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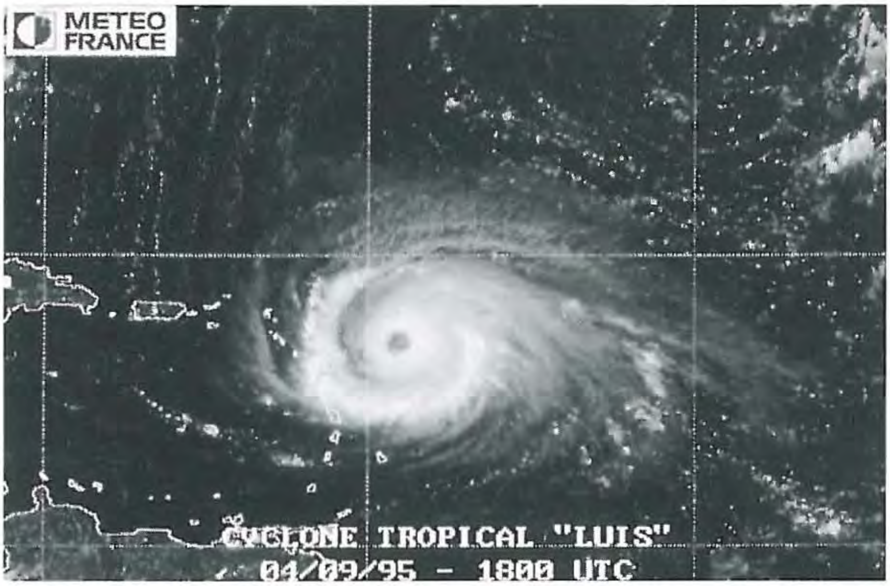

Name / Number	"Luis" # 13	Nom / Numéro
Date start	**29 August / Août 1995**	Date début
Date end	**11 Sept / Septembre 1995**	Date fin
Class	**4**	Classe
Minimum Pressure	**936 hpa**	Pression minimale
Maximum Sustained Wind Speed	**120-145 knots / noeuds**	Vitesse maximum soutenue des vents

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

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Cover page: Severe meteorological conditions have an effect on our daily lives. Here on the cover page, we can see a satellite photograph of the hurricane "Luis" (see short description on page 117) which had a violent impact on our Atlantic Coasts (see story on page 112). Not only severe meteorological conditions have an influence on our daily lives, but they also have an impact on the expenditure we have to protect ourselves from their negative effects (see story on page 105).

Page couverture: Les conditions météorologiques hostiles affectent continuellement nos vies. Ici nous voyons en page couverture une photographie satellitte de l'ouragan "Luis" (voir description succincte en page 117) dont les effets se sont faits sentir jusqu'aux côtes de l'Atlantique (voir article en page 112). Non seulement les conditions météorologiques défavorables ont une influence certaine sur le quotidien de nos vies, mais elles ont également une incidence sur les dépenses que l'on doit encourir pour se protéger de leurs effets négatifs (voir article en page 105).

Merci!

La photographie satellite de l'ouragan "Luis" est une gracieusetée de Météo-France. Elle est reproduite ici avec la permission du Rédacteur de MetMar.

The satellite photograph of hurricane "Luis" is a courtesy of Météo-France. It is reproduced here with the authorization of the Editor of MetMar magazine.

Next Issue - Prochain numéro

The next issue of the ***Bulletin 24 (6)***, December 1996, will go to press by mid-December. We need your contributions, short articles, notes, presentations, chronicles, etc., by early December. Don't miss your chance!

Le prochain numéro du ***Bulletin 24 (6)***, Décembre 1996 sera mis sous presse vers la mi-décembre. Vos contributions sont les bienvenues. Veuillez bien me les faire parvenir d'ici le début du mois de décembre. Ne manquez surtout pas votre coup!

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Impact of Climate on the Cost of Buildings

by D. Yazici[1], K. Pressnail[1], D. O'Malley[1], L. O'Malley[1], and D. Etkin[2]

Résumé

A cause des besoins toujours changeants de l'industrie pour les données sur le climat, une étude fut entreprise pour déterminer l'influence du climat sur les coûts de construction et d'opérations de bâtiments. Un bâtiment typique d'un étage servant d'entrepôt fut utilisé comme modèle et soumis à des conditions environnementales variées, incluant la neige, la pluie, le vent, la profondeur de pénétration de la gelée, la température et les radiations solaires. La conception fut modifiée pour tenir compte des nouvelles charges et le coût des composantes du bâtiment fut déterminé. Un logiciel sophistiqué de simulation d'énergie a été utilisé pour déterminer la protection requise du bâtiment et les coûts d'opération pour sept sites différents au Canada. Quoique les résultats soient valables pour la conception du bâtiment sujet à cette étude, ceux-ci sont à tout le moins des indications utiles des impacts du climat sur les coûts de bâtiments.

Introduction

A study was undertaken by Yazici (Yazici et. al., 1994) to determine the influence of climate on the cost of construction and operation of buildings. This paper summarizes the results of this investigation in regards to the influence of climate on the design, construction and operation of buildings. In order to examine the influence of climate on the incremental costs of construction and the operation of buildings, a typical one storey warehouse facility was designed in accordance with the National Building Code of Canada (NBCC) requirements and all relevant material design codes. Figure 1 reveals the floor plan for the warehouse facility used in this investigation. The building's structural system was a beam and column construction and consisted of regularly spaced steel columns on concrete foundations with steel beams and girders. The lateral loads to which the building would be subjected were resisted by exterior steel bracing. The shallow foundations were designed for the structure with the assumed soil condition being a typical Canadian clay-till soil with a bearing capacity of 500 kPa. The building envelope consisted of modular precast panels for the wall cladding, with an inverted protected membrane roofing system.

A series of designs were developed by subjecting the warehouse building model to various environmental loads, including: snow, rain, wind, depth of frost penetration, temperature and solar radiation. Since the construction and operating costs were highly dependent upon the location, each design was evaluated on a cost per square metre of floor area using the cost indices for Toronto.

The impact that climate has on the cost of a building was broken down into four basic components: structural, building envelope, mechanical and operating. Each of these cost components was examined as the environmental loading conditions on the warehouse facility were changed. In order to simplify the analysis, the structural costs corresponding to the various loading conditions were determined independently from any given location. However, the remaining three cost components had to be estimated for representative sites. For comparison purposes, all four of the cost components were assembled and presented for seven selected sites across Canada.

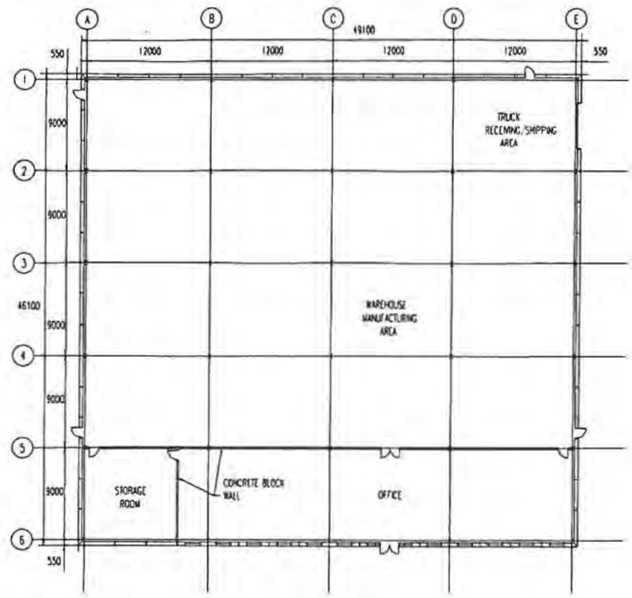

Figure 1: The Floor Plan for the Warehouse Facility

Impact Costs

The objective of this study was to investigate the influence of environmental loading on the building design and the estimated construction cost. Table 1 summarizes the relationships between the environmental loads and the individual building components. To indicate clearly the influence of the environmental loads, the building cost

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Environmental Load	Building Component
Snow and Rain	Beams, Girders, Joists, Columns and Foundation
Vertical Wind Pressures	Beams, Girders, Joists, Columns and Foundation
Lateral Wind Pressures	Bracing and Foundation
Frost Penetration	Foundation Wall
Temperature and Solar Radiation	Building Envelope, Mechanical System, Operating Cost

Table 1: Environmental Loads and the Affected Building Components

was separated into the following four components: structural costs, building envelope costs, mechanical costs, and operating costs.

Two assumptions had to be made to provide a meaningful cost comparison. First of all, it was established that the costs would be expressed per square metre of building area. This procedure was not only in agreement with the typical construction practice, but it also allowed for cost comparisons to be made with similar projects. The computer software program GFD3 (Anonymous, 1990) was used to perform both the structural analysis and to price the steel. The 1992 edition of the "Yardsticks For Costing" (Anonymous, 1992) was used to cost the bracing, foundations, slab on grade, and building envelope. The mechanical system was designed and priced with the assistance of the Trane Company.

Secondly, all of the building costs were based on Toronto, Ontario indices. It was acknowledged that the construction costs fluctuate from city to city based on a variety of factors; however, these local variations were not within the scope of this project. Although the structural components of the design were able to be evaluated independently from the site, the three remaining systems were specific to each location. It was for that reason that the building operating requirements for each of the building designs were assessed using energy simulation software, specific to seven Canadian cities.

Structural Costs

The design of beams, girders, joists and columns is governed by the forces that are imposed by vertical loads including snow, rain and vertical wind pressures. It is important to note that vertical environmental loads are more pronounced on a single storey building than in a multi-storey building, where the floor loading governs. Vertical loading, including snow, rain and wind loading, were evaluated using climatic data tables published in Chapter 1 of the supplement to the National Building Code of Canada (NBCC). Fourteen design simulations were evaluated by incrementally increasing the vertical snow, rain, and wind loads from 0 kPa to 10 kPa. These factored loads were applied to the structure and member sizes were selected accordingly. The results of the design yield a linear profile for the unit cost of the beams, girders, joists and columns versus live load. The slope of the line was found to be approximately $1.50/m^2 per 0.1 kPa of vertical live load.

Since the bracing requirements of a building are determined by lateral or horizontal wind loads, the building model was subjected to ten different wind pressures ranging between 0 kPa and 2 kPa. The results of the bracing design and cost calculations indicated that the unit cost was constant up to a loading of 0.875 kPa and then increased almost linearly for larger loads. For loads less than 0.875 kPa, it was found that the member size was not governed by the imposed loads but rather by serviceability requirements. For lateral loads above 0.875 kPa, the slenderness of the member did not govern design; rather, it was the tensile resistance of the member that governs. Bracing costs ranged between $1.26/m^2 of floor area for wind loads less than 0.875 kPa to $1.70/m^2 for a 1.5 kPa wind load.

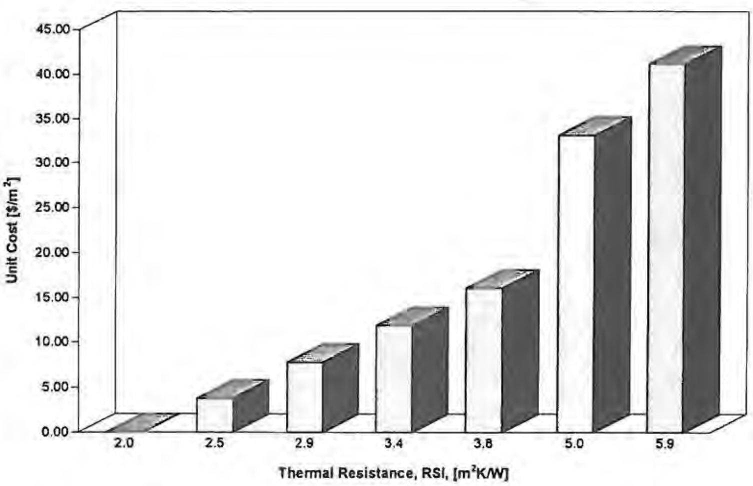

Figure 2: Incremental Unit Cost of the Building Envelope, Wall and Roof Insulation [At an RSI of 2.0 m^2·K/W, the Total Cost Equals $271.45]

In order to produce an accurate footing and foundation wall design, the influence of the depth of frost penetration had to be considered along with both vertical and lateral loads. Fourteen load combinations were considered, in which each simulation had a constant vertical load and a variable lateral load. Each load combination was then repeated for five depths of frost penetration or footing depths. It was determined that the unit cost of the foundation wall increased by approximately $3.00/m^2 of floor area per 1.0m increase in depth. The footing costs were found to vary from $1.50/m^2 at a depth of 1.2m and a vertical load of 1.0 kPa to $6.30/m^2 at a depth of 2.4m and a vertical load of 6.0 kPa.

Building Envelope Costs

The design and costing of the building envelope, wall and roof assemblies was assumed to be a function of only the insulating value of the wall. The thermal resistance of the wall was increased from 2.0 to 5.9 $m^2 \cdot K/W$ by varying the thickness of the DOW Styrofoam SM and by adding batt insulation to the wall cavity. The base cost of the building envelope is $271.45/m^2, with an RSI 2.0 $m^2 \cdot K/W$ and increases as per Figure 2.

Mechanical Costs

The component costs of the mechanical systems were provided by Trane Canada, with attention only being given to the differences in mechanical systems between the seven cities. Items that were common to all cities, such as ductwork, were not considered in the cost estimate. There was very little difference noted between the mechanical unit cost from one city to another, as the cost estimate ranged between $14.76/m^2 and $16.19/m^2. This lack of variance was probably due to the fact that cities which required larger heating unit sizes generally required smaller cooling unit sizes.

Operating Costs

The energy requirements of the warehouse facility was determined for each of the seven locations, after varying both the insulation levels and climatic conditions. In order to accurately ascertain the building's energy requirements, the model had to account for all of the significant factors influencing the energy demand, including both the relevant building and climatological data. The BESA Design v 2.10 energy simulation software package was used to incorporate the hourly climatological data to estimate the total energy requirements for the building. The use of a one hour time increment allowed the accurate definition of the building operating conditions with parameters that were unique to each time increment. The most noticeable of these parameters included the internal loads and actual hourly weather data.

The first step in the creation of the model was to divide the building into a number of discrete zones upon which the hourly heat balance calculations were evaluated. After defining the two zone boundaries, the building construction of each zone was described using parameters that included: the zone floor area, the average floor to ceiling height, gross wall area and orientation, a description of the wall or roof including solar absorptivity, thermal conductivity and density, the area of the glass for each particular wall orientation and a description of the glazing including a shading coefficient.

The energy consumption of a building is dependent on the heat gains or losses through the building envelope. The envelope loads accounted for in this study included: air leakage, ventilation and heat transmission through the building sections. Also, estimates were included for the internal loads for the facility, including the heat generated by the occupants, lights, and equipment. Based on the expected occupancy, the ventilation rate was approximated as being 330 L/s for the warehouse facility. The infiltration rates also were estimated during both periods of operation and dormancy of the air handling system. Although each city actually has its own unique value, for simplicity it was assumed that all cities had the same infiltration rate.

The final step in the creation of the building model was to assign the mechanical air conditioning systems and thermostat settings to each zone. All of the temperatures for the warehouse facility were assigned in accordance with ASHRAE Standard 90-1. The most suitable mechanical system for the warehouse facility was selected with the assistance of the Trane Company . It was assumed that a successful simulation was one in which the setback temperature was not exceeded for more than 50 hours of the year, and the heating and cooling setpoint was maintained for all hours with the exception of the first hour of central system operation. In a situation where these requirements were not met, the heating or cooling units were adjusted and the simulation repeated until compliance was achieved.

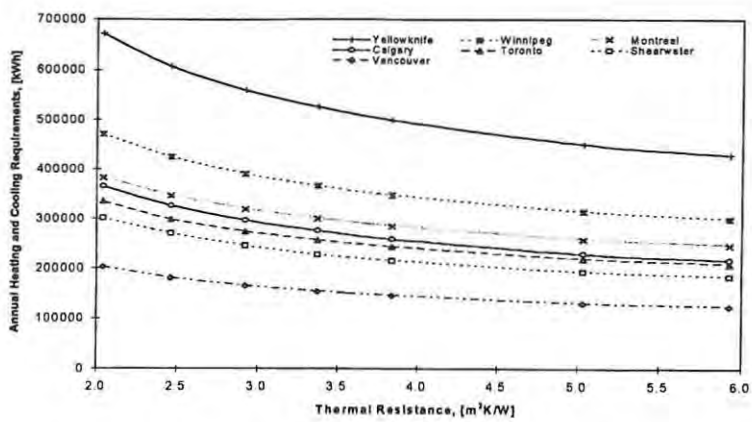

Figure 3: Simulation Results - Relationship Between Annual Heating and Cooling Requirements and the Thermal Resistance

Figure 3 presents the simulation results for the seven cities that were studied. Although the results are not surprising, they clearly illustrate that as the level of insulation increases the annual heating and cooling costs decrease. The relationship between the level of insulation and heating and cooling cost is a very good example of the law of diminishing returns, where levels of higher insulation have less impact on heating and cooling costs.

