Climatic Perspectives

A WEEKLY REVIEW OF CANADIAN CLIMATE

NOVEMBER 4, 1983 (Aussi disponible en français) VOL.5 NO.44

FOR THE PERIOD OCTOBER 25-31, 1983

● Increasing carbon dioxide, what are the consequences?

The GAZETTE, Montreal, Friday, October 21, 1983

Don't panic over Earth warming says new study

WASHINGTON (AP) — Atmo- would allow time to conduct more
spheric buildup of carbon dioxide extensive research on the problem
from human activities climate changes and refine estimates of its impact.

A-14 The GAZETTE, Montreal, Wednesday, October 19, 1983

Major report predicts catastrophic global warming by 1990s

WASHINGTON (UPI) — A warm- ployee Stephen Seidel and consul-
ing trend from the tant Dale Keyes.
Keyes said in an intervie-
here by the years 1990 to 2000, and
have to learn how to live with
ning for the global warmi
could have a cli-

THE GLOBE AND MAIL, SATURDAY, OCTOBER 22, 1983 P.1

Greenhouse effect: what happens in Canada?

By MICHAEL KEATING

Two recent U. S. studies have documented what will happen globally when a predicted warming of the earth causes what is now known as "the greenhouse effect," but what about the details for Canada?

Gordon McKay, head of the Canadian Climate Centre, said that humanity is so locked into burning of fuels that the greenhouse effect is virtually inevitable. The only things that can stop the change are the discovery of a cheap way of scrubbing CO2 out of smoke or a massive switch to non-

Réchauffement de la terre au début des années 1990

Des conséquences catastrophiques?

WASHINGTON (AP) — Un réchauf- Le rapport intitulé «Pouv
fement de la terre, qui pourr étarder l'effet de serre» co
des conséquences cata ème un arrêt total de l'util
ommencer au arbon ne retarderait que
risque augmentation de deux d
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autres études - pouv
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de serre mais le
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The Citizen, Ottawa, Tuesday, Oct. 18, 1983, Page 7

Hausse de 100 pour cent
ort se fonde sur des proje
adémie nationale des
accroissement
ioxide de car-
hain.

'Greenhouse effect' will warm Earth by 1990s: report

By Philip Shabecoff
The New York Times

WASHINGTON — The Protection Agency warming

re
ap-
ature

LA PRESSE, MONTRÉAL, MERCREDI 19 OCTOBRE 1983

La fin du siècle sera «chaude»

A-9

WASHINGTON (D'après UPI et AP) — Un réchauffement de la Terre inévitable et qui pourrait être catastrophique commencera à faire sentir ses effets dans les années 90.

nmental
that the
"green-
in the

● Major storm lashes the Maritimes

● Dates of first snow cover across Canada...

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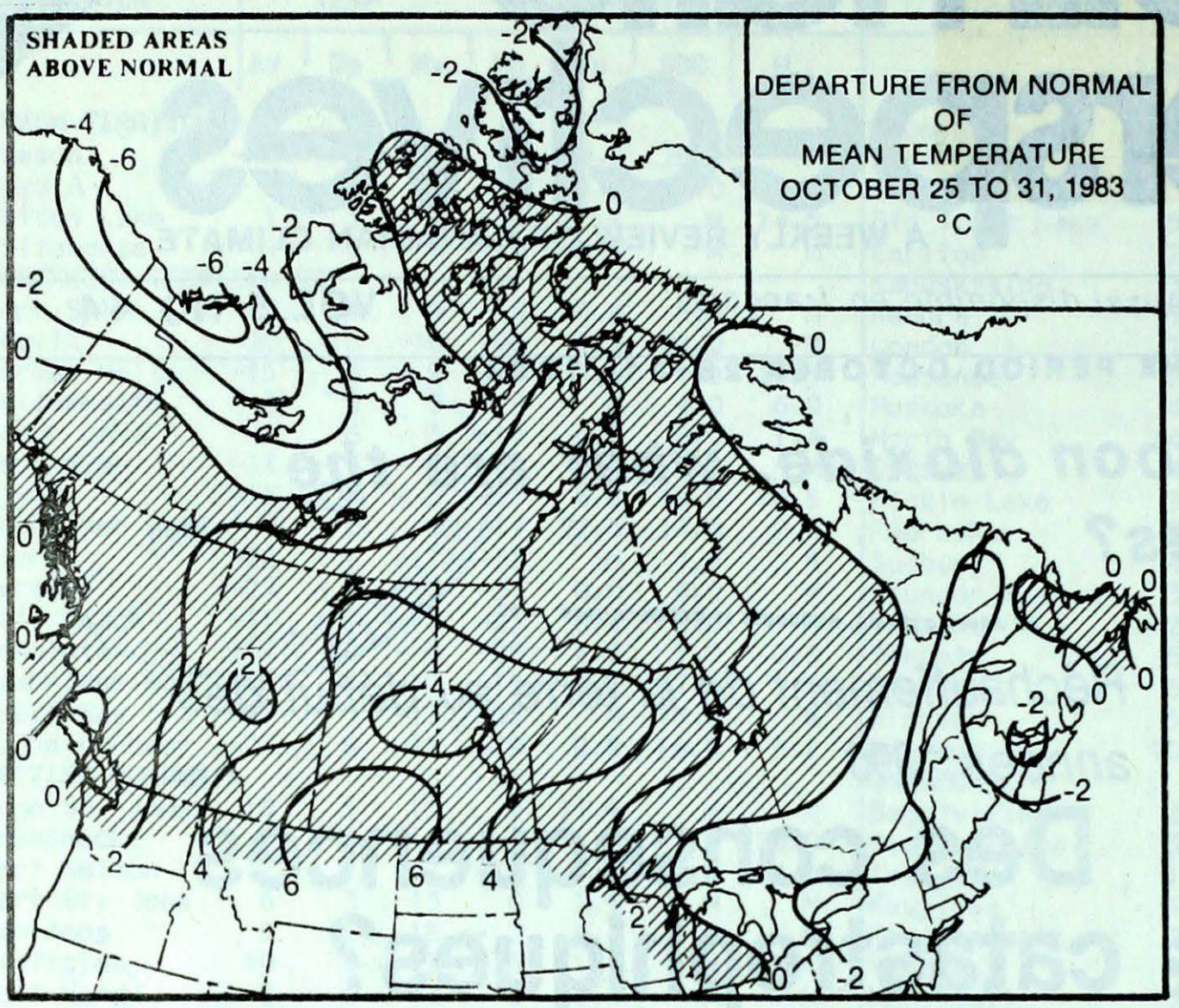
UDC: 551.506.1(71)

NOTE: The data shown in this publication are based on unverified reports from approximately 225 Canadian synoptic stations.

