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Climatic Perspectives

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CLIMATIC HIGHLIGHTS

WEATHER IMPACT ON AGRICULTURE IN 1989: A NATIONAL OVERVIEW

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Unprecedented weather events in 1989 resulted in multi-million-dollar crop losses and damage. There were two short-lived, extreme events which were responsible for most of the damage; a severe winter kill in British Columbia, and a series of heavy thunderstorms which unleashed copious amounts of precipitation on southwestern Ontario on July 19 and 20. These two cases are studied in this article. As well, surface weather patterns associated with the 50-kPa (upper atmospheric, altitude of approximately 5000 metres) circulation, and their impacts on agriculture, are briefly reviewed.

Most of Canada's agricultural areas experienced varying degrees of winter kill during the 1988-1989 winter season. Poor snow cover and rapid drops in temperature are the main climatic factors responsible for winter kill. The most devastating damage occurred in British Columbia, where a nearly-stationary atmospheric ridge, caused by a stable upper atmospheric pattern, extended northward along 150°W longitude allowing a record-breaking Arctic high pressure system (107.4 kPA) to cover British Columbia, southern Alberta and Saskatchewan from January 30 to February 1. Sparse snow cover, strong winds because of a tight surface-pressure gradient and dramatic decreases in air temperatures resulted in extensive kill to potted ornamental trees, fruit trees, perennial crops and forage. The sharp drop in temperature, over 30 Celsius degrees during a 20-hour period at Williams Lake, B.C., is illustrated in ***Figure 1***. The winter kill was magnified by mild temperatures (mid-teens at Kamloops) which had caused a dehardening of the crops, and made them even more vulnerable to the cold temperatures which followed. Losses included: an estimated 1.6 to $2.0 million worth of potted ornamental trees; 40 to 50% of the strawberry crop; 10 to 15% of the cranberries; and 20 to 25% of the raspberries. Up to 50% of forage crops had to be reseeded. Damage to heating systems and structures due to high winds and power outages during the cold spell caused the freezing of greenhouse vegetables and floriculture with an estimated loss of $1.5 million. Virtually all of British Columbia's apricot crop was destroyed.

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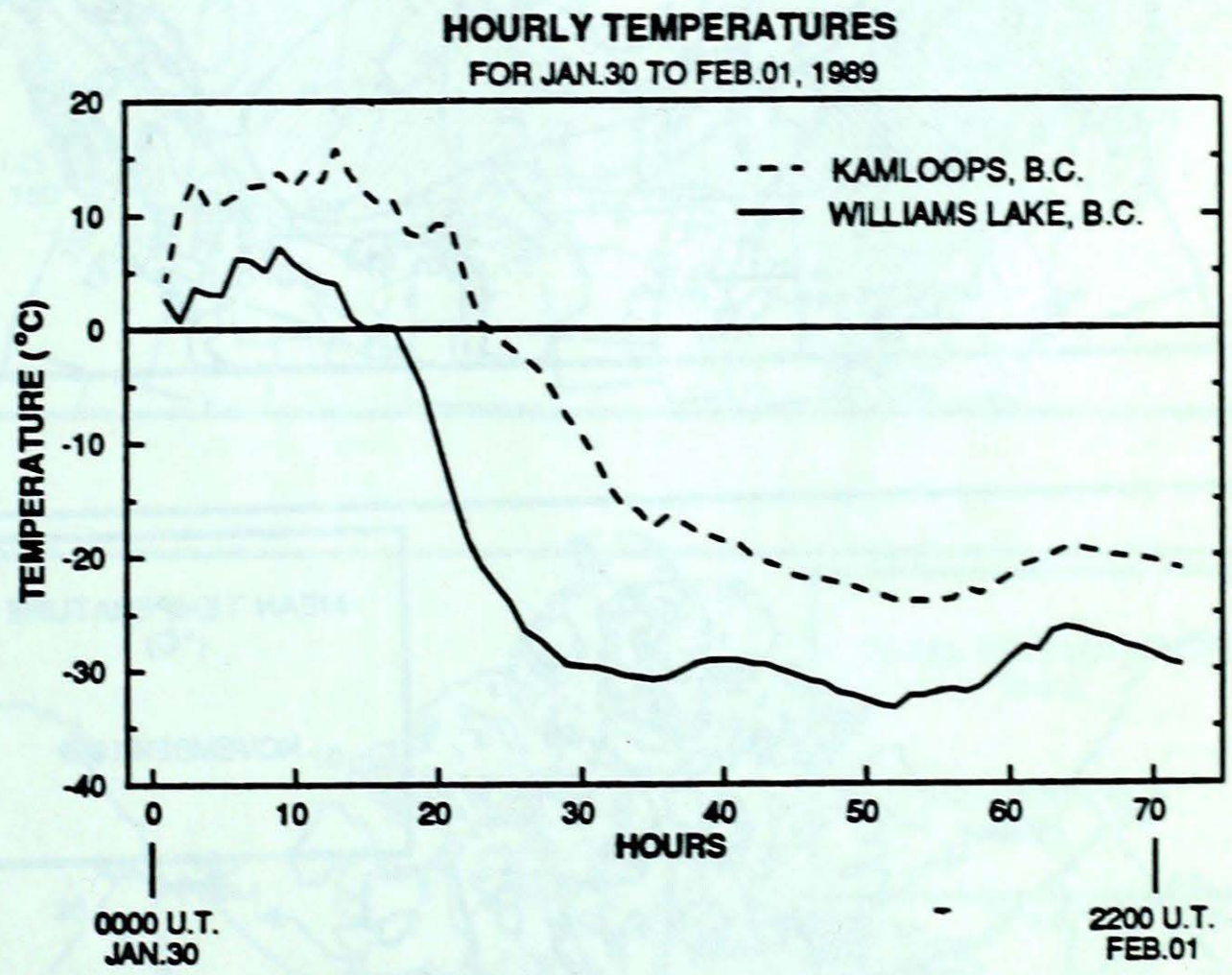
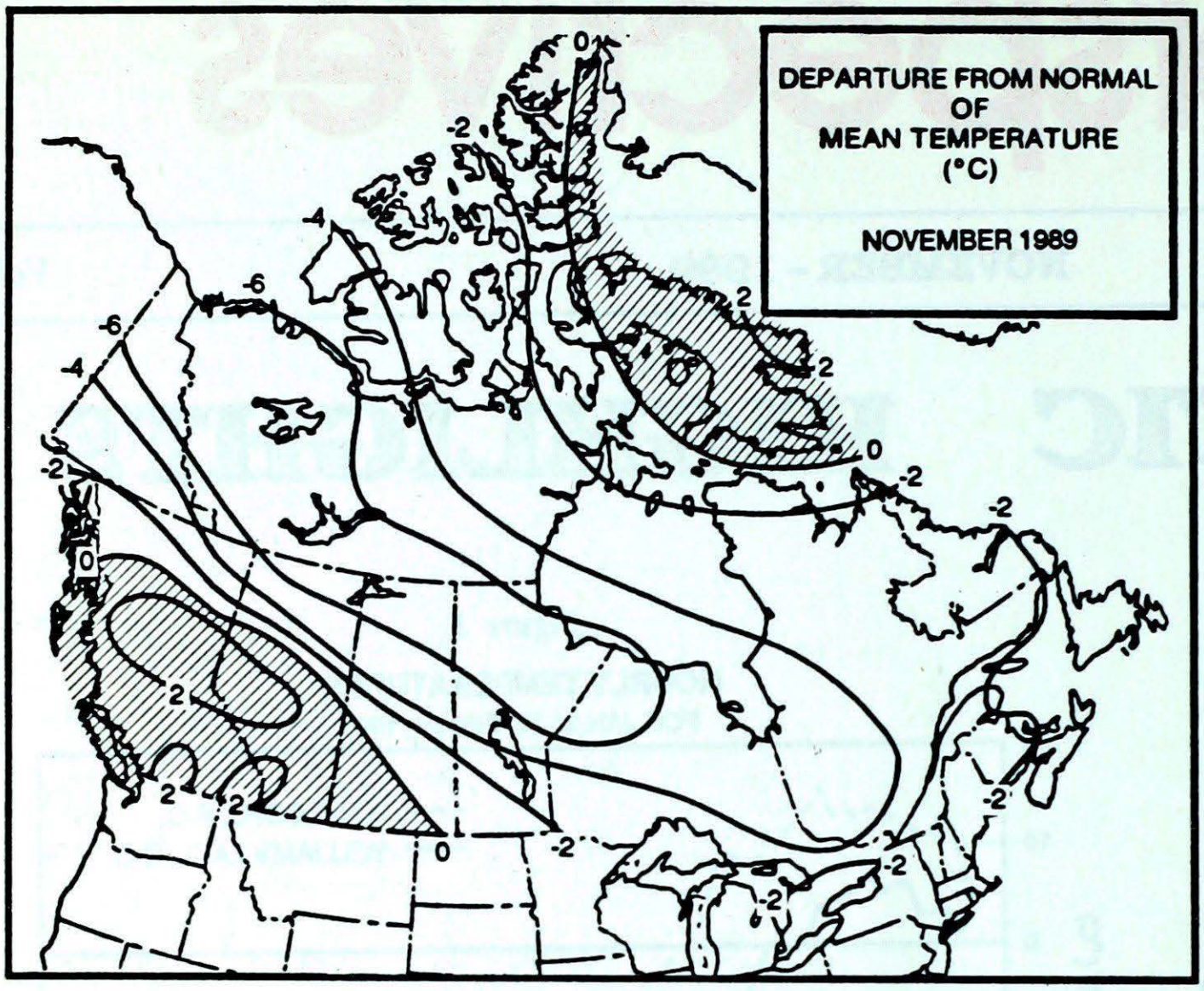
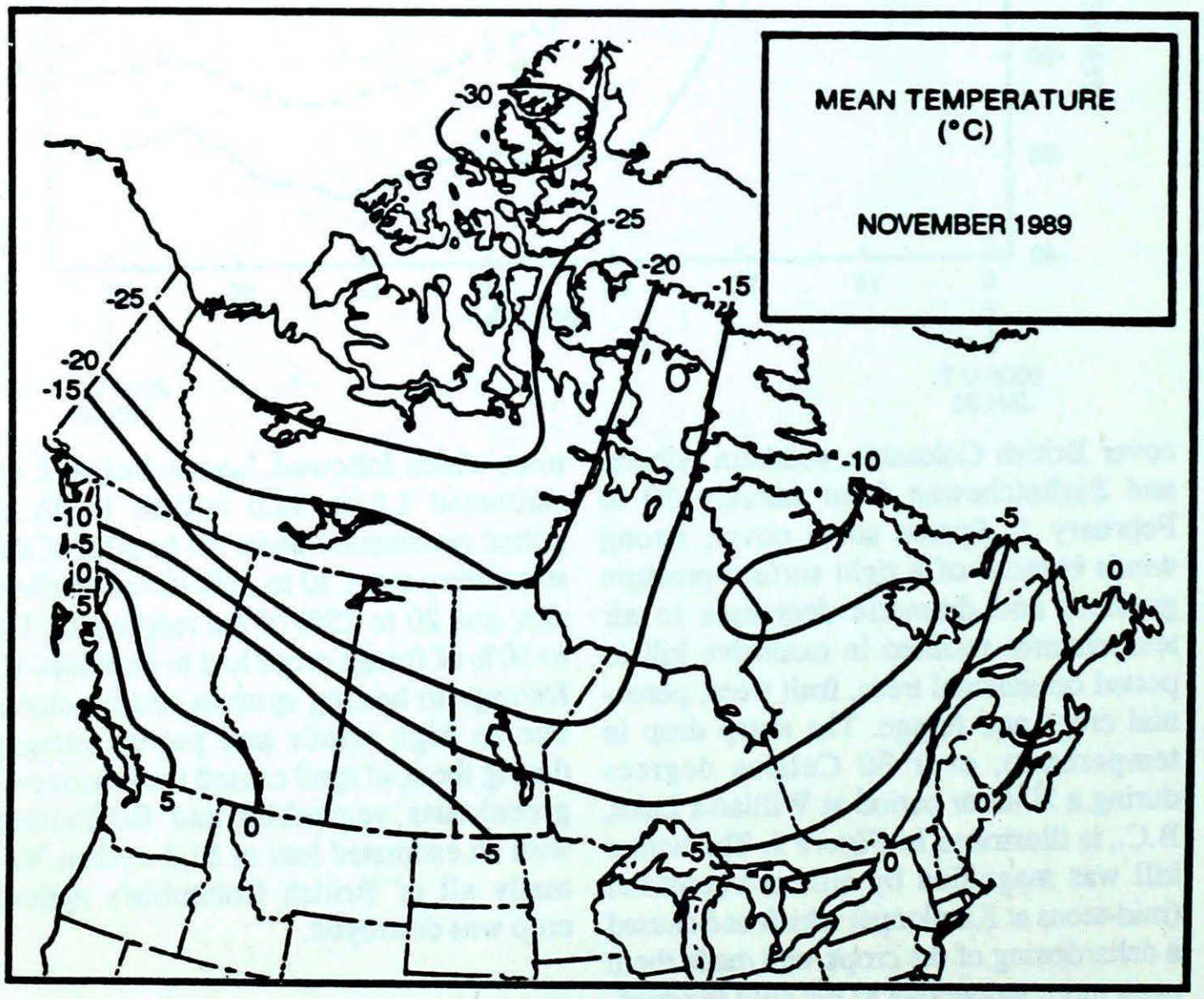
Figure 1







Across the country

Yukon

After a spell of mild weather early in the month, winter set in with a vengeance. The first week saw a mixture of rain, freezing rain and snow in the south. The freezing rain caused numerous vehicle accidents. The unusually-mild weather and lack of snow at the beginning of the period played havoc with a London-based film crew trying to shoot a winter scene for a commercial in the famous White Pass area.

By the second week of the month temperatures plummeted, records fell and problems began for the many government facilities, which had converted from the traditional oil and wood heating to propane. The extreme cold turned the propane to jel, disabling the heating systems. Nursing stations and community hospital facilities in Mayo, Pelly Crossing, Ross River and Faro had to be temporarily shut down. During the weekend of the 11th, Ross River set a new record-low temperature of -52°C for the month of November, beating the previous recorded of -49°C set in 1985. This temperature came very close to breaking the Yukon's all-time lowest temperature record of -54°C for the month of November, set at Braeburn Lodge in 1985. Dawson also established a new monthly low temperature record of -47°C on the 13th; the maximum reading that day never climbed above -41°C. During this cold spell, Whitehorse set new daily-low temperature records on five consecutive days. By the end of the third week, temperatures in many southern districts recovered to above freezing.

