CANADA'S GREEN PLAN

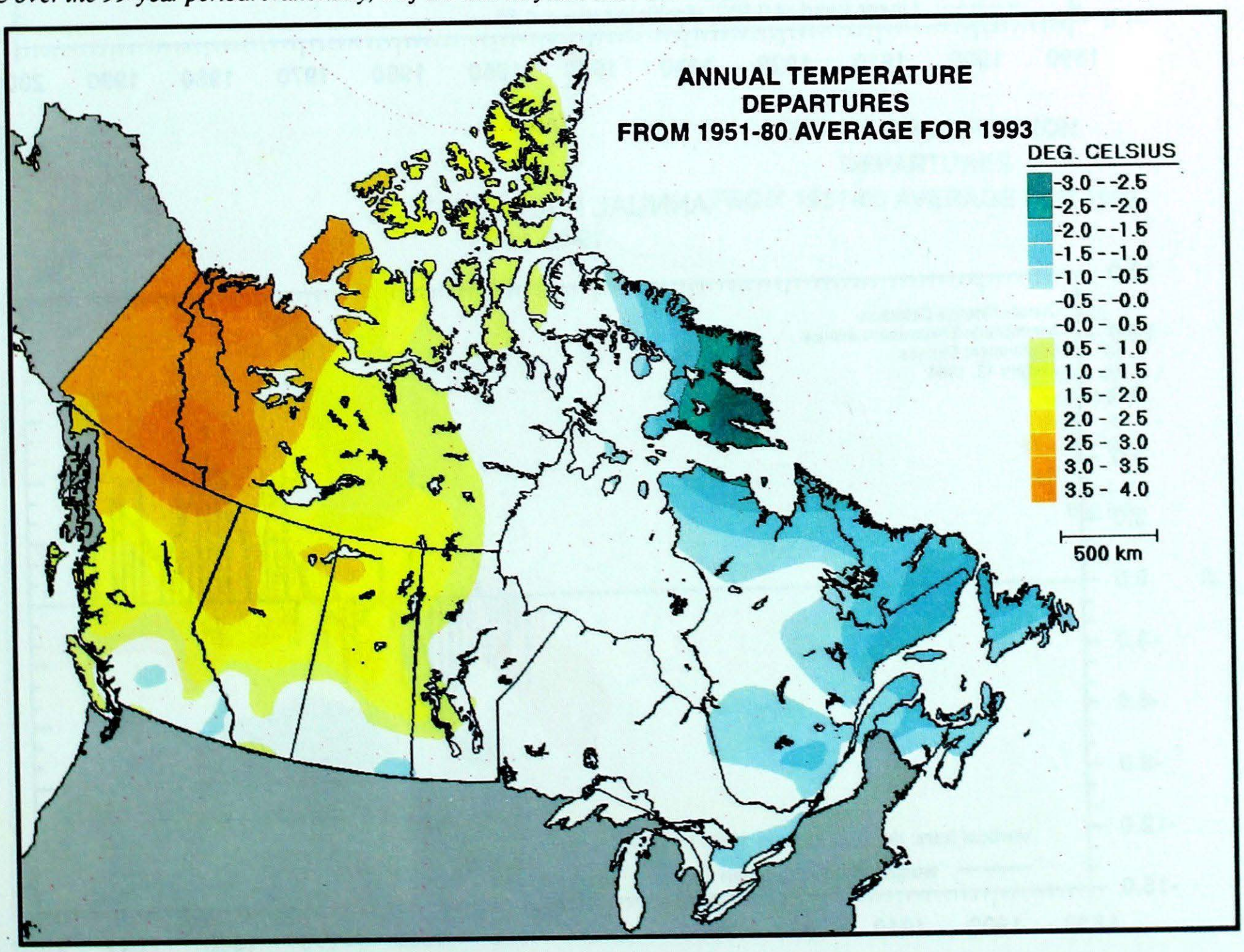
Climatic Perspectives

Monthly Review + Annual 1993 Review **DECEMBER • 1993** *Vol. 15*

1993

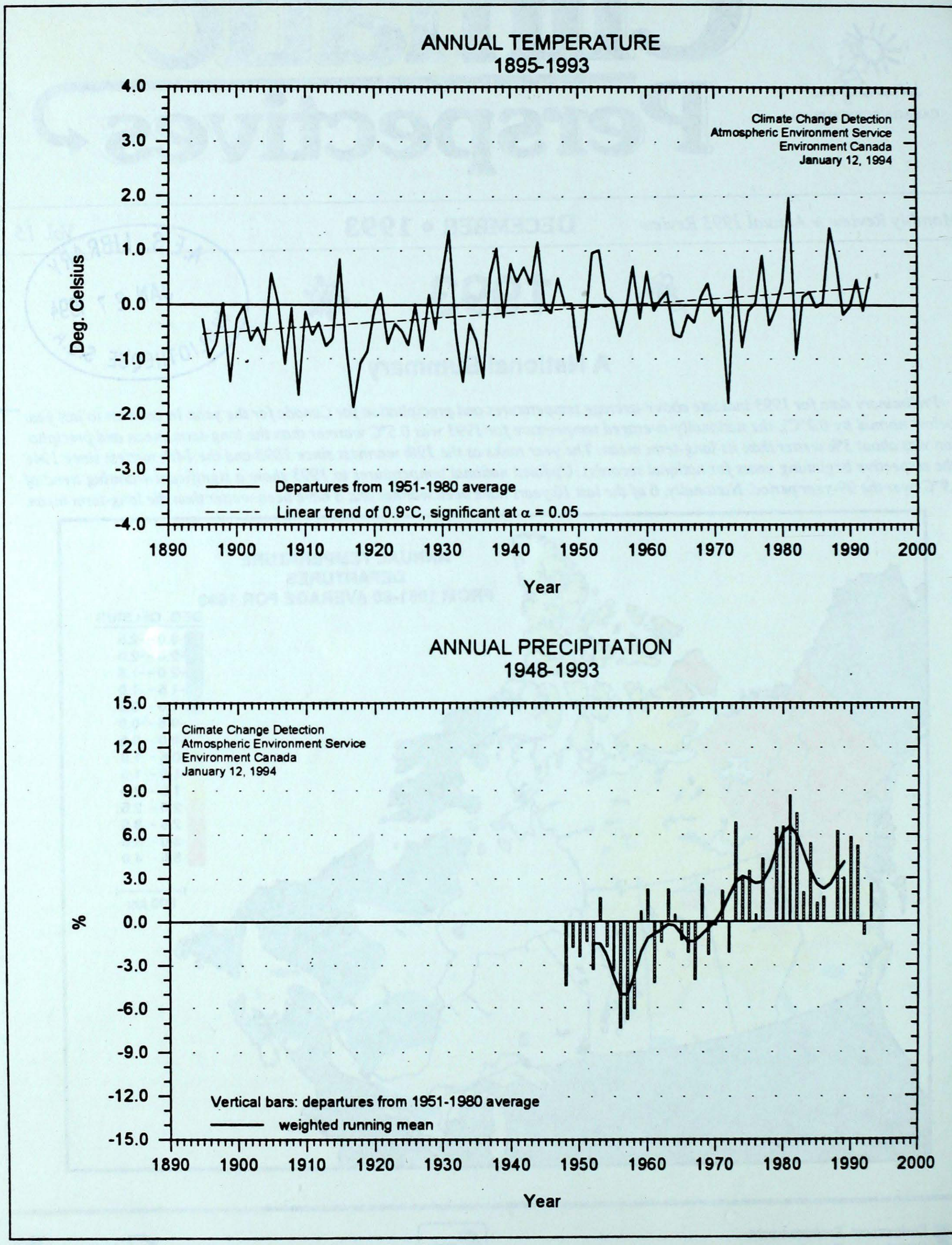
A National Summary

Preliminary data for 1993 indicate above-average temperatures and precipitation for Canada for the year. In contrast to last year (below normal by 0.2°C), the nationally-averaged temperature for 1993 was 0.5°C warmer than the long-term mean and precipitation was about 3% wetter than its long-term mean. The year ranks as the 19th warmest since 1895 and the 14th wettest since 1948 (the respective beginning years for national records). Updated national temperatures to 1993 show a significant warming trend of 0.9°C over the 99-year period. Nationally, 6 of the last 10 years have been warmer and 8 have been wetter than the long-term mean.



Environment Canada Environnement Canada

Canada

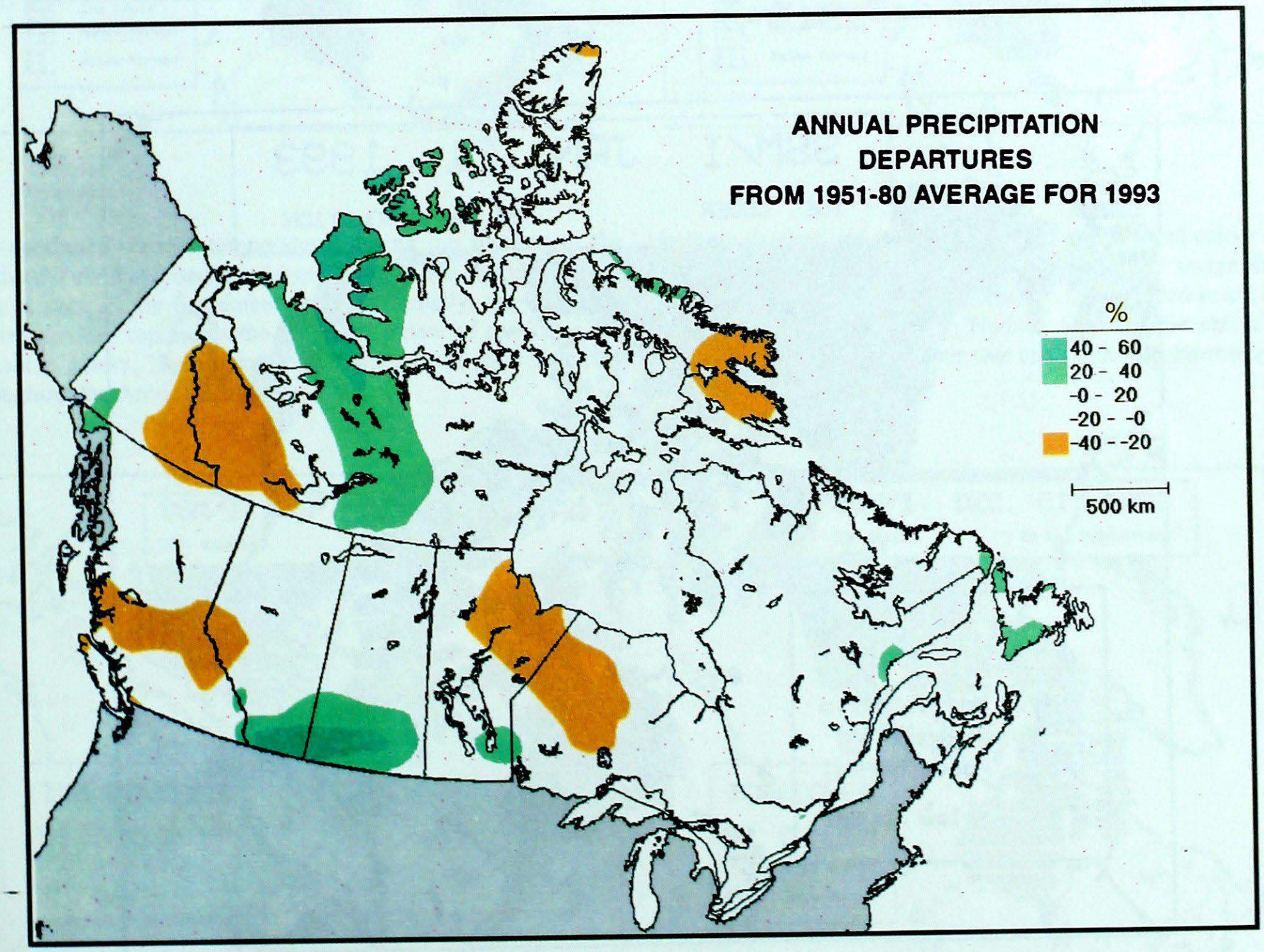

ANNUAL TEMPERATURE
1895-1993
Climate Change Detection
Atmospheric Environment Service
Environment Canada
January 12, 1994
Deg. Celsius
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
Departures from 1951-1980 average
Linear trend of 0.9°C, significant at α = 0.05
1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000
Year
ANNUAL PRECIPITATION
1948-1993
Climate Change Detection
Atmospheric Environment Service
Environment Canada
January 12, 1994
%
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
Vertical bars: departures from 1951-1980 average
weighted running mean
1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000
Year

Most of the country, east from Ontario, in 1993, was again colder than average (from the lower Great Lakes to Atlantic Canada and northwards to Baffin Island). Throughout this region annual temperatures averaged close to 1.0°C below normal for the second year in a row. In Atlantic Canada and in central Quebec, 7 and 5 of the last 10 years, respectively, have been colder than normal, while in the lower Great Lakes, 6 of the last 10 have been warmer.

From the lower Great Lakes to Atlantic Canada, precipitation was slightly above normal, averaging about 6 to 10% wetter than the normal for the year. In Atlantic Canada, 1993 was among the wettest 5% of years there since 1895.

In the west, from Manitoba to the Pacific Coast, and northwards to the Yukon Territory and the District of Mackenzie in the Northwest Territories, 1993 was warmer than normal. Throughout most of this vast region, 9 of the last 10 years have been warmer than normal. The greatest warming of 1993, as evidenced throughout the northwest, took place mostly during the winter and spring seasons. Northern British Columbia and the Yukon averaged 2.8°C warmer than normal making 1993 among the warmest 2% of years in this region since 1901. In the neighbouring District of Mackenzie, it was among the warmest 4% of years there since 1895, averaging about 2.3°C warmer than normal for the year.

The boreal forest region of mid-latitude Canada, from Labrador to British Columbia, was generally drier than normal during 1993 averaging about 3% below normal in the east and about 6% below in the west. Much of the grain-growing region of southern Saskatchewan and Alberta averaged about 30% wetter than normal during the year, making 1993 among the wettest 8% of years there since 1895. However, seven of the last 10 years in this region have been drier than normal. Throughout



British Columbia, the Yukon Territory and much of the District of Mackenzie in the Northwest Territories, precipitation was below normal for the year by about 10 to 20 percent. In southern British Columbia, 1993 was the third dry year in a row. Along the Pacific Coast, it was 20% drier than normal for the year and among the driest 7% of years there since 1911.

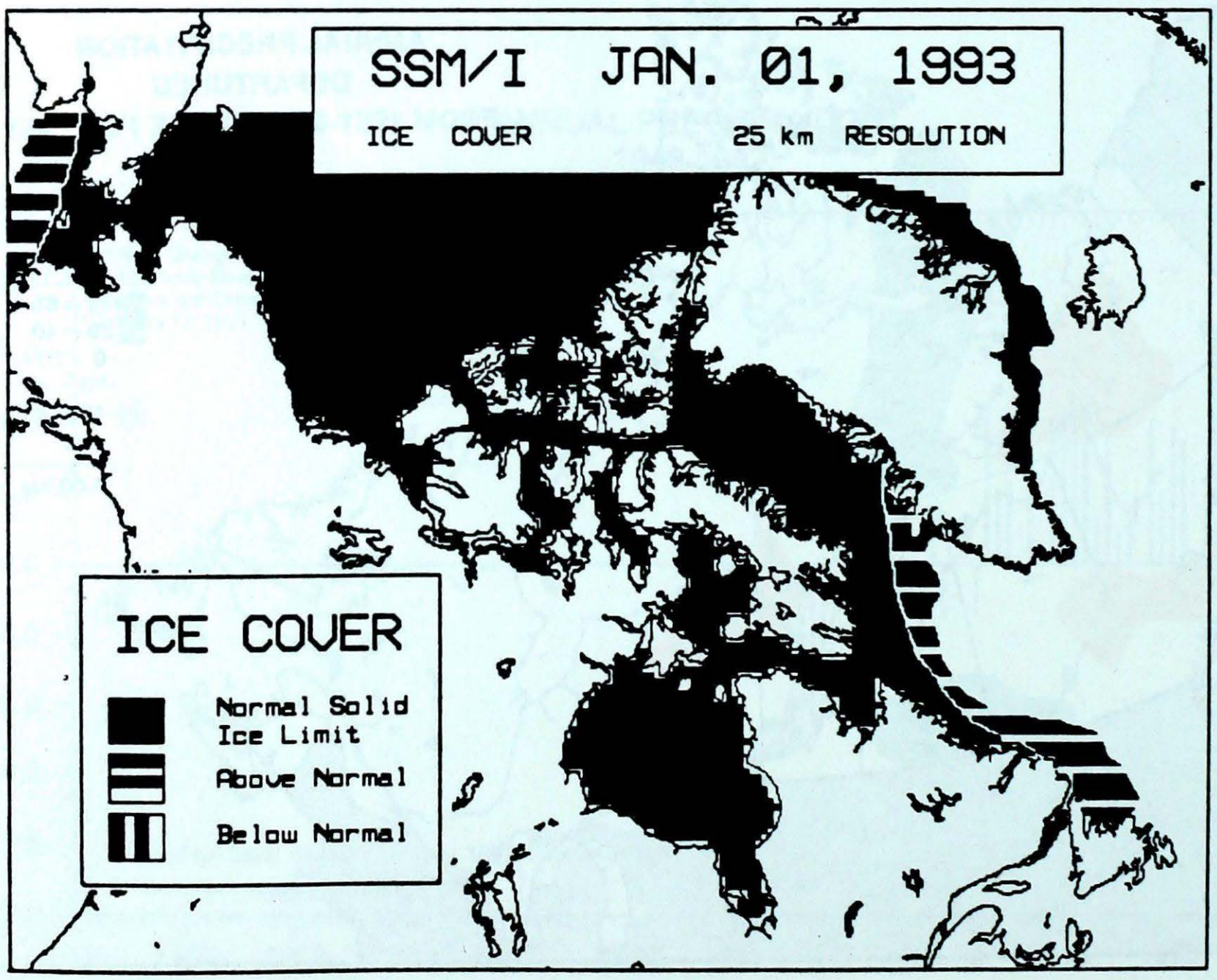
In the North, much of the Central High Arctic was warmer than normal for 1993; although, 6 of the last 10 years in this region have actually been colder than normal. Precipitation averaged about 20% above normal, making 1993 among the wettest 9% of years in the central Arctic since 1948. In the extreme northeast, in the vicinity of Ellesmere and Baffin Islands, 1993 was in the driest one-third of years there since 1948, although in the local area around Clyde, it was about 30% wetter than normal for the year.

