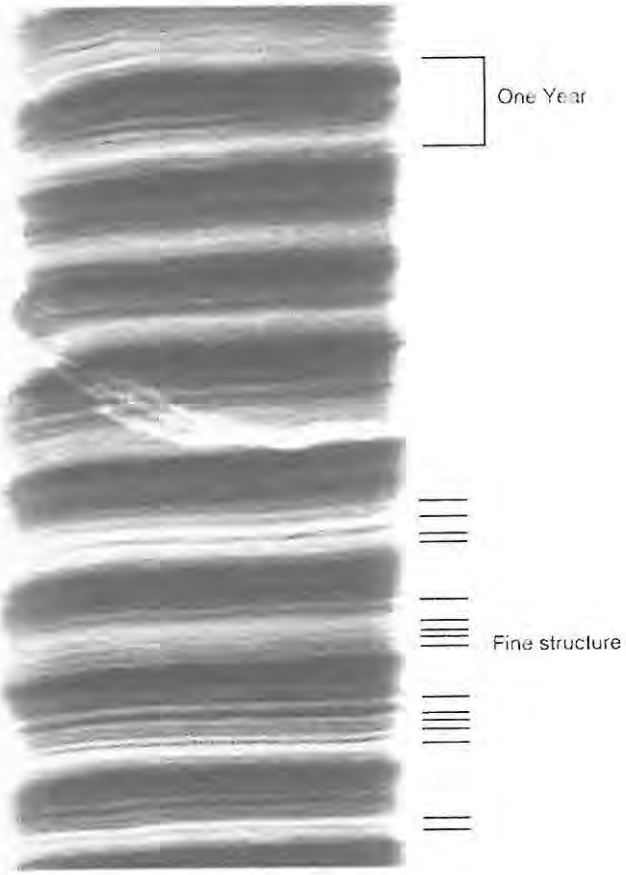

Figure 6. X-ray photograph of a small section of sediment core from Saanich Inlet (courtesy of Kurt Grimm, UBC).

This past summer, the Ocean Drilling Program research vessel JOIDES RESOLUTION obtained cores in Saanich going back in time about 12,000 years - the time of the last ice age. These cores contain a wealth of information, and a number of interesting investigations and analyses presently underway. However, there is one feature of the summer varves that we think is the result of the tidal process that we have discussed in this article. Within the light coloured varve which is composed of siliceous material from diatom shells are a series of micro-varves. We believe that this fine detail within the productive summer season is the evidence of the periodic "summer blooms" that are produced pumping of nutrients into the euphotic zone by the variations in tidal mixing over the neap-spring cycle.

This Saanich Inlet Study has improved our understanding of the oceanography of this unusual inlet and its interaction with the adjacent tidally active region. As the population of the region continues to grow so will the demands to dispose of wastes in marine waters. It is our hope that by quantifying transport processes in this fjord we will be better able to asses and manage the impacts of our wastes on its waters.

References:

Bronk, D.A., P.M. Glibert and B.B. Ward 1994. Nitrogen Uptake, Dissolved Organic Nitrogen Release, and New Production. Science, Vol. 265, 1843-1846.

Farmer, D.M. and H. J. Freeland 1983. The Physical Oceanography of Fjords. Progress in Oceanography Vol. 12, No. 2, 147-220.

Griffin, D. A. and P.H. LeBlond 1990. Estuary/Ocean Exchange Controlled by Spring-Neap Tidal Mixing. Estuarine and Coastal and Shelf Science 30, 275-297.

Parsons, T.R., R.I. Perry, E.D. Nutbrown, W. Hsieh and C.M. Lalli 1983. Frontal Zone Analysis at the Mouth of Saanich Inlet, British Columbia, Canada. Marine Biology 73,1-5.

Takahashi, M., W.H. Thomas, D.L.R. Siebert, J. Beers, P. Koeller and T.R. Parsons 1975. The Replication of Biological Events in Enclosed Water Columns. Deep Sea Research, Vol. 24, 775-780.

Takahashi, M., D.L. Siebert and W.H. Thomas 1977. Occasional blooms of phytoplankton during the summer in Saanich Inlet, B.C., Canada. Deep Sea Research, Vol. 24, 775-780.

Projet InterMET

par Nathalie Gauthier[1], Pascale Roucheray[1] et Peter Zwack[1]

Abstract

The goal of the InterMET Project is to develop an educational environment on Internet which will enable young people to acquire knowledge and skills in atmospheric sciences and in the interpretation of meteorological charts. The preferred educational approach is constructivist because it emphasizes the processing and organization of information within the context of knowledge construction processes. This environment will offer a privileged method of exchange between the students and expert meteorologists. The project will be developed in Montréal and run on a trial basis in pilot classes at the Secondary two level in three different school environments (privileged, underprivileged, multiethnic) of the Montréal region. More precisely, its goal is to train students and teachers at the Secondary level. The Canadian Meteorological and Oceanographic Society has accepted to finance 10% of project's budget. 50 % of InterMET is sponsored by the Government of Québec. Therefore, the site will be developed for the Québec school program, in French, in its first phase. An English version, for anglophone schools in Québec and other Canadian provinces, is also in the works.

Introduction

Il est communément entendu qu'il est nécessaire de développer et de maintenir une conscience scientifique chez la population. En ce qui concerne la météorologie, cette nécessité est particulièrement criante. La météorologie est un sujet scientifique qui concerne tout le monde et est au coeur des préoccupations récentes en matière d'environnement. Elle fait hélas l'objet de critiques de la part de la population parce qu'elle ne saisit pas la complexité de cette science. Le développement d'une culture scientifique-météorologique susciterait des changements d'attitudes et de comportements tant individuels que collectifs face à la perception et l'utilisation de la météorologie et de notre milieu atmosphérique.

Une telle culture se développe principalement par une formation de la population qui débute dès le plus jeune âge. Nous voulons donc apporter notre contribution à cette formation en développant un outil pédagogique interactif et multimédia, disponible sur le réseau Internet et qui utilisera les techniques du WWW (World Wide Web).

InterMET est destiné à la formation en météorologie des élèves et des professeurs québécois de 2^{ième} secondaire et répondra aux objectifs du programme d'étude de sciences physiques 214. La météorologie est un sujet idéal pour répondre à une démarche d'intégration des matières puisqu'elle fait appel à plusieurs sciences (physique, mathématique, chimie, géographie, informatique). Nous souhaitons donc que le développement d'un outil d'enseignement tel qu'InterMET contribue au maintien et à la promotion des cours de météorologie dans le milieu scolaire. Éventuellement, une version d'InterMET visant l'éducation populaire (grand public) sera développée.

Pourquoi utiliser Internet?

Plusieurs raisons ont motivé le choix d'Internet comme support pour ce projet.

1. LA PORTABILITÉ: Un cours disponible par Internet est accessible à tout utilisateur qui possède un outil de navigation (Netscape, Explorer etc.), peu importe le type d'ordinateur qu'il utilise. Certaines écoles utilisant des PC et d'autres des Mac, toutes pourront bénéficier des services d'InterMET.
2. LE TEMPS RÉEL: La météorologie s'observe tous les jours. Il est donc plus motivant d'avoir accès à des données en temps réel (photos satellites, images radar, cartes) pour les exercices et les exemples que de toujours utiliser des données qui datent de plusieurs semaines, voire plusieurs années.

3. LA MISE À JOUR CONTINUELLE du contenu: Les mises à jour seront disponibles rapidement pour les utilisateurs sans qu'ils aient à s'équiper d'un nouvel outil, comme c'est le cas pour les logiciels sur disquettes ou CD.

4. LA COMMUNICATION ENTRE LES DIFFÉRENTS ACTEURS: InterMET offrira un service de courrier électronique qui permettra des échanges entre les professeurs/élèves et les professionnels de la météorologie. L'idée de mettre les élèves en contact avec les professionnels constitue une valeur exceptionnelle. D'une part, cela démystifie le monde du travail et de la recherche, et d'autre part, cela permet une vision plus humaine de la science et stimule l'élève qui pourra s'identifier à ces personnes. Internet permettra également les échanges entre différentes classes et écoles donnant ainsi la possibilité d'élaborer des projets intéressants.

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5. LA COLLABORATION ENTRE LE SECTEUR ÉDUCATIF ET LES DÉVELOPPEURS DU SITE: Nous invitons tous les intervenants des milieux scolaire et scientifique à proposer et à développer des scénarios ou activités pédagogiques (hypertextes, sciptes JAVA, etc.). InterMET se veut un lieu ouvert et de convergence en matière d'enseignement de la météorologie. Les propositions retenues seront intégrées au site InterMET et le ou les noms des auteurs seront affichés pour chacune des activités.

Les objectifs poursuivis

Parmi les objectifs poursuivis, citons les quatre suivants:

1. Favoriser l'utilisation des nouvelles technologies de l'information dans les écoles secondaires par les élèves et les professeurs.

2. Préparer les jeunes d'aujourd'hui à utiliser demain l'information et les outils météorologiques.

3. Développer la pensée scientifique chez les jeunes, en favorisant la démarche scientifique dans les activités proposées sur InterMET.

4. Permettre aux parents des élèves d'accéder à un service intelligent et convivial qui pourra les guider dans leur démarche d'éducateur parental en leur proposant des livres, des activités à faire à la maison, etc.

Nous voulons créer un outil qui sera flexible et facilement adaptable aux différentes méthodes pédagogiques des professeurs. Nous voulons mettre l'accent sur l'interactivité par l'entremises de laboratoires virtuels et d'exercices interactifs.

Les partenaires

Le projet InterMET sera développé en collaboration avec CyberScol, société à but non lucratif de Sherbrooke (Québec) dont l'objectif est d'étudier et de promouvoir le potentiel d'Internet en éducation (http://cyberscol.qc.ca/).

