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CMOS BULLETIN SCMO

Canadian Meteorological and Oceanographic Society

La Société canadienne de météorologie et d'océanographie

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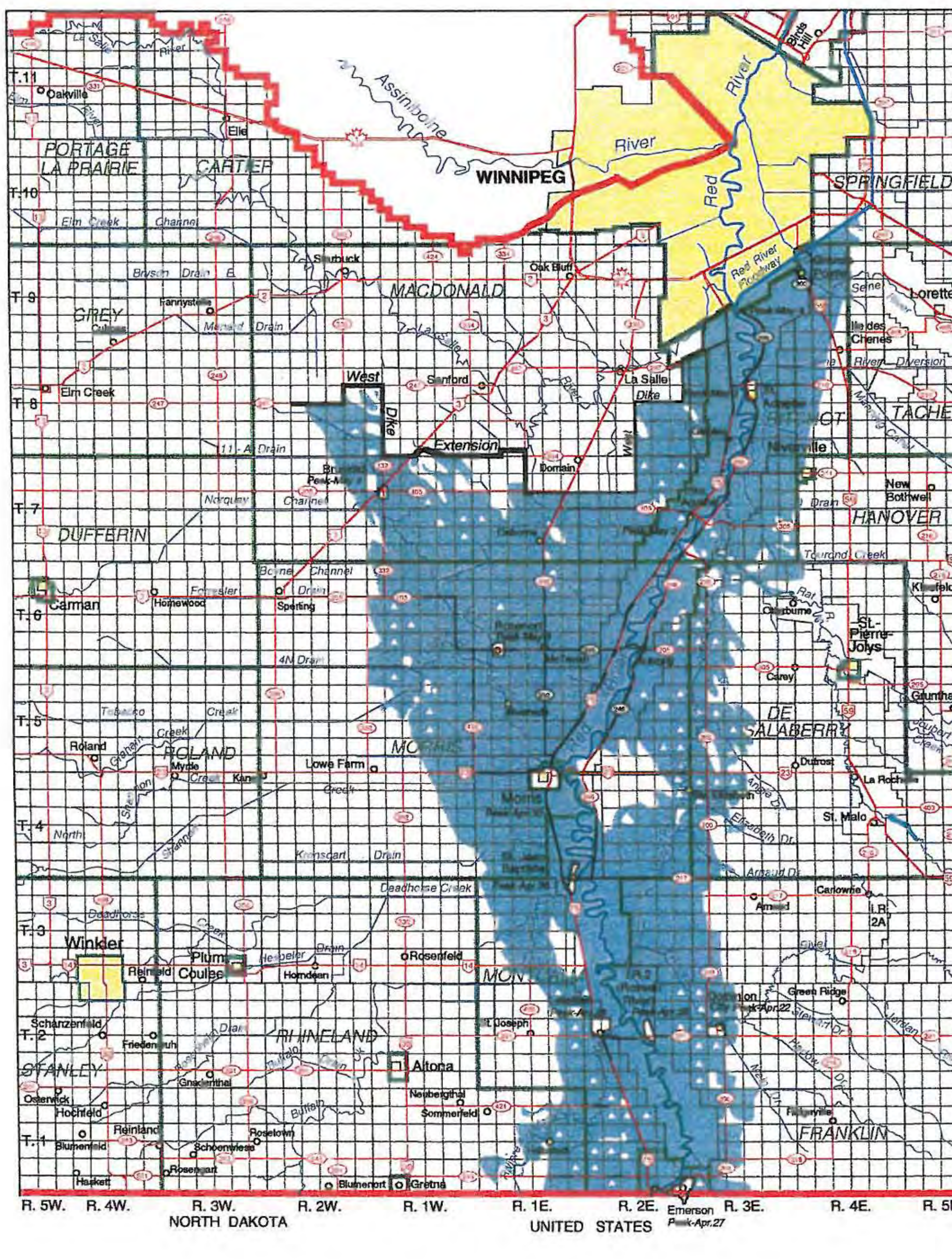
RED RIVER VALLEY

Maximum Flooded Area for 1997

VALLÉE DE LA RIVIÈRE ROUGE

Superficie couverte par la crue maximum en 1997



CMOS Bulletin SCMO

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

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Cover page: In Spring 1997, the Red River in Manitoba experienced extreme flooding conditions, causing the river to overflow. Thousands of persons had to be moved because of this natural disaster. Flood damages are estimated to be over $200 million but savings of the order of $6 billion were achieved because of emergency measures such as diking. We are showing on the front page a map of the area covered by water during the peak condition. It is based on Radarsat imagery from April 27, May 1, 4 and 8, 1997 and on aerial photography from April 29, May 1 and 2, 1997. The map is courtesy of the Manitoba Water Resources Department. Lines in red indicate the roads. Lines in black indicate the flooded roads. Read Warkentin's article on the various causes of this historic flood on page 128.

Page couverture: Au printemps de 1997, la rivière Rouge au Manitoba a sorti de son lit à cause d'une crue exceptionnelle des eaux. Des milliers de personnes ont dû être déplacées à cause de cette catastrophe naturelle. Les dégats matériels sont estimés à plus de 200$ millions mais des économies de plus de 6$ milliards ont été réalisées par des mesures d'urgence comme l'utilisation de digues. Nous montrons en page couverture une carte des régions recouvertes par les eaux durant la période de la crue maximum. Elle est basée sur l'imagerie Radarsat du 27 avril, du 1er, 4 et 8 mai et sur des photographies aériennes du 29 avril, du 1er et 2 mai. La carte est une courtoisie du ministère des ressources naturelles du Manitoba. Les lignes en rouge représentent des routes. Les lignes en noir représentent des routes recouvertes par les eaux. Lire en page 128 l'article de Warkentin décrivant les causes diverses de cette crue exceptionnelle.

Next Issue - Prochain numéro

Don't miss our December 1997 issue on Climate Change It will be worth reading!

Ne manquez pas de lire notre numéro de décembre 1997 sur le changement climatique. Il vous intéressera sûrement.

Canadian Meteorological and Oceanographic Society (CMOS)

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Adresses électroniques de la SCMO

.....from the President's desk

Is the Weather Service underfunded?

I suspect most of us have an opinion. Here's one perspective. The other day, while surfing the net I came across a NOAA site which lists reporting weather stations of the world. It seemed like a golden opportunity to do some analysis. The table shows for the G7 countries, China and Russia, the number of stations, the ratio of stations to country area, and of stations to GDP. Station counts are taken from the listings found at: ftp://ftp.ncdc.noaa.gov/pub/data/globalsod/stnlist-sorted.txt

	Stations	Stns/Area	Stns/GDP
Canada	692	69	103
China	633	66	18
France	200	363	17
Germany	301	843	21
Italy	135	448	13
Japan	304	805	12
Russia	1,054	62	134
U.K.	302	1,237	27
U.S.A.	1,635	167	23

From a science point of view it's density of observations that's important. The table shows that Canada has a significantly lower observing station density (St./area) than the other G7 countries, but comparable to China and Russia. Station density in the USA is more than twice that in Canada. And in turn, in the US the station density is significantly less than in Europe and Japan.

The situation is turned around when looked at from a cost point of view. Canada operates more stations per unit of its national GDP (St./GDP) than every country listed, except Russia. On this cost basis we operate four times as many as the USA, and six times as many as France.

Does this mean that, because its limited economic base and large area mitigate against a high density network, Canada is destined to suffer from sub-optimal quality forecasts? It might seem so, but we don't know this because there is no international standard of comparison of the quality (better stated as usefulness) of forecasts. However, it remains clearly in Canada's best interests to continue the push to exploit remote sensing, low cost network stations, and to make the best use of asynoptic data.

... (Continued next page)
... (Suite à la page suivante)

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.....from the President's desk (continued; suite)

Weather on the Radio

Even if we were able to produce perfect forecasts, they would be of little good if they didn't get to people who could use them. We recently took advantage of a CRTC study to point out the important role of radio in forecast, and particularly warning, dissemination. My letter follows, for your information.

5 September 1997

Secretary General, CRTC,
Ottawa, Ontario,
K1A ON2

Dear Ms. Talbot-Allan:

On 1 August 1997 in Public Notice CRTC 1997-104, you called for input regarding "A Review of the Commission's Policies for Commercial Radio". The following comments are offered on behalf of the Canadian Meteorological and Oceanographic Society (CMOS).

CMOS is a federally registered non-profit organization with the aim of advancing meteorology and oceanography in Canada. As such, we have a particular interest in ensuring that Canadians have access to prompt and reliable weather information, and in particular weather warnings. Radio can be a highly effective means of achieving this. The review of policies that the Commission is now undertaking offers a welcome opportunity to highlight opportunities for improvement.

Public safety is a first order role of government. The CRTC, as the government agency with delegated responsibility for broadcasting, is one trustee for this responsibility in the broadcast arena. With the redistribution of responsibilities from the former Department of Communications that mandate is now shared with Industry Canada (IC) which has responsibility for emergency broadcasting. Effective broadcast policy demands a complementary approach between the CRTC and IC if Canadian broadcasters are to compete more successfully, and serve audiences better. This review is a very rare opportunity to make the case for emergency and weather warning radio broadcast services, which must be considered within the overall context of radio broadcasting, and has received little attention by the CRTC. Therefore the Canadian Meteorological and Oceanographic Society requests the courtesy of being allowed to address the public hearing.

The Broadcasting Act, section 3 (1) b defines the activity of broadcasting as being a "public service". It recognizes, under section 26 (2), a further obligation of broadcasters for matters of "urgent importance". In CRTC 1997-104 the commission sets out the elements of the current broadcasting policy, which include that "radio should provide service that is relevant to local communities". What could be more relevant to the community than public safety? But there is now no official emergency broadcast system in Canada, no specific obligation on broadcasters beyond section 26 (2) which has never been used, and no obligation to broadcast weather warnings. There is a clear expectation. For instance, emergency organization public service announcements advise citizens to keep a battery operated radio available. Environment Canada relies on the broadcast media as a primary means of distributing weather warnings. Naturally many broadcasters voluntarily provide emergency and weather warning service, in particular after the event when it becomes "news". In fact, CMOS has recently recognized excellence in two such cases, the service provided by radio station CFAX in Victoria for the storm of December 1996 and, coverage of the Saguenay flood by the cable network RDI.

CMOS believes that the provision of public good weather services, in particular for weather warnings, should be an acknowledged element of "service that is relevant to local communities". Our unscientific observations indicate a very mixed response to airing weather warnings. Few stations appear to cut into programs immediately, others wait for an appropriate break or a news report, and others seem to ignore them, perhaps because the program content is being originated remotely. In some cases, as was experienced for the Edmonton tornado 10 years ago, no matter how good the scientific weather prediction, the value is lost when the warning broadcast is not made promptly. In that Edmonton case, of the 27 people killed 15 were in the Evergreen Trailer Park. The weather office had issued a tornado warning 40 minutes before the tornado approached the trailer park, yet most people didn't know the tornado was coming. Only one of the four TV stations broadcast the tornado warning.

The Commission might study this matter within the context of the question in CRTC 1997-104 "Are there circumstances under which private commercial FM stations should make more substantial commitments to local programming than the one-third level set out in the local programming policy", recognizing always the industry's need to compete more successfully and serve audiences better.

CMOS wishes to emphasize that, if the study does find a need for improvement, a regulatory approach may not be the answer. For example, one non-regulatory approach would be to actively encourage broadcasters to commit in their promise of performance to provision of emergency service to an agreed standard, including prompt broadcast of weather warnings. The Commission might keep a list of broadcasters that make such a commitment and publicize it as a public service. This could be a way for a station to demonstrate its commitment to the community, and market itself. The absence of such a station would indicate to a community the need to take alternative measures.

Our specific recommendation is that the CRTC in cooperation with IC, guided by an advisory group of stakeholders which should include Emergency Preparedness Canada, Environment Canada and, the Canadian Association of Broadcasters and others, commission a study to document the existing level of public service provided by Canadian radio broadcasters for emergency and weather warning situations. The study should be mindful that any recommendations address not only public safety, but be practical within the context of a competitive broadcast industry.

CMOS thanks the CRTC for the opportunity to submit this brief and looks forward to discussion of the issue during subsequent phases of the review.

Sincerely,
(original letter signed by John D. Reid)

John Reid,
President / Président

"PUBLISH-IN-CANADA-FIRST" POLICY

CMOS is currently experiencing a shortage of articles for publication in Atmosphere-Ocean (A-O), possibly for some of these reasons:

- A-O does not have a sufficient distribution (about 650, incl. 300 in US and overseas);
- A-O's timeliness is not good enough (6 months from receipt to publish), peer review is too strict (there have been complaints);
- page charge is too high ($75/page, 6.5 x 9 inches; we sometimes have to grant reductions);
- US journals have more prestige;

or for other reasons, such as:

- there are fewer scientists, as a result of funding cuts;
- there are fewer original research results to publish in journals like A-O;
- scientists are publishing less (some government departments are stressing relevance and impact rather than papers, as criteria for promotion).

A check with University of Toronto Press, our printer, has revealed that several of the Journals they publish are experiencing a shortage of articles at this time. At any rate, CMOS is concerned, and has asked for suggestions from its co-editors. We have started to send a plea to some of our members.

One of the co-editors has suggested that Canadian granting agencies should have a "*Publish in Canada First*" policy, to encourage scientists to publish at least some of the resulting findings in Canada. CMOS believes there would be merit in this suggestion, and wishes to consult other journals or societies for their views on the topic.

If there was some agreement to pursue the idea, CMOS would like to join with others, as we have rather little capability of our own to embark on a large campaign. We think that the three research councils, government departments, universities, NGOs and possibly some private agencies should be approached. This could be a big project.

It is possible that the topic has been discussed in the past and found to be unrealistic. CMOS is not aware of it. Feedback can be sent to CMOS at one of the addresses above, or to the author.

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The Red River Flood of 1997
An Overview of the Causes, Predictions, Characteristics and Effects of the Flood of the Century

by: A. A. Warkentin[1]

Résumé

L'inondation printanière de 1997 sur la rivière Rouge au Manitoba a été la plus importante jamais enregistrée au cours de ce siècle. Les niveaux maximums entre la frontière des États-Unis et l'ouvrage de régulation contre les crues de la rivière Rouge, situé juste au sud de Winnipeg, ont excédé de 0,6 à 1,5 mètres ceux des grandes inondations de 1950 et de 1979. Les niveaux au centre-ville de Winnipeg ont été de 1,5 mètres plus élevés pour tous les cas d'inondation depuis 1969, date à laquelle l'ouvrage de régulation contre les crues de la rivière Rouge a été mis en service. L'utilisation d'ouvrages de régulation contre les crues majeures a réduit le niveau maximum de 3 mètres à Winnipeg. Le coût total des dégâts causés par l'inondation sera probablement supérieur à 200 millions de dollars, toutefois, on estime à 6 milliards de dollars les économies qu'on enregistrera par la construction préventive d'ouvrages de régulation contre les crues et de digues d'urgence.