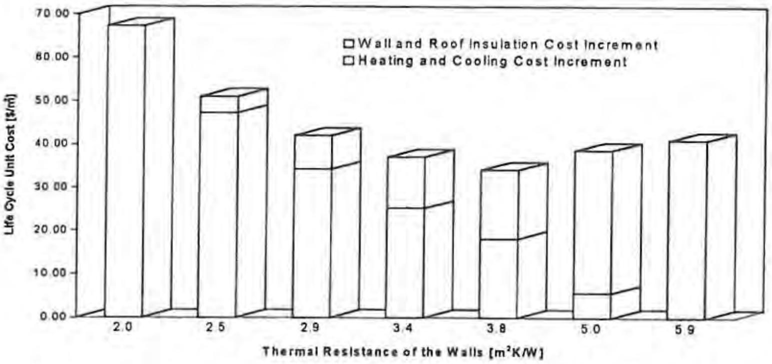

Figure 4: Life Cycle Cost of Toronto Wall and Roof Designs

A life cycle cost analysis was performed to determine the optimum levels of insulation for each location. Figures 4 and 5 demonstrate the results obtained for Toronto and Vancouver. These optimum levels were specific to the warehouse facility and the assumed operating characteristics. In addition, it was found that the incremental savings in operating costs increased with the severity of the climate.

A summary of all the building costs is very difficult to present, as each component is a function of different environmental loads and are specific to a location. However, Table 2 summarizes the costs for each of the seven locations with the environmental loads in accordance with the NBCC. All of the construction costs were based on Toronto indices, the optimum level of insulation for each location and a site-specific electricity rate.

Projected impacts

In order to estimate the impact cost of climate on industrial buildings, it is necessary to examine the total value of new building construction in conjunction with the incremental cost of climate. However, the extrapolation of the total value of new construction from building permit statistics is subject to a certain amount of error. Not only are the building statistics often incomplete, but errors often exist within the cost estimates themselves. For example, cost estimates include estimates of labour rates and productivity; however, these often vary. Thus, estimates of new cost of construction may be in error. It is for these reasons that there is a limited degree of accuracy of the impact costs of climate on buildings (Yazici, 1995).

Statistics Canada provide summaries of the annual dollar values of new construction based on the type of occupancy. In order to determine the dollar value of new construction in Ontario, two assumptions had to be made. Although warehouse buildings were classified as commercial, they were considered as industrial occupancies for this report. Inflation was not considered in this analysis, since there was very little during the period investigated. These assumptions were made to facilitate extrapolation from the existing data and result in a conservative value for new construction in Canada.

Using information obtained from Ontario building permit statistics between 1983 and 1992, the annual average value for new industrial building construction was estimated at $1.12 billion. This value represents the cost of new construction in Ontario for industrial occupancies, and is used in all calculations regarding impact costs of climate on buildings in Ontario. Warehouses contribute approximately 25.6% to the average annual value of new industrial construction.

The climate impact costs on industrial buildings in Ontario were estimated using the building permit data in conjunction with the incremental cost of climate. Since the building permit statistics only distinguished between the type of occupancy, the sample building design costs were extrapolated to estimate the impact cost of climate on all new industrial buildings. The Toronto Base design was used to estimate the "equivalent" total building area constructed annually. This "equivalent" total building area was used in conjunction with the incremental cost of climate to estimate the impact cost of climate.

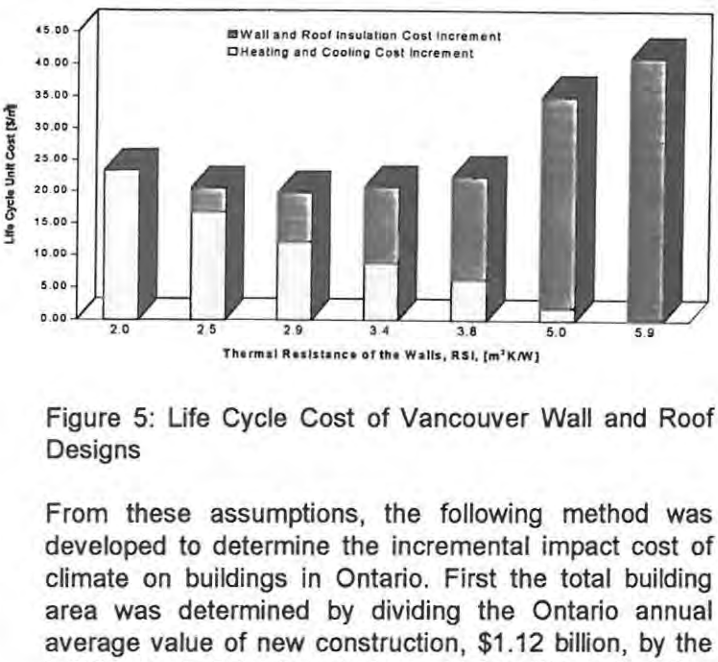

Figure 5: Life Cycle Cost of Vancouver Wall and Roof Designs

From these assumptions, the following method was developed to determine the incremental impact cost of climate on buildings in Ontario. First the total building area was determined by dividing the Ontario annual average value of new construction, $1.12 billion, by the building cost of the Toronto base design. This calculation resulted in the determination of the "equivalent" number of buildings built annually. Next, this value was multiplied by the area of the sample building to find the total "equivalent" building area. Finally, the "equivalent" building area was then multiplied by the incremental cost per square metre per unit climatic parameter variation; thereby providing the estimated impact cost of climate on buildings in Ontario.

Based on the Ontario annual average dollar value of new construction, the Toronto base design resulted in the generation of approximately 1140 "equivalent" buildings

	Calgary	Montreal	Shearwater	Toronto	Vancouver	Winnipeg	Yellowknife
Insulation Level (RSI)	5.03	5.03	3.37	3.80	2.90	5.03	5.93
Electricity Rate ($/kWh)	0.075	0.069	0.109	0.082	0.045	0.062	0.152
Operating (kWh)	229423	257861	226979	242486	164807	314483	428950
Unit Costs ($/m²)							
Structural Costs	125.86	153.71	150.87	129.90	144.23	141.06	144.23
Footing / Foundation	11.28	11.04	7.56	6.74	7.22	13.46	*
Envelope	304.53	304.53	283.32	287.55	279.20	304.53	312.51
Mechanical	14.76	16.19	14.76	15.88	15.88	16.19	15.37
Slab on Grade	23.25	23.25	23.25	23.25	23.25	23.25	23.25
Operating: PresentWorth	106.50	110.13	153.15	128.78	48.86	120.68	403.56
TOTAL	586.18	618.85	632.89	592.10	518.64	619.17	898.92

* Permafrost foundation

Table 2: Summary of the Construction and Operating Unit Costs

annually. This represented approximately 2.6 million square metres of "equivalent" new construction annually. Cost estimates were prepared by the incremental variation of snow loads, rain loads, wind loads and the January 2.5% temperature. Table 3 summarizes the impact costs determined for each of the load variations. It was determined that the wind load had the largest climatic impact cost on new buildings in Ontario, followed by rain and snow loads respectively. The effect of temperature was not able to be compared due to the dissimilar units of measure.

Conclusion

This study sought to determine the influence of climate on the incremental cost of construction and operation of buildings. A single storey warehouse facility was chosen as a base building. Further, to facilitate cost comparisons, cost indices for Toronto, Ontario were used as a basis throughout. While the use of this cost basis assisted in the cost comparison, the influence of climate on construction productivity was not considered. Such an influence, although deserving of research, was beyond the scope of this report. To include the effect of climate on productivity in this study would have added another level of variability to a problem that was already complex.

Comparison of various building component costs were made after a uniform cost basis was established. Relationships between environmental loads and building component costs were then made. The relationship between vertical live loads and structural steel costs was almost linear with the slope of the line being approximately $1.50/m² per 0.1 kPa of vertical live load. The increase in structural steel costs which occurred when the environmental loads were increased was due to two effects. First, as the loading increased, larger steel sections had to be used. Secondly, the unit cost for supply and erection of steel sections increased with an increase in section area. The structural costs of this building represented approximately 23% of the total building cost.

Vertical live loads also influenced the cost of footings. This study demonstrated that the cost of footings was a function of the vertical load and depth. The relationship between the unit cost of footings and the vertical load was represented by a curve that increased in slope as the vertical load increased. The cost of footings for this building in Toronto was only approximately 1-2% of the total building cost.

Load Variation	Relationship	Typical Range in Canada	Impact Cost Due to Load Variation
Rain Load	Linear	0.1 kPa to 0.7 kPa	$4.5 million per 0.1 kPa
Snow Load	Relatively Linear	0.6 kPa to 8.7 kPa	$3.6 million per 0.1 kPa
Wind Load:			
Between 0 and 0.88 kPa	Relatively Linear	0.24 kPa to 1.2 kPa	$8.2 million per 0.1 kPa
Greater Than 0.88 kPa	Relatively Linear	0.24 kPa to 1.2 kPa	$7.6 million per 0.1 kPa
January 2.5% Temperature			
Between -16 °C and -35 °C	Relatively Linear	-49 °C to -2 °C	$2.5 million per 1 °C
Between -6 °C and -16 °C	Relatively Linear	-49 °C to -2 °C	$0.6 million per 1 °C

Table 3: Summary of the Impact Costs on New Industrial Buildings in Ontario

Lateral loads due to wind also affected the cost of the building. In this study, which used a building that was 7.5 m in height, the lateral wind loads only affected the cost of bracing. It was found that a step function relationship exists between bracing and the lateral wind load. While lateral wind loads influence building costs, this influence was less than 1% of the total building cost. Accordingly, the influence of lateral wind loads on this low-rise building was almost insignificant.

The freezing index, due to its correlation with the depth of soil freezing, is a factor used in the design of foundation walls and footings. In this study, it was determined that the unit costs for footings increased with footing depth. This cost increase was related to the cost of excavating a proportionally larger and deeper excavation for footing placement. A linear relationship was found between the unit cost of the foundation wall and the depth of foundation. This linear relationship was expected since the height of the foundation wall increases with increasing foundation depths. The cost of footings and foundation walls in this building represented 1-2% of the total building cost. Accordingly, the influence of the depth of frost penetration on building costs was not very significant.

The last environmental loads to be considered were those due to air temperature and solar radiation. These climatic factors, together with wind, influence the cost of the building envelope, mechanical system, and building operation. In order to assess the impact of these environmental loads, it was necessary to identify specific sites and to design the building envelope and mechanical systems for each location.

The design of the building envelope was based on varying the amount of insulation in the walls and roof. To determine the optimum level of thermal insulation for a given site, it was necessary to balance heating and cooling cost savings with the additional costs of insulation. This study revealed that there was a diminishing return when higher insulation levels were used. Further, as the severity of the climate increased, so did the incremental heating and cooling cost savings. While the results depicted are specific to the building design used in this study, the trends shown in Figure 3 are representative of all buildings.

Using hourly energy simulation software that incorporates climatic databases, such as CWEC weather files, a designer can select an optimum level of thermal insulation. For example, the lowest cost option for the base building situated in Toronto and Vancouver can be selected, as shown graphically in Figures 4 and 5 respectively. Once the optimum level of thermal insulation has been selected, building envelope costs can be determined. In this study, the building envelope costs represented approximately 46% of the total building cost.

Once the building envelope had been selected, the mechanical costs could be determined. Since warmer climates required less heating and more cooling than colder climates, the total mechanical costs were almost equal for all seven selected sites. Savings in heating equipment in a warmer climate were off-set by the cost of larger cooling equipment for cooling periods. Thus, mechanical unit costs were almost independent of the climate. Here, the mechanical costs were about 2.5% of the total building cost.

As shown in Table 2, the annual heating and cooling requirements were in the range of 164,807 kWh to 428,950 kWh, with Vancouver the lowest and Yellowknife the highest. Using appropriate and site specific values for inflation, energy cost escalation, discount rate, economic life, and electricity cost, the present worth heating and cooling costs were evaluated. These values were between the range of $48.86/m^2$ for Vancouver and $403.56/m^2$ for Yellowknife. Heating and cooling costs were approximately 24% of the total building cost.

In summary, the largest cost components of the building were structural steel, the building envelope, and building heating and cooling. A comparison of the average unit costs for the seven locations is presented in Figure 6.

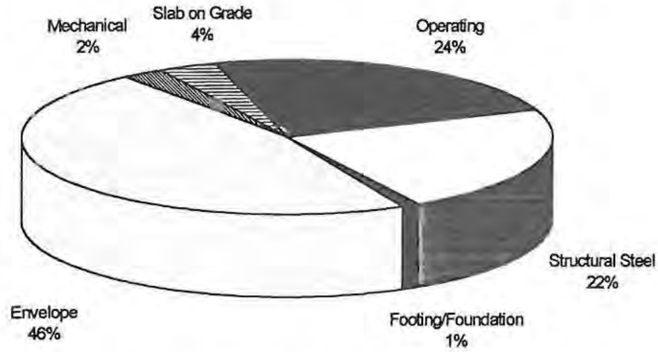

Figure 6: Summary of Unit Costs

Recommendations for future research

All of the costs were affected by climate. However, it should be remembered that all of the data presented in this article is specific to the building design used in this study. Other building shapes, types, and orientation should also be investigated to determine the incremental cost of climate. It is through such investigations that a broader perspective of the impact of climate on the cost of buildings may be obtained.

Furthermore, it would be helpful to determine the sensitivity of the costs of all buildings to environmental loadings. For example, in this study, the incremental cost of vertical live loads on the structural steel costs was found to be approximately $\$1.50/m^2$ per 0.1 kPa of vertical live load. Unfortunately, this finding can not be extrapolated to include all buildings, since it is specific to the design presented. However, other building types could be examined in further studies. From such studies, the cost and benefit implications of climatic data-gathering and interpretations could be made on a regional, provincial or even a national basis.

There are other influences of climate on building costs which have not been presented within this article. For example, the design used in this study was expected to last for 30 years, and the same building materials were used for each site. Where the climate is more extreme, materials that are more durable and more expensive, may have to be used. This issue was beyond the scope of this study. However, it is an issue which could be examined in further studies.

As well, there are other issues which were beyond the scope of this study, but deserve research. At times, buildings are over-designed because of uncertainties in loading and material performance. Where environmental loads are considered, uncertainties lead to designs which may fail or may be so over-designed that economic resources are wasted. Thus, there may be latent building costs associated with uncertain or incomplete climatic data. Again, this is an area which is deserving of research.

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Significant and extreme waves
generated by hurricane Luis
as observed by Canadian meteorological buoys
and the Cunard cruise ship Queen Elizabeth 2

by Ralph Bigio[1]

Résumé

L'ouragan tropical Luis est passé au-dessus d'un ensemble de bouées météorologiques canadiennes du 10 au 11 septembre 1995. L'oeil de l'ouragan passa directement au dessus de deux de ces bouées. Cet ouragan a généré des vagues d'une hauteur significative de 17 mètres et de 30 mètres pour les vagues maximum. Ces vagues furent enregistrées par une des bouées et furent ressenties à bord d'un croiseur de luxe de la Cunard, le Queen Elizabeth 2 (QE2). Les observations des bouées sont discutées et comparées à celles faites à bord du QE2.

La force des vents rapportée par le QE2 est de loin supérieure à celle rapportée par les bouées. Ceci est vraisemblablement causé par la distorsion du champ éolien autour du navire. Cependant, les hauteurs de vagues rapportées par le QE2 sont presque identiques à celles des bouées avoisinantes. Ceci confirme la capacité des bouées à enregistrer correctement des vagues extrêmes.

Les vagues les plus hautes de cette tempête sont le résultat d'un fetch piégé. On décrit un modèle simple de prédiction de ces vagues en utilisant la théorie de Bretschneider.

