



Climatic Perspectives

Monthly Review

MAY - 1988

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CLIMATIC HIGHLIGHTS

P.Scholefield, Monitoring and Prediction Division

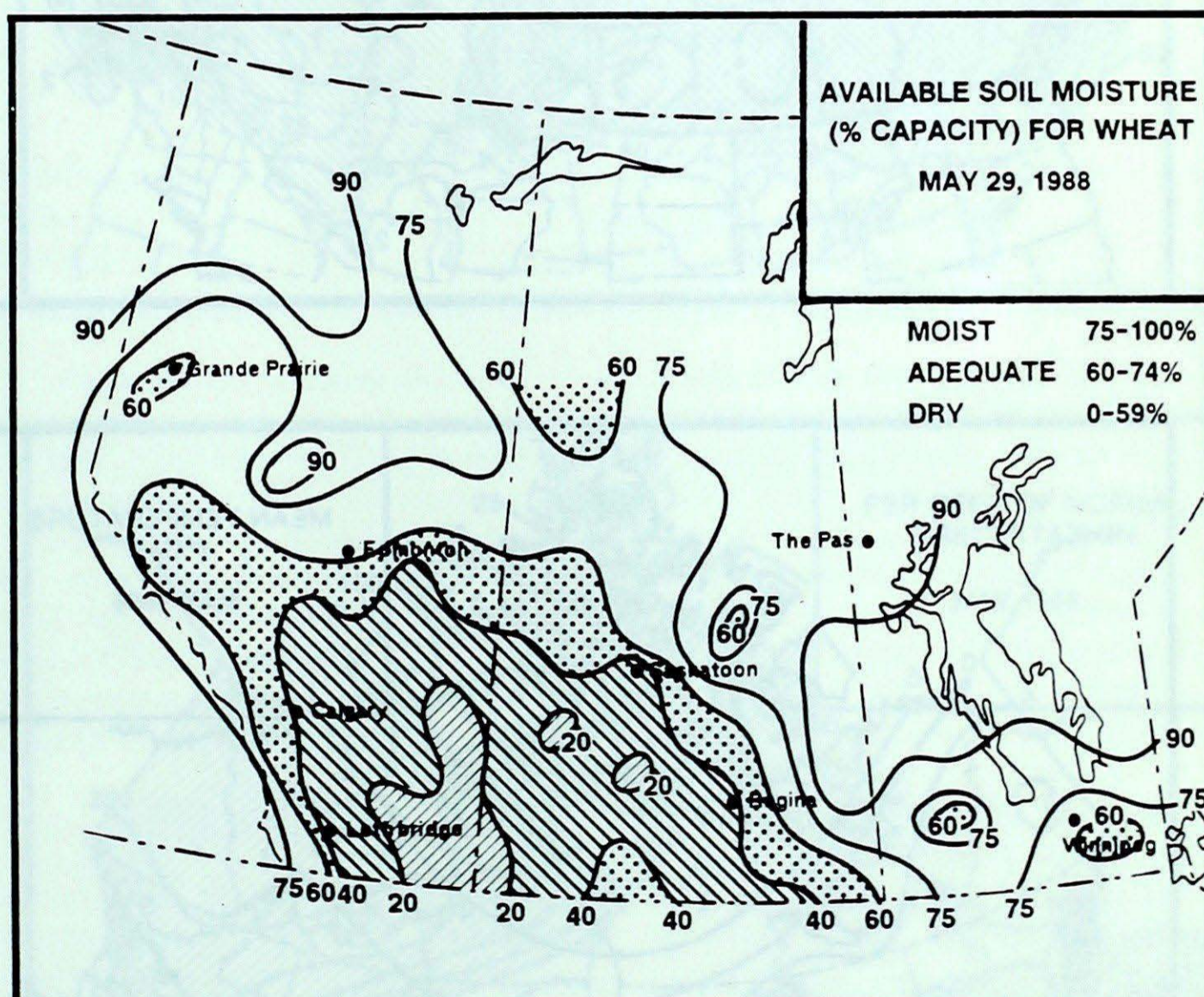
Drought conditions intensify across the Prairies

Continued dryness up to the end of May across most of the Prairie grain belt (see map on page 3) has reached the critical stage due to the progression of the growing season. Timely precipitation will be needed from now on to realize a decent harvest. Soil moisture reserves are now so low that a continuation of the current dry spell or an interruption of a timely rain pattern throughout the remainder of the season could be devastating to crops.

The extreme south-eastern part of Alberta and south-western part of Saskatchewan have now experienced below-normal precipitation for nine consecutive months. Contributing to the severity of this drought has been a prolonged period of above-normal temperatures which also extends back nine months to include the month of September in Alberta and back to the month of November in Saskatchewan and southwestern Manitoba.

The amount of soil moisture that is available for one of the most important Prairie crops, wheat, gives a good measure of the accumulative effect of this prolonged period of drier and warmer than normal weather. Using this index, the accompanying map clearly indicates the extent and relative magnitude of the drought conditions.

Drought concerns were greatly alleviated by well-above normal rainfall in central and western parts of Manitoba and the southern interior of B.C., although the Thompson River Valley in B.C. remains in a vulnerable state.



The information for this map is produced weekly by the AES Scientific Services Division in Winnipeg and is based on a soil-moisture model which uses daily temperature and precipitation data from 140 stations across the Prairie provinces and northwestern Ontario

Across the country

Yukon and NWT

An above-normal temperature regime continued through the month of May over most of the Yukon. Anomalies were, however, weaker than the preceding month. The first two weeks were particularly warm over central and southern regions when the mercury climbed above 15°C and 20°C at numerous locations (23°C at Dawson, Mayo and Stewart Crossing on the 11th). Just as people were getting used to the idea of an early summer, a cold air mass returned the area to a temperature regime more typical of early spring.