Canada



WEEKLY TEMPERATURES EXTREMES (°C)

	MAXIMUM		MINIMUM	
YUKON TERRITORY	7.6	Faro	-28.6	Komakuk Beach Shingle Point
NORTHWEST TERRITORIES	9.6	Fort Smith	-41.1	Eureka
BRITISH COLUMBIA	23.4	Kamloops	- 9.3	Fort Nelson
ALBERTA	26.5	Medicine Hat	-10.4	Edson
SASKATCHEWAN	27.1	Swift Current	- 7.1	Prince Albert
MANITOBA	21.4	Dauphin	-8.1	Churchill
ONTARIO	21.8	Windsor	-7.2	Britt
QUEBEC	16.6	Montréal/Dorval	-13.2	Kuujjuaq Schefferville
NEW BRUNSWICK	15.1	Miscou Island	-7.2	St. Stephen
NOVA SCOTIA	15.7	Sable Island	-5.5	Inverness
PRINCE EDWARD ISLAND	12.5	East Point	-1.5	Charlottetown Summerside
NEWFOUNDLAND	15.3	Argentia VTMS	-14.4	Churchill Falls

ACROSS THE NATION

Warmest mean temperature	19.9	Lethbridge, ALB
Coolest mean temperature	-25.4	Eureka, NWT

ACROSS THE COUNTRY...

Yukon and Northwest Territories

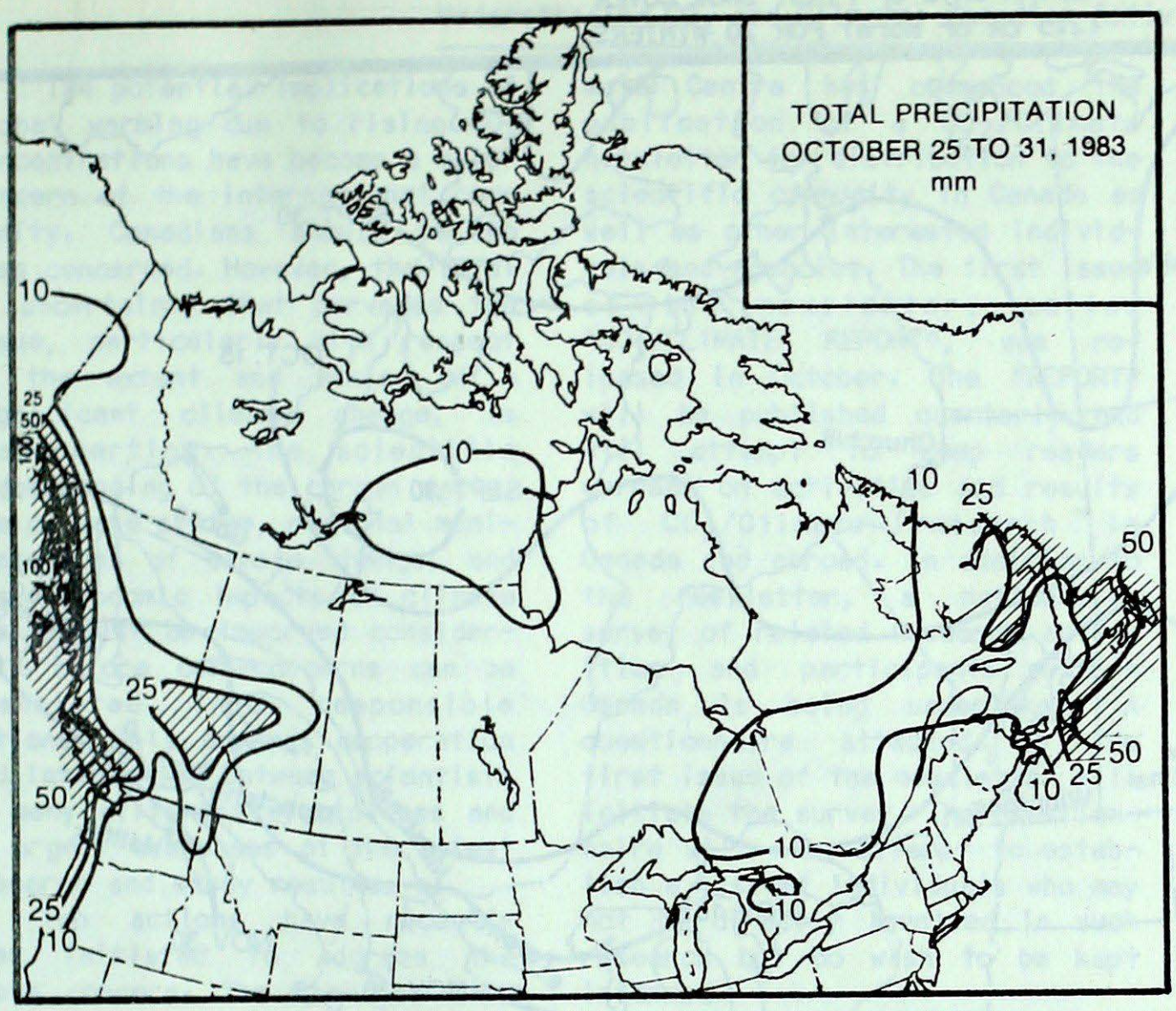
Wintery air continued to produce bitterly cold temperatures in the western Arctic; mean values were 5 to 8 degrees below normal. In contrast, the readings were nearly 3° above normal in the eastern Keewatin District. Precipitation was light almost everywhere. Snow depth amounts were becoming more appreciable. Clyde had the deepest snow cover on the ground, 53 cm. Extensive low clouds and freezing rain hampered air navigation in the central and southern Yukon throughout most of the week. On October 28, snow and strong winds severely restricted visibilities on the Haines Highway. Portion of this highway, south of Haines Junction, had to be closed.