Sur une superficie d'au moins 1 840 kilomètres carrés, les terres ont été inondées lorsque la rivière Rouge s'est élevée de 12 mètres au-dessus des niveaux hivernaux. Par contre, huit villes de la vallée entourées de digues sont demeurées à sec et la ville de Winnipeg a subit peu de dégâts en raison des ouvrages de régulation contre les crues et de digues d'urgence. Cependant, une municipalité, un hameau et de nombreuses propriétés agricoles dans la vallée ont été sérieusement inondés.

La cause principale de l'inondation de 1997 est due à la neige accumulée extrême représentant le niveau du 98[e] centile. La grande humidité dans la couche arable due aux fortes pluies de 1996 et un mauvais synchronisme du ruissellement provenant de régions sources majeures du bassin sont d'autres facteurs qui sont à considérer. Au début d'avril, une grosse tempête ayant pris naissance au Colorado a grandement favorisé l'inondation par l'apport de 50 à 90 mm d'eau sous forme de pluie (au sud) et de neige (au nord). Les précipitations hivernales ont été probablement sous-estimées en raison des nombreuses tempêtes de neige accompagnées de vents forts. Des relevés aériens de la neige au moyen d'une source de rayons gamma ont indiqué une teneur en eau maximale record dans la neige accumulée au sol.

Abstract

The 1997 spring flood on the Red River in Manitoba was the highest recorded this century. Peak stages from the United States Boundary to the Red River Floodway Control Structure just south of Winnipeg were 0.6 to 1.5 metres higher than for the great floods of 1950 and 1979. Levels in downtown Winnipeg were 1.5 metres higher than for any flood since 1969 when the Red River Floodway went into operation. Use of major flood control works reduced the peak stage in Winnipeg by 3.0 metres. Total flood damages will likely exceed $200 million while damages prevented by flood control works and emergency diking is estimated at over $6 billion.

At least 1,840 square kilometres of valley lands were flooded as the Red River rose 12 metres above winter levels. Eight valley towns with ring dikes remained dry and the City of Winnipeg sustained little damage due to flood control works and emergency diking. However, one town, one hamlet and numerous farm properties in the valley were seriously flooded.

The main cause of the 1997 flood was an extreme snowpack which was at the 98[th] percentile level. Other factors included high topsoil moisture due to heavy fall rains in 1996, and unfavourable timing of runoff from major source areas in the basin. A major storm in early April, spawned in Colorado, added greatly to the flooding by dumping 50 to 90 mm of water in the form of rain (south) and snow (north). Winter precipitation was likely underestimated due to numerous snowstorms with strong winds. Airborne gamma snow surveys indicated a record high water content of the snowpack.

Antecedent Conditions

The Red River in Manitoba had experienced a minor flood in 1995 and a significant flood in 1996, the latter having peak stages only one foot or so lower than the 1979 and 1950 floods. The summer following the 1996 flood was relatively dry which seemed to be a good harbinger for 1997 at the time. Autumn soil moisture is a very important factor affecting the flood potential due to heavy clay soils (gumbo) which are relatively impermeable when wet. However, weather patterns changed following mid September, 1996. Significant rains on September 27, October 17-18, October 25-26 and October 28-30 greatly increased soil moisture, setting the stage for another possible flood.

[1]Hydrometeorologist, Water Resources Branch, Manitoba Natural Resources, Winnipeg, Manitoba.

Soil moisture was measured by the airborne gamma technique (T.R. Carroll et al, 1992) in early November, 1996. It averaged 29 percent soil moisture by weight for the upper 20 cm of soil over the entire watershed in Canada and the United States, excluding the Assiniboine River. South of Grand Forks, this moisture level was the 3rd highest since 1979 when the U.S. National Weather Service began these surveys. From Grand Forks to Emerson it was the 7th highest. Surveys in the Manitoba portion began in 1994; the 1996 moisture level of 28.5 percent was higher than that of 1995 but below the 33.5 percent of late October, 1994.

Soil moisture modelled by the Winnipeg Climate Centre of Environment Canada with the assistance of Manitoba's Department of Agriculture showed soil moisture by volume generally in the 60% to 90% of capacity range, with some areas greater than 90%. Soil moisture is modelled to a depth of 120 centimetres.
In summary, the soil moisture at freeze-up in the autumn of 1996 was above average and in some areas well above average. It was much higher than for the 1979 flood. However, it was not extremely high as it has been in some other years.

Winter Conditions (November 1/96 - March 20/97)

The winter was unusually long and cold with snowcover developing in early November, 1996 and remaining until mid April, 1997. There were four blizzards producing heavy snow and blowing snow and resulting in closure of major highways. Snowfall was difficult to measure due to the strong winds and heavy drifting, likely resulting in significant underestimation of precipitation at many sites. Reported precipitation was well above average in November, December and January. Manitoba Water Resources has computed monthly averages of precipitation reports in the watershed since 1940 based on data provided by Environment Canada and the U.S. National Weather Service.

The recorded precipitation for the 1996-1997 season and the 1940-1996 averages are as follows:

	Nov	Dec	Jan	Feb	Mar	Total
1996-97 Season	47	31	37	11	28	154
1940-96 Average	22	16	15	13	24	90

Weekly snowcover maps issued by Minnesota's Department of Natural Resources showed the snowcover at the 95th to 99th percentile over most of the watershed throughout the winter. Generally below average winter temperatures and high snowpack albedos combined to produce minimal losses from the snowpack.

Despite below average winter temperatures, soil frost depths were generally below average with many areas reporting virtually no frost. This can be attributed to heavy snowcover which began early in the winter. An airborne gamma snow survey conducted February 6-12, 1997 further quantified the snowcover. The water content of the snow averaged 140 mm upstream of Fargo, 122 mm from Fargo to Grand Forks, 115 mm from Grand Forks to Emerson and 112 mm from Emerson to Winnipeg. The snow cover in the United States portion was the highest on record and in the Manitoba portion among the highest on record. This, together with the above average soil moisture, did not bode well for the Red River Valley. Spring weather would be critical.

Spring Weather (March 21 - June 23)

A two week period of very gradual melting began on March 21 and continued until April 4. Temperatures during this period ranged generally from -5° C to +5° C with some melting during the daytime and freezing at night. There was plenty of sunshine and dew points were low. From Grand Forks to Winnipeg much snow disappeared, probably more through sublimation than by melting. Field surveys in southern Manitoba showed that by early April snowcover in many areas had decreased to much less than 100 percent, and as low as 50 percent on western tributaries. There was little evidence of ponded water or runoff as melt water was soaking into the generally unfrozen soil. Thoughts turned to the 1956 situation when a record snowpack melted very slowly, resulting in minimal flooding. Manitoba's River Forecast Centre was on the verge of downgrading its flood forecast when at the beginning of April, weather forecasts in both Canada and the United States began to mention the possibility of a "Colorado Low". These words strike fear into hearts of Red River Valley inhabitants since history has proven that such disturbances produce the most vicious snowstorms in this region.

Weather forecasts proved to be very accurate as a full-blown Colorado Low developed and, in characteristic form, moved in a north-northeasterly path across eastern Minnesota into northwestern Ontario. The Red River Valley, situated just west of its path in the area of maximum overrunning and vertical motion took the brunt of the storm.

Winds of 80 kph reduced visibilities to zero, created huge drifts and brought transportation to a standstill for days. The movement of the low was quite slow due to its deepening as strong troughing aloft nearly caused the low to become a vertical cut-off low. The resultant long duration of precipitation was a key factor resulting in storm precipitation totals reaching as high as 90 mm. The trajectory of the low resulted in the entire Red River Watershed from the northeast tip of South Dakota to Lake Winnipeg receiving the heavy precipitation. An important feature of the storm was that it produced a lot of rain in the headwater area (upstream of Halstad) where runoff from winter snow was already more advanced. Freezing rain, ice pellets and snow predominated in the northern half of the U.S. portion while Manitoba received ice pellets followed by heavy snow. Cold weather followed the storm with temperatures as low as -20° C. Thawing did not resume until April 13, a week later.

A reasonable approximation of reported precipitation for the April storm is given on Figure 1. which shows total April precipitation. Precipitation for the remainder of the month was only about 5 mm in the U.S. portion and 5-10 mm in most Manitoba regions. Average reported precipitation for the basin was 67 mm compared to the normal of 40 mm. It is likely that the true precipitation for April was considerably greater than reported, perhaps as much as 90 mm on average. The difficulties of estimating snowfall under extreme winds have been well documented by Environment Canada (B.E Goodison, R.F Hopkinson}. Precipitation following the early April blizzard up to the time of the crest of the Red River in early May was well below average.

Melt of the snowpack was not particularly rapid on the whole, although some rapid melting occurred April 18-19 in the northern United States portion. In the Manitoba potion the snow melted gradually from April 13-25. The melt rate was much slower than in 1979 when a somewhat lesser snowpack melted entirely in three days.

Total Winter/Spring Precipitation

Total basin precipitation from the start of winter to near the crest of the Red River in early May (Nov.1/96-Apr 30/97) as reported totals 221 mm, much above the normal of 130 mm. A bar graph of total winter and effective spring precipitation for each year from 1950 onward is shown on Figure 2. It is likely that the true total for the 1996-97 season was considerably greater than 221 mm due to the fact that there were four major snowstorms with strong winds.

An airborne gamma snow survey was conducted April 10-12 following the storm. It showed that the net moisture input since early November, 1996 had risen to 150 to 170 mm at most Manitoba points. In the U.S. portion the net inputs were 100 to 150 mm. These are the highest values on record. The observed water contents, adjusted to values above 35 percent soil moisture by weight, are shown on Figure 3. The gross moisture input must have been considerably greater since sublimation losses would have been at least 25 mm and water soaking below the 20 cm soil depth is not recorded. The latter would have been substantial, especially in the portion of the watershed south of Halstad.

Runoff Conditions

Runoff was underway in the Fargo area prior to the April storm but had barely begun in the area from Grand Forks to Winnipeg. This type of situation favours strong growth in the peak discharge as it moves northward. Simultaneous melt and runoff throughout the watershed, which has often occurred in past years, results in northern tributaries having long spent their fury when mainstem crests arrive from the south. In such cases the peak grows little and may even decrease as it moves northward. Growth of the peak flow in 1997 was further favoured by the April storm which produced rain in the south and snow in the north. The rain quickened runoff in the south but the high albedo of heavy snow in the north retarded melting. As a consequence peak flows from two main source areas in the United States, the southern portion upstream of Halstad and the Red Lake River, arrived at Grand Forks simultaneously. The peak continued to grow somewhat from Grand Forks to Winnipeg because northern tributaries were still running high when the mainstem peak arrived.

The spring runoff volume for the Red River at Emerson up to June 15 was 6.75 million acre-feet (8.33 million cubic decametres), representing an average runoff depth of 135 mm. This is almost identical to the 1950 runoff volume. Yet the 1997 peak discharge at Emerson was about 130,000 cubic feet per second compared to that of 94,000 cfs in 1950. The peak at the Floodway Inlet just south of Winnipeg was 138,000 cfs compared to that of 94,000 in 1950. The higher 1997 peaks resulted mainly from the unfavourable timing effects described above.

The 1997 spring runoff was particularly heavy in the headwater area upstream of Halstad, in the lower Pembina River Watershed and on most eastern tributaries of the Red River in Manitoba. Many streams in these areas recorded record or near record high flows. Flows on western tributaries in Manitoba were high but well below those of 1974 and 1979.

The 1997 spring runoff could have been considerably greater had it not been for the snowpack losses prior to the April blizzard and the four weeks of dry weather following the blizzard. Additional precipitation would have had a very high runoff coefficient due to the saturated and flooded fields. An 1826 flood magnitude could have developed with the occurrence of one additional major storm or several moderate storms.

Flood Conditions

The Red River reached above bankfull levels about April 20 and receded back within its banks in late May. Crest elevations 37 to 40 feet above winter levels occurred from late April to early May. The "Red Sea" inundated 1836 km^2 compared to 1000 km^2 in 1979. The flooded area between Emerson and Winnipeg for the 1979 flood is illustrated on Figure 4 (shown on front cover). About 28,000 Manitobans were evacuated to ensure their safety. Some 2,000 cattle and 45,000 hens were moved out of the Valley. Ring dikes protected eight valley towns but one town and a hamlet, which had no permanent dike, were flooded. The City of Winnipeg was protected by major flood control works constructed in the late 1960s; only two dozen homes were flooded. Canada's military deployed 8,600 soldiers, the largest peace-time deployment to assist with emergency flood fighting. About 756,000 m^3 of earth and 142,000 tons of limestone were used to construct the Z-dike, an extension of the west dike of the Red River Floodway

Control Structure. The dike would normally take four months to build but was finished in one week. Total flood damages for the 1997 flood may reach $200 million compared to over $600 million (present value) for the 1950 flood. Damages prevented by flood control works and emergency diking in 1997 are in excess of three billion dollars for a 1957 level of development. Damages prevented for the 1997 level of development are not well known but could be two to three times greater.

Flood Forecasting Methodologies

Manitoba's River Forecast Centre employs an index type of model to predict the runoff volume and peak discharge for the Red River at Emerson. This is used in the preparation of flood outlooks which are issued during the winter and early spring. Once spring runoff is well underway, Manitoba depends on U.S. National Weather Service predictions for the Red River at Pembina, North Dakota located just south of the International Boundary.

The index model used for runoff outlooks consists of statistical relationships for the U.S. portion of the watershed, treating the entire area as one basin for computational purposes. Autumn soil moisture is represented by an Antecedent Precipitation Index (API) based on weighted monthly precipitation from May to October. The appropriate monthly weights have been carefully selected based on analysis of data from 1941 onward. Other variables used are the cumulative winter precipitation which includes effective spring precipitation, and a degree-day type of melt index. Also a winter temperature index is used to approximate sublimation losses and soil temperatures. Information from airborne gamma snow surveys, conventional snow surveys, satellite microwave snow surveys, modelled soil moisture, airborne gamma soil surveys and measured soil temperatures etc. has been increasingly used in recent years to improve estimates of soil and snowpack conditions.

Flood routings are performed using the Muskingum method from Emerson to Winnipeg. For both outlooks and operational forecasts, daily predicted flows at Emerson are routed together with daily predicted flows for 13 Manitoba tributaries including the Assiniboine River. The Muskingum procedure performed very well for the 1997 flood. However, it does not enable predictions of flood levels on the floodplain well away from the river.

While present forecasting procedures worked well for the 1997 flood, the River Forecast Centre plans to update flow forecasting procedures to make them more physically based. This may include application of a dynamic routing model to the Red River.