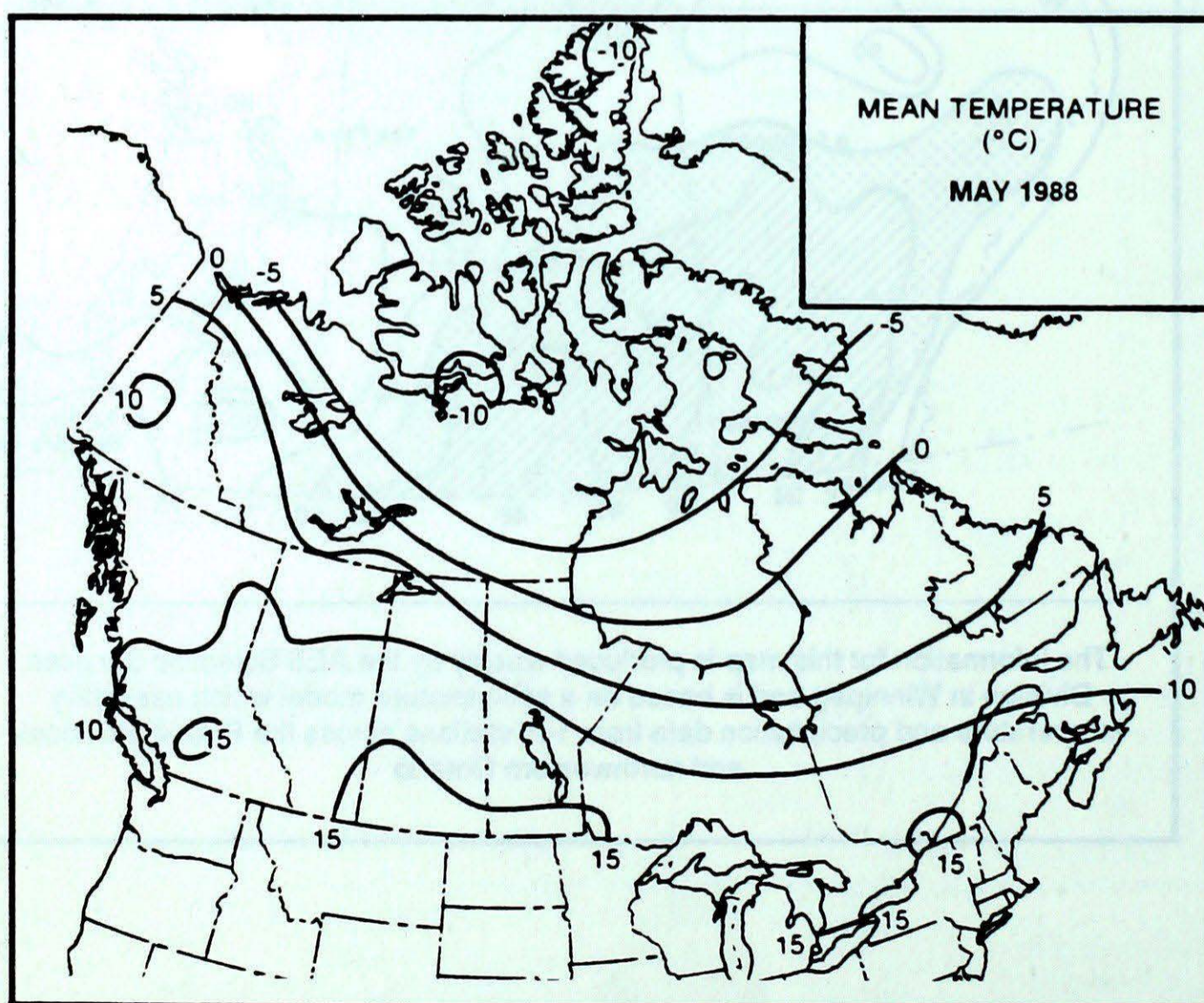
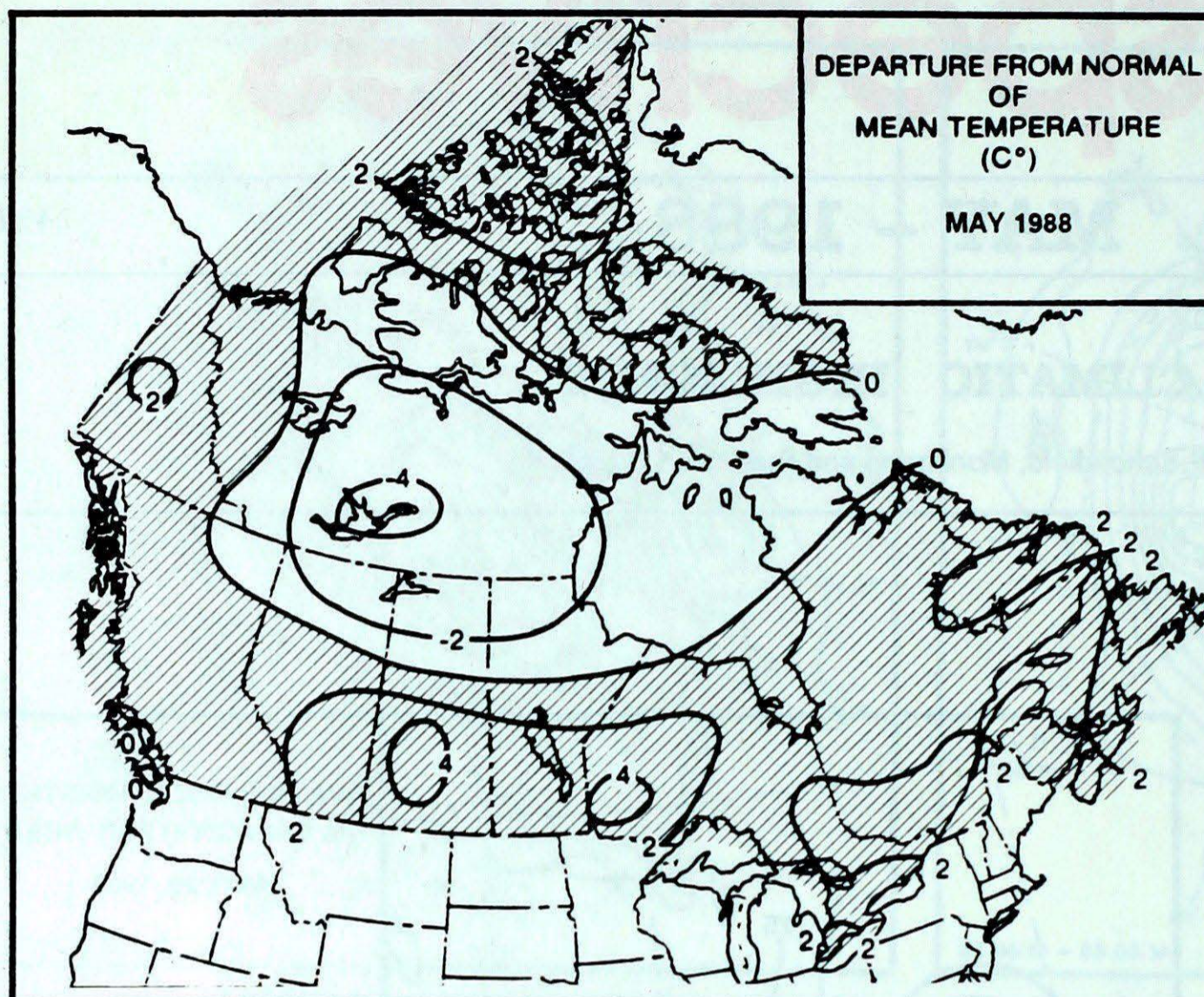
After a dry start to the month, precipitation amounts rose rapidly throughout the Yukon. Monthly amounts rose to as high as 500% of normal in the south which was primarily due to storms on the 14th, 15th and between the 17th and 20th of the month. This erased any concerns about drought and forest fires.