Introduction

Hurricane Luis was a remarkable storm. It is rare to have the eye of a hurricane pass directly over an instrumented buoy - Luis' eye passed directly over two. It is rare for a storm to generate 30-metre waves near the continental shelf - a third buoy recorded such a wave; a fourth buoy recorded waves almost that high. It is rare to be able to confirm such high waves with independent observations - the Cunard luxury liner *Queen Elizabeth 2* (QE2) experienced and reported these waves. The encounter produced minor damage on the ship.

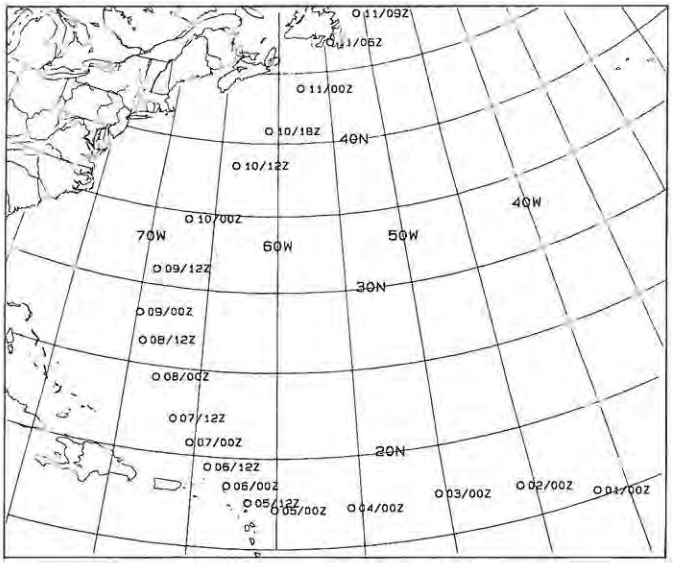

Figure 1: Track of Hurricane Luis through the Western Atlantic

In other ways this hurricane was ordinary. Its westward track across the tropical Atlantic was normal. So was the way it turned northward, accelerated, and became extratropical. During the tropical phase, the maximum sustained wind speed was estimated at about 130 knots, a little higher than that of many such storms, but still in the normal range.

This system began as a tropical wave between the African coast and the Cape Verde Islands on August 26 1995 and became a tropical depression on the 28th. It intensified quickly and became a hurricane at 31/0600 UT when it was near 14N 39W. The storm's track through the Western Atlantic is shown in Figure 1.

Definitions

For deep-water waves, the basic relationships are

$$C^2 = g\,L / 2\,\pi$$
$$C = L / T$$

and

$$C_g = C / 2$$

where

C = phase velocity,
g = acceleration of gravity,
L = wavelength,
T = wave period, and
C_g = group velocity.

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With C in knots, L in feet, and T in seconds, these reduce to the following working approximations:

$$C \approx 3\,T$$
$$C_g \approx 1.5\,T$$
$$L \approx 5\,T^2$$

Wave height (H) is a function of windspeed, fetch, and wind duration. Fetch is the distance over which the wind does not change significantly in speed or direction. Duration is the time for which the wind blows without significant change in speed or direction.

In any fetch the wind produces waves with a range of heights and periods. The corresponding energy spectrum (wave energy is proportional to H^2T^2) usually has one dominant peak and may have one or more secondary peaks. The period represented by the dominant peak in the energy spectrum is defined as the "peak period" or T_p. Canadian meteorological buoys report T_p for wave period. Significant waveheight (H_{sig}) is the average height of the one-third highest waves in a spectrum. Maximum waveheight (H_{max}) is the highest wave observed in a spectrum. Canadian meteorological buoys report both H_{sig} and H_{max}. A detailed description of how Canadian buoys determine wind and wave parameters is given in a report by AXYS Environmental Consulting Ltd [AXYS 1996].

A "trapped fetch" occurs when a storm moves in the same direction and at the same speed as the wave group it generates. Trapped fetch is sometimes called "captive fetch" or "dynamic fetch".

Wind Field Around Hurricanes

Consider first a stationary symmetrical hurricane. Isobars and isotachs around such a system are very nearly circular. The typical horizontal wind profile is isotropic and peaks at the radius of the eye. Within the eye, wind drops off rapidly. Outside the eye wind also drops, but less rapidly.

If such a hurricane begins to move, the pressure field loses symmetry and the wind field becomes anisotropic. Summing vectors shows that wind speed increases to the right of the track and decreases to the left. The wind maximum is now on the right side of the track and just outside the eye.

Wave Field Around Hurricanes

In a stationary hurricane, waves spend very little time in their generating areas. Windspeeds can be very high, but fetches are short because of the curvature of the isobars. As a result, most hurricane-generated waves are fetch-limited. Soon after being generated they leave their generating areas and radiate tangentially outwards as swell. As with the wind field, the typical wave field around a stationary hurricane is isotropic.

In a moving hurricane, the wave maximum shifts to the right of the track because that is where the strongest winds are. And since the storm is moving, the waves to the right of the track will spend more time in their generating area because they are moving with the storm. The longer they spend in the generating area, the more they build.

Within a fetch the waves have a range of heights and periods. All waves moving in the same direction as the hurricane will be amplified because they spend more time in their fetch. But the waves experiencing the greatest amplification will be the waves whose group velocity is equal to the hurricane's forward speed. As a result, the hurricane whose forward velocity is V will preferentially amplify waves whose period is

$$T = V / 1.5$$

If the hurricane's speed and direction do not change, waves with this period will quickly become the most energetic group in the spectrum. Wave groups with other periods will be less affected because they will be moving faster or slower than the fetch.

Another way to express this is that the amplification reaches a peak when the hurricane's velocity (V) reaches a critical velocity (V_{crit}) equal to the group velocity of the waves - in other words, when

$$V = V_{crit}$$

where

$$V_{crit} = C_g = 1.5\,T$$

When this condition occurs, the waves with period T will be trapped in their fetch.

When waves are trapped in this way, they will not stop building until they reach full development, or until the hurricane changes speed or direction. Waves still radiate tangentially outward, but now the highest waves propagate from the right side of the track and move in the same direction as the hurricane. The lowest waves propagate from the left side of the track and move in the opposite direction.

Tracks of Hurricane Luis and the QE2

Luis' track was provided by the US National Hurricane Centre [Lawrence 1996] and is shown in Figures 1 and 2. Figure 1 shows the track through the western Atlantic while Figure 2 focuses on the track through the buoy array.

As it turned northeastwards, the hurricane began to accelerate. Prior to 09/0000 UT the forward speed (V) of the hurricane was about 10 knots. By the time it reached buoy 44137 it was moving northeastward at about 33

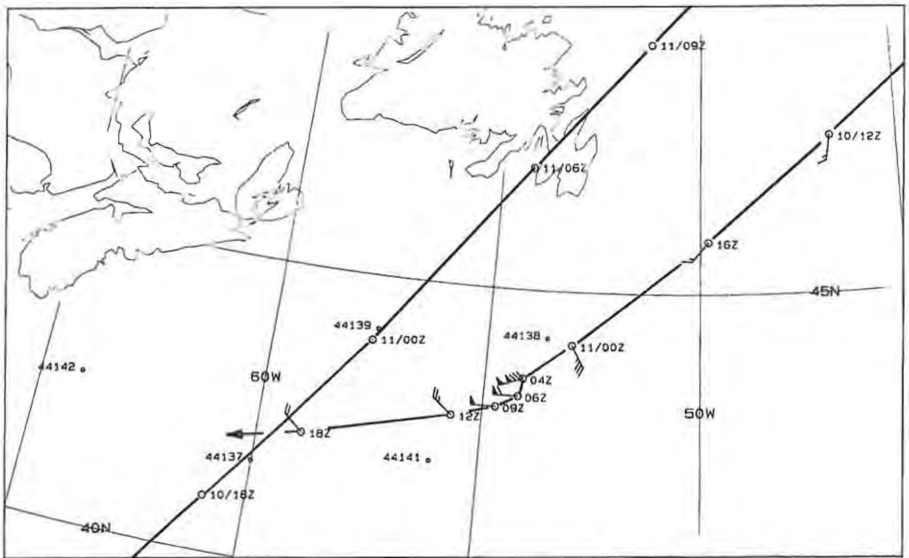

Figure 2. Tracks of hurricane Luis and the cruise ship QE2 through the Canadian buoy array.

knots. It continued accelerating to about 40 knots (and became extratropical) by the time it reached buoy 44139. From here it accelerated to about 57 knots as it moved into the Labrador Sea, then decelerated rapidly.

As Luis was approaching the buoy array from one direction, the QE2 was approaching from the other on a scheduled crossing destined for New York. The positions and winds reported by the QE2 are shown in Figure 2.

Data from the QE2

The QE2 reported weather routinely in the standard synoptic SM format and in the normal way to the Global Telecommunications System. It is from these reports that all but one of the winds shown in Figure 2 were taken. The report for 11/0400 UT represents the worst conditions the QE2 experienced, and was recorded in the ship's log but was not transmitted.

Additional wind and wave data were recorded in the ship's log during the storm. Cunard kindly provided a copy of the Navigator's log[1] for this study. Wind and wave data from this log are shown in Figure 3. It is worth noting that waveheight reports from the QE2 are remarkably consistent with those from buoy 44141 - the buoy which reported the highest waves (and the strongest winds).

In the log, the windspeed at 0130 UT was recorded as 120 knots (62m/s). But for 0130 UT the Navigator's log says

> *"Wind speed indicator dial has maximum reading of 120 knots. The needle is now hard over on the stop at this wind speed."*

so the sustained wind was probably stronger. The entry for 0135 UT says

> *"Severe gusts of wind 'flatten seas'. Anemometer carried away with loud bang. ... Wind speed estimated at 130-140 knots in gusts."*

Winds thereafter were estimated. It should be noted that the anemometer was mounted about 32m above the water line and that wind estimates were for the height of the ship's bridge - about 29m above the water line. These winds were reduced to 5m (using the algorithm developed by S. D. Smith [Smith 1981]) to permit comparison with buoy data, and plotted in Figure 3.

Even when the QE2's winds were reduced to 5m they were significantly stronger than even the strongest gust reported by any buoy during the storm. At buoy 44141 (which reported the strongest winds) the strongest 10-minute mean wind speed was about 26 m/s at 10/2300 UT. The strongest 8-second gust was about 34 m/s - also at 11/2300 UT. (Again, a detailed description of how Canadian buoys determine wind and wave parameters is given in a report by AXYS Environmental Consulting Ltd [AXYS 1996].) A large part of the difference between winds reported by the QE2 and those reported by buoy 44141 is likely due to flow distortion over and around the ship's superstructure.
Mean and maximum wind speeds recorded by the primary anemometer on buoy 44141 are shown in Figure 4. (Compare with windspeeds in Figure 3.) Those recorded by the secondary anemometer were not shown because they agree very closely with those of the primary. Anemometers on buoy 44138, the one closest to the QE2, were not working.

Buoy data

Locations of the offshore buoys (all are 6-metre NOMAD buoys) are shown in Figure 2. Wave data from these buoys are shown in Figures 5 to 9. Note that the points at which period is shown as 32 seconds are spurious. They represent points at which the software could not determine the period.

The highest observed waves had periods of 18 seconds. For these waves, the group velocity (C_g) was about 27 knots. Between 09/1800 and 10/1800 UT, Luis had an average forward speed (V) of about 26 knots. Since V was so close to C_g these waves remained "trapped" in the generating area, and wave growth continued as though the fetch were unlimited. By 11/0000 UT, V had increased to 38 knots, thus ending the period of unlimited wave growth. The following table shows how V increased between 09/1200 UT and 11/1200 UT. For each time, the table gives the average speed over the preceding 6 hours.

UT	V
09/1200	19
09/1800	18
10/0000	21
10/0600	25
10/1200	23
10/1800	33
11/0000	38
11/0600	40
11/1200	57

At all these buoys, the wave peak was preceded by several hours of 2.5m 14-second waves - a background swell. At the three buoys that experienced the highest waves (44137, 44138, and 44141), these 14-second swells appeared to end 6-8 hours before the highest waves arrived. At that time, the peak period dropped sharply to 7 seconds, then rose gradually to 18 seconds. This sharp drop represents the point at which energy (proportional to H^2T^2) in shorter-period wind-waves became greater than energy in the longer-period background swell. The 14-second swells were still present, but were now less energetic than wind waves and would have been represented by a secondary peak in the energy spectrum.

Buoy 44139 did not show this sharp drop in period because the hurricane was moving at about 40 knots when it passed this location. At this speed, wind-waves were undoubtedly duration-limited, and remained less energetic than the swell.

Buoy 44142 also showed this sharp drop, but it occurred <u>after</u> heights and periods peaked. This buoy is so far to the left of Luis' track (500 km) that none of the highest waves reached this location. But the drop still represents the point at which energy in wind-waves became greater than that of the swell. In this case the wind-waves were generated in the wake of the storm.

The highest waves were recorded at buoy 44141. The wave peak is missing from the record at buoy 44138, but the shape of the wave height curve is almost identical to, and slightly lower than, that at buoy 44141. Thus one can reasonably estimate that, at buoy 44138, H_{sig} peaked at about 15m and that highest waves were about 25m.

The size of the innermost (highest) waveheight isopleths on a waveheight analysis for 11/0000 UT can be estimated from the wave record at buoy 44141. Interpolating between the hourly reports as necessary, we can estimate that H_{sig} was over 10m for about 5 hours, and over 15m for about 1.5 hours. Using the group velocities determined from the wave periods it can be shown that the area with $H_{sig} > 10$m was about 180 km long, and the area with $H_{sig} > 15$m was about 75 km long.

Forecasting the waves around Luis

According to Bretschneider and Tamaye [1976], when V does not exceed V_{crit}, waves generated by a moving hurricane can be described by

$$k = [\, 1 + (V \cos(A) \;/\; 2U)\,]^2$$
$$H = k\, h$$
$$T = k\, t$$

where

V is the forward speed of the hurricane,
U is the wind speed,
A is the angle between the U and V vectors,
h is the wave height if the hurricane were stationary,
t is the wave period if the hurricane were stationary.

To the right of the track, U and V have the same direction so k is a maximum. To the left, U and V are in opposite directions so k is a minimum.

Note that U and V must have the same sense. By convention, wind direction refers to the direction <u>from</u> which the wind is blowing, while hurricane direction is the direction <u>towards</u> which the hurricane is moving. When A is determined graphically, this is not a problem because both vectors show directions correctly. But when a numerical solution is used, one must be sure that if U refers to the direction <u>from</u> which the wind is blowing, then V must indicate the direction <u>from</u> which the hurricane is moving.

To apply this relationship, one needs an input wind field. This can be obtained by combining Hurricane Centre estimates and forecasts of wind field with (usually scarce) real observations. One also needs to know what the wave heights and periods would have been without the amplification caused by a trapped fetch. How to obtain this is up to the forecaster - many use the Bretschneider nomogram [Bretschneider 1970] combined with experience.

Applying this relationship to Luis using a Bretschneider nomogram [Bretschneider 1970] and wind estimates from the Canadian Hurricane Centre predicts a peak H_{sig} of 15m 180 - 280 km to the right of the track. Buoys 44141 and 44138 and the QE2 reported peak H_{sig} of 15-17m 240 - 280 km to the right of track. It predicts a peak H_{sig} of 8-9m from about 90 km behind the eye to about 240 km ahead of the eye. Buoys 44137 and 44139 reported peak H_{sig} of 11m and 9m (respectively) along the track of the eye.

While such accuracy might be inadequate for a hindcast, it would be considered excellent for operational forecasting - especially when one considers the sparseness of data, the current capabilities of operational models, and the pressure of deadlines.

Conclusions

The track of hurricane Luis through the Canadian buoy array provided a unique opportunity to examine the wave field around a hurricane. The two previous storms that generated such high waves in this area (Hallowe'en 1991 and March 1993) had led to questions about the ability of these buoys to record extreme waves. In this storm, experienced human observers on the QE2 gave us independent waveheight reports which were remarkably consistent with buoy data. Thus we can now say that these buoys <u>are</u> capable of recording such sea states. It should be noted however, that because of a design limitation, Canadian buoys cannot report waves higher than about 30.2m [AXYS 1996].