Flood Forecasts for 1997

Forecasts of Red River 1997 crest elevations were issued by Manitoba's River Forecast Centre from February through the spring. These forecasts were quite accurate considering information on watershed conditions at the time the forecasts were issued.

Observed crest elevations from Emerson to Morris were within the range predicted on April 9, 1997 just after the major blizzard. At Ste. Agathe and St. Adolphe the actual crest was equal to the top of the range given in the April 9 forecast. Crests above and below the Floodway Inlet were 1.7 feet and 1.5 feet higher than the top of the range on the April 9 forecast. In downtown Winnipeg the crest was 0.2 feet above the top of the forecast range.

The increase in level forecasts on April 9 after the blizzard was not very great due to favourable weather during the two weeks prior to the blizzard, which had greatly depleted snowcover with little evidence of runoff or ponding. The April 9 forecast was issued based on an assessment of the flood potential by Manitoba's River Forecast Centre soon after the early April blizzard which produced heavy precipitation throughout the watershed.

Forecast crest elevations were revised upward April 18th and 20th when it became apparent that the crest at Grand Forks and Drayton would be higher than earlier predicted by the U.S. National Weather Service. The volume forecast was also increased significantly at this time.

Late in April, crest forecasts for points from Ste. Agathe northward were revised upward somewhat when it became apparent that high crests on many Manitoba tributaries would occur at virtually the same time that peak flows arrived from the United States.

Crest forecasts issued in February and March, 1997 and subsequent forecast updates are shown on Table 1 together with the main reasons for the forecast revisions.

Red River Flood Statistics

1. Red River at Emerson

1997 Peak Discharge	132,000 cfs
1996 Peak Discharge	72,000 cfs
1979 Peak Discharge	92,500 cfs
1950 Peak Discharge	94,000 cfs

2. Red River in Downtown Winnipeg

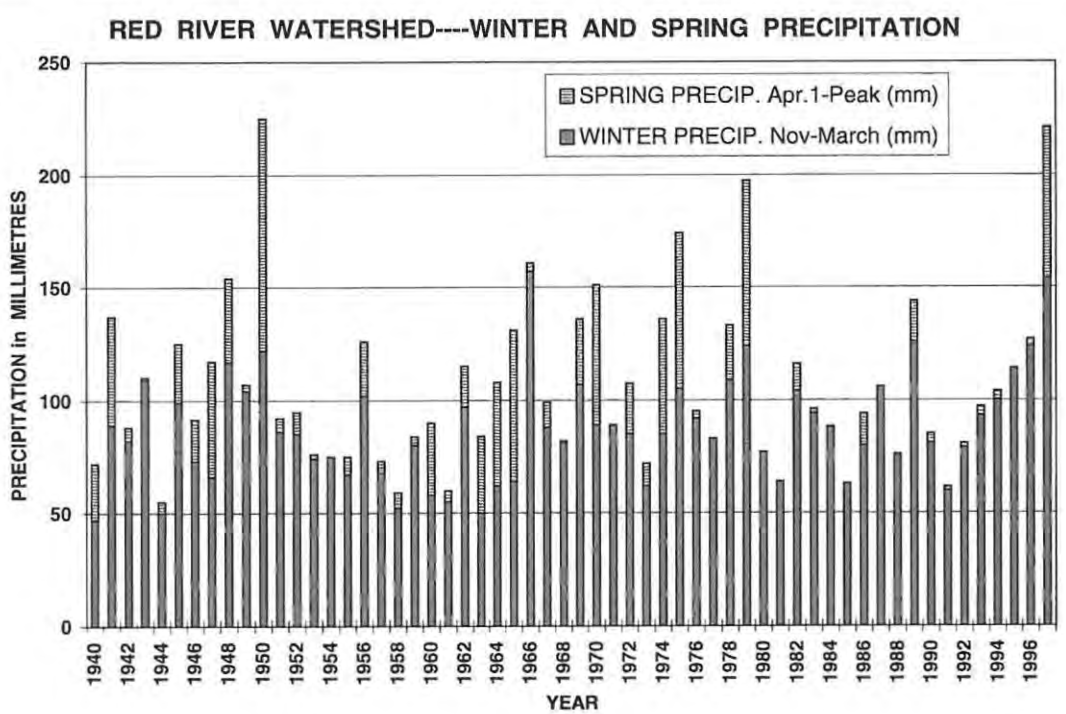
1997 Peak Discharge	162,000 cfs (natural)
1997 Peak Discharge	80,000 cfs (actual)
1996 Peak Discharge	108,000 cfs (natural)
1996 Peak Discharge	58,000 cfs (actual)
1979 Peak Discharge	107,000 cfs (natural)
1979 Peak Discharge	55,200 cfs (actual)
1966 Peak Discharge	88,500 cfs (actual)
1950 Peak Discharge	108,000 cfs (actual)
1826 Peak Discharge	225,000 cfs (actual)

3. Red River at Morris

1997 Peak Stage	783.3 feet
1996 Peak Stage	779.5 feet
1979 Peak Stage	781.3 feet
1966 Peak Stage	778.9 feet
1950 Peak Stage	781.7 feet

Table 1: Review of Red River Crest Forecasting Spring of 1997

Predicted Crest Elevations in Feet						
Forecast Date	Emerson	Morris	Ste. Agathe	Floodway Inlet	Winnipeg (James Area)	Selkirk (PTH #4)
February 24	790.5-793.0	780.5-783.5	773.0-775.5	765.8-769.2	10.3-22.5	
March 21	791.0-793.0	781.0-783.5	773.0-775.5	765.2-769.0	19.3-22.3	
Favourable Melt Followed by April 4-6 Blizzard						
April 10	792.0-793.5	782.0-784.0	774.5-776.0	767.3-769.6	19.7-24.3	725.0-727.5
River Levels at Grand Forks rise much higher than predicted						
April 18	793.0-793.5	783.0-784.0	775.5-776.5	768.3-769.5	20.4-24.3	725.0
Crest Levels at Grand Forks revised upward significantly						
April 20	794.0-795.0	784.5-785.5	776.5-777.5	769.0-770.0	23.5-24.5	726.5-727.5
Manitoba Tributaries Crests coincident with Emerson Crest						
April 27	Near Peak	784.5-785.5	777.0-778.0	769.0-770.5	24.0-25.0	727.0-728.0
Upward Based on Flow Measurements at Ste.Agathe						
April 29	Crested	Near Peak	776.5	770.0-770.5	24.0-25.0	727.0-728.0
Observed Conditions						
Actual Crest	792.5	783.0	776.5	771.3	24.5	726.2
Crest Date	April 27	April 30	May 2	May 4	May 2-4	May 4-5
Total Rise (ft)	40.3	39.8	37.0	38.3	24.0	N/A



Red River Flood Statistics (Continued)

4. Red River Above Floodway Inlet

1997 Peak Stage	771.3 feet
1996 Peak Stage	764.6 feet
1979 Peak Stage	765.0 feet
1966 Peak Stage	763.0 feet
1950 Peak Stage	766.0 feet

5. Red River in Downtown Winnipeg

1997 Peak Stage	761.9 feet (natural)
1997 Peak Stage	752.1 feet (actual)
1996 Peak Stage	757.9 feet (natural)
1996 Peak Stage	747.0 feet (actual)
1979 Peak Stage	757.7 feet (natural)
1979 Peak Stage	746.8 feet (actual)
1966 Peak Stage	752.1 feet (actual)
1950 Peak Stage	757.1 feet (actual)
1826 Peak Stage	764.1 feet (actual)

Note: "Natural" refers to what would have occurred without the use of major flood control works such as the Red River Floodway, the Assiniboine River Diversion, and the Shellmouth Reservoir.

Reference:

Goodison, B.E., 1981: *Compatibility of Canadian snowfall and snow cover data*, Water Resources Research, Vol. 17, No. 4, 893-900.

Note from the Editor:

Although some of the physical measurements including the above statistics are not given in the SI units system as they should, we have decided to leave them as they are mainly for two reasons:

1) this paper is not a research paper but a factual description of the 1997 flood;

2) during the course of event, these units were used for communicating with the public; therefore, people in Manitoba can easily refer to these.

To convert feet to metres, divide the values indicated by 3.28084. To convert cubic-feet per second to cubic-metres per second, divide the values by 35.315.

Note du Rédacteur:

Bien que certaines mesures physiques ainsi que les statistiques données plus haut ne sont pas dans le système de données SI, nous avons décidé de les laisser telles quelles principalement pour deux raisons:

1) cet article n'est pas un article de recherche scientifique mais une description détaillée de la crue de 1997;

2) durant la crue de la rivière Rouge, ces unités étaient utilisées pour communiquer avec le public; ainsi, les gens du Manitoba sont familiers avec ces données.

Pour convertir les pieds en mètres, divisez les valeurs indiquées par 3,28084.

Pour convertir les pieds-cubes par seconde en mètres-cubes par seconde, divisez les valeurs indiquées par 35.315.

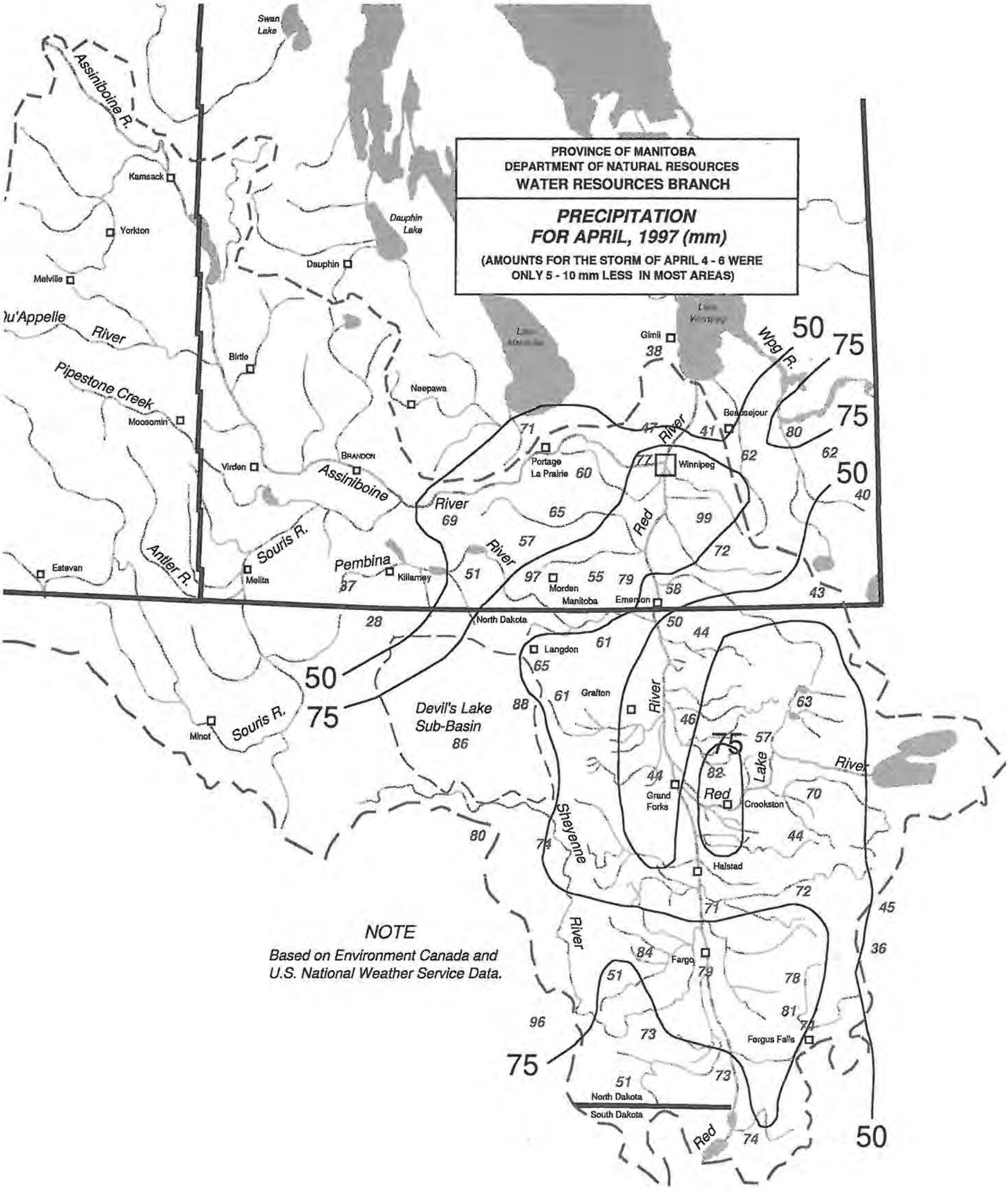


Figure 1: Precipitation for April 1997 (mm)

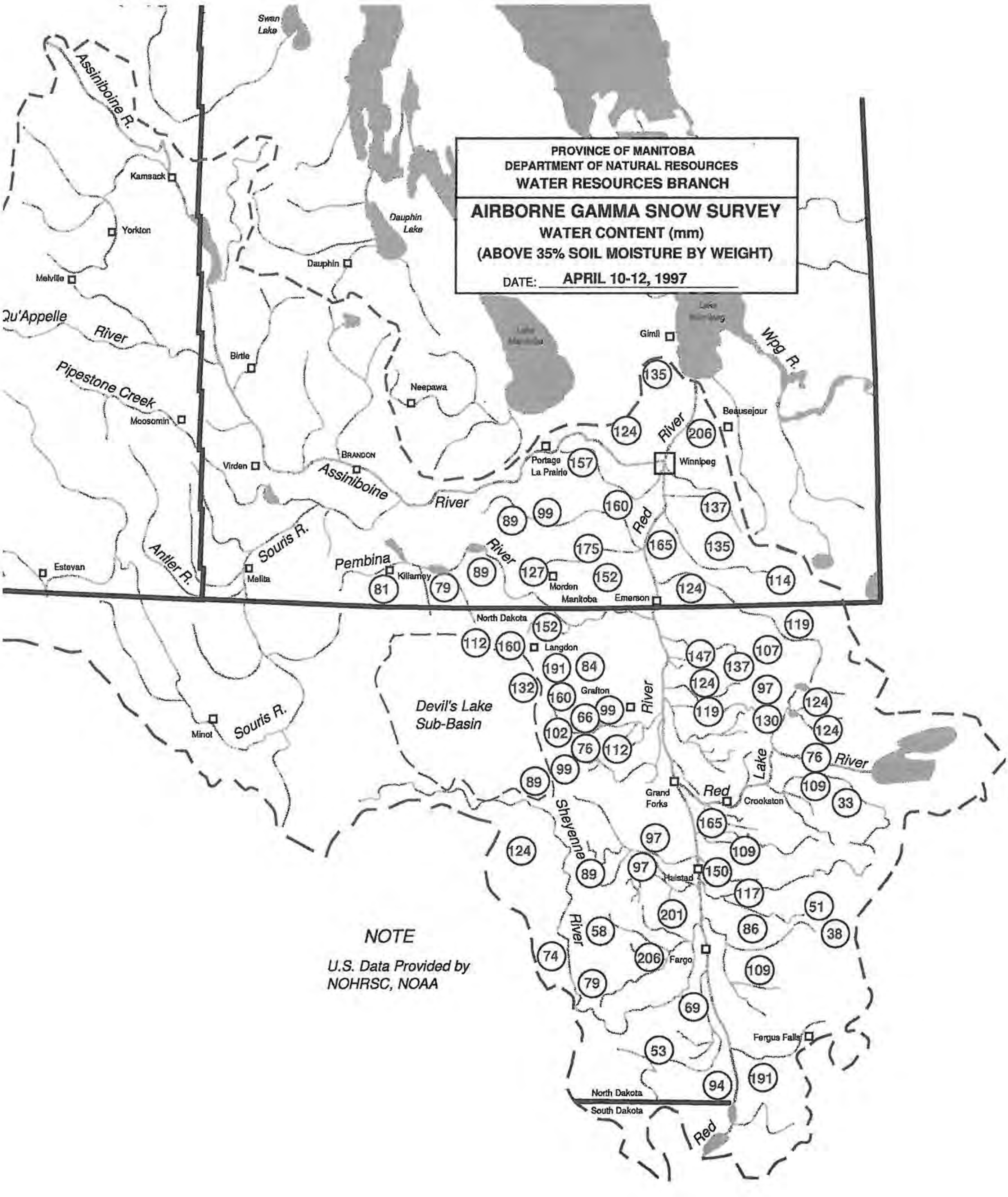


Figure 3: Airborne Gamma Snow Survey (Water Content in mm) April 10-12, 1997

GRAVITY CURRENTS IN THE ENVIRONMENT AND THE LABORATORY

Second Edition
by John E. Simpson
Cambridge University Press, 1997
ISBN 0 521 56109 4, Hardback

Book Reviewed by Peter Smith
Bedford Institute of Oceanography, Dartmouth, N.S.