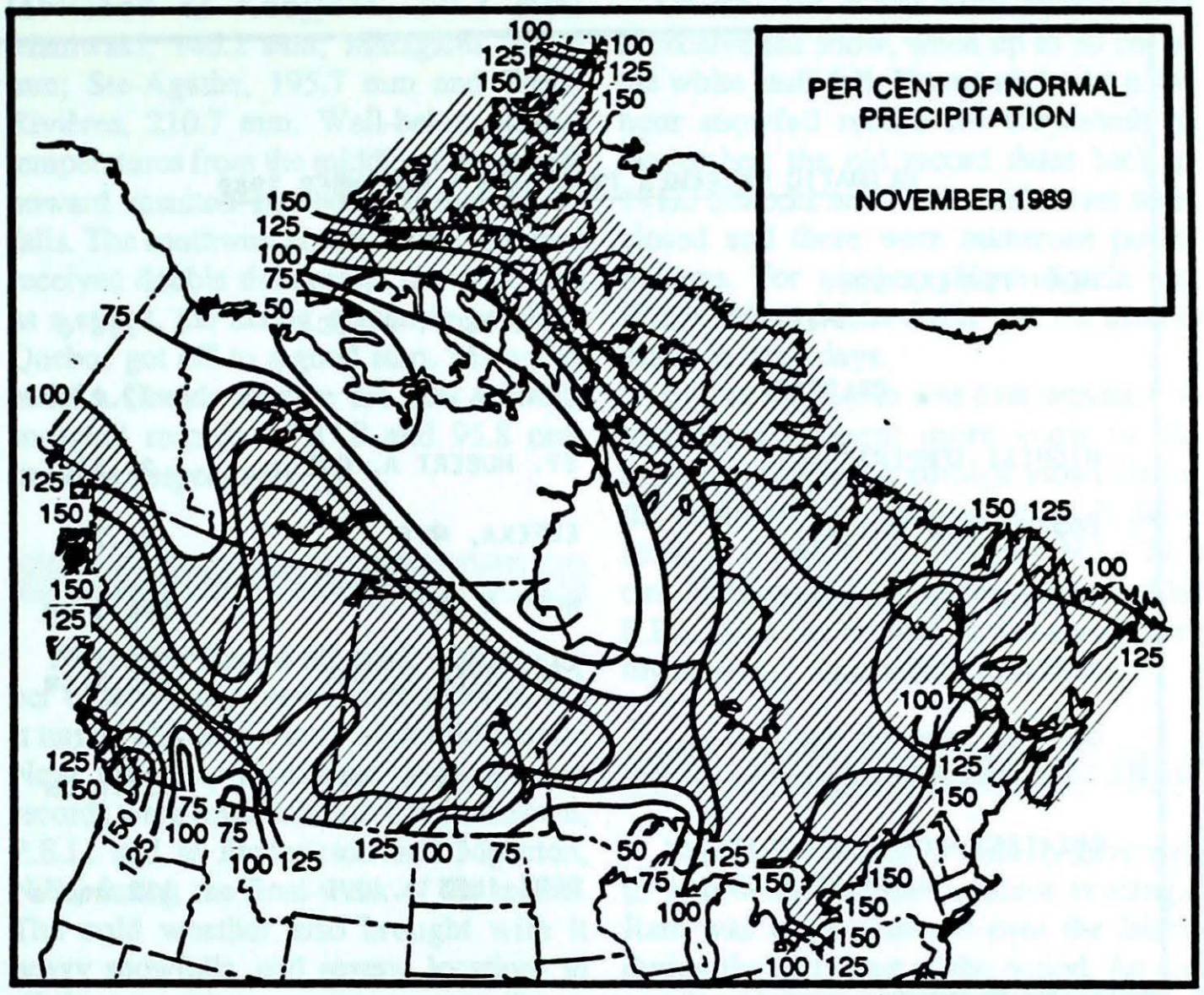
While blizzards were common in the far north, heavy snowfalls engulfed the central Yukon, ranging from 30 to 60 centimetres. Two areas in the Yukon received double their normal monthly snowfall - along the Dempster Highway in the Ogilvie Mountains and in the southern Yukon at Carcross. Whitehorse received 27 cm of snow this month, which is midway between the extreme monthly snowfall records of 5 and 69 centimetres established in 1942 and 1978, respectively.

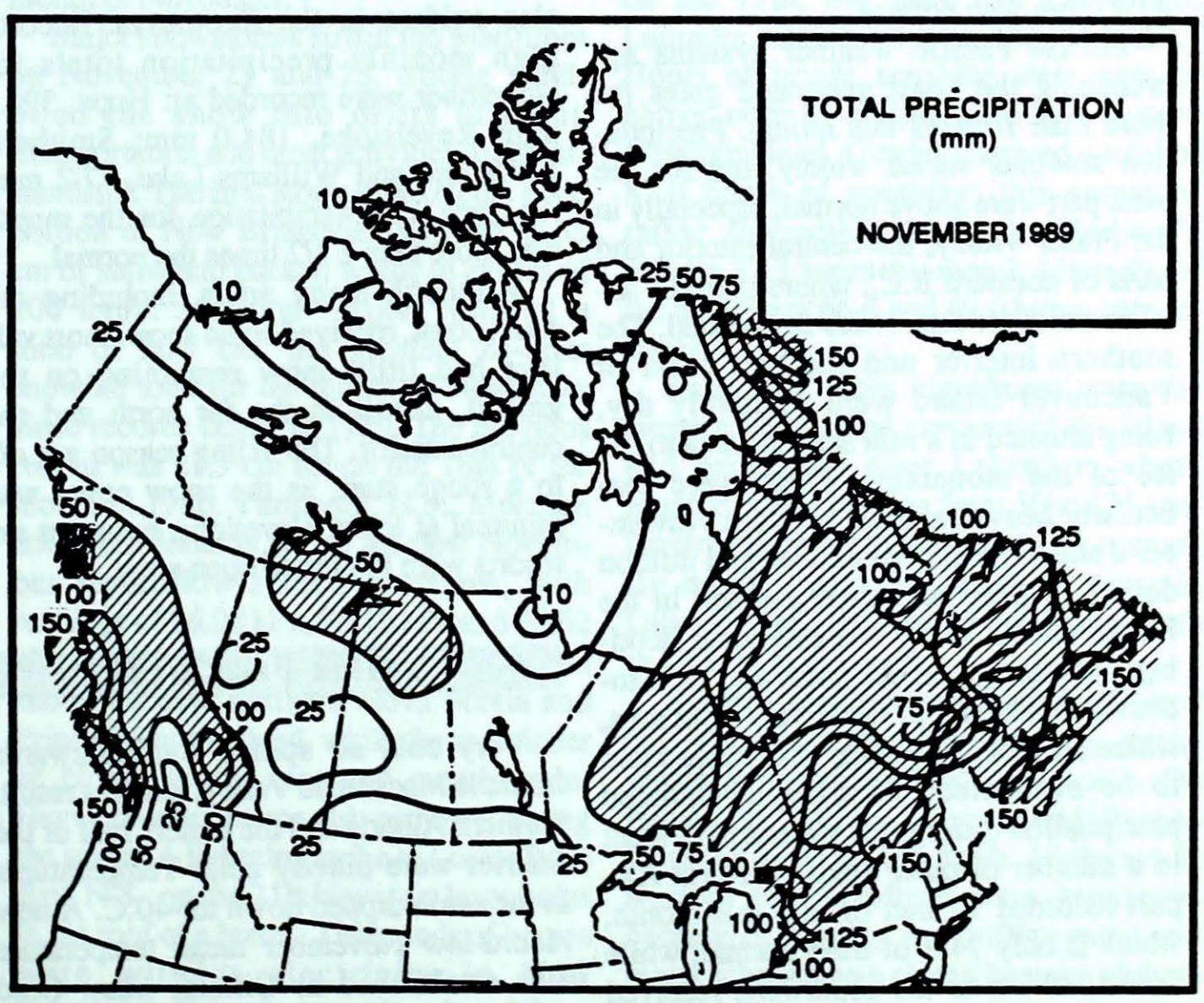
Northwest Territories

Except for the extreme eastern Arctic, it was an abnormally-cold month. Temperatures by the end of the first week were dropping down to the mid-minus thirties and forties, with the coldest values in the western Arctic. In the Mackenzie Valley, all ferries were pulled out of service and ice bridges are now in place. Only the ferry at Fort Providence, in the southern Mackenzie, was still operating across the ice-covered Mackenzie River, trying to keep the supply route to Yellowknife open until an ice bridge is ready for use. At the end of the month, the ferry had to operate 24 hours a day in order to prevent the channel from freezing.

Weather and blizzard warnings were issued regularly for the District of Keewatin and the eastern Arctic. At times, winds gusted in excess of 100 km/h along the Baffin Island coast, where snow depths by the end of the month increased to between 50 and 150 centimetres. Some buildings and structures were damaged because of the winds.

The short shipping season in the eastern Arctic ended November 22, with the aborted attempt of the ice-strengthened ore carrier, MV *Arctic* and the Canadian ice breaker, CCGS *John A. MacDonald* to reach Nanisivik on the west coast of Baffin Island. Ice conditions were too difficult, and the two ships were only able to reach the entrance to Lancaster Sound before having to turn back.





British Columbia

A southwesterly circulation allowed a mild and moist Pacific air mass to cover most of the province. Only the extreme north was unusually cold and winter-like during the period. Although temperatures across the southern two-thirds of the province were above normal, no records were broken. Readings managed to climb to the double digits. For the most part November was a cloudy month, with some coastal communities receiving only half their normal sunshine. Northeastern B.C.

CLIMATIC EXTREMES IN CANADA - NOVEMBER 1989

MEAN TEMPERATURE:		
WARMEST	CAPE SCOTT A, BC	7.6°C
COLDEST	EUREKA, NWT	-32.2°C
HIGHEST TEMPERATURE:	ST. HUBERT A, QUE	21.5°C
LOWEST TEMPERATURE:	EUREKA, NWT	-48.2°C
HEAVIEST PRECIPITATION:	HOPE A, BC	596.1 mm
HEAVIEST SNOWFALL:	CAPE DYER A, NWT	215.6 cm
DEEPEST SNOW ON THE GROUND ON NOVEMBER 30, 1989:	CAPE DYER A, NWT	130.0 cm
GREATEST NUMBER OF BRIGHT SUNSHINE HOURS:	SEPT-ÎLES A, QUE	112 hours

received the most hours of bright sunshine, 20% more than normal.

Intense Pacific weather systems approaching the coast generated gales for more than 10 days this month. Precipitation amounts varied widely, but for the most part were above normal, especially in the Fraser Valley, the central interior and parts of northern B.C., where monthly totals were more than twice the normal. The southern interior and the east coast of Vancouver Island were relatively dry, being situated in a rain shadow area to the lee of the mountains. There were particularly heavy rainfalls between November 8 and 11, which caused several million dollars in flood and slide damage in the Fraser Valley. There was additional flooding and damage on the north end of Vancouver Island and in the Rivers Inlet area, where the isolated village of Owikeno had to be evacuated. Topography-induced precipitation differences were also evident in a number of other areas. Victoria Airport recorded 97 mm of rain this month, which is only 74% of their normal, while Sooke, 40 km to the southwest, received 317 mm of rain, or 170% of their average rainfall for the month. Such discrepancies, as a result of upslope and subsidence, were also evident in the Kootenays. Record-high monthly precipitation totals for November were recorded at: Hope, 596.1 mm; Revelstoke, 184.0 mm; Smithers, 119.9 mm and Williams Lake, 77.2 mm. At Hope, the precipitation for the month was more than 2 1/2 times the normal.

Although many areas, including the south coast, received some snow, most valleys had little snow remaining on the ground, except in the far north and the central interior. The skiing season got off to a rough start, as the snow cover was minimal at lower elevations, but most ski resorts were hoping to open soon.

Prairie Provinces

Very cold air spilled southeastwards from the Mackenzie Valley, and as a result, northern Alberta and the eastern half of the Prairies were bitterly cold. Temperatures in the north dipped down to -40°C. A new record-low November mean temperature was established at Gillam, Man. Cold Arctic air did manage to make several brief intrusions into southern Alberta, but for the most part, the southern two-thirds of the province was influenced by a mild flow of Pacific air. A chinook pushed temperatures into the mid-teens during the second week of the month in southern Alberta.

Most of the Prairies, except the Grande Prairie region of Alberta and south-central and northeastern Manitoba, received ample precipitation, with most of the precipitation falling as snow. Heaviest snowfalls occurred in the Rockies and the northern portions of Alberta and Saskatchewan. By month's end northern communities had received between 50 and 80 centimetres of snow. The ski areas of Banff and Jasper received as much as 45 cm, and began the ski season with the best snow conditions in more than a decade. In contrast, Churchill only received 10 cm, less than a quarter of their normal monthly snowfall. Although the snowfalls in the south were significant, by the end of the month there was a noticeable lack of snow on the ground across the southern agricultural districts. There now is a growing concern that a large portion of the soil moisture that was replenished earlier in the season has been lost through evaporation and sublimation.

Total hours of bright sunshine followed the precipitation pattern; in areas where precipitation was light, sunshine was plentiful, while in other areas it was below-normal.

Ontario

Winter arrived early this year as a northwesterly circulation pushed cold Arctic air southwards. Record-cold temperatures, strong winds and heavy snowfalls were common. It was more like mid-winter than mid-fall. In northeastern Ontario, this was the coldest November since 1936 and snowiest since the mid-sixties. Elsewhere across the province, this November ranks as the coldest since either 1959 or 1976 across central regions, and the chilliest since 1986 in southern and northwestern Ontario. New record-low monthly mean temperatures were set at Sault Ste. Marie, Earlton, Sudbury, North Bay and Wawa.

Numerous disturbances crossed the province, producing record monthly

precipitation and snowfall amounts and gale-force winds. At Toronto Island, the November mean wind speed of 24.1 km was the highest since November 1950. The storms left in their wake, bitterly cold temperatures. The strongly contrasting, relatively warm waters of the Great Lakes produced frequent and sometimes heavy snow squalls to the lee of the Lakes. A new high November precipitation record was set at both Wiarton and Muskoka. In addition, there were record November snowfalls at Wiarton, 115 cm; Sault Ste Marie, 113 cm; Gore bay, 88 cm; Sudbury, 72 cm and St Catharines, 27 cm. This was the snowiest November since the mid-sixties at Earlton, Timmins, Kapuskasing and Muskoka, with snowfalls of between 75 and 100 centimetres. Only extreme southwestern Ontario and the Thunder Bay-Kenora region had below-normal snowfalls. Compared to the last few winters, the skiing season got off to an early start this year.

As can be expected with this type of weather pattern, sunshine was in short supply, especially where the wind blew off the Great Lakes.

Quebec

Across the western half of the province this was one of the wettest and coldest Novembers in 50 years. Numerous monthly snowfall, precipitation and temperature records were broken.

Except for the Magdalen Islands, temperatures averaged well-below normal. Mean monthly-temperature records were broken at Maniwaki, Matagami, Mirabel, Ste-Agathe, Québec City and Val d' Or, and were tied at Roberval and Dorval.

A succession of cyclonic storms moving across the province produced hefty amounts of precipitation, especially in the extreme southwest corner, where monthly amounts were one-and-a-half times the normal. At nearly 200 mm, the southern Laurentians and the Montréal area received approximately twice their normal monthly precipitation. Trois-Rivières recorded the most precipitation in the province this month, while La Grande Rivière received the most snow. New November precipitation records were established at Kuujjuak, 90.2 mm; Maniwaki, 146.2 mm; Matagami, 102.6 mm; Ste-Agathe, 195.7 mm and Trois-Rivières, 210.7 mm. Well-below-normal temperatures from the middle of the month onward resulted in above-normal snowfalls. The southwest corner of the province received double the normal snowfall, and as a result, the skiing season in southern Quebec got off to a good start. Matagami and La Grande Rivière set new monthly snowfall records of 87.9 and 95.8 centimetres, respectively.

Maritimes

November started off mild, with a number of new daily-temperature records, but it turned cold and wintry after mid-month. New monthly-minimum temperature records were established at Charlottetown, P.E.I., and at Fredericton and Moncton, N.B., during the final week of the month. The cold weather also brought with it heavy snowfalls, and several locations in all three maritime provinces reported new record-high snowfall amounts for the month of November.

Major snowstorms struck the Maritimes on November 21 and 23. Strong winds piled the snow into drifts bringing transportation and most activities to a near-standstill. The first storm blanketed a good portion of New Brunswick with up to 35 cm of snow and packed winds in excess of 100 km/h. Moncton Airport received a total of 30.7 cm, the greatest 24-hour snowfall total for the month of November since records began in 1939. The previous record was 21.9 cm set on the 18th of the month in 1980. Yarmouth, N.S., Moncton and Saint John, N.B., all set new November record-low station pressures, with readings of 96.08 kPa, 96.10 kPa and 95.62 kPa, respectively. A mixture of rain and snow fell over northern Nova Scotia and Prince Edward Island, while the remainder of Nova Scotia received mostly rain. Heavy thunderstorms also occurred during the storm. A lightning strike at Lower Rose Bay, N.S., on the 21st blew two large holes in the roof of a home. Thousands of homes were without electricity in New Brunswick. Schools were closed, and there were numerous accidents.