The Bretschneider model, while old, demonstrated that it can forecast waves in a trapped fetch to an accuracy sufficient for operational forecasting. It has the added virtue that it is easy to apply - a very important virtue for tools used in operational forecasting.

Acknowledgements

The author is grateful to Grant Laversuch, Operations Manager for Cunard Lines, for providing information from the Navigator's log of the QE2; to Captain Ronald Warwick, who was Master of the QE2 on that crossing, for his kind cooperation; to Val Swail of Environment Canada for suggesting this study; and to Bridget Thomas, Fred Dobson, Ed Rappaport, and Alan Ruffman for their helpful suggestions.

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[1]: The Navigator's log was compiled after the storm had passed. It contains excerpts from the Ship's Log.

Figure 3 - Winds and waves as recorded in the QE2's Log 950911.0000Z to 950911.0700Z

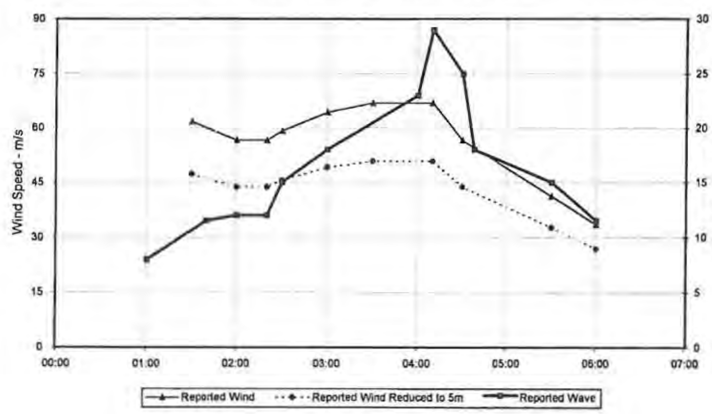


Figure 4 - Wind (Primary Anemometer) at Buoy 44141 during Hurricane Luis - 950910.0000Z to 950913.0000Z

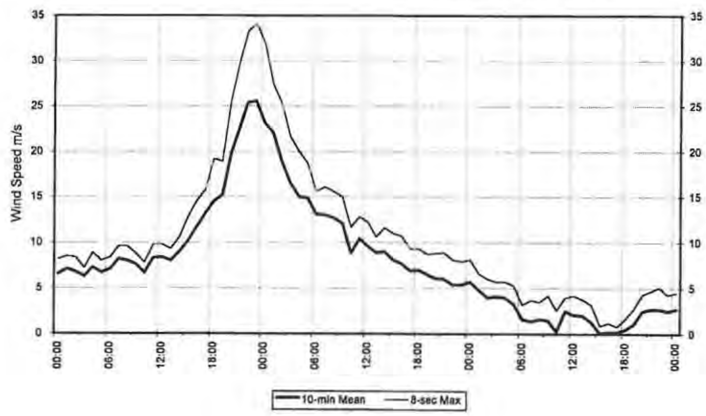


Figure 5 - Waves at Buoy 44137 during Hurricane LUIS
950910.0000Z to 950913.0000Z

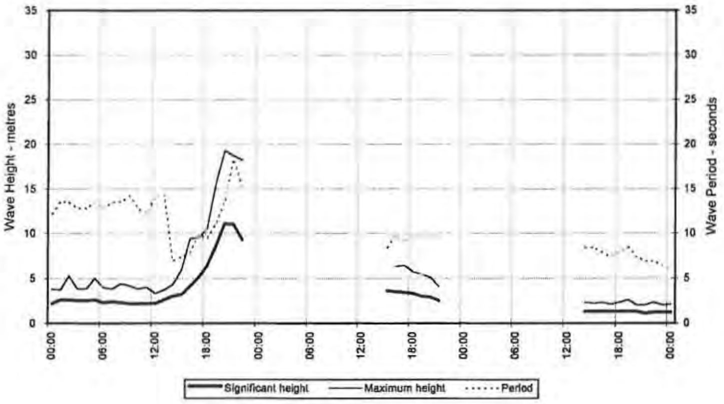


Figure 6 - Waves at Buoy 44138 during Hurricane LUIS
950910.0000Z to 950913.0000Z

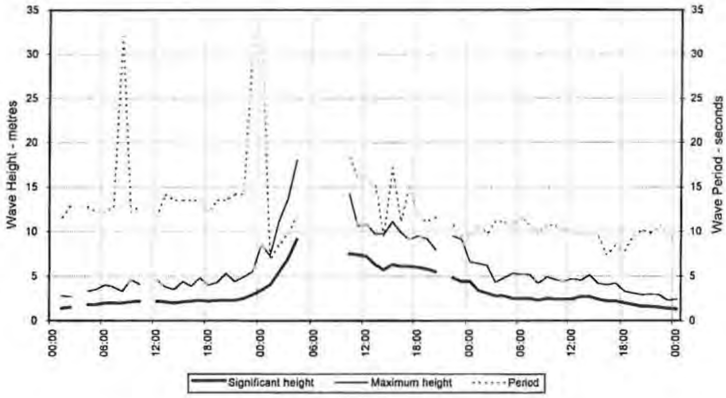


Figure 7 - Waves at Buoy 44139 during Hurricane LUIS
950910.0000Z to 950912.0000Z

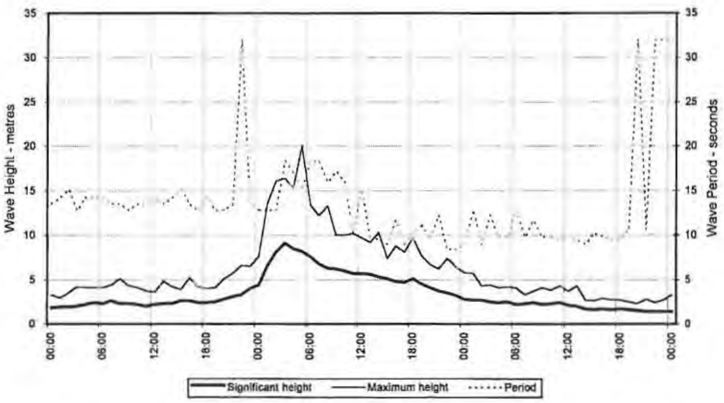


Figure 8 - Waves at Buoy 44141 during Hurricane LUIS
950910.0000Z to 950913.0000Z

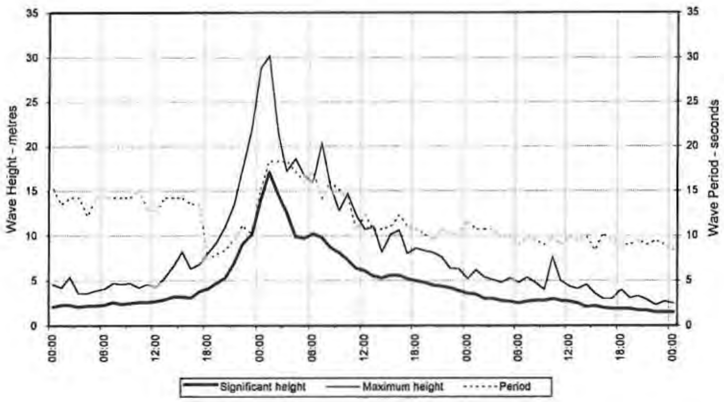
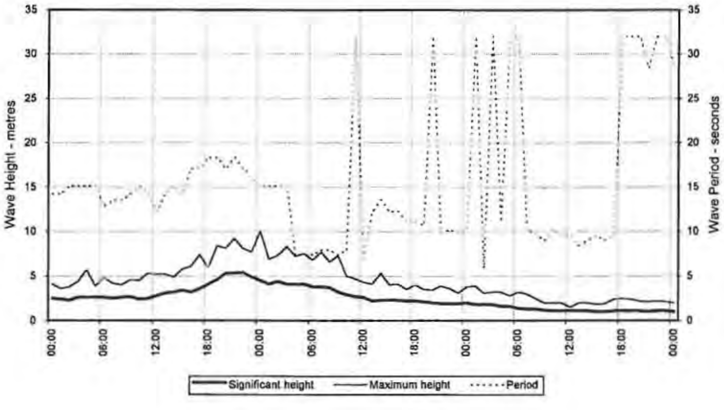


Figure 9 - Waves at Buoy 44142 during Hurricane LUIS
950910.0000Z to 950913.0000Z



Description de l'ouragan "Luis"

"Dès la naissance de la dépression tropicale n° 13, par 11,6°N et 27,5°W, il est clair que ce système est potentiellement dangereux pour les Antilles. Jusqu'au 2 septembre, Luis se déplace vers l'ouest-nord-ouest en se renforçant considérablement: c'est un ouragan de classe 4 qui est positionné le 2 par 17°N et 47°W, à 1 500 km à l'est d'Antigua. Dès lors, Luis va se déplacer vers l'ouest le long du 17°N jusque sur les Petites Antilles qu'il aborde le 4 en soirée. Les îles touchées de plein fouet sont Antigua, Barbuda, Saint-Barthélemy, Saint-Martin et Anguilla. Après avoir semé la désolation, il remonte vers le nord en laissant le continent américain à bonne distance, mais touche le sud de Terre-Neuve le 11, en perdant ses caractéristiques tropicales. Luis est le cyclone le plus intense à avoir traversé les Petites Antilles depuis Hugo en 1989. Les îles de la Guadeloupe, de Monserrat, de Nevis, les îles Saint-Kitts, Saint-Eustache et Saba ont également été touchées par la bordure active de cet ouragan majeur". Extrait tiré de: MetMar, Météo-France, Numéro 171, juin 1996, p.30. Reproduit avec la permission du Rédacteur.

A More Comprehensive View of the Dynamics of Arctic Sea Ice as Revealed through 85.5 GHZ SMM/I Imagery

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Introduction

The 85.5 GHz channels on the Special Sensor Microwave Imager (SSM/I) have historically not been used very much for estimating large scale geophysical properties of sea ice (Steffen et al., 1992) because of high attenuation due to atmospheric moisture and liquid water. During winter over the Arctic Basin, atmospheric moisture is typically low and atmospheric attenuation is not a serious problem. As a result, the higher pixel resolution of 85.5 GHz imagery compared to lower frequency channels can be used to advantage to observe the sea ice surface. It turns out that at pixel resolutions of 12.5 km, large multiyear ice floes and large leads which form over the Arctic Basin can be resolved. Animation of daily SSM/I imagery over periods of several months to several years has been done and the results reveal important dynamic behaviour of the sea ice pack not observed before.

Quantitative Ice Motion

To quantify the ice motion seen in the animation, an image matching technique developed by Noetix Research Ltd. under contract to AES, Ice Branch was used. The method is based on maximum cross correlation between windowed portions of a pair of SSM/I images. The method has been completely automated in a software package called Tracker (Hirose et al, 1991). The technique has been applied to 85.5 GHz SSM/I daily average imagery from the National Snow and Ice Data Center to obtain ice motion over the entire Arctic Basin for a contiguous two-month period. The accuracy of 85.5 GHz SSMI derived ice motions is evaluated by comparing results with Arctic drift buoys. Figure 1 shows ice motion estimated between January 13 and January 17, 1994 using the technique. The vectors in white are ice motion estimated using the image matching technique. The small square marks the beginning of the displacement vector. The black vectors are ice motions estimated from Arctic buoy drift. The large circular region centred over the North Pole is a data void region of the sensor. The ice motion shows the very strong anti-cyclonic Beaufort Sea Gyre in the Canada Basin and large ice motion in Fram Strait (between Svalbard and Greenland). This is very consistent with the surface pressure pattern at the time which was characterized by a very intense anticyclone circulation over the Canada Basin/Beaufort Sea and strong pressure gradient over the North Greenland Sea. The average displacement of all the Arctic buoys over the Basin is 6.5 km per day. The average motion at the buoy locations using the imaging technique is 6.6 km per day.

A series of SSM/I image pairs over a two-month period December 1, 1993 to January 31, 1994, were used to estimate ice motion over the Basin and to compare results to Arctic buoy drift. Figure 2 shows a scatter plot of comparisons over the Canada Basin and Makarov Basin. A total of 391 comparisons were made and the correlation coefficient is 0.75. In general, results compare well with buoy drift but there is a tendency for the image matching technique to overestimate motion by about 10 per cent compared to the buoys.

Climate Applications

Sea ice motion is important for understanding climate processes at the sea ice-atmosphere-ocean interface. Differential ice motion determines the extent of open water within the ice pack which in turn greatly influences local sensible and latent heat exchange with the atmosphere, the rate of new ice production, brine production within the surface layers of the ocean, and ice ridging and thickness distribution. On longer time scales, sea ice motion determines the rate that sea ice is advected out of the Arctic Basin through Fram Strait and through the Canadian Archipelago and is therefore important in sea ice budget studies of the Arctic Ocean. This is also important in determining the rate of freshening of the North Atlantic and the intensity of thermal-haline circulation of the global ocean (Aagaard and Carmack, 1989).

Results obtained for the two-month period indicate that, except for the summer months when atmospheric moisture and liquid water content is high, obstruction due to cloud is not a serious problem with 85.5 GHz data. As a result, it should be possible to produce a database of large scale ice motion over the Arctic Basin for the entire record of SSM/I imagery (September 1987 to the present). This data would provide much more spatial detail than is currently available from buoy data and would be useful in sea ice budget studies of the Arctic Basin and in sea ice model validation.

The large aggregate scale ice motion information over the entire Arctic Basin obtained from SSM/I 85.5 GHz imagery compliments ice motion obtained from other types of imagery such as synthetic aperture radar (SAR) and AVHRR which provides regional and local scale ice motion information.

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416/739-5700; tagnew@doe.on.doe.ca). A more complete evaluation of the technique can be found in Agnew et al. (1996).

Acknowledgments

The authors would like to thank the National Snow and Ice Data Centre for providing the processed SSM/I data on CD-ROM and the Polar Science Centre, Seattle, Washington for providing the Arctic Buoy data for this study. This work is supported in part by the Canadian Panel on Energy Research and Development.

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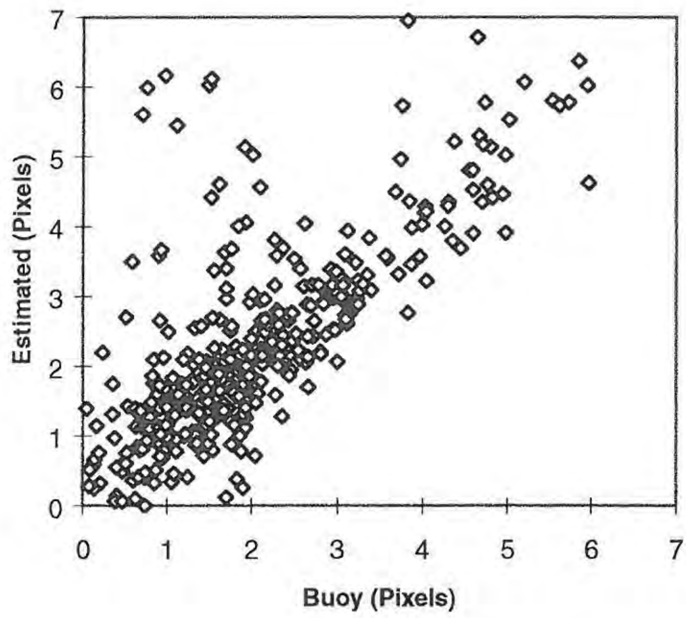


Fig. 2. Scatter plot of drift buoy versus SSM/I estimated ice displacements for a two-month period December 1, 1993 to January 31, 1994.