Pour mener à terme le projet InterMET, nous bénéficions d'un budget total de 110 000 dollars dont 50% provient d'une subvention du Fonds de l'Autoroute de l'Information (FAI). Plusieurs partenaires contribueront également au projet soit en argent, soit en temps d'expertise. Nos partenaires actuels sont:

1. La Société Canadienne de Météorologie et d'Océanographie (SCMO) nationale et le centre de Montréal offrant une contribution de 11 000$.

2. Météomédia offrant une contribution de 10 000$ ainsi que l'accès aux données météorologiques.

3. Vidéotron offrant une contribution de 24 000 $.

4. Le département des Sciences de la Terre de l'Université du Québec à Montréal (U.Q.A.M.) offrant un local.

5. Le Centre de Recherche sur le Climat et les Changements à l'échelle du Globe (C2GCR) offrant 2 000$ en temps d'expertise.

6. La firme de consultants CDZ inc. offrant 1 000$ en temps d'expertise.

L'utilisation d'Internet comme support pour le projet contribuera à augmenter la visibilité de nos partenaires.

Nous retrouvons donc, pour ce projet, une rare convergence de spécialistes de nombreux domaines. En effet, le milieu universitaire (groupe de recherches), le secteur privé (Météomédia, CDZ) et des sociétés de professionnels de la météorologie travailleront de concert avec des spécialistes en pédagogie (professeur, conseiller pédagogique), un infographiste et un spécialiste en informatique pour mener à bien le projet.

Architecture du site InterMET

L'architecture prévue du site est exposée par l'image suivante.

Le Pavillon de l'éducation contient le cours comme tel. L'utilisateur y trouvera la théorie, où l'accent sera mis sur les représentations graphiques, animations, séquences vidéo, des laboratoires virtuels, des exercices-simulations interactifs ainsi qu'une banque d'analogies et d'exemples. On suggérera également dans ce pavillon des scénarios pédagogiques que le professeur pourra utiliser ou adapter à sa propre démarche pédagogique. Un historique de la météorologie et la présentation des instruments météorologiques viendra compléter cette partie du site.

Certaines applications (exercices, laboratoires virtuels) pourront être installées sur l'ordinateur local pour être utilisées sans avoir à les télécharger à chaque fois.

Le Coin des parents proposera des sites Internet à visiter, des livres, des expériences à réaliser à la maison, etc.

La boîte aux CyberLettres proposera un service d'échanges, par courrier électronique, entre les professionnels de la météorologie (et de l'environnement) et les classes.

Le coin des spécialistes et les visites guidées présentera des personnes clés de la recherche, de la prévision et de l'information météorologique. Il présentera des visites guidées dans des établissements tels que Météomédia, les stations de mesures et d'observations, les sites de campagnes de mesures à objectifs plus spécifiques (le transport des polluants, etc.) et autres organismes. Une

rubrique faisant la promotion des activités offertes par d'autres organismes sera également présentée.

Dans la partie Observations et Prévisions du jour on présentera les observations et prévisions les plus récentes. Il y aura également des présentations d'animations satellitaires.

L'ensemble des activités qui se dérouleront en classe sera conçu de façon à ce qu'elles s'inscrivent systématiquement à l'intérieur du concept unificateur suivant: le fonctionnement d'un centre virtuel de météorologie où le «learning by doing» sera omniprésent. En effet, à la fin de sa formation en météorologie la classe sera en mesure d'interpréter des cartes en temps réel et de produire une prévision du temps, simple mais juste et de simuler un mini-centre de météorologie et de prévisions en accord avec le programme d'étude en vigueur au Québec.

L'expertise et l'approche développées dans le cadre du projet InterMET pourront être, par la suite, récupérées pour d'autres projets de formation en sciences sur Internet.

InterMET sera développé en français. Toutefois, nous prévoyons une version anglaise du site afin que toutes les écoles du Québec et éventuellement du Canada puissent utiliser le site. L'exportation d'InterMET vers les autres provinces canadiennes exigera évidemment une adaptation du contenu selon les différents programmes d'étude.

Étapes de réalisation du projet

La première phase du projet, d'une durée de 9 mois comprendra les étapes suivantes:

- Étude didactique du contenu et de présentation;
- Élaboration et conception d'un prototype;
- Formation des professeurs des classes pilotes;
- Mise à l'essai dans 3 classes pilotes;
- Évaluation formative du prototype par les classes pilotes;
- Conception et élaboration de la suite du projet;
- Présentation d'une première version opérationnelle d'InterMET.

Project InterMET

CMOS has signed a partnership agreement with the Société CyberScol Inc., University of Sherbrooke for "Project InterMet". This project won a major subvention competition from the Government of Quebec for promoting the use of the internet in secondary schools in that province. Through CyberScol, Pascale Roucheray and Nathalie Gauthier, in collaboration with Prof. Peter Zwack at UQAM, submitted the proposal to support the teaching of meteorology, a required subject in Quebec schools.

InterMET is intended to assist teachers and students in acquiring a knowledge of atmospheric sciences and learning how to use and interpret weather maps. Various modules will cover the fundamentals of how meteorological data and information are developed and organized, gradually progressing to more complex subjects where interactive projects will be undertaken by the students, with their parents, teachers and specialists in meteorology. It will incorporate texts, images, video, sound and animation. Project InterMET will be developed at UQAM by Ms. Roucheray and Ms. Gauthier, who will then conduct a pilot test in three second-year high school classes, from privileged, under-privileged and multi-ethnic "milieux" of Montreal.

Other partners in the project include Météomédia, Montréal, C^2GCR (Centre de recherche sur le climat et les changements à l'échelle du globe), McGill University, C.D.Z. Environnement Inc., Westmount, Qué. and APMQ (Association Professionnelle des Météorologistes du Québec Inc.).

CMOS will be able to use the material for educational and demonstration purposes to foster and encourage the teaching of meteorology and atmospheric sciences in Canadian schools. It should fit well into a long term CMOS outreach program.

The superbly written proposal on Project InterMET obtained the backing of the above-mentioned partners and was awarded a grant of $68,000 from the Government of Québec. An outstanding initiative!

We will keep you informed on progress accomplished in later issues of the Bulletin.

Neil J. Campbell.
Executive Director.

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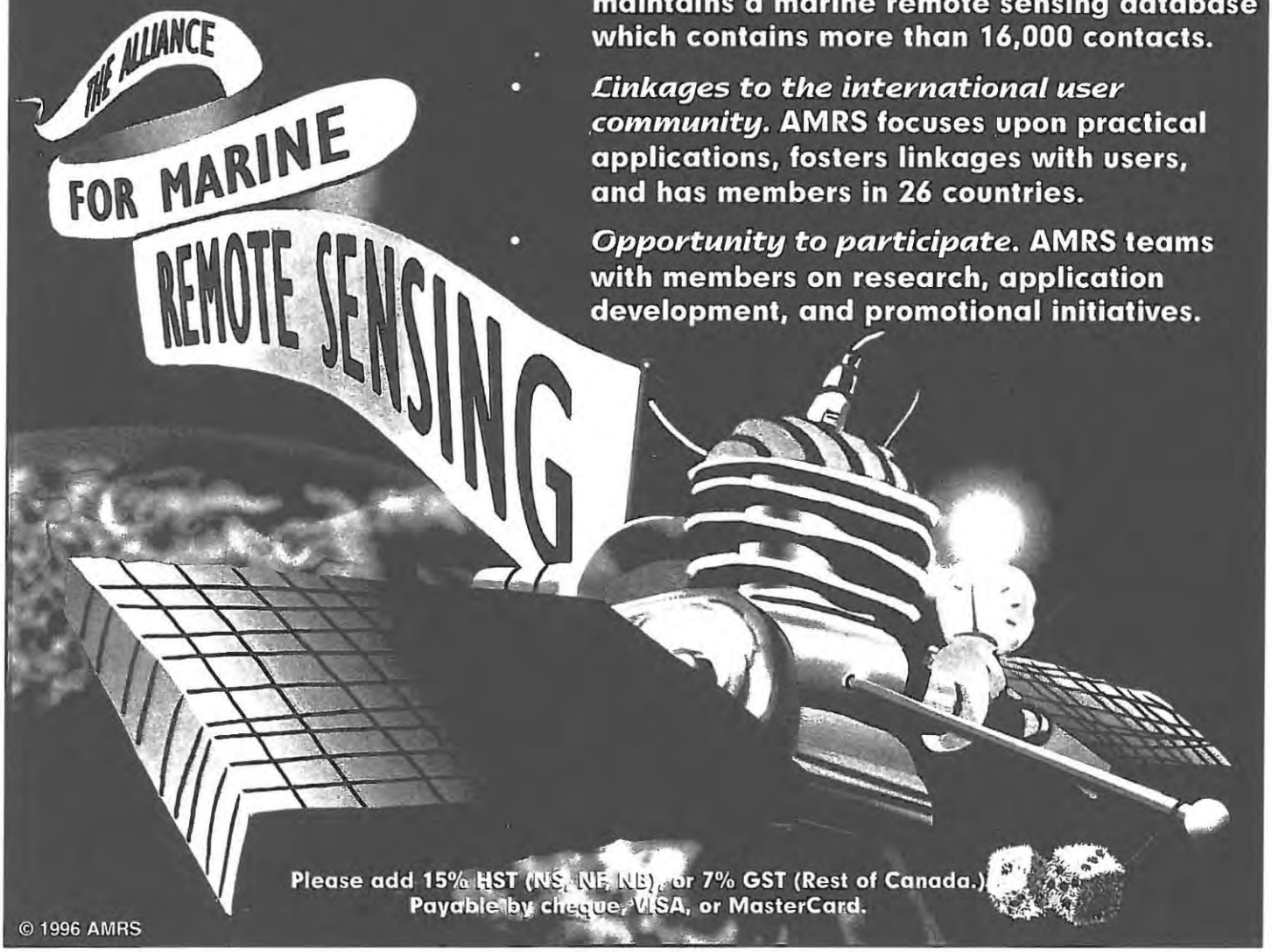

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WORKSHOP ON GREENHOUSE GASES IN AGRICULTURE

12-14 March 1996
Sainte-Foy, Qué
Report presented by Richard Asselin

I was fortunate to be invited to participate in the above workshop, which marked the conclusion of a five year environmental research program by Agriculture and Agri-Food Canada (AAFC). Globally, it is estimated that agriculture contributes about 16% of the total greenhouse gas effect, 10% through methane and 3% each through carbon dioxide and nitrous oxide. At the beginning of this program, it was estimated that Canadian agriculture contributed about 6% of Canada's emissions, but there was much uncertainty about the processes and the numbers. In the context of Canada's committment to stabilize its emissions at the 1990 level by year 2000, it was therefore necessary to assess more precisely the role of agriculture.