Climate Change Detection Division

1993 - The Ice Year in Review

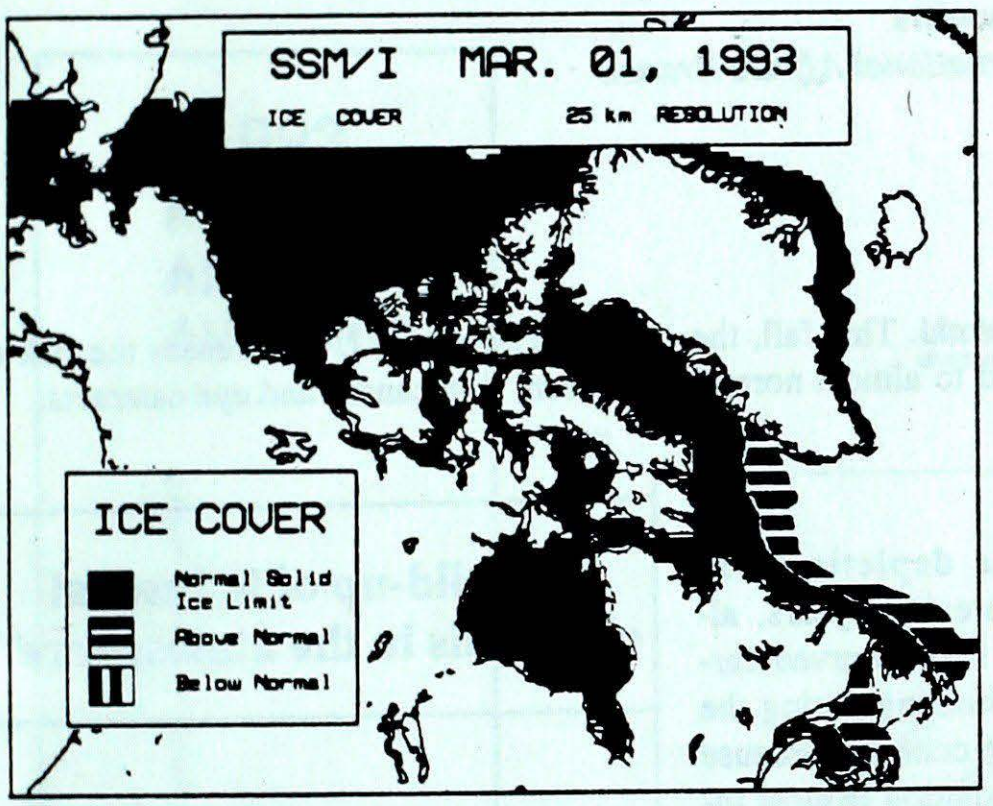
□ ***Arvids Silis, Arctic Adaptation Division***

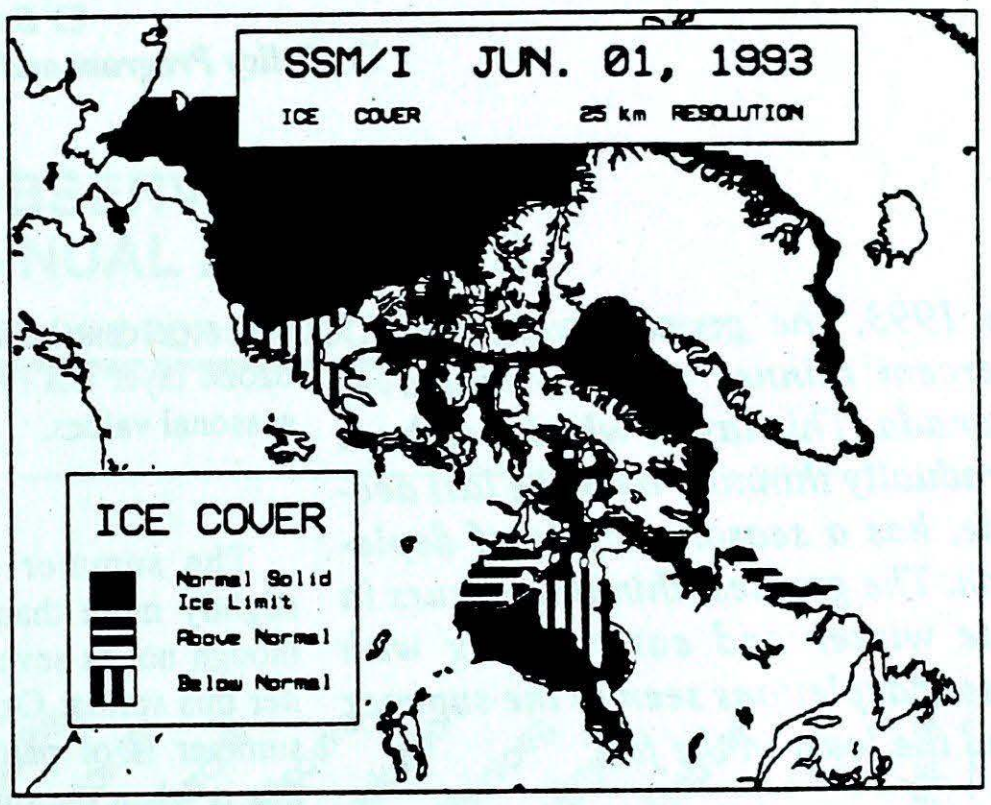
The year started off with slightly more than the normal amount of solid ice on the eastern coast of Canada and also in the Bering Sea.



March continued the trend of more than normal amounts of ice cover on the Eastern coast. Normally, the month of March also represents the maximum extent of sea ice in Canadian waters.

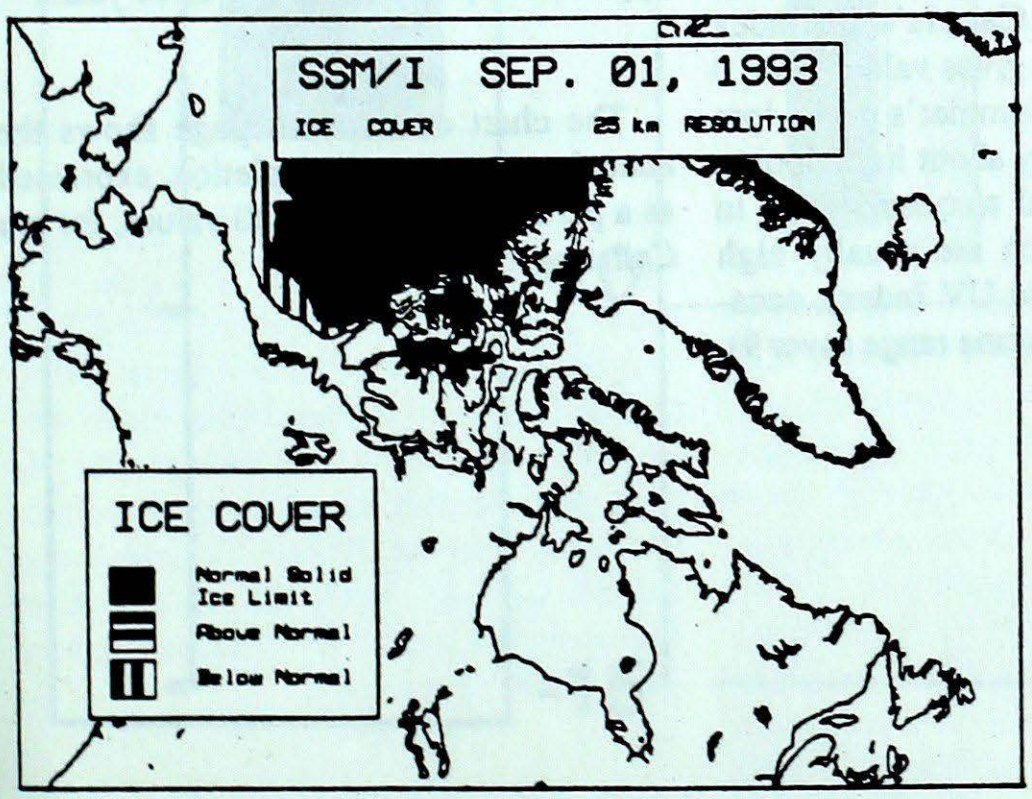
The image from June shows the varied patterns of breakup experienced by different areas. Normal breakup is found in the Chukchi sea and in northern Baffin Bay. A milder spring in the southern Beaufort accounts for the accelerated breakup in that area. Normally at this time, the Beaufort area would just be starting to break up.

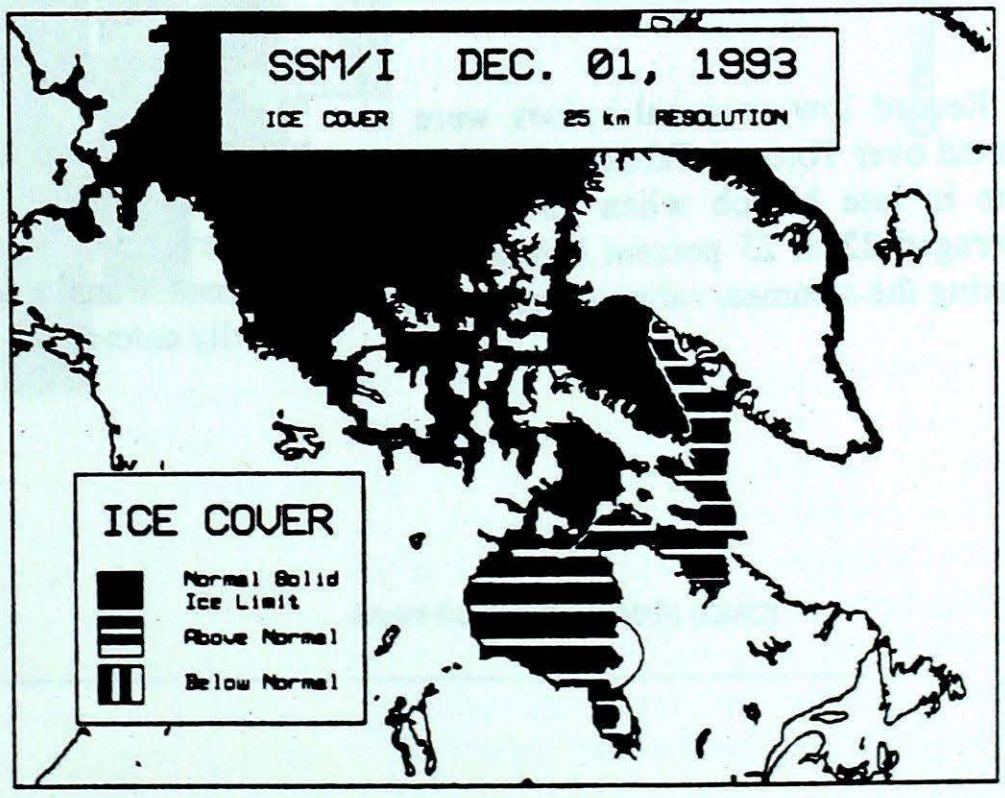




The continued warmer temperatures during the summer in the northern Yukon resulted in a larger ice free area in the Beaufort Sea, as seen in the September image. Normally, the month of September also represents the minimum extent of sea ice in the Canadian waters. There were normal amounts of solid ice cover throughout the Arctic Archipelago.

Northern Quebec and the eastern Arctic experienced colder than normal temperatures during the fall. The December image shows that a greater than normal ice extent was experienced in not only the Baffin Bay area, but also Hudson Bay. By the end of the month, above normal ice cover was at a point that resembled the January image.





1993 Ozone review

☐ *Bob Saunders*
☐ *Policy Program and International Affairs Branch*

In 1993, the ozone layer was 7.7 percent thinner than normal over Canada. This layer, which has been gradually thinning over the last decade, has a seasonal cycle of depletion. The greatest thinning occurs in late winter and early spring with lesser depletions seen in the summer and the least in the fall.

This year has followed the usual cycle, with the greatest thinning observed from January to April, when ozone values averaged about 14 percent below normal.

"Record low seasonal values were reported..."

Record low seasonal values were reported over Toronto, Edmonton and Resolute in late March when ozone values averaged 22 to 25 percent below normal. During the summer, values averaged about seven percent below normal. This fall, the ozone layer has returned to almost normal seasonal values.

The summer ozone depletion was slightly more than in previous years, although not as severe as that observed earlier this spring. Ozone thinning during the summer is of particular concern because this is when the sun's radiation is most intense and ultraviolet (UV) values are naturally at their highest.

"Using Environment Canada's UV Index scale..."

Using Environment Canada's UV Index scale (which generally gives values from 0 to 10 in Canada), this summer's ozone loss increased UV values by about half a point. This means that typical summer values in southern Canada, which are usually high (between 7 and 9 on the UV Index), occasionally entered the extreme range (over 9). Over exposure to UV increases the risk of sunburn, skin cancer and eye cataracts.

"...build-up of industrial chemicals in the atmosphere"

The low ozone values observed throughout 1993 can be attributed to the build-up of industrial chemicals in the atmosphere, as well as lingering volcanic debris from Mt. Pinatubo, which erupted in the Philippines in 1991. Scientists suspect that the volcanic debris may be interacting with the industrial chemicals, leading to increased ozone depletion. Debris from major volcanic eruptions can remain in the upper atmosphere for two to three years.

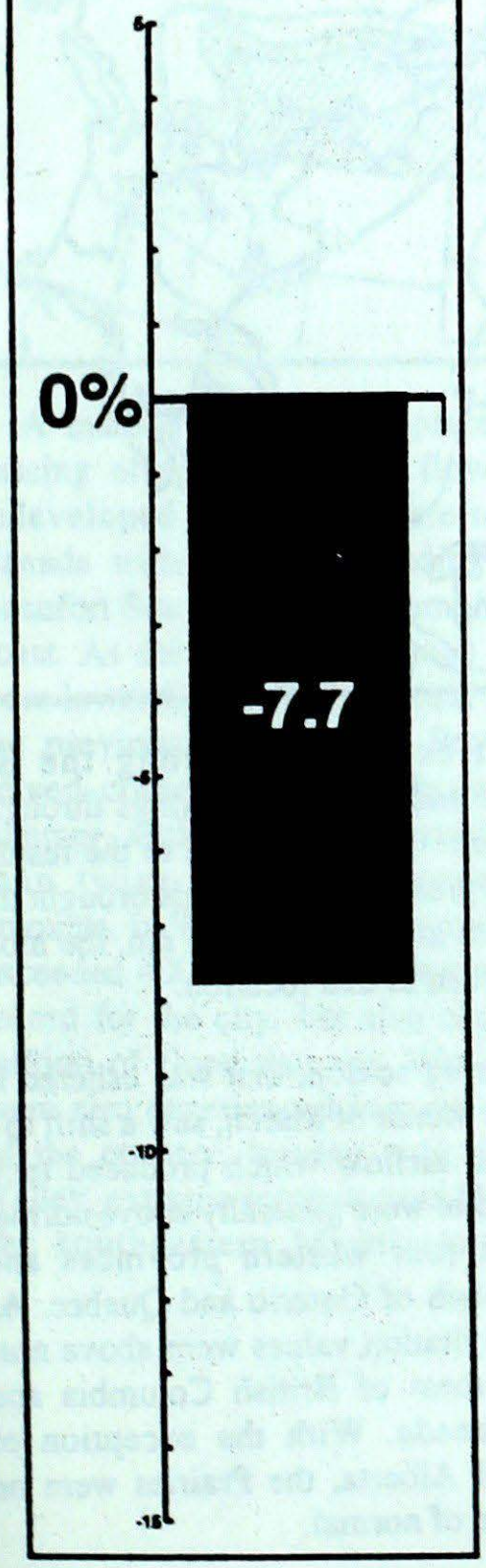
The chart on the next page shows the annual average ozone depletion, expressed as a percentage of pre-1980 values, for ten Canadian observing sites.