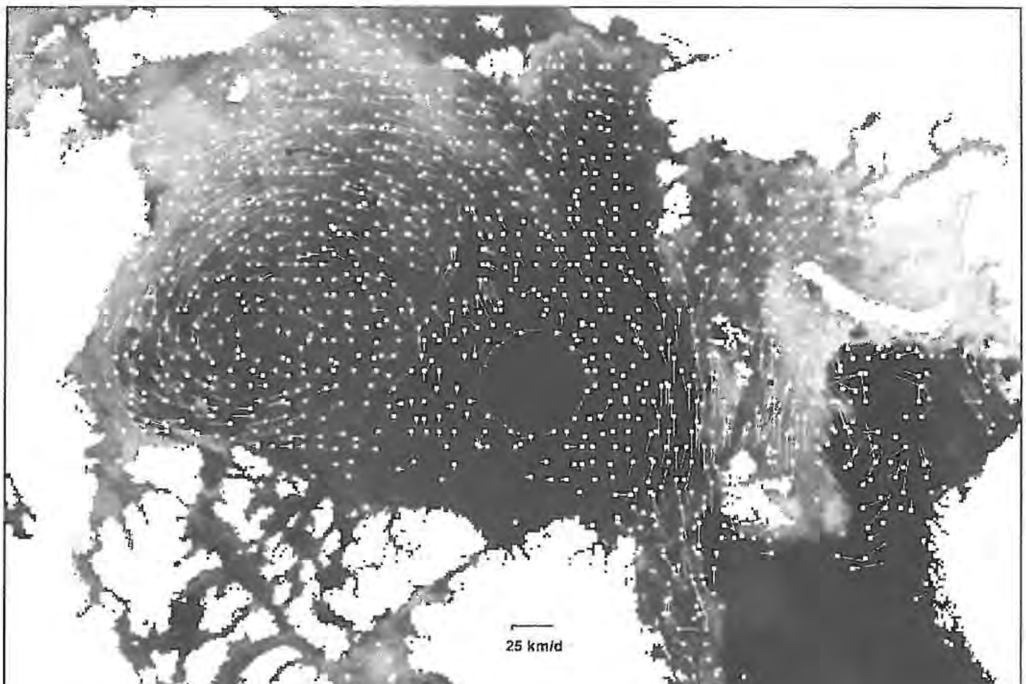


Fig. 1. Estimated 4-day ice motion vectors for January 13 to 17, 1994, with SSM/I 85.5 GHz image for January 13 as background. Ice motion vectors in white are from the maximum cross correlation technique and vectors in black are from Arctic drifting buoys.

Il faut aimer la mer!
par Savonius Rotor

Tel aurait pu être le titre de la conférence-ouverture donnée par le Dr. Paul Leblond et offerte au grand public lors de la récente conférence internationale "Zone Côtière Canada 1996". Tenue à Rimouski, Québec, du 11 au 16 août 1996, le thème de la conférence était "Les zones côtières: gestion intégrée et développement durable". Plus de 433 scientifiques venant de plus de 37 pays différents s'étaient réunis pour discuter entre eux des enjeux économiques environnementaux et sociaux du développement durable pour la zone côtière et des conditions essentielles requises pour assurer une gestion intégrée de cet écosystème à la fois fragile mais très important. Faut-il rappeler que plus des deux tiers de l'humanité vivent à moins de 100 km du bord de la mer?

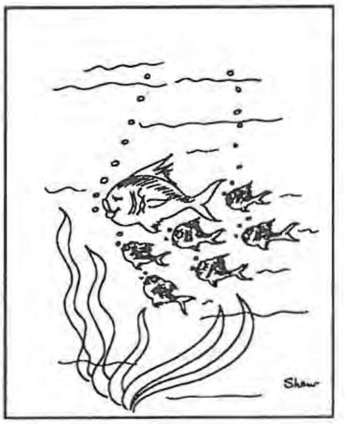
"La conquête romantique de la mer, c'est aimer l'océan comme on aime la terre".

Devant une salle comble (Centre océanographique de Rimouski), le Dr. Leblond a présenté deux modèles différents pour l'humanité dans sa "conquête de la mer"[1]. Il y a en premier lieu le modèle Attila, guerrier Hun, qui détruit tout et qui ne laisse derrière lui que désolation et ruines. Il y a le modèle Clovis, premier roi des français, qui, lui aussi redoutable guerrier, sut s'intégrer à son environnement, le respecter, l'utiliser à bon escient et s'en faire un puissant allié. Aux ruines et cendres d'Attila, il opposa la possibilité d'un développement durable et une intégration efficace de l'activité humaine avec son environnement.

Qui dit gestion, implique par le fait même quelques principes élémentaires de gestion. En premier lieu, l'information utilisée doit être suffisante, fiable et disponible à temps. Ces trois caractéristiques sont importantes dans le processus décisionnel: les décideurs impliqués dans la gestion de la zone côtière doivent avoir une compréhension la plus complète possible du problème en question et de son environnement marin; cette information, bien que non-absolue, doit également être assez fiable (d'où critères de qualité et gestion du risque) pour éclairer les décideurs; et, enfin, elle doit être à temps, l'information en retard de deux mois n'est plus utile!

Pourquoi, se demande, le Dr. Leblond, l'humanité veut-elle conquérir la mer? L'homme, un animal curieux par nature, veut explorer son univers et par conséquent son univers marin. Qui ne connaît pas les explorations presque légendaires faites par Cousteau? Dans cette tâche incessante, il veut découvrir autant les richesses des eaux de surface que celles en profondeur. Par contre, l'exploration de l'univers marin est difficile et complexe: c'est un milieu hostile et vaste. Et chaque mesure est ponctuelle dans le temps et dans l'espace tri-dimensionnel. Il doit de plus expliquer ses découvertes; cette explication présuppose une méthode scientifique pour classer et intégrer ces connaissances et une approche d'ingénierie dans l'application des connaissances acquises. En fin de compte, parce qu'il est important de connaître pour mieux protéger et de comprendre pour mieux agir, cette exploration rendra possible l'exploitation de l'univers marin, une exploitation sans pillage tout en assurant la durabilité de l'écosystème.

Pour illustrer ce processus à son auditoire, le professeur Leblond a utilisé comme image une cascade d'eau apparentée au processus de la connaissance. Tout au haut de la cascade, il y a la matière, l'énergie et les organismes vivants. Entraînés par les lois inéluctables de la gravité terrestre, il y a au pied de la chute la découverte de l'information, son intégration et sa dissémination en incluant son application. Dépendant de la conduite humaine, ce processus peut entraîner le progrès humain au lieu d'entraîner comme c'est si souvent le cas l'unique profit. Ce progrès humain sera atteint si cette conquête de la mer se fait d'une manière romantique et la "conquête romantique de la mer c'est, selon Paul Leblond, aimer l'océan comme on aime la terre". Le professeur n'hésite pas à franchir le pas et souhaite que tous, scientifiques, gouvernements, entreprises et le grand public, que tous et chacun cultivent la zone côtière comme on cultive un jardin organique. De là, il deviendra facile pour tous de changer nos attitudes et d'arrêter d'utiliser la mer comme poubelle de l'humanité.



Le conférencier a conclu sa présentation en disant qu'il faut aimer la mer (la mère), source de toute vie. Cette conférence fut grandement appréciée par l'auditoire et plusieurs questions furent adressées au Dr. Leblond qui a su répondre aux "colles" posées non seulement avec tact mais également avec une pointe d'humour de bon aloi. Puisse Clovis triompher!

[1]: Titre de la conférence prononcée par le Dr. Paul Leblond, University of British Columbia, Vancouver, B.C.

Note from the Editor: It must be noted that Savonius Rotor is now fully bilingual and can express himself in both official languages, English and French.

Mending the Ozone Hole
by Arjun Makhijani and Kevin R. Gurney
1995, MIT Press
ISBN 0-262-13308-3, 355pp.

Book reviewed by Keith C. Heidorn, PhD, ACM,
Spectrum Educational Enterprises, Victoria, B.C.

One of the major global environmental concerns facing us all today is the decline of the stratospheric ozone layer which regulates the flux of UVB radiation into the lower atmosphere and onto the surface. If we are at all distressed by the potentially adverse impacts of human-induced depletion of the ozone layer, we should be equally concerned over what is causing the depletion and what can be done to stop and repair the damage.

I have read several books which tell the history of the plight of the ozone layer; however, they generally lack technical information and often portray the Montreal Protocol as the "white knight" saving the day just in the nick of time. Don't get the wrong impression; I support the work of the Montreal Protocol and see it as a landmark in global cooperation. However, we must ask: "Have compromise, industrial reticence and international bickering opened a gap between the promise and reality of avoiding further significant destruction of the ozone layer? Are we doing enough to avoid catastrophic impacts?" In Mending the Ozone Hole, Makhiljani and Gurney attempt to answer these questions.

The ultimate goal of the book is to show that the equivalent chlorine (chlorine plus weighted bromine) content of the atmosphere can be reduced more quickly with readily-available technologies replacing the use of ozone-depleting compounds (ODCs). Using a simple model, the authors estimate the length of time required for the atmosphere to return to a concentration equivalent to pre-ozone-hole days for three emission scenarios: a Copenhagen Amendment scenario, an Accelerated Phaseout scenario and a Saving-Our-Skins scenario. The model results show that the Saving-Our-Skins scenario drops the content to target levels 23 years faster than the Copenhagen Amendment scenario and 13 years faster than the Accelerated Phaseout scenario. However, it would have been instructive if an additional scenario for the original Montreal Protocol phaseout deadlines had also been included to show how the changes in international agreements have improved the situation.

Mending the Ozone Hole, however, goes far beyond simply setting a course for the repair of our stratospheric ozone layer. It is an overview of the full breadth of the stratospheric ozone issue, describing the layer itself, the impacts of increased UVB radiation, the role of ODCs in stratospheric ozone chemistry, the major uses of the ODCs and alternatives to them, the regulatory frameworks, the industrial response to the crisis and the projections of atmosphere levels of chlorine and bromine under several emission-reduction scenarios. All are tightly woven into a book of 355 pages. I found the sections on the wide variety of uses of ODCs and the potential alternatives to their use particularly informative.

The book does have some poor or inconsistent definitions of the analogy for the greenhouse effect; the definition of erythema as sunburn at one place and a "rash" in another. My other major concern is that several figures 2.1, 2.2, and 3.7 are poorly labelled and confusing to the non-expert and expert alike (although the latter can work out the confusion from the text).

The main purpose of the book, however, should not be lost in the wealth of technical information: that we can and must move more quickly to reduce the chlorine/bromine content to "pre-ozone-hole normal levels." The process will not be not a simple one. As Makhiljani and Gurney state: "No single step will stop the buildup of ozone-depleting chlorine and bromine in the atmosphere during the next few years. Many steps, each one important, are needed."

Overall, this reviewer recommends this book to all with an interest in the impacts of and on the ozone layer and commends the authors on their painstaking work in compiling so much technical information in so compact a text. If I were teaching a course on the stratospheric ozone layer as an environmental problem, this is the book I would choose as my text. If I had to have one book on my shelf as a reference on the problem, this would be my choice.

Rain

Planning vacations in Spain?
Then better stay in the plain.
The law of friend Shaw
Is just an old saw,
The MOUNTAINS get most of the rain!

The Happy Weather Forecaster!

INTERNATIONAL CONFERENCE "COASTAL ZONE CANADA '96"

A call for International Action for the Sustainable and Wise Use of Coastal and Ocean Resources:

"the Rimouski Declaration"

RECOGNIZING that the coastal and ocean environments of all coastal nations are together of global significance for biodiversity and natural resources, and as such each coastal nation has an international responsibility for their wise use;

AWARE and CONCERNED of the continuing reduction in coastal and ocean biodiversity and resources loss and degradation of habitats, and the decline in environmental quality especially resulting from pollution;

REITERATING the international obligations to sustain and enhance all coastal and ocean environments, both natural and cultural;

FULLY ACCEPTING the principles laid down by the Rio Declaration, in particular those of sustainable development and the precautionary approach, and the need to make significant progress on international agreements and declarations including the UN Conference on Human Environment, the World Commission on Environment and Development, "the Brundtland Report", the World Coast Conference "Noordwijk Guidelines" and the Global Program of Action "the Washington Declaration";

ACKNOWLEDGING both the cultural and economic importance of coastal zones and oceans, the need to respect the rights and interests of indigenous peoples, and the need to involve fully coastal communities in the management of coasts and oceans;

The Coastal Zone Canada '96 International Conference in Rimouski calls upon Governments of coastal nations, in accordance with the principle of subsidiarity:

TO ACCEPT responsibility for the sustainable use of coastal and marine resources and take a strong lead in developing national frameworks for integrated management of coastal and marine resources;

TO DEFINE clear national aims, objectives and targets for the sustainable use of coastal and ocean resources, and to reflect these in appropriate policy guidance;

TO DEVELOP and IMPLEMENT national coastal and ocean action programmes which contribute to the long-term goal of sustainable use of coastal and ocean resources;

TO PROVIDE the legal, financial and administrative mechanisms in order to enable national coastal and ocean action programmes;

TO PROVIDE the resources necessary to implement national coastal and ocean action programmes and in particular, to build capacity and empower communities to take a full and active role in the wise management of coastal and ocean resources;

TO DEVELOP specific programmes of coastal and ocean education, training and research in order to improve understanding, awareness and appreciation of coastal and ocean environments.

Adopted at Rimouski, Québec, Canada - August 16, 1996.

Note from the Editor: Coastal Zone Canada '96 International Conference was held in Rimouski, Québec, from August 11 to 16, 1996. After five full days of lectures and conferences in Coastal Zone Management at the Université du Québec à Rimouski, the 433 delegates coming from 37 different countries have unanimously adopted what is now called "the Rimouski Declaration". This resolution was sent to Dr. G. Kullenberg, Secretary of the Intergovernmental Oceanographic Commission to follow up. For the benefits of our readers, we are reproducing here this solemn declaration.

Conférence internationale "Zone Côtière Canada '96"

"La Déclaration de Rimouski"

ATTENDU que les environnements côtier et océanique de toutes les nations côtières ont une portée globale sur la biodiversité et les ressources naturelles et que toutes les nations côtières ont une responsabilité devant leurs pairs pour un usage avisé;

AVERTI et INQUIET de la continuelle réduction de la biodiversité des zones côtières et des océans, de la dilapidation des ressources, de la dégradation des habitats et du déclin de la qualité de l'environnement qui résulte surtout de la pollution;

RÉITÉRANT les obligations internationales de soutenir et améliorer les environnements côtiers et océaniques, tant naturel que culturel;

ACCEPTANT PLEINEMENT les principes stipulés dans la Déclaration de Rio, en particulier ceux sur le développement durable et l'approche de précaution, et convaincu du besoin de faire des progrès significatifs depuis les déclarations et accords internationaux comme la Conférence des Nations Unies sur l'environnement humain, la Commission mondiale sur l'environnement et le développement, le "Rapport Bruntland", la Conférence sur les zones côtières Noordwijk et le Programme d'action globale de la Déclaration de Washington;

RECONNAISSANT l'importance à la fois économique et culturelle des zones côtières et des océans, le besoin de respecter les droits et les intérêts des peuples autochtones et le besoin d'impliquer pleinement les communautés locales dans la gestion des côtes et des océans;

La Conférence Zone Côtière Canada 1996 de Rimouski demande aux gouvernements des nations côtières, en conformité avec le principe de subsidiarité:

D'ACCEPTER la responsabilité d'un usage durable des ressources côtières et marines et de prendre la tête dans le développement de structures nationales pour une gestion intégrée des ressources côtières et marines;

D'ÉTABLIR des visées nationales, des objectifs et des cibles claires pour l'usage durable des ressources côtières et océanes et de les traduire dans des politiques appropriées, y compris pour les eaux intérieures et les embouchures où des mesures appropriées n'ont pas encore été prises;

DE DÉVELOPPER et D'IMPLANTER des programmes d'action nationaux pour les côtes et les océans qui contribueront à l'objectif à long terme de l'usage durable des ressources côtières et océanes;

DE FOURNIR les cadres légaux, financiers et administratifs qui permettront la mise en action des programmes nationaux d'action pour les côtes et les océans;

DE FOURNIR les ressources nécessaires pour implanter les programmes nationaux d'action et en particulier de donner les capacités et les pouvoirs aux communautés pour qu'elles jouent un rôle actif dans une gestion prudente des ressources côtières et océanes;

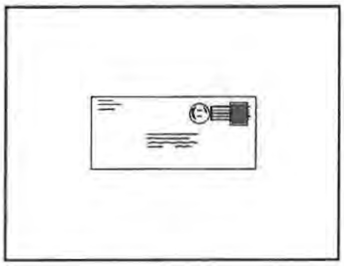
DE FAVORISER l'émergence de programmes d'éducation, d'apprentissage et de recherche spécialisés sur les côtes et les océans de manière à améliorer notre compréhension, notre perception et la valeur des environnements côtiers et océaniques.

Adoptée à l'unanimité à Rimouski, Québec, Canada, le 16 août 1996.