British Colombia

It was cloudy and wet except in the North. Mean temperatures ranged from near normal along the Coast to 4° above normal in the southeast. Daytime readings in the South reached the mid-teens, but only the single digit values in central and northern regions. Heaviest precipitation was reported along the Coast and in the central interior. The northern third of the province remained relatively dry allowing the harvest, in the Peace River District, to be completed.

Prairies

It was a pleasantly warm Autumn week. Daytime temperatures in the early and latter parts of the period reached the low twenties in the South and the mid-teens in the North. Many new maximum temperature records were established; both Swift Current and Medicine Hat reached 27° on October 26. With the exception of central Alberta, precipitation amounts were light and many stations in the South recorded no measurable precipitation. On October 27, a band of heavy snow fell across the Edson and Edmonton Districts. Amounts ranged from 18 cm at Edson to less than 10 cm east of Edmonton.



HEAVIEST WEEKLY PRECIPITATION (mm)

YUKON	10.2	Dawson
NORTHWEST TERRITORIES	20.3	Cape Hooper
BRITISH COLUMBIA	146.0	Prince Rupert
ALBERTA	33.2	Jasper
SASKATCHEWAN	4.8	Meadow Lake
MANITOBA	11.8	Churchill
ONTARIO	17.8	Timmins
QUEBEC	27.6	Natashquan
NEW BRUNSWICK	16.4	Charlo
NOVA SCOTIA	64.0	Sydney
PRINCE EDWARD ISLAND	22.0	Charlottetown
NEWFOUNDLAND	70.5	St.John's

Record wheat harvest in Alberta

According to the Alberta Agriculture, the wheat harvest in Alberta was a record this year- about 7 million tonnes. About 98 per cent of the 1983 crops have been harvested. Unsettled weather and heavy frosts have delayed harvesting in the Norhern and Peace River Regions. The depleted soil moisture reserves have hampered fall field work in the South and Northwest. The overall quality of the 1983 crop was better than last year's, although August heat wave contributed to light bushel weights.

Ontario

The passage of a vigorous cold front near the week's end brought an end to the mild Autumn weather. On October 28, southern Ontario experienced record low temperatures and storm force winds. The temperatures plummeted to -5° in many communities. Areas that had so far escaped frost had their first freeze of the season. Damage from the high winds was confined to fallen trees, torn off roofs and knocked down power lines. Many apple orchards lost a portion of their unharvested varieties during the windstorm.

Snow fell in the North between the 28th and 30th of October, but melted by the weekend.

Québec

A small twister damaged 45 houses and destroyed 2 other buildings at St-Timothée near Valleyfield on October 28. At least 7 people were injured and property damage was estimated at $1.5 million. The twister was associated with a strong cold front that crossed southwestern Québec on the evening of October 28. Afterwards, cold air covered the province, and snow fell in southwestern areas.