With the exception of the high Arctic, which benefitted from an injection of mild air from the Gulf of Alaska, the above-normal temperature regime of the previous month came to an end. There were some pronounced variations with record daily high temperatures on Baffin Island and record lows in the Mackenzie valley at the middle of the month.

British Columbia

It was generally a wet and cloudy month in B.C. The temperature regime across the province remained close to normal with departures from the mean varying between -0.4 and $+0.8^{\circ}\text{C}$ (except $+1.4^{\circ}\text{C}$ at Burns Lake). Cloudy skies moderated daytime and nighttime temperatures.

A flow pattern more typical of winter kept a steady stream of weather systems passing across the province. The result was above-normal precipitation amounts at most locations such as the southern Okanagan and northwestward near Smithers where amounts exceeded 200% of normal. New records for the month of



May were established at Vancouver with 279% and Dease lake with 277% of normal.

Prairies

Except in northern regions, above normal temperatures continued to prevail over the prairies. Rainfall varied considerably, with generally low values in Alberta, Saskatchewan, and southeast Manitoba, and generous amounts in an area extending from southeast Saskatchewan to northeast Manitoba.

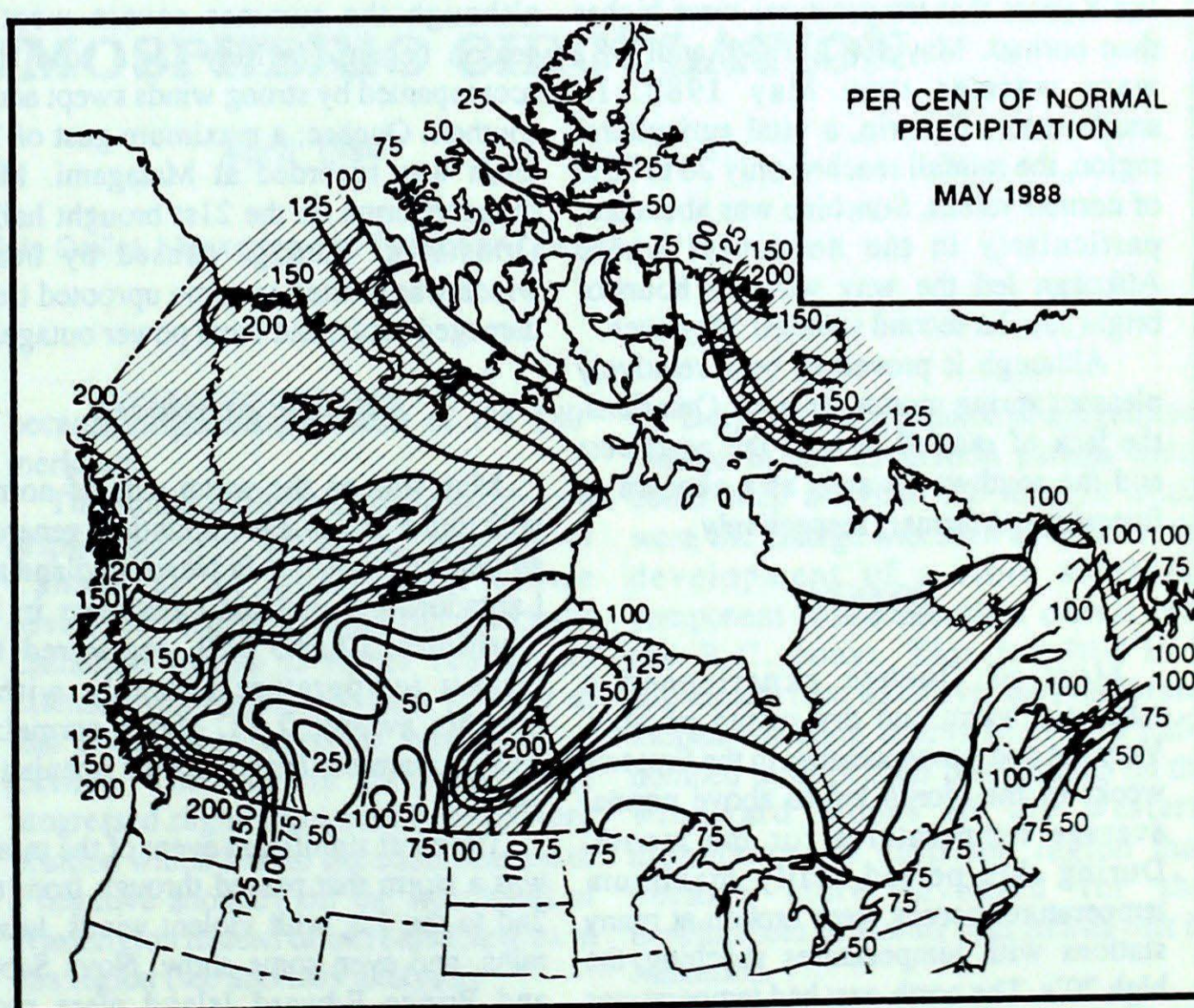
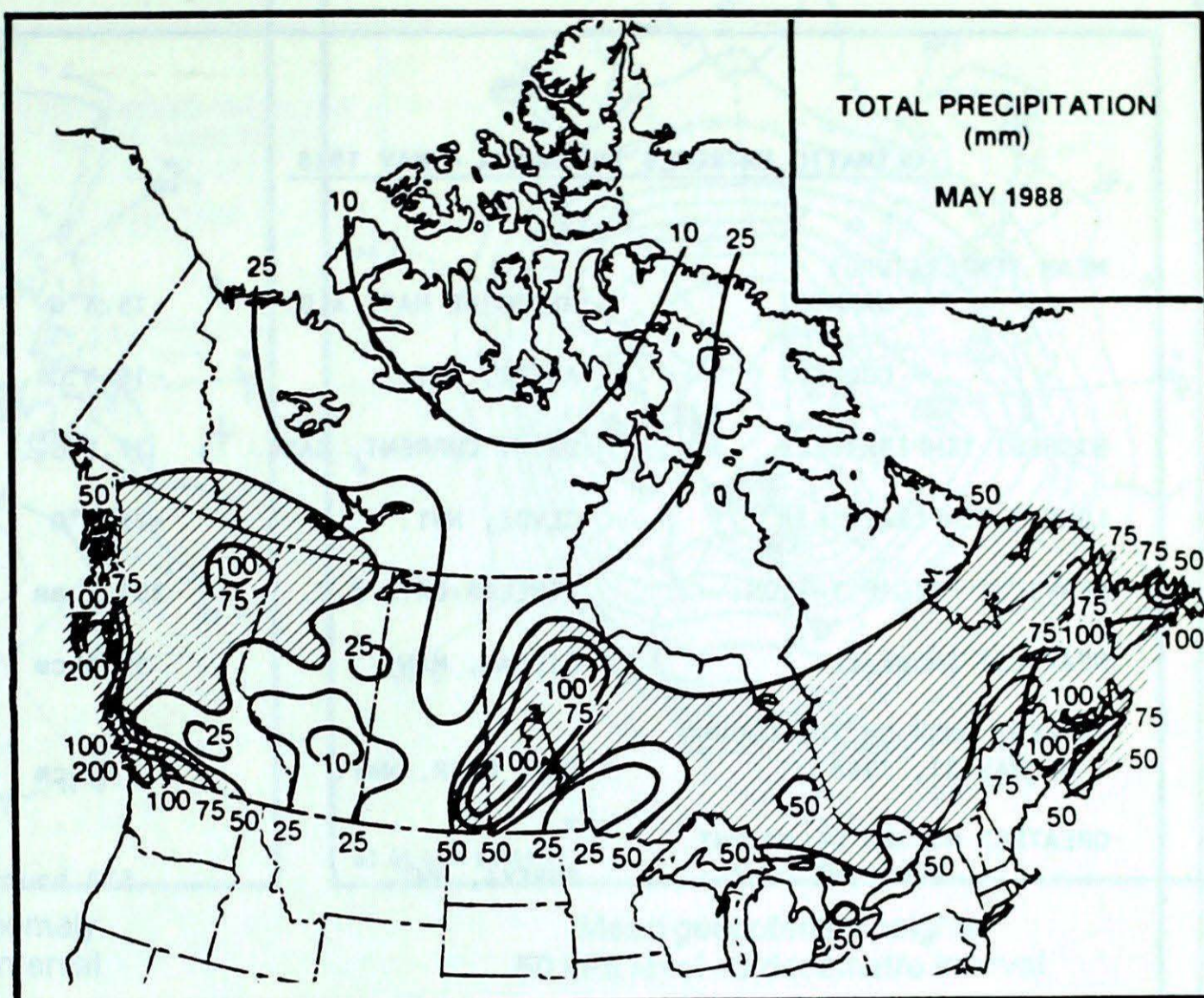
In Alberta, daily maximum temperatures broke some long standing records, mostly between the 13th and the 16th of the month. The highest temperature reached was 34°C at Medicine Hat on the 16th, and the coldest was -8°C at High Level on the 2nd. A few scattered showers brought no significant relief from the dry conditions in the south. On the 23rd, vigorous thunderstorm cells triggered a squall line which sped through central Alberta. Strong winds with gusts to 100km/h whipped dry top soil into a massive dust storm.