STATE OF CANADA'S OZONE LAYER - ANNUAL AVERAGES

OZONE WATCH

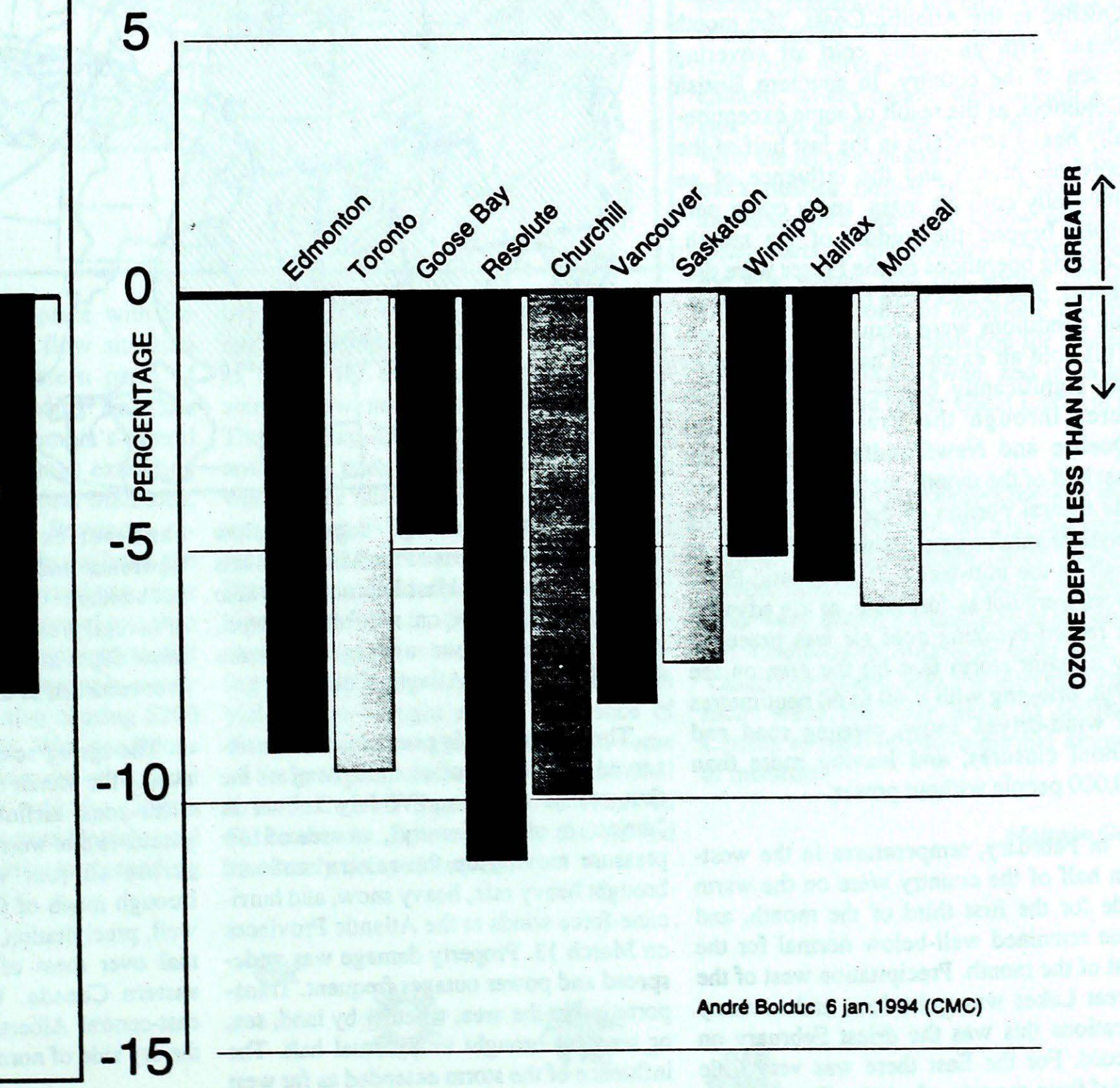
Environment Canada
Environnement Canada

1993 NATIONAL ANNUAL AVERAGE



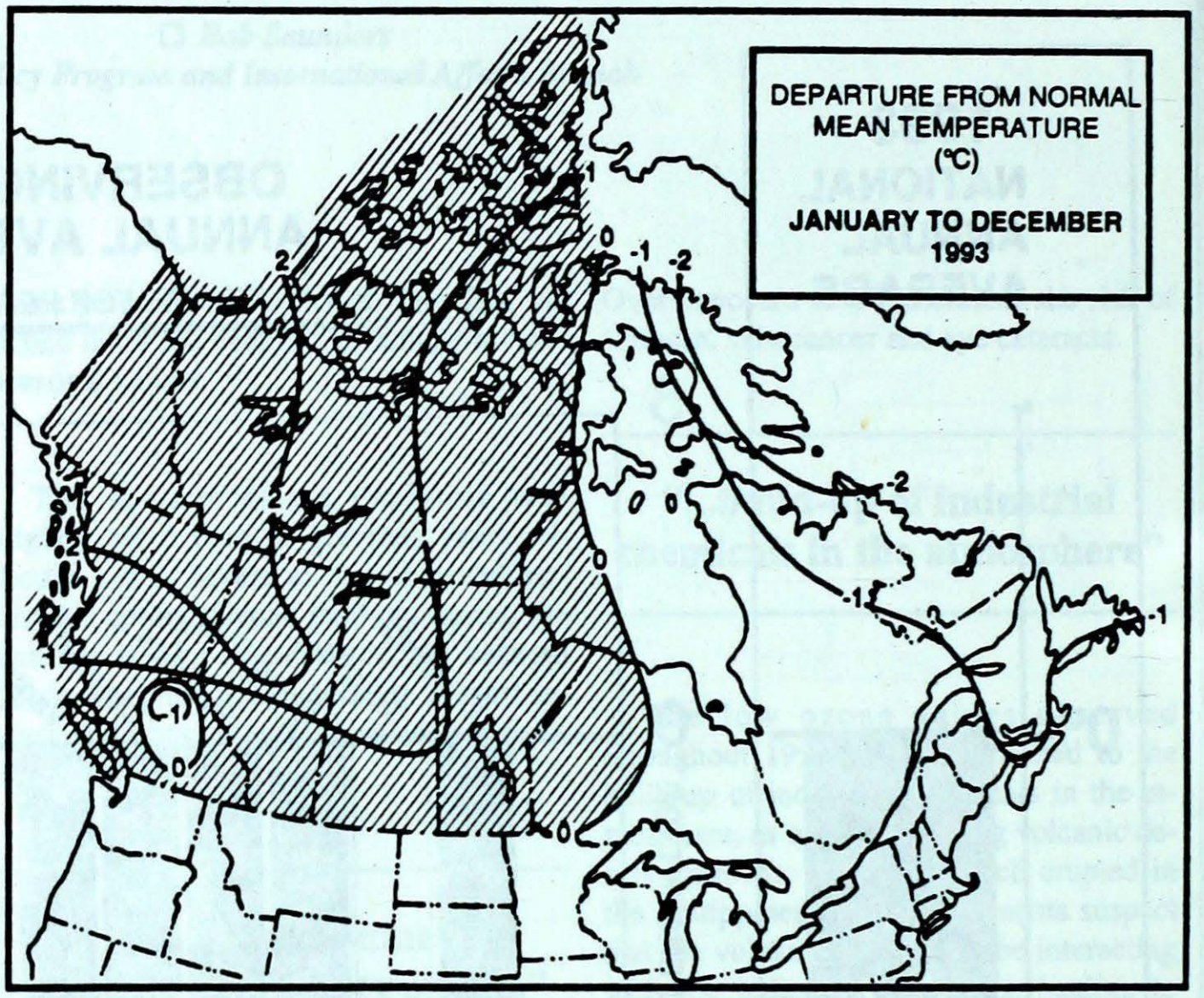
OBSERVING SITES ANNUAL AVERAGES

% VALUES ARE FOR PERIOD JAN-DEC. 93 .. FINAL



André Bolduc 6 jan.1994 (CMC)

Weather and Climate Impacts in 1993 in Canada

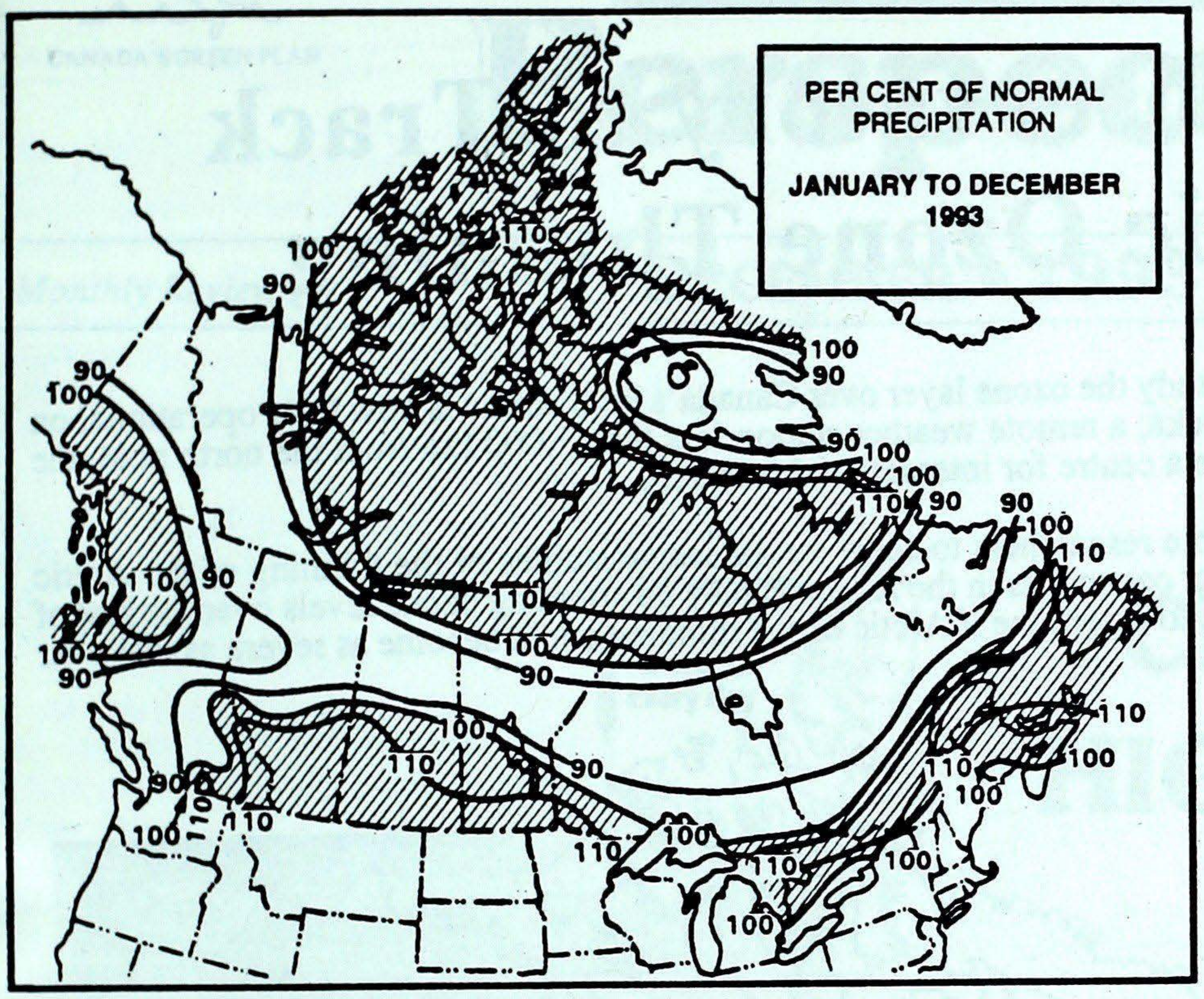


The cold trough that had become established over the Pacific Coast at the end of 1992 persisted through the first month of 1993. As a result, while January mean temperatures were above normal from the Yukon southeastward to the Great Lakes, across southern British Columbia they were as much as 2 degrees below normal. In the eastern half of the country, temperatures were also below normal from mid-Quebec to the Atlantic Coast. The month began with unusually cold air covering much of the country. In southern British Columbia, as the result of some exceptionally heavy snowfalls in the last half of the previous month and the influence of an unusually cold air mass, snow cover persisted beyond the middle of the month. Logging operations on the Fraser were disrupted, pipe bursts were frequent, and driving conditions were frequently hazardous. This cold air extended eastwards, producing significantly below-normal temperatures through the Prairies to central Quebec and Newfoundland. During the last half of the month, warm air moved into the central portion of the country, raising daytime maximums across the Prairies as high as the mid-teens. The Atlantic Provinces were not as fortunate, as the advance of record-breaking cold air was preceded by a major storm that hit the area on the 27th, bringing with it 40 to 60 centimetres of wind-driven snow, causing road and school closures, and leaving more than 10,000 people without power.

In February, temperatures in the western half of the country were on the warm side for the first third of the month, and then remained well-below normal for the rest of the month. Precipitation west of the Great Lakes was quite low, and in many locations this was the driest February on record. For the East there was very little relief from the grip of winter. Temperature values remained several degrees below normal. In some parts of the Maritimes this was not only the coldest February, but also the coldest month on record. As well, snowfall was above average from the Great Lakes to the Atlantic Coast.

The winter's biggest punch was reserved for what is often thought of as the first month of spring. Widely known as "the storm of the century", an area of low pressure moving up the eastern seaboard brought heavy rain, heavy snow, and hurricane-force winds to the Atlantic Provinces on March 13. Property damage was widespread and power outages frequent. Transportation in the area, whether by land, sea, or air, was brought to a virtual halt. The influence of the storm extended as far west as Lake Huron, with snowfalls of 30 to 55 centimetres recorded along the St. Lawrence and blizzard warnings throughout southern Ontario. Added to the results of several previous storms, this brought the snow depth at Ottawa to 135 cm, the most ever recorded at that location.

The spring season, that was ushered in during the month of March, saw a shift to a more zonal airflow which produced temperatures that were generally above normal across all four western provinces and through much of Ontario and Quebec. As well, precipitation values were above normal over most of British Columbia and eastern Canada. With the exception of east-central Alberta, the Prairies were on the dry side of normal.



A marked change took place with the passing of spring. A split flow situation redeveloped over the western parts of Canada with a ridge extending from the Beaufort Sea to British Columbia's central coast. As the result of a trough extending from lower California to central Manitoba, the previously-dry Prairie Provinces received copious rainfalls throughout the summer, with many areas receiving more than twice their usual precipitation amounts. In Winnipeg, the summer rainfall exceeded 400 mm, setting not only a new record for the city, but also causing $200 million of flood damage. Wet conditions were also experienced in most other parts of the country, leaving only the Ottawa Valley, extreme southwestern Ontario, and the southeastern Maritimes recording below-normal rainfall totals for the summer. Temperatures also took quite a swing, as means for the June to August period were below normal from Vancouver to Thunder Bay. The Arctic, Ontario, Quebec and a few parts of the Atlantic Provinces were above normal, largely the result of a very warm August. Despite the cool weather in the western provinces, most Prairie grains had ripened before the first significant frost on September 12. However, the excessive moisture, while bringing with it the potential for very high yields, also brought a high incidence of disease which lowered the quality of some of the grain. In addition, a heavy snowfall that followed September's frost in Saskatchewan, flattened crops and slowed an already-delayed harvest.

Through the autumn months temperature patterns were remarkably consistent, with very little change appearing from one month to the next. The upper ridge that extended from the Beaufort Sea to Vancouver Island enabled temperatures to remain above normal across British Columbia and the western Arctic. The trough that had been responsible for the cool, wet summer in the Prairies gradually moved eastwards and joined with another trough extending from Baffin Island to Lake Michigan. Combined with the effects of the western ridge, this allowed much cooler air to flood southward from the Arctic resulting in an autumn with below-normal temperatures for all of Canada east of the Rockies. The most significant departures from normal were found in northern Ontario, where means were almost 4 degrees cooler than the long-term average. With the jet stream and its associated storm track pushed farther south, precipitation amounts were generally below normal in many parts of the country. Nevertheless, the few storms that did appear dropped significant amounts of moisture, resulting in above-normal precipitation for southern Alberta and Saskatchewan, and in an area running from the lower Great Lakes to the Maritimes.

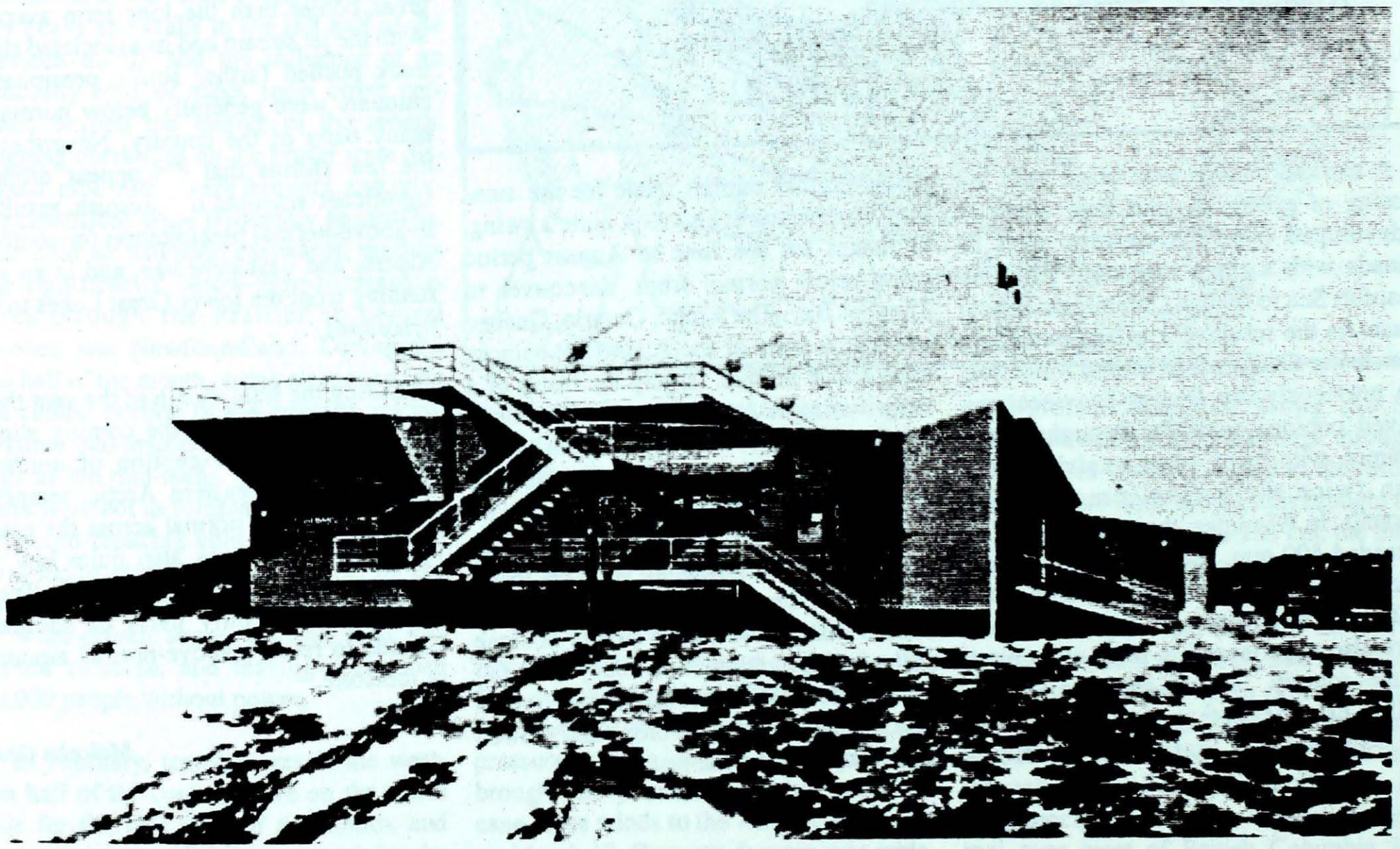
During the final month of the year there was little real sign of the coming winter season. With the exception of northern Quebec and the eastern Arctic, temperatures were above normal across the country. Precipitation was also quite low, as Vancouver Island and the Atlantic Provinces were the only parts of southern Canada to receive above-normal amounts of moisture.

Malcolm Geast

New Observatory to Track Arctic Ozone Thinning

A new scientific observatory to study the ozone layer over Canada's high Arctic is now fully operational on Ellesmere Island. Located at Eureka, a remote weather station less than 1,000 km from the north pole, the ultra-modern facility will become a centre for international research.

The new observatory will enable researchers to carry out intensive studies of the thinning of the Arctic ozone layer. Scientists suspect that ozone loss in the far north may be affecting ozone levels over the rest of Canada. Their work will also help to determine if Arctic ozone thinning could become as severe as that over Antarctica.



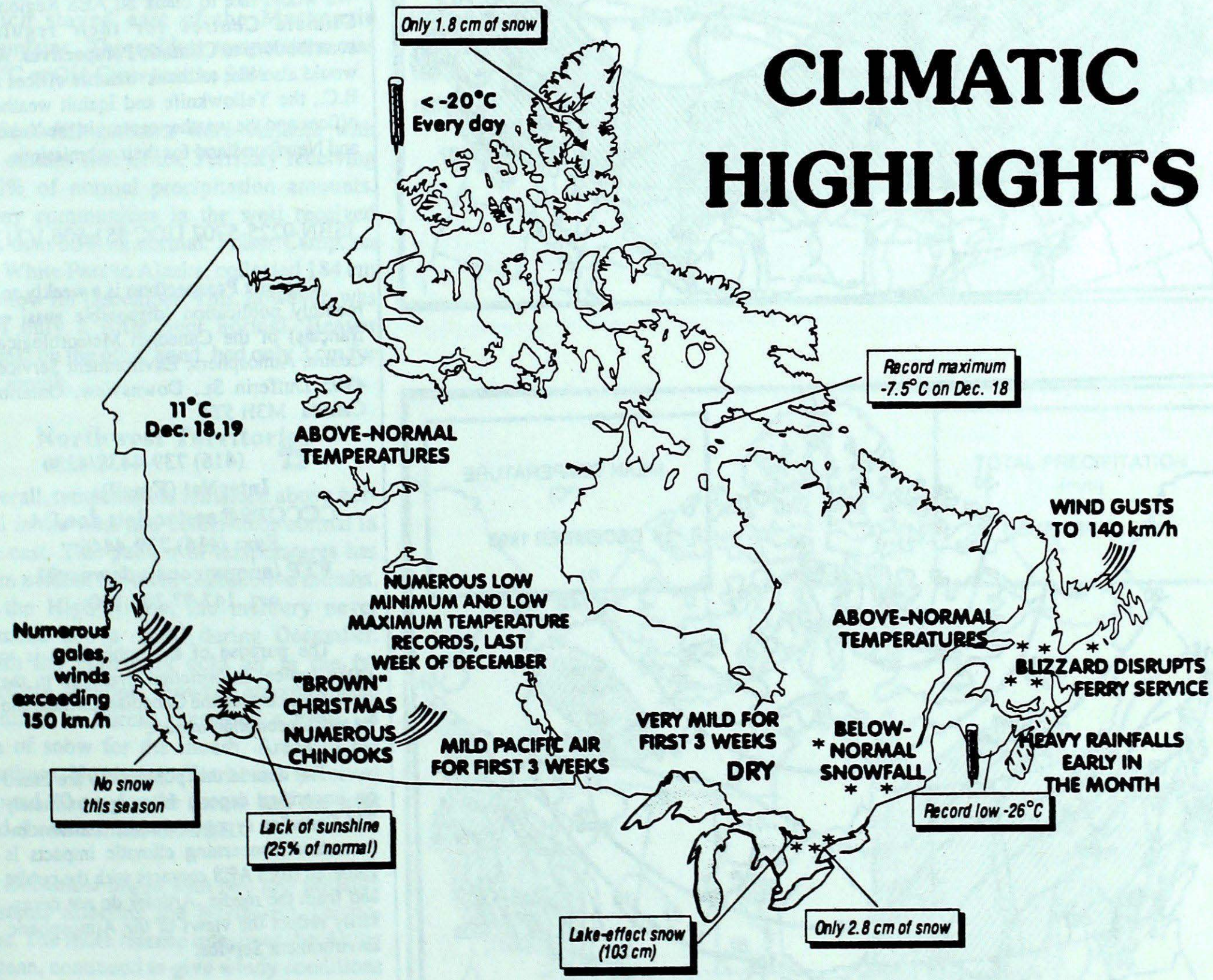
The Environment Canada High Arctic ozone observatory at Eureka, Ellesmere Island, N.W.T.