Avis du Rédacteur: La Conférence internationale Zone Côtière Canada '96 s'est tenue à Rimouski, Québec, du 11 au 16 août 1996. Après cinq jours complets de présentations et de conférences sur la gestion de la zone côtière à l'Université du Québec à Rimouski, les 433 délégués, venant de 37 pays différents, ont adopté à l'unanimité ce qui est maintenant convenu d'appeler "La Déclaration de Rimouski". Dans le but d'y faire suite, cette résolution fut envoyée au Dr. G. Kullenberg, Secrétaire de la Commission Océanographique Intergouvernementale. Pour le bénéfice de nos lecteurs, nous reproduisons ici cette déclaration solennelle.

Letters to the Editor / Lettres au Rédacteur

Winter Storms, Global Warming and the Next Ice Age - Reflections from a Cluttered Desk



After an enjoyable vacation in the warm tropical climate of southern India (in January 1996) and a brief visit to my former home-town Pune (located about 200 km south of Bombay), I returned to the wintry climate of Toronto (my adopted home in Canada for the past 27 years) and found my office desk cluttered with several journal papers, reports and documents, waiting to be perused. A quick glance at the papers and documents revealed that most of the papers were on global warming and anthropogenic increase in greenhouse gases produced by fossil fuels and other related topics.

During my long flight from Bombay to Toronto, I had been grappling with the Newsweek magazine report on the 'blizzard of the century' that hit New York and Washington in early January (1996) and an elaborate interpretation by Dr. James Hansen (of NASA in Washington) that such extreme winter storms are the direct result of global warming! The Newsweek magazine also carried an interview with Dr. Philip Jones (a leading British climatologist working at the University of East Anglia) who has been monitoring the Earth's surface temperature changes using available data of the past one hundred years or more. According to Jones' calculations, the net rise in the planet's mean temperature between 1900 and 1995 was about 0.5 deg (C) and this increase was directly related to increase in greenhouse gases. (It was, however, not clear to me how Jones calculates the Earth's mean temperature and whether his calculation takes into account the impact of rapid urbanization that is taking place in many cities in Asia and Africa).

As I was browsing through my desk while reflecting on the Newsweek magazine's reports, my eyes caught the IPCC (Intergovernmental Panel on Climate Change) summary report on the scientific assessment of climate change that was released at the IPCC meeting in Madrid (Spain) in November 1995. The report's important findings were that the mean global temperature has increased by between about 0.3 and 0.6 deg (C) since the late 19th century and that the 20th century global mean temperature is at least as warm as any other century since 1400 AD. (Data prior to 1400 are too sparse to allow reliable estimation of global mean temperature). The report also concludes that although the growth rates of concentration of greenhouse gases (carbon dioxide, methane and nitrous oxide) were lower than expected during the 1990s, the balance of evidence suggests that there is a discernible human influence on global climate. This was the first time the IPCC has pointed a finger at the ever increasing socio-economic activities world over and in particular in the developing (third world) countries as the root cause of global warming! No wonder representatives of some third world countries and, in particular, of two oil-producing countries (Kuwait and Saudi Arabia) refused to accept this conclusion which, in their opinion, was a ploy to put a curb to some of their mega projects which may impact the global environment. The reaction of the developing countries at the IPCC meeting in Madrid was no different from that of Dr. V. Gowariker (former science advisor to the Prime Minister of India and now vice-chancellor of Pune University) who, while opening a climate forecasting workshop at the India Meteorological Department in Pune, assailed the western world for creating a bogey of global warming to serve their vested interests. The climate workshop which was held at Pune in mid-January 1996 was attended by mostly Indian meteorologists and a few U.S. scientists. Dr. Gowariker further remarked in his opening speech that the mean surface temperature of the northern hemisphere had recorded a steep rise of over 0.5 deg. between 1890 and 1940. Why did the western world, asked Dr. Gowariker, not take notice of the fact earlier while raking up the global warming matter now? Dr. Gowariker's question, I thought, was a very valid one and could not be brushed aside easily.

As I continued browsing through my desk, there were two journal papers dealing with the impact of urbanization on increase in surface temperature with particular reference to south and east Asia where explosive population growth and rapid urbanization of overpopulated cities have led to

Note from the Editor

The ideas expressed in the letters to the Editor are the sole responsability of their respective authors. Our readers are encouraged to provide comments and/or criticism.

Avis du Rédacteur

Les idées exprimées dans les lettres au Rédacteur sont la seule responsabilité de leurs auteurs respectifs. Nos lecteurs sont encouragés à les critiquer et à nous faire parvenir leurs commentaires.

a sharp increase in mean surface temperature. A paper by Dr. L. Hingane (Climate Change, January 1996) documents a linearly increasing trend of about +1.5 deg per 100 years at Bombay and Calcutta, two largest cities of India. Another paper by Dr.F.Fujibe (Papers in Meteorology and Geophysics, October 1995) shows an increase of 2 to 5 deg (C) per 100 years in minimum temperature at several large cities in Japan. These two papers and several others cited therein seemed to suggest strongly that rapid urbanization of many cities in developing countries could contribute significantly to the increase in the mean surface temperature as estimated by Jones and which is used by the IPCC as the yardstick of global warming due to greenhouse gases. Is it global warming or is it urbanization that the IPCC and others are concerned about? If the urbanization is causing the mean temperature at several large cities to increase by two degrees or more per 100 years, why is an increase in the global mean temperature by only one-half of one degree causing so much concern?

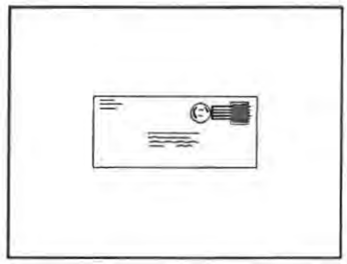
Among the remaining documents and papers was a fascinating article with an eye-catching title 'The next ice age' appearing in the April 1996 issue of 'Toronto Life', a popular magazine dealing with life-style and socio-economic issues of Toronto. It was an informative and a well-researched article by Ms Elaine Dewar who in her introductory paragraphs provided a good background on the greenhouse warming hypothesis first put forward by a British scientist named John Tyndall in 1861. Ms Dewar further analyzed the opinion of several Canadian scientists whom she had interviewed while preparing the article. According to Prof. Doug Larson (University of Guelph), there was no signature of global warming on the old forest of southern Ontario and on the tree-ring data that he has been studying for the past several years. Larson and his colleagues had further studied the white-cedar dendrochronology and prepared proxy temperature data for southern Ontario going back almost 1,400 years. These proxy data, according to Larson and colleagues, would be very useful in validating the climate models in a hindcast mode. Ms Dewar's interview with Prof. W. Peltier (a widely respected geophysicist at the University of Toronto) brought out a startling new twist to the global warming debate, namely, that the present warming may prevent (or delay) the next ice age! Prof. Peltier and his co-workers are developing climate models which will simulate the global climate of 6,000 years ago as defined by the proxy findings of the period. Based on successful simulation of the past climate, the models can then be used to analyze the future state of the global climate under increased carbon-dioxide load.

As I continued sifting through various remaining documents and reports over the next several weeks, the greenhouse warming issue appeared to be far from certain. In the meantime, the winter season of 1996 turned out to be one of the coldest over most regions of Canada with minimum temperature records broken at several locations in western Canada. Based on the climatological summary, the mean temperature at many locations in western Canada during January-March 1996 was below normal by 2 to 3 deg (C). By mid April (1996), Winnipeg set a new record for consecutive number of days of snow on the ground - a whopping 156 days! As I was watching the weather channel at home during the Easter weekend, several ski slope operators in central Ontario were claiming one of the best and the longest ski seasons ever! The weather channel was showing temperature values at various Canadian and American locations while aptly playing the classic song 'Where have all the flowers gone?' in the background. I looked out in the backyard of my home where some snow was still on the ground and the weekend weather was promising to be snowy and still winter-like. I could not help saying to myself 'Where has all the greenhouse warming gone?'

Madhav L. Khandekar
Climate Research Branch, AES, Downsview, Ontario

The Recovery of an Alace FLoat

Alace floats are not meant to be recoverable; however, given that the conductivity cells have been malfunctioning we decided that it was important to try and get one back for a detailed examination. An Alace float is not painted, and a dull grey float is a very difficult optical target at sea; we hoped that the antenna would be easily visible. The target was P-Alace float 578, that was launched at OWS Papa 12 months ago. We were to attempt recovery on its 73rd ascent.



I had a high quality position for the target just before it descended beneath the surface after ascent 72, ARGOS quality flag 1, which means good to 300 metres. Deep drifts vary rather slowly, one deep drift is highly correlated with the previous one. I'd guess that with 5 days' ascents, the decorrelation time is about 4 ascents, or 20 days. So I sent the ship a forecast (I was not on board for this operation) of exactly the time and place where and when it would appear at the surface. The John P. Tully, on current mission Line P also known as WOCE repeat hydrography PR07, arrived at the specified location about 30 minutes before the time of arrival and the electronics technician started setting up the radio direction finder that was to be used to home in on the ARGOS beacon. (We had borrowed two very high quality locators from Scripps.) However, before the equipment was working someone looked over the side of the ship and said, "Oh, there it is". The float was on board the ship within 20 minutes of breaking the sea surface and before it ever had a chance to transmit its last message to the Système ARGOS. Frank Whitney has asked that next time I forecast the position, please be more precise so they know which side of the ship they should look on! My position was about 50 metres out. Nobody has ever managed to recover one of these before, and the received wisdom is that nothing will grow on it at depth, and if anything starts to grow on it during the time at the surface then the fouling will be killed by cycling it to high pressure and low temperature. Now the facts....

The entire case of the instrument was coated in brown algal slime, and there are many small gooseneck barnacles beginning to grow on it. The conductivity cell is well fouled with slime, small wonder that salinity began to drift. The P-Alace float will be returned to Webb Research. They wish to subject the float to detailed examination, because they have never got one back before. However, they will be asked to refurbish the float so we will be able to re-deploy it next year. We will have to think carefully about this recovery operation. It was so simple it is almost breathtaking. The question is, can we RELY on being able to do that? If we can rely on recovering floats, then the cost of monitoring the ocean for a project like GOOS is considerably reduced. Note that this particular float was launched with energy in its batteries sufficient for about 125 profiles. It has actually managed 73 cycles between the deep parking depth and the sea surface.

This is in my opinion a very good performance. The buoyancy adjustment relies on mechanical systems operating at the limits of design, and yet they can supply 73 cycles with no hint of imminent failure. The trial deployment has supplied us with some excellent information about the performance of this technology. One thing that we have learned that perhaps might have been predictable, is that we really do still have a lot to learn about measuring salinity in the ocean.

Howard Freeland
DFO, Institute of Ocean Sciences, Sidney, B.C.

Quotes of the month

"Some of the most significant discoveries have emerged from the productive friction that occurs when different perspectives rub against each other and produce the spark of new insight."
Vice President Al Gore, AAAS Meeting, Baltimore, Maryland, 12 February 1996.

"The validity of a science is .... its ability to predict."
A well known axiom!

1-day Symposium to honour the retirement of Profs. P.H. Leblond and S. Pond, Friday, 13 December 1996, at the University of British Columbia

A 1-day symposium is planned to honour the retirement of Profs. Paul Leblond and Stephen Pond. After the invited talks, there will be a banquet in the evening of 13 December 1996. Ann Gargett and Rick Thomson, from the Institute of Ocean Sciences, are in charge of the scientific program, while William Hsieh and Steve Calvert at UBC are in charge of the local arrangements. If you are interested in attending, please notify William Hsieh (william@ocgy.ubc.ca) by 1 November. A more detailed scientific program will be released later.

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CFD 97 - 5th Annual Conference of the CFD Society of Canada Victoria, British Columbia, Canada, May 25-27, 1997

Call for Papers

You are invited to attend the 5th Annual Conference of the Computational Fluid Dynamics (CFD) Society of Canada at the University of Victoria. The conference objectives are to bring together CFD researchers, developers and users from a wide spectrum of disciplines, and to provide a forum for the exchange of ideas amongst individuals, institutions and companies involved in CFD research and applications. Topics of interest include: Aerospace; Algorithms; Atmospheric Flows; Automotive Engineering; Bio-fluid Mechanics; Climate Modelling; Combustion; Environmental Flows ; Energy Systems; Heat & Mass Transfer; Material Processing; Meteorology; Multi-Phase Flows; Oceanography; Petrochemical Engineering;

Propulsion Systems; Turbulence; Visualization; Wind Engineering.

Victoria, B.C., is located on the southern tip of Vancouver Island, bordering the Pacific Ocean and is easily reached by air or ferry from Vancouver, B.C. or Seattle, WA. Victoria, the city of gardens and the provincial capital of British Columbia, is a major tourist destination with a bustling downtown and Inner Harbour surrounded by fine examples of turn of the century architecture such as the Legislative Buildings and the Empress Hotel. In addition to its English heritage, Victoria boasts the oldest Chinatown in North America, and is a centre for Northwest Coast Indian art exhibited in the unique collection of the Royal BC Museum. Southern Vancouver Island offers access to many pristine wilderness areas, rain forests, beaches and the Gulf and San Juan Islands, with opportunities for hiking, cycling, sailing, golf and ocean kayaking.

Acceptance of contributed papers will be based on reviewed extended abstracts of 500-1000 words plus figures, with the following schedule:

- Abstracts (500-1000 words plus figures) due: **Jauary 10, 1997;**
- Notification of acceptance: **February 19, 1997;**
- Final camera-ready manuscripts due: **April 15, 1997.**

For further information and paper submission, please contact: Prof. Andrew Weaver
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For current information on program, accommodation, registration, travel etc., see: http://ceor.seos.uvic.ca/cfd97

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WWW: http://wikyonos.seos.uvic.ca/climate-lab.html

31st Annual CMOS Congress University of Saskatchewan, Saskatoon June 2 - 6, 1997

The theme for the Congress is simply "Water and Energy Cycles". It was chosen with the thought that several large field projects, notably BOREAS and GEWEX, for which water and energy cycles are major components, will be approaching important milestones about the time of the Congress. This theme also fits in with those of previous congresses hosted by the Saskatchewan Centre: Saskatoon-1981, with the theme "Hydrometeorology" and Regina-1986 with the rather prophetic theme, "Drought: The Impending Crisis" (1988 turned out to be one of the worst drought years on record). Please refer to the call for papers on page 132 for more information.

31ième congrès annuel de la SCMO Université de Saskatchewan, Saskatoon 2 au 6 juin 1997

Le thème du congrès est tout simplement "Les cycles de l'eau et de l'énergie". Ce thème a été choisi en considérant que plusieurs grands projets de mesure, tels que BOREAS et GEWEX, dont les cycles de l'eau et de l'énergie sont des composantes importantes, arriveront à des étapes importantes lors du congrès. Ce thème est également semblable aux autres thèmes choisis pour les congrès antérieurs tenus en Saskatchewan: Saskatoon en 1981 dont le thème était "Hydrométéorologie" et Régina en 1986 dont le thème prophétique était "Sécheresse - la crise imminente" (l'an 1988 fut d'ailleurs une année des pires sécheresses). Prière de consulter l'appel pour des présentations à la page 132 pour plus d'information (en anglais seulement; la version française paraîtra au prochain numéro).

The 30th Annual CMOS Congress in Toronto, 26-31 May, 1996 by Dave Hudak[1] and Ted Shepherd[2]

The e-mail abstract submission system developed for the Kelowna CMOS Congress in 1995 was used to handle the abstracts. With this system in hand, we decided to set the submission deadline for the end of February, 1996. Jim Drummond wrote software to display all abstract submissions on the World Wide Web: as soon as the abstracts had been accepted by the system, they immediately appeared under the relevant session title. Any changes were also immediately visible on the Web. Because we kept the information up to date on the Web, the program only went to press on May 21. Consequently, we had very few no-shows, which contributed to a smooth program. There were 270 oral presentations and 21 poster presentations.

The conference was held on the campus of the University of Toronto. The schedule was somewhat different this year. The scientific sessions were held on Monday through Thursday. This meant that the CMOS committee meetings were held on Sunday followed by an ice breaker. This helped people benefit from reduced airfares by staying over a Saturday night. The following Friday was available for special workshops and meetings. The first five half-days began with a plenary session, as opposed to having all the plenary speakers in a single session. This meant that there was ample opportunity to make announcements to the assembled participants, which helped the organization of the Congress. The plenary speakers were felt to be extremely good in speaking to a wide audience. The session "Perspectives on the Climate System", held on the Wednesday afternoon (when there was no plenary session), consisted only of invited talks and was extremely successful, attracting a large audience. (If anything it was perhaps TOO successful, in that the competing sessions suffered somewhat reduced numbers). Allowing (unpaid) invited speakers within regular sessions seemed to work out well, and should be encouraged in the future. In total, there were 30 sessions, up to 5 taking place concurrently, covering most areas of meteorology and oceanography.