In Saskatchewan and Manitoba, a heat wave near the end of the month was mainly responsible for the above normal temperature average for the month. Much above normal rainfall amounts in a band from south-eastern Saskatchewan to north-eastern Manitoba were brought by frontal systems which crossed central regions near the middle of the month, and southern regions by the end of the month. On several occasions, tornados and funnel clouds were observed in connection with these systems.

Ontario

May 1988 was a very sunny, warm, and generally dry month across Ontario. Once again, northern regions had temperatures which were more above normal than southern regions.

In many northwestern communities, it was the warmest May since 1980, although temperatures did vary considerably, with some record daily low minimum values occurring on the 14th. In the south, May was warmer than normal, but not very



CLIMATIC EXTREMES IN CANADA - MAY 1988

MEAN TEMPERATURE:		
WARMEST	MEDICINE HAT, ALB.	15.8°C
COLDEST	ALERT, NWT.	-10.4°C
HIGHEST TEMPERATURE:	SWIFT CURRENT, SASK.	37.3°C
LOWEST TEMPERATURE:	CLYDE, NWT.	-26.2°C
HEAVIEST PRECIPITATION:	ETHELDA BAY, B.C.	307.2 mm
HEAVIEST SNOWFALL:	GILLAN, MAN.	55.0 cm
DEEPEST SNOW ON THE GROUND ON MAY 31, 1988:	CAPE DYER, NWT.	87 cm
GREATEST NUMBER OF BRIGHT SUNSHINE HOURS:	EUREKA, NWT.	538 hours

unusual, though it was the 6th time in the last 8 years that temperatures were higher than normal. May 1982, 1986, and 1987 were warmer than May 1988. In southwestern Ontario, a vital agricultural region, the rainfall reached only 20 to 30% of normal values. Sunshine was abundant, particularly in the north-east where Atikokan led the way with 309 hours of bright sun, its second sunniest May ever.

Although it proved to be a relatively pleasant spring month for most Ontarians, the lack of rainfall in both the northwest and the southwest stands as a concern to foresters and farmers respectively.

Québec

Most of Quebec experienced a relatively warm and dry month of May. Very hot and sunny weather in the first two weeks of the month led to above normal average temperatures for the month. During this period, daily maximum temperature records were broken at many stations with temperatures reaching the high 20's. The north-east had temperatures reaching close to 30C on the 23rd.

Rainfall amounts were generally low, although the summer severe weather season began. On May 13, a cold front accompanied by strong winds swept across southern Quebec; a maximum gust of 107 km/h was recorded at Matagami. More thunderstorms on the 21st brought hail to Ormstown. Damage caused by heavy winds was limited to some uprooted trees, damaged roofs, and local power outages.