CANADA'S GREEN PLAN

Climatic Perspectives

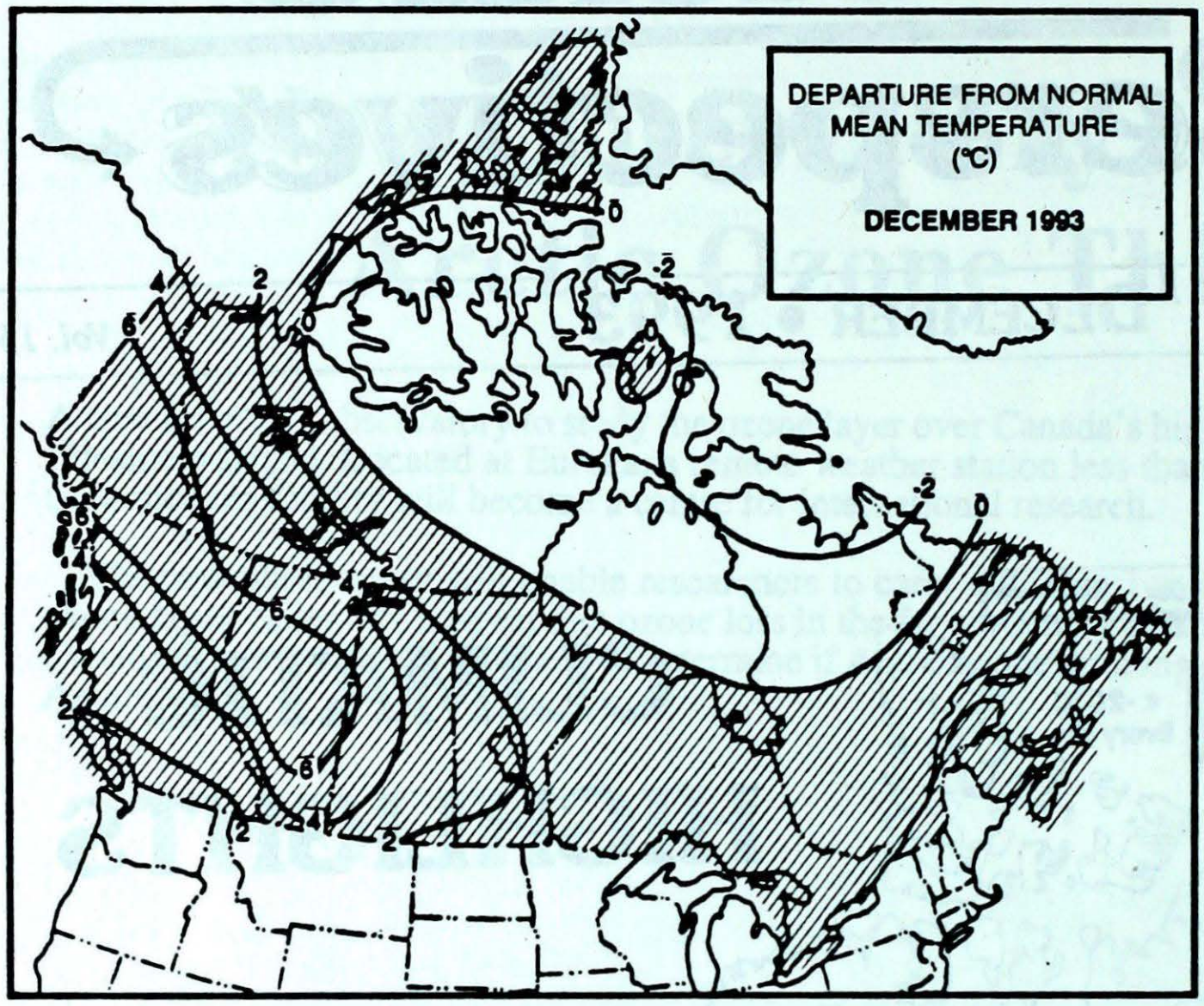
Monthly Review **DECEMBER • 1993** *Vol. 15*

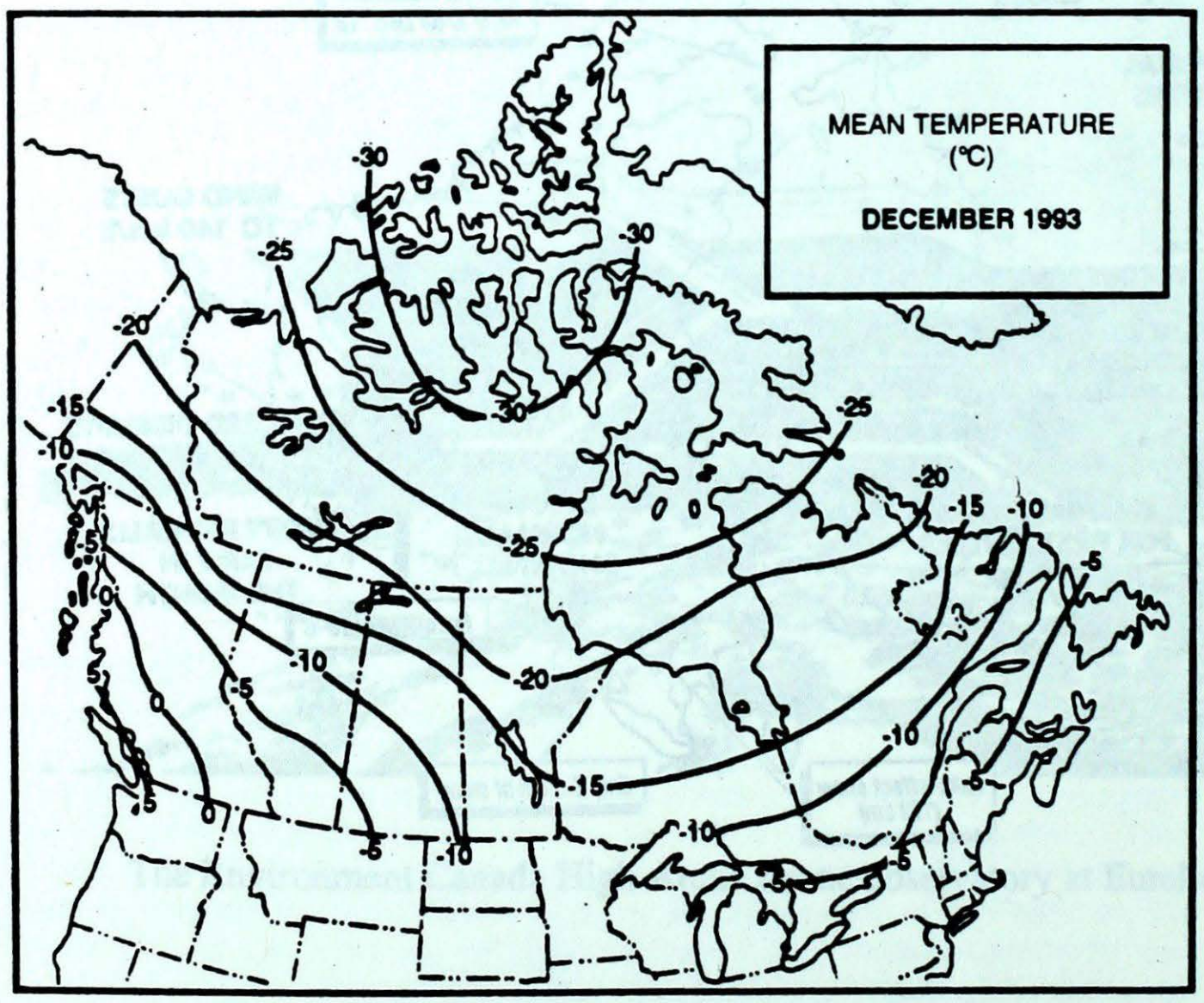
CLIMATIC HIGHLIGHTS



Environment Canada Environnement Canada

Canada





CLIMATIC PERSPECTIVES
VOLUME 16

Managing editor . . . . . *A. Saulesleja*
Editor English version . . . . . *B. Taylor*
French version . . . *Alain Caillet*
Associate editor . . . . . *Annette Goessl*
Long-range forecasts . . . *Aaron Gergye*
Data manager . . . . *M. Skarpathiotakis*
Computer support . . . . . *Robert Eals*
Art layout . . . . . *K. Czaja*
Translation . . . . . *D. Pokorn*
Cartography . . . . . *T. Chivers*

We would like to thank all AES Regional Climate Centres for their regular contributions to **Climatic Perspectives**. We would also like to thank weather offices in B.C., the Yellowknife and Iqaluit weather offices and the weather centres in the Yukon and Newfoundland for their submissions.

ISBN 0225-5707 UDC 551.506.1(71)

Climatic Perspectives is a weekly and monthly publication (disponible aussi en français) of the Canadian Meteorological Centre, Atmospheric Environment Service, 4905 Dufferin St., Downsview, Ontario, Canada M3H 5T4

☎ **(416) 739-4438/4330**
InterNet (Email):
CCCOPS@aestor.dots.doe.CA
Fax: (416) 739-4446
FTP (anonymous): downsv01
or: 142.97.205.100

The purpose of the publication is to make topical information available to the public concerning the Canadian Climate and its socio-economic impact.

The data in this publication are based on unverified reports from approximately 225 Canadian synoptic weather stations. Information concerning climatic impacts is gathered from AES contacts with the public and from the media. Articles do not necessarily reflect the views of the Atmospheric Environment Service.

Annual Subscriptions and changes:

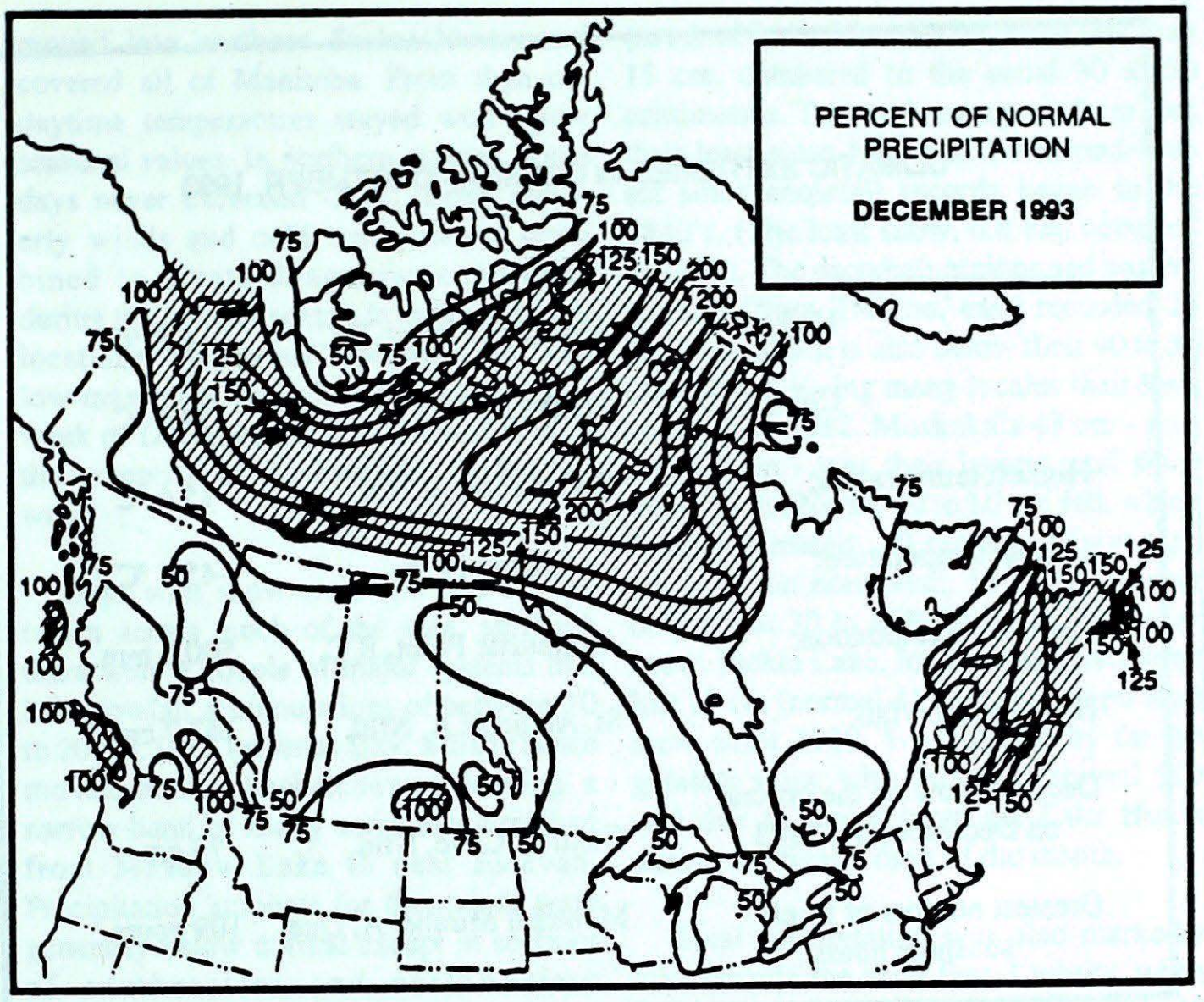
Albert Wright (416) 739-4156
Fax: (416) 739-4264

Across the country

Yukon

The Yukon enjoyed a milder-than-average month of December. Carmacks, Braeburn and Haines Junction were up to 9 degrees above normal. Old Crow was 4 degrees above normal. The warm spot, for the second month in a row, was Haines Junction with 11°C on both the 18th and 19th. Every station in the Yukon recorded maximums above freezing during some part of the month due to intrusions of mild Pacific air which stayed east of the Mackenzie Mountains. The coldest temperature was -46°C at Old Crow, on the 31st.

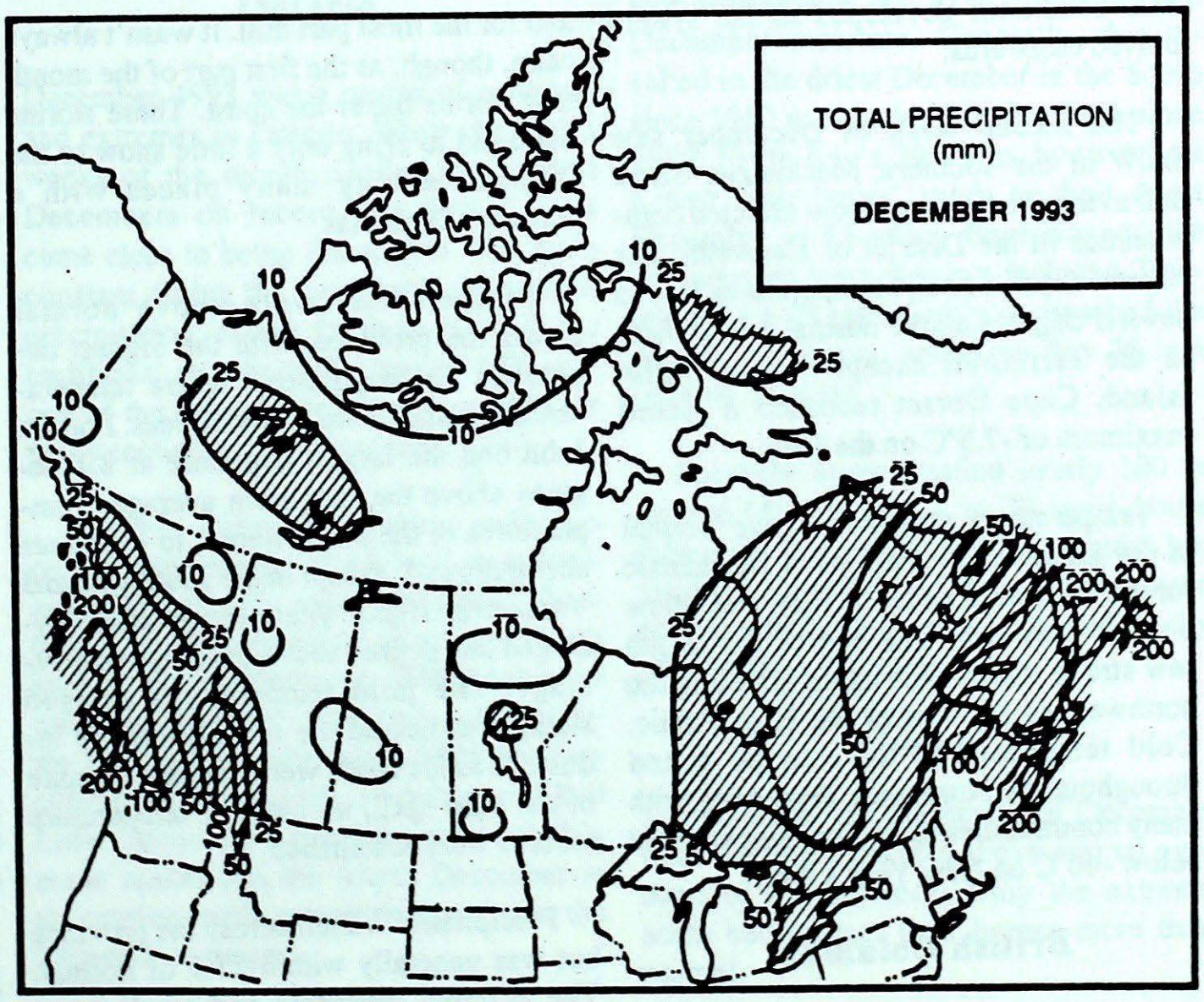
Snowfall amounts were variable with the eastern side of the Territory receiving 150% of normal precipitation amounts. Many communities in the west received less than 50% of normal. Fraser Camp, on the White Pass to Alaska, collected 184 cm of snow for December. This, however, was still only a little over normal. Beaver Creek, on the other hand, had only 3 cm for the month.



Northwest Territories

Overall, temperatures remained above normal in the west and colder-than-normal in the east. This pattern of temperatures has been evident for three consecutive months. In the High Arctic, the mercury never climbed above -20°C during December. With the extremely cold air in the far northern sections, snowfall amounts were minimal as Eureka measured a mere 1.8 cm of snow for the month. Areas in the southern Northwest Territories received around 20 cm for the month and the west had above-normal snowfall.

December began with two low pressure systems affecting the Northwest Territories. The more intense one, over the Arctic Ocean, continued to give windy conditions to northern and western sections of the High Arctic islands. The second one, crossing Hudson Bay, deposited several centimetres of snow and brought strong easterly winds to mainland District of Keewatin and southern Baffin Island. Bliz-



CLIMATIC EXTREMES IN CANADA - DECEMBER, 1993

Mean temperature:		
Highest	Amphitrite Point, B.C.	6.5 ℃
Coldest	Eureka, N.W.T.	-34.6 ℃
Highest temperature:	Greenwood A, N.S.	15.6 ℃
Lowest temperature:	La Grande IV A	-45.4 ℃
Heaviest precipitation:	Amphitrite Point, B.C.	500.8 mm
Heaviest snowfall:	St. Anthony A, Nfld.	167.7 cm
Deepest snow on the ground on December 31, 1993	Comfort Cove, Nfld.	79 cm
Greatest number of bright sunshine hours:	Montréal Mirabel A, Que.	109 hours

zard conditions developed as the system moved eastwards.