The objectives of the program were:

1) to understand and quantify the role of agriculture on the concentration of greenhouse gases; and
2) to make recommendations to reduce the contribution of agriculture to the greenhouse effect, all from a Canadian perspective.

Only carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) were considered in this program, but there were other initiatives related to NO_x, volatile organic compounds, ozone, ethanol and Parkland agriculture, which may also contribute to the greenhouse effect. These were being carried out separately under general coordination. The program was carried out by more than 100 teams, from several research centres, universities and contractors, using about $6 million incremental funding. The program was strongly focused by means of workshops, competitive proposals and annual review of the progress of each team, to ensure that the objectives were addressed effectively and the deliverables were achieved. The program was under the control of three senior scientists, with general direction from three research centre directors and the help of a headquarters coordinator.

The program was structured such that process studies were carried out for each of the three gases separately, but ecosystem studies included interaction between the gases, and scaling up was carried out at the level of the major agro-ecosystems of Canada. Since the $6 million was used to lever considerably more a-base and other research program resources, a tremendous amount of research was actually carried out and this is what was being summarized at the final workshop. I will not attempt to cover the whole subject here, but only to bring out what appeared to me to be the major discoveries and findings, which could be of interest to CMOS members. More complete accounts can be found on the internet at http://res.agr.ca/neri, including several of the posters, names of scientists and lists of publications.

Jumping directly to the main conclusion, it was found that Canadian agriculture contributes about 11.7% of Canada's emissions (compare to the initial estimate of 6%), as calculated in units of CO_2, based on the 100 year greenhouse warming potential of methane ($21xCO_2$) and nitrous oxide ($310xCO_2$). Using Statistics Canada's census of agriculture as the basis for the estimate of the activity level , the contributions were calculated as follows (in megatons of equivalent CO_2):

Census Year	1986	1991	% of Canada
CO_2	18.6	17.0	4 %
CH_4	17.8	20.4	29 %
N_2O	30.4	30.2	56 %
Total	66.8	67.6	11.7 %

These numbers are in fact one of the environmental indicators selected by AAFC, and will therefore continue to be made available in the future. (The 1996 figures will be available in about six months.)

These results are absolutely new, and have not been discussed publicly yet. I will venture my own simplified interpretation, but will refer serious readers to AAFC authorities for the official view. Basically, CO_2 emissions have gone down between 1986 and 1991 as a result of soil conservation and more careful use of fertilizers, whereas methane has increased because of a significant increase in the number of ruminants.

Agricultural CO_2 is released from decaying organic matter, internal combustion engines in machinery and transportation, and the manufacture of fertilizers. Of course, agriculture is also a process which extracts CO_2

from the air and fixes it in the form of organic matter: food, by-products and other essential products, the fate of which is outside agriculture. One is therefore concerned with the net effect on CO_2 concentration. Since the early 1980's, Canada has made a significant effort in soil conservation, which is seen most vividly as a decrease of summerfallow and in the use of minimum tillage, where possible. Minimum tillage, in turn, helps conserve organic matter in the soil, and reduces energy use in machinery, both of which reduce CO_2 emissions. At the same time, efforts to increase yield by optimal use of fertilizers have contributed to the fixation of more CO_2, part of which remains in the soil. Soil conservation is an excellent story in Canadian agriculture: it is estimated that by 1998 Canadian soils will stop being a source of CO_2, and that they will in fact be storing carbon at the rate of 10 kg/ha/year by 2010. This story is very well told in a 1995 report, The Health of our Soils, available from AAFC (Publication 1906/E or /F). Thus, concerning net CO_2 emissions from agriculture, it can be expected that they will continue to decrease for another 10 years or so, and stabilize around 2010, as a result of already initiated efforts. No significant new or additional remedial techniques have been identified to further reduce the net emissions.

Agricultural methane is mainly exhaled by ruminant animals as a by-product of digestion, but is also released by manures and by the decomposition of organic matter under anaerobic conditions. A very careful experiment has determined that a herd of 118 cows in a high efficiency dairy barn produced as much as 525 litres of methane per cow per day, whereas beef cattle on pasture produce closer to 200 litres, depending on weight of the animals, feed consumed, and other conditions. Research indicates that methane production can be reduced up to 30% by improving the quality and quantity of feed, including the addition of oil to the diet. There are also commercial feed additives that are claimed to reduce methane emission. The research found that these additives become less effective with time, as the rumen microorganisms adapt to them. Improving feed quality and quantity is a strategy which can probably be implemented by Canadian farmers, but there were no studies to determine whether this would be economically feasible. If it can be made economical, this strategy could lead to a very significant reduction in Canadian agricultural methane emissions. Unfortunately, farmers in less-developed countries may be less able to apply this strategy. The other method would be to reduce the number of ruminants, but this might have compensating effects on CO_2 emissions, if pastures, which hold high amounts of carbon, were to be converted to crops. There would also be negative economic consequences.

From manures, methane is mainly emitted from liquid storage systems, but very little from dry manures. The research did not specifically address the reduction of this methane, which would require more aerobic conditions, possibly resulting in more odours. Methane is also emitted from soils under anaerobic conditions, such as high moisture, but it can also be absorbed by soils. Overall these processes do not contribute a large amount in Canadian agro-ecosystems.

The most surprising revelations of the research program had to do with nitrous oxide. Specifically, the emissions calculated are about six times what had been estimated previously, and the nature of the emissions was found to be very episodic, with about half of the emissions released in the spring or the snowmelt period. Although little can be done about the main triggering mechanism, which is precipitation (or snowmelt), the emissions are obviously related to the amount of nitrogen fertilizers applied (including manures), their formulation, coating (e.g.slow release), the timing of application, the amount of crop residues left on the field and nitrogen fixed biologically (e.g. legume crops), etc. Thus, although release of N_2O is the most complex and the least understood of the three processes, the research has nevertheless identified a number of strategies which make sense (and sometimes cents!), and which would likely decrease its greenhouse effect. However, more research would be required to quantify the relative merit of the different methods and the circumstances in which they would be effective. Therefore, one cannot expect a significant reduction in N_2O from agriculture in the short term, but probably in the long term.

In summary, Agriculture and Agri-Food Canada have completed an outstanding environmental research program which has precisely quantified Canadian agriculture's contribution to the greenhouse effect, and has identified several techniques to reduce this contribution. Since the contribution is more than 10% of Canada's total contribution, it is most fortunate that reduction techniques are available. There is no doubt that these will be applied as time goes on, since most of them make economic sense and they tend to bring the agricultural system closer to optimum efficiency. Greenhouse gases released by agriculture represent an energy waste from the system; reducing them is good for everyone.

Note: Dr. Richard Asselin is the Director of CMOS Publications.

Nouveau contrat d'impression pour Atmosphère-Océan: des économies importantes pour la SCMO!

Introduction

C'est une bonne pratique d'affaire que de renouveler périodiquement les ententes contractuelles. Comme ceci n'avait pas été fait depuis quelques années pour l'impression de Atmosphère-Océan, ce devint une première priorité pour moi, en tant que nouveau directeur des publications.

Appel d'offres

La Société n'ayant pas de documentation sur ce qui avait été fait dans le passé, il fallait donc décrire précisément nos besoins afin d'inviter des soumissions. Il est vite apparu que ce travail n'est pas simple. Heureusement, les Presses scientifiques du CNRC, qui ont pour mission de promouvoir la dissémination d'information scientifique canadienne, s'empressèrent de me fournir une copie des spécifications qu'ils utilisent eux-mêmes pour la publication de leurs 14 revues scientifiques. Il s'agit d'un document assez impressionnant de 40 pages, qu'un travail de quelques jours me permit de réduire à environ quatre pages pour les fins de A-O. Notre appel d'offre fut envoyé à 13 compagnies préalablement sélectionnées pour leur habileté à remplir nos besoins en photocomposition, en imprimerie ou les deux.

Évaluation

Sept compagnies répondirent à notre appel. Un comité composé de la rédactrice technique, d'un codirecteur scientifique et de moi-même fut constitué. L'évaluation était en deux phases, une première partie subjective traitant des questions de réputation, qualité, fiabilité, disponibilité, accès, etc, et une deuxième phase quantitative évaluant le coût total de production pour un numéro typique de la revue. Le coût de certaines options fut considéré par la suite.

Chacune des compagnies présentait une proposition pour la photocomposition ainsi que l'impression, mais seulement deux avaient la capacité de faire eux-mêmes la photocomposition au complet. En effet, A-O comporte des équations scientifiques qui requièrent des techniciens très spécialisés et des logiciels spéciaux pour la photocomposition. La proposition d'une des compagnies fut éliminée car elle ne se conformait pas à toutes les exigences de notre demande.

Résultats

Les coûts des différents éléments variaient considérablement d'une compagnie à l'autre, ce qui faisait osciller le coût d'un numéro typique de 7 000$ à 10 000$ environ. En fin de compte, la proposition des Presses de l'Université de Toronto (UTP) fut choisie comme la plus avantageuse pour la SCMO. Il n'y aura donc pas de changement d'imprimeur pour A-O, mais on peut s'attendre à ce que le prix soit réduit d'environ 30% par rapport à ce que nous payons auparavant, soit environ 12 000$ d'économie par année. Voilà donc le fruit de nos efforts, et de la magie de la compétition!

Ventilation des coûts

Il peut être intéressant d'examiner le détail des coûts d'un numéro typique d'A-O (128 pages).