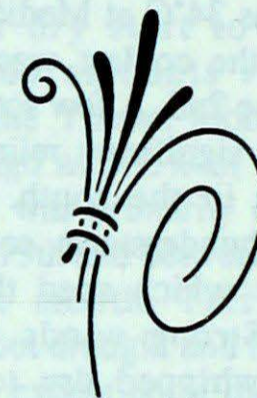
Atlantic provinces

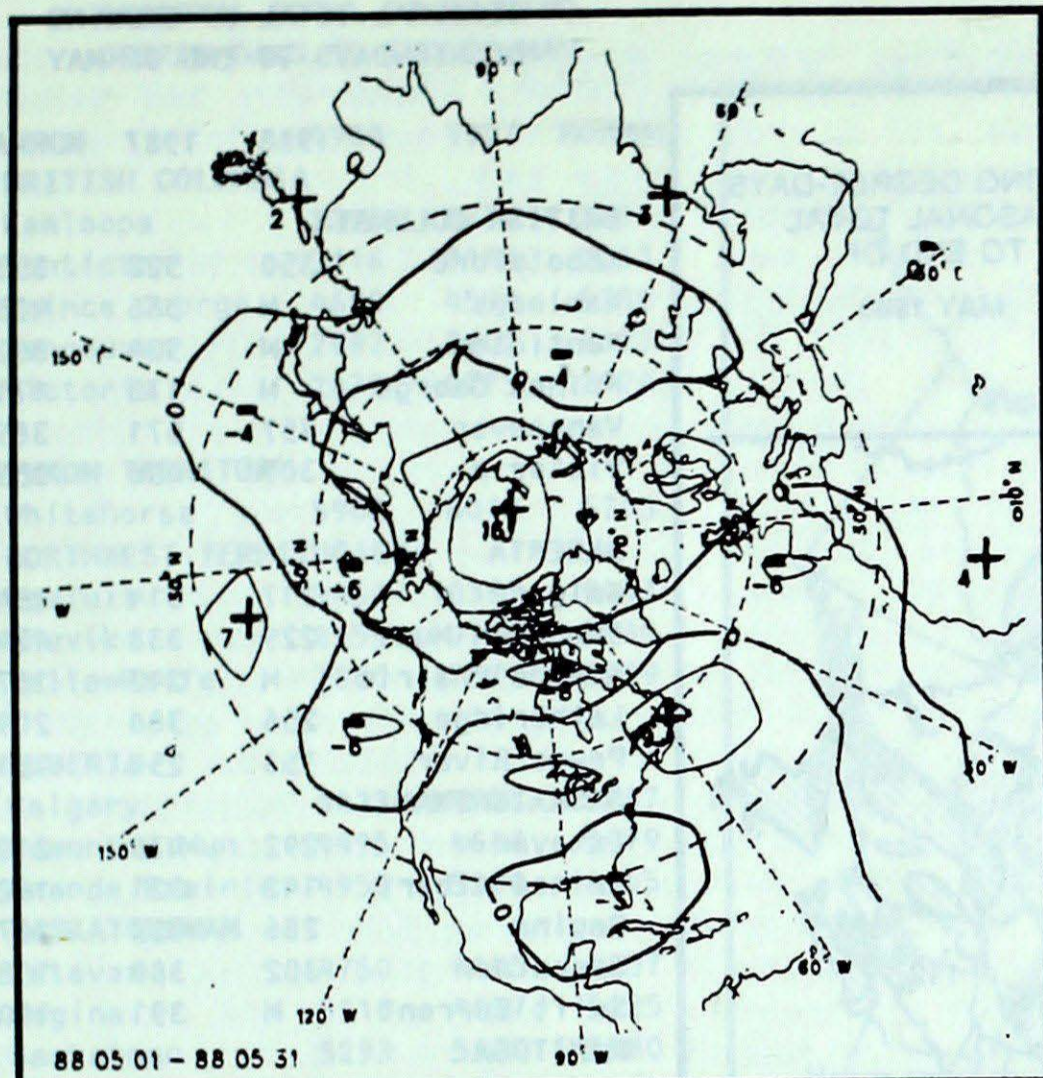
May was on the warm side of normal with rather variable precipitation, generous amounts of sunshine in Newfoundland and Labrador, and variable cloudiness in the maritimes. Charlo N.B. registered the largest temperature anomaly with a monthly average 2.6°C above normal: it was its warmest May since its opening in 1967.

The most significant event of the month was a storm that passed through from the 2nd to the 4th, with violent winds, heavy rains, and even some snow. Nova Scotia and Prince Edward Island were most heavily affected. Gusts reached 148 km/h on Cape Breton Island, and rainfall

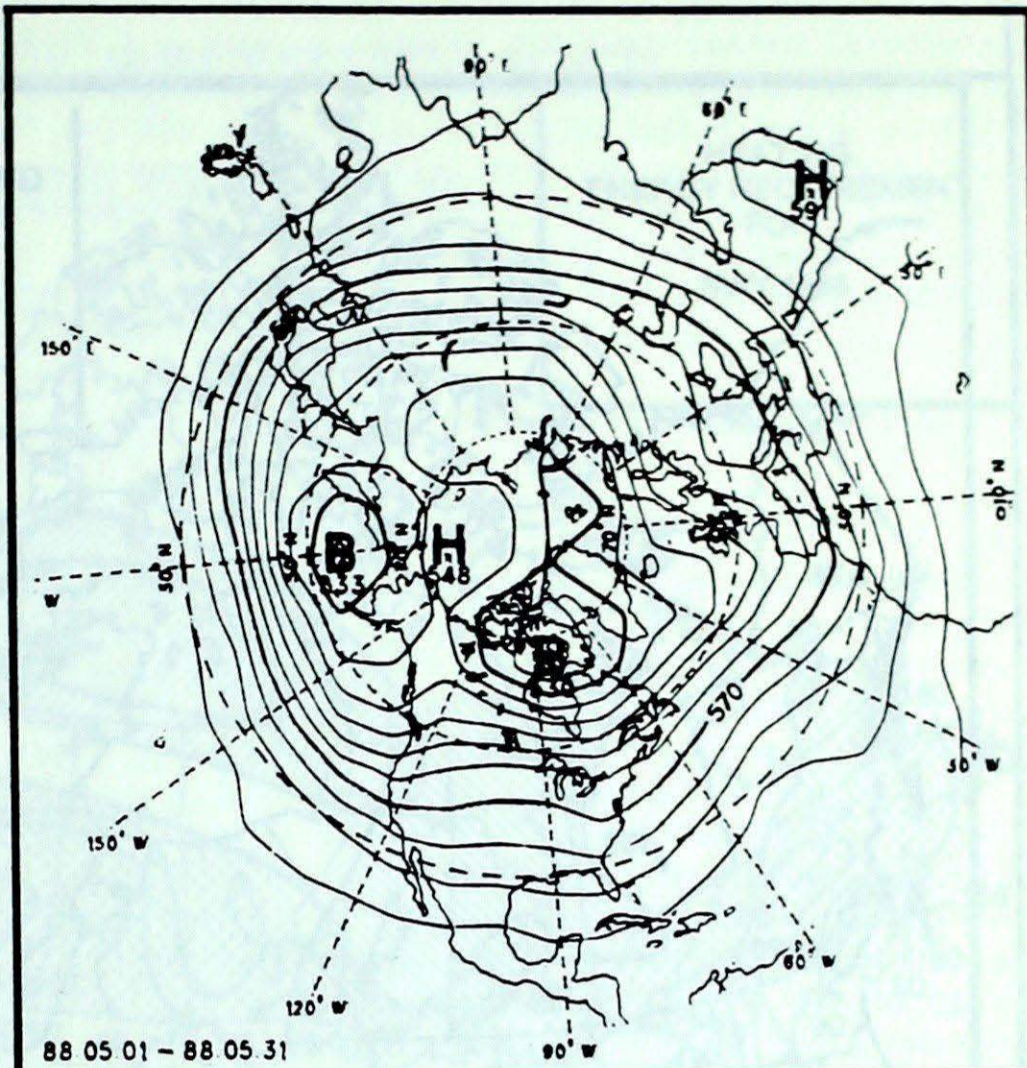
reached 100mm at Sable Island. Lobster fishermen lost over 5000 traps, including 60-70% of the traps on Pictou Island. No loss of life was reported, but the storm did cause material damage and traffic accidents.

Newfoundland also fell under the influence of the storm, but the effect was mostly limited to strong winds, with gusts reaching 139km/h. The rest of the month was pleasant and sunny on the island and in Labrador. The proportion of snow in the precipitation totals was lower than normal except in northern Labrador.