The second week of December saw snow in the southern Mackenzie. Snow and extensive blowing snow affected communities in the District of Keewatin. For several days in a row, temperatures stayed several degrees above normal everywhere in the Territories except eastern Baffin Island. Cape Dorset recorded a record maximum of -7.5℃ on the 18th.

Temperatures remained above normal in the southwestern District of Mackenzie for the third week of December, and below normal elsewhere. The end of the month saw strong winds once again affecting the northwestern sections of the High Arctic. Cold temperatures were to be found throughout the Northwest Territories with many communities recording temperatures below -40℃ on New Year's Eve.

British Columbia

The last month of the year was typical of most winter months - mild, generally dry and for the most part dull. It wasn't always calm, though, as the first part of the month saw storms batter the coast. These storms managed to bring only a little snow to the interior leaving many places with a "brown" Christmas.

Temperatures were above normal across the province, with the highest departures in the northeast where temperature anomalies were 6 to 8 degrees. Fort St. John had the largest departure at 8.1 degrees above the long-term average. Temperatures in the south were 2 to 4 degrees above normal, except in the southwest and Vancouver Island where temperatures averaged one degree above the long-term average. The mild temperatures delayed skiing and slowed the oil and forestry industries as ice roads were delayed. In spite of the mild spell, no monthly temperature records were established.

Precipitation varied across the province but was generally within 25% of normal. The extreme northeast and small areas around Prince George and Princeton were the driest with 50% of normal precipitation but no records were established.

A major storm crossed the south coast on the weekend of the 4th. Strong winds downed power lines and disrupted ferry traffic between Vancouver Island and the Mainland. Injuries resulted from debris lifted by winds of 90 km/h in Victoria. Heavy rains caused flooding at Port Alberni, Vancouver Island, December 9th. Heavy rains and more flooding occurred on the 12th as another Pacific system dumped 87.8 mm of rain on Campbell River. Winds exceeding 150 km/h sank a 15-metre dragger but the crew was rescued.

Snowfall was generally below normal with most areas receiving 50 to 75% of normal. The coast received little or no snow. The only areas with above-normal snowfall were the eastern slopes of the Coast Mountains, where localized areas received up to 155% of the long-term average, and small areas around Mackenzie and Castlegar which recorded 115% of normal.

Sunshine was generally below normal with only the extreme northeast and scattered areas in the south receiving above-normal sunshine. Values fell to below 50% of average in the Central Interior and all but extreme southern Vancouver Island. The Columbia was the dullest with a record 25% of normal sunshine. Abbotsford shone with 135% of normal sunshine. There were a few record-low sunshine amounts, the most noticeable being Revelstoke with only 6.7 hours eclipsing the old record of 9.5 hours.

Alberta

December was mild and dry throughout the province. At the beginning of the month, western regions enjoyed mild and sunny conditions due to an upper ridge of high pressure over the province. Only the extreme north remained cold. Chinook winds developed on the 3rd raising temperatures well-above normal throughout the province. Wind speeds across the south reached 100 km/h and produced daytime

highs in excess of 10°C. More-seasonal values returned by the 5th as chinook winds abated. Chinooks redeveloped on the 10th, producing record highs of 15°C across the south. The mild air also moved into northern Alberta resulting in several record highs on the 11th. The frigid arctic air was held at bay until the 21st with above-normal temperatures enjoyed throughout the province. For the rest of the month, Pacific disturbances crossed the province giving light snowfalls. The greatest snowfalls occurred in the mountains and in the foothills where up to 50 cm were recorded. The mild, moist air was a source of persistent fog over many areas throughout the period.

Mild temperatures in the south all-but-eliminated the snowcover over wide areas in the south and temperatures were close to 10°C on Christmas Day. Colder air swept across the province on Boxing Day leaving even southern regions shivering in the minus teens by late in the day. Temperatures in the northeast fell below the -40°C mark. By the 29th, all but the extreme northeast was once again experiencing temperatures 5 to 10 degrees above normal.

December 1993 was the 8th warmest on record for Calgary and the 10th warmest for Edmonton. Calgary also recorded the lowest December mean wind speed (7.8 km/h) since records began in 1933, despite the occurrence of strong chinook winds, at times, this month.

Saskatchewan and Manitoba

Monthly temperatures registered above normal for the first time since April 1993. Mild Pacific air flowing across the Prairies dominated the first 20 days of December but was replaced by bitterly-cold temperatures the last 10 days of the month. The monthly mean was above normal for much of Saskatchewan by 3 to 6 degrees and most of Manitoba was 2 degrees above normal.

The mild air from the Pacific was moist and as a result there was extensive cloud across the region for much of December. However, by the 20th, cold arctic air moved into northern Saskatchewan and covered all of Manitoba. From then on, daytime temperatures stayed well-below seasonal values. In northern regions, some days never exceeded -30°C. Brisk northerly winds and cold temperatures combined to create dangerous conditions during the holiday season in many northern locations. Numerous low-minimum and low-maximum records were set the last week of December in both provinces with the exception of southwestern Saskatchewan.

Days with snow were few and far between across much of the area, although there were a couple of major systems that left snowfall accumulations of between 10 to 20 cm. On Christmas Day, a disturbance moved across Saskatchewan leaving a narrow band of heavy snow that stretched from Meadow Lake to near Estevan. Precipitation amounts for the month were generally below normal except in sections of southeastern and northwestern Saskatchewan.

Ontario

December 1993 was a month of contrasts and extremes in Ontario. While the first 3 weeks of the month rivalled the mildest Decembers on record, the final 7 days came close to being the coldest. The main constant during the month was the lack of precipitation, except for those areas in the traditional snowbelts. December 1993 was one of the driest Decembers on record for many sections of the province.

Monthly mean temperatures ended up on the positive side of the long-term average with monthly means generally from 0.5 to 1.5 degrees milder than normal. As such, however, December 1993 was not as mild as December 1992 and was actually the coldest December since 1989 at a few sites including London, Hamilton and Red Lake. December's relatively mild monthly mean makes this the fourth December in succession with temperatures above the long-term average.

Snowfall was unusually light, with lake-effect snow contributing most significantly to the December totals. Southern Ontario (south of Lake Simcoe) recorded less than 15 cm, compared to the usual 30 to 50 centimetres. Toronto's meagre 2.8 cm was their least since 1943 and the second-lowest since snowfall records began in the 1840's. (The least snow, 0.8 cm, occurred in 1877). The snowbelt regions and eastern Ontario (from Trenton, east) recorded 25 to 55 cm which is also below their 40 to 80 cm normal, giving many locales their least snow since 1982. Muskoka's 43 cm - normal 85 cm - was their lowest total since 1974. In the North, 40 to 60 cm fell, which is approximately 20 cm shy of average, while in the northwest, 15 to 20 cm was only about 30 to 60% of usual December snow. Pickle Lake, for example, measured just 13 cm (normal 41 cm), the lowest total there since 1939. Wiarton had by far the greatest snow with 103 cm (normal 109 cm) due to heavy snow off Lake Huron during the final 7 days of the month.

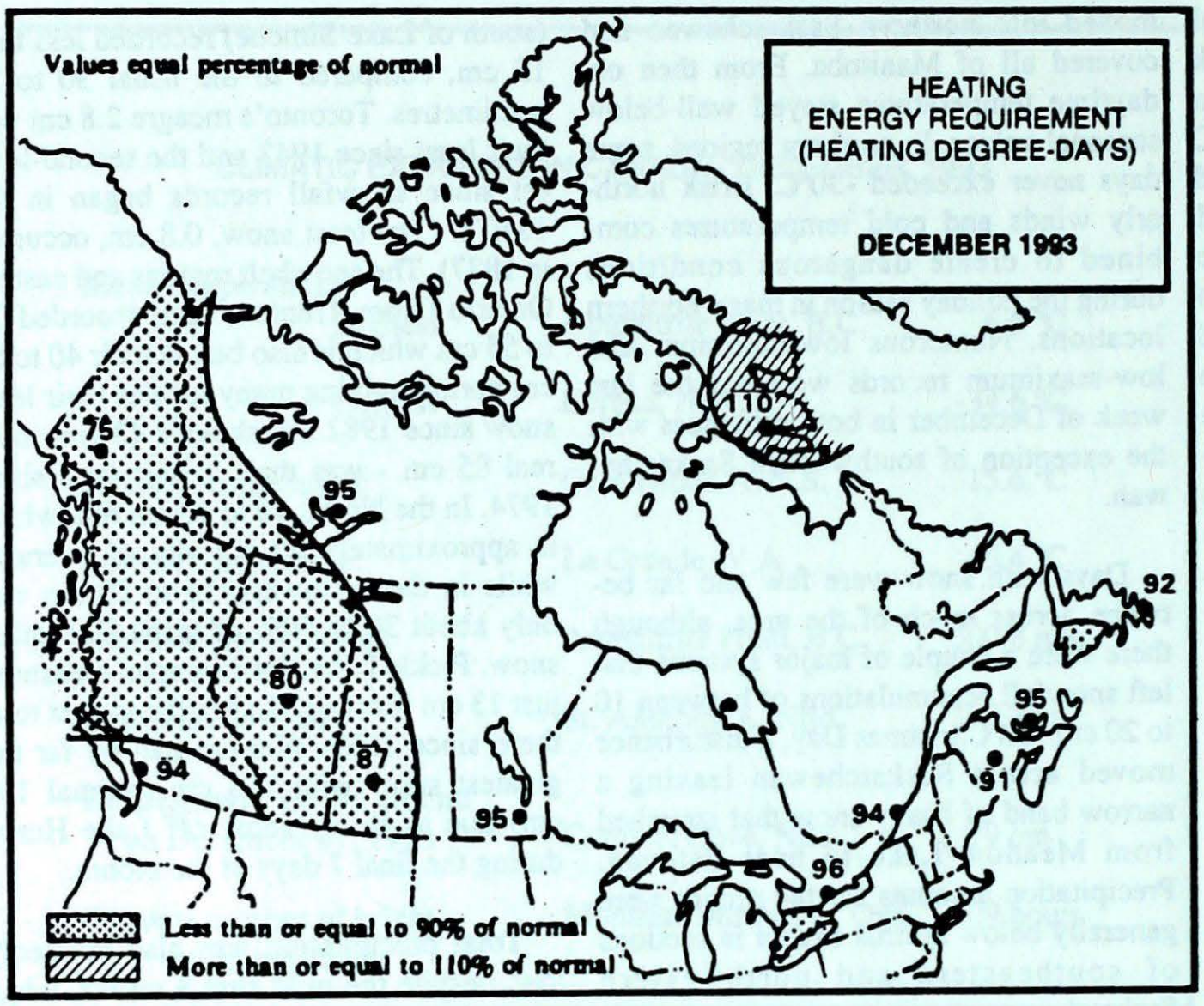
Total precipitation was also markedly low, despite the mild first 3 weeks, when rainfall was minimal. Totals in the 20 to 40 mm range were common around the province representing just 25 to 75% of normal December moisture. Generally, this resulted in the driest December in the South since 1960 and the least in the North since 1989. North Bay's 39.8 mm, however, set a new "low water" mark as their driest December in 55 years. Exceptions to the dry weather were few but included Trenton, where 73 mm closely approached the normal of 83 mm, and Gore Bay 70 mm (normal 74 mm).

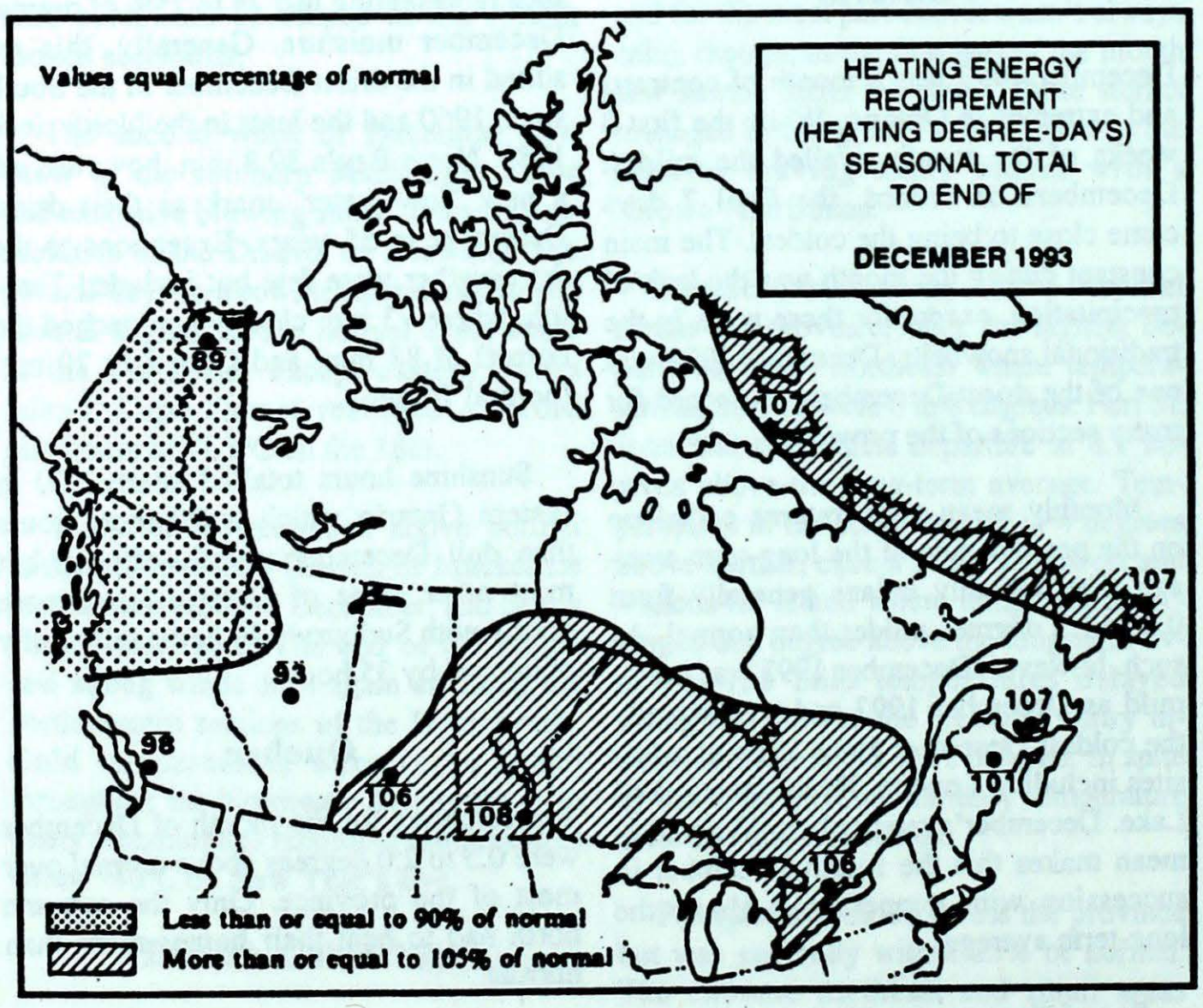
Sunshine hours totalled nearly 100 in eastern Ontario which is 20 more hours than dull December usually affords, but most other areas of Ontario fared more poorly with Sudbury's 49 hours falling shy of normal by 35 hours.

Quebec

Temperatures for the month of December were 0.5 to 2.0 degrees above normal over most of the province. Only the extreme north had to heat their homes more than normal.