On the 23rd, it was Nova Scotia's turn to receive the snow, when up to 30 cm of the white stuff fell. Yarmouth broke a 24-hour snowfall record for the month of November; the old record dates back to 1912. Schools and some businesses were closed and there were numerous power outages. For northern Nova Scotia and Prince Edward Island this was the second storm in three days.

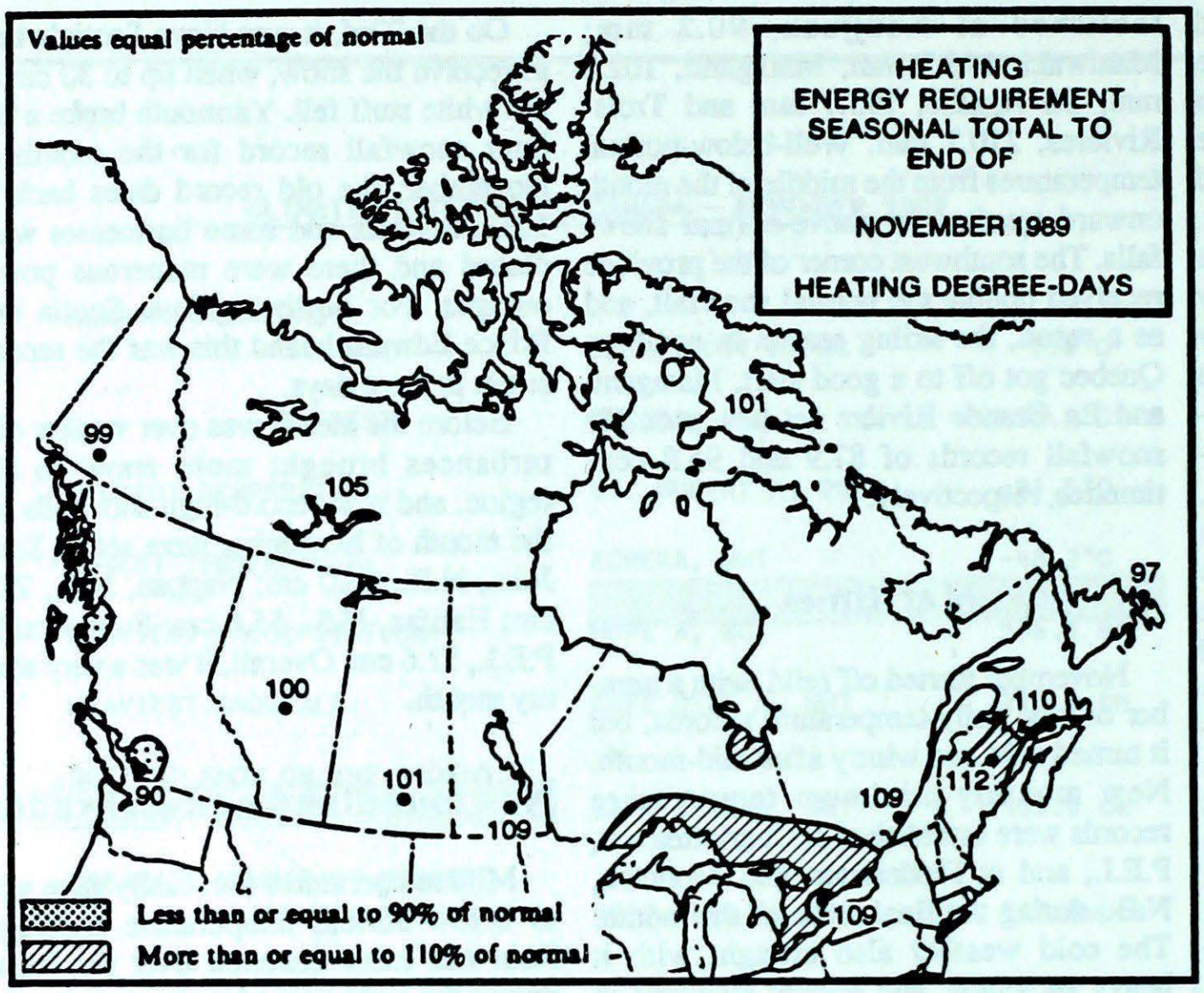
Before the month was over weaker disturbances brought more snow to the region, and new record-high snowfalls for the month of November were set at: Saint John, N.B., 66.0 cm; Nappan, N.S., 78.7 cm; Halifax, N.S., 55.6 cm; Summerside, P.E.I., 51.6 cm. Overall, it was a very stormy month.

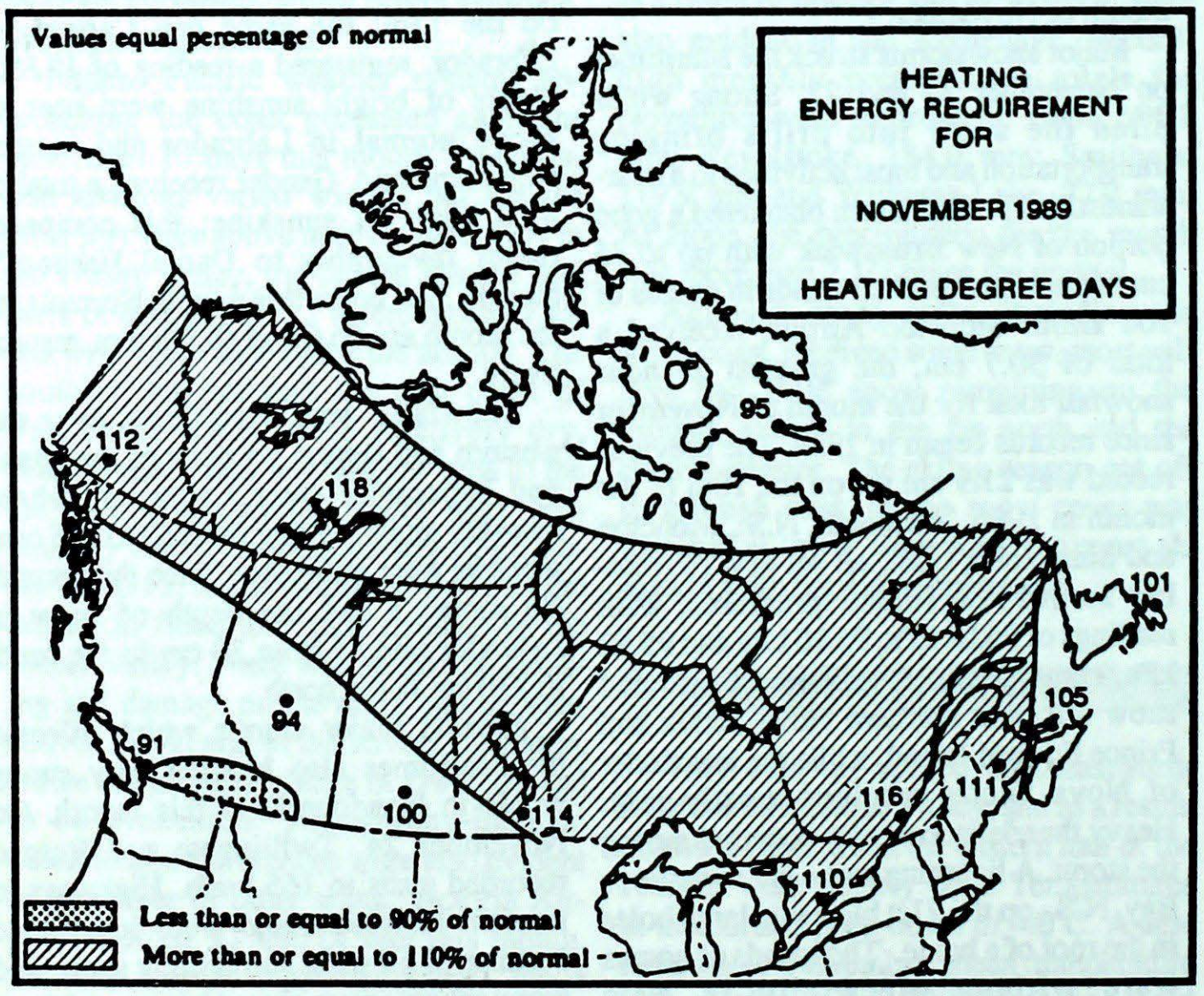
Newfoundland and Labrador

Mild temperatures eventually gave way to below-normal temperature readings. Rain was more common over the Island during the early part of the period. An unusually-high maximum temperature of 18.9°C was recorded at Daniel's Harbour on the 17th; the same day Cartwright, Labrador, registered a reading of 12.8°C. Hours of bright sunshine were near or above normal in Labrador and eastern Newfoundland. Gander received a total of 87.0 hours of sunshine; this compares rather favourably to Daniel Harbour's meagre 32.3 hours this month. Normals for the month are 66.6 and 49.0 hours, respectively.

Snowfalls were significant over the western and central portions of the Island and especially over Labrador, where monthly totals ranging from 50 to 125 centimetres were more than twice the normal. By month's end the depth of snow in Labrador ranged from 30 cm in the south to 130 cm in the north.

Several major storms which affected the Maritimes also brought very strong winds to Newfoundland this month. On November 24, Twillingate and Burgeo recorded gusts to 165 km/h. Highways in western Newfoundland were impassable because of blowing and drifting snow, and many schools were closed because of these storms.