Mean geopotential height anomaly
50 kPa level - 5 decametre interval



Mean geopotential heights
50 kPa level - 5 decametre interval

50 kPa ATMOSPHERIC CIRCULATION

April 1988

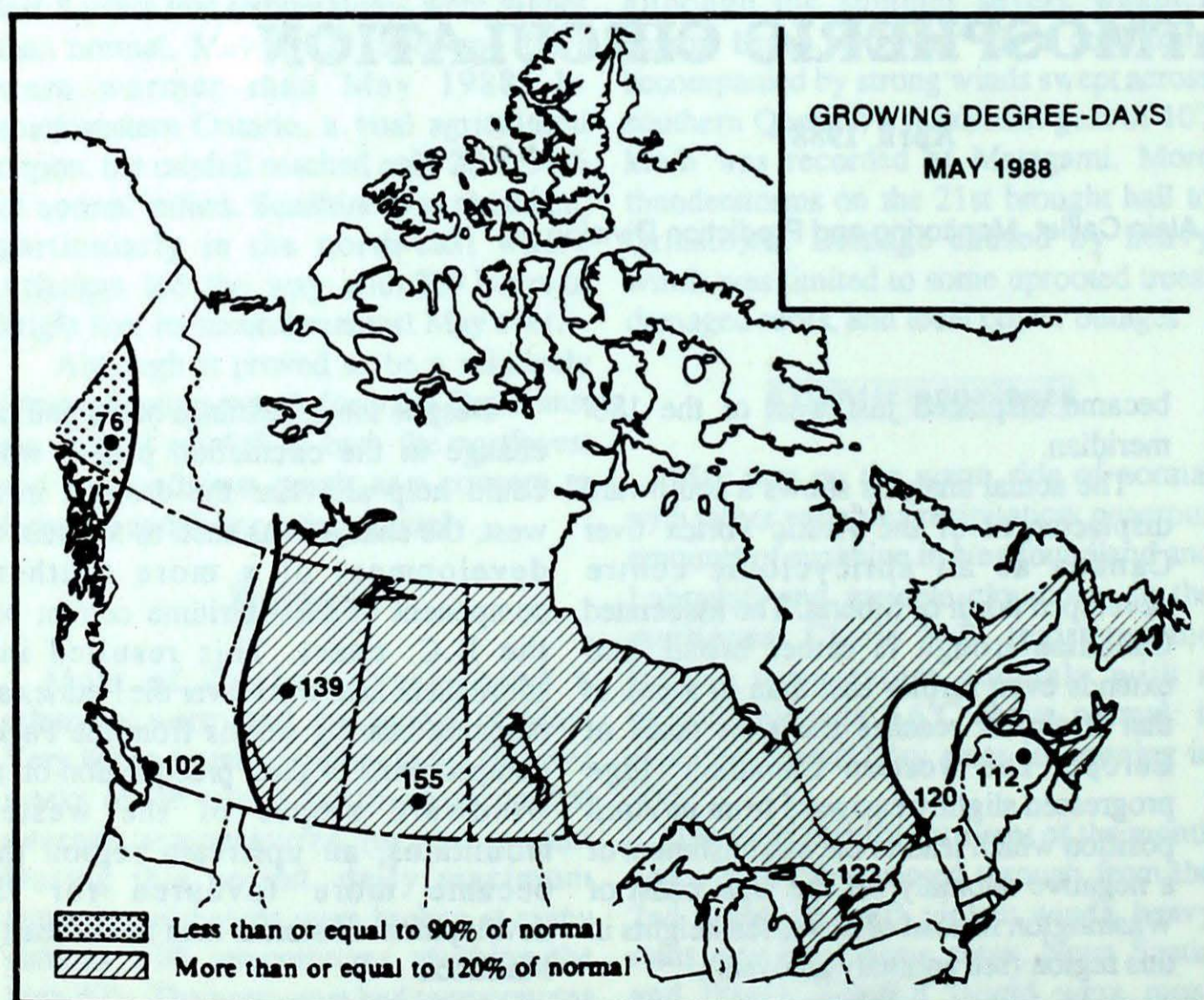
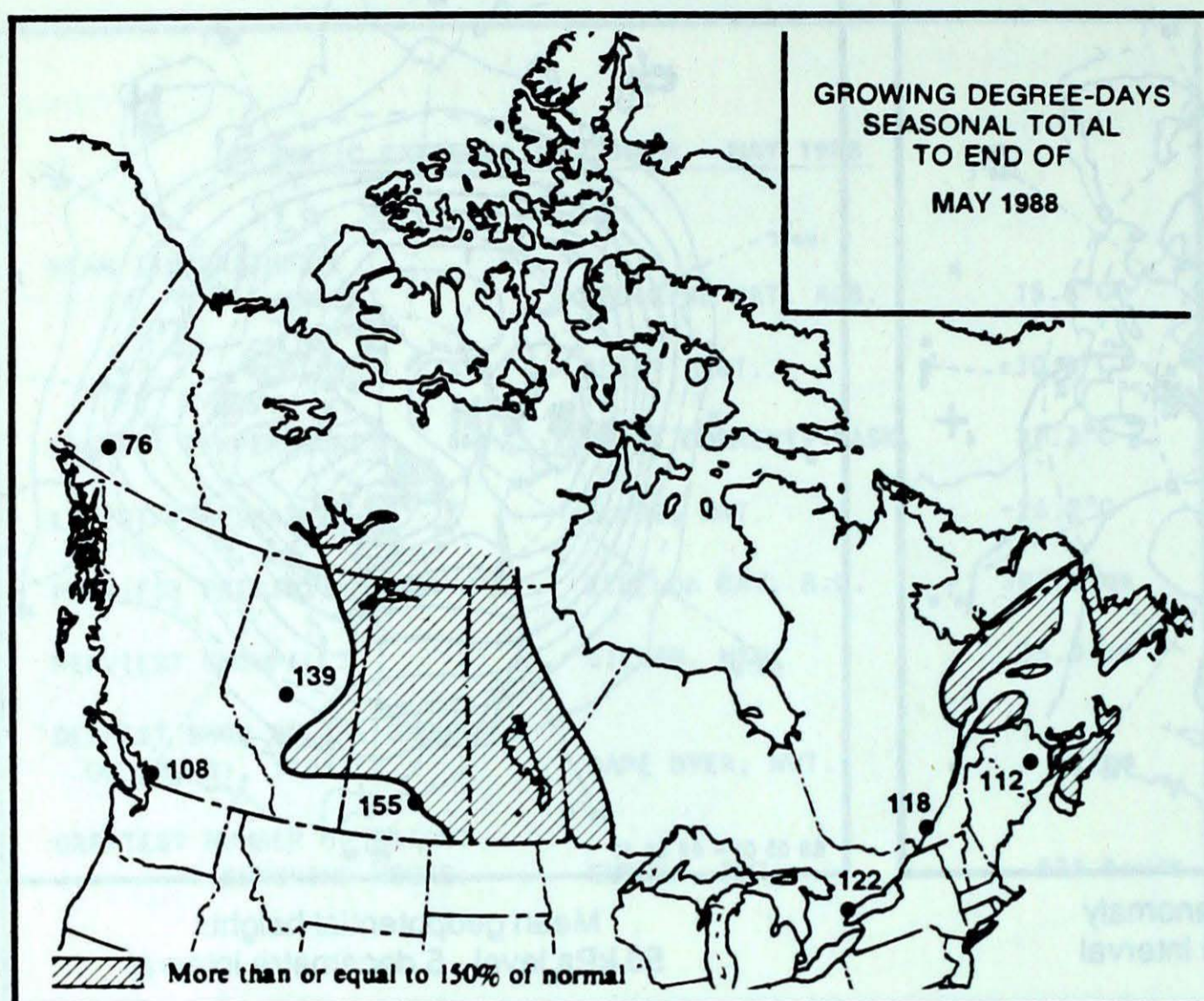
Alain Caillet, Monitoring and Prediction Division