In this book, Dr. Simpson provides comprehensive survey of nature and behaviour of gravity currents in the environment and of various attempts to model and understand them in the laboratory. The text may be divided into two segments. The first part (Ch.1-10) provides a series of lucid descriptions of natural processes related to gravity currents with emphasis on meteorological aspects as they relate to aviation and gliding. There is also some discussion of related processes in oceans, rivers and lakes (e.g. tidal and internal bores, turbidity currents), and some aspects of environmental science including the behaviour of oil spills on calm water, ventilation in mine shafts, gas clouds, and house fires. The second part of the book (Ch.11-18) describes an extensive series of laboratory studies and a few numerical model results designed to simulate various types of gravity currents and isolate their salient features. This portion begins with an "anatomy" of the gravity current, noting its important physical features and distinguishing it from various types of waves, then continues with the descriptions of the particular aspects of flows in different settings (e.g. in the presence of ambient stratification or the earth's rotation). Although there is very little mathematical formalism in the book, the level of physical reasoning is aimed at the informed reader, most suitably in the range from advanced undergraduate to research scientist.

The major strengths of this work lie in its excellent phenomenological descriptions of gravity currents in the environment, supported by graphic, often dramatic, images collected from around the world. These images are supplemented by clear instructive schematic diagrams illustrating the processes at work. In the second part of the book, the author uses ingenious laboratory experiments, often his own, to reproduce the important aspects of the natural behaviour, then describes the physical mechanisms involved. Starting with the classical "lock exchange" problem, he proceeds to consider separately the effects of ambient stratification, turbulence, viscosity, suspended material, and rotation on the behaviour of simple gravity currents. In each case he uses clear physical reasoning to derive the governing parameters, then maps both laboratory and natural results in the appropriate parameter space. The reader is left with rich insights into these dynamic processes.

The primary weaknesses of the book are its superficial descriptions of some of the oceanic phenomena associated with gravity currents. In particular, the accounts of internal bores, turbidity currents, and tidal fronts are somewhat cursory and outdated with respect to recent work. A very brief reference is given to large scale geophysical flows, but there is no mention of deep overflow currents such as the Denmark Strait Overflow or Mediterranean Outflow, a notable omission of oceanic gravity currents at the largest scales. Furthermore, there are some glaring misprints/mistakes in the text; Canadians, at least, will wince at the reference to "Fisher River, Georgia, USA", which, according to the citation, is meant to be, "Fraser River, Strait of Georgia, BC, Canada."

In spite of the errors and omissions, the overall value of such a comprehensive guide to this ubiquitous process is unmistakable. It would be a welcome addition to the library of any scientist or student interested in fluid dynamics or the natural sciences.

Now to the Weather Confessions of a TV Weatherman

By Edwin Maher

Eagle Eye Publishing, 1996, Soft-bound
P.O. Box 5049, South Frankston
Victoria 3199, Australia.
Aus.$19.95 + $3 for postage/handling.

Book reviewed by Uri Schwarz

When I am asked what work I do, and I answer that I am a meteorologist, a weatherman, people's faces usually brighten and they start talking about their TV weatherman. That is the only type of weatherman (or woman) most of them know. No wonder that CMOS has been trying for quite some time to ensure the professional quality of TV weathercasters (as we now call them), because they have become our profession's shopwindow.

That raises, of course, the difficult question as to which type of expertise is more important for a TV weathercaster: meteorology or TV presentation; this is also discussed early in Maher's book. He quotes one of the first Australian TV weathercasters, meteorologist Bill Crowder, according to whom the TV industry has not yet reached a firm conclusion, but the pendulum may have swung in favour of expertise in TV presentation. I think David

Phillips, our well-known climatologist and himself a frequent presenter of weather lore on TV, has summed up what is needed (as quoted on the back-cover of Maher's book): "A good weather broadcaster must be a jack-of-all trades - a forecaster, computer technician, educator, journalist, psychologist and entertainer."

Maher's interesting and often amusing book of reminiscences - or confessions as he calls them - concentrates a great deal on Australia and New Zealand where he lives and works. As so many TV weathercasters, he started out from journalism and then, via radio, moved into TV. He shows that the move from radio to TV brought about also the birth of TV weathercasting: Jim Fidler, a young scientist in Indiana started radio weather broadcasts in 1934 and then began the first TV broadcast in Cincinnati in the late 1930's.

After the Second World War, TV weathercasting emerged in earnest, spreading quickly from the USA to the rest of the world. Canada's Percy Saltzman, complete with tossed chalk, is featured right after the beginnings in the USA. Many seniors will remember him as someone who brightened the TV news. He, too, came from the Weather Service, took to TV entertaining, and returned to weathercasting towards the end of his career.

The development of the physical props of TV weathercasting is also shown, sometimes with photos (of which the book abounds), from magnet-backed arrows and numbers to complex Chromakey, where weather charts, satellite pictures, etc., are fed into the camera, the shadow of the weathercaster is subtracted, and many other computerized, automated procedures take place, of which the watching public has no inkling.

The book is chock-full of amusing stories of planned and unplanned fun during TV weather forecast presentations, such as giving the forecast while standing on one`s head, or inappropriate things being said when the weathercaster thought that his or her microphone was switched off. Or the case of the British weathercaster broadcasting from the Liverpool dòcks as a streaker passed in front of the camera (complete with colour photo!). In Canada, we have hardly any meteorological TV comics; we probably take weather seriously here. But there are also heroic tales, such as the one of the Miami weathercaster who, during a hurricane which claimed 62 lives, stayed on the air the whole night, broadcasting from a bunker and telling people trapped in crumbling buildings how to remain as safe as possible.

A useful discussion concerns the meaning of weather terms. David Phillips is quoted as saying that meteorological terminology may well be clear to meteorologists but may mean something quite different to the public. The author mentions that terms such as "unsettled weather" or even "fair" are banned by Environment Canada. Accounts of weathercasting in Canada, Australia, the USA and Britain are amplified by vignettes from Germany to Hong Kong and from Switzerland to Saudi Arabia. They give the reader a birdseye view of the state of the art/science of weathercasting around the world.

And the future? Despite the rapid advances of satellite and computer techniques in depicting and even forecasting the weather and making it available via the Internet, the author is convinced that there will always be a demand for local forecasts presented by local personalities. And while some networks demand that weathercasters possess a degree in meteorology, he believes that it really comes down to the need to be able to communicate the information effectively. Well, we in CMOS, as our colleagues in the American Meteorological Society, agree with David Phillips that there is a need for both, meteorological knowledge as well as communication skills.

Nevertheless, Mr. Maher's chatty and easy-to-read book will be found informative, amusing and even thought-provoking by all concerned with TV weathercasting, and even by viewers interested in what is going on behind their screens.

Books in search of a Reviewer

John Lazier, BIO, has received from Cambridge University Press three books which are in need of a reviewer. The books are:

1. Currents of Change
   El Nino's impact on climate and society
   by Michael H. Glantz
   Cambridge University Press, 1996.

2. Perils of a Restless Planet
   Scientific Perspectives on Natural Disasters
   by Ernest Zebrowski, Jr.
   Cambridge University Press, 1997.

3. Regional Frequency Analysis
   An approach Based on L-Moments
   by J.R.M. Hosking and J.R. Wallis
   Cambridge University Press, 1997.

If you are interested in reviewing any of the books listed above or interested to become part of the reviewing team, please contact John at:

J_LAZIER@BIONET.BIO.DFO.CA

Patrick Duncan McTaggart-Cowan
1912 - 1997

Patrick McTaggart-Cowan died of a massive heart attack on Saturday, October 11, 1997 at Bracebridge, Ontario.

Pat first gained international fame as a transatlantic weather forecaster during World War II. He will be remembered by many pilots, meteorologists and all others involved in ferrying American-built aircraft over the ocean to Britain and the European war theatre. In the late 1930s he had been the prime developer of forecasting methods and procedures for the first flights of Pan American and Imperial Airways. Early in the war he was named Chief Meteorological Officer of the Royal Air Force Ferry Command and given responsibility for weather services for all Ferry Command delivery flights.

Patrick Duncan McTaggart-Cowan, son of Garry and Laura Alice (Mackenzie) McTaggart-Cowan, was born near Glasgow in Scotland in 1912 and emigrated as a child with his parents to Vancouver, Canada, a year later. An honours graduate in Mathematics and Physics from the University of British Columbia (1933), he was named a Rhodes Scholar and graduated from Corpus Christi College, University of Oxford in 1936. That year he was hired by the Canadian meteorological service and sent to Croydon airport to join a few young British meteorologists to study and teach themselves transatlantic meteorology and to develop forecasting methods for the planned experimental transatlantic flying boat flights.

After a six months' study period, Pat returned to Canada and was sent to Botwood, Newfoundland, to establish an aviation forecast office and become its officer-in-charge. The office was set up as a result of an earlier international agreement involving Canada, Britain, Ireland and the United States in which Canada assumed responsibility for all air traffic control, communications and meteorology services in Newfoundland and Canada for the flying boat flights. Pat hired and trained meteorological observers and worked with the wireless officers in developing procedures and schedules to obtain thousands of words of coded weather messages each day and to exchange analyses and forecasts with Britain and the United States. The first test of the new organization took place when successful flights took place between Botwood, Newfoundland, and Foynes, Ireland, in July 1937.

Very little was known of transatlantic meteorology sixty years ago. Beyond the regular North American and European station observations, the only pertinent information available to forecasters were observations from a few ships, and aircraft observations of the lower atmosphere taken in Newfoundland and Ireland. From these observations, the meteorologists attempted to forecast flying weather over the North Atlantic Ocean, a region that regularly experienced some of the most severe temperate-latitude cyclonic storms in the world. But, a successful system was devised by which very useful forecasts were prepared for each of ten zones across the ocean between Newfoundland and Ireland. Continuous wireless contact was maintained between the flying boats in flight and Botwood over the western half of the ocean and Foynes, Ireland over the eastern half.

The communications and meteorological systems were honed in 1937 and 1938 and, in the summer of 1939, forty-two flights were made by Pan American and Imperial Airways. Looking forward to the use of land-based aircraft flights, a Newfoundland airport had been opened late in 1938 at Gander and the meteorological office was moved there. Other meteorologists had arrived to assist McTaggart-Cowan but he was the one who travelled from Gander to Botwood to brief the flight captains whenever a flight was planned. When war was declared in September 1939, the governments decided to close down operations and to mine the runways to prevent possible enemy use. But McTaggart-Cowan and the other senior officers at Gander managed to keep the airfield open and both British Overseas Airways and Pan American Airways made several flights in 1940. By that time, the value of Gander to the Royal Canadian Air Force for antisubmarine patrols and for aircraft ferrying to Britain was realized. By 1941, the Royal Air Force had taken over ferrying operations and the American military forces began to use Newfoundland airport. McTaggart-Cowan facilitated their entry into transatlantic meteorology by sharing facilities and through the complete exchange of observations, forecasts, methods and personnel.

It was in these early war years that Pat won the acclaim of the military authorities for his organizational abilities and the respect of the ferry pilots for his uncanny accuracy in forecasting the weather for their transatlantic flights. It was the latter who, with mingled affection and exasperation when Pat found it necessary to forecast fog and poor flying weather, nicknamed him "McPhog" although to those who worked for him he was popularly known as "McT-C."

Pat became Chief Meteorologist with the RAF Ferry Command and moved to Montréal, Dorval airport, early in 1942 to direct all aviation weather services for the Command. Even with the administrative responsibilities, he kept a hand in forecasting until late 1944 when he spent several weeks in Chicago helping draft regulations for the proposed International Civil Aviation Organization. The next year he was named secretary for air navigation in the organization but, in 1946, Pat returned to the Meteorological Division headquarters in Toronto to become Assistant Director and to take charge of all forecasting work. He succeeded Andrew Thomson as Director in 1959.

During the twenty years following the war, despite staff shortages, Pat led the expansion of Canadian meteorology to meet the rising civilian demands for forecasts and services. Up-to-date manuals for observing, forecasting and communications were prepared and published; the structure of service was reorganized, the public weather forecasting service was decentralized, meteorologists were seconded to military and other civilian government agencies (Pat called it a single-service system to best utilize a small number of meteorologists in a large country), operational meteorologists were encouraged to do research (Pat was particularly interested in the jet stream), a Central Analysis Office was opened and an extensive facsimile network for distributing centrally-analyzed weather maps was developed - these are but a few of the postwar improvements Pat McTaggart-Cowan planned and successfully directed over those years.

Perhaps because he was forced to deal with shortages of trained personnel in those postwar years, Pat became interested in higher education and when offered the position of founding president of the new Simon Fraser University in Burnaby, British Columbia (suburban Vancouver) he accepted and left meteorology late in 1963. During Pat's postwar period in meteorology he had by no means limited himself to national service affairs. He was president of Canadian Branch of the Royal Meteorological Society in 1950-51 and a governor of the Arctic Institute in the 1960s. He was a vice-president in 1960-61 and a councillor at different times with the American Meteorological Society and was the author of the Society's organization plan in 1960.