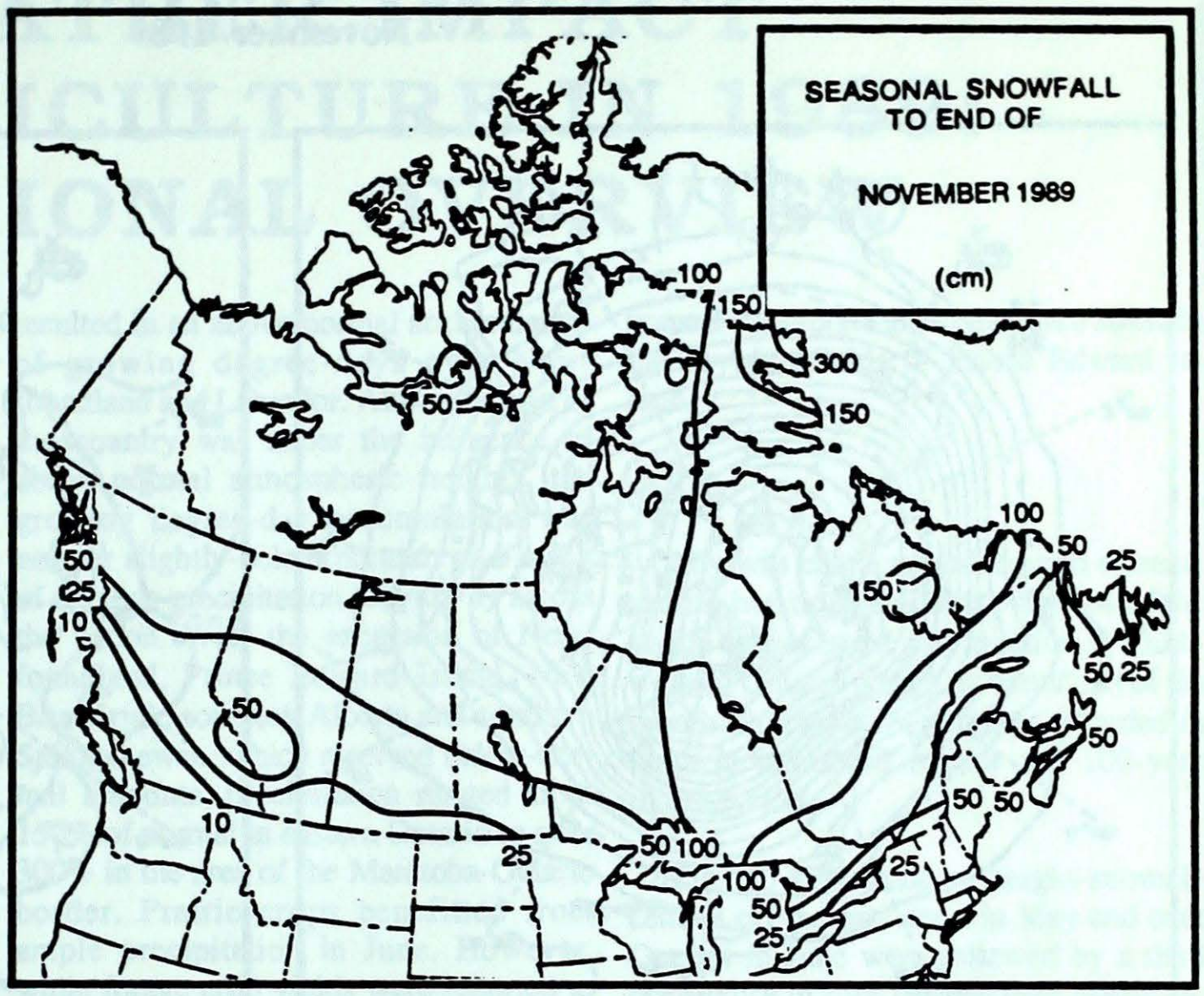


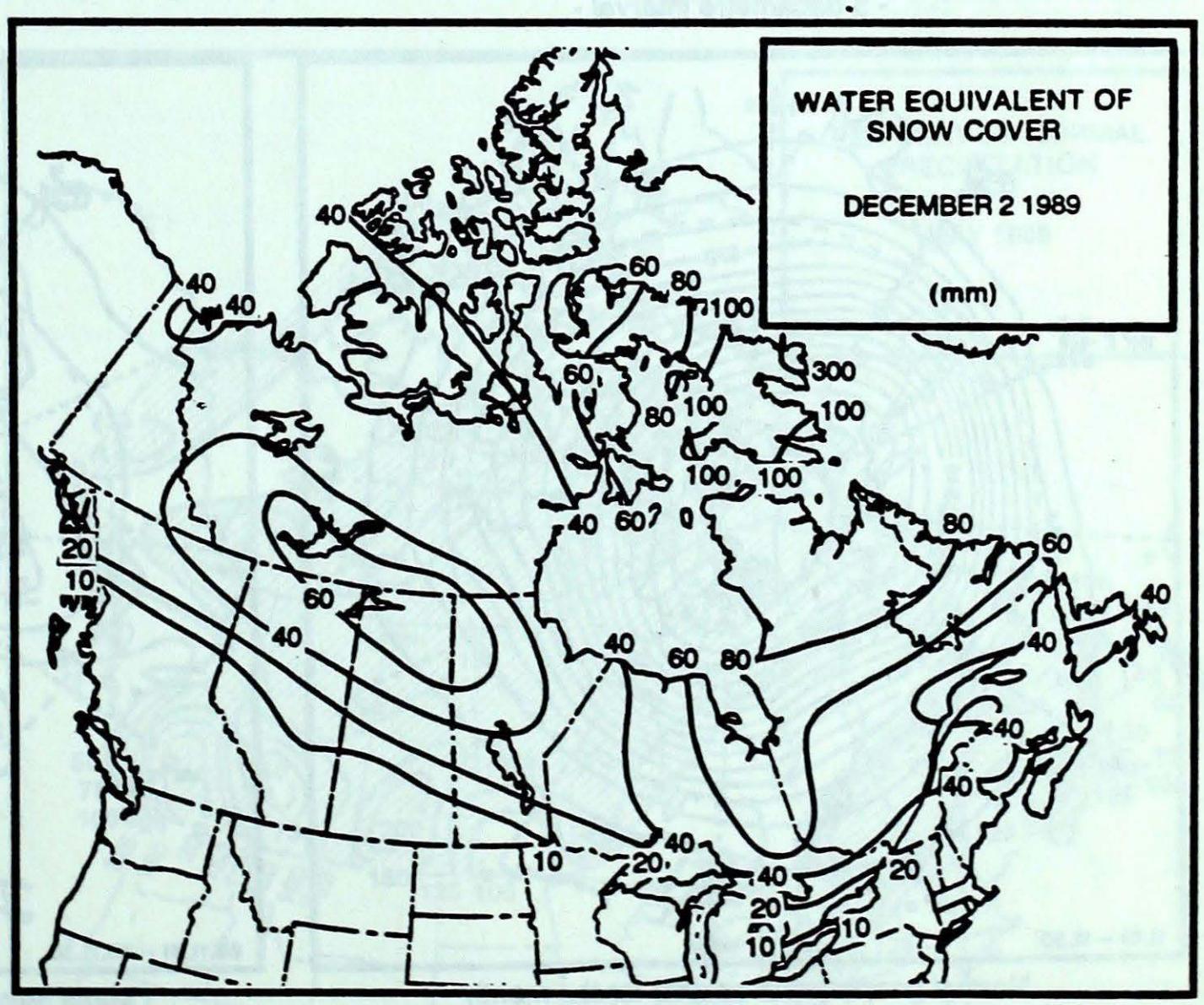
SEASONAL TOTAL OF HEATING DEGREE-DAYS TO END OF NOVEMBER

	1989	1988	NORMAL
BRITISH COLUMBIA			
Kamloops	844	841	887
Penticton	814	807	844
Prince George	1323	1417	1500
Vancouver	705	733	779
Victoria	834	859	853
YUKON TERRITORY			
Whitehorse	1934	2008	1953
NORTHWEST TERRITORIES			
Iqaluit	2813	3484	*
Inuvik	2808	2985	2788
Yellowknife	2193	2166	2083
ALBERTA			
Calgary	1271	1319	1369
Edmonton Mun	1313	1310	1318
Grande Prairie	1487	1564	1563
SASKATCHEWAN			
Estevan	1230	1244	1183
Regina	1319	1376	1301
Saskatoon	1376	1387	1357
MANITOBA			
Brandon	1421	1435	1332
Churchill	2322	2233	2289
The Pas	1679	1506	1536
Winnipeg	1332	1302	1222
ONTARIO			
Kapuskasing	1565	1440	1456
London	877	852	795
Ottawa	993	979	924
Sudbury	1278	1168	1141
Thunder Bay	1403	1308	1276
Toronto	867	854	793
Windsor	728	724	659
QUEBEC			
Baie Comeau	1528	1462	1442
Montréal	948	949	870
Quebec	1148	1162	1087
Sept-Iles	1604	1488	1532
Sherbrooke	1166	1165	1156
Val-d'Or	1488	1381	1392
NEW BRUNSWICK			
Charlo	1266	1263	1228
Fredericton	1100	1063	981
Moncton	1071	1048	983
NOVA SCOTIA			
Sydney	1007	1002	898
Yarmouth	916	878	887
PRINCE EDWARD ISLAND			
Charlottetown	1048	994	923
NEWFOUNDLAND			
Gander	1194	1218	1180
St. John's	1111	1097	1141

SEASONAL SNOWFALL TOTALS (cm) TO END OF NOVEMBER

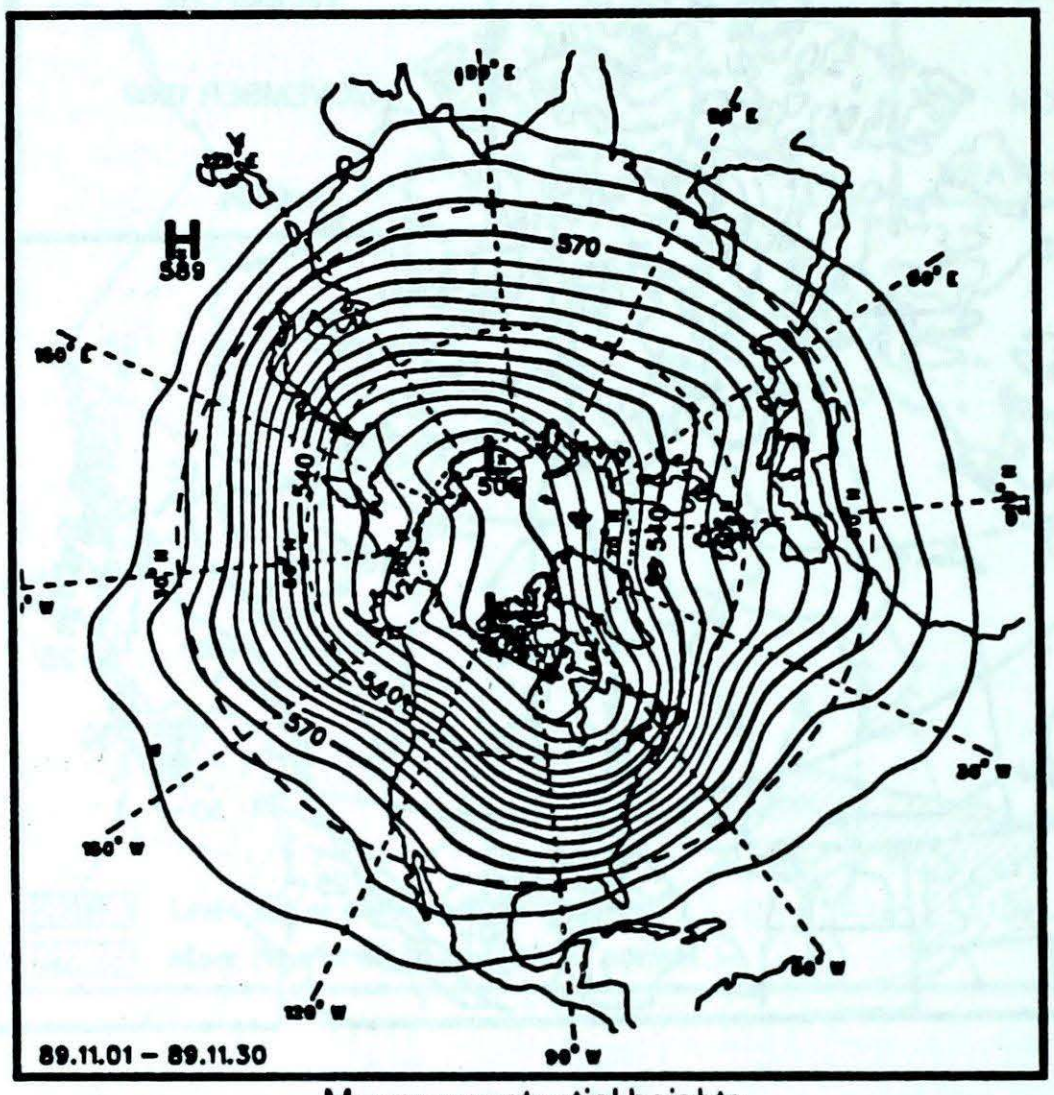
	1989	1988	NORMAL
YUKON TERRITORY			
Whitehorse	57.2	56.0	42.5
NORTHWEST TERRITORIES			
Cape Dyer	393.6	411.0	241.3
Inuvik	85.4	71.4	75.6
Yellowknife	71.0	69.9	56.7
BRITISH COLUMBIA			
Kamloops	4.7	10.6	12.4
Port Hardy	3.2	4.4	4.2
Prince George	26.4	13.2	50.0
Vancouver	0.0	0.2	2.8
Victoria	0.0	0.6	2.3
ALBERTA			
Calgary	17.8	18.1	35.7
Edmonton Namao	24.9	9.4	26.5
Grande Prairie	36.2	22.6	42.4
SASKATCHEWAN			
Estevan	15.9	18.8	23.1
Regina	29.7	16.6	24.2
Saskatoon	30.8	9.4	23.4
MANITOBA			
Brandon	28.2	28.2	23.3
Churchill	52.6	106.0	77.3
The Pas	65.0	30.1	43.8
Winnipeg	17.8	39.0	27.3
ONTARIO			
Kapuskasing	146.2	79.0	85.0
London	44.0	20.2	26.3
Ottawa	43.6	34.8	25.5
Sudbury	74.0	42.2	38.6
Thunder Bay	23.6	33.6	33.1
Toronto	5.0	0.0	8.9
Windsor	18.6	3.8	11.6
QUEBEC			
Baie Comeau	66.3	29.2	41.6
Montréal	42.6	47.2	22.9
Québec	66.3	29.0	38.3
Sept-Iles	56.4	62.6	61.4
Sherbrooke	36.4	28.8	42.4
Val-d'Or	103.0	92.6	63.7
NEW BRUNSWICK			
Charlo	34.3	35.5	42.9
Fredericton	60.1	15.0	22.7
Moncton	53.1	25.3	24.7
NOVA SCOTIA			
Shearwater	36.6	0.4	9.5
Sydney	58.6	20.0	14.6
Yarmouth	39.0	1.6	8.3
PRINCE EDWARD ISLAND			
Charlottetown	63.2	8.2	24.2
NEWFOUNDLAND			
Gander	44.2	101.1	44.1
St. John's	24.4	29.0	25.6