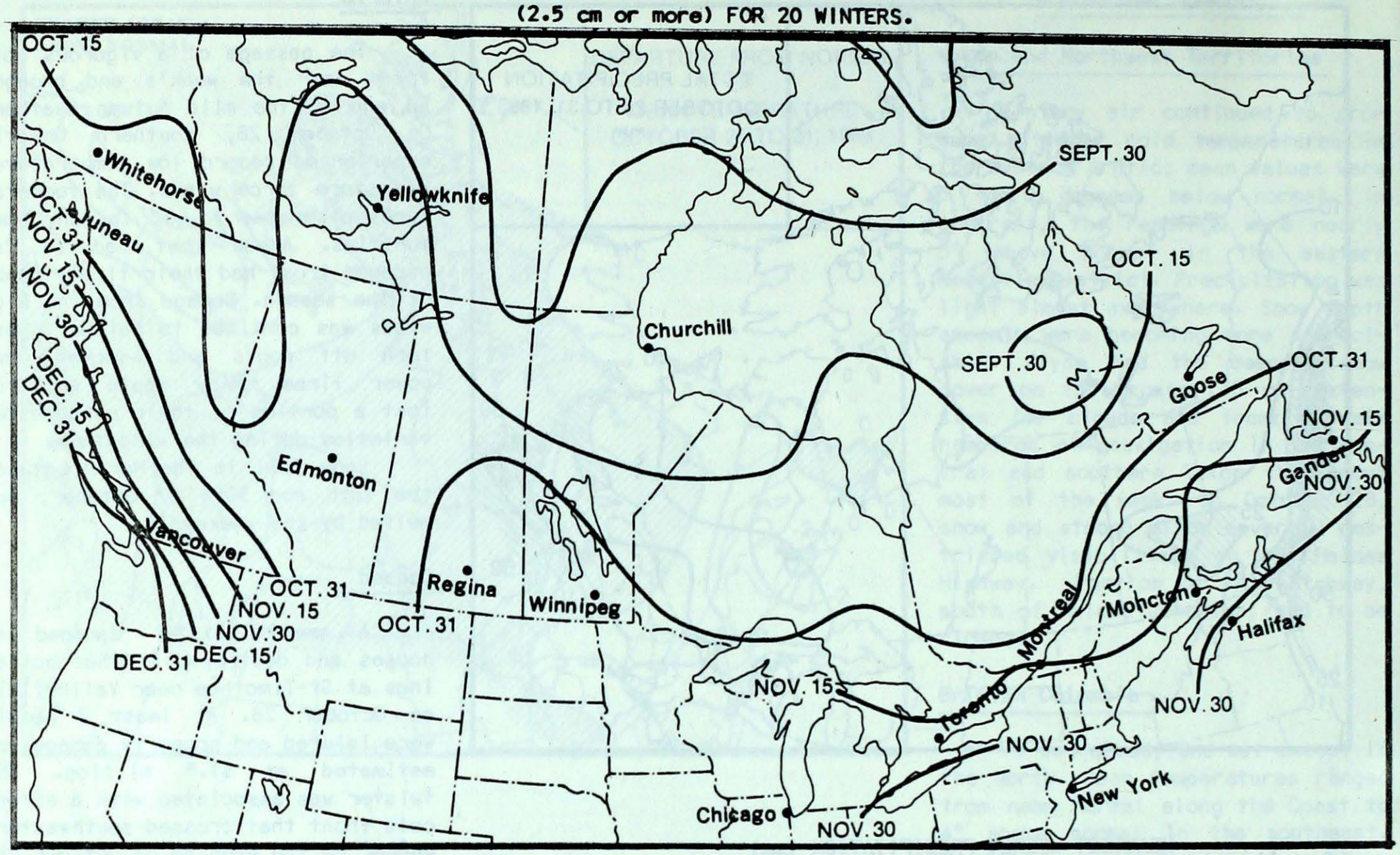
Atlantic Provinces

A severe storm struck the East Coast on the 25th and 26th of October. Strong winds gusting near 130 km/h and violent rainfall caused extensive damage on Cape Breton and Prince Edward Island. Ingonish and Gabarus areas of Cape Breton suffered the most; many wharves and cottages were destroyed. The high water waves generated by the storm sank at least 30 fishing boats and tossed about 2,000 lobster traps into the water. Thousands of residents experienced power outages that lasted from 15 minutes to 15 hours.

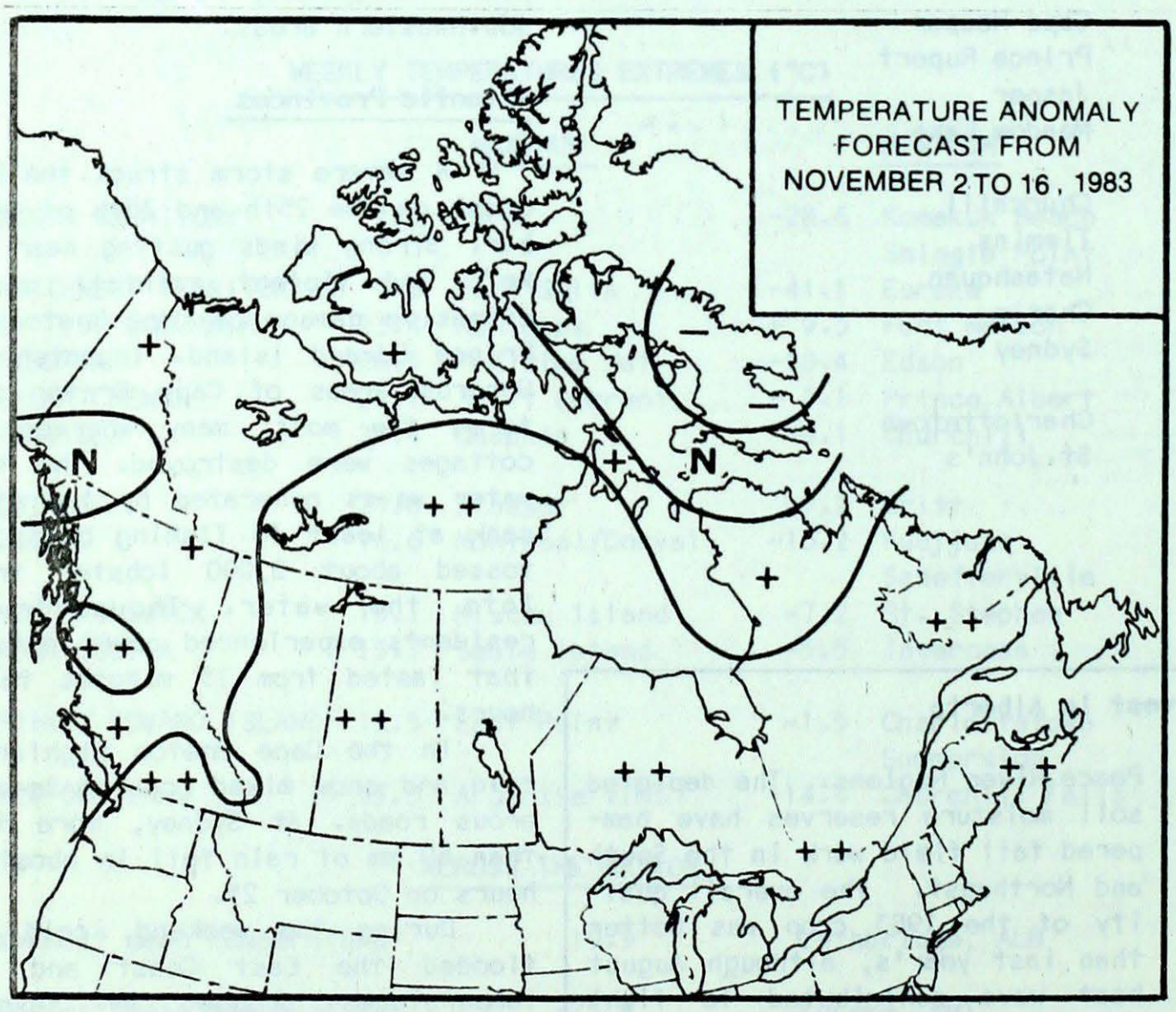
In the Cape Breton Highlands, rain and snow mixed created treacherous roads. At Sydney, more than than 60 mm of rain fell in about 12 hours on October 25.

During the weekend, cold air flooded the East Coast and the temperatures dropped by several degrees.

MEDIAN DATE OF FIRST SNOW COVER
(2.5 cm or more) FOR 20 WINTERS.