After the war, during his period in meteorology, Pat was very active in affairs of the World Meteorological Organization. He was a leader in the postwar synoptic meteorology and aeronautics working groups where new codes and the details of the transmission of synoptic observations were determined. Later, when he became the Canadian director, he was a member of the Executive Committee (Council) from 1960 to 1964, first as an elected member and then as President of Region IV (North and Central America).

At Simon Fraser University, Pat dealt with the provincial politicians and bureaucrats, presided over the construction of the buildings, the recruitment of staff and the shaping of academic programs leading to the opening of the university in September 1965. It was, however, Pat's misfortune to become a university president during a period of major student unrest. University presidents at that time were often caught in untenable positions between Boards of Governors and the students. Pat left the university in 1968.

That year Pat was appointed executive director of the Science Council of Canada in Ottawa where his main role was in assisting Canadian industry to improve its competitiveness. In 1970, when a tanker went aground on the coast of Nova Scotia and spilled oil which covered 300 km of coastline, Pat was named by the government to direct the entire operation to clean up of the spill. The army, the navy and several civilian agencies were involved and Pat recruited scores of experts to work on the various associated problems. It was a major job and although most of the oil was reclaimed after several months, winter storms brought up more oil and the cleanup task took parts of the next three years.

Just before he retired from the Science Council in 1975, Pat became concerned about climate change and instituted a program called Living With Climate Change and directed meetings of scientists and government officials from Canada, the United States and Mexico in an attempt to warn governments and the public of the possible consequences. But it would be more than a decade before governments grasped the significance of the subject and began to take action.

Patrick McTaggart-Cowan was a much honoured and decorated man both at home and abroad. In Canada, he was made an Officer of the Order of Canada in 1979, a high honour for a Canadian civilian. He was awarded the Patterson Medal in 1965 for distinguished service to meteorology and, in 1967, the Centennial Medal. He was the recipient of seven honorary degrees including those from the universities of British Columbia, St. Francis Xavier, Lakehead, McGill and Simon Fraser. In 1944, the government of the United Kingdom made him a Member of the Order of the British Empire in recognition of his services to RAF Ferry Command. In the United States, he was awarded the Robert M. Losey Award of the American Institute of

Aeronautics and Astronautics in 1959 for his outstanding contributions to the science of meteorology as applied to aviation. The American Meteorological Society honoured him with the C.F. Brooks Award (1965) for outstanding services to the Society and the Cleveland Abbe Award (1976) for distinguished service to atmospheric sciences. He was an honorary member of the Canadian Meteorological and Oceanographic Society and an honorary member and fellow of the American Meteorological Society.

Pat led an active life in retirement although he turned down many appointments. For some time he continued as a member of the National Research Council's Associate Committee on Scientific Criteria for Environmental Quality and he served on the selection committee for the annual Royal Bank Award. On his farm at Bracebridge he kept bees, sold the honey and classed himself as a "non-viable farmer." He organized a local beekeepers' society and was proud to be an honorary life member of the Bracebridge Agricultural Society.

Patrick McTaggart-Cowan is survived by Margaret, his wife of 58 years; daughter Gillian, an oceanographer, and her family; and son James, a meteorologist, and his family; a brother, Ian, and a sister, Pamela Charlesworth.

Morley Thomas

Erhard Reinelt
1923 - 1997

Professor Emeritus, Erhard Reinelt, died on October 7, 1997, aged 74, in Vancouver. Art, as he was known to his friends, served in the Department of Geography at the University of Alberta from 1965 to 1987, following a career as a weather forecaster with the Meteorological Service, and "a late-life PhD", as he liked to say.

Art was well-known as a pioneer in satellite meteorology, having established the first "automatic picture transmission" receiver at a Canadian university. For more than a decade in the seventies and early eighties, his satellite meteorology laboratory provided cloud images to Edmonton TV stations and weather forecasters. In the classroom, his rather formal dress and manner were tempered by a ready smile and an eagerness to engage in friendly banter and witty repartee with his students. His wry sense of humour and his delight in the richness and clarity of the English language are captured in a short auto-biographical sketch which he wrote for a collection of essays in honour of Prof. Richmond W. Longley. Art was the co-editor of this festschrift along with Prof. Keith Hage. Here are the words he penned in 1978:

> *"Erhard R. Reinelt, a product of Alberta, Toronto, and 15 years with the Meteorological Service of Canada, was charmed by Dick Longley into joining him at the University of Alberta in 1965. A weather forecaster at heart, he actually preferred working the graveyard shift, because it provided him with both the maximum temptation and maximum opportunity to play God. Given to hyperbole, and a professor in spite of himself, he is wont to say that his specialty is generality, although, when pressed, will admit to having some affinity for the sloppier aspects of synoptic meteorology".*

Never one to blow his own horn, Art wouldn't appreciate someone doing it posthumously. Suffice it to say that his memory will be warmly cherished by members of the former Department of Geography, and especially by his many graduate students who are now boldly forecasting the weather across the country and around the world. We extend our sympathy to his wife Doris and his family, and we will miss him.

Rob Cross

Hubert H. Lamb
1922 - 1997
tribute to an old friend

Most weathermen have been brought up in physics, mathematics and chemistry. From these sources we have put together modern meteorology as an amalgam of physics and chemistry with complicated applied mathematics - the complexity of which has grown to the point where the *Quarterly Journal of the Royal Meteorological Society* is, and its competitors are, incomprehensible to most outsiders, who find Stephen Hawking or Roger Pentose easier to read. *Atmosphere-Ocean* is a bit easier, and so is Ed Lorenz' *The Essence of chaos* (Lorenz, 1993). But the impression I derive from our research journals is that we don't want any outsiders to know what we mean.

Hubert Lamb was entirely different. Every word he wrote was easily understood even by lay readers, though he was aiming at his fellow professionals, hoping to persuade them that there was more to meteorology than the Navier-Stokes equations. He had two basic interests - history and taxonomy - and these two disciplines applied to world climate and its interaction with human activities. Both interests turned out to be timely.

He was never really at home in the U.K. Meteorological Office, where such ideas were at odds with the thinking of the day, which was to move as quickly as possible towards numerical weather prediction. Sir Graham Sutton, his Director-General for several years, spoke warmly of his major book, *Climate: Present, Past and Future* (Lamb, 1972) as ..."a treasure house of information gathered in a lifetime of dedicated work... No other work in this field approaches it in scope and reliability" (p.xxiii, Vol.1). But others in Met. Office were less generous, and it was with relief to his friends that he accepted, in 1972, the new post of Director of the Climate Research Unit (CRU) at the University of East Anglia. With the enthusiastic support of the Dean of the School of Environmental Sciences, Keith Clayton, Lamb's Unit pushed forward to become one of the leading centres of research into global climate, precisely as the world as a whole was waking up to climate's importance. With the later help of Tom Wigley and a small crowd of dedicated workers, CRU played a key role in the assembly and standardization of world data for the *Intergovernmental Panel on Climate Change*. A close working relationship with the Hadley Centre for Climate Change at the Meteorological Office made England the chief supplier of reliable world data for the climatic research enterprise -- a fitting memorial to Hubert. Gordon Manley, in many ways his exemplar, would have been delighted.

But to return to his prime interests, he was obsessed with the taxonomy of weather types, in the fashion of Baur's Grosswetterlagen, initially as they affected the British Isles, but later as they underlay world climate as a whole. He was sure that the endless procession of weather changes could actually be classified into a finite number of types. He catalogued those applicable to the British Isles from 1861 onwards (Lamb, 1972). These have since been updated and rendered more objective. The series is available to 1995 (Hulme and Barrow, 1997) in a volume celebrating the twenty-fifth anniversary of CRU. I never shared Hubert's conviction that the continuum called climate could be so classified, and I recall arguing with him on commuter trains into London thirty years ago, when we lived only eight miles apart. But I must now yield the point.

As a historian of climate, Hubert pursued his second interest very much as a traditional historian would have done, and few other do. His deep interest in climatic change was focused on the historical epoch, i.e., the time of written records. He followed Gordon Manley's lead, and went well beyond it. His 1982 book *Climate, History and the Modern World*, dedicated to Moira, his wife, (Lamb, 1982), covers prehistory in a cursory fashion, and then focuses enthusiastically on later centuries as the written record became progressively stronger. The whole book depends on what we could now call proxy evidence. But the emphasis is away from palaeoecological and literary sources – until the modern epoch. No other work so clearly indicates what Hubert's intentions and achievements were.

He was a determined man, and would always state his views loudly and clearly. On one shared train journey out of Waterloo Station he and I were arguing (at midnight) loudly enough to have one of our fellow passengers ask us (impolitely) to shut up. Hubert apologized sincerely, but continued his exposition, declining to shut up. His persistence and advocacy were among the reasons why climate moved from being a poor relation in the meteorological world to its present status as a central concern of humankind. Loud voices were needed to bring this about, and Hubert's voice was among the loudest, and ultimately, one of the most persuasive. We shall miss him greatly.

References:

Hulme, M, and E Barrow, eds, 1997; *Climate of the British Isles*, Appendix B, London, Routledge.
Lamb, H.H., 1972; *Climate: Present, Past and Future*, 2 Vols. London, Methuen.
Lamb, H.H., 1982; *Climate, History and the Modern World*, London, Methuen.
Lorenz, F., 1993; *The Essence of Chaos*, Seattle, University of Washington Press.

F. Kenneth Hare, C.C., F.R.S.C.

Additional Information

Hubert Lamb was born September 26, 1922, the son of Professor E.H. Lamb of London, and grandson of the celebrated mathematician of the same name. He went to Trinity College Cambridge (as did Newton!) and eventually received his Sc.D. degree from Cambridge University. He was heavily influenced by Lewis F. Richardson, the pioneer of numerical weather prediction, and absorbed some of Richardson's Quaker heritage of goodwill and good works. He was Vice-President of the Royal Meteorological Society, from which he received the Symons Memorial Medal in 1987.

Summary of 12th Symposium on Boundary Layers and Turbulence

by Roland Stull[1,2]

The 12th Symposium on Boundary Layers and Turbulence (BLT12) was held in Vancouver, Canada, during 28 July - 1 Aug 1997. It was co-sponsored by the American Meteorological Society (AMS) and the Canadian Meteorological and Oceanographic Society (CMOS). The conference was held on the University of British Columbia (UBC) campus, where the local host was the Atmospheric Science Programme of the Dept. of Geography.

With 319 attendees from 18 countries (Table 1), this conference was about twice as large as any previous AMS conference on this topic. There were 23 oral sessions, of which 19 also had poster components (Table 2). A total of 159 oral presentations and 169 poster presentations were made. None of the sessions were parallel sessions. A prototype electronic web-based abstract submission and blt12 program display was also employed.

A new format was utilized in this conference to maximize the number of papers that could be presented. The six oral speakers of each of three morning session and seven speakers of the two afternoon sessions were allowed 10 minutes each, with no questions allowed from the audience. Timing was via a digital alarm clock that gave continuous display of elapsed time, so speakers could pace their talk. All questions were saved until the end of the session, when the speakers adjourned to a special location designated as the "Speakers' Corner". It was here that other participants could ask longer questions, and the speakers could utilize white-boards to sketch their answers. The "Speakers Corners" were concurrent with the coffee breaks.

Each of the three morning sessions also included about 10 poster presentations of 90 seconds each. In this short period, speakers were encouraged to limit their talk to three transparencies: first having the title, authors, affiliation, and poster number; second having a stimulating or provocative figure; and third having a summary list of conclusions. The actual poster display for all sessions was immediately after lunch, with cookies served in the poster area to attract attendees.

One of the sessions was to commemorate the 30th anniversary of the Kansas field experiment, an experiment that solidified belief in Monin-Obukhov similarity theory for the surface layer. This session included a panel discussion on the legacy of the Kansas experiment, with panelists Joost Businger, Frank Bradley, John Wyngaard, Soren Larsen, Paul Frenzen, Ulf Hoegstroem, and Frans Nieuwstadt. Also from the Kansas experiment was Duane Haugen, who was the banquet speaker. The participants in the Kansas field program and data analysis were honoured with the award of commemorative T-shirt, (Fig 1).

Table 1. Countries represented at the BLT12 conference, along with the number of participants from each.

187	United States
56	Canada
18	The Netherlands
9	Sweden
8	Germany
7	Switzerland
7	United Kingdom
4	Australia
4	Austria
3	Denmark
3	France
3	Italy
3	Spain
2	Israel
2	Japan
1	Korea
1	Mexico
1	New Zealand

As in the previous BLT conference, prizes were awarded to the best student presentations and posters. Oral Competition: 1st Place - Berenice Michels - 2.5 - A study of the effect of entrainment on mixed layer scaling; 2nd Place - Mark Piper - 11.2 - An investigation of surface layer turbulence during a frontal passage; and 3rd Place - Bart Brashers - 12.3 - Latent heat flux estimates from satellites. Poster Competition: 1st Place - Vadim Polonichko - 13.5 - Models and observations of Langmuir circulations; 2nd Place - Job Verkaik -15.8 - An evaluation of a K-Gill anemometer for turbulence studies; 3rd Place - Brian Pollard - 15.6 - A comparison

[1] Atmospheric Science Programme, Department of Geography, University of British Columbia, 1984 West Mall, Vancouver, BC V6T 1Z2, Canada.
(email: rstull@geog.ubc.ca)

[2] Summary published with the authorization of the American Meteorological Association (AMS).

of a volume-imaging radar with Large Eddy Simulations. We commend these students on their outstanding presentations.

The full preprint volume from this conference is available from the American Meteorological Society. Also, the following web page containing abstracts and author information will be maintained for two years after the conference: http://www.geog.ubc.ca/~blt12/.

Table 2. Session topics

1	Flatland/LIFT field program
2	Mixed layers and clear entrainment
3	Cloudy boundary layers
4	Cloudy boundary layers & cloud entrainment
5	Dispersion and concentration fluctuations
6	Stable boundary layer
7	Coherent structures and nonlocal parameterizations
8	Large-eddy simulation and direct-numerical simulation
9	Wavelets, fractals, and chaos methods
10	Boundary layer models
11	Surface layers
12	Ocean boundary layers
13	Marine surface layers
14	COAST96 field experiment
15	Instrumentation
16	Plant, soil, and biosphere micrometeorology
17	Field experiments
18	MERMOZ & BOREAS field programs
19	Urban BLs
20	Surface flux
21	Mountains and complex terrain
22	Boundary layer over heterogeneous surfaces

Acknowledgements: Sincerely appreciated is the major effort of screening the abstracts and chairing the sessions that was done by the other members of the program committee: Peter Bechtold, Stephen Burk, Richard Cederwall, Peter Duynkerke, James Edson, Chris Fairall, Pierre Mourad, Bill Neff, Tim Oke, Steven Oncley, Brian Sawford, and Peter Taylor. Chris Fairall is also commended for his role as Master of Ceremonies for the Kansas banquet and panel discussion. We thank Ed Andreas and Peter Taylor for judging of the student competition, and to Jim Edson for organizing it. Larry Greischar ran the poster sessions with his usual calm efficiency.