The analyses of 50-kPa height heights and anomalies reflect the seasonal radiative changes that occur at this time of the year. The anomaly analysis over North America and the Arctic regions shows almost a complete reversal in the sign of the anomaly from the April analysis: the north pole and north-east Siberia changed from strongly negative to strongly positive while over most of Canada and off the west coast of the U.S., the positive anomalies of March and April changed to negative. Note the persistence of the negative anomaly centre over the Aleutians which weakened and

became displaced just west of the 180° meridian.

The actual analysis shows a southward displacement of the Arctic vortex over Canada as an anticyclonic centre developed north of Siberia. The associated Canadian trough is rather broad, and extends even further east than in April so that it almost reaches the west coast of Europe. The western Canadian ridge progressed slightly eastward from its April position which lead to the establishment of a negative anomaly off the west coast of Washington instead of increased heights in this region (see anomaly analysis).

Despite the appearance of a significant change in the circulation pattern which could help alleviate the drought in the west, the change was such as to cause the development of a more southerly component of the Maritime current over the B.C. coast. This resulted in a subsequent heat wave over the Prairies and moisture-bearing storms from the Pacific dumped most of their precipitation on the windward slopes of the western mountains, an upstream region that became more favoured for the development of storms than further east in Manitoba.



**SEASONAL TOTAL OF GROWING
DEGREE-DAYS TO END OF MAY**

1988 1987 NORMAL

BRITISH COLUMBIA

Abbotsford	350	522	355
Kamloops	M	586	425
Penticton	M	534	392
Prince George	M	173	171
Vancouver	357	571	389
Victoria	309	496	353

ALBERTA

Calgary	217	314	154
Edmonton Mun.	229	338	174
Grande Prairie	M	247	167
Lethbridge	256	388	209
Peace River	153	254	151

SASKATCHEWAN

Estevan	292	478	219
Prince Albert	142	321	162
Regina	286	423	197
Saskatoon	302	380	198
Swift Current	M	391	190

MANITOBA

Brandon	142	383	188
Churchill	M	M	M
Dauphin	147	378	171
Winnipeg	M	451	198

ONTARIO

London	291	448	298
Mount Forest	161	323	191
North Bay	130	192	188
Ottawa	307	379	274
Thunder Bay	M	207	120
Toronto	263	422	292
Trenton	263	411	285
Windsor	350	532	398

QUEBEC

Baie Comeau	M	85	67
Maniwaki	227	190	187
Montréal	303	397	276
Quebec	190	189	188
Sept-Îles	46	64	34
Sherbrooke	195	191	225

NEW BRUNSWICK

Charlo	134	161	119
Fredericton	179	199	189
Moncton	136	168	142

NOVA SCOTIA

Sydney	108	94	64
Truro	129	151	122
Yarmouth	109	200	151

PRINCE EDWARD ISLAND

Charlottetown	126	131	96
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NEWFOUNDLAND

Gander	M	106	49
St. John's	M	81	27
Stephenville	82	68	74

(M = Missing)

SEASONAL TOTAL OF HEATING
DEGREE-DAYS TO END OF MAY

	1988	1987	NORMAL
BRITISH COLUMBIA			
Kamloops	3296	3172	3716
Penticton	3116	3143	3463
Prince George	4699	4590	5238
Vancouver	2697	2602	2923
Victoria	2870	2775	2974

YUKON TERRITORY

Whitehorse	5960	6013	6705
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NORTHWEST TERRITORIES

Iqaluit	9468	10307	9411
Inuvik	8959	9716	9930
Yellowknife	7860	7571	8409

ALBERTA

Calgary	4423	4343	5197
Edmonton Mun	4495	4646	5479
Grande Prairie	4959	5380	6005

SASKATCHEWAN

Estevan	4750	4405	5457
Regina	5118	4837	5825
Saskatoon	5293	5070	5980

MANITOBA

Brandon	5497	5283	5953
Churchill	8771	8576	8851
The Pas	6100	5884	6721
Winnipeg	5302	5050	5812

ONTARIO

Kapuskasing	6161	5768	6106
London	3841	3724	3929
Ottawa	4420	4316	4529
Sudbury	5123	4853	5237
Thunder Bay	5403	4995	5499
Toronto	3883	3758	3938
Windsor	3436	3215	3483

QUÉBEC

Baie Comeau	5723	5669	5705
Montréal	4243	4341	4334
Quebec	4955	4912	4887
Sept-Îles	5832	5877	5825
Sherbrooke	4843	4903	5051
Val-d'Or	5938	5704	5905