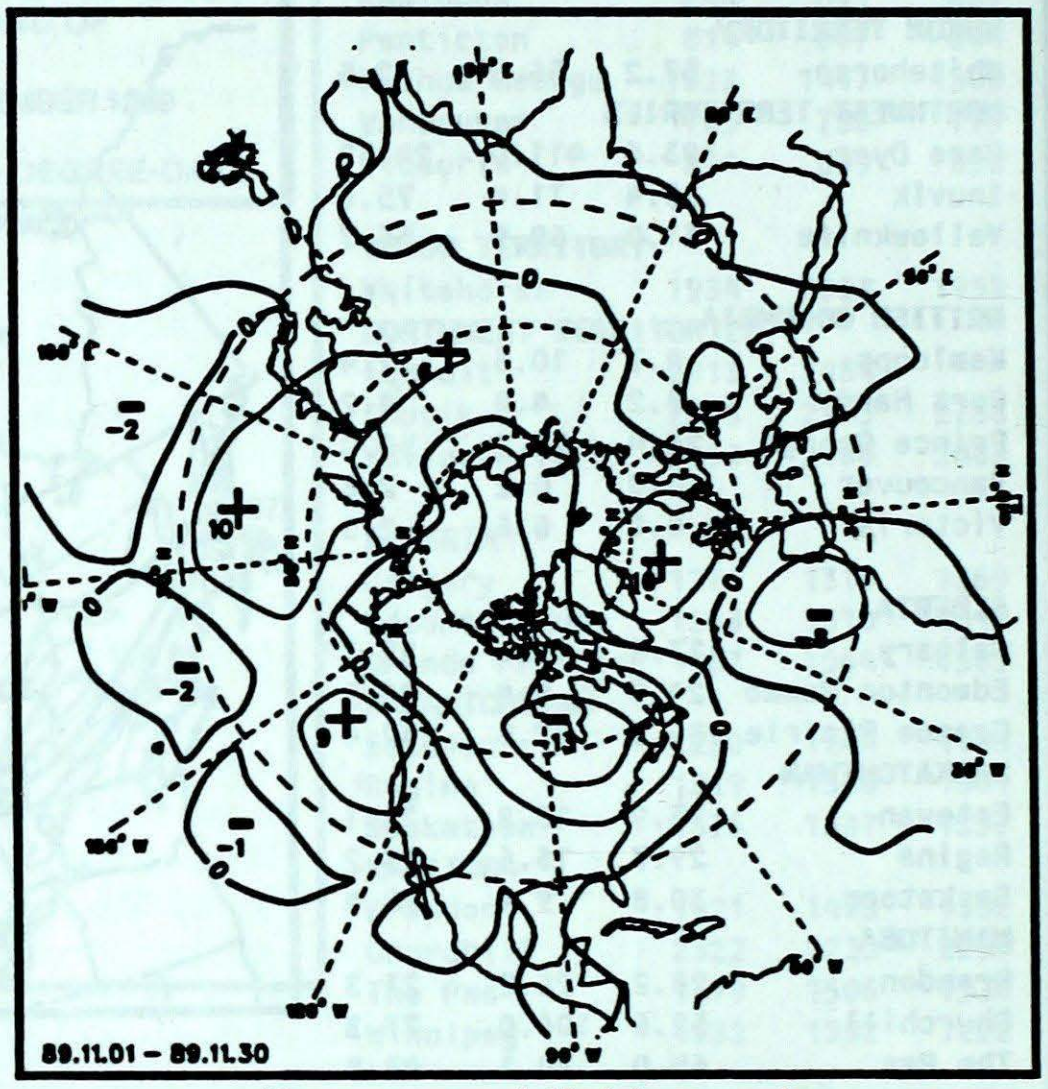


50-kPa ATMOSPHERIC CIRCULATION

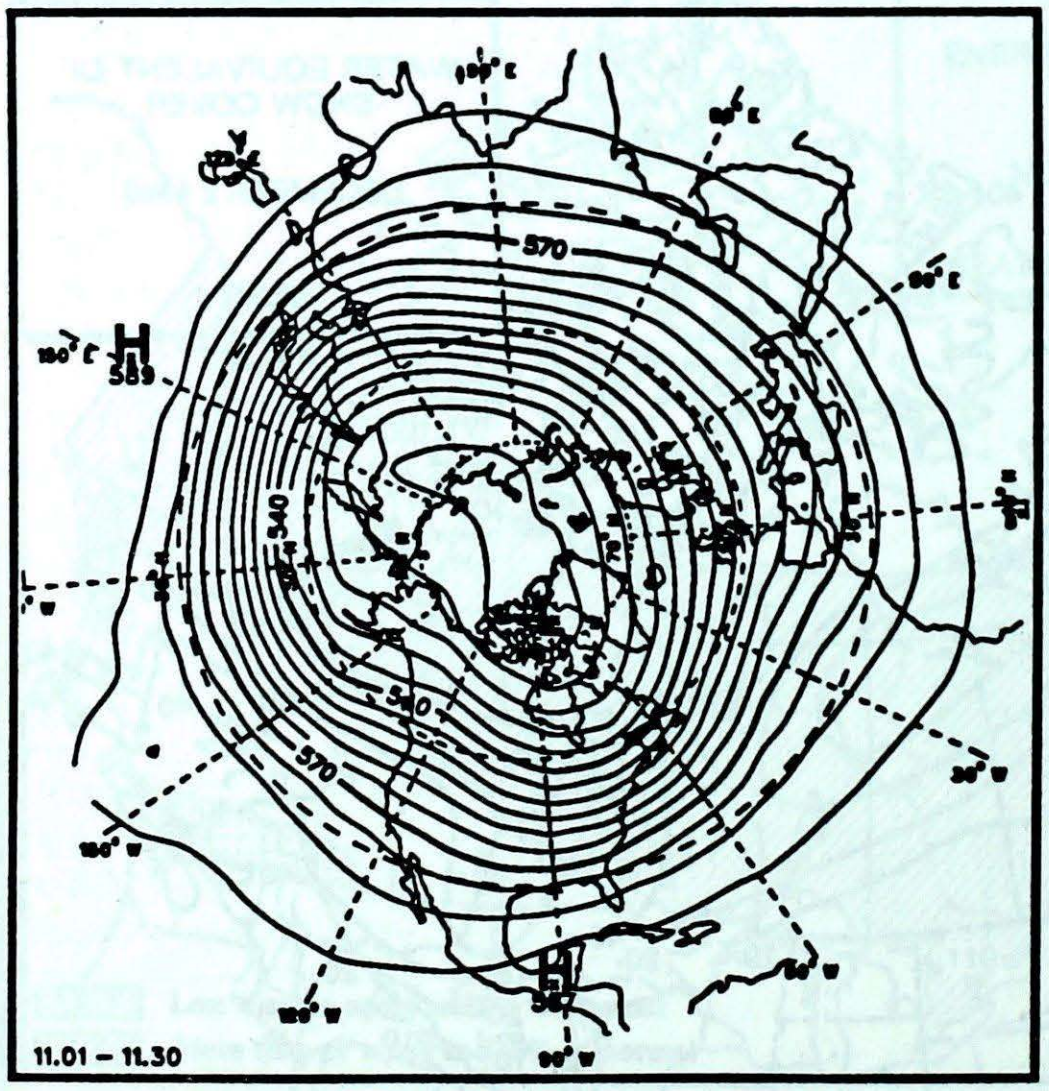
November 1989



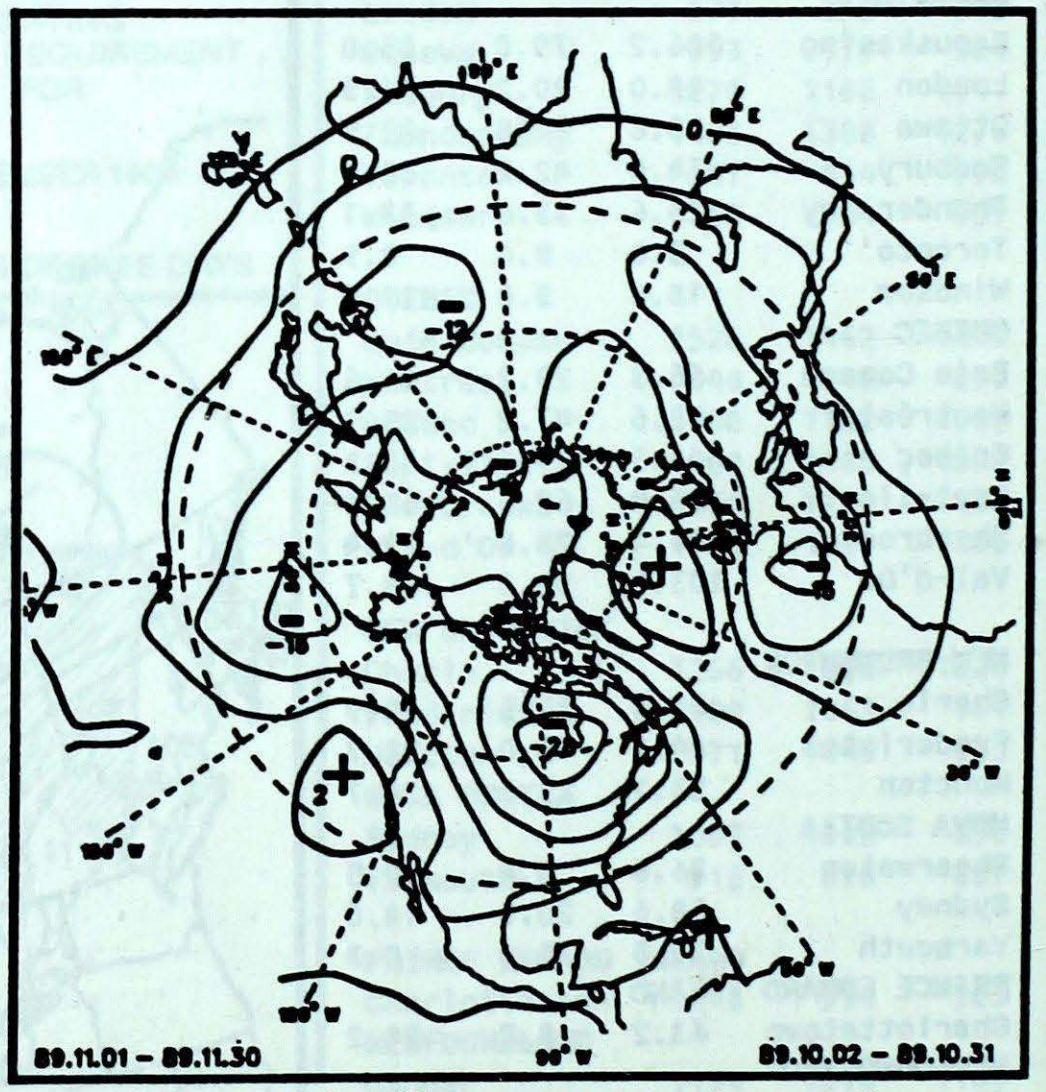
Mean geopotential heights
- 5 decametre interval -



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 -

WEATHER IMPACT ON AGRICULTURE IN 1989: A NATIONAL OVERVIEW

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Winter damage also took its toll in the Prairies, Quebec and the Maritimes as a result of poor snow cover and cold outbreaks following mild periods, which had brought crops out of dormancy. In the Swift Current area, 75% of winter wheat and up to 50% of canola was killed. Perennial crops, cereals, and forage all suffered from winter kill in Quebec, New Brunswick and Prince Edward Island.

May

The 1989 growing season started off with above-normal 50-kPa heights positioned off the east coast. Positive height anomalies also dominated most of central and eastern Canada. Negative height anomalies affected southern British Columbia, Alberta, and Manitoba. This pattern was reflected at the surface with a much-above-normal accumulation of growing degree-days by May 31 in eastern Canada. Crops did not really benefit from this excess of growing degree-days because above-normal precipitation ***(Figure 2)*** fell over most of Quebec and Ontario, thus delaying seeding. Seeding of spring field crops was also delayed in southeastern Saskatchewan and southern Manitoba, due to a lack of precipitation and inadequate soil moisture. Southwestern Alberta was also affected by the lack of precipitation and poor soil-moisture reserves. British Columbia, however, benefitted from a somewhat cloudier and cooler May, conditions which did not stress the perennial crops that had survived the winter. In Nova Scotia, berries benefitted from favourable growing conditions.

June

In June, another positive 50-kPa height-anomaly centre, located in Quebec, resulted in an above-normal accumulation of growing degree-days over Newfoundland and Labrador. Although most of the country was under the influence of above-normal atmospheric heights, the growing degree-day accumulation was near or slightly-below normal, as a result of copious precipitation ***(Figure 3)*** across the nation. With the exception of Newfoundland, Prince Edward Island, New Brunswick, southern Alberta and southern Saskatchewan, which received below-normal amounts, precipitation ranged from 150% of normal in eastern Ontario to over 300% in the area of the Manitoba-Ontario border. Prairie crops benefitted from ample precipitation in June. However, while forage crop yields were reported to be 25% higher in Nova Scotia due to favourable growing conditions, drier-than-normal conditions led to moisture stress in the soybean fields of Prince Edward Island.

July

July was characterized by two extreme events: hot, dry conditions over most of the nation and extreme precipitation in southwestern Ontario during the latter part of the month. Precipitation amounts recorded in Ontario exceeded by far the 100-year return period.

The 50-kPa positive height-anomaly centres off the east coast in May and over Quebec in June were followed by a third occurrence in July, centred over Manitoba. With the exception of the Maritimes, which were under the influence of below-