...continued on page 26



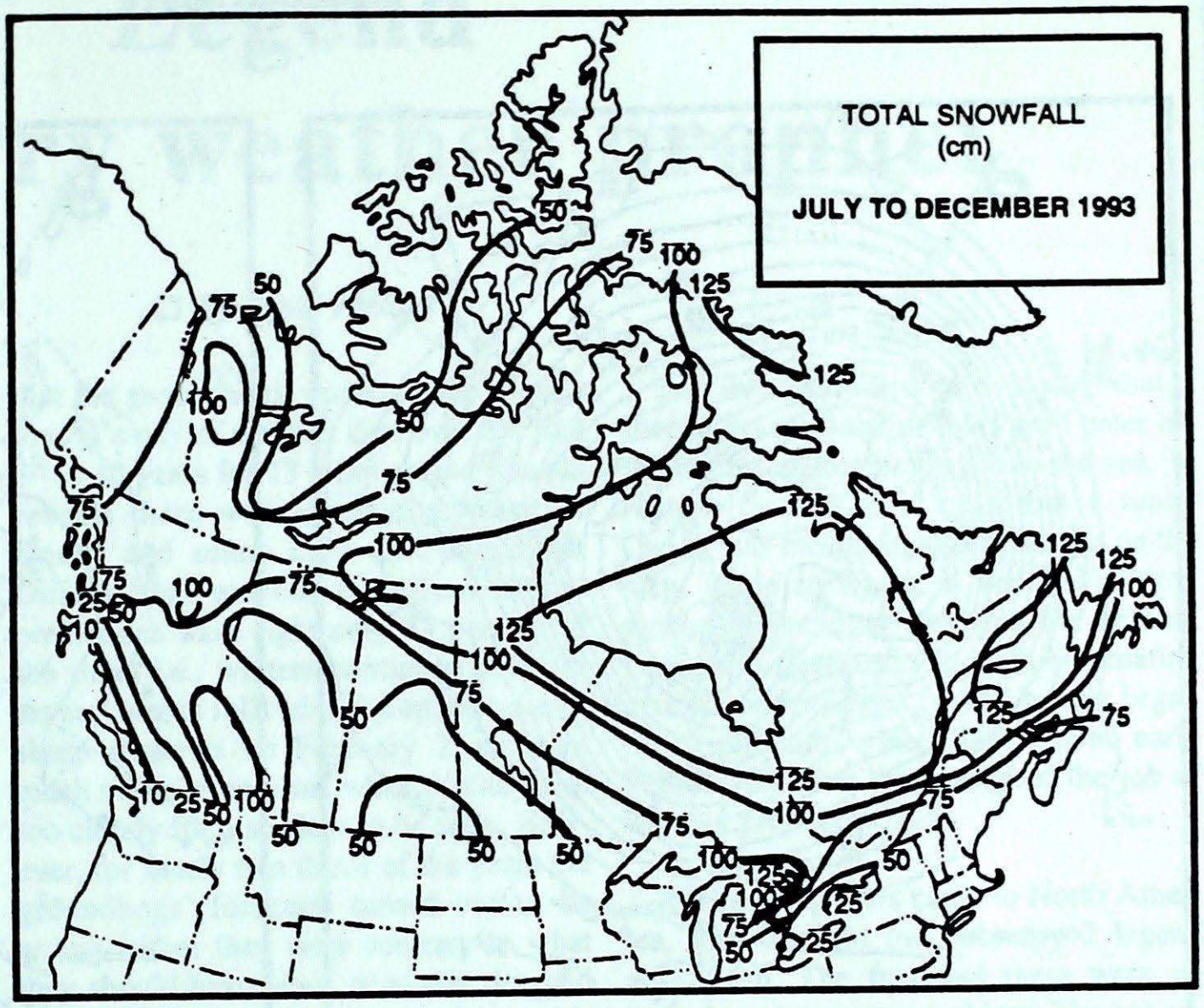


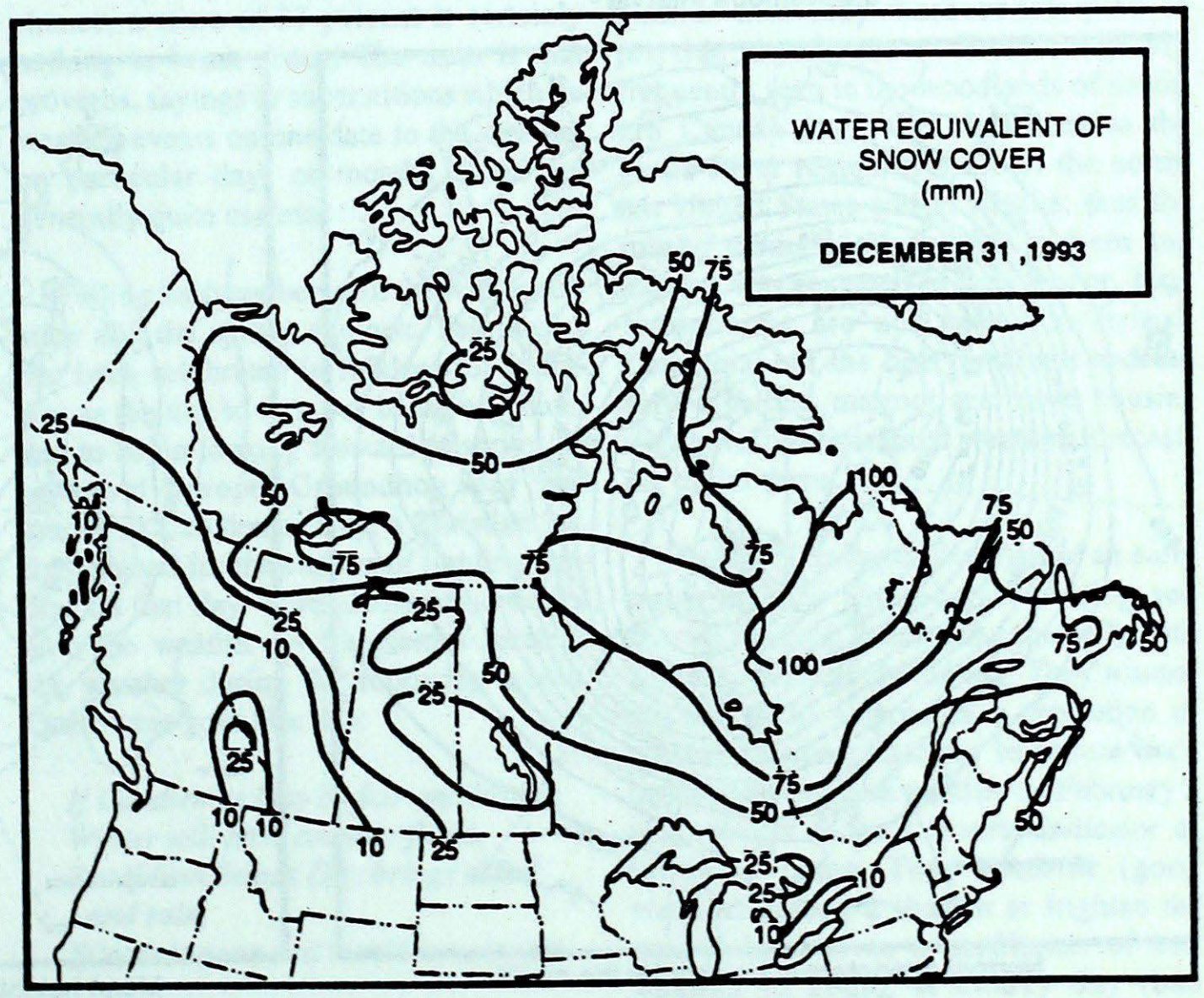
SEASONAL TOTAL OF HEATING DEGREE-DAYS TO END OF DECEMBER

	1993	1992	NORMAL
BRITISH COLUMBIA			
Kamloops	1500	1669	1533
Penticton	1443	1496	1414
Port Hardy	1446	1513	1577
Vancouver	1190	1188	1218
Victoria	1249	1271	1280
YUKON TERRITORY			
Whitehorse	2568	3151	3025
NORTHWEST TERRITORIES			
Iqaluit	4273	4220	4010
Inuvik	3723	4209	4188
Yellowknife	3330	3324	3382
ALBERTA			
Calgary	2090	2374	2168
Edmonton Mun.	2038	2352	2197
Grande Prairie	2214	2769	2536
SASKATCHEWAN			
Estevan	2358	2413	2085
Regina	2385	2469	2257
Saskatoon	2496	2627	2352
MANITOBA			
Brandon	2583	2680	2337
Churchill	3797	3730	3534
Dauphin	2477	2581	2325
Winnipeg	2399	2476	2214
ONTARIO			
Kapuskasing	2623	2573	2468
London	1508	1561	1461
Ottawa	1784	1769	1721
Sudbury	2175	2149	2015
Thunder Bay	2366	2311	2176
Toronto	1541	1547	1459
Windsor	1352	1303	1274
QUEBEC			
Baie Comeau	2372	2398	2318
Montréal	1702	1683	1642
Québec	2012	1949	1942
Sept-Îles	2532	2556	2429
Sherbrooke	1961	1982	1981
Val d'Or	2531	2498	2361
NEW BRUNSWICK			
Fredericton	1760	1807	1739
Moncton	1791	1800	1708
NOVA SCOTIA			
Sydney	*	1369	*
Yarmouth	1402	1604	1454
PRINCE EDWARD ISLAND			
Charlottetown	1708	1678	1603
NEWFOUNDLAND			
Gander	2010	2120	1854
St. John's	1875	1941	1746

SEASONAL SNOWFALL TOTALS (cm)
TO END OF DECEMBER

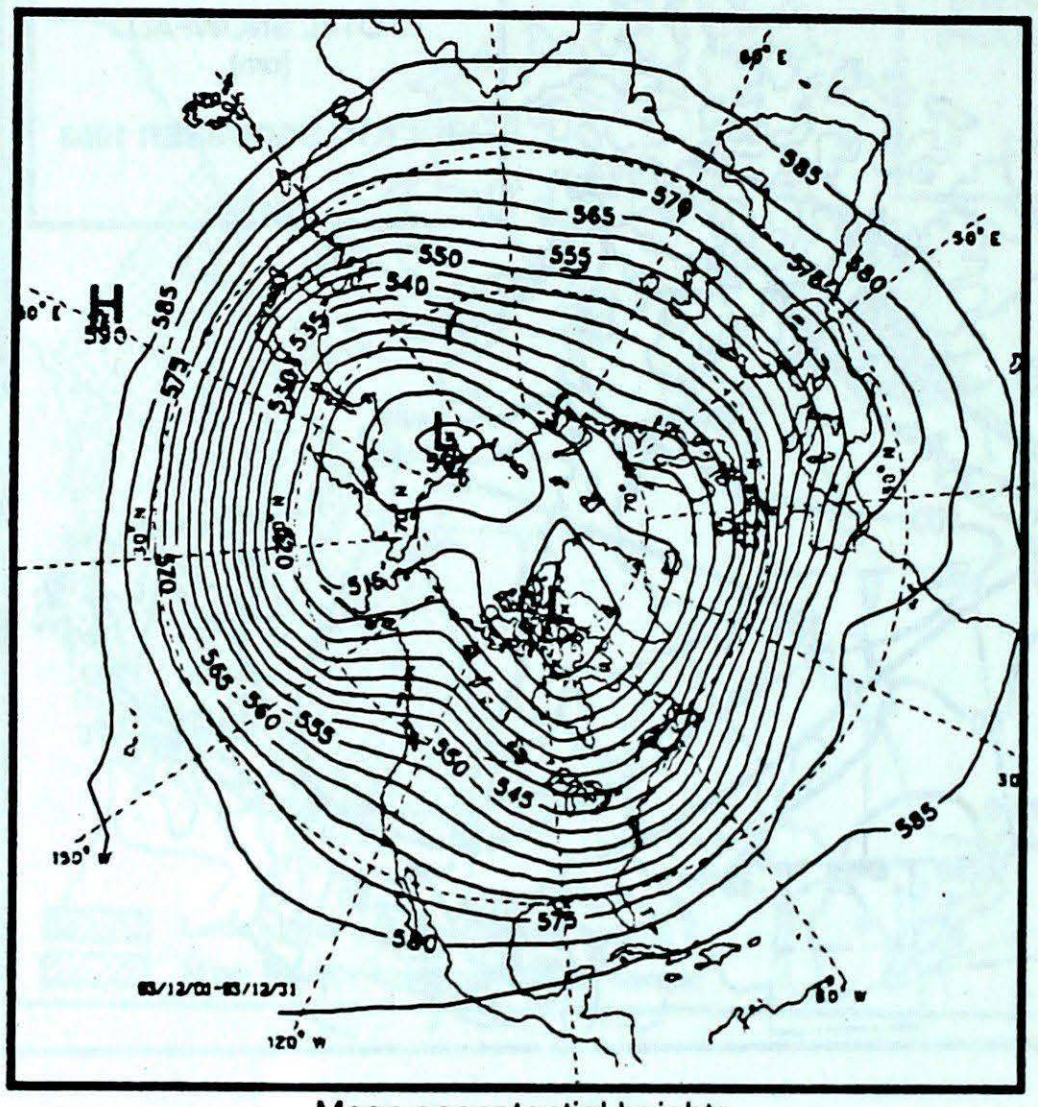
	1993	1992	NORMAL
BRITISH COLUMBIA			
Kamloops	17	58	42
Port Hardy	2	25	20
Prince George	40	178	103
Vancouver	0	35	20
Victoria	0	20	15
YUKON TERRITORY			
Whitehorse	67	135	69
NORTHWEST TERRITORIES			
Iqaluit	99	101	116
Inuvik	82	119	96
Yellowknife	88	70	79
ALBERTA			
Calgary	24	79	57
Edmonton Mun.	36	59	54
Grande Prairie	32	65	77
SASKATCHEWAN			
Estevan	55	55	43
Regina	42	59	45
Saskatoon	*	54	45
MANITOBA			
Brandon	23	54	49
Churchill	*	74	100
The Pas	65	64	72
Winnipeg	42	82	48
ONTARIO			
Kapuskasing	123	191	139
London	30	85	78
Ottawa	59	56	82
Sudbury	91	105	96
Thunder Bay	70	115	80
Toronto	13	49	47
Windsor	14	17	40
QUEBEC			
Baie Comeau	91	103	134
Montréal	71	22	82
Québec	136	60	124
Sept-Îles	118	126	151
Sherbrooke	71	36	112
Val d'or	142	106	129
NEW BRUNSWICK			
Fredericton	36	67	92
Moncton	65	120	97
NOVA SCOTIA			
Sydney	93	97	80
Yarmouth	72	30	52
PRINCE EDWARD ISLAND			
Charlottetown	87	131	97
NEWFOUNDLAND			
Gander	182	126	115
St. John's	73	80	91



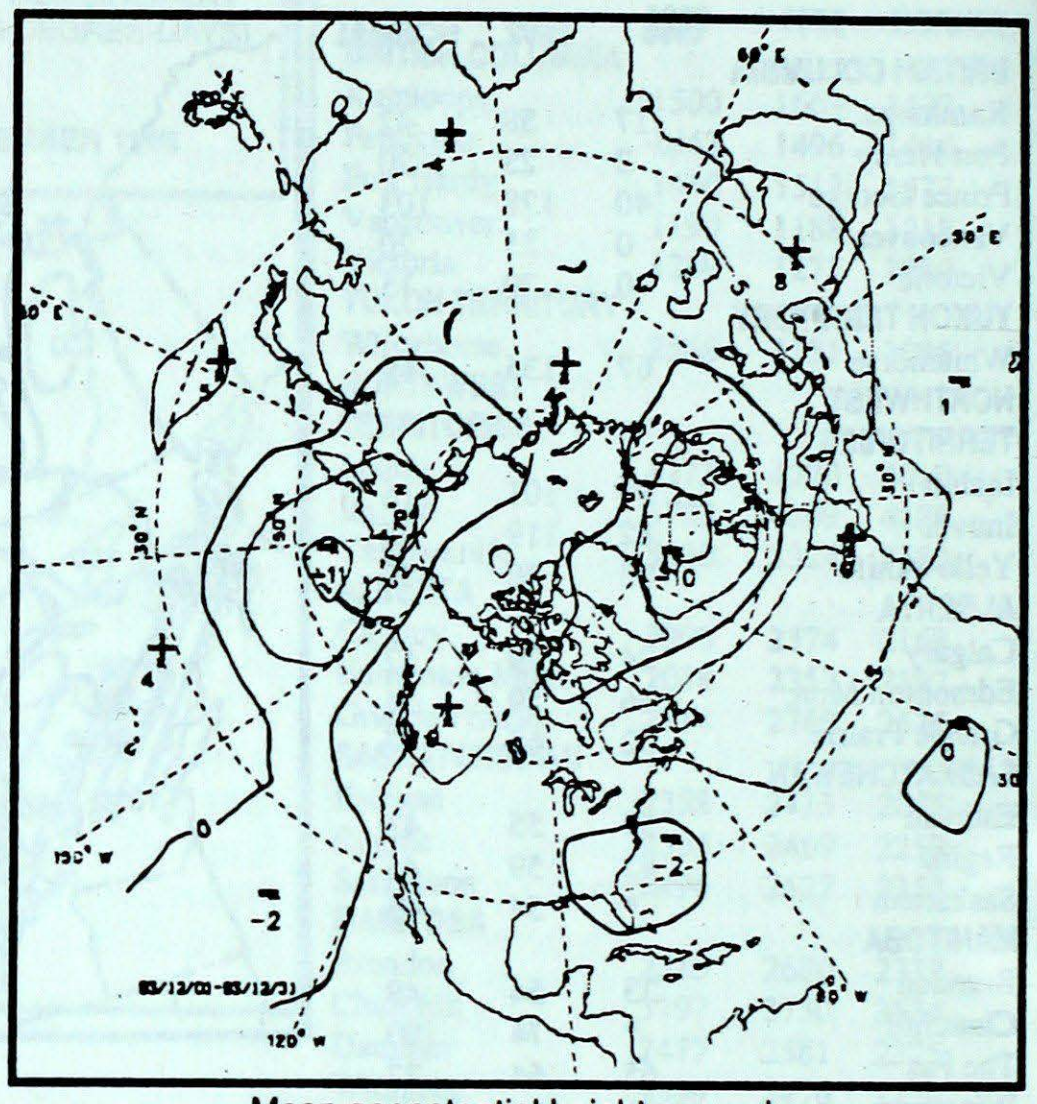


50-kPa ATMOSPHERIC CIRCULATION

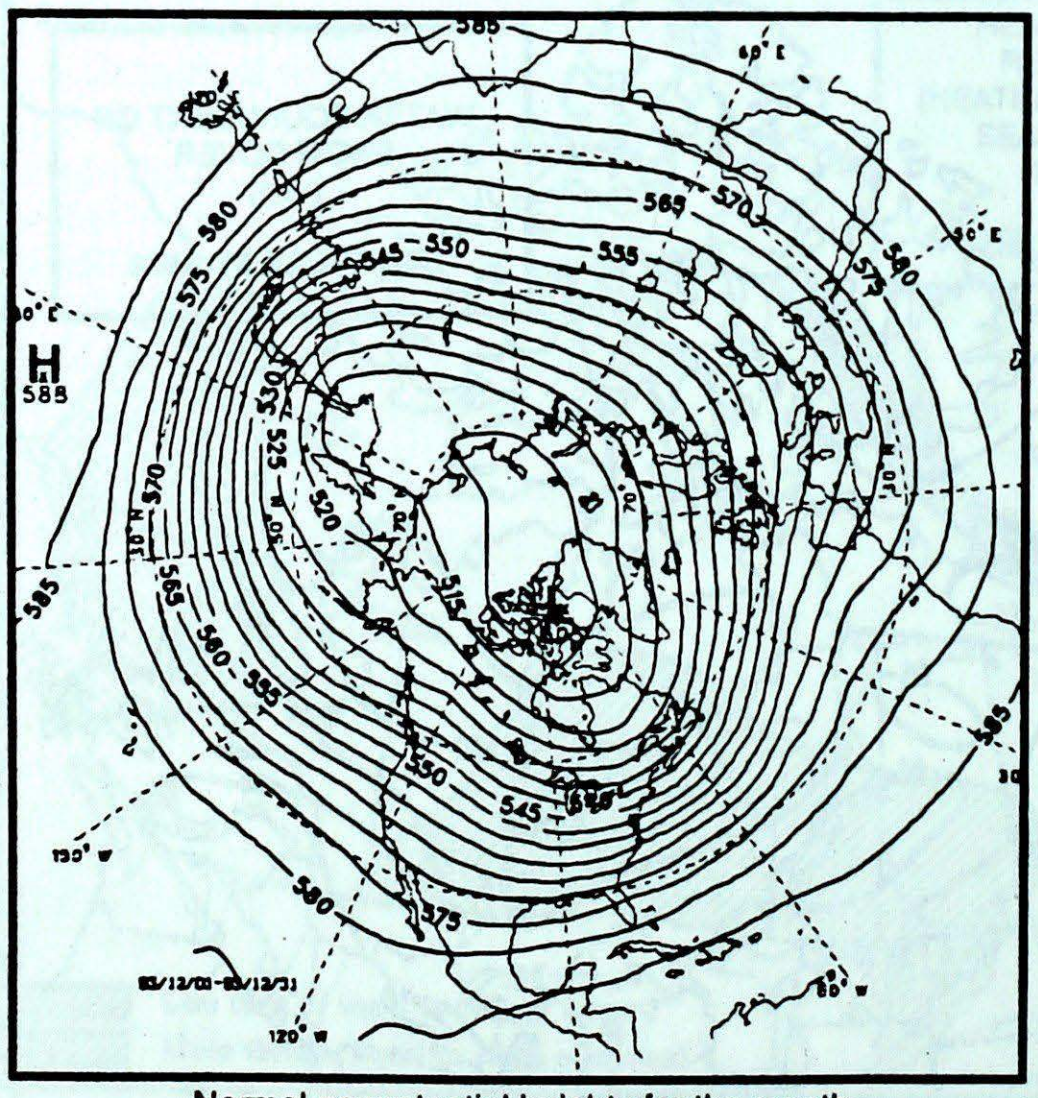
December 1993



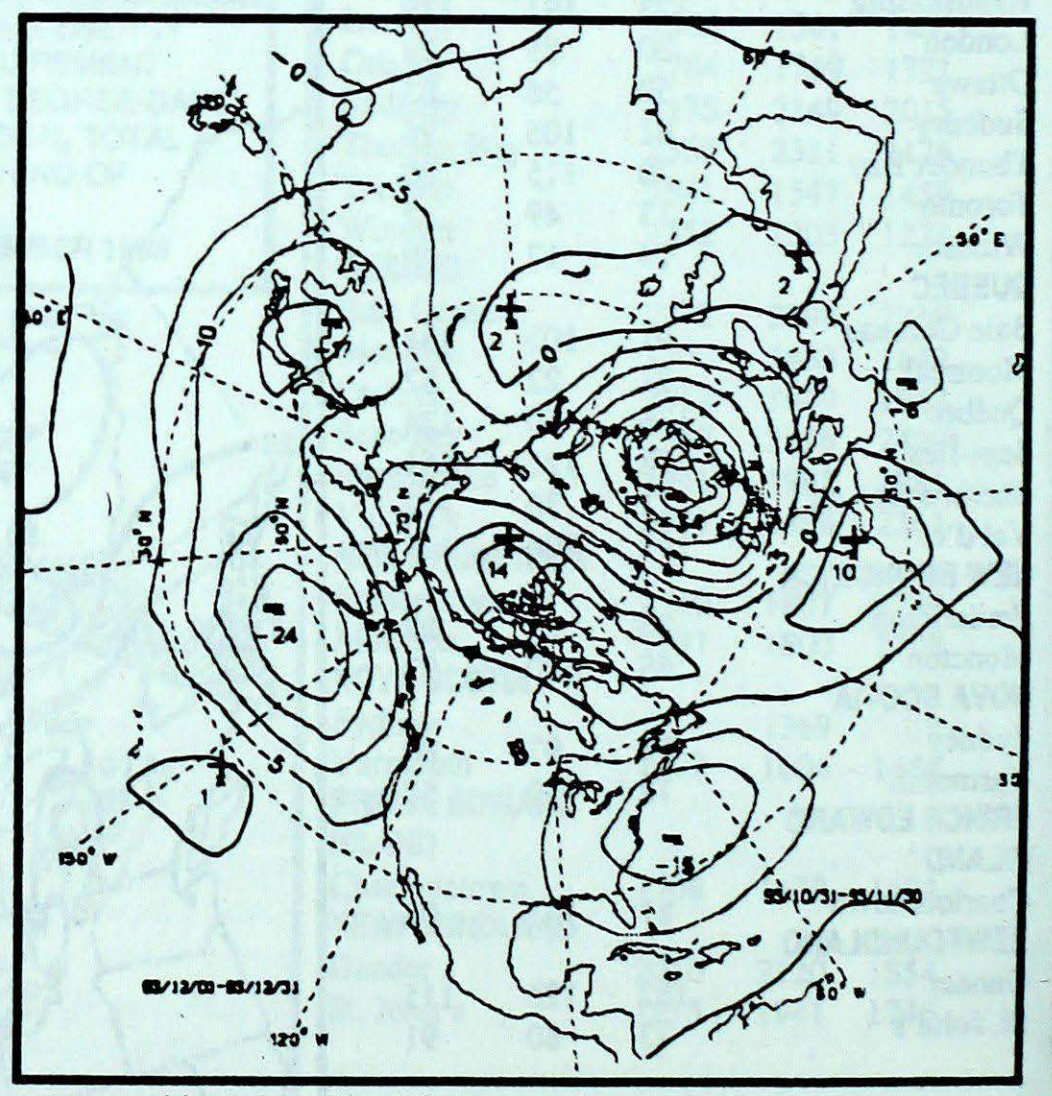
Mean geopotential heights
- 5 decametre interval -



Mean geopotential height anomaly
- 5 decametre interval -



Normal geopotential heights for the month
- 5 decametre interval -



Mean heights difference w/r to previous month
- 5 decametre interval -

Legend of a furry weather prophet

□ *By David Phillips*

Every year on February 2, winter-weary North Americans pin their hopes for fair weather on a furry, burrow-dwelling rodent.