Tableau de ventilation des coûts

Item	Coût en $
Rédaction technique	1 500
Traduction	200
Photocomposition	3 050
Photographies et diagrammes: balayage et ajustement	700
Changements après les épreuves	300
Films négatifs pour imprimer chaque page	500
Impression et reliure de 700 copies	2 200
Couverture	250
50 tirés à part de chaque article	600
Emballage et préparation pour la poste	150
Frais de poste au Canada (350 copies)	30*
Frais de poste aux USA et outremer (250 copies)	600
Taxes	600
Total	10 680

* Subventionnés.

Évidemment, plusieurs variables influenceront le prix final réel, soit le nombre de pages, le nombre de copies, le nombre d'illustrations et de tableaux, les pages couleur, etc. Si on suppose qu'un chercheur coûte environ 250 000$ par année (incluant son salaire, personnel de

soutient, équipement et autres dépenses), et qu'il produit en moyenne trois articles scientifiques, on peut considérer que chaque article a coûté environ 80 000$, soit un total d'environ 400 000$ pour le numéro typique de A-O. Donc le coût d'impression et de distribution de la recherche est d'environ 2.5% du coût total! Il faudrait aussi tenir compte du travail bénévole des critiques et réviseurs scientifiques.

Visite aux Presses de l'Université de Toronto

En vue de finaliser les détails du contrat (un an, renouvelable pour deux ans au même prix), Sheila Bourque et moi avons fait une visite aux Presses le 12 février dernier. Nous avons été très bien accueillis par le gérant des ventes et les chefs de toutes les sections. Tous les aspects du contrat et des problèmes de production furent discutés. Nous avons terminé notre visite par un coup d'oeil rapide sur les différentes opérations de l'entreprise. UTP est maintenant une entreprise autonome dont les profits sont réinvestis dans la publication de volumes scientifiques. Elles publient ainsi environ 400 titres par an, et ont en tout temps environ 900 projets à divers stages de production. Plus de 100 employés réguliers travaillent aux presses, en plus d'environ 100 employés à temps partiel pour la distribution et les magasins.

Atmosphère-Océan est imprimé par le procédé offset avec plaques de métal, afin d'assurer la plus haute qualité, requise pour les illustrations scientifiques. Le papier choisi est exclusif à UTP; à l'avenir il s'agira de papier rencontrant les exigences du papier recyclé (coût supplémentaire d'environ 200$), comme il se doit pour une société à mission environnementale comme la SCMO.

Conclusion

La SCMO est fière de contribuer à la diffusion de la recherche en météorologie et en océanographie au Canada. Les efforts que nous avons déployés pour minimiser les coûts ont porté fruit, et nous devrons examiner comment disposer des économies ainsi réalisées. Les options qui se présentent sont: retourner un "profit" à la SCMO, réduire les coûts d'abonnement, réduire les frais d'auteur, augmenter les efforts de promotion, conserver un coussin dans le compte de A-O, ou une combinaison de toutes ces options. Au cours des prochains mois, nous examinerons ces choix et prendrons les décisions appropriées. Une chose est cependant certaine, les hauts standards de qualité seront maintenus, en coopération avec les Presses de l'Université de Toronto. De plus, l'expérience et les connaissances que nous avons acquises et documentées grâce à ce travail seront disponibles à l'avenir ou pour d'autres publications.

Remerciements

Je tiens à remercier Sheila Bourque, Peter Bartello, Dorothy Neale et Neil Campbell qui ont tous contribué à ce travail fort intéressant.

Richard Asselin,
Directeur des publications.

New Printing Contract for ATMOSPHERE-OCEAN: Big Savings for CMOS!

Introduction

It is good business to renew periodically our business contracts. Since this had not been done for a number of years with regard to printing of Atmosphere-Ocean, it became my first priority as the new Director of Publications.

Invitation to Tender

Since the Society did not have any documentation on what had been done in the past, our needs had to be well defined in order to invite bids. Quickly, it became apparent that the task was not simple. Fortunately, the NRC Research Press, whose mandate is to promote the dissemination of Canadian scientific information, were very eager to provide me with a copy of the specifications they use for the publication of their 14 scientific journals. It consists of a rather impressive 40-page document, which I was able to reduce to about four pages for A-O purposes after a few days' work. Our invitation to tender was sent to 13 companies previously chosen for their capability to meet our needs in typesetting, in printing or in both.

Evaluation

Seven companies answered our invitation. A committee made up of the technical editor, one of the co-editors and myself was struck. The evaluation was in two phases, the first one subjective concerning the question of reputation, quality, reliability, availability, access, etc, and a second phase quantitative evaluating the total cost of production for a typical issue of the journal. The cost of certain options were later considered.

Every company presented a proposal for typesetting as well as for printing, but only two had the capability of doing all the typesetting themselves. Actually, A-O has scientific equations which require very specialized technicians and special software for typesetting. One company's proposal was eliminated because it did not conform to all the requirements we specified.

Results

The cost of the different elements varied considerably from one company to the next, which made the cost of a typical issue fluctuate from $7,000 to around $10,000. Finally, University of Toronto Press (UTP) came out with the best price and was chosen by CMOS. So there will be no change in printer for A-O, but we can expect to pay around 30% less than what we are paying right now, a savings of around $12,000 per year. So here are the fruits of our labor, and the magic of competition!

Breakdown of costs

Cost Breakdown Table

Item	Cost in $
Technical Editing	1 500
Translation	200
Typesetting	3 050
Photographs and diagrams: scanning and adjustments	700
Changes after proofs	300
Negatives to print each page	500
Printing and binding of 700 copies	2 200
Covers	250
50 reprints of each article	600
Packing and preparation for postage	150
Cost of postage for Canada (350 copies)	30*
Cost of postage for USA and overseas (250 copies)	600
Taxes	600
Total	10 680

* Subsidized.

It might be interesting to examine in detail the costs of a typical issue of A-O (128 pages). Of course, many variables will influence the actual final cost. They are the number of pages, the number of copies, the number of illustrations and tables, colour, etc. If we suppose that a researcher costs around $250,000 per year (including his salary, support staff, equipment and other expenses), and that he produces on average three scientific articles, we can consider that each article costs around $80,000, that is a total of around $400,000 for a typical issue of A-O. Therefore, the cost of printing and distribution of the research is about 2.5% of the total! We should also take into account the volunteer work by the referees and scientific reviewers.

Visit to the University of Toronto Press

In order to finalize the contract details (one year, renewable for two years at the same price), Sheila Bourque and myself visited U of T Press last February 12. We were welcomed by the sales manager and the supervisors of each section. Every aspect of the contract and production problems was discussed. We ended our visit with a short tour of the company. UTP is now an autonomous company whose profits are reinvested in the publication of scientific books. It publishes around 400 titles per year, and has around 900 projects running at different stages of production at all times. Over 100 regular employees work at U of T Press, on top of the 100 employees or so working part time in distribution or in their stores.

Atmosphere-Ocean is printed by offset with metal plaques, in order to insure the highest quality, required for scientific illustrations. The paper chosen is exclusive to UTP; in the future, recycled paper will be used (additional cost of around $200), as should be by a Society such as CMOS which has an environmental mission.

Conclusion

CMOS is proud to contribute to the distribution of research in meteorology and oceanography in Canada. The efforts which we have devoted to minimize costs have borne fruit, and we will examine how to use the savings realized. These are the options: return a "profit" to CMOS, reduce the cost of subscriptions, reduce the author fees, increase promotional efforts, keep a cushion in the A-O account, or a combination. In the following months, we will examine these options and will make the appropriate decisions. However, one thing is certain; we will maintain, in cooperation with University of Toronto Press, high standards of quality. Furthermore, the experience and knowledge acquired and documented through this work will be available in the future for other publications.

Acknowledgements

I would like to thank Sheila Bourque, Peter Bartello, Dorothy Neale and Neil Campbell who have all contributed to this very interesting project.

Richard Asselin,
Director of Publications.

Announcement of a CMOS Scholarship

Following the discussions on a proposed CMOS scholarship last year at the Annual Congress; Council considered a number of options for implementation. A decision was made to form a partnership with the Natural Sciences and Engineering Research Council (NSERC) for the scholarship.

Under the terms of the agreement NSERC will advertise the scholarship in their Awards Guide and peer review all potential applicants. Candidates for a CMOS Scholarship must first of all be holders of an NSERC scholarship and secondly have indicated his/her intent to carry out research studies in atmospheric or ocean sciences (physical or chemical oceanography) in a Canadian university. Applications of such candidates will be referred to CMOS for final review and selection.

The first award will be made in 1998. It is valued at $5,000 and will be awarded for a two year period provided the student continues to hold an NSERC scholarship. In the second and following years of operation CMOS will be committed to $10,000 annually.

The door is now open for all members, chapters and centres to support this new initiative financially and help us out in setting up a Scholarship Trust Fund.

Peter Zwack and Michel Béland.

Échange de publicité

Afin d'attirer de nouveaux membres, la SCMO a conclu une entente de réciprocité avec l'Alliance for Marine Remote Sensing, en vertu de laquelle chaque société offre gratuitement à l'autre une page de publicité et un envoi de publication. Les abonnés de CMOS Bulletin CSMO recevrons donc la publication "Backscatter" avec leur Bulletin de juin 1997.

Richard Asselin,
Directeur des publications, SCMO.

Publicity exchange

As part of our effort to recruit new members, CMOS has reached an agreement with the Alliance for Marine Remote Sensing whereby each society offers a free page of advertising and a free publication mailing to the other. Subscribers of the CMOS Bulletin SCMO will receive the publication Backscatter with their June issue of the Bulletin.

Richard Asselin,
Director of Publications, CMOS.

Fellows and Honorary Fellows

A Proposed New Category of Membership in CMOS by Council

The rationale for proposing a category of a "Fellow" and Honorary Fellow in CMOS stems from a number of observations not the least of which is to find ways and means of stimulating more interest and involvement in the affairs of the Society than heretofore.