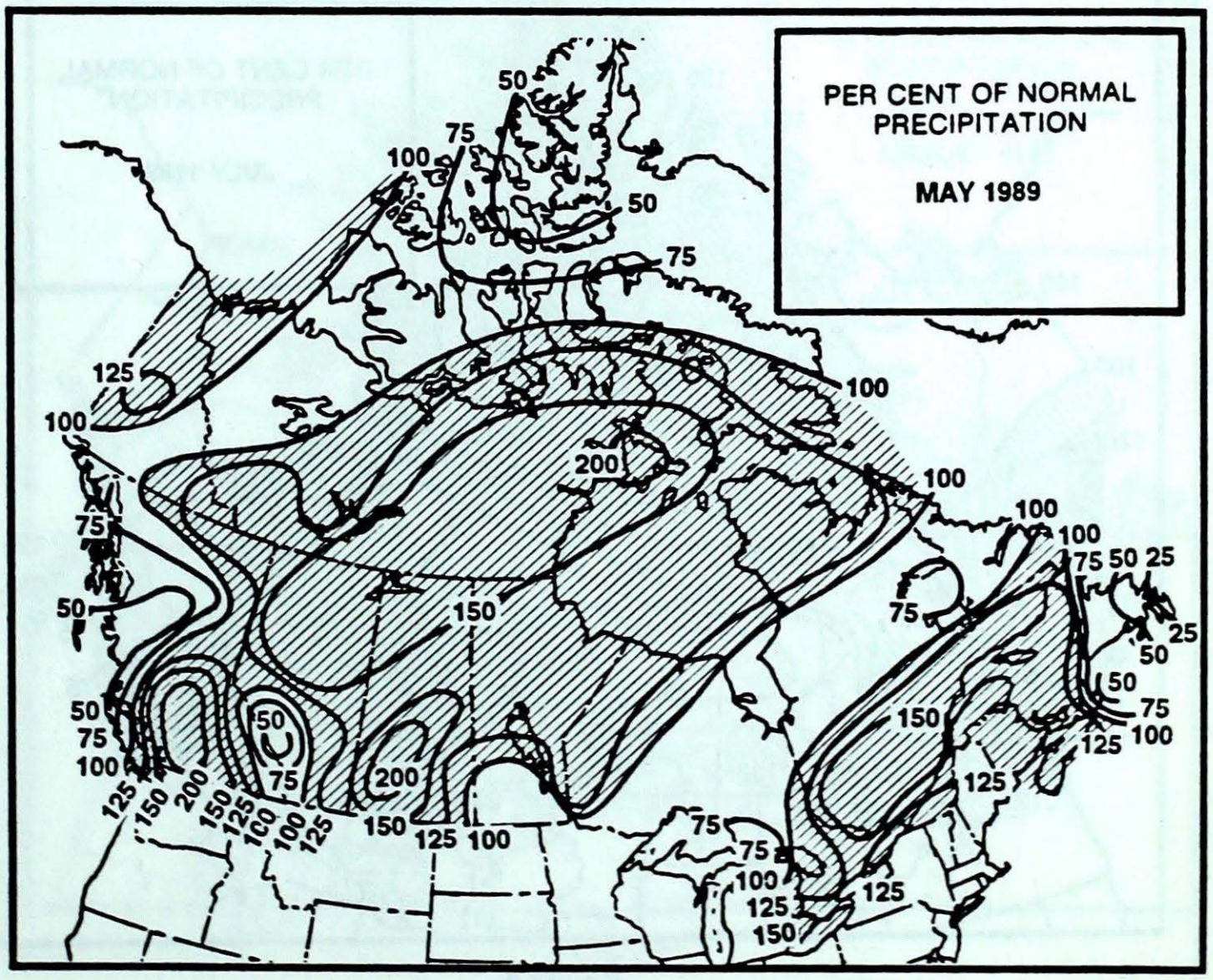

Figure 2

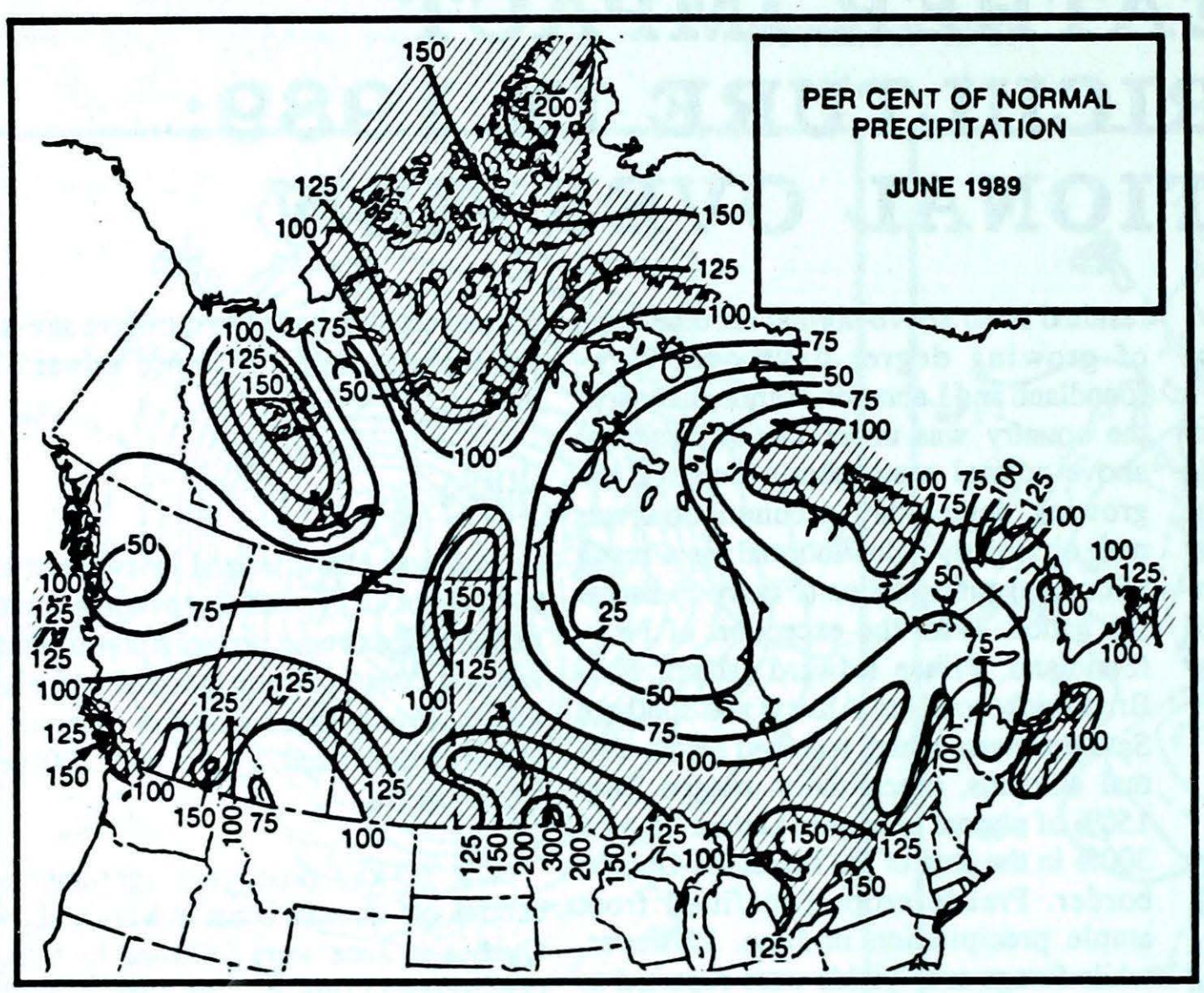

Figure 3

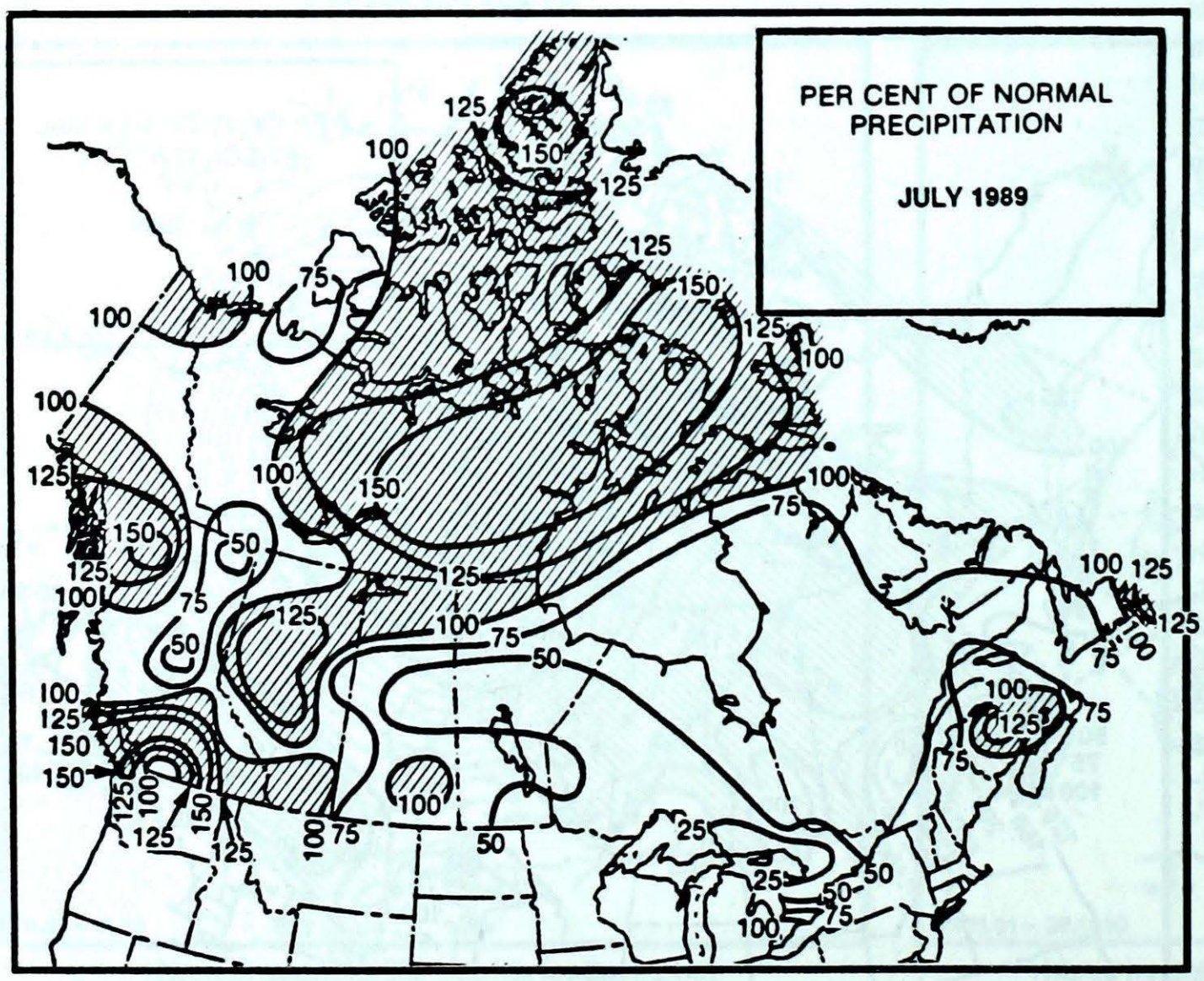

Figure 4

normal atmospheric heights, the remainder of the country experienced positive height anomalies. This resulted in an above-normal accumulation of growing degree-days from the Prairies to Quebec, accompanied by below-normal precipitation (***Figure 4***). The areas most affected were the agricultural areas of; Quebec, northern Ontario and southern Manitoba. British Columbia experienced normal to below-normal growing degree-day accumulations and much-above-normal precipitation. By the end of July, Prairie crops, particularly barley and canola, were showing signs of the hot temperatures and lack of moisture, resulting in rapid maturation. Wet and cool conditions in British Columbia, which had persisted in June, resulted in disease, and poor fruit and vegetable quality. In Quebec, honey production and crops such as cereals, corn, potatoes, and forage suffered from the hot, dry conditions.

Quebec's strawberries, blueberries and apples were also affected by the drought, resulting in smaller-sized fruit and lower yields. Particularly affected were raspberries which matured rapidly during the compressed growing season, with yields considerably reduced over sandier soils. Late-seeded crops were particularly vulnerable to the drought. Second-haying was also delayed and the excessive heat had a detrimental effect during the grain-filling stage.

Dry conditions in New Brunswick resulted in floral abortion in vegetables, particularly peppers. Tip burns in cauliflower were also reported. However, the grain crops were not affected by the dry conditions. A dry July resulted in a lower incidence of weather-induced diseases. Low-bush blueberries were greatly affected by the dry conditions in Nova Scotia and potato crops in the eastern end of Prince Edward Island exhibited signs of lack of moisture. Crops in central Ontario suffered from the extreme heat and lack of moisture.

On the other hand, record-breaking rains were unleashed on southwestern Ontario's Essex County and surrounding areas. A near-stationary 50-kPa low was

centred over Illinois on July 20, with a trough extending northeastward over southwestern Ontario. The depression was nearly vertical with considerable instability and high moisture content. The surface trough was aligned along Lake Erie, and a moderate flow was observed along the axis of the lake. The enhanced convergence resulted in heavier rainfall, since winds were light elsewhere. Sporadic but heavy rain due to thunderstorms lashed the southern part of Essex County from 7 pm on Wednesday, July 19, until early the next afternoon. The greatest (***Figure 5***) unofficial rainfall totals were 419 mm and 406 mm at two locations between Harrow and Colchester. Harrow reported 264.2 mm. Significant soil erosion was reported in Windsor, Kingsville, Leamington and Point Pelee. Agricultural damage was estimated at 10 to $20 million. Thirty per cent of the Essex County tomato crop was lost.

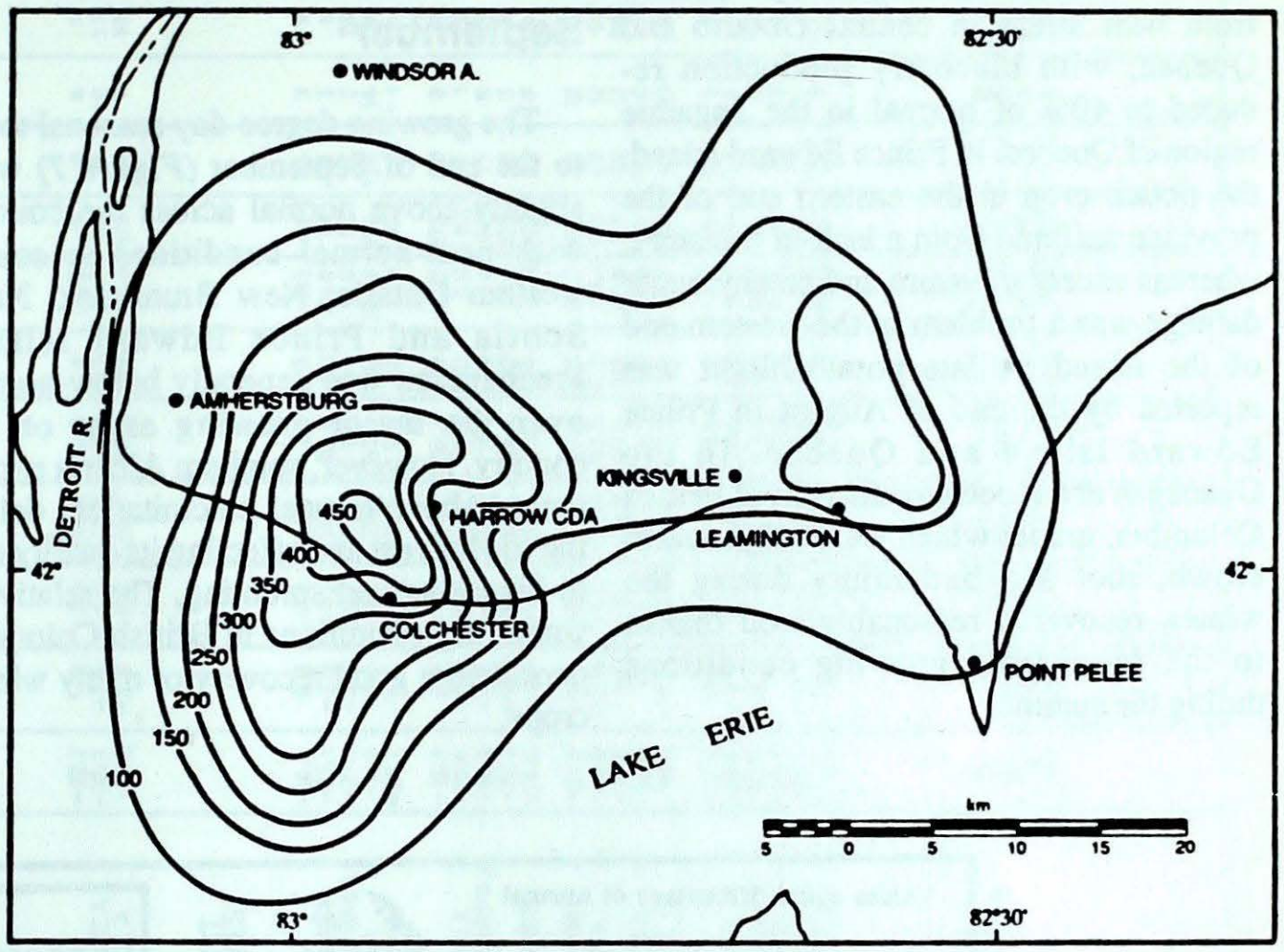

Figure 5

August

August was the fourth consecutive month of the growing season in which a 50-kPa positive height-anomaly centre affected Canadian agriculture, dominating most of western and central Canada. As a result, growing degree-day accumulations were above normal over most of the Prairies, but were near or slightly-below normal over southern Alberta due to above-normal precipitation (***Figure 6***). Below-normal precipitation and low soil-moisture reserves over southern Manitoba and the southeastern corner of Saskatchewan exacerbated the problem of crops already stressed by above-normal growing degree-day accumulations. East of the Great Lakes, the growing degree-day accumulations were near normal except above normal over the Maritimes.

Hail caused losses of 10 to 20% in wheat, barley and canola in the Dauphin area of Manitoba. The driest prairie areas were the southwestern corner of Manitoba and southeastern Saskatchewan.

Precipitation was below normal over southern Ontario, southern Quebec, New Brunswick, Prince Edward Island and

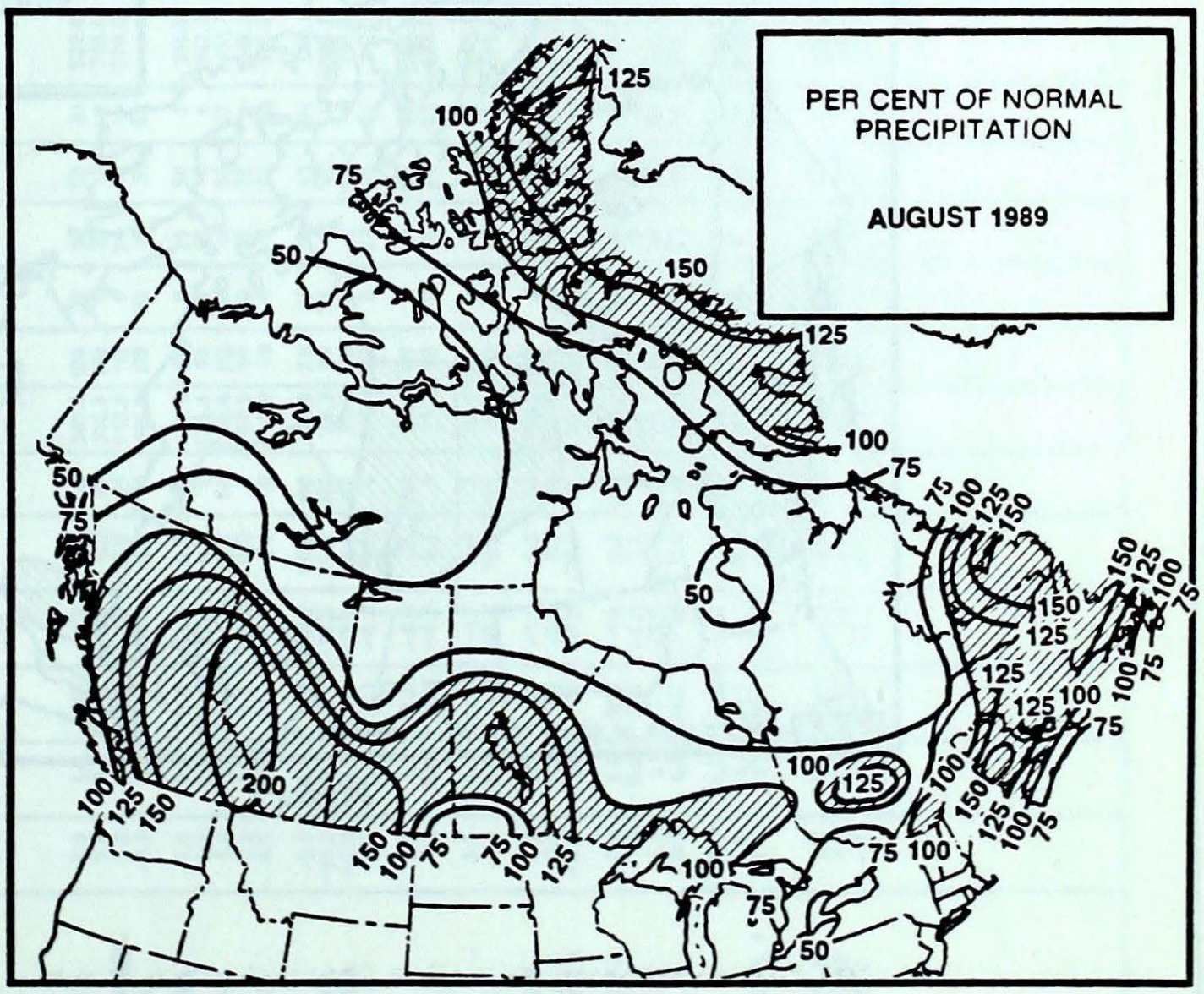

Figure 6

southern Nova Scotia. Most crops suffered from heat stress in central Ontario and Quebec, with blueberry production reduced to 40% of normal in the Sagamie region of Quebec. In Prince Edward Island, the potato crop in the eastern end of the province suffered from a lack of moisture, whereas excess moisture and patchy water damage was a problem in the western end of the island. A late potato blight was reported by the end of August in Prince Edward Island and Quebec. In the Okanagan and Kootenay districts of British Columbia, grapes which were subjected to crown, root and bud injury during the winter, recovered reasonably well thanks to the favourable growing conditions during the summer.

September

The growing degree-day seasonal totals to the end of September *(Figure 7)* were slightly-above normal across the country with near-normal conditions in southwestern Ontario, New Brunswick, Nova Scotia and Prince Edward Island. Precipitation was generally below-normal over the major growing areas of the country. However, southern Alberta experienced above-normal precipitation, delaying the harvest and affecting its quality due to bleaching and sprouting. The relatively warm, dry conditions in British Columbia permitted a good recovery of many winter crops.

Conclusion

The impact of the 1989 drought was different from that of 1988 in that it occurred later in the season, allowing fall-seeded and some early-seeded spring crops to achieve good yields. The total Canadian production of major grains in 1989 was 50.4 million metric tonnes, which was only slightly higher than the 10-year average and represents a 28% increase over the 1988 crop. The poor weather conditions which prevailed during harvest have taken a serious toll on the quality of all major and specialty crops.