There were 354 conference registrants. About two-thirds pre-registered. The breakdown of attendees was 40% regular members, 30% non members, 25% student members, and 5% retired members. Ten commercial exhibitors displayed their products at the congress. In addition, they were given the opportunity to make a short presentation to one of the plenary sessions. At the end of the sessions on both Monday and Tuesday, a reception was held in the exhibits/poster area to allow attendees the opportunity to meet the exhibitors and examine the posters in an informal setting.

The opening ceremonies of the congress included welcoming remarks by both the Hon. Sergio Marchi, Federal Minister of the Environment, and Prof. J.R.S. Pritchard, President of the University of Toronto. The Minister used the occasion to announce the establishment of an NSERC Industrial Research Chair in Atmospheric Remote Sounding from Space. That evening, the CMOS delegates were invited to a reception honouring Professor Jim Drummond, the first recipient of the Research Chair. The Patterson Luncheon which recognizes distinguished service to meteorology in Canada was held on Tuesday with 80 attendees. This year there were joint winners of the Patterson Medal, Jacques Derome of McGill University and Des O'Neill, retired from AES. At the same time, the oceanographers held the third annual Tully Luncheon at the Faculty Club Pub. The AGM was held on Tuesday evening and saw the installation of Peter Zwack of UQAM as the new President of CMOS. The annual CMOS awards banquet was held on Wednesday evening in the Great Hall of Hart House on the university campus. The guest speaker was Gordon McBean, Assistant Deputy Minister of AES. He spoke eloquently about the 125 years of weather services in Canada that is being celebrated this year. The presentation of the CMOS awards then followed.

Our thanks go to members of the Scientific and Local Arrangements Committees whose efforts ensured a successful congress. We would especially thank Jim Drummond, for putting in many, many hours on setting up (and dealing with) the web site, and for preparing the abstracts book. The relevant software is now available for future CMOS Congresses (or other scientific conferences); for more details, please contact: jim@atmosp.physics.utoronto.ca

[1] Chairman, Local Arrangements Committee, 30th CMOS Congress.
[2] Chairman, Scientific Program Committee, 30th CMOS Congress.

Connexion '96 Conference: Announcement

Environment Canada will host the fifth in the series of Connexion conferences on December 5-6, 1996, at the Château Laurier Hotel in Ottawa, Ontario. *Connexion'96* will bring together business, labour, academic, environmental, and government leaders to discuss key priorities and challenges facing our country. Participants will hear distinguished speakers share their views on the environmental agenda, including The Honourable Sergio Marchi, Minister of the Environment, and the renowned authority on environmental security - Dr. Thomas Homer-Dixon. *Connexion'96* will provide delegates with the opportunity to exchange views, contribute to progress on a wide range of issues, and to expand their network contacts with leading decision-makers on the environment. To request additional information or a registration form, please call toll free 1 (800) 505-8860 or, in the National Capital Region, call (613) 723-6043.

Avis: Conférence Connexion 96

Environnement Canada sera l'hôte de la cinquième de la série des conférences Connexion les 5 et 6 décembre 1996, au Château Laurier d'Ottawa. *Connexion 96* regroupera des représentants des entreprises, des syndicats, des universités, des milieux de l'environnement et des cadres supérieurs des gouvernements pour étudier les grands défis que notre pays doit, en priorité, relever. Les participants pourront entendre d'éminents conférenciers leur faire part de leurs points de vue sur le programme environnemental. Il y aura, entre autres, l'honorable Sergio Marchi, ministre de l'Environnement, et une autorité de renom en matière de sécurité environnementale, M. Thomas Homer-Dixon. *Connexion 96* fournira aux délégués l'occasion d'échanger leurs opinions, de faire progresser une foule de dossiers et d'élargir leur réseau de personnes-ressources en côtoyant les principaux décideurs dans le domaine de l'environnement. Pour obtenir d'autres renseignements à ce sujet ou pour recevoir un formulaire d'inscription, veuillez composer sans frais le 1-800-505-8860 ou, dans la région de la capitale nationale, le 613-723-6043.

Call for papers
CMOS 31st Annual Congress
Saskatoon - June 2-6, 1997

The 31st CMOS Annual Congress will be held at the University of Saskatchewan, Saskatoon, Saskatchewan, Canada, June 2-6, 1997. The theme of the congress is "Water and energy cycles", to reflect current focus on two major inter-disciplinary research projects in Canada, BOREAS and GEWEX.

A "Marine Icing Workshop" will be held concurrently with the Congress, co-sponsored by the National Energy Board, NSERC, and CMOS.

A special session on "Hail" is also planned in conjunction with a 40th Anniversary Reunion commemorating the Alberta ALHAS/ALHAP hail programs.

In addition to these, special sessions are also being planned in agriculture hydrology and soil science, oceanography and hail. As in past congresses, oral and poster papers, and commercial exhibits in all areas of meteorology, oceanography and hydrology are invited. A preliminary list of sessions follows:

1. Agriculture/Forest Meteorology/Climatology;
2. Agriculture Hydrology and Soil Science;
3. Air Quality;
4. Atmospheric Chemistry;
5. Atmospheric Dynamics;
6. Atmospheric Modelling;
7. Atmospheric/Oceanic Waves;
8. Aviation Meteorology;
9. BOREAS;
10. Boundary Layer Meteorology;
11. Chemical Oceanography and Limnology;
12. Client and Commercial Services;
13. Climate/Interannual Variability;
14. Climate Change;
15. Climate Modelling;
16. Cloud and Precipitation Physics;
17. Coastal Ocean and Inland Waters;
18. Cold Climate Hydrology;
19. Data Assimilation;
20. Fisheries and Biological Oceanography;
21. Geophysical Fluid Dynamics;
22. GEWEX/MAGS/GCIP;
23. Hail;
24. Hydrometeorology;
25. Long-Range/Seasonal Forecasting;
26. Marine Icing Workshop;
27. Mesoscale Processes & Severe Weather;
28. Middle Atmosphere: Dynamics, Chemistry & MAM;
29. Ocean Circulation and Modelling;
30. Operational Oceanography;
31. PaleoClimate;
32. Radiation;
33. Remote Sensing and Radar;
34. Sea Ice and Arctic Research;
35. Weather Forecasting;
36. WOCE.

Abstracts of papers must be received by the Scientific Program Committee (Chair: G.S. Strong) by 5:00 PM, 14 February, 1997. Authors are strongly encouraged to submit abstracts by E-mail. A template for sending an electronic abstract can be obtained through the CMOS Congress 97 homepage at:
http://ecsask65.innovplace.saskatoon.sk.ca/pages/cmos97/congrs97.html/
or via anonymous ftp to:
ecsask65.innovplace.saskatoon.sk.ca, file:/pub/cmos/abstract/form.

The committee will greatly appreciate all efforts to submit abstracts electronically, as this will accelerate the approval and printing processes and therefore reduce our costs, and also provide you a faster response. You may still submit your abstract in hard- (paper) or soft-copy (diskette) by forwarding it to:

Dr. G.S. Strong
Chair, CMOS Congress '97 Scientific Program
C/O Atmospheric Environment Service
11 Innovation Boulevard
Saskatoon, Saskatchewan
S7N 3H5 Canada

In submitting a diskette, please use either MS-Word, Word-Perfect, or Word Star, and indicate the name and version number of the word processor used on your diskette.

Most queries regarding CMOS Congress '97 may be answered by accessing our homepage address given above. For other general enquiries regarding the scientific program or exhibits, please contact Dr. Strong at:

E-mail: StrongG@nhrisv.nhrc.sk.doe.ca
Phone: (306) 975-5685; Fax: (306) 975-6516.

For inquiries specific to the "Marine Icing Workshop", please contact Prof. E.P. Lozowski at:

E-mail: Edward.Lozowski@ualberta.ca.
Phone: (403) 492-0348; Fax: (403) 492-2030.

For general enquiries regarding registration, accommodation, or other local arrangements, please contact Mr. Joe Eley at:

E-mail: EleyJ@nhrisv.nhrc.sk.doe.ca
Phone: (306) 975-5685; Fax: (306) 975-6516.

Calendrier 1997 de la Royal Meteorological Society

Le calendrier 1997 de la Royal Meteorological Society est maintenant disponible. C'est un magnifique calendrier avec des photographies artistiques illustrant la météorologie.

Le coût est de 4,99 livres Sterling pour chaque calendrier ou 20,80 pour cinq. Ce coût inclus les frais de poste et d'emballage. On peut se le procurer en écrivant à la Royal Meteorological Society, 104 Oxford Road, Reading, Berkshire, England, RG1 7LL.

Royal Meteorological Society Calendar for 1997

The 1997 Royal Meteorological Society Calendar is now ready for distribution. It is beautifully produced with photographs of high meteorological and artistic merit.

The cost is (British sterling) 4.99 each or 20.80 for five, including postage and packing, and can be ordered from the: Royal Meteorological Society, 104 Oxford Road, Reading, Berkshire, England, RG1 7LL.

International Environmental Conference to Compare Results of Modelling versus Measuring

(Southampton, UK) The First International Conference on Measurements and Modelling in Environmental Pollution (MMEP 97) will bring together environmental engineers and scientists from around the world. The conference will be held April 22-24, 1997, in Madrid, Spain.

Conference organizers are seeking papers on all aspects of measuring and modelling of various environmental pollution problems. The emphasis will be on comparing the results obtained with these two different techniques, and weighing how each technique complements the other in providing useful information for the implementation of possible control strategies.

The conference is intended to be the first of a series on this important aspect of environmental studies, providing a forum for discussion and exchange of ideas on the interaction between modelling and measuring. An important part of the Conference will be devoted to presenting recent developments on environmental instrumentation, such as new techniques for gas measurements, the use of fiber optics, etc. Additionally, satellite imaging for environmental applications will receive special attention. Papers of a more theoretical nature which are in the general framework of the conference may also be accepted.

The conference is being organized by the Wessex Institute of Technology, Southampton, UK and the Technical University of Madrid, Spain. It will be chaired by Professor C.A. Brebbia of the Wessex Institute and Professor R. San Jose of the Technical University of Madrid. The Scientific Advisory Committee for the conference is composed of researchers from around the world. Exhibit facilities will be available.

For more information, please contact the Conference Secretariat at the address provided below, or go to Web page http://www.witcmi.ac.uk/ and click on the conference information link. Enquiries and or abstracts should be sent to:

Liz Kerr, MMEP 97 Conference Secretariat,
Wessex Institute of Technology,
Ashurst Lodge,
Ashurst, Southampton, SO40 7AA, UK.
Tel: 44(0) 1 703 293223; Fax: 44(0) 1 703 292853;
E-mail: wit@wessex.witcmi.ac.uk

1995 Prizes and Awards
Prix et bourses pour 1995

The Prizes and Awards for 1995 were distributed as follows:
Les prix et bourses pour 1995 ont été octroyés de la manière suivante:

President's Prize / Prix du président:
To/À: **Dr. Ted Shepherd,** of the Department of Physics at the University of Toronto, for his outstanding contributions to nonlinear hydrodynamic stability theory and the Hamiltonian structure of geophysical fluid dynamics.

Dr. Shepherd is becoming widely recognized as one of the world's leading geophysical fluid dynamicists. His advances in nonlinear stability theory and the formulation of the basic physics of geophysical fluid dynamics in Hamiltonian form are fundamental contributions to atmospheric and oceanic dynamics. These advances have provided new insights and clarifications of phenomena and concepts such as available potential energy, baroclinic instability, wave-mean flow interactions and conservation laws. In particular, his 1993 Atmosphere-Ocean paper entitled "A unified theory of available potential energy" is an elegant example of the value of Hamiltonian dynamics in resolving difficulties with earlier theory. Dr. Shepherd is also playing an important leadership role in applied atmospheric research, such as in the Middle Atmosphere Modelling project. For his outstanding contributions, both nationally and internationally, Dr. Shepherd is awarded the 1995 CMOS President's Prize.

The Dr. Andrew Thomson Prize in Applied Meteorology / Le prix Andrew Thomson en Météorologie appliquée:
To/À: **Mr. Richard Raddatz,** of the Winnipeg Climate Centre of the Atmospheric Environment Service, for his innovative studies and the development of techniques in mesoscale meteorology on the prairies.

For over twenty years, Mr. Raddatz has contributed significantly to applied meteorology in western Canada. His studies have ranged from model simulations of cold easterly circulations over the western plains, to the mesoscale analysis of rainfall measurements for agrometeorological applications, to the estimation of prairie crop yields based on crop-specific model output. The work has led to the development of a variety of useful techniques in the field of applied meteorology with specific application to operational meteorology within the weather service. For these significant contributions, Mr. Raddatz is awarded the Dr. Andrew Thomson Prize in Applied Meteorology for 1995.

Prize in Applied Oceanography / Prix en océanographie appliquée:
To/À: **Dr. Howard Freeland,** of the Institute of Ocean Sciences in Sidney, B.C., for providing current ocean conditions to the BC fishing community and public through his monthly "Sea Watch" column in The Westcoast Fisherman, and for his many other significant contributions to the applications of oceanography in Canada.

Every month, Dr. Freeland publishes in The Westcoast Fisherman magazine an analysis of surface ocean temperatures in the eastern North Pacific, including maps of the mixed layer temperatures and their anomalies. He describes the current ENSO conditions and their likely effect on our regional waters and our fisheries, and he provides instructions on how to obtain the same information from the Electronic Bulletin Board of the Institute of Ocean Sciences. He has also made available, on the same Bulletin Board, a continually updated map of the latest observations from the AES/DFO network of instrumented data buoys off the west coast of Canada. For this extensive public service, for his many significant research contributions to west coast oceanography, and for his dedicated and wise editorial work for Atmosphere-Ocean and the CMOS Newsletter, Dr. Freeland richly deserves the 1995 Prize in Applied Oceanography.

The Rube Hornstein Prize in Operational Meteorology / Le prix Rube Hornstein en Météorologie opérationnelle:
To/À: **Mr. Laurie Neil,** of the Pacific Weather Centre of the Atmospheric Environment Service, for his significant contributions to the development and application of operational satellite meteorology.

Mr. Neil is considered a leader in operational satellite meteorology in Canada as a result of developing, over fifteen years, analysis techniques to meet operational requirements in forecast centres across the country. His contribution to the field extends to the training of meteorologists and technical staff in satellite interpretation and analysis. Internationally, as a result of his recognized expertise, Mr. Neil has contributed to the success of a number of conferences, workshops and publications in satellite meteorology. For his outstanding contributions to satellite meteorology techniques and training, Mr. Neil is awarded the 1995 Rube Hornstein Prize in Operational Meteorology.

The J.P. Tully Medal in Oceanography / La médaille J.P. Tully en Océanographie:
To/À: **Dr. Steven Calvert,** of the Department of Oceanography at the University of British Columbia, for his fundamental contributions to the understanding of the chemistry of marine sediments, and for his leadership roles in ocean geochemistry and Canadian oceanography.

Dr. Calvert has developed a prominent international reputation for his research on the factors which control the accumulation of organic matter in ocean basins. Through careful and clever analyses of ocean cores, his research has disproved earlier and widely accepted hypotheses, and laid the foundation for our present understanding that the magnitude of primary production is the major phenomenon that controls the accumulation of organic-rich sediments in ocean basins. This work has attracted wide attention in the oceanographic, geological and petroleum communities. In addition to his outstanding research productivity, Dr. Calvert has provided exceptional service to the oceanographic and earth sciences communities in Canada, through his leadership of national committees and programs, his administrative and teaching contributions at UBC, and his support of the integration of ocean geochemistry into Canadian oceanography and CMOS. For his contributions to international scientific research and oceanographic administration within Canada, Dr. Calvert is awarded the J.P. Tully Medal for 1995.

Graduate Student Prizes / Prix étudians gradués:
1) To/À: **Dr. Paul Kushner,** of the Department of Physics at the University of Toronto, for his significant contributions in the extension of atmospheric dynamical theory to semi-geostrophic dynamics.