The Society is facing a downtrend in membership and subscriptions to A-O and a general malaise of interest in supporting the Bulletin as judged by the lack of articles and letters to the editor. Many Centres are far from active and indeed in some cases have not elected or appointed a full slate of officers.

If the Society is to survive and do the things it should, members will have to become more involved in one way or another. One of the suggested ways of drawing more interest of members in the Society is to bring them into direct contact with the affairs of the Society and at the same time recognize them for their personal achievements and contributions to the goals of the Society. This proposal is to recognize our colleagues for their work by bestowing the status of "Fellow of the Society". Many societies including the AMS, AAAS and IEEE to name a few, so honour members and others. It is a means of involving them in the affairs and functions of their respective organizations.

The following identifies some of the considerations and procedures that might apply:

To Become a Fellow of CMOS

To qualify as a Fellow of CMOS (FCMOS) the individual would be recognized for his/her contribution to the scientific, professional, educational and weathercasting fields in atmospheric and ocean sciences in Canada.
The qualifications and criteria for nominating or electing an individual as a "Fellow" should take into account the following:

a) contribution and achievements of the individual to his/her chosen career;
b) the contributions which the individual might be expected to make to the Society;

Other considerations:

a) the recommendations of the nominators;
b) the number of Fellows in the Society.
c) representation of a regional, linguistic or other diversity of the Society.

Nomination, Election and Term of Office of Fellows

Fellows shall be elected at any Annual or Special Annual Meeting of the Society.

Fellows Committee: The Council shall appoint a Committee (Fellows Committee) for the Nomination of Fellows, composed of the Past-president, the Chairman of the Scientific Committee, the Chairman of the Accreditation Committee and one other member as yet to be determined.

The Chair of the Committee shall normally be the immediate Past-president of the Society.

Nomination and Election Procedure: The Committee shall solicit nominations from members. A nomination form is to be prepared and used. The relevant information is to be prepared and when complete, co-signed by two members in good standing.

The Fellows Committee will review all nominations and draw up a list of nominees for consideration as inductees. All nominations for appointment as Fellows are to be kept on an active file for two successive years after the first year of nomination.

In approving Fellows of the Society, the Fellows Committee shall take into account the above requirements for appointment.

The recommendations of the Fellows Committee shall be presented to Council which in turn is to announce the election at the next Annual or Special General Meeting.

Fellows may resign, or be struck from the Forum for cause by a two-thirds majority of those present and voting at an Annual General Meeting.

Honorary Fellows:
In a separate recommendation, the Fellows Committee may also present the names of individuals who are judged to have provided outstanding services to their field of endeavour and the Society. These individuals may be elected by the Annual General Meeting as Honorary Fellows of the Society.

Life Members named prior to the passage of the present By-Law shall continue to be recognized as such.

Honorary Fellows are normally elected for life but may resign, or be struck from the Forum for cause by a two-thirds majority of those present and voting at an Annual General Meeting.

Honorary Fellows shall receive notice and may attend Annual and General Meetings of the Forum of Fellows of the Society.

An Honourary Fellow must be a member in good standing.

The Forum of Fellows

When one-quarter of the number of Fellows has been elected the Fellows shall create a "Forum of Fellows" (the Forum).

Role of the Forum: In any regularly constituted Annual or Special General Meeting, the Forum shall meet and consider inter alia:

i) the report of the Fellows Committee and, recommend candidates for consideration as Fellows or Honorary Fellows.

ii) matters, issues or concerns of relevance to the Society and recommend appropriate actions for Council or the Society.

Rights and Duties

1) Fellows are members in good standing.
2) Fellows are eligible to serve on council and committees.
3) Fellows are expected to promote the objectives of the Society and take part in the Forum of Fellows.
4) Fellows are entitled to identify themselves as a Fellow of the Canadian Meteorological and Oceanographic Society by the use of the letters "FCMOS".
5) Fellows may resign, or be struck from the Society for cause by a two-thirds majority of those present and voting at an Annual General Meeting.

Council

Note du Rédacteur

À cause de problèmes techniques, nous ne pouvons pas présenter la version française dans ce numéro. Nous la ferons paraître dans le prochain numéro du *CMOS Bulletin SCMO*. Nous nous excusons auprès de nos lecteurs francophones pour ce contretemps.

Avis important à l'intention des enseignants de niveau pré-collégial spécialistes des sciences atmosphériques

Atelier d'été en météorologie

Comme par les années passées, la Société canadienne de météorologie et d'océanographie (SCMO) a été invitée à choisir un enseignant canadien qui participera au PROJET ATMOSPHÈRE. Il s'agit d'un atelier d'été à l'intention des enseignants de niveau pré-collégial spécialistes en sciences atmosphériques; cet atelier est parrainé par l'American Meteorological Society (AMS) et la National Oceanic and Atmospheric Administration (NOAA) américaine. Il aura lieu du 21 juillet au 1er août 1997 au centre de formation du National Weather Service à Kansas City au Missouri.

Les dépenses de l'enseignant choisi seront assumées par l'AMS et la NOAA, à l'exception des déplacements à destination et au retour de Kansas City. La SCMO et le Conseil canadien pour l'enseignement de la géographie offrent chacun 200 $, soit au total 400 $, pour les déplacements.

Les anciens participants du Canada ont trouvé leur expérience très enrichissante et stimulante. Les exposés de l'atelier sont présentés par les scientifiques américains les plus réputés dans le domaine. Les enseignants sont revenus avec du matériel, des ressources et des modules didactiques qu'ils peuvent facilement adapter dans leurs cours.

Étant donné que l'échéance du dépôt du nom du candidat canadien choisi approche rapidement, les enseignants intéressés sont priés de demander un formulaire de candidature et la brochure de renseignements par écrit, par téléphone, par télécopieur ou par courrier électronique à l'adresse suivante :

N.J. Campbell
Directeur exécutif
SCMO - Atelier d'été
Bureau 112, Immeuble McDonald
150, rue Louis-Pasteur
Ottawa (Ontario) K1N 6N5
Téléphone: (613) 990-0300
Télécopieur: (613) 993-4658
Courriel: cmos@ottmed.meds.dfo.ca

Important Notice for Pre-college Teachers of Atmospheric Meteorology Workshop

Summer Meteorology Workshop

As in several previous years, the Canadian Meteorological and Oceanographic Society (CMOS) has again been invited to select a Canadian teacher to participate in PROJECT ATMOSPHERE. This is a summer workshop for pre-college teachers of Atmospheric Science topics sponsored by the American Meteorological Society (AMS) and the National Oceanic and Atmospheric Administration (NOAA) of the United States. It takes place July 21 - August 1, 1997 at the National Weather Service Training Center, Kansas City, Missouri.

The expenses for the participating teacher are paid by AMS/NOAA, except for the travel to and from Kansas City. CMOS and the Canadian Council for Geographic Education contribute $200 (Canadian) each (total $400) towards the travel expenses.

Previous Canadian participants have found their attendance a very rewarding and significant experience. Presentations are made at the Workshop by some of the most respected American Scientists in this field. Participants have returned with material, resources and teaching modules readily adaptable to classroom presentations.

In view of the rapidly approaching deadline for submitting the name of the selected candidate to the AMS, interested teachers are urged to request as soon as possible an application form and a brochure giving further details about the Workshop by writing, phoning, faxing or e-mailing to the following address:

Dr. N.J. Campbell
Executive Director
CMOS - Summer Workshop
Suite 112, McDonald Bldg
150 Louis-Pasteur
Ottawa, ON K1N 6N5
Tel: (613) 990-0300
Fax: (613) 993-4658
e-mail: cmos@ottmed.meds.dfo.ca

Update on the Summit of the Sea St. John's, Newfoundland September 1-6, 1997

The Summit is only months away and the registration brochure is now available. This Conference will also have the capability to accept registrations over the Internet. You may check it out at:-

http://www.newcomm.net/cabot500/summit.htm

World leaders have been invited to give the plenary lectures and the Panelists for each session are likewise very distinguished. The theme is *"Understanding and Managing the Oceans"* and the plenary is organized into four daily sessions as follows:-

Tuesday, September 2 - Ocean Management and International Law

- Keynote speakers:

Elisabeth Mann Borgese, International Oceans Institute;
Wiliam O'Neil, Secretary-General, IMO;

- Panel:

Ed Miles, Past President, Law of the Sea Institute;
Dr. Arthur Hanson, CEO, International Institute for Sustainable Development;
Magnus Johannesson, Secretary, Ministry of the Environment, Iceland;
David McDowell, Director General, IUCN.

Wednesday, September 3 - Ocean Science and Technology

- Keynote Speakers:

James Baker, Chief Administrator, NOAA;
John Woods, Dean, Graduate School of the Environment, Imperial College, London;

- Panel:

Gunnar Kullenberg, Executive Secretary, IOC;
Sylvia Earle, SeaWeb, USA;
Hiroshi Ohba, CEO, Kawasaki Heavy Industries;
Serge Garcia, Director, Fisheries Resources Division, FAO.

Thursday, September 4 - Sustainable Fisheries

- Keynote Speakers:

Satya Nandan, Fiji Ambassador to the UN;
Victor Young, CEO, Fisheries Products International;
Harald Rosenthal, Institut fur Meereskunde, Kiel;

- Panel:

John Crosbie, Chancellor, Memorial University;
William Broderick, Commercial fisherman;
Scott Parsons, ADM, Science, DFO;
Michael Sutton, Director, WWF, Endangered Species;
Alistair Goodlad, Chairman, Saga Seafoods Ltd.

Friday, September 5 - Oceans in History and Culture

- Keynote Speakers:

Federico Mayor, Director General, UNESCO;
Leslie Harris, President Emeritus, Memorial Univ.;

- Panel:

Rex Murphy, Journalist and Broadcaster;
Christopher Pratt, Artist, Member of the Order of Canada;
Annie Proulx, Author, Pulitzer prize winner.

Dr. Arthur May will be Conference Chairman, while Premier Tobin and Minister Mifflin will give welcoming addresses. The latter will also launch the Ocean Charter as a Canadian contribution to the International Year of the Oceans in 1998.