The following student volunteers performed outstanding jobs with the microphones, computers, timing, and sundry other activities associated with a successful conference: Larry Berg, Gordon Drewitt, Josh Hacker, Eva Jork, Henryk Modzelewski, Trevor Newton, Magdalena Rucker, Jenny Salmond, Edi Santoso, Aisheng Wu, and Li Xuhua. Deserving particular mention are Henryk Modzelewski, who spent countless hours designing and operating the web pages and broadcasting email messages, and Magdalena Rucker who arranged the projection and microphones and priced printing of the preprint volume.

The team from AMS headquarters are thanked for their tight and efficient control of the whole conference process: Debbie Fleming, Evelyn Mazur, and Karen Morrisey.

Summit of the Sea[3]

September 1-6, 1997

St. John's, Newfoundland.

The Summit of the Sea has come and gone. It turned out to be a great success despite the worries and set-backs that happened along the way. Concerns over attendance stayed with us until rather late in the day, but eventually a very healthy turnout of over 500 presented themselves, from forty-one countries. A few speakers dropped by the wayside due to various last minute problems, but only a few. The final list included the Heads of no fewer than five UN Organizations and a youth contingent of high school seniors from seven countries made sure that their presence was felt.

So what was achieved? One of the lasting impressions that I had personally was the seamless mix of the global ocean issues with those of Newfoundland and the Maritimes in general. The setting of the intense and personal local problems within the context of similar or related worldwide issues seemed to both personalize the need for action and highlight the need for nations to cooperate. For example, the problem of overfishing, that contributed to the local moratorium on northern cod, resulted in a call from the Conference for nations, including Canada, to ratify the UN Convention on Straddling Fish Stocks and Highly Migratory Fish Stocks. The Convention is in existence but needs ratification by another 15 nations in order to be brought into force.

[3] Ref: *CMOS Bulletin SCMO*, Vol 25, No.2, p.57.

That result was only one of many challenges laid down by the Conference. In fact the final declaration was called "***The Summit Challenge***", which challenged the participants, their governments and the relevant UN Organizations to address identified areas in fisheries, aquaculture, science and data, marine resources, pollution, management and law, security and culture. The Challenge was presented in draft form on the final day and will be finalized over the coming weeks.

The wrap-up session also gave an opportunity to the youth group to present their own views to the participants in an interesting and lively discussion period. In addition to the plenary sessions, the Core Conference gave many interest groups the opportunity to hold special sessions on related subjects. Taking advantage of this opportunity were such varied organizations as the Canadian Hydrographic Service, the Intergovernmental Commission, the United Nations Environment Programme, the Canadian military, the Engineering Council on Oceanic Resources, the Fisheries and Agricultural Organization and many others.

Predictably, the weather was unpredictable; however, the hospitality was good, the discussions interesting and the companionship marvellous. Many thanks to the tireless work of the Conference manager Dave Finn and his helpful crew.

Geoff Holland,
Department of Fisheries & Oceans
Chairman, IOC.

Project Atmosphere Report

The sky is the biggest science laboratory in the world (Roderick Scofield, P.H.D. NOAA) and it is absolutely free. Generations of sailors have looked to this laboratory to predict weather. (When the sun is in its house, it will rain).

Canadians are preoccupied with weather and no wonder; we have so much of it. Maritimers often muse, wait fifteen minutes and the weather will change. Children explore shapes in the clouds, farmers pray for rain and tourists hope for sun. Our lives are completely dependent upon weather.

It is little wonder, therefore, that students from primary to Grade 12 love to learn about weather. It is a common cross-curricular theme from English poetry to geography experiments.

CMOS and the American Meteorological Society (AMS) have teamed together to ensure that geography teachers are well-equipped to present weather and climatic principles to a wide audience of students.

"Project Atmosphere", hosted by AMS in Kansas City, Missouri, is an intense two-week program designed to make teachers knowledgeable about the science of weather. A typical day began with a lecture from a leading meteorologist in a respective field. All speakers were outstanding and made difficult concepts easy to grasp. The lecture was supported by sample lessons that turned the abstract to the concrete. A personal favourite was the afternoon weather briefing. AWIPS, a super-computer programmed with a variety of satellite imagery, produced time-sensitive models of daily weather events. This powerful tool made the amateur (me) feel like a professional forecaster. The afternoon session mirrored the morning format. A highlight of the daily routine was the hands-on teaching unit.

The lesson plans were designed to ensure that teachers became well-grounded in the elements of meteorology. Although these modules were created specifically for teachers, they can be easily tailored to fit any curriculum.

This workshop has been open to Canadian teachers for the last four years. This year, I was fortunate to be selected as the Canadian representative. It is interesting to note that the majority of teacher participants were elementary science teachers. As the only geography teacher, I was pleased to see how well the program paralleled the Grade 10 physical geography curriculum of Nova Scotia. In a sea of science teachers and meteorologists, I felt at home.

Each teacher attending the Institute must guarantee a minimum of two workshops to model the units. I am looking forward to sharing these lessons with Canadian teachers.

Project Atmosphere is a rewarding, highly-motivating experience. This is a testament to the expertise and enthusiasm of the organizing team. A heartfelt thank-you from Canada.

Helen McWilliams
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Note from the Editor:

Helen McWilliams is the successful candidate who attended the Project Atmosphere Workshop. This Summer Meteorology Workshop for pre-college teachers of Atmospheric Science topics is sponsored by the American Meteorological Society and the National Oceanic and Atmospheric Administration of the United States. The Workshop was held at the National Weather Service Training Centre, in Kansas City, Missouri, between July 21 and August 1, 1997. (Ref: CMOS Bulletin SCMO, Vol.25, No.2, p.56).

The International Conference on the World Climate Research Programme Achievements, Benefits and Challenges Geneva, Switzerland, 26-28 August,1997

Since the inception of the World Climate Research Programme (WCRP) in 1980, there have been major changes in the way the world perceives climate. Governments and industry at the highest levels have become concerned about the broad implications of climate variability and change for human well-being, ecosystems and economic development. The WCRP is the main international mechanism to foster and coordinate the essential basic research needed into the Earth's climate system and has laid the foundations for changing views on anthropogenic climate change, and opened up possibilities for increasingly confident seasonal and annual climate predictions. Bearing in mind the need for a critical overview of climate policy requirements, the international sponsors of the WCRP, the World Meteorological Organization (WMO), the International Council of Scientific Unions (ICSU) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO, jointly organized a major conference on the WCRP at the International Conference Centre of Geneva from 26 to 28 August 1997. The Conference was designed to offer research scientists, policy makers and technical experts alike the opportunity to review the accomplishments during the first seventeen years of the WCRP and to help set the course to meet the challenges facing the programme during the next ten to fifteen years.

The Conference attracted wide attention and well over 300 representatives from the climate research and policy communities from eighty different countries around the world participated. A welcoming statement was given by Mme. R. Dreifuss, Federal Councillor and Representative of the Federal Government of Switzerland, who stressed the importance of knowing as precisely as possible the extent and rate of climate change brought about by human activity. Opening addresses were also given by Professor G.O.P. Obasi, the Secretary-General of WMO, Professor W. Arber, the President of ICSU and Mr. G. Holland, the President of IOC.

The Conference was then treated to a series of reviews of progress made as a result of the WCRP and the practical accomplishments. This was followed by a series of presentations setting out the new challenges to be faced and the need to develop further inter-disciplinary cooperation to understand fully the effects of global climate change and climate variability. The strategy and plans proposed by the WCRP to carry forward the necessary activities were also described. The highlight of the Conference was the preparation of and agreement on a comprehensive statement taking stock of the achievements and benefits of the WCRP and considering the challenges lying ahead. The statement was addressed to the governing bodies of WMO, ICSU and IOC and through them to the governments of all nations, in particular the Parties to the United Nations Framework Convention on Climate Change and the United Nations Convention to Combat Desertification. The main points of the statement are summarized in the following paragraphs.

Need for commitment to the WCRP

The statement emphasized that, if nations are to be able to meet their fundamental obligations to ensure safety of their citizens, they must better understand, monitor, predict and manage the natural extremes of flood and drought and the threat of human-induced climate change in the decades ahead.

It is critically important that they now reinforce their commitment to cooperative international research through the WCRP and its associated global environmental observing, research and service programmes.

Achievements of the WCRP

The statement identified a number of significant contributions that have been made by the WCRP including:

- the capability to observe, describe and predict climate anomalies related to the ENSO phenomenon for several seasons in advance;

- improved modelling of the physical climate system, thereby providing increasingly confident predictions of climate variations and change;

- data analysis and model simulations that underpinned the first suggestion of a discernible anthropogenic climate change signal;

- vastly increased knowledge of the ocean circulation and its behaviour;

- raising the level of scientific, governmental and public appreciation of the importance of climate issues.

Research priorities and challenges

The overall research priorities for the WCRP for the next decade were seen to be:

- assessing the nature and predictability of seasonal to interdecadal variations of the climate system at global and regional scales, and providing the scientific basis for operational predictions of these variations for use in climate services in support of sustainable development;

- detecting climate change and attributing causes, and projecting the magnitude and rate of human-induced climate change, regional variations, and related sea level rise (as needed for input to the IPCC, UNFCCC and other Conventions).

To meet these objectives, numerous research challenges and issues have to be addressed:

- studying natural fluctuations of climate and investigating their predictability;

- assessing the potential effects of global warming on the frequency and intensity of natural fluctuations in climate;

- reducing uncertainties associated with the hydrological cycle and improving predictions of regional precipitation and run-off anomalies on time scales from seasons to centuries;

- obtaining a complete view of the world's ocean circulation and designing, in the light of new scientific results and technological developments, a global observational system for the oceans;

- improving our ability to provide longer-term warnings of floods and other extreme events;

- assessing the impact of aerosols on the climate system;

- refining estimates of the effects of trace (greenhouse) gases on global warming;

- exploiting all available data (including oceanic and palaeo-climatic) and model results in discerning climate change and its attribution to specific causes;

- investigating (with IGBP) the responses of terrestrial and marine ecosystems to climate variability and change;

- developing regional and smaller-scale models to give more realistic simulations of regional and local climate variations and change, with special attention to sensitive regions such as arid and desert areas;

- expanding activities in the WCRP to investigate the role of ice and snow, frozen ground and permafrost in climate;

- clarifying the impact of ozone depletion in the lower stratosphere and the increase of stratospheric water vapour on global climate;

- investigating the potential effects of emissions from the growing fleet of civilian aircraft.

Data requirements

The Conference also agreed that comprehensive observations of the climate system were critical, and noted with concern the decline in conventional observation networks in some regions. This was a serious threat to continuing progress in climate research, and to detection of climate change and attribution of its causes. Without action to reverse this decline and development of global climate observations, the ability to characterize climate change and variations over the next 25 years would be even less than during the past quarter century. In some regions, for example, drought-prone parts of Africa, climate change detection, prediction of seasonal and long term variations and reliable assessment of climate impacts could become impossible. The Conference urged that more financial support and commitment should be given to the Global Climate Observing System (GCOS), the climate-related aspects of the Global Atmosphere Watch (GAW), and the climate components of the Global Ocean Observing System (GOOS) and of the Global Terrestrial Observing System (GTOS). The Conference additionally recognized that long-term stable support must be provided for data management, information systems, analysis and reanalysis, quality control, data archiving and distribution. This must go hand in hand with free and unrestricted access to all climate-related data for research purposes (which is an agreed international obligation of the UNFCCC) and for protecting the safety of life and property. Finally, the importance of rescuing long-term historical data sets existing at present in non-electronic form before they are permanently lost was pointed out.

Capacity building

The Conference stressed that scientific capacity in climate research in developing countries must be fostered. In particular, a critical mass of research activities and of research scientists should be built up, centred round existing institutions where possible. Cooperation between developing countries in particular regions should be strengthened, and the funding required for sustained capacity building activities found. Developing countries should be encouraged to indicate their own priorities within the WCRP framework.

The full final text of the Conference statement is being widely distributed and will be included in the proceedings of the Conference, together with extended abstracts of all presentations made. The proceedings will appear as a major WCRP publication in the next few months.

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The Canadian GEWEX Research Program (MAGS)

by Wayne Rouse[4]

GEWEX is the acronym for Global Energy and Water Experiment. It is an international research program designed to understand and model the global energy and water cycles. Canadian GEWEX is focused on the energy and water cycling in the Mackenzie Basin, hence the acronym MAGS for Mackenzie GEWEX Study. The reasons for selection of the Mackenzie Basin for concentrated research efforts are as follows. Canadian researchers can make special contributions to the global GEWEX program because of their extensive research experience with high latitude energy and water cycling systems. The Mackenzie is the largest north-flowing river system which empties into the Arctic Basin from Canada and one of the largest in the world. The Mackenzie River is a major contributor of fresh water to the Arctic Basin. In common with other high latitude regions, the year to year variability in climate and the water balance in the Basin is large and impacts from climate change are also likely to be large. Monthly temperature deviations from the normal as large as 12 C are not uncommon in the winter and early spring months. In this relatively low precipitation region, it is the spring snow melt which exerts the largest influence on river flow. Variability in the overall depth of the snow pack and the rapidity of melt results in interannual variations, measured near the mouth of the Mackenzie, as large as 100% in the peak runoff month of June. Mid-summer variability is equally as large, being influenced by both the antecedent snow-melt regime and by summer precipitation amounts. Such variability exerts strong impacts on the salinity of the central Arctic Ocean basin and especially its peripheral seas.

MAGS research is designed to understand, quantify and model terrestrial land-atmospheric energy and water cycling in the Mackenzie Basin. The eventual goal is to improve monthly and seasonal prediction of these cycles. The major water vapour inputs to the basin derive from the north Pacific Ocean and exports are downstream to central Canada.