TEMPERATURE ANOMALY FORECAST



Temperature Anomaly Forecast

The temperature anomaly forecast, for each of the 70 Canadian stations, is prepared by searching historical weather maps to find cases similar to the present one. The principle used is that a prediction for the next 15 days may be based on what is known to have actually happened during 15-day periods. After the five best cases are selected, the surface temperature anomalies are calculated. This results in five separate forecasts, which are averaged to provide the forecast depicted.

++	much above normal
+	above normal
N	normal
-	below normal
--	much below normal

Understanding CO_2 and Climate: Canadian Activities

The potential implications of global warming due to rising CO_2 concentrations have become a major concern of the international community. Canadians should be no less concerned. However, the level of uncertainty that pervades the issue, particularly with respect to the extent and timing of a significant climate change, is disconcerting. The scientific understanding of the carbon cycle, the climate system, regional manifestations of climate change, and socio-economic impacts of climate change must be imporved considerably before our concerns can be translated into responsible actions. This demands cooperation and interaction between scientists in many different disciplines and an urgent awareness of the latest research and study results.

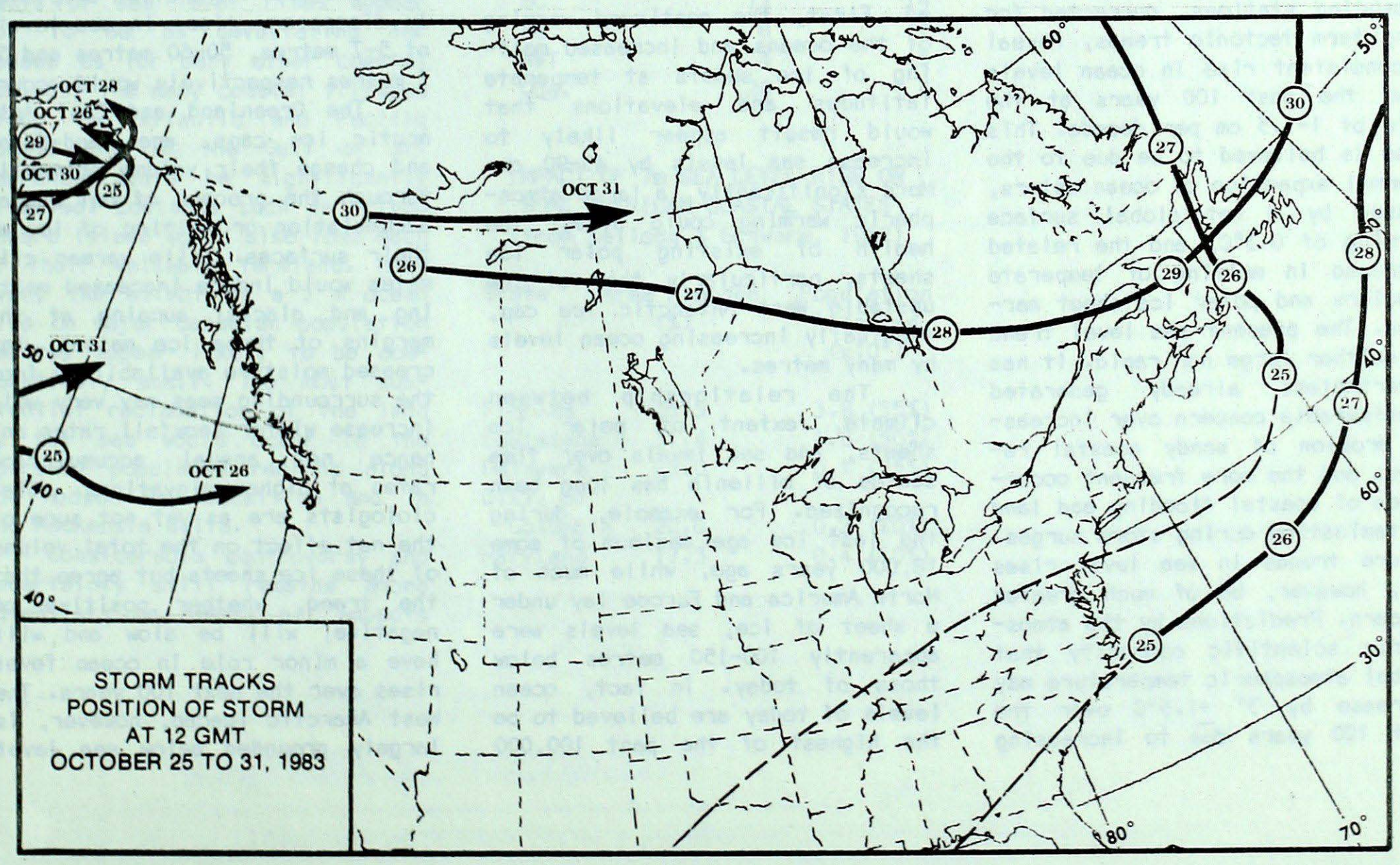
Two actions have recently been initiated to address the above concern. The Canadian Climate Centre has commenced the publication of a CO_2/Climate newsletter for distribution to the scientific community in Canada as well as other interested individuals and agencies. The first issue of the newsletter, called "CO_2/CLIMATE REPORT", was released in October. The "REPORT" will be published quarterly and will attempt to keep readers current on activities and results of CO_2/Climate research in Canada and abroad. In addition to the newsletter, a nation-wide survey of related research activities and participants within Canada is being undertaken. A questionnaire attached to the first issue of the newsletter will initiate the survey. The questionnaire will also attempt to establish a list of individuals who may not be directly involved in such research but do wish to be kept informed.

The introductory issue of the "CO_2/CLIMATE REPORT" provides a series of articles on existing programmes within AES, some recent assessments of the CO_2 issue within the international community, and several recent meetings. Future issues will be thematic in nature, concentrating on a specific aspect of the research activities in each issue. They will also provide information on recent publications, past and upcoming meetings and developments in research programme.

The first issue of the "REPORT" and the survey questionnaire is being distributed widely within the Canadian research communities. Interested individuals who have not received a copy of either document can obtain a copy by contacting the Climate Program Office of the Canadian Climate Centre. (Telephone 667-4525/4652).