Nearly all the present theoretical understanding of large-scale atmospheric dynamics is based on the "quasi-geostrophic" theory, a seriously limited model of the atmosphere. Dr. Kushner's Ph.D. thesis, entitled "Wave-Activity Conservation Laws and Stability Theorems for Semi-Geostrophic Dynamics", has contributed to a new perspective through the extension of atmospheric *dynamics to a more general and physically realistic theory, "semi-geostrophic" dynamics. His research has two highly important ramifications: first, it provides for the first time a unified finite-amplitude theoretical underpinning for the semi-geostrophic model, and second, it suggests a way in which the quasi-geostrophic theory may be generalised to yet more complex models. For this work, which is expected to become part of the standard body of theory in atmospheric and oceanic dynamics, Dr. Kushner is awarded the CMOS Graduate Student Prize.*

2) To/À: **Dr. James Voogt,** of the Department of Geography at the University of British Columbia, for his innovative contributions to the description and understanding of the urban heat island.

Dr. Voogt's doctoral thesis, entitled "Thermal Remote Sensing of Urban Surface Temperatures", is novel and makes a fundamental contribution to both remote sensing and urban climatology, His work compares the full three-dimensional surface temperature of cities with the partial the temperature of the complete urban-atmosphere interface, including its temporal and spatial variation. His research is also a major contribution to the remote sensing of complex surfaces. For these contributions, Dr. Voogt is awarded the CMOS Graduate Student Prize.

<u>Environmental Citation / Citation environnementale:</u>

To/À: **Lighthouse Keepers of British Columbia,** and their families, for their dedicated environmental monitoring of coastal waters for the last sixty years.

For sixty years the Lighthouse Keepers of British Columbia, and their families, have been engaged in a project to monitor the physical state of the ocean for the benefit of science and environmental protection. For minimal personal reward they have measured and recorded the temperature and salinity of the coastal ocean every day, in good weather and in bad weather. They have also reported extreme weather events, oil spills and unusual sightings of marine animals. This has given environmental scientists on the west coast a remarkable picture of the variations in the state of the ocean from 1935 to the present day, and provided a unique data base for studies of climate change. For their dedicated environmental stewardship, CMOS is pleased to present the Lighthouse Keepers of British Columbia with an Environmental Citation.

Congratulations to all recipients!
Félicitations à tous les récipiendaires!

125^e anniversaire des services météorologiques au Canada

La planification est bien avancée dans la préparation du numéro spécial de décembre 1996 du CMOS Bulletin SCMO qui sera dédié au 125^e anniversaire des services météorologiques au Canada. Mais nous avons encore besoin de votre aide pour compléter le travail. Pourquoi ne pas aller fouiller dans vos albums photographiques pour rechercher quelques vieilles photographies, des articles de presse ou des articles qui sont encore recouverts de poussière accumulée au cours des années? Testez votre mémoire et ramenez à la vie des anecdotes longtemps oubliées, de vieilles histoires et des événements spéciaux, quelqu'ils soient, et envoyez les nous par courrier, fac-similé ou courrier électronique. N'oubliez pas d'inclure la provenance du matériel soumis. Vous avez jusqu'à la mi-novembre pour nous envoyer vos trouvailles. Les photographies sont particulièrement les bienvenues mais elles devraient être en noir et blanc, lustrées, titrées et datées.

IAMAS • IAPSO

Earth, Ocean, Atmosphere: Forces For Change

IAMAS/IAPSO Joint Assemblies
1-9 July, 1997 World Congress Centre,
Melbourne, Australia

Visit our Web Page:http://www.dar.csiro.au/pub/events/assemblies
The Joint Assemblies will feature a major trade display.
We invite enquiries from potential exhibitors.
A Call for Papers and additional information is available from:
IAMAS/IAPSO Secretariat,
Convention Network, 224 Rouse St,
Port Melbourne Victoria 3207, AUSTRALIA
Ph:+61 3 9646 4122; Fax:+61 3 9646 7737 E-mail:mscarlett@peg.apc.org

125th Anniversary of Weather Services in Canada

Planning is under way to dedicate the December 1996 issue of the CMOS Bulletin SCMO to the 125th Anniversary of Weather Services in Canada, but we need your help to pull it off. How about digging through your old photograph albums/diaries, etc. and search out old photos, clippings or articles that have been gathering dust for years. Test your memory and bring to life some of those long-forgotten anecdotes, old stories, events, whatever, and send them to us by mail, Fax or E-Mail along with your credit lines. You have until the end of August* 1996 to get your material to us. Black and white photographs are particularly welcome but they should be glossy, titled and dated.

*extended to mid-November

Invitation à présenter des communications 31ème congrès annuel de la SCMO

Le 31e 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. Le thème du congrès sera «les cycles de l'eau et de l'énergie» afin de refléter l'importance actuelle de deux projets de recherches interdisciplinaires au Canada, BOREAS et GEWEX.

Un "Atelier sur le glaces marines", co-parrainé par l'Office national de l'énergie, le CRNSG et la SCMO, aura lieu en même temps que le congrès. Une session spéciale sur la "Grêle" est également prévue concurremment avec la réunion du 40ème anniversaire commémorant les programmes sur la grêle ALHAS/ALHAP de l'Alberta. Il y aura également des sessions spéciales sur l'hydrologie agricole et la science des sols, et sur l'océanographie.

Comme au cours des derniers congrès, 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. Voici la liste préliminaire des sessions:

1. Agriculture/météorologie forestière/climatologie;
2. Hydrologie agricole et science des sols;
3. Qualité de l'air;
4. Chimie de l'atmosphère;
5. Dynamique de l'atmosphère;
6. Modélisation de l'atmosphère;
7. Vagues océaniques et atmosphériques;
8. Météorologie aéronautique;
9. BOREAS;
10. Météorologie de la couche limite;
11. Océanographie chimique et limnologie;
12. Services commerciaux et aux clients;
13. Climat et variabilité interannuelle;
14. Changement climatique;
15. Modélisation du climat;
16. Physique des nuages et des précipitations;
17. Océan côtier et eaux intérieures;
18. Hydrologie du climat froid;
19. Assimilation des données;
20. Océanographie biologique et des pêches;
21. Dynamique géophysique des fluides;
22. GEWEX/MAGS/GCIP;
23. Grêle;
24. Hydrométéorologie;
25. Prévisions à long terme et saisonnières;
26. Atelier sur le glaces marines;
27. Processus à mésoéchelle et phénomène météorologique violent;
28. Atmosphère moyenne: Dynamique, chimie et MAM*;
29. Circulation océanique et modélisation;
30. Océanographie opérationnelle;
31. Paléoclimat;
32. Rayonnement;
33. Télédétection et radar;
34. Glaces de mer et recherche arctique;
35. Prévision météorologique;
36. WOCE;

* modélisation de l'atmosphère moyenne.

Les résumés de présentation doivent parvenir au président du Comité du programme scientifique avant 17h00 le 14 février 1997. Nous recommendons fortement aux auteurs de soumettre leur résumé par courrier électronique. Un modèle pour transmettre un résumé électronique peut être obtenu par la page d'accueil du congrès 1997 de la SCMO à http://ecsask65.innovplace.saskatoon.sk.ca/pages/cmos97/congrs97 ou par protocole de transfert de fichier anonyme à ecsask65.innovplace.saskatoon.sk.ca, fichier /pub/cmos/abstracts/form.

Le comité apprécierait grandement que tous les efforts possibles soient déployés pour soumettre vos résumés par courrier électronique puisque cela accélérera le processus d'acceptation et d'impression et ainsi réduira les coûts et vous donnera une réponse plus rapide.

Vous pouvez toujours soumettre votre résumé sur papier ou sur disquette à:

Dr. G.S. Strong, Président
Comité du programme scientifique du Congrès 1997
a/s Service de l'environnement atmosphérique
11 Innovation Boulevard
Saskatoon, Saskatchewan
S7N 3H5 Canada

Si vous soumettez votre résumé sur disquette, veuillez utiliser soit MS-Word, Word Perfect ou Word Star et indiquer le nom et la version du logiciel de votre disquette.

La page d'accueil, dont l'adresse est indiquée plus haut, répond à la plupart des questions concernant le Congrès 1997. Pour des renseignements plus généraux sur le programme scientifique ou les expositions, veuillez contacter le Dr. Strong à:
cour. élec.: Strong@nhrisv.nhrc.sk.doe.ca
téléphone: (306) 975-5809; télécopieur: (306) 975-6516.

Pour des renseignements sur l'Atelier sur les glaces marines, veuillez s'adresser au Prof. E.P. Lozowski à:
cour. élec.: Edward.Lozowski@ualberta.ca
téléphone: (403) 492-0348, télécopieur: (403) 492-2030.

Pour des renseignements d'ordre général sur l'inscription, l'hébergement ou les arrangements locaux, veuillez s'adresser à M. Joe Eley à:
cour. élec.: EleyJ@nhrisv.nhrc.sk.doe.ca,
téléphone: (306) 975-5685, télécopieur: (306) 975-6516.

CMOS Prizes and Awards for 1996

The Canadian Meteorological and Oceanographic Society's annual call for nominations for Prizes and Awards is now underway. All Society members are encouraged to consider nominating individuals of the meteorological and oceanographic community who have made significant contributions to their fields. The awards program provides an opportunity for scientists to recognize their peers, and for media recognition of the sciences of meteorology and oceanography.

The awards categories and criteria are given below. Each category has different and specific nomination criteria which must be met before any nomination can be considered. There is a deadline of January 31st, 1997 for nominations to be received by the Secretary of the Prizes and Awards Committee. Nominations can be made to:

Mr. David Phillips
CMOS Prizes and Awards Committee
3320 Pleasant Street
Richmond, B.C. V7E 2P4
Telephone: (604) 664-9185
Fax: (604) 664-9004
E-Mail address:
phillipsd@ecvancouver.pwc.bc.doe.ca

Prix et Bourses de la SCMO pour 1996

Les nominations pour le programme annuel de Prix et Bourses de la Société canadienne de météorologie et d'océanographie sont maintenant acceptées. Tous les membres sont invités à proposer la candidature d'individus de la communauté météorologique ou océanographique ayant apporté une contribution significative leur domaine. Le programme de prix procure une occasion aux scientifiques de reconnaître le mérite de leurs pairs. Cela permet également aux sciences de l'océanographie et de la météorologie d'être citées par les média.

Les catégories et les critères des prix sont donnés ci-bas. Chaque catégorie a des critères spécifiques et différents, lesquels doivent être respectés, avant qu'une nomination soit considérée. La date limite pour la réception des nominations par le secrétaire du Comité des prix et bourses, est vendredi le 31 janvier 1997. Les nominations peuvent être adressées à:

Monsieur David Philips
Secrétaire du comité SCMO pour les prix et bourses
3320, rue Pleasant
Richmond, B.C. V7E 2P4
Téléphone: (604) 664-9185
Facsimilé: (604) 664-9004
Courrier électronique:
phillipsd@ecvancouver.pwc.bc.doe.ca

Prizes and Awards Criteria

a) The President's Prize

May be awarded to a member or members of the Society for a recent, published contribution or body of work of special merit in the fields of meteorology or oceanography.

b) The J. P. Tully Medal in Oceanography

May be awarded to an individual for outstanding scientific contributions and leadership which have had a significant impact on Canadian oceanography.

c) The Dr. Andrew Thomson Prize in Applied Meteorology

May be awarded to a member or members of the Society for an outstanding contribution to the application of meteorology in Canada.

d) The Prize in Applied Oceanography

May be awarded to a member or members of the Society for an outstanding contribution to the application of oceanography in Canada.

e) The Rube Hornstein Prize in Operational Meteorology

May be awarded to an individual for providing outstanding operational meteorological service in its broadest sense,

Critères d'éligibilité des Prix et Bourses

a) Prix du président

Peut être décerné à un ou plusieurs membres de la SCMO pour une publication récente, un livre ou une contribution importante dans les domaines de la météorologie et de l'océanographie.

b) Médaille J.P. Tully en océanographie

Peut être décernée à une personne dont les contributions scientifiques exceptionnelles et le leadership ont eu un impact significatif en océanographie au Canada.

c) Prix Dr. Andrew Thomson en météorologie appliquée

Peut être décerné à un ou plusieurs membres de la Société pour une contribution remarquable en météorologie appliquée au Canada.

d) Prix en océanographie appliquée

Peut être décerné un ou plusieurs membres de la Société pour une contribution remarquable en océanographie appliquée au Canada.

e) Prix Rube Hornstein en Météorologie opérationnelle

Peut être décerné à une personne ayant procuré un service exceptionnel dans son sens le plus large. Par but excluding the publication of research papers as a factor, unless that research has already been incorporated into the day-to-day performance of operational duties. The work for which the prize is granted may be cumulative over a period of years or may be a single notable achievement.

f) The Graduate Student Prizes
May be awarded for contributions of special merit in meteorology or oceanography by graduate students registered at a Canadian university or by Canadian graduate students registered at a foreign university.

g) Environmental Citations
May be awarded to individuals or groups who have made some outstanding contribution in helping to alleviate pollution problems, in promoting environmental improvement, stewardship or awareness, or in developing environmental ethics.

h) Citation for Outstanding Radio and Television Weather Presentation
Only Canadian weather products or programs will be considered. Nominations can be made for high standards of performance over a period of time or the media outlet's response to a particular event. Normally, submissions include audio tapes of three consecutive radio broadcasts or VHS recordings of three consecutive telecasts along with the date and time of the programs, and the names and addresses of the presenter and station. However, letters of support can also be provided by either Centres or individual Society members. Nominations will be judged on the quality of information, the educational value, the appeal to the audiences, and the level of technical and professional presentation.

Please Note

1. Some prize categories require that a nominee must be a member of CMOS.
2. Receipt of submissions by the Secretary will not be acknowledged unless requested. Acknowledgment when requested will be by telephone.
3. The current title, full address and phone number of the nominee must accompany the submission.
4. Nominees (who have not received awards) in previous years may be renominated. All criteria provided above apply to renominations. The Committee has recently adopted a policy of considering nominations (kept on file) submitted in the two preceeding years. Nominators are encouraged to re-affirm and/or update these nominations.

contre, la publication des articles de recherche sera exclue, à moins que cette recherche soit déjà incorporée comme aide quotidienne dans le travail opérationnel. Le travail pour lequel le prix est accordé peut être cumulatif sur une période de plusieurs années ou peut être une seule contribution remarquable.

f) Prix étudiant gradué
Peut être décerné à des étudiants gradués ayant apporté une contribution notable en météorologie ou en océanographie et qui sont inscrits à une université canadienne, ou à des étudiants canadiens inscrits à une université étrangère.

g) Citations environnementales
Peuvent être décernées à des individus ou groupes ayant apporté une contribution importante aux problèmes de la pollution, en promouvant une meilleure qualité environnementale ou en développant un code d'éthique environnemental.

h) Citation pour l'excellence en présentation des prévisions météorologiques à la radio ou à la télévision
Seules les production canadiennes sont éligibles. La nomination peut être basée sur un standard élevé et soutenu de communications ou sur la reconnaissance des médias sur un événement particulier. Une bande audio de trois émissions radiophoniques consécutives ou un enregistrement VHS de trois émissions télévisées consécutives est requis. La date, le temps des émissions, le nom du présentateur, la station, la ville, etc, doivent être indiqués. Toutefois si désirée, une telle justification peut accompagner la bande afin d'aider le comité de sélection. Les extraits soumis seront jugés pour leur valeur informative et/ou éducative, attrait pour le public, et auront un niveau de présentation technique et professionnel élevé, etc.

Veuillez prendre note

1. Certaines catégories de prix sont réservées aux membres de la SCMO.
2. Un accusé de réception pour les candidatures ne sera pas envoyé par le secrétaire à moins d'une demande formelle. Si désiré, un tel accusé se fera par téléphone.
3. Le titre actuel de chaque candidat, ainsi que son adresse complète et numéro de téléphone, doivent être envoyés avec la mise en candidature.
4. Les candidats des années précédentes, qui n'ont pas reçu de prix, peuvent être reconsidérés. Les critères énoncés ci-dessus s'appliquent également à ces nominations. Le comité considérera désormais les nominations antérieures et conservées durant les deux dernières années. Nous encourageons les personnes qui ont fait ces nominations à les réitérer ou à les préciser.

Note: le genre masculin est uniquement utilisé pour alléger le texte.

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