Convective processes involve precipitation to and evaporation and sublimation from the surface. Surface water is lost through basin runoff into the Beaufort Sea. The annual net water balance may not be zero, as substantial water storage can occur in the extensive wetlands, large lakes and in glacier ice. All of the horizontal and vertical water cycling is accompanied by energy cycling. One major mandate of MAGS is to research and model the atmospheric and surface components of the system and to aggregate the components into a basin-wide model system. A second equally important mandate is to increase our understanding of, and ability to model, all high latitude meteorological and hydrological processes. Special features of these systems include condensation and cloud-forming processes in different seasons, precipitation mechanisms and types, redistribution of snow on the ground, sublimation and evaporation processes in cold environments, energy, water and permafrost interactions, the role of very large lakes and of wetlands in the energy and water cycles of cold environments and the accurate measurement and modelling of solar and net radiation, temperature and snow and rain amounts in a data-sparse region. Detailed surface process studies are concentrated in sub-basins in the continuous permafrost environment in the vicinity of Inuvik, N.W.T., in a discontinuous permafrost mountainous environment of the southern Yukon, in a wetland discontinuous permafrost region near Fort Simpson, N.W.T. and at a boreal forest site representing the southern part of the Mackenzie Basin. Enhanced river discharge measurements are also being undertaken within specific sub-basins. Tools which will be explored and exploited involve the use of various forms of remote sensing (satellite, aircraft, radar) and the employment of regional meteorological models and land-surface segments of general circulation models. MAGS involves the efforts of government and university research scientists.

Research programs of both government and university researchers are fully cooperative and in a number of cases closely integrated. Financing of MAGS is provided by government agencies and by the Natural Sciences and Engineering Research Council of Canada (NSERC).

Segments of the research have been ongoing for three years and partial financial backing for this first phase MAGS is secured for a further three years. A major thrust of the program is a concerted measurement program called CAGES (Canadian GEWEX enhanced study) in which all components of MAGS will be undertaken simultaneously for a water year. CAGES will commence in early summer of 1998.

The enhanced observation plan of MAGS represents an integral part of an international effort striving to improve the representation of land area water and energy cycles within climate and other models. The observational component is being supported by the leading weather prediction centres around the world. This effort is being coordinated through the Working Group on Numerical Experimentation to ensure that there is a maximum international involvement in the development of the assimilation fields, in the analysis of the ensuing information, and in the transferability of information from other regions to MAGS and from MAGS to other regions. There will be a large international community concerned with the analysis of the comprehensive information being obtained within MAGS. This includes four other continental-scale GEWEX experiments

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focused on the Mississippi Basin, the Amazon Basin, the Baltic Sea and Siberia. MAGS has the personnel and resources to provide the most comprehensive data set possible for a north-flowing major river system to the international scientific community.

The eventual outcome of MAGS, the development of fully coupled models to simulate the seasonal water and energy cycles over the basin, will allow for more credible predictions of climate variability. This information is needed as Canada strives to understand how climate change may affect us all, or as specific groups that would be most directly affected by climate in or near the Mackenzie Basin. These latter groups include, for example, aboriginal people, hydroelectric agencies, other natural resource industries, communication and tourism.

The address of the MAGS homepage is http//www.tor.ec.gc.ca/GEWEX/MAGS which is regularly updated. It contains news of all meetings and other events of significance to MAGS. Also information can be obtained from the Secretariat.

Secretariat, Canadian GEWEX Program
National Hydrologic Centre
11 Innovation Blvd., Saskatoon, SK S7N 3H5
Tel: (306) 975-5809; Fax: (306) 975-6516

MIT Professor Visits University of Victoria

MIT Professor Emeritus Edward N. Lorenz recently spent three days visiting the University of Victoria's School of Earth and Ocean Sciences and the AES's Canadian Centre for Climate Modelling and Analysis. Prof. Lorenz is a remarkable man who, in his eightieth year, gave three lectures in as many days and was also able to sustain an intense schedule of scientific visits and discussions.

His third talk, which described collaborative research with MIT's Prof. Kerry Emanuel, dealt with the very contemporary question of where to optimally take a supplemental weather observation (assuming such a luxury is possible), or conversely, where to optimally take a reduced number of observations.

Prof. Lorenz used a simple chaotic model which generates weather like variability on a 40 point latitude circle to illustrate a novel new approach to this problem. Half of the circle was arbitrarily labelled "land", and the half was labelled "ocean". He examined how well one could forecast future states of this model (at 6 hour, 12 hour, 24 hour, etc., leads) if you had 20 fixed land stations and one ocean station. He showed that one could do reasonably well with a judiciously chosen ocean point. If one had some knowledge of where to expect activity during the forecast period, and if an observation could be taken from that point, one could do better. Prof. Lorenz showed that breeding methods could be used to identify the location that should be sampled. He then asked whether the fixed land observations were really needed at all. The answer, for his simple model, is that only 3 or 4 observations are needed for each forecast cycle if there are no restrictions on where those observations can be taken. Similar results were obtained when a constraint was placed on the distance that an observing point can be moved between successive forecast cycles. Prof. Lorenz plans to extend this work to more complex models and to consider the effects of further restrictions on sampling.

Prof. Lorenz's work challenges us to think, at least briefly, about the conventional notion of the "ideal" observing system as one that is fixed in space and has more or less uniform global coverage. In the discussion, Prof. Lorenz emphasized that the conventional, fixed system should never be scrapped. There is an unassailable need for the conventional network of accurate long term in-situ observations, and it deserves the strongest protection possible. One can, however, imagine a new breed of satellites that are designed to probe points in the atmosphere within their field of view on demand rather than continuously. Such satellite systems would presumably be substantially cheaper to build and operate than present systems because they would need to return only a fraction of the data returned by present systems.

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Atmosphere-Ocean Volume 35-4

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Ocean Circulation and Climate
The Conference of the
World Ocean Circulation Experiment
Halifax, Nova Scotia, Canada
24 - 29 May 1998

WOCE is a component of the World Climate Research Programme investigating the role played by the ocean circulation in the earth's climate system. Its aim is to develop improved ocean circulation models for use in climate research. Planning started in the early 1980s to take advantage of new earth observing satellites and of the advances in computer power to model the global ocean.

The WOCE observational phase from 1990-1997 has used satellites and *in-situ* physical and chemical measurements to produce a data set of unprecedented scope and precision. It has resulted in the development of new observational techniques that have changed our view of the oceans. None of this would have been possible without the wholehearted co-operation of scientists in the over 20 countries involved.

WOCE is now entering its phase of Analysis, Interpretation, Modelling and Synthesis (AIMS) which will continue until 2002. The reconciliation of model results and observations, and ultimately the assimilation of ocean data into models, presents the ocean science community with a novel set of challenges. The results from WOCE are having a profound influence on understanding the physics, chemistry and biology of the world's oceans and their interaction with the atmosphere.

Science Organizing Committee

Prof Gerold Siedler, Chair, Germany;
Dr Trevor McDougall, Australia;
Dr Bernard Barnier, France;
Prof Carl Wunsch, USA;
Dr Nobuo Suginohara, Japan;
Dr Allyn Clarke, Canada;
Dr John Gould, WOCE/IPO, UK;
Dr Andrea Frische, WOCE/IPO, Germany.

The Conference

The 1998 WOCE Conference "Ocean Circulation and Climate" marks the end of the observational phase and looks towards the challenges of WOCE AIMS. It will be WOCE's first global meeting since the 1987 Planning Conference in Paris.

It will provide an opportunity for scientists who have been involved in the observational and modelling activities to display the progress made towards the programme's objectives and to highlight the intellectual challenges that remain to derive maximum benefit from the enormous investment already made in WOCE.

It is planned to issue the first set of WOCE data CD-ROMs to conference participants.

The conference is sponsored through the WCRP by the World Meteorological Organization, the Intergovernmental Oceanographic Commission, the International Council for Scientific Unions and the Scientific Committee on Oceanic Research. It will be organized in association with the Canadian Meteorological and Oceanographic Society and the Department of Fisheries and Oceans.

Conference Structure

Registration will commence on Sunday, 24th May 1998. In order to provide the greatest opportunity for interaction between the scientists with varying interests. There will be no parallel sessions. Each day will have a particular theme relating to the overall objectives of WOCE:

- WOCE Overview - its Origins, Technologies and Issues;
- The Large-Scale Heat, Freshwater, Carbon and Momentum Fluxes;
- The Global Flow Field;
- Formation and Circulation of Water Masses;
- The Future.

A series of invited plenary lectures will be given in the mornings. Afternoons will be dedicated to posters. Posters will, as far as possible, be related to the daily themes and will be available for viewing throughout each day. The list of plenary session speakers has been published in the second announcement already issued in August 1997.

Poster submissions

The call for poster presentations will be made in August 1997 with a submission deadline of February 1998. A book of poster abstracts will be produced prior to the meeting.

Venue

The Conference will be held in the Halifax World Trade and Convention Centre located in the centre of Halifax, the capital of Nova Scotia. It is within easy reach of hotels, shops, restaurants and local transportation. It is close to various historical sites and to the Halifax waterfront.

Accommodation

A block of rooms is being held in three business class hotels linked to the Conference Centre by enclosed pedways. Other accommodation options will range from luxury hotels to university dormitories.

Registration

Completion of the registration form found on the WOCE Conference WWW Page

http://www.soc.soton.ac.uk/OTHERS/woceipo/wconf

will ensure that you receive the second circular (issued in August 1997) containing details of the plenary lectures, poster submissions and accommodation options.

Travel Support

Limited funding will be available to support the participation of students presently or planning to be involved in WOCE research and to scientists from countries with emerging economies. An indication of whether you may require support should be made at the time of initial registration.

Sponsorship

The organizers welcome financial sponsorship of the conference. This could be in the form of sponsorship of specific events such as receptions and coffee breaks or could be used to reduce the planned conference registration fee or to fund travel grants. The Director of the WOCE Project Office would be happy to discuss any offers of sponsorship.

1998 CMOS Congress 1998

Visit their homepage:
dfomr.dfo.ca/science/ocean/cmos/congrs98.html

You will find up-to-date information on registration, accommodation, abstracts and the scientific program. The selected hotel to hold the Congress is the Dartmouth Holiday Inn. This choice should minimize transportation cost and allows for reduced rates for the conference registrants.

The selected theme for the 1998 Congress is:

Atmosphere-Ocean Climate Variability.

Note also that contrary to what was announced earlier, the dates of the Congress are from the 1st to the 4th of June, not the 5th.

Oscar Koren has arranged for Air Canada to be designated as the carrier for CMOS annual congresses. AC was designated for '97 also but insufficient members used the service for us to obtain any free passes. Congress '98 will not benefit because any free tickets will not be available until the following year. However, if more members use the service this year that would help CMOS.

Oscar has noted that a positive response from Air Canada has been received. Call Air Canada at 1-800-361-7585 and take advantage* of:

- Special convention rates for travel within North America, the Caribbean, Bermuda and Mexico;
- Substantial savings with Air Canada and Continental Airlines' joint Convention fares;
- Aeroplan or OnePass miles that can be redeemed on any Air Canada or continental route, worldwide;
- Savings up to 50% on the regular Economy Class Fares; and finally,
- Overseas passengers will be offered the best available fare.

By ensuring your Event Number **CV982085** appears on your ticket, regardless of the fare purchased, you will help support your organization financially.

* certain rules and conditions will apply.

1998 Congrès de la SCMO 1998

Consultez leur page d'accueil:
dfomr.dfo.ca/science/ocean/cmos/congrs98.html

Vous y trouverez des renseignements pertinents sur l'enregistrement, le logement, la présentation des résumés ainsi qu'une description du programme scientifique. L'hôtel choisi pour la tenue du congrès est le Holiday Inn de Dartmouth. Ce choix devrait minimiser les frais de transports en plus des prix réduits pour les congressistes.

The thème choisi pour le congrès de 1998 est:

Changement climatique dans l'atmosphère et l'océan.

Prière de noter également que contrairement à ce qu'il a été annoncé au départ, les dates du congrès sont du 1er au 4 juin, et non jusqu'au 5.

Technical Conference on Meteorological and Environmental Instruments and Methods of Observation (TECO-98) with Exhibition (METEOREX-98) 13 to 15 May 1998

Conference Announcement

The World Meteorological Organization is pleased to announce the WMO Technical Conference on Meteorological and Environmental Instruments and Methods of Observation (TECO-98) with Exhibition (METEOREX-98), 13 to 15 May 1998 in Casablanca, Morocco.

The Conference will immediately follow the forthcoming twelfth session of the WMO Commission on Instruments and Methods of Observation (CIMO-XII, 4 to 12 May 1998, Casablanca, Morocco) and will be held at the same venue. Under the conference theme:

Measurements: a widening horizon of technology and applications

Experts from National Meteorological and Hydrological Services, research institutes and the private sector will address the following main subjects:

1. New developments, operational experience and results of intercomparisons in meteorological and environmental measuring technology related to:

- Surface measurements including sensors, automatic stations and systems for specific applications and requirements;

- Upper-air in situ measurements, including alternatives for OMEGA-dependent wind finding systems;

- Surface-based remote sensing techniques.

2. Quality management, sensors calibration technology and methodology, validation of surface-based remote sensing systems.

3. Management and cost aspects related to instruments and observing methods; technology transfer; capacity building including training needs and opportunities.

Simultaneous interpretation of English, French, Russian and Spanish will be available. Abstracts of proposed papers, not exceeding half a page, are to be sent to the WMO Secretariat by 31 October 1997. It is intended to publish the accepted papers prior to the TEC0-98 in the WMO Instruments and Observing Methods Report series. Details on the format of the papers and presentations will be contained in the acceptance letter to be sent to authors.

Chairperson of the Organizing Committee:

Dr A. Van Gysegem,
Institut royal météorologique de Belgique,
3 Av. Circulaire, B-1180 Bruxelles, Belgique
Tel: (+32 2~ 3730 562; Fax: (+32 2) 3751 259
E-mail: Andre.VanGysegem@mailserv.oma.be

WMO point of contact:

Mr K. Schulze, WMO, WWW Department,
P.O. Box 2300,
CH-1211 Geneva 2, Switzerland
Tel: (+ 41 22) 7308 409; Fax: (+41 22) 7330 242
E-mail: schulze@www.wmo.ch

AES Point of contact:

Bruce Angle
Atmospheric Environment Service
4th Floor, North Tower
Les Terrasses de la Chaudière
10 Wellington Street
Hull, Québec K1A 0H3
Tel: (819) 997-3844; Fax: (819) 994-8854

or: Mary Regan
Tel: (819) 994-4320
E-Mail: Mary.Regan@ec.gc.ca
Address and fax number as above.

NUMERICAL METHODS for ATMOSPHERIC and OCEANIC MODELLING: The André J. Robert Memorial Volume

This CMOS book will be available at the end of November. You can read the abstracts on the CMOS Homepage. If you have not ordered your copy yet, please contact NRC Research Press at:

Tel: 613-993-0151;
Fax: 613-952-7658;
researchjournals@nrc.ca

Ce livre de la SCMO sera disponible à la fin de novembre. Vous pouvez consulter les résumés à la page d'accueil de la société. Si vous n'avez pas encore commandé votre copie, contactez les Presses scientifiques du CNRC à:

Tél: 613-993-0151;
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The Thermohaline Circulation
European Geophysical Society
Nice, France
April 20-24, 1998

The aim of this session is to bring together scientists studying the thermohaline circulation (THC) from observations or from model results. This is timely for two reasons:

1. The WOCE experiment is providing a wealth of new high quality measurements that lead to much better descriptions of the large scale THC and associated heat, freshwater, geochemical fluxes in various basins of the world ocean.