Groundhogs command national attention on net-work news and in frontpage headlines when they make their annual midwinter weather prediction. So revered are these pug-nosed rodents that in 1987, the foremost forecaster of them all, Punxsutawney Phil from Pennsylvania, was invited by President Reagan to the Oval Office to mark the centennial of Phil's and his forebears' weather forecasting.

According to legend, the groundhog emerges from his burrow precisely at noon on February 2 to look for its shadow. If it is a sunny day and the groundhog sees its shadow, it returns to its hole to sleep and winter continues for six more weeks. (Not bad news by most Canadian standards!) If it does not see its shadow, it remains outside because the worst of winter is over and warmer weather is on its way.

In fact, there is a grain of truth to the shadow aspect of the legend. Sunny days in winter are generally associated with colder, drier Arctic air and cloudy days with milder, moist Maritime air. Given the tendency for weather conditions to persist for several days before changing, the weather on any February 2 may continue for a few days, but not necessarily longer than that.

Can a groundhog actually predict the length of winter? Groundhog Day organizers boast that the rodents' forecasts are accurate 75 to 90 percent of the time. However, meteorological records prove that the groundhogs' success rate is quite low. A study of weather data over the past 30 to 40 years for 13 cities across Canada reveals there was an equal number of cloudy and sunny days on February 2. During that period, the groundhogs' predictions were right only 37 percent of the time, i.e., winters continued cold for several weeks following the appearance of sharp shadows on February 2, or were much milder than usual when that day was too cloudy for a shadow to be seen. However, for nearly two thirds of the years the groundhogs' forecasts turned out to be wrong, either they were contrary to what they should have been, or winter dragged on its normal duration. Given that in this case 33 percent accuracy can occur by chance, a score of 37 percent is certainly nothing to boast about! The truth is that proverbs, sayings or superstitions which tie weather events on one date to the weather on particular days or months ahead are generally quite useless.

Falling halfway between the winter solstice and the spring equinox, February 2 has been celebrated in folklore for centuries as the day to turn our backs on winter and to begin looking forward to spring. In medieval Europe, Groundhog Day was known as Candlemas Day, a Christian festival named for the custom of lighting candles on that day. Several rhymes describe how the weather on Candlemas foretells the weather during the following weeks. One rhyme goes like this:

If Candlemas Day be fair and bright;
Winter will have another flight,
But if Candlemas Day brings cloud and rain,
Winter is gone and won't come again.

In Germany there is a saying that a shepherd would rather see a wolf enter his stable on Candlemas Day than the sun. In France, country folk warn that a sunny Candlemas means another winter is on the way, while in Spain, a wet February 2 means the cold is over for the season. Europeans observed that such hibernating animals as the hedgehog and badger began to stir on warm winter days around early February, so that they assigned the job of weather prophet to them.

When the settlers came to North America, they brought the February 2 legend with them. The fact that there were no hedgehogs was not a problem. The behavior of groundhogs and other rodents was so similar that they were conscripted to provide the forecast. Groundhogs are frequently seen in the woodlands of southern Canada from the Maritimes to the Peace River region, and across the northern United States and in Alaska; thus the role of spring harbinger fell to them and the day was renamed in their honor. Real groundhogs are not native to British Columbia, but the hoary marmot and the yellow-bellied marmot are close cousins who have been assigned weather-forecasting duties there.

Early settlers hoped for signs of an early spring so they could begin planting and shorten the time to harvest, especially with winter provisions dwindling. They wanted the animal to emerge as a prediction of warmth to come and not to retreat back into its burrow. The weather on February 2 was thought to be a reverse indicator of things to come. Thus sunshine (good weather) casting a shadow to frighten the animal is seen as a prediction of bad weather to come. A cloudy day (bad

weather) prevented a shadow so the furry creature could leave its den without fear, foretelling early warmth.

What early settlers did not realize was that the groundhog sleeps later than the European hedgehog and is less likely to stir even on warm winter days. When February 2 rolls around, the worst of winter's weather is usually over the western European, but not in Canada. Compared to western Europe, Canadian winters are generally longer with much more cold and snow yet to come. In early February, the openings to groundhog burrows are usually buried under deep layers of snow and ice.

Wiarton Willie of Wiarton, Ontario, near Georgian Bay is unlikely to appear above ground until early to mid-March, six to eight weeks after his special day. Brandon Bob of Manitoba sleeps 'till late March or early April. According to groundhog expert and zoology professor Dr. Edward Bailey of the University of Guelph, when the mature male groundhog finally arouses from hibernation and surfaces, he does not look for his shadow, nor even for food, but rather travels from burrow to burrow searching for a mate. Since the female emerges from her cozy den several weeks later, males bide their time fighting territorial battles with other males.

Nearly everyone knows that the groundhog story is a cute hoax - pure superstition. After all the sight of the network media interviewing people in tuxedos and top hats trying to coax a groundhog out of a hole on February 2 for any sign that will provide a precise weather forecast for the next weeks is about as silly as it can possibly get.

Despite the fact that probably few people really believe it, the groundhog myth lives on and provides us with an opportunity to rejoice that winter is at least half over. For some communities, Groundhog Day is an important tourist attraction, and a good reason for a mid-winter party. For the lowly groundhog - more often a bane to farmers, gardeners and highway crews - it represents his "15 minutes" of fame in the sunlight.

	Chance of Groundhog Seeing Its Shadow (Percent)	Correct Groundhog Forecasts* (Percent)
St. John's	53	41
Charlottetown	50	41
Halifax	50	42
Fredericton	48	34
Montreal	52	36
Toronto	54	29
Ottawa	48	42
Winnipeg	78	30
Regina	63	38
Edmonton	60	26
Vancouver	23	35
Whitehorse	43	42
Yellowknife	50	50

***Correct just by accident or chance - 33 percent of the time**

Index

of 1993 *Climatic Perspectives* articles

DECEMBER 1993

STATION	Temperature C				Snowfall (cm)	% of Normal Snowfall	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of month (cm)	No. of days with Precip 1.0 mm or more	Bright Sunshine (hours)	% of Normal Bright Sunshine	Degree Days below 18 C
	Mean	Difference from Normal	Maximum	Minimum									
BRITISH COLUMBIA													
ABBOTSFORD A	3.8	0.6	15.7	-5.7	0.0	0	201.5	88	0	15	73	136	440.2
ALERT BAY	5.0	1.1	6.4	0.5	0.0	0	201.9	86	0	20	*	*	403.3
AMPHITRITE POINT	6.5	1.0	11.6	1.3	0.0	0	500.8	111	0	17	*	*	357.1
BLUE RIVER A	-4.3	3.5	7.8	-18.2	90.1	83	92.1	76	64	16	12	41	*
CAPE SCOTT	6.9	2.1	11.5	1.9	2.4	20	264.2	71	0	20	*	*	344.4
CASTLEGAR A	-0.8	1.2	5.6	-11.3	78.8	104	119.3	111	35	16	24	77	581.4
COMOX A	4.9	1.2	11.9	-2.3	0.0	0	276.0	130	0	15	14	*	406.0
CRANBROOK A	-4.2	2.4	6.1	-14.7	25.5	61	30.6	66	8	8	41	65	688.2
DEASE LAKE	-9.7	6.3	3.2	-24.8	21.6	52	17.8	53	28	7	35	85	854.8
FORT NELSON A	-16.5	4.5	3.6	-27.0	13.2	49	9.2	43	38	4	63	*	1064.5
FORT ST JOHN A	-5.1	8.1	5.4	-18.5	19.0	47	18.0	50	6	4	54	*	714.2
HOPE A	3.3	1.7	11.7	-3.8	0.2	0	195.1	67	0	14	3	78	454.6
KAMLOOPS A	0.3	3.1	11.9	-9.6	12.0	40	32.2	100	1	11	34	70	550.3
KELOWNA A	-0.8	2.3	11.0	-11.2	34.5	91	41.2	95	17	12	24	59	582.4
MACKENZIE A	-4.8	5.9	4.5	-20.5	86.6	109	78.6	92	64	13	14	37	707.1
PENTICTON A	0.9	1.3	11.3	-8.3	15.0	65	30.2	97	2	9	21	53	530.7
PORT ALBERNI A	4.8	2.2	10.9	-2.7	1.0	4	240.6	71	0	25	11	*	409.3
PORT HARDY A	4.7	1.2	8.9	-0.9	0.0	0	257.0	93	0	18	21	48	411.5
PRINCE GEORGE A	-2.6	5.3	7.1	-15.2	25.8	49	25.5	45	4	6	29	62	639.6
PRINCE RUPERT A	4.8	3.4	10.9	-2.7	1.0	3	240.6	85	0	25	11	34	409.3
PRINCETON A	-2.8	2.9	5.9	-12.9	20.6	46	18.0	34	2	8	53	*	*
REVELSTOKE A	0.9	5.1	6.2	-11.5	61.8	44	109.0	75	28	15	7	25	594.0
SANDSPIT A	5.4	2.0	11.5	-2.3	0.0	0	209.0	117	0	21	28	70	392.1
SMITHERS A	-3.6	4.0	3.4	-13.9	38.0	67	34.8	58	19	7	23	60	670.2
TERRACE A	0.6	4.0	6.4	-5.8	66.8	63	146.9	76	1	28	15	49	539.5
VANCOUVER INT'L A	4.5	0.6	12.9	-3.8	0.0	0	162.3	89	0	14	56	116	418.4
VICTORIA INT'L A	5.0	0.8	11.2	-2.7	0.0	0	110.0	70	0	14	42	82	402.5
WILLIAMS LAKE A	-4.6	3.1	5.5	-19.7	29.3	59	24.8	60	22	9	20	42	701.1

STATION	Temperature C				Snowfall (cm)	% of Normal Snowfall	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of month (cm)	No. of days with Precip 1.0 mm or more	Bright Sunshine (hours)	% of Normal Bright Sunshine	Degree Days below 18 C
	Mean	Difference from Normal	Maximum	Minimum									
YUKON TERRITORY													
MAYO A	-16.3	7.9	-1.7	-35.9	18.9	77	13.1	58	*	*	*	*	*
WHITEHORSE A	-8.2	8.4	4.7	-28.1	24.6	102	17.5	87	13	6	27	118	810.2
NORTHWEST TERRITORIES													
BAKER LAKE A	-29.1	-0.9	-9.4	-41.2	18.4	211	17.3	211	29	5	17	244	1460.1
CAMBRIDGE BAY A	-31.4	-1.4	-20.2	-40.2	9.6	152	6.4	119	18	3	0	*	1533.4
CLYDE A	-27.2	-2.8	-12.0	-38.4	31.6	400	26.4	338	40	6	0	*	1400.5
COPPERMINE A	-27.6	-1.7	-12.8	-40.0	3.8	33	2.8	25	18	1	0	*	1413.1
CORAL HARBOUR A	-27.5	-2.0	-8.0	-43.7	21.0	194	21.0	206	26	5	11	36	1408.2
EUREKA	-34.6	0.2	-20.4	-42.5	1.8	72	1.2	50	6	0	0	*	1629.7
FORT SIMPSON A	-20.5	4.3	-12.2	-37.7	20.6	86	21.8	118	34	8	24	84	1182.7
FORT SMITH A	-17.7	3.9	-3.1	-38.9	35.4	142	19.0	86	54	9	20	71	1106.0
IQALUIT	-26.1	-4.3	-6.6	-43.4	25.8	104	14.6	66	18	5	6	32	1367.4
HALL BEACH A	-27.1	0.3	-13.2	-40.9	14.8	161	12.3	141	25	5	*	*	1400.0
HAY RIVER A	-17.9	3.0	-5.6	-33.5	28.3	109	20.4	83	54	5	*	*	1112.8
INUVIK A	-23.8	3.4	-12.8	-40.7	24.8	119	19.6	113	40	8	0	*	1274.6
NORMAN WELLS A	-22.9	3.6	-13.7	-41.5	45.0	233	31.3	166	23	9	8	62	1268.6
POND INLET A	-28.9	*	-14.6	-37.5	9.2	*	6.6	*	7	3	0	*	1454.0
RESOLUTE A	-29.6	-0.3	-21.1	-41.5	3.0	57	2.8	57	22	1	0	*	1475.4
YELLOWKNIFE A	-22.2	1.8	-6.9	-40.1	44.0	200	27.6	152	26	11	39	183	1247.8
ALBERTA													
BANFF	-5.8	3.1	6.0	-19.0	30.0	67	24.2	64	10	5	*	*	736.8
CALGARY INT'L A	-1.9	5.9	15.0	-17.0	8.2	39	3.6	22	0	1	112	114	616.9
COLD LAKE A	-9.4	4.8	3.4	-30.6	27.9	106	17.9	72	23	5	45	59	850.1
CORONATION A	-7.7	4.1	5.0	-24.0	11.8	52	12.6	64	10	3	88	104	796.0

DECEMBER 1993

STATION	Temperature C Mean	Difference from Normal	Maximum	Minimum	Snowfall (cm)	% of Normal Snowfall	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of month (cm)	No. of days with Precip 1.0 mm or more	Bright Sunshine (hours)	% of Normal Bright Sunshine	Degree Days below 18 C
EDMONTON INT'L A	-6.2	6.9	7.1	-21.7	9.6	37	10.2	47	3	3	95	122	749.3
EDMONTON MUNICIPAL	-4.6	5.8	7.4	-16.9	12.0	*	11.4	46	3	5	98	125	700.2
EDMONTON NAMAO A	-5.1	6.7	7.3	-17.8	9.8	36	8.6	33	2	3	*	*	715.1
EDSON A	-5.6	7.3	9.5	-21.5	31.0	139	22.8	94	10	5	106	161	732.6
FORT MCMURRAY A	-11.0	6.0	6.2	-28.7	27.3	93	15.2	61	26	7	50	81	901.2
GRANDE PRAIRIE A	-5.9	7.5	6.5	-21.4	19.6	57	17.4	54	2	5	79	*	739.1
HIGH LEVEL A	-16.6	4.7	1.1	-29.9	24.5	79	22.9	95	38	5	*	*	1073.7
JASPER	-5.8	3.4	5.0	-20.5	32.0	98	25.2	77	16	7	70	*	736.4
LETHBRIDGE A	-0.9	4.9	14.6	-20.1	11.7	46	10.8	49	0	4	87	96	584.3
MEDICINE HAT A	-3.1	4.5	9.5	-18.0	11.6	61	13.4	82	0	5	73	84	651.8
PEACE RIVER A	-7.2	8.1	5.1	-21.7	8.3	32	7.1	33	4	2	*	*	780.5
RED DEER A	-4.1	7.3	10.6	-22.2	11.2	52	9.9	49	2	3	*	*	742.5
ROCKY MTN HOUSE A	-5.5	3.6	14.1	-23.9	28.9	116	24.2	109	10	7	*	*	728.6
SLAVE LAKE A	-6.6	8.2	8.1	-22.5	20.4	65	14.0	43	2	4	54	92	761.8
SUFFIELD A	-3.7	*	8.4	-19.2	7.2	*	5.1	*	1	2	69	*	671.6
WHITECOURT A	-5.0	8.1	8.6	-20.2	28.0	101	20.0	75	6	6	*	*	710.5
SASKATCHEWAN													
BROADVIEW	-10.7	3.3	3.3	-36.5	27.6	131	23.8	120	11	10	75	78	889.2
ESTEVAN A	-9.5	1.6	4.2	-37.1	24.8	127	18.0	92	16	7	53	51	850.0
KINDERSLEY	-8.4	4.4	6.3	-27.7	9.0	44	6.8	35	10	4	61	*	818.9
LA RONGE A	-13.6	4.0	3.4	-34.5	21.9	79	19.9	89	27	6	*	*	981.7
MEADOW LAKE A	-10.7	*	2.8	-36.0	28.0	*	21.4	*	17	7	55	*	890.0
MOOSE JAW A	-7.2	3.5	7.0	-28.8	24.7	98	13.9	65	12	5	47	55	780.2
NIPAWIN A	-12.5	*	1.0	-32.5	16.6	*	10.2	*	24	4	54	*	945.7
NORTH BATTLEFORD A	-9.6	4.5	6.8	-30.6	11.8	52	8.4	40	6	4	*	*	855.6
PRINCE ALBERT A	-11.2	5.3	2.7	-34.2	15.2	64	12.8	59	12	4	50	70	907.3
REGINA A	-9.4	3.4	3.6	-36.0	24.6	118	18.2	109	19	8	52	62	848.5
SWIFT CURRENT A	-6.0	3.9	6.6	-27.0	22.2	107	19.4	97	12	5	66	78	740.7
YORKTON A	-11.7	2.9	0.8	-33.0	21.0	88	18.6	82	18	8	60	69	919.8
MANITOBA													
BRANDON A	-12.5	1.9	1.4	-34.1	15.4	79	9.3	49	8	3	60	*	946.4
DAUPHIN A	-11.9	2.4	2.4	-32.6	18.9	73	10.6	44	10	4	63	67	926.3
GILLAM A	-22.1	1.4	-1.9	-39.3	11.9	37	7.4	24	32	3	*	*	1243.3
ISLAND LAKE	-19.7	1.0	-1.8	-39.8	24.0	41	19.8	59	35	4	*	*	1169.0
LYNN LAKE A	-20.7	1.1	-0.3	-40.4	11.0	33	8.6	34	33	2	54	87	1198.8
NORWAY HOUSE A	-18.1	*	-2.8	-38.3	40.0	*	32.8	*	29	10	*	*	1118.2