For additional information please contact:

Summit of the Sea Core Conference Secretariat
John Cabot 500th Anniversary Celebrations
Box 1997, Station C, St John's, NF
Canada A1C 5R4

Prepared by Geoff Holland,
Chairman, IOC.

Job! Job! Job! Job!

Entry level meteorologist / hydrologist is looking for a job. Master of Science degree - Geography with specialization in Hydrology, Meteorology, and Climatology.

Worked for Environment Canada (Data Analyst-Climate), using the Atmospheric Environment Service Oracle data retrieval system and suitable softwares.

Dariusz Lysak
Tel: (416) 446-0628

Proposed By-Law Amendments

ARTICLE 5
Changes to the Constitution or By-Laws

By-Law (a) of this article requires that any proposed change must be published in the *CMOS Bulletin SCMO* or mailed to all members.

By-Law (b) of the same article requires notification two months prior to a meeting when a vote could be taken.

Reason for the Proposed Change
Notification two months prior to the AGM makes it impossible to use the April issue of the Bulletin as a vehicle of communication for By-Law amendments. The issue does not go to press before the 1st of April and also it must await the finalization of the Annual Review and Auditor's statement, all of which are now incorporated into the April issue. The timing of receipt of reports from committees, Centres and the auditor is out of the hands of CMOS and it would be helpful for the two month notification to be reduced to 21 days.

It is therefore proposed that the two month notification in Article 5 para b) be amended to read 21 days.

BY-LAW 1 - Memberships

To recognize proposed new membership category

Amend a) from:

a) in accordance with Article 3 of the constitution, the membership of the Society consists of:

Regular Members, Sustaining Members,
Corporate Members, Student Members,
Life Members, Associate Members

change to read:

Regular Members, Sustaining Members,
Corporate Members, Student Members,
Honorary Fellows, Fellow Members,
Associate Members

replace e) which reads:

Life membership may be granted to members of the Society who have provided exceptional long-term service and support to the Society. A life membership is proposed by Council, and must be approved by the Annual General Meeting. Life Members are not expected to pay fees and shall receive Society publications of their choice.

with:

The title "Honorary Fellow" may be granted to members of the Society who have provided exceptional long-term service and support to the Society and/or throughout his/her career have made outstanding contributions to the scientific, professional, educational and weathercasting fields in atmospheric or ocean sciences in Canada. An Honorary Fellow is proposed by Council on recommendation of a "Fellows Committee", and must be approved by an Annual General or Special Meeting. Honorary fellows must be members in good standing.

new f)

Life members named prior to the passage of the present By-Law shall continue to be recognized as such.

new add the following:

g) The title "Fellow of the Society" may be granted to members of the Society who have provided exceptional long-term service and support to the Society and/or who have made outstanding contributions to the scientific, professional, educational and weathercasting fields in atmospheric and ocean sciences in Canada. A Fellow membership is proposed by Council on recommendation of a "Fellows Committee", and must be approved by an Annual General or Special Meeting. A Fellow must be in good standing.

The following paragraphs of By-Law 1 are to be re-ordered accordingly

In place of j)

Any member may resign from the Society by submitting a written resignation to the Society.

substitute:

Any member may resign from the Society by submitting a written resignation to the Society. Fellows may be struck from the Society for cause by a two-thirds majority vote of those present and voting at an Annual or special Meeting.

BY-LAW 16 - Committees, Editorial Boards and Working Groups

To recognize current organizational structure and name change of Broadcaster Endorsement Committee

For paragraph a) which reads:

The Committees appointed by the Council are: The

Accreditation Committee, the Broadcaster Endorsement Committee, the Nominating Committee, the Prizes and Awards Committee, the Education Committee for Meteorology, the Professionalism Committee, and the Scientific Committee. The Chairmen of the Membership Committee is appointed by Council and each Centre appoints one member. Ad hoc committees are appointed by Council, as required.

replace with

The Committees appointed by the Council are: The Accreditation Committee, the Weathercaster Endorsement Committee, the Nominating Committee, the Prizes and Awards Committee, the Education Committee, the Private Sector Committee, the Scientific Committee, the Fellows Committee, and the Scholarship Committee whose chairman shall be the Vice-President of CMOS. Ad hoc and other committees may be appointed by Council, as required.

Canadian Meteorological and Oceanographic Society Prizes and Awards

To recognize the creation of a CMOS Scholarship

After g) add a new paragraph h)

The CMOS Postgraduate Scholarship is awarded annually in association with the Natural Sciences and Engineering Research Council of Canada as a Postgraduate Supplement. The successful student must be eligible for an NSERC scholarship and indicate his/her intention to pursue advanced studies and research in atmospheric or oceanographic sciences (physical or chemical) at a recognized Canadian university with postgraduate studies in these fields. The award is tenable for a maximum of 24 months, provided that the holder continues to be a full-time candidate for a higher degree in a Canadian University.

Renumber old h) as i).

General By-Law Amendments

To recognize the need to remove gender distinction throughout the text.

With reference to the present text of the By-Laws, dated April 1995, where the text reads "chairman or chairmen" it is to be amended to read "chairperson or chairpersons", respectively.

Modifications proposées aux règlements

ARTICLE 5 Modification de la Constitution ou des règlements

Le règlement (a) de cet article requiert que tout changement proposé, doit être publié, dans le *CMOS Bulletin SCMO* ou distribué par courrier à tous les membres.

Le règlement (b) du même article requiert que l'avis soit envoyé deux mois avant la tenue de la réunion ou le vote pourrait avoir lieu.

Raison du changement proposé
Cet avis de deux mois avant l'assemblée générale nous empêche d'utiliser le numéro d'avril du Bulletin comme véhicule de communication des modifications aux règlements. Le numéro n'est pas imprimé avant le 1er avril et il doit également attendre la rédaction définitive de la Revue Annuelle et le Rapport des vérificateurs, tous ces documents faisant maintenant partie du numéro d'avril. La date de réception des rapports des comités, des Centres et du vérificateur n'est pas du contrôle de la SCMO et il serait utile si l'avis de deux mois serait réduit à 21 jours.

Il est donc proposé que l'avis de deux mois de l'article 5 paragraphe b) soit modifié à 21 jours.

RÈGLEMENT 1 - Adhésion

Afin de reconnaître une nouvelle catégorie de membre

Changer a) de:

a) Conformément à l'article 3 de la Constitution, les types de membres de la Société sont:
membres réguliers, membres corporatifs,
membres de soutien, membres étudiants,
membres à vie, membres associés

remplacer pour lire:

membres réguliers, membres de soutien,
membres corporatifs, membres étudiants ,
Fellows honoraires, Fellows,
membres associés.

remplacer e) qui se lit comme suit:

Les individus qui ont offert à la Société leur soutien et des services exceptionnels au cours de nombreuses années, peuvent devenir membres à vie. La désignation de membre à vie doit être recommandée par le conseil et doit recevoir l'approbation de l'assemblée générale

annuelle. Les membres à vie sont exemptés de cotisation et reçoivent les publications de leur choix de la Société.

par:

Les individus qui ont offert à la Société leur soutien et des services exceptionnels au cours de nombreuses années et/ou qui ont contribué exceptionnellement durant leur carrière aux domaines scientifiques, professionnels, éducatifs et de la prévision du temps dans les sciences marines ou atmosphériques, peuvent devenir "Fellow honoraire". La désignation "Fellow honoraire" doit être recommandée par le conseil sous la recommandation du "Comité des Fellows" et doit recevoir l'approbation de l'assemblée générale annuelle ou d'une réunion spéciale. Les "Fellows honoraires" doivent être membres en règle.

nouveau f)

Les membres à vie nommés avant l'adoption des règlements actuels garderont leur titre.

nouveau g) qui se lit comme suit:

g) Les individus qui ont offert a la Société leur soutien et des services exceptionnels au cours de nombreuses années et/ou qui ont contribué exceptionnellement aux domaines scientifiques, professionnels, éducatifs et de la prévision du temps dans les sciences marines ou atmosphériques peuvent devenir "Fellow de la Société". La désignation "Fellow" doit être recommandée par le conseil sous la recommandation du "Comité des Fellows" et doit être approuvée à l'assemblée générale annuelle ou à une réunion spéciale. Les "Fellows" doivent être membres en règle.

Les paragraphes suivants du règlement 1 doivent être réorganisés.

À la place de j)

Tout membre peut démisionner de la Société en soumettant une demande écrite à la Société.

remplacer par:

Tout membre peut démissionner de la Société en soumettant une demande écrite à la Société. Pour des motifs le justifiant, les "Fellows" peuvent être radiés de la Société par une majorité des deux-tiers des votes des membres votants à une assemblée annuelle ou à une assemblée spéciale.

RÈGLEMENT 16 - Comités, Conseils de rédaction, et groupes de travail

Afin de reconnaître la structure organisationnelle actuelle et le changement de nom du comité pour l'approbation de présentateurs d'information météo (radio et télé) remplacer le paragraphe a) qui se lit comme suit:

Le conseil d'administration désigne les comités suivants: le comité d'accréditation, le comité pour l'approbation de présentateurs d'information météo (radio et télé), le comité de mise en candidature, le comité des prix et récompenses, le comité d'éducation en météorologie, le comité sur le professionnalisme, et le comité scientifique. Le président du comité d'éligibilité des membres est désigné par le conseil d'administration et chaque Centre désigne un membre. Le conseil d'administration peut selon le besoin désigner des comités spéciaux.

par

Le conseil d'administration désigne les comités suivants: le comité d'accréditation, le comité pour l'approbation de présentateurs météo, le comité de mise en candidature, le comité des prix et récompenses, le comité d'éducation, le comité sur le secteur public, le comité scientifique, le comité des Fellows, et le comité des bourses dont le président sera le vice-président de la SCMO. Le conseil d'administration peut selon le besoin désigner d'autres comités et des comités spéciaux.