2. There is a mounting evidence from both observations and models that the THC varies on large range of time scales from seasonal to secular. Which of these are internally generated and which are externally forced ? How does the oceanic variability couple to the atmospheric variability ?

Detailed information about the Nice EGS General Assembly is available on WWW at:

http://www.copernicus.org/EGS/EGS.html
email:egs@copernicus.org

Alain Colin de Verdière
Laboratoire de Physique des Océans
B.P. 809
29285 Brest cedex
Tel: 02 98 01 62 24; Fax 02 98 01 64 68

or Jocelyne LE GALL
DRO/UM/LPO
IFREMER/Centre de Brest
B.P. 70
29280 Plouzane
Tel: (33) 98.22.42.76

Call for Papers
32nd Annual CMOS Congress
Dartmouth, N.S. --- 1-4 June, 1998

The Halifax Centre of the Canadian Meteorological and Oceanographic Society (CMOS) will host the 32nd Annual CMOS Congress at the Holiday Inn in Dartmouth, N.S. during 1-4 June, 1998. The theme of the congress is *"Atmosphere-Ocean Climate Variability"*, to reflect major national and international research initiatives in this field. Contributions are particularly sought in areas of climate variability and impacts at both global and regional scales, but oral or poster papers and commercial exhibits are invited from all areas of meteorology and oceanography. Special sessions are presently planned for WOCE/CLIVAR research, Arctic marine and atmospheric chemistry, biological cycles and ocean biogeochemistry at high latitudes, and forecasting of the coupled atmosphere-ocean system. Additional sessions will be organized according to the scientific content of the contributions. As well, one of the congress days will be designated for Education, and another for Industry, in order to encourage the participation of local educators and to showcase the work of local industries.

Immediately preceding the CMOS Congress, the Conference of the World Ocean Circulation Experiment will be held in Halifax, N.S., during 24-29 May, 1998.

CMOS abstracts must be received by the Scientific Program Committee (Co-chairs: P.C. Smith, D.G. Wright) by 5:00 PM on Friday, February 6, 1998. Authors are strongly encouraged to submit abstracts via E-mail. A template for sending an electronic abstract may be obtained from the conference web site:

http://dfomr.dfo.ca/science/ocean/cmos/congrs98.html

For those without Internet access, a template and instructions may be obtained by sending an E-mail message to:

template@georgs.bio.dfo.ca

The automatic reply will contain all the information needed to submit an abstract via E-mail. The Committee will greatly appreciate all efforts to submit abstracts electronically, as this will facilitate the approval and printing processes considerably, and produce a faster response to the authors. Hard- (paper) and soft-copy (diskette) submissions will also be received by:

Dr. Peter C. Smith, Co-chair
CMOS Congress '98 Scientific Program
Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, N.S. B2Y 4A2 CANADA

For soft-copy submissions, please use either MS-Word, Word Perfect, or Word Star, and label the diskette with the name and version number of the word processor used. Most questions regarding CMOS Congress '98 may be answered by accessing the homepage address given above. For other general inquiries regarding the scientific program, please contact Dr. Peter Smith at:

E-mail: pc_smith@bionet.bio.dfo.ca
Tel: (902) 426-3474 or (902) 426-3857;
Fax: (902) 426-7827.

For general inquiries regarding registration, accommodation, or other local arrangements, please contact Dr. Clive Mason at:

E-mail: c_mason@bionet.bio.dfo.ca
Tel: (902) 426-6927 or (902) 426-3857;
Fax: (902) 426-7827.

Invitation à présenter des communications 32ième congrès annuel de la SCMO Dartmouth, N.-É.--- 1 au 4 juin 1998

Le centre d'Halifax de la Société Canadienne de Météorologie et d'Océanographie (SCMO) sera l'hôte du 32e congrès annuel de la SCMO qui se tiendra à l'hôtel Holiday Inn, Dartmouth, N.-É. du 1er au 4 juin 1998. Le thème du congrès, la " *Variabilité du climat atmosphère-océan*", a été choisi pour refléter les importantes initiatives de recherche entreprises au niveau national et international dans ce domaine. Nous invitons les auteurs à soumettre des résumés en particulier dans les domaines de la variabilité climatique et de ses impacts autant au niveau global que régional, mais également dans tous les domaines de la météorologie et de l'océanographie en présentation orale, en affiche ou en kiosque commercial. A l'heure actuelle, des sessions spéciales sont prévues pour la recherche WOCE/CLIVAR, la chimie marine de l'arctique, les cycles biologiques et la biogéochimie de l'océan aux hautes latitudes, et finalement, pour la prévision du système couplé atmosphère-océan. Des sessions additionnelles seront ajoutées en fonction du contenu scientifique des résumés soumis. De plus, une des journées du congrès sera dédiée à l'éducation et une autre à l'industrie, pour encourager la participation des éducateurs de la région et pour offrir une vitrine de présentation du travail des industries de la région.

Il est à noter que la conférence " World Ocean Circulation Experiment " se tiendra à Halifax immédiatement avant le congrès de la SCMO, du 24 au 29 mai 1998.

Les résumés des communications pour le congrès de la SCMO devront être reçus par le comité du programme scientifique (co-présidents: P.C. Smith et D.G. Wright) avant 17h00 HNM, le vendredi 6 février 1998. Nous encourageons fortement les auteurs à soumettre leur résumé par courrier électronique. Un formulaire pour envoyer un résumé par voie électronique peut être obtenu au site WEB du congrès:

http://dfomr.dfo.ca/science/ocean/cmos/congrs98.html

Pour ceux qui n'ont pas un accès à Internet, un formulaire avec les instructions pertinentes peuvent être obtenus en envoyant un message par courrier électronique à:

template@georgs.bio.dfo.ca

Une réponse automatique fournira l'information nécessaire pour soumettre un résumé par courrier électronique. Le comité vous sera grandement reconnaissant de vos efforts pour soumettre les résumés par voie électronique puisque ceci facilitera les processus d'approbation et d'édition tout en permettant une réponse plus rapide aux auteurs. Les résumés peuvent également être soumis sous forme papier ou sur disquette par courrier à:

Dr. Peter C. Smith, co-président,
Programme scientifique, Congrès de la SCMO 1998,
Institut océanographique de Bedford,
C.P. 1006,
Dartmouth, N.-E. B2Y 4A2 CANADA

Pour les soumissions électroniques, veuillez utiliser MS-Word, WordPerfect ou Word Star et indiquer sur la disquette le nom et la version du traitement de texte utilisé. La plupart des questions pour le congrès 1998 de la SCMO ont leur réponse au site Internet cité plus haut. Pour d'autres questions d'ordre général concernant le programme scientifique, vous êtes prié de contacter Dr Peter Smith aux coordonnées suivantes:

E-mail: pc_smith@bionet.bio.dfo.ca
Tél.: (902) 426-3474 ou (902) 426-3857;
Fax: (902) 426-7827.

Pour des questions d'ordre général concernant l'inscription, le logement et autres informations locales, vous êtes prié de contacter Dr Clive Mason aux coordonnées suivantes:

E-mail: c_mason@bionet.bio.dfo.ca
Tél.: (902) 426-6927 ou (902) 426-3857;
Fax: (902) 426-7827.

Call for Papers
Environmental Prediction Workshop
Halifax, N.S. – February 17-19, 1998

As part of its commitment to expanding knowledge for sustainable development, the Atlantic Region of Environment Canada will be hosting a workshop on Environmental Prediction in Halifax on February 17, 18 and 19 of 1998.

The goals of the workshop are:

- to share knowledge from environmental experts who either are using or could use predictive techniques in their work;
- to study prediction models being used in non-traditional areas;
- to bring together information on what is being done in the area of environmental prediction;
- to expose users of environmental data to new analytical techniques and methods;
- to better understand the effect of changing environmental conditions on ecosystems;
- to identify better ways to use predictive outputs in decision and policy making.

Examples of areas from which contributions are sought:

- hydrology, oceanography, fishery and forestry applications;
- air and water quality and pollutant transport, impact of modelling pollutants;
- artificial intelligence applications;
- environmental data and monitoring;
- data sources and methods;

Oral or poster papers and exhibits are invited from all areas that are related to these topics. Oral presentations will be expected to be of the order of 15 to 20 minutes.

This is a preliminary call for papers. More details will follow regarding location, names of invited speakers, etc. A workshop web site will be established on Environment Canada's Green Lane (www.ns.ec.gc.ca) to keep participants informed of the latest developments regarding the workshop.

Abstracts must be received by the Program Committee by December 31, 1997. Authors are encouraged to submit abstracts via E-mail. Send abstracts to any one of the following committee members:

Mr. Steve Miller, Chair
Maritimes Weather Centre
1496 Bedford Highway
Bedford, N.S. B4A 1E5
email: steve.miller@ec.gc.ca
Tel: (902) 426-7576

Dr. Tom Clair
Canadian Wildlife Service
P.O. Box 6227
Sackville, N.B. E0A 3C0
email: tom.clair@ec.gc.ca
Tel: (506) 364-5070

Dr. Peter Eaton
Environmental Protection Branch
45 Alderney Drive
Dartmouth, N.S. B2Y 2N6
email: peter.eaton@ec.gc.ca
Tel: (902) 426-4491

Dr. Hal Ritchie
Atmospheric Science Division
1496 Bedford Highway
Bedford, N.S. B4A 1E5
email: ritchie.harold@ec.gc.ca
Tel: (902) 426-5610

CMOS Prizes and Awards: REMINDER

The Canadian Meteorological and Oceanographic Society's annual call for nominations for Prizes and Awards is under way. All Society members are **strongly** encouraged to consider nominating individuals of the meteorological or oceanographic community who have made significant contributions to their fields. The award categories are:

1) President's Prize;
2) Tully Medal in Oceanography;
3) Applied Meteorology;
4) Applied Oceanography;
5) Operational Meteorology;
6) Graduate Student;
7) Environmental Citation;
8) Media Weather Presentation.

Each category has different and specific nomination criteria which must be met before any nomination can be considered. For details, please see p. 134-135 of Vol. 24, No.5, October 1996, *CMOS Bulletin SCMO* or contact D. Phillips (address below).

Each year there is a deadline of January 31 for nominations to be received by the secretary.

Mr. Dave Phillips, Secretary
CMOS Prizes and Awards Committee
200-1200 West 73rd Avenue
Vancouver, B.C. V6P 6H9
Tel: (604) 664-9185; Fax: (604) 664-9004
e-mail: dave.phillips@ec.gc.ca

McGill University

New Faculty Position

Environmental (Atmospheric or Oceanic) Chemistry

This new appointment is for a joint, tenure-track Assistant Professor in Environmental (Atmospheric or Oceanic) Chemistry shared between the Department of Atmospheric and Oceanic Sciences and the Department of Chemistry.

Applicants for this position should have a Ph.D. degree and will normally have had postdoctoral or industrial experience in a research field of interest to the hiring departments. The successful applicant will be expected to teach at the undergraduate and graduate levels, and also to participate in the newly created, undergraduate McGill School of the Environment, supervise graduate research, and establish a vigorous research program. The minimum salary for an Assistant Professor is currently $43,000 per annum. Review of applications will begin immediately and will continue until the position is filled, with the latest starting date being September 1, 1998. For more information about McGill University and the two Departments involved, see

http://www.mcgill.ca.

Candidates should forward a curriculum vitae, a research proposal (including details of start-up funds necessary), and arrange to have at least three letters of recommendation sent to:

Professor Ian S. Butler, Chair
Department of Chemistry, McGill University
801 Sherbrooke St. West, Montréal,
Québec, Canada H3A 2K6

In accordance with the Canadian employment and immigration regulations, this advertisement is directed to Canadian citizens and permanent residents of Canada; however, applications from all outstanding candidates will be considered. McGill University is committed to equity in employment.

From the NSERC Newsletter - Contact

Giving Thanks...

If you've just finished a successful summer in the field, chances are that you owe some of that success to local people. Why not take a few minutes then, to send a note of thanks? Or, let us join you in thanking them.

Remember, if you are funded by NSERC in any capacity, you may nominate private citizens who have provided assistance, or material or logistic support. For instance, a chemical engineering professor at Dalhousie University recently nominated two employees of an American firm that gave him access to its testing facility near Kansas City, Missouri, and paid for the materials needed as well. He estimated the cash equivalent of the firm's contribution at $60,000, and said that the research could not have been undertaken without this support. Both individuals also displayed a keen interest in the personal well-being of the Ph.D. candidate under the professor's supervision who spent the summer there, providing him with a wonderful training opportunity.

Now, more than ever before, when the research enterprise is in need of public support, it is particularly important for researchers to take the time to communicate with the public and in doing so, help to build support for research sponsored by NSERC.

To nominate one or more individuals, just send us a note including details of how they helped you as well as their name and mailing address, and we'll send them a "Friend of NSERC" certificate thanking them on your behalf and NSERC's for their help (note: the intent is not to recognize personal acts of kindness and courtesy - that is left to the individual who experienced them).

<u>Address nominations to:</u>

Friends of NSERC
Communications Division
NSERC
Ottawa, Ontario K1A 1H5
Fax: (613) 943-0742;
E-mail: comm@nserc.ca

ACCREDITED CONSULTANTS
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401 Bently Street, Unit 4
Markham, Ontario, L3R 9T2 Canada
Tel: (416) 477-4120
Telex: 06-966599 (MEP MKHM)

Richard J. Kolomeychuk
CMOS Accredited Consultant
Applied Climatology and Meteorology
Hydrometeorology, Instrumentation

Envirometrex Corporation
14A Hazelton Ave., Suite 302
Toronto, Ontario, M5R 2E2 Canada
Tel: (416) 928-0917 Fax: (416) 928-0714
e-mail: kolomey@ibm.net

Tom B. Low, Ph.D., P.Eng
CMOS Accredited Consultant
Research and Development Meteorology

KelResearch Corporation
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Downsview, Ontario, M3J 2H5 Canada
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e-mail: kel@nexus.yorku.ca

Ian J. Miller, M.Sc.
CMOS Accredited Consultant
Marine Meteorology and Climatology
Applied Meteorology, Operational Meteorology
Broadcast Meteorology

Météomédia / The Weather Network
1755, boul. René-Levesque Est, Suite 251
Montréal, Québec, H2K 4P6 Canada
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Atmosphere-Ocean Climate Variability / Changement climatique dans l'atmosphère et l'océan

1 - 4 June 1998 — 1 - 4 juin 1998

Peter Smith pc_smith@bionet.bio.dfo.ca ☎ (902) 426-3474 Dan Wright dwright@emerald.bio.dfo.ca ☎ (902) 426-3474	Chairmen, Scientific Program Committee	Présidents Comité du programme scientifique
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