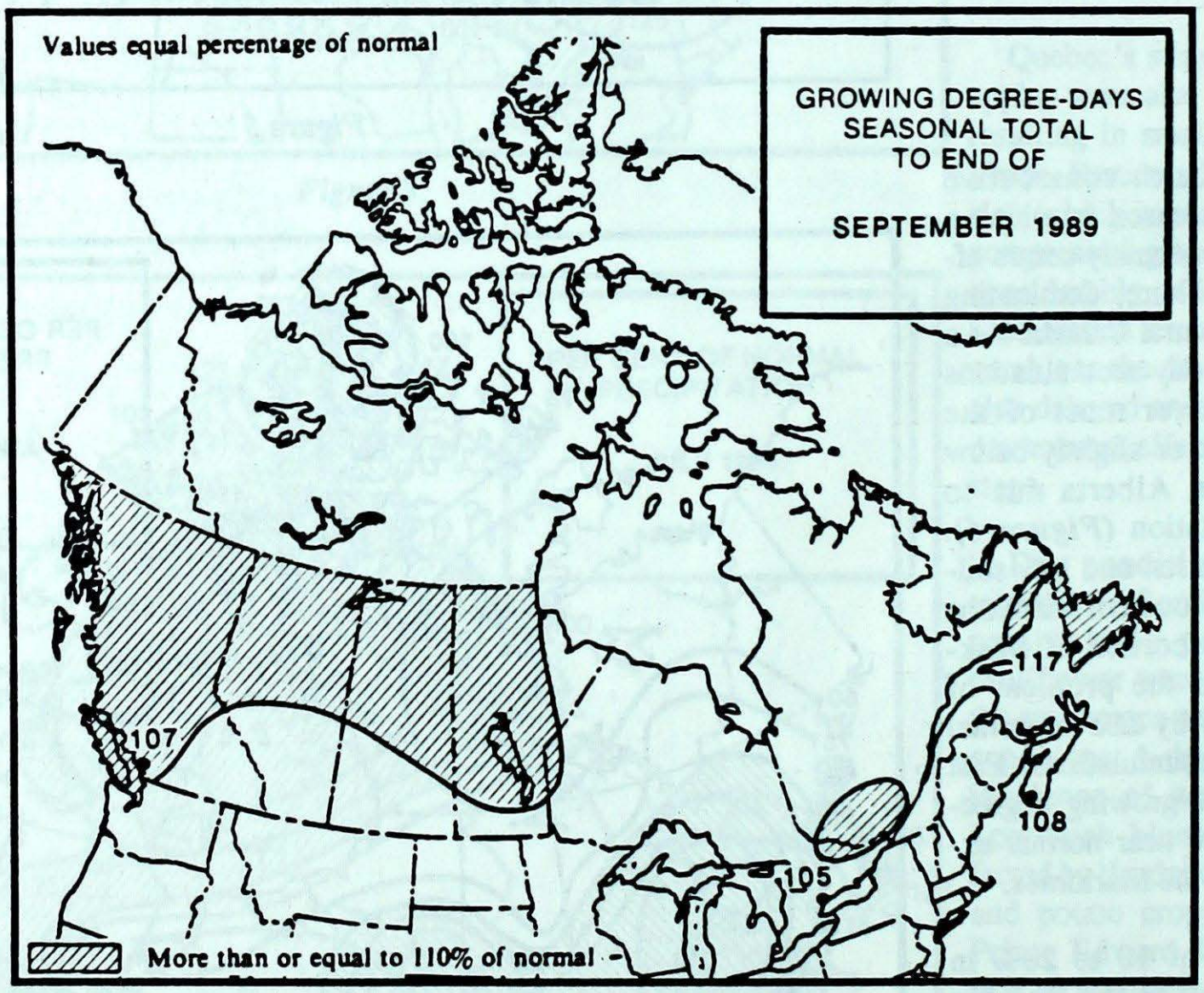

Figure 7

NOVEMBER 1989

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
BRITISH COLUMBIA													
ABBOTSFORD A	7.0	1.4	15.0	-0.7	0.0	0	345.8	180	0	18	58	81	329.4
ALERT BAY	5.8	0.1	12.2	-0.4	4.5	65	316.4	149	0	22	0	*	365.5
AMPHITRITE POINT	8.0	0.6	12.6	1.2	2.0	91	446.0	112	0	24	0	*	300.9
BLUE RIVER A	-1.2	1.5	10.7	-13.8	11.8	21	146.6	175	32	19	31	68	*
CAPE ST JAMES	7.6	0.7	11.4	1.4	0.8	21	173.6	93	0	24	56	*	314.0
CAPE SCOTT	7.6	0.8	13.3	2.2	0.0	0	336.4	95	0	25	0	*	312.3
CASTLEGAR A	2.9	1.1	13.2	-6.1	18.2	60	86.4	112	4	11	50	87	451.7
COMOX A	6.2	0.9	16.5	-0.3	0.0	0	88.5	46	0	15	58	*	347.2
CRANBROOK A	0.5	2.4	12.7	-11.3	2.1	9	15.2	49	0	6	62	75	525.9
DEASE LAKE	-9.3	-0.8	4.0	-32.2	69.0	199	61.9	211	37	14	43	71	818.1
FORT NELSON A	-16.9	-4.9	-2.0	-32.6	29.0	102	20.3	89	34	6	73	*	1046.3
FORT ST JOHN A	-7.0	-1.0	11.3	-25.4	30.0	97	38.3	123	0	6	107	*	750.7
HOPE A	6.4	1.7	16.1	-0.3	0.0	0	596.1	266	0	23	15	52	347.2
KAMLOOPS A	2.7	1.1	19.4	-6.0	4.7	41	25.8	117	0	8	67	94	459.3
KELOWNA A	3.1	2.0	19.7	-6.8	0.2	2	23.2	89	0	6	54	93	448.5
LYTTON	5.6	3.2	18.7	-1.7	0.6	3	31.3	45	0	7	46	70	362.0
MACKENZIE A	-1.8	2.6	9.6	-16.5	72.2	146	74.8	125	9	13	41	85	594.3
PORT ALBERNI A	6.5	1.6	15.2	-1.4	2.0	28	184.7	64	0	21	19	*	345.3
PORT HARDY A	5.9	0.6	15.2	-2.4	3.2	80	328.0	134	0	21	41	67	361.5
PRINCE GEORGE A	-0.3	2.6	11.9	-10.8	25.4	64	68.9	136	0	10	46	70	549.9
PRINCE RUPERT A	5.2	1.3	11.6	-1.6	11.7	133	508.7	190	0	26	25	49	377.5
PRINCETON A	2.1	3.0	16.6	-6.0	1.4	8	21.2	56	0	7	52	*	*
REVELSTOKE A	1.4	1.1	7.7	-8.5	92.9	182	184.0	190	14	19	37	87	500.3
SANDSPIT A	6.5	1.0	14.4	-1.2	0.0	0	210.4	116	0	20	54	84	346.3
SMITHERS A	0.2	2.5	11.3	-8.7	24.2	63	119.9	206	0	14	41	88	534.6
TERRACE A	2.4	2.1	10.1	-5.1	59.6	122	296.7	165	0	19	20	36	468.4
VANCOUVER INT'L A	7.0	1.1	14.7	-1.6	0.0	0	213.1	142	0	17	61	88	330.6
VICTORIA INT'L A	7.0	1.0	15.9	-1.9	0.0	0	97.0	74	0	17	77	99	330.7
VICTORIA MARINE	7.5	0.9	14.2	1.0	0.0	0	317.2	183	0	18	0	*	315.7
WILLIAMS LAKE A	-1.0	1.6	12.4	-12.2	28.2	91	77.2	246	8	10	46	63	571.0

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
YUKON TERRITORY													
DAWSON A	-22.1	*	-3.5	-47.9	56.9	*	28.2	*	*	*	*	*	*
WATSON LAKE A	-16.3	-2.5	4.0	-43.4	38.4	103	28.7	90	30	10	53	123	1029.2
WHITEHORSE A	-12.1	-3.3	6.8	-38.9	26.8	113	22.9	116	13	7	48	82	904.1
NORTHWEST TERRITORIES													
ALERT	-26.6	0.0	-7.4	-39.0	7.4	85	7.0	84	24	3	*	*	1336.8
BAKER LAKE A	-23.1	-2.8	-4.2	-37.0	22.8	131	11.6	70	25	5	*	*	1083.9
CAMBRIDGE BAY A	-27.1	-3.3	-12.7	-38.4	4.0	44	4.0	52	17	2	28	275	1355.0
CAPE DYER A	-11.7	3.0	1.8	-27.0	215.6	317	207.9	352	130	14	*	*	889.2
CAPE PARRY A	-23.7	-5.4	-13.6	-32.6	5.8	38	3.1	32	4	1	*	*	1282.1
CLYDE A	-16.5	0.9	-0.1	-29.2	29.3	179	26.5	175	38	8	2	40	1034.7
COPPERMINE A	-27.5	-7.8	-15.9	-37.7	6.2	41	6.0	42	36	1	25	206	1366.4
CORAL HARBOUR A	-18.2	-0.7	-1.5	-25.2	16.1	89	15.4	86	25	6	38	66	1086.5
EUREKA	-32.2	-0.7	-17.0	-48.2	19.6	653	13.2	528	22	3	*	*	1506.5
FORT RELIANCE	-18.9	-4.9	-4.8	-32.6	22.2	86	17.2	79	22	5	*	*	1107.6
FORT SIMPSON A	-21.6	-5.9	-6.8	-40.8	37.0	146	37.0	153	39	12	73	143	1188.8
FORT SMITH A	-17.4	-5.8	-3.0	-33.2	63.5	220	49.1	188	43	12	61	*	1064.2
IQALUIT	-11.6	1.4	3.1	-25.9	77.4	210	67.8	197	29	12	30	65	888.1
HALL BEACH A	-19.8	1.7	-4.8	-34.6	24.8	192	24.8	197	53	8	*	*	1133.7
HAY RIVER A	-18.5	-7.2	-3.1	-34.9	55.7	142	55.7	151	47	15	*	*	1081.1
INUVIK A	-27.9	-7.2	-13.0	-40.1	13.6	60	11.0	61	23	6	1	5	1377.4
MOULD BAY A	-29.6	-3.0	-12.3	-39.7	10.6	241	10.4	281	20	4	*	*	1428.7
NORMAN WELLS A	-24.4	-6.2	-8.2	-38.8	33.4	157	24.5	117	12	6	33	104	1270.7
POND INLET A	-21.4	*	-1.3	-37.5	24.2	*	20.0	*	19	8	2	*	1183.0
RESOLUTE A	-26.7	-2.2	-12.5	-39.4	7.6	125	7.6	133	26	2	*	*	1341.3
YELLOWKNIFE A	-20.2	-6.1	-2.4	-34.7	53.4	178	34.3	140	22	8	56	134	1147.4
ALBERTA													
BANFF	-2.6	1.3	8.0	-18.0	44.0	137	65.8	212	7	11	*	*	*
CALGARY INT'L A	-0.7	2.0	14.3	-13.9	14.2	87	17.2	135	0	5	100	81	560.9
COLD LAKE A	-6.5	-0.3	7.4	-23.9	25.3	119	24.7	122	2	9	84	90	735.8
CORONATION A	-4.6	0.3	11.0	-23.7	23.4	147	18.0	120	2	6	76	59	677.7

NOVEMBER 1989

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EDMONTON INT'L A	-3.8	1.7	9.2	-22.2	25.8	143	32.3	193	5	12	66	64	653.1
EDMONTON MUNICIPAL	-2.4	1.3	8.7	-18.1	22.4	*	31.1	198	2	10	74	69	609.9
EDMONTON NAMAO A	-3.0	1.9	8.2	-19.0	21.5	128	26.6	148	1	11	*	*	629.9
EDSON A	-3.8	2.1	14.2	-22.0	22.6	88	26.8	146	6	8	70	75	653.7
FORT CHIPEWYAN A	-16.6	-6.5	0.0	-39.0	83.2	334	66.6	279	51	*	*	*	*
FORT MCMURRAY A	-12.8	-4.6	7.8	-33.0	52.5	180	41.5	165	22	12	63	76	923.5
GRANDE PRAIRIE A	-4.3	1.7	11.2	-26.7	22.8	87	17.4	63	0	7	103	*	669.1
HIGH LEVEL A	-16.9	-6.2	1.5	-38.0	56.4	194	48.6	192	37	11	60	86	1046.2
JASPER	-1.7	2.2	9.8	-16.6	33.2	135	44.8	151	12	10	58	*	588.6
LETHBRIDGE A	1.0	1.8	16.8	-14.6	21.8	116	23.8	142	0	6	89	*	509.4
MEDICINE HAT A	-0.7	0.9	15.5	-21.9	20.6	146	27.9	191	0	5	92	82	562.7
PEACE RIVER A	-6.8	1.3	7.6	-25.9	23.7	108	37.1	185	3	10	*	*	769.9
RED DEER A	-3.9	0.7	13.4	-18.8	21.1	140	22.7	150	8	9	*	*	654.9
ROCKY MTN HOUSE A	-3.7	-0.1	13.8	-21.8	27.6	139	19.6	109	8	9	*	*	651.9
SLAVE LAKE A	-5.1	0.9	11.6	-20.4	20.2	86	33.4	160	0	11	77	78	691.5
WHITECOURT A	-3.8	2.5	11.2	-22.5	33.1	151	37.8	161	4	13	*	*	653.1
SASKATCHEWAN													
BROADVIEW	-6.1	-0.3	10.4	-25.5	29.2	196	25.8	188	2	9	95	88	721.0
COLLINS BAY	-17.0	*	-4.2	-29.9	96.0	*	61.4	*	54	18	62	*	1069.7
CREE LAKE	-16.1	-5.8	1.4	-36.2	65.6	233	44.6	210	32	13	63	100	1024.3
ESTEVAN A	-3.6	0.0	13.6	-21.0	10.5	70	14.0	86	0	7	*	*	646.7
HUDSON BAY A	-10.8	*	7.8	-30.6	41.4	*	30.0	*	8	12	81	*	864.5
KINDERSLEY	-4.5	0.7	10.5	-22.3	20.5	201	17.8	142	3	4	88	*	675.9
LA RONGE A	-12.5	-4.1	5.2	-31.4	54.4	155	50.8	198	18	11	*	*	916.0
MEADOW LAKE A	-8.0	*	6.7	-28.1	28.0	*	14.7	*	4	5	69	*	779.6
MOOSE JAW A	-2.8	0.8	15.8	-22.7	19.2	103	26.3	157	3	*	99	90	625.0
NIPAWIN A	-11.1	*	7.7	-31.0	28.9	*	21.1	*	16	6	88	*	873.5
NORTH BATTLEFORD A	-5.5	0.3	8.3	-22.1	25.2	184	23.0	161	3	7	*	*	695.4
PRINCE ALBERT A	-9.1	-1.9	7.9	-30.4	32.0	184	27.5	162	9	7	78	93	813.6
REGINA A	-5.1	0.0	11.7	-23.2	23.3	164	22.5	167	4	8	89	86	691.9
SASKATOON A	-5.9	-0.2	8.9	-24.7	18.8	148	22.9	156	2	6	*	*	717.6
SWIFT CURRENT A	-3.0	0.7	13.6	-23.5	18.0	121	21.8	138	1	*	*	*	630.7
YORKTON A	-7.7	-1.8	8.9	-26.1	27.4	141	28.0	139	4	8	95	105	768.3
MANITOBA													
BRANDON A	-7.1	-1.4	8.1	-25.1	27.8	167	25.6	141	4	*	102	*	753.1
CHURCHILL A	-17.6	-5.5	-1.6	-30.1	12.6	30	6.8	18	19	2	82	164	1068.2
DAUPHIN A	-7.6	-2.4	8.4	-24.7	31.1	130	29.2	116	1	9	102	109	766.8
GILLAM A	-19.3	-7.5	-2.8	-39.4	29.8	67	18.4	58	28	6	*	*	1116.8
GIMLI	-8.5	*	11.3	-26.9	33.7	*	25.9	*	2	12	94	99	795.7
ISLAND LAKE	-14.3	-6.4	2.4	-31.2	63.9	127	47.6	130	34	14	*	*	968.5
LYNN LAKE A	-18.9	-7.1	*	-33.9	71.3	190	*	*	45	11	59	97	1106.5