H. Hengeveld

STORM TRACKS

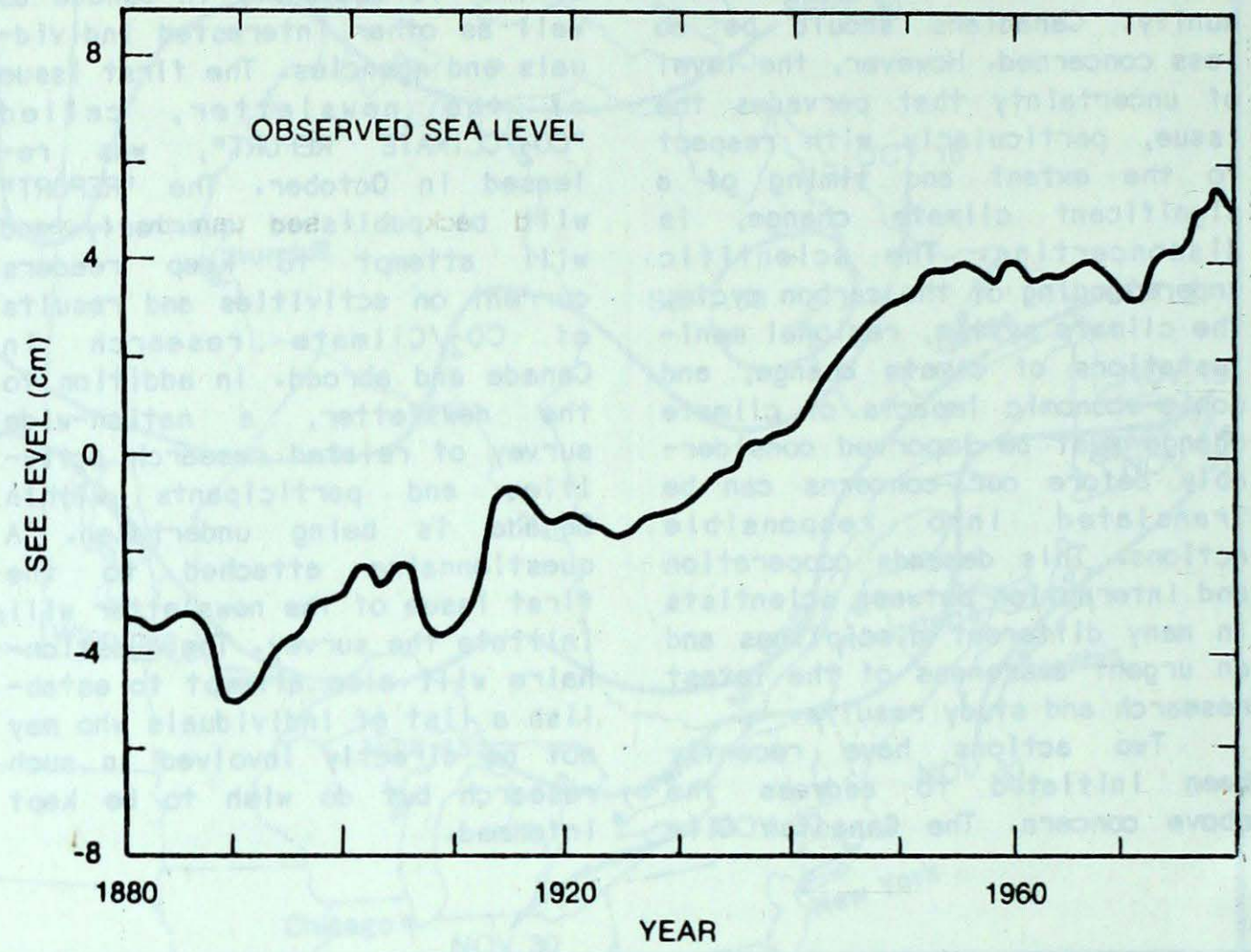


CLIMATE CHANGE AND RISING SEA LEVELS

by
H.G. Hengeveld
Canadian Climate Centre

The threat of rising ocean levels around the world is becoming a major international concern. Recent analyses of sea level records reveal a gradual rise has already been taking place during the past century. New projections of the impacts of potential global warming indicate the possibility of a 0.5 m rise within the next 100 years. There is a further risk of a 5.7 m rise in the centuries thereafter. The implications for coastal dwellers are serious!

Until recently, changes in sea levels measured along coastal areas were assumed to be regional in character and caused by tectonic uplifting or subsidence of the affected land mass. These changes have been particularly evident, and problematic, in such diverse areas as Venice (Italy), Galveston (Texas) and Long Beach (California). Now, however, scientists have uncovered significant evidence that today's ocean level rises are global in nature and, furthermore, climate related. Careful analysis of data from a world-wide network of sea level measuring stations, corrected for long term tectonic trends, reveal a consistent rise in ocean levels over the past 100 years at the rate of 1-1.5 cm per decade. This rise is believed to be due to the thermal expansion of ocean waters, caused by a net global surface warming of 0.3°C, and the related increase in melting of temperate glaciers and polar ice sheet margins. The present sea level trend is neither large nor rapid. It has nevertheless already generated considerable concern over increased erosion of sandy coastal regions and the more frequent occurrence of coastal flooding and land contamination during storm surges. Future trends in sea level rises may, however, be of much greater concern. Predictions by the atmospheric scientific community that global atmospheric temperature may increase by 3° ±1.5°C over the next 100 years due to increasing concentration levels of atmosphere carbon dioxide suggest that ocean levels may be dramatically affected. First, the continued warming of the oceans and increased melting of ice sheets at temperate latitudes and elevations that would result appear likely to increase sea levels by 45-90 cm. More significantly, a large atmospheric warming could affect the health of existing polar ice sheets, particularly that of the unstable West Antarctic ice cap, eventually increasing ocean levels by many metres.