STATION	Temperature C Mean	Difference from Normal	Maximum	Minimum	Snowfall (cm)	% of Normal Snowfall	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of month (cm)	No. of days with Precip 1.0 mm or more	Bright Sunshine (hours)	% of Normal Bright Sunshine	Degree Days below 18 C
THE PAS A	-14.9	2.7	0.5	-36.8	26.0	92	16.8	76	14	4	80	107	1020.2
THOMPSON A	-21.6	0.4	-3.2	-42.7	15.4	35	9.7	30	26	5	92	136	1228.1
WINNIPEG INT'L A	-12.7	1.3	0.2	-32.6	15.2	73	13.0	68	9	6	67	72	952.0
ONTARIO													
EARLTON A	-11.0	1.6	3.6	-36.8	40.0	74	36.8	65	19	7	*	*	897.5
GERALDTON A	-13.7	*	5.4	-41.7	24.0	*	22.8	*	14	7	*	*	983.1
GORE BAY A	-4.6	0.9	5.7	-30.5	55.2	95	69.8	93	30	13	*	*	701.9
HAMILTON A	-2.7	0.7	9.3	-21.6	16.8	49	35.1	45	3	8	*	*	641.2
KAPUSKASING A	-13.4	1.3	2.6	-40.9	39.4	74	44.0	83	29	11	*	*	974.0
KENORA A	-12.2	1.9	-0.2	-33.8	17.4	57	14.8	47	13	5	*	*	936.8
KINGSTON A	-3.3	1.7	9.0	-28.3	27.0	56	54.8	49	10	10	99	129	658.1
LONDON A	-3.2	0.3	9.9	-18.8	14.4	28	42.8	49	9	10	59	105	657.1
MUSKOKA A	-6.1	1.0	8.5	-32.4	43.3	59	57.5	59	22	14	*	*	736.7
NORTH BAY A	-8.0	1.7	7.8	-35.3	45.0	74	39.8	53	27	12	82	106	805.4
OTTAWA INT'L A	-6.4	1.3	8.5	-31.7	42.4	75	53.8	67	23	11	100	126	757.3
PETAWAWA A	-8.2	2.0	6.2	-33.6	27.2	50	22.4	29	*	2	*	*	811.4
PETERBOROUGH A	-5.0	1.4	10.1	-28.1	16.6	43	32.4	40	8	3	*	*	713.0
PICKLE LAKE	-16.0	1.7	-0.8	-39.7	12.8	31	12.0	33	21	5	*	*	1054.2
RED LAKE A	-14.7	1.4	0.1	-37.6	20.2	64	12.6	39	21	6	71	*	1014.6
ST CATHARINES A	-1.7	-0.2	10.5	-20.6	20.2	70	52.4	66	2	8	56	*	609.3
SARNIA A	-2.3	0.3	10.9	-17.6	13.1	34	24.7	34	0	9	62	94	627.6
SAULT STE MARIE A	-5.7	1.0	7.8	-32.5	48.6	64	57.2	72	18	14	54	87	734.5
SIOUX LOOKOUT A	-12.9	2.2	-0.4	-39.3	16.2	47	14.0	42	23	5	*	*	960.8
SUDBURY A	-8.7	1.5	3.7	-36.0	41.4	73	51.7	80	29	10	49	57	825.6
THUNDER BAY A	-10.2	0.9	6.7	-33.4	19.4	42	18.8	45	11	7	80	86	873.1
TIMMINS A	-11.7	2.3	3.8	-40.2	50.7	71	50.8	80	28	9	*	*	919.5
TORONTO	-0.6	*	10.6	-18.1	2.8	*	27.6	*	0	8	*	*	575.3
TORONTO INT'L A	-2.5	1.0	10.0	-20.7	8.8	27	28.8	45	0	7	*	*	641.3
TORONTO ISLAND A	-1.1	*	11.2	-18.0	2.2	8	27.2	*	0	7	*	*	590.8
TRENTON A	-4.0	0.5	10.5	-31.8	35.3	76	73.5	89	14	12	*	*	679.8
WATERLOO WELLINGTON	-4.0	0.3	9.3	-24.8	17.2	46	36.4	47	10	9	*	*	681.8
WAWA A	-9.3	*	4.7	-37.3	68.6	*	55.8	*	32	12	*	*	846.4
WIARTON A	-3.6	0.1	8.4	-24.2	103.2	112	74.2	69	33	16	51	111	669.0
WINDSOR A	-1.6	0.3	12.0	-16.3	11.0	38	20.2	28	2	5	*	*	605.2

DECEMBER 1993

STATION	Temperature C				Snowfall (cm)	% of Normal Snowfall	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of month (cm)	No. of days with Precip 1.0 mm or more	Bright Sunshine (hours)	% of Normal Bright Sunshine	Degree Days below 18 C
	Mean	Difference from Normal	Maximum	Minimum									
QUEBEC													
BAGOTVILLE A	-11.5	0.6	3.3	-39.5	52.2	62	43.8	56	37	10	*	*	914.6
BAIE COMEAU A	-8.6	1.7	4.3	-33.3	44.6	58	89.4	86	15	15	82	97	825.8
BLANC SABLON A	-5.7	1.9	6.2	-19.3	68.0	81	86.8	58	6	17	37	*	747.5
INUKJUAK A	-18.7	-0.8	-2.1	-40.0	35.2	152	30.0	133	36	8	*	*	1136.2
KUUJJUAQ A	-21.0	-2.6	-0.9	-43.1	34.1	87	34.1	89	15	12	52	96	1207.4
KUUJJUARAPIK A	-16.8	-1.1	0.6	-39.7	42.0	100	42.0	101	12	10	35	*	1079.3
LA GRANDE IV A	-18.1	*	-1.0	-45.4	55.0	*	39.4	*	46	13	61	*	1120.3
LA GRANDE RIVIERE A	-17.3	*	0.4	-40.3	24.0	*	25.0	*	53	7	45	*	1093.0
MONT JOLI A	-7.3	1.0	6.1	-27.3	55.4	62	91.4	97	12	13	45	76	783.1
MONTREAL INT'L A	-5.6	1.3	7.3	-30.6	45.0	77	65.8	76	15	9	102	127	730.5
MONTREAL MIRABEL I/	-7.5	*	6.5	-32.3	46.2	*	67.2	*	21	9	109	*	788.2
NATASHQUAN A	-7.4	1.8	5.1	-27.2	81.4	121	128.2	118	18	15	102	116	792.8
QUEBEC A	-8.6	0.4	3.7	-32.3	69.8	81	93.0	82	38	14	91	120	825.3
ROBERVAL A	-11.9	0.8	4.1	-39.2	61.4	77	62.8	78	34	7	80	*	926.7
SEPT-ILES A	-9.1	1.9	4.8	-31.2	55.4	62	110.6	106	17	12	76	79	840.2
SHERBROOKE A	-7.8	0.8	5.4	-30.8	52.6	70	64.2	66	14	13	85	*	797.5
ST HUBERT A	-5.6	1.4	8.0	-29.5	36.4	*	71.8	72	12	10	94	*	732.7
VAL D'OR A	-12.7	0.5	1.9	-40.5	45.4	71	43.8	63	33	12	63	75	951.0
NEW BRUNSWICK													
CHARLO A	-7.1	1.6	7.6	-28.0	62.8	68	72.8	63	13	12	84	92	778.3
FREDERICTON A	-4.4	2.1	14.3	-28.6	31.6	46	143.1	121	13	14	*	*	692.5
MONCTON A	-4.1	1.3	13.8	-26.7	56.0	78	174.8	144	35	13	78	85	684.8
SAINT JOHN A	-3.4	1.4	13.1	-26.7	52.6	83	191.8	116	40	15	85	92	663.9

STATION	Temperature C				Snowfall (cm)	% of Normal Snowfall	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of month (cm)	No. of days with Precip 1.0 mm or more	Bright Sunshine (hours)	% of Normal Bright Sunshine	Degree Days below 18 C
	Mean	Difference from Normal	Maximum	Minimum									
NOVA SCOTIA													
GREENWOOD A	-1.6	0.7	15.6	-20.6	81.8	133	190.4	158	59	20	*	*	605.8
HALIFAX INT'L A	-1.6	1.3	13.0	-22.3	60.9	113	260.7	145	38	14	*	*	607.7
SABLE ISLAND	3.7	1.1	14.0	-9.8	9.0	48	176.0	122	0	15	41	77	445.1
SHEARWATER A	-0.4	1.1	12.6	-18.6	63.6	169	213.4	144	25	16	82	88	569.2
SYDNEY A	-1.2	0.6	12.3	-22.2	91.1	139	251.5	154	78	18	61	91	594.3
YARMOUTH A	0.8	1.1	14.3	-16.6	71.8	164	210.6	148	48	18	61	98	525.6
PRINCE EDWARD ISLAND													
CHARLOTTETOWN A	-3.0	0.9	12.6	-23.7	70.4	97	140.2	109	22	16	*	*	609.5
SUMMERSIDE A	*	*	*	*	*	*	*	*	*	*	*	*	*
NEWFOUNDLAND													
BONAVISTA	-0.2	1.3	12.3	-14.0	56.4	145	159.2	166	23	17	*	*	562.6
BURGEO	-0.7	1.1	10.9	-17.4	36.5	72	257.2	138	23	8	*	*	604.6
CARTWRIGHT	-8.6	0.5	8.4	-29.5	35.6	53	39.2	52	10	8	59	96	824.9
CHURCHILL FALLS A	*	*	*	*	*	*	*	*	*	*	*	*	*
COMFORT COVE	-3.0	1.1	12.9	-21.4	155.8	217	204.2	189	79	24	*	*	649.3
DANIELS HARBOUR	-2.1	1.8	12.0	-17.0	129.4	185	151.0	165	50	19	9	28	622.8
DEER LAKE A	-3.0	2.2	9.4	-27.5	150.4	174	161.0	143	65	18	*	*	649.2
GANDER INT'L A	-2.5	1.3	12.0	-18.0	147.6	208	210.0	194	83	23	59	85	635.4
GOOSE A	-12.5	0.5	8.0	-34.2	32.1	44	38.1	52	20	9	76	104	946.3
MARY'S HARBOUR	-7.4	-0.3	6.3	-31.1	59.0	91	90.0	109	31	16	*	*	784.8
PORT AUX BASQUES	-0.5	1.2	10.7	-15.6	120.2	222	252.4	162	98	19	28	*	573.5
ST ANTHONY	-5.2	2.5	4.5	-26.0	167.7	268	204.7	186	75	22	*	*	719.7
ST JOHN'S A	-0.2	1.3	14.8	-16.3	46.9	72	121.0	75	28	20	55	*	563.2
ST LAWRENCE	0.3	1.3	12.6	-18.0	69.6	212	199.6	160	32	20	*	*	550.5
STEPHENVILLE A	-0.6	2.0	13.8	-17.2	111.8	139	187.8	165	67	17	23	*	573.0
WABUSH LAKE A	-17.8	0.8	0.3	-42.5	71.4	*	53.2	73	43	13	74	*	1110.0

AGROCLIMATOLOGICAL STATIONS — DECEMBER 1993

STATION	Temperature C				Snowfall (cm)	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of month (cm)	No. of days with Precip 1.0 mm or more	Bright Sunshine (hours)	Degree days above 5 C	
	Mean	Difference from Normal	Maximum	Minimum							This month	Since jan. 1st
BRITISH COLUMBIA												
AGASSIZ	4.4	1.4	13.5	-2.5	0.0	189.3	72	0	15	67	20.0	2401.4
SUMMERLAND	0.1	1.2	10.5	-6.5	15.2	31.4	96	8	11	19	0.8	2081.4
ALBERTA												
BEAVERLODGE	-3.9	7.7	7.0	-18.0	24.5	19.4	60	3	5	77	0.5	1318.5
LACOMBE	-6.8	4.7	9.0	-21.5	4.0	4.5	24	9	2	79	0.0	1170.7
SASKATCHWAN												
INDIAN HEAD	-10.5	2.5	4.0	-40.0	43.3	37.4	174	48	8	**	0.0	1396.5
MELFORT	-11.4	5.1	1.5	-32.0	8.8	8.8	35	28	3	52	0.0	1109.0
REGINA	-9.9	3.1	4.0	-40.0	15.4	14.6	81	10	6	**	0.0	1319.8
SCOTT	-9.9	4.3	5.5	-29.5	10.1	9.7	47	5	5	37	0.0	1201.7
SWIFT CURRENT	-6.2	4.1	6.5	-28.0	10.8	9.2	57	20	3	55	0.0	1417.1
MANITOBA												
BRANDON	-11.8	2.3	2.1	-35.5	9.2	9.2	46	10	2	**	0.0	1409.2
MORDEN	-10.5	3.9	0.0	-29.0	12.8	12.8	55	9	5	75	0.0	1637.0
GLENLEA	-12.5	-0.2	0.0	-33.0	20.2	20.2	91	0	4	72	0.0	1486.3
ONTARIO												
DELHI	-2.5	0.4	10.0	-20.0	8.0	46.8	55	3	11	**	2.8	2177.0
ELORA	1.4	6.6	13.8	-11.1	1.4	59.9	84	2	11	**	0.0	1839.9
HARROW	-1.3	0.4	11.0	-21.0	13.2	32.9	45	6	8	47	3.5	2432.8
KAPUSKASING	-13.3	1.4	2.5	-42.5	40.4	37.3	73	21	11	49	0.0	1276.6
OTTAWA	-6.3	1.2	7.7	-31.2	36.6	57.7	80	10	11	100	1.1	2081.9
SMITHFIELD	-2.6	1.9	10.8	-32.0	36.7	209.9	217	1	11	**	1.6	2276.6

Courtesy of Agriculture Canada

STATION	Temperature C				Snowfall (cm)	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of month (cm)	No. of days with Precip 1.0 mm or more	Bright Sunshine (hours)	Degree days above 5 C	
	Mean	Difference from Normal	Maximum	Minimum							This month	Since jan. 1st
QUEBEC												
LA POCATIERE	-7.4	0.8	7.0	-29.5	43.5	88.5	98	20	10	90	0.0	1631.4
NORMANDIN	-14.1	0.0	2.1	-44.5	*.*	48.5	68	25	21	85	0.0	1258.4
NEW BRUNSWICK												
FREDERICTON	-3.9	2.5	14.0	-26.5	27.0	142.9	116	1	15	86	3.2	1815.0
NOVA SCOTIA												
KENTVILLE	-0.9	1.5	15.0	-20.0	67.6	289.3	222	50	19	60	10.1	1848.2
NAPPAN	-1.8	2.2	15.0	-24.0	43.5	152.8	129	40	13	62	7.5	1671.8
PRINCE EDWARD ISLAND												
CHARLOTTETWN	*.*	*.*	*.*	*.*	*.*	*.*	**	***	***	**	*.*	*.*
NEWFOUNDLAND												
ST.JOHN'S WEST	0.3	1.7	11.5	-19.0	37.0	89.4	51	24	20	47	12.5	1086.3

Courtesy of Agriculture Canada

...continued from page 15

The extreme eastern and northern sections of the province were the only two areas to receive more-than-normal precipitation. Elsewhere, from 55 to 95% of normal precipitation was received. In general, the accumulation of snow was less than normal.

Sunshine totals were close to normal, with most stations recording 85 to 125% of normal.

A cold outbreak, towards the end of the month, was responsible for temperatures 6 to 12 degrees below normal, province-wide. Despite the extreme cold, there were no new monthly records established.

Maritimes

The month was generally cloudy, wet and mild.

Winter was late arriving in the Maritimes; up until the last week of the month all areas had well-below normal snowfall totals as temperatures were well-above seasonal values. CFB Shearwater, Nova Scotia, recorded no measurable snow during the first 22 days of the month. During the holiday season, however, snow, strong winds and record-low temperatures disrupted the lives of most Maritimers. A storm on Christmas Day provided a white Christmas to most areas. On the 30th, a major storm tracking along the Atlantic Coast of Nova Scotia, on its way to Newfoundland, dumped up to 44 cm of snow on Halifax-Dartmouth, 6.8 cm more than their normal for the month. Yarmouth, Nova Scotia, reported 39.6 cm and Charlottetown, Prince Edward Island, 37.0 cm. Winds gusting in excess of 100 km/h were reported at a number of locations. Blizzard conditions were widespread, bringing a number of major centres to a virtual standstill. All forms of transportation were delayed or cancelled, there were power outages and reports of damage in a number of areas. Aulds Cove, Nova Scotia, reported considerable damage with preliminary estimates over 1 million dollars. Much of New Brunswick escaped the brunt of the storm.

Mean temperatures for the month, in all areas, ranged from approximately 1 to 2 degrees above normal. Some extremely cold temperatures were recorded on the 27, 28 and 29th, with several locations setting new record-low maximum temperatures. On the 27th, Saint John, New Brunswick, set both a new daily-record low minimum of -26°C and a low daily maximum of -19°C.

Precipitation totals were generally well-above normal, with the exception of Charlo, New Brunswick, where the total was 70% of normal. Kentville, Nova Scotia, on the other hand, with 289.3 mm, more than doubled the normal for the month. A couple of storms early in the month produced some heavy rainfalls - Western Head and CFB Shearwater, Nova Scotia, reported totals of 88 and 66 mm, respectively, on the 5th and St. Stephen, New Brunswick, reported 87 mm on the 11th.

Newfoundland and Labrador

Above-normal temperature and precipitation values were recorded over much of Newfoundland during December 1993. Sunshine hours were well-below normal over western locations. During the first three weeks, a changeable weather pattern prevailed with a mixture of rain or snow on most days. Temperatures varied during the month with a maximum of 14.8°C at St. John's on the 6th, to a minimum of -27.5°C at Deer Lake on the 30th. Mean monthly temperatures were near 2 degrees above normal. Frequent light precipitation early in the month gave way to several major storms late in the month. On December 24th, a major storm dropped 30 to 45 cm of snow, bringing a white Christmas to most regions except the Avalon Peninsula. Strong winds accompanied the storm with gusts to 141 km/h at Twillingate. Ferry service was disrupted and vehicular travelling was hazardous. Another storm on December 30-31st brought the old year to a close with a bang. Western locations reported 30 to 40 centimetres with lesser amounts in eastern locations. Wind gusts to 140 km/h, associated with this storm, delayed Marine Atlantic Service by 35 hours and highways in western Newfoundland were closed during the peak of the storm. Total precipitation was well-above-normal at central and western locations. Gander recorded 210 mm, a new monthly record. In St. John's, total monthly precipitation was 121 mm, about 25 mm below normal.

In Labrador, below-normal snowfall and near-normal temperatures prevailed during the month. A mixture of fair weather, occasional light snow and seasonable temperatures gave way to below-normal temperatures late in the month. Wabush Lake reported a minimum of -42.5°C on the 29th. Overall, mean temperatures were close to normal. Snowfall was well-below-normal in central regions with Goose Bay reporting 32.1 cm, about 35% of normal. However, in the west, Wabush Lake recorded 71.4 cm, close to normal.

ACCO™/MC

YELLOW	25970	JAUNE
BLACK	25971	NOIR
BLUE	25972	BLEU
RL BLUE	25973	BLEU RL
GREY	25974	GRIS
GREEN	25975	VERT
TANGERINE	25977	TANGERINE
RED	25978	ROUGE
EX RED	25979	ROUGE EX

MADE IN CANADA BY/FABRIQUÉ AU CANADA PAR
ACCO CANADIAN COMPANY LIMITED
COMPAGNIE CANADIENNE ACCO LIMITÉE
TORONTO CANADA