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
NORWAY HOUSE A	-14.4	*	2.1	-32.0	49.4	*	33.4	*	25	7	*	*	972.5
PORTAGE LA PRAIRIE	-6.7	-2.6	9.7	-24.1	28.5	108	20.5	70	1	8	*	*	739.4
THE PAS A	-11.8	-4.3	4.6	-29.9	46.7	148	40.7	141	18	10	75	113	892.7
THOMPSON A	-18.6	-7.2	-3.9	-34.0	36.0	107	35.1	118	40	7	100	147	1096.8
WINNIPEG INT'L A	-7.7	-3.2	8.0	-24.5	16.4	75	17.4	69	1	7	98	108	772.3
ONTARIO													
BIG TROUT LAKE	-15.0	-6.0	1.4	-36.0	44.2	104	41.6	101	32	10	89	*	990.5
EARLTON A	-7.2	-4.7	6.0	-29.1	76.7	196	98.7	140	33	16	*	*	734.3
GERALDTON A	-10.3	*	4.7	-33.6	53.0	*	51.6	*	21	12	*	*	849.7
GORE BAY A	-1.1	-3.0	9.2	-19.2	88.0	344	117.1	144	12	17	*	*	573.2
HAMILTON RBG	3.0	*	18.2	-9.6	10.8	*	105.0	*	*	13	86	*	*
HAMILTON A	2.2	-1.2	17.4	-10.1	17.6	153	103.1	147	*	16	*	*	675.4
KAPUSKASING A	-9.2	-4.8	6.0	-29.2	104.2	169	99.8	125	72	18	*	*	810.3
KENORA A	-7.8	-3.2	8.5	-24.7	26.8	72	27.0	67	2	9	*	*	774.0
KINGSTON A	1.7	-1.2	14.0	-14.5	19.2	133	124.2	132	3	19	85	109	490.5
LONDON A	2.0	-1.1	17.6	-9.4	34.0	139	133.7	158	5	16	61	81	480.0
MOOSONEE	-10.1	-5.6	5.4	-29.2	99.4	210	86.7	131	39	11	44	87	843.9
MUSKOKA A	-1.7	-2.8	13.3	-20.9	84.9	211	172.2	170	21	23	*	*	590.2
NORTH BAY A	-4.7	-3.7	8.4	-23.7	69.0	201	129.5	150	30	17	61	93	683.0
OTTAWA INT'L A	-1.4	-2.6	12.8	-18.1	40.4	177	140.3	181	9	19	75	94	582.2
PETAWAWA A	-3.3	-2.8	12.5	-24.8	54.2	287	90.4	138	20	18	*	*	637.6
PETERBOROUGH A	0.3	-1.7	16.1	-16.0	17.9	113	172.2	165	2	16	*	*	532.6
PICKLE LAKE	-12.1	-4.5	3.0	-31.0	55.0	113	51.9	106	32	13	*	*	900.2
RED LAKE A	-10.0	-3.9	5.1	-28.2	57.2	171	49.2	132	20	14	66	*	840.6
ST CATHARINES A	3.8	-0.8	10.9	-8.3	26.6	324	93.8	148	0	17	*	*	427.1
SARNIA A	2.4	-1.4	17.8	-8.3	7.6	47	93.8	127	0	12	84	91	467.8
SAULT STE MARIE A	-2.2	-2.9	7.3	-18.6	112.7	272	123.6	144	15	22	56	88	606.2
SIOUX LOOKOUT A	-8.8	-3.5	3.8	-23.9	41.7	92	50.7	102	16	12	*	*	803.4
SUDBURY A	-5.3	-4.1	7.9	-23.8	72.4	226	104.6	134	28	13	70	90	699.0
THUNDER BAY A	-6.1	-3.5	8.0	-22.8	18.6	62	22.5	43	3	7	98	113	721.7
TIMMINS A	-8.1	-4.3	5.6	-27.9	99.1	162	103.1	131	55	18	*	*	783.8
TORONTO	3.7	*	16.9	-11.2	15.0	*	95.8	*	*	13	*	*	430.3
TORONTO INT'L A	1.9	-1.4	17.2	-13.2	5.0	63	80.4	128	*	12	*	*	484.5
TORONTO ISLAND A	3.2	*	14.0	-10.3	3.9	66	87.0	*	0	13	*	*	444.0
TRENTON A	1.3	-1.9	16.4	-14.0	23.0	176	156.2	181	3	20	*	*	502.7
WATERLOO WELLINGTON	1.2	-1.3	16.4	-11.5	16.2	113	129.3	177	*	15	*	*	505.7
WAWA A	-5.9	*	6.3	-26.0	75.9	*	86.1	*	14	16	*	*	716.0
WIARTON A	0.2	-2.7	15.0	-12.6	114.6	291	201.6	213	15	22	49	81	525.5
WINDSOR A	3.5	-0.9	19.2	-8.7	3.4	30	63.6	98	0	9	*	*	436.5

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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	-4.6	-2.6	16.5	-22.8	52.7	112	68.0	93	25	15	*	*	678.8
BAIE COMEAU A	-4.3	-2.5	9.5	-22.5	55.1	155	98.5	123	7	13	97	115	670.0
BLANC SABLON A	-2.6	-1.9	12.9	-18.1	34.8	97	76.4	78	0	16	80	*	567.7
CHIBOUGAMAU CHAPAIS	-8.8	*	11.8	-30.3	58.8	*	128.5	*	10	18	46	91	804.2
GASPE A	-2.8	*	16.6	-21.1	62.1	*	136.8	*	15	16	94	*	623.4
INUKJUAK A	-9.3	-2.1	1.2	-25.2	73.4	193	67.4	170	14	15	35	*	817.9
KUUJJUAQ A	-10.6	-2.3	3.9	-27.4	88.0	246	90.2	225	41	13	58	112	859.3
KUUJJUARAPIK A	-8.8	-3.9	3.0	-23.9	91.8	175	88.0	144	24	21	45	119	803.6
LA GRANDE IV A	-12.1	*	5.8	-36.4	61.0	*	77.6	*	33	12	66	*	903.8
LA GRANDE RIVIERE A	-11.3	*	2.0	-29.2	95.8	*	86.6	*	37	14	53	*	881.7
MANIWAKI	-3.5	-3.2	15.3	-25.2	65.0	251	146.2	197	24	19	59	89	645.3
MATAGAMI A	-9.7	*	11.2	-31.1	87.9	*	102.6	*	32	20	45	96	832.4
MONT JOLI A	-2.4	-2.1	19.2	-16.7	31.8	90	63.8	86	10	13	67	88	611.6
MONTREAL INT'L A	-0.7	-2.7	19.7	-15.9	36.8	174	175.8	217	8	21	74	86	559.5
MONTREAL MIRABEL I/	-2.3	*	18.8	-19.8	42.4	*	193.6	*	19	20	85	*	607.7
NATASHQUAN A	-3.6	-2.5	10.7	-24.7	46.4	141	141.8	123	13	15	103	121	646.9
QUEBEC A	-3.0	-2.8	17.9	-21.4	75.0	221	171.2	176	39	19	71	96	630.6
SCHEFFERVILLE A	-12.0	-3.0	5.1	-29.0	77.2	126	100.2	153	50	13	67	153	900.4
SEPT-ILES A	-5.0	-2.5	9.4	-23.3	28.6	56	140.0	140	110	12	112	119	691.3
SHERBROOKE A	-1.4	-1.3	20.0	-22.2	28.8	78	94.4	98	5	17	69	*	582.4
STE AGATHE DES MONT	-4.1	-2.4	14.1	-23.2	95.8	233	195.7	182	36	21	64	91	663.9
ST HUBERT A	-0.5	-2.3	21.5	-17.8	27.2	*	162.1	182	7	19	74	*	553.9
VAL D'OR A	-7.8	-4.4	8.5	-29.6	82.4	172	133.0	168	36	21	48	82	774.9
NEW BRUNSWICK													
CHARLO A	-2.5	-1.7	16.8	-18.1	33.9	91	92.1	116	8	12	92	97	609.5
CHATHAM A	-1.3	-2.2	18.7	-20.4	53.1	203	118.3	115	16	15	97	*	575.4
FREDERICTON A	-0.5	-1.9	18.4	-18.7	58.0	284	139.1	131	21	14	85	*	555.1
MONCTON A	-0.1	-2.1	19.0	-17.4	77.4	358	134.7	122	30	19	87	90	542.6
SAINT JOHN A	0.9	-1.4	18.4	-16.3	66.0	455	234.4	161	20	20	102	106	513.0

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	2.7	-1.2	20.6	-13.8	53.2	364	166.6	154	7	20	*	*	461.4
HALIFAX INT'L A	2.3	-1.1	17.9	-12.1	55.6	467	169.3	111	TR	18	*	*	472.0
SABLE ISLAND	7.6	0.3	16.5	-4.9	19.6	632	179.0	131	0	18	61	87	313.8
SHEARWATER A	3.5	-1.1	16.2	-11.2	36.4	466	173.8	122	TR	17	100	*	435.8
SYDNEY A	3.1	-0.7	17.9	-11.7	58.2	485	207.2	129	7	24	74	99	446.9
YARMOUTH A	4.6	-0.6	16.9	-7.0	38.8	606	184.6	137	0	18	81	92	400.9
PRINCE EDWARD ISLAND													
CHARLOTTETOWN A	1.2	-1.7	17.0	-15.0	60.6	281	171.4	142	17	23	*	*	505.7
SUMMERSIDE A	1.5	-1.5	0.1	-13.0	51.6	304	149.4	149	30	*	70	74	496.7
NEWFOUNDLAND													
BONAVISTA	3.3	-0.1	16.8	-8.4	19.2	171	95.0	99	0	15	*	*	440.4
BURGEO	2.0	-1.0	12.0	-12.9	38.3	325	209.9	114	6	20	*	*	315.7
CARTWRIGHT	-3.5	-1.7	12.8	-16.8	80.3	173	108.4	136	38	15	67	96	646.9
CHURCHILL FALLS A	-10.5	-2.4	8.6	-28.3	100.6	142	96.4	120	49	16	67	129	854.4
COMFORT COVE	0.9	-0.7	18.4	-13.6	43.2	129	83.8	76	13	17	*	*	512.3
DANIELS HARBOUR	0.6	-1.2	18.9	-15.0	48.2	184	130.6	127	13	18	52	66	508.9
DEER LAKE A	-0.9	-1.9	17.5	-21.0	63.5	183	132.5	122	26	210	*	*	554.3
GANDER INT'L A	1.0	-0.9	18.2	-13.1	40.4	127	109.0	102	9	17	87	130	512.0
GOOSE A	-6.2	-2.4	12.6	-21.3	121.6	213	124.1	165	50	15	62	94	725.4
MARY'S HARBOUR	-2.7	-1.8	11.9	-18.5	46.8	114	105.6	118	28	14	*	*	621.1
PORT AUX BASQUES	1.7	-1.5	11.8	-10.1	50.0	439	210.0	135	6	24	57	*	488.9
ST ANTHONY	-2.3	-1.0	10.0	-17.2	73.0	190	150.4	120	28	17	*	*	579.0
ST JOHN'S A	3.2	-0.2	18.4	-8.7	24.0	113	130.4	80	2	21	97	143	444.8
ST LAWRENCE	3.5	0.0	7.2	-6.4	25.3	281	184.4	137	0	23	*	*	434.7
STEPHENVILLE A	1.9	-1.0	17.4	-11.7	54.9	225	185.5	151	15	22	36	66	480.2
WABUSH LAKE A	-10.9	-2.8	8.2	-19.8	70.7	104	76.6	100	24	12	68	124	867.1

AGROCLIMATOLOGICAL STATIONS — NOVEMBER 1989

STATION	Temperature C										Degree days above 5 C	
	Mean	Difference from Normal	Maximum	Minimum	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)	This month	Since jan. 1st
BRITISH COLUMBIA												
AGASSIZ	7.1	1.1	15.5	-1.0	0.0	409.7	193	0	21	51	67.0	2295.3
KAMPLOOPS	*.*	*.*	*.*	*.*	*.*	*.*	**	***	***	**	*.*	*.*
SIDNEY	7.4	1.2	15.5	0.5	0.0	107.3	83	0	21	67	73.3	2000.3
SUMMERLAND	7.2	4.7	19.5	-4.0	0.0	19.4	76	0	6	57	38.0	2288.8
ALBERTA												
BEAVERLODGE	-3.7	1.4	12.0	-23.5	14.0	16.8	63	0	5	98	5.3	1331.3
ELLERSLIE	*.*	*.*	*.*	*.*	*.*	*.*	**	***	***	**	*.*	*.*
LACOMBE	-3.6	0.8	9.5	-19.5	19.0	21.2	153	10	6	69	0.0	1329.4
LETHBRIDGE	*.*	*.*	*.*	*.*	*.*	*.*	**	***	***	**	*.*	*.*
VEGREVILLE	*.*	*.*	*.*	*.*	*.*	*.*	**	***	***	**	*.*	*.*
SASKATCHWAN												
INDIAN HEAD	-5.5	-0.4	10.0	-24.0	16.4	31.3	183	5	12	**	0.0	1831.2
MELFORT	-8.9	-2.0	6.0	-27.0	20.8	20.8	110	20	6	77	0.0	1579.0
REGINA	-5.3	0.4	11.0	-25.0	14.2	27.5	204	3	9	**	0.0	1765.7
SASKATOON	*.*	*.*	*.*	*.*	*.*	*.*	**	***	***	**	*.*	*.*
SCOTT	-5.7	0.5	8.0	-24.0	23.6	23.1	167	6	8	80	*.*	1214.7
SWIFT CURRENT	-2.6	1.3	13.0	-23.0	15.0	19.0	146	2	6	71	10.8	1687.5
MANITOBA												
BRANDON	-6.4	-1.4	10.1	-26.5	23.0	23.0	116	4	8	**	0.0	1932.0
GLENLEA	-5.5	-0.6	12.0	-23.0	24.8	18.4	76	7	4	**	0.0	2157.0
MORDEN	-8.0	-4.5	8.0	-28.0	24.8	24.8	97	2	10	**	*.*	1926.8
ONTARIO												
DELHI	2.6	-1.1	16.0	-12.0	23.0	147.9	179	16	***		*.*	*.*
ELORA	0.4	-1.5	15.8	-12.3		97.9	149	7	***	**	*.*	*.*
GUELPH	1.1	-1.4	16.4	-12.6	11.5	137.5	184	1	13	74	22.3	1991.4
HARROW	3.7	-0.8	18.0	-9.0	0.0	40.4	60	0	6	97	40.1	2436.4
KAPUSKASING	-9.3	-5.1	5.5	-33.5	75.9	96.5	131	27	18	40	0.0	1394.5
OTTAWA	-0.5	-2.1	13.7	-18.1	31.2	123.4	167	10	17	75	16.0	2195.7
SMITHFIELD	2.4	-0.6	16.3	-14.0	10.0	228.6	259	0	13	**	30.6	2215.9
VINELAND	*.*	*.*	*.*	*.*	*.*	*.*	**	***	***	**	*.*	*.*
WOODSLIE	*.*	*.*	*.*	*.*	*.*	*.*	**	***	***	**	*.*	*.*

STATION	Temperature C										Degree days above 5 C	
	Mean	Difference from Normal	Maximum	Minimum	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)	This month	Since jan. 1st
QUEBEC												
LA POCATIERE	-2.4	-2.8	18.0	-19.0	37.8	79.2	102	15	19	97	8.0	1783.9
L'ASSOMPTION	-0.9	-2.0	21.0	-18.0	24.6	196.8	236	16	20	79	19.7	2110.3
LENNOXVILLE	*.*	*.*	*.*	*.*	*.*	*.*	**	***	***	**	*.*	*.*
NORMANDIN	-6.3	-3.4	14.5	-26.5	40.4	78.2	133	10	14	83	5.0	1503.5
STE.CLOTILDE	0.6	-1.3	20.0	-21.0	28.0	147.7	184	5	18	75	30.0	2154.5
NEW BRUNSWICK												
FREDERICTON	0.1	-1.6	18.0	-21.5	41.7	105.0	94	19	14	85	34.2	1865.0
NOVA SCOTIA												
KENTVILLE	3.6	-0.4	19.5	-11.0	51.7	164.3	138	5	17	66	67.5	2043.1
NAPPAN	1.5	-1.5	18.0	-15.0	78.7	181.4	168	10	19	75	48.2	1809.0
PRINCE EDWARD ISLAND												
CHARLOTTETWN	2.6	-0.8	17.0	-13.0	48.6	152.8	138	19	20	60	53.8	1133.0
NEWFOUNDLAND												
ST.JOHN'S WEST	3.9	0.4	17.5	-9.0	18.8	121.0	72	2	15	88	38.8	1486.3