Société canadienne de météorologie et d'océanographie
Prix et récompenses

Afin de reconnaître la création d'une bourse SCMO

Après g) ajouter un nouveau paragraphe h)

La Bourse de troisième cycle de la SCMO est décernée chaque année en collaboration avec le Conseil de recherche sur les sciences naturelles et le génie comme supplément de troisième cycle. Le candidat doit être éligible à une bourse du CRSNG et indiquer ses projets concernant ses études supérieures et ses recherches en sciences de l'atmosphère et des océans (physique ou chimique dans une université canadienne offrant des études de troisième cycle dans ces domaines). Ce prix est offert pendant une période maximale de 24 mois, si le récipiendaire poursuit ses études supérieures à temps plein dans une université canadienne.

Renommer l'ancien h) par la lettre i).

Modifications générales aux règlements

Afin de retirer la distinction par sexe dans le texte.

Dans le présent texte des règlements, daté avril 1995, où l'on peut lire "président ou présidents", il est proposé que la modification se lise comme suit: "le président ou la présidente ou les président(e)s".

CMOS 31st Annual Congress
Saskatoon, Saskatchewan

The 31st Annual Congress of the Canadian Meteorological and Oceanographic Society will be held at the University of Saskatchewan, Saskatoon, Saskatchewan, Canada from June 2 to June 6, 1997. The CMOS committee meetings will be held on Sunday June 1 at the National Hydrology Research Centre.

Oral and poster papers, and commercial exhibits in all areas of meteorology, hydrology, oceanography and limnology are all welcome. Special interdisciplinary sessions will be held on GEWEX and BOREAS. Any other groups wishing to hold a special session should contact Joe Eley or Geoff Strong about space arrangements.

Early registration is encouraged with the incentive of reduced registration fees. To qualify for early registration rates, cash, cheque or money order must be received by 5 May 1997. Registration fees are 90% refundable until 31 May. CMOS cannot accept payment by credit card.

Social Activities

In addition to the full scientific agenda, this year's program includes an ice breaker, two cash bar receptions and a banquet for discussion in a more relaxed setting. The banquet will be held in Marquis Hall on the U. of Saskatchewan campus. Full registration includes one free drink ticket to both receptions and a banquet ticket. Additional banquet tickets may be purchased with registration at the congress.

A special luncheon at $15 has also been arranged for the awarding of the Atmospheric Environment Service's Patterson Medal for outstanding contribution to Meteorology.

Lunches

Lunch will be available in Marquis Hall as well as in other cafeteria locations on campus. There are also restaurants within walking distance of campus.

Congress Location

The Congress will be held in the Arts Building on the University of Saskatchewan campus. The University is centrally located close to downtown Saskatoon.

The University is about a 20 minute walk from downtown Saskatoon. All hotels and motels in Saskatoon are within a 10 minute drive of the university.

Parking on campus is limited. However, there are two all-day pay lots ($2 and $3) on campus as well as numerous metered locations and hourly pay lots. The streets nearest the campus have a 2 hour limit. Free all-day street parking south of the campus can be accessed by a 15 minute walk.

Air Travel

The city of Saskatoon is serviced by several major airlines including Air Canada, Canadian, and Westjet.

Student Travel

Students interested in attending the CMOS Congress should contact their local CMOS Centre Executive for information regarding travel assistance funding.

Special Needs

University of Saskatchewan is wheelchair accessible. Special meals are available on request.

Accommodations

Reasonable accommodations are available in the Student Residences on campus. Rates are as follows (taxes included): double occupancy, $24.47 person/night; single occupancy, $27.82 person/night; suites, $36.38 person/night. Meal packages are available. Several quality hotels are located in downtown Saskatoon or near the airport.

Downtown Area

- Delta Bessborough (Postcard hotel)
Tel: (306) 244-5521; $75/85 (CMOS rate).
- Ramada (limited space)
Tel: (306) 244-2311; $69.
- Radisson
Tel: 1 (800) 333-3333; $76 (University rate).
- Parktown (nearest to Campus)
Tel: (306) 244-5564; $58 to $66.

Near Airport

- Saskatoon Inn
Tel: (306) 242-1440; $58 to $78

If a motel is desired, call Joe Eley for further information.

Commercial Exhibitors

Some commercial booths and sponsorships (eg. coffee breaks, program advertisements) were still available at press time. For more information, contact Oscar Koren at the following address:

- Oscar Koren, CMOS-97 Exhibits Convenor
Tel: (905) 669-2365; Fax: (905) 669-4838;
e-mail: koreno@aestor.am.doe.ca

Information about all aspects of the Congress, and a process for submitting abstracts are available on the Web site:

http://ecsask65.innovplace.saskatoon.sk.ca/pages/cmos97/congrs97.html/

Otherwise, for the scientific program, contact:

- Dr. Geoff Strong, Scientific Program Committee
Tel: (306) 975-5809; Fax: (306) 975-6516;
e-mail: Geoff.Strong@ec.gc.ca

For registration, accommodations and space contact:

- Joe Eley, Local Arrangements Committee
Tel: (306) 975-5685; Fax: (306) 975-6516;
e-mail: Joe.Eley@ec.gc.ca

Last minute news on the CMOS Congress!

Air Canada has been appointed the official airline for travel to the CMOS Congress in Saskatoon. It offers savings of up to 50% on the regular Economy Class Fares by quoting our event number CV972404 (14 days advance booking required). To take advantage of the savings, please call Air Canada at 1-800-361-7585 or your travel agent. When purchasing your ticket, ask that event number CV 972404 be entered by the ticket agent in the Tour Code Box on each ticket, regardless of the fare purchased.

31ième congrès annuel de la SCMO Saskatton, Saskatchewan

Le 31ième Congrès annuel de la Société canadienne de météorologie et d'océanographie se tiendra à l'Université de la Saskatchewan à Saskatoon, Saskatchewan, Canada du 2 au 6 juin 1997. Les réunions des comités de la SCMO auront lieu le dimanche 1er juin au "National Hydrology Research Centre".

Les présentations orales et écrites ainsi que les expositions commerciales sur les tous les domaines de la météorologie, de l'océanographie et de l'hydrologie sont les bienvenues. Des sessions interdisciplinaires spéciales sur BOREAS et GEWEX auront lieu. Tout autre groupe intéressé à organiser une session spéciale devrait entrer en contact avec Joe Eley ou Geoff Strong pour les arrangements concernant les locaux.

Nous encourageons les inscriptions anticipées en offrant une réduction sur les frais d'inscription. Afin de se qualifier pour l'inscription anticipée, l'argent comptant, les chèques ou les mandats-postaux doivent être reçus au plus tard le 5 mai 1997. Les frais d'inscription sont remboursables à 90% jusqu'au 31 mai. La SCMO n'accepte pas les paiements par carte de crédit.

Activités sociales

En plus du programme scientifique complet, le congrès de cette année comprend une réception de bienvenue, deux réceptions à bar payant et un banquet afin de discuter dans une atmosphère plus relaxante. Le banquet aura lieu au Hall Marquis sur le campus de l'Université de la Saskatchewan. Les frais d'inscription pour tout le congrès comprennent un billet échangeable contre une boisson gratuite à chaque réception et un billet pour le banquet. D'autres billets pour le banquet peuvent être achetés lors de l'inscription au congrès.

Un déjeuner spécial au coût de 15$ a également été organisé pour la remise de la médaille Patterson du Service de l'environnement atmosphérique pour contribution exceptionnelle à la météorologie.

Repas

Des repas seront servis au Hall Marquis ainsi qu'à d'autres cafétérias sur le campus. Il existe également des restaurants facilement accessibles à pied du campus.

Lieu du congrès

Le congrès aura lieu au Pavillon des Arts de l'Université de la Saskatchewan. L'université est située près du centre-ville de Saskatoon.

L'université est à environ 20 minutes à pied du centre-ville de Saskatoon. Tous les hôtels et motels de Saskatoon sont à moins de 10 minutes en voiture du l'université.

Le stationnement sur le campus est limité. Par contre, il existe deux stationnements journaliers (2$ et 3$) sur le campus ainsi que de nombreux parcomètres et stationnements à l'heure. Le stationnement dans les rues près du campus est limité à deux heures. À une quinzaine de minutes à pied au sud du campus, il est possible de se stationner dans la rue gratuitement.

Transport aérien

La ville de Saskatoon est desservie par plusieurs grandes lignes aériennes telles que Air Canada, Canadien et Westjet.

Transport des étudiants

Les étudiants intéressés à participer au Congrès de la SCMO devraient se mettre en contact le Centre local de la SCMO de leur région pour de l'information sur la possibilité d'obtenir du financement pour le voyage.

Besoins spéciaux

L'université de la Saskatchewan est accessible aux les chaises roulantes. Des repas spéciaux peuvent être commandés.

Hébergement

Il existe de l'hébergement à prix modique dans les résidences sur le campus. Les tarifs sont les suivants (taxes incluses): occupation double, 24,47$ par nuit/par personne; occupation simple, 27,82$ par nuit/par personne; suites, 36,38$ par nuit/par personne. Des forfaits-repas peuvent être achetés. Plusieurs hôtels de qualité sont situés dans le centre-ville de Saskatoon ou près de l'aéroport.

Centre-ville

- Delta Bessborough (Postcard hotel)
Tél.: (306) 244-5521; 75$/85 (Tarif de la SCMO).
- Ramada (nombre limité de chambres)
Tél.: (306) 244-2311; 69 $
- Radisson
Tél.: 1 (800) 333-3333; 76 $ (Tarif universitaire).
- Parktown (le plus près du campus)
Tél.: (306) 244-5564; 58 $ à 66 $

Près de l'aéroport
- Saskatoon Inn
Tél.: 306-242-144058 $ à 78 $

Pour des renseignements sur les motels, veuillez communiquer avec Joe Eley.