Global mean sea level trend from tide-gauge data corrected for tectonic trends (Adapted from Gornitz et al, 1982)

The relationship between climate, extent of polar ice sheets, and sea levels over time scales of millenia has long been recognized. For example, during the last ice age maximum of some 18,000 years ago, while much of North America and Europe lay under a sheet of ice, sea levels were apparently 100-150 metres below those of today. In fact, ocean levels of today are believed to be the highest of the past 100,000 years. Should the remaining ice sheets on Greenland, East Antarctica and West Antarctica completely disappear, rises in sea levels of 5-7 metres, 50-60 metres and 5-7 metres respectively would occur.

The Greenland and East Antarctic ice caps, are land-based and change their volume primarily through the process of net annual accumulation or melting of ice at their surfaces. While warmer climates would induce increased melting and glacial surging at the margins of these ice masses, increased moisture availability from the surrounding seas may very well increase winter snowfall rates and hence net annual accumulation rates at higher elevations. Glaciologists are as yet not sure of the net effect on the total volume of these ice sheets but agree that the trend, whether positive or negative, will be slow and will have a minor role in ocean level rises over the next 100 years. The West Anarctic Icecap, however, is largely grounded below sea level

and is considered unstable. A global warming of 3°C appears likely to be adequate to remove the ice shelves buttressing this ice sheet, resulting in a relatively rapid surge of the entire ice mass into the oceans. Estimates on how soon this could occur vary from one to five centuries from now.

The socio-economic impacts of a major global sea level rise could be devastating. More than 30% of the world's population lives within 50 km of adjoining oceans and seas. River deltas and lowlands, generally the most fertile and densely populated regions of the world, would be threatened by salt water insurgence. Major coastal cities would experience massive flooding, while individual countries such as those of the European lowlands, Bangladesh, Japan and other island nations would be particularly vulnerable. Results of a recent study on the impacts of a 7 metre sea level rise on Americans suggest that four of the coastal states as well as the District of Columbia would lose 17-35% of their land area, affecting 11 million people. Florida would be most significantly affected.

Although the potential impacts of sea level rises appear not to be as devastating for Canada as for many other coastal nations, the many coastal villages along the Atlantic and Pacific coasts and in the Gulf of St. Lawrence would be significantly affected. Lowlands such as Prince Edward Island would also lose much of their valuable farmland. However, the effect of a 5 m ocean rise on major Canadian population centres appear likely to be comparatively small. The most substantial reclamation of the land by the sea would occur in the sparsely populated regions along the Hudson Bay coastline and in the Mackenzie delta.

Considerable controversy and uncertainty still remains among scientists on almost all aspects of the probability, magnitude, timing and impact of future sea level rises. Much more research must be undertaken to improve our understanding and our future projections before our concern can be translated into action. Nor are the potential impacts of sea level rises inescapable. Techniques already developed in low lying coastal regions of the world to hold back the sea can be adopted for many of the threatened areas. Time will likely be available to develop and implement new strategies. However, an ocean rise of at least 0.5 metres over the next 100 years now appears highly probable, while an additional 5-7 metre rise could occur within the next few centuries. The ability of coastal populations in coping with such rises will depend on their resilience and preparation. Improving these must be the objectives of the coming decades.

CLIMATE STATIONS IN CANADA
Below 10 Metres ASL

Province/ Territories	# of Stations < 10 m ASL	%
PEI	5	24
Nfld	25	23
NS	14	15
BC	72	14
NB	8	11
NWT	4	5
Que.	20	4

IMPACT OF 7m SEA LEVEL RISE ON SOME AMERICAN COASTAL STATES
(from Kellogg & Schware, 1982)

State	Area Flooded (%)	Population Affected ($\times 10^6$)
Florida	35.5	3.8 (55%)
Louisiana	31.4	1.8 (50%)
Delaware	25.0	0.1 (25%)
Dist. of Columbia	20.0	0.2 (20%)
Maryland	17.3	0.4 (10%)

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Gornitz, V., S. Lebedeff, J. Hansen, 1982: Global Sea Level Trend in the Past Century, Science, Vol. 215, 1611-1614.

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TEMPERATURE, PRECIPITATION AND BRIGHT SUNSHINE DATA FOR THE WEEK ENDING 0600 GMT NOVEMBER 1, 1983

STATION	TEMP				PRECIP		SUN
	Av	Dp	Mx	Mn	Tp	SOG	H
YUKON TERRITORY							
Dawson	-11	- 3	0	-22	10.2	33.0	M
Mayo A	- 5	0	4	-17	4.2	12.0	M
Watson Lake	- 3	1	8	-17	1.6	3.0	20.9
Whitehorse	- 1	1	5	- 9	2.4	2.0	25.8
NORTHWEST TERRITORIES							
Fort Smith	0	3	10	- 6	3.8	0.0	12.7
Inuvik	-21	- 8	-13	-29	3.4	31.0	5.8
Norman Wells	-11	- 2	- 4	-18	4.2	8.0	18.1
Yellowknife	- 4	1	2	-12	2.0	3.0	15.4
Baker Lake	-10	1	- 2	-19	13.5	20.0	M
Cape Dyer	-10	- 1	- 3	-22	1.6	11.0	M
Clyde	- 9	0	- 1	-20	4.8	55.0	M
Frobisher Bay	- 9	- 2	1	-26	2.4	15.0	M
Alert	-23	0	-16	-27	1.8	9.0	M
Eureka	-29	- 4	-15	-41	M	12.0	M
Hall Beach	-13	1	- 1	-22	2.7	12.0	M
Resolute	-17	0	- 5	-24	0.2	7.0	2.3
Cambridge Bay	-15	0	- 9	-20	1.0	17.0	6.8
Mould Bay	-22	- 1	-17	-29	M	17.0	0.0
Sachs Harbour	-17	- 2	- 7	-28	M	19.0	M
BRITISH COLUMBIA							
Cape St. James	9	1	12	6	80.3	M	M
Cranbrook	7	5	19	- 4	1.0	M	31.8
Fort Nelson	- 1	3	9	- 9	0.0	3.0	M
Fort St. John	5	4	13	- 3	1.4	M	M
Kamloops	8	3	23	- 4	0.4	M	27.4
Penticton	9	3	17	- 3	1.1	M	38.5
Port Hardy	7	0	11	0	49.9	M	14.2
Prince George	5	2	12	- 2	19.0	M	7.3
Prince Rupert	6	- 1	11	0	146.0	M	13.4
Revelstoke	5	1	12	0	50.6	M	3.3
Smithers	4	1	9	- 3	16.0	M	M
Vancouver	9	1	14	2	34.2	M	28.8
Victoria	9	0	16	2	12.7	M	27.3
Williams Lake	4	1	12	- 3	31.0	M	24.1
ALBERTA							
Calgary	9	5	23	- 4	0.0	M	32.6
Cold Lake	5	3	14	- 5	8.2	M	M
Coronation	5	3	19	-10	0.0	M	41.2
Edmonton Namao	6	3	14	- 3	19.0	M	M
Fort McMurray	4	4	14	- 5	2.8	M	M
Jasper	5	2	13	- 4	33.2	M	21.3
Lethbridge	10	5	25	- 9	0.0	M	M
Medicine Hat	11	6	27	- 5	0.0	M	52.2
Peace River	4	3	13	- 3	0	M	M
SASKATCHEWAN							
Cree Lake	3	X	10	- 4	0.2	M	M
Estevan	9	6	23	- 2	0.0	M	61.0
La Ronge	4	4	15	- 5	2.2	M	M
Regina	8	6	22	- 4	0.0	M	51.9
Saskatoon	6	4	19	- 6	0.0	M	M
Swift Current	10	7	27	- 5	0.0	M	51.3
Yorkton	6	4	19	- 6	0.0	M	54.7
MANITOBA							
Brandon	6	4	21	- 6	0.0	M	M
Churchill	- 1	3	5	- 8	11.8	3.0	10.5
The Pas	4	3	13	- 4	0.0	M	42.0