Expositions commerciales

Quelques espaces commerciaux et parrainage (ex. pause-café, publicité dans le programme) étaient toujours disponibles au moment de mettre sous presse. Pour de plus amples renseignements, veuillez contacter Oscar Koren à l'adresse suivante:

- Oscar Koren, président des expositions SCMO-97
Tél.: (905) 669-2365; téléc.: (905) 669-4838;
courriel: Koreno@aestor.am.doe.ca

Toute l'information sur le Congrès et sur le processus de soumission des résumés est accessible sur le site Web:

http://ecsask65.innovplace.saskatoon.sk.ca/pages/cmos97/congrs97.html/

Sinon, pour le programme scientifique, veuillez vous mettre en contact avec:

- G.S. Strong, Président du Comité du programme scientifique
tél.: (306) 975-5809; téléc.: (306) 975-6516;
courriel: Geoff.Strong@ec.gc.ca

Pour l'inscription, l'hébergement et les locaux:

- Joe Eley, Comité des arrangements locaux
tél.: (306) 975-5685; téléc.: (306) 975-6516;
courriel: Joe.Eley@ec.gc.ca

Dernière nouvelle!

Air Canada a été choisi comme le transporteur officiel pour le congrès de Saskatoon. Il offre des réductions jusqu'à 50% sur les tarifs réguliers de classe économique, pourvu que le numéro d'événement CV972404 soit mentionné (réservation requise 14 jours à l'avance). Pour profiter de ce rabais, veuillez appeler Air Canada au 1-800-361-7585, ou votre agent de voyage. En achetant votre billet, demander qu'on inscrive le numéro d'événement CV972404 dans la boîte du code de voyage sur chaque billet, peu importe le tarif obtenu.

Jim Bruce received the Massey Medal

The photograph includes both Mr. Jim Bruce, who is the 1996 recipient of the Massey Medal and Mr. Gilbert Grosvenor, former President of the National Geographic Society, recipient of the Society's 1996 Gold Medal. These honours were presented at The Royal Canadian Geographical Society's Fellows dinner on October 17, 1996 at the Canadian Museum of Nature.

Photograph courtesy of "McElligott Photography Ltd."

Announcement

19-24 July 1998. First International conference on Fog and Fog Collection, Vancouver, Canada. To focus attention on fog collection as a sustainable water supply, and to highlight the role of fog in hydrological , ecosystem and air pollution studies. Deadline for 300-word abstracts: 1 September 1997. Contact: First International Conference on Fog and Fog Collection, P.O. Box 81541, 1057 Steeles Avenue, West, North York, Ontario, Canada M2R 2X1.
URL: http://www.tor.ec.gc.ca/armp/Events/html;
email robert.schemenauer@ec.gc.ca

The Massey Medal

Established in 1959 by the Massey Foundation, the Massey Medal is a sterling silver medal plated in 24K gold.

It is awarded annually by The Royal Canadian Geographical Society to recognize outstanding personal achievement in the exploration, development or description of the geography of Canada. Eligibility is restricted to Canadian citizens, although in special circumstances, the Medal may be awarded to a non-Canadian, subject to agreement by the Massey Foundation. It is always awarded to an individual, never a group. In a year in which no nominee is deemed to qualify, the Medal may be withheld.

The presentation of the Massey Medal is made at Rideau Hall by the Society's Patron, the Governor General when His Excellency's schedule permits. In years when this is not possible, a special award ceremony is held elsewhere in Ottawa, with the President of the Society presiding. The cost of the Medal and the travelling expenses incurred by the recipient are met by the Massey Foundation.

La Médaille Massey

Établie en 1959 par la Fondation Massey, la médaille Massey est décernée chaque année par la Société pour rendre hommage à un citoyen canadien ayant apporté une contribution exceptionnelle à l'exploration, au développement ou à la description de la géographie du Canada. La médaille Massey est remise uniquement à des citoyens canadiens; cependant dans des circonstances hors de l'ordinaire, il se peut, qu'avec l'approbation de la Fondation Massey, que celle-ci soit remise à un citoyen non-canadien. Cette médaille est toujours décernée à un individu et non à un groupe. Dans le cas où les personnes nominées au cours de l'année ne se qualifient pas pour recevoir cette médaille, il se peut qu'elle ne soit pas remise.

La présentation de la médaille Massey se fait traditionnellement à Rideau Hall par le Patron de la Société, le Gouverneur général, lorsque l'horaire de celui-ci le permet. Au cours des années où cette tradition ne peut se réaliser, une cérémonie spéciale tenue par le Président de la Société est organisée dans la région d'Ottawa. Le coût de la médaille ainsi que les frais de déplacement du récipiendaire sont assumés par la Fondation Massey.

MEMBERSHIP APPLICATION FORM – 1997
DEMANDE D'ADHÉSION

CANADIAN METEOROLOGICAL AND OCEANOGRAPHIC SOCIETY
LA SOCIÉTÉ CANADIENNE DE MÉTÉOROLOGIE ET D'OCÉANOGRAPHIE
Bur. • Suite 112, Imm. McDonald Bldg., Univ. d'/of Ottawa
150 Louis Pasteur, Ottawa, Ont. K1N 6N5
Tel • Tél: (613) 562-5616 Fax • Téléc: (613) 562-5615
E-Mail: cap@physics.uottawa.ca

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(NAME, ADDRESS AND POSTAL CODE - NOM, ADRESSE ET CODE POSTAL)

TITLE / TITRE: ☐ DR. / DR. ☐ MR. / M. ☐ MS / MME ☐ OTHER / AUTRE _____

AREA OF WORK / SECTEUR D'EMPLOI: ☐ INDUSTRY / INDUSTRIE ☐ GOV'T / GOUV. ☐ UNIV. / UNIV. ☐ RES. INST. / INST. RECH. ☐ OTHER / AUTRE

LANGUAGE OF PREFERENCE / LANGUE PRÉFÉRÉE: ☐ ENGLISH ☐ FRANÇAIS

TEL. (B) FAX

E-MAIL

TEL. (R)

MAIN INTEREST - INTÉRÊT PRINCIPAL: ☐ METEOROLOGY - MÉTÉOROLOGIE ☐ OCEANOGRAPHY - OCÉANOGRAPHIE

☐ LOCAL CENTRE / CHAPTER - CENTRE / SECTION LOCALE

VIS	VANCOUVER ISLAND CENTRE	MTL	CENTRE DE MONTRÉAL
BCM	B.C. MAINLAND CENTRE	QUE	CENTRE DE QUÉBEC
ALT	ALBERTA CENTRE	RIM	CENTRE DE RIMOUSKI
SSK	SASKATCHEWAN CENTRE	HFX	HALIFAX CENTRE
WIN	WINNIPEG CENTRE	NFD	NEWFOUNDLAND CENTRE
TOR	TORONTO CENTRE	NBK	NEW BRUNSWICK CHAPTER
OTT	OTTAWA CENTRE	INT	INTERNATIONAL & USA

OPTIONAL - FACULTATIF

GENDER / SEXE: ☐ MALE / MASC. ☐ FEMALE / FÉMININ

DATE OF BIRTH / DATE DE NAISSANCE: ☐☐ Y-A ☐☐ M ☐☐ D-J

IF THIS IS A STUDENT APPLICATION PLEASE PROVIDE THE NAME AND SIGNATURE OF ONE OF YOUR PROFESSORS.
FOR RECORDS ONLY; PLEASE INDICATE THE INSTITUTION AND YEAR STUDIES WILL BE COMPLETED.
SI VOUS DÉSIREZ DEVENIR MEMBRE ÉTUDIANT, S.V.P. OBTENIR LE NOM ET LA SIGNATURE D'UN DE VOS PROFESSEURS.
POUR DOSSIERS SEULEMENT; S.V.P. INDIQUEZ LE NOM DE VOTRE INSTITUTION ET L'ANNÉE OÙ VOUS FINIREZ VOS ÉTUDES.

PROFESSOR'S NAME AND SIGNATURE - NOM ET SIGNATURE D'UN PROFESSEUR

INSTITUTION YEAR - ANNÉE

☐ DO NOT CIRCULATE MY NAME OUTSIDE CMOS
S.V.P. NE PAS FOURNIR MON NOM À D'AUTRES ORGANISMES

☐ DO NOT PUBLISH MY NAME IN DIRECTORY
NE PAS PUBLIER MON NOM DANS LE RÉPERTOIRE

MEMBERSHIP FEES - COTISATION DE MEMBRE	RATE - TARIF	REMITTANCE / REMISE
REGULAR - RÉGULIER	45.00	
STUDENT - ÉTUDIANT *	20.00	
CORPORATE - CORPORATION * (FIRMS/CORPORATIONS, INSTITUTIONS)	225.00	
SUSTAINING - DE SOUTIEN * (INDIVIDUALS ONLY/PARTICULIERS)	170.00	
RETIRED - RETRAITÉ	30.00	

* INCLUDES ALL PUBLICATIONS
* DONNE DROIT À TOUTES LES PUBLICATIONS

SPECIAL INTEREST GROUPS / GROUPES D'INTÉRÊTS SPÉCIAUX		
INDICATE YOUR CHOICE (OPTIONAL) - DONNER VOTRE CHOIX (FACULTATIF)		
HYDROLOGY - HYDROLOGIE	0.00	
AGRICULTURE & FOREST - AGRICULTURE ET FORÊT	0.00	
OPERATIONAL METEOROLOGY - MÉTÉOROLOGIE D'EXPLOITATION	0.00	
FLOATING ICE - GLACES FLOTTANTES	0.00	
FISHERIES OCEANOGRAPHY - OCÉANOGRAPHIE DES PÊCHES	0.00	
MESOSCALE METEOROLOGY - MÉTÉOROLOGIE DE L'ÉCHELLE MÉSO	0.00	

PUBLICATIONS SUBSCRIPTIONS / ABONNEMENTS AUX PÉRIODIQUES		
CMOS BULLETIN SCMO	GRATIS	
ATMOSPHERE - OCEAN *	37.45	
PROGRAM & ABSTRACTS - PROGRAMME ET RÉSUMÉS	GRATIS	
* OUTSIDE OF CANADA * EXTÉRIEUR DU CANADA	35.00	

TOTAL NOTE: G.S.T. INCLUDED - T.P.S. INCLUSE
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