STATION	TEMP				PRECIP		SUN
	Av	Dp	Mx	Mn	Tp	SOG	H
Thompson	1	4	11	- 7	3.8	M	21.2
Winnipeg	6	3	15	- 5	0.2	M	53.5
ONTARIO							
Big Trout Lake	3	4	11	- 3	3.4	M	M
Earlton	3	0	12	- 4	M	M	M
Kapuskasing	2	1	14	- 4	11.5	M	M
Kenora	6	3	14	- 2	1.2	M	M
London	5	- 2	19	- 5	3.1	M	40.6
Moosonee	3	1	13	- 7	10.4	M	24.7
Muskoka	4	- 2	16	- 7	7.0	M	M
North Bay	3	- 1	15	- 4	10.0	M	28.5
Ottawa	5	- 1	16	- 4	15.3	M	42.1
Pickle Lake	4	4	13	- 3	4.8	M	M
Red Lake	4	3	14	- 4	0.2	M	37.2
Sudbury	3	0	15	- 5	7.2	M	33.9
Thunder Bay	5	2	20	- 6	0.5	M	48.6
Timmins	2	0	12	- 5	17.8	M	M
Toronto	5	- 2	19	- 5	0.2	M	M
Trenton	5	- 2	17	- 6	5.0	M	M
Wiarton	5	- 2	16	- 4	12.0	M	28.3
Windsor	7	- 1	22	- 1	0.7	M	M
QUEBEC							
Bagotville	1	- 2	11	- 7	11.6	M	M
Blanc-Sablon	3	1	9	- 6	26.0	M	M
Inukjuak	- 1	1	4	- 8	10.1	2.0	8.2
Kuujjuaq	- 4	- 1	5	-13	1.6	2.0	M
Kuujjuarapik	1	1	7	- 3	6.4	M	3.5
Manawaki	4	0	16	- 7	14.8	M	M
Mont-Joli	1	- 2	7	- 7	10.6	M	13.6
Montréal	4	- 2	17	- 4	4.0	M	38.0
Natashquan	2	- 1	6	- 6	27.6	0.0	M
Nitchequon	- 1	1	4	-10	6.2	12.0	18.4
Québec	2	- 2	10	- 5	3.0	M	22.5
Schefferville	- 4	- 1	5	-13	3.9	2.0	26.9
Sept-Iles	- 1	- 2	7	- 7	16.3	2.0	27.0
Sherbrooke	2	- 1	15	- 5	8.4	M	27.1
Val-d'Or	2	1	12	- 3	11.0	M	18.9
NEW BRUNSWICK							
Charlo	2	- 2	8	- 5	16.4	M	19.9
Fredericton	4	- 2	12	- 5	0.6	M	M
Saint John	4	- 2	11	- 2	0.6	M	43.4
NOVA SCOTIA							
Greenwood	5	- 2	14	- 3	1.8	M	M
Shearwater	6	- 2	14	0	1.7	M	42.7
Sydney	6	- 1	14	- 2	64.0	M	27.2
Yarmouth	6	- 2	14	1	1.4	M	46.8
PRINCE EDWARD ISLAND							
Charlottetown	5	- 2	12	- 2	22.0	0.0	M
Summerside	5	- 2	11	- 2	9.0	0.0	30.5
NEWFOUNDLAND							
Gander	4	0	13	- 3	23.0	M	12.9
Port aux Basques	5	0	11	0	22.2	0.0	M
St. John's	5	0	14	- 3	70.5	M	M
St. Lawrence	6	1	14	- 2	54.7	M	M
Cartwright	1	- 1	7	- 6	26.8	8.0	M
Goose	- 2	- 3	5	-11	20.6	7.0	M
Hopedale	- 1	- 1	5	- 7	19.9	2.0	M

Av = weekly mean temperature (°C)
Mx = weekly extreme maximum temperature (°C)
Mn = weekly extreme minimum temperature (°C)
Tp = weekly total precipitation (mm)
Dp = Departure of mean temperature from normal (°C)

SOG = snow depth on ground (cm), last day of the period
H = weekly total bright sunshine (hrs)

X = not observed
P = extreme value based on less than 7 days
M = not available at press time

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