NEW BRUNSWICK

Charlo	5209	5247	4959
Fredericton	4674	4735	4510
Moncton	4658	4808	4497

NOVA SCOTIA

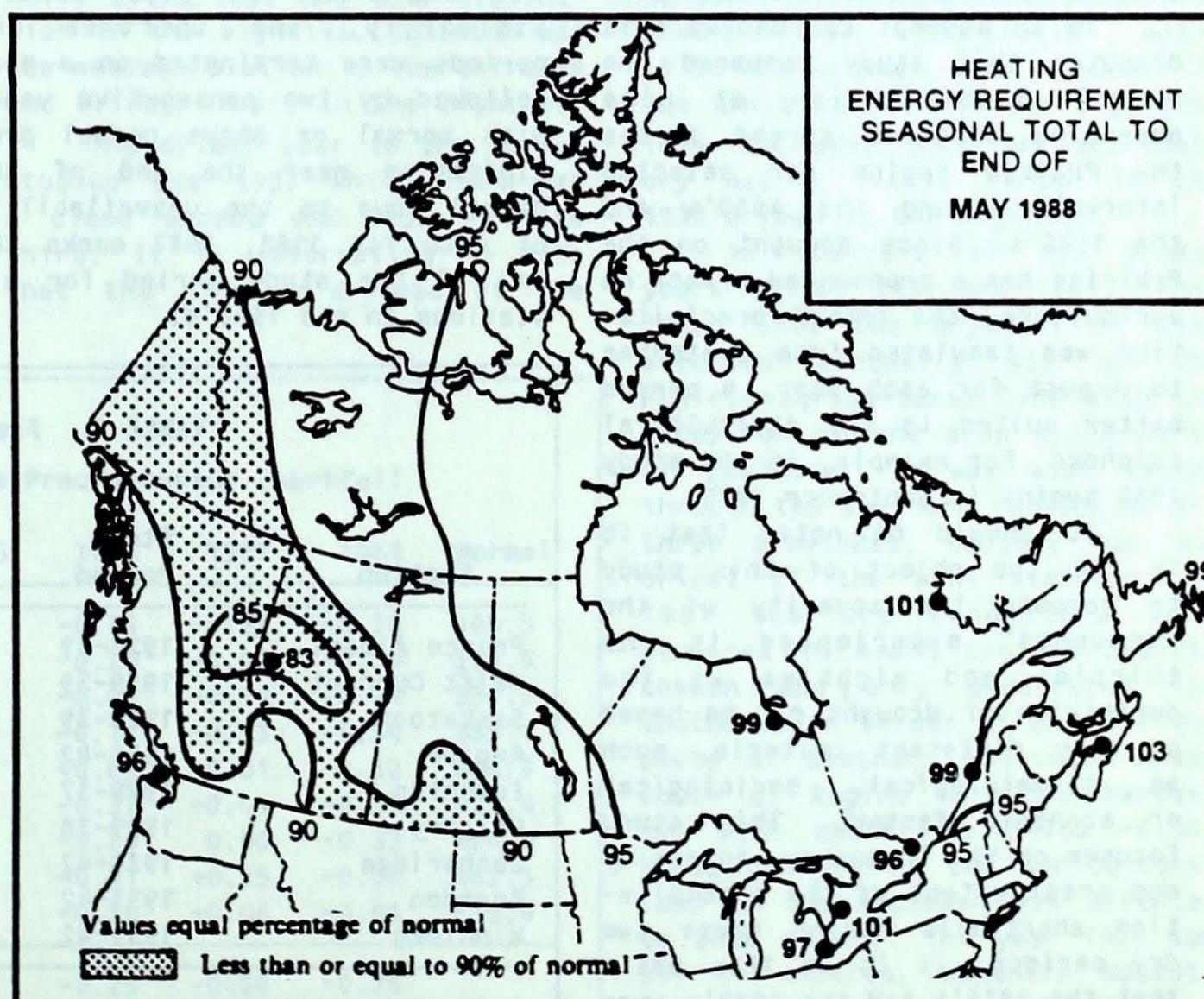
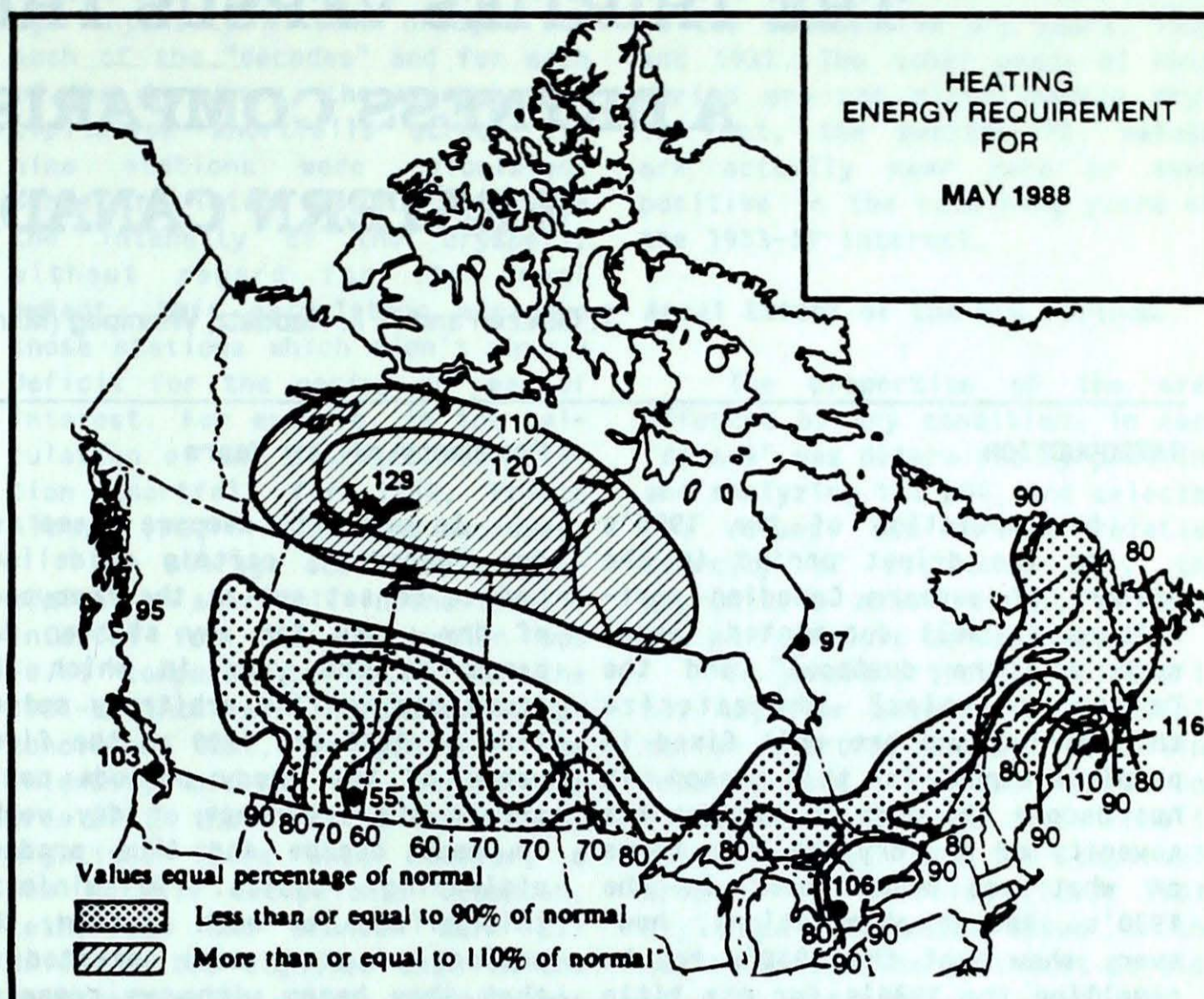
Halifax	2753	4188	3893
Sydney	4357	4655	4186
Yarmouth	3907	3980	3801

PRINCE EDWARD ISLAND

Charlottetown	4548	4749	4390
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NEWFOUNDLAND

Gander	4835	5044	4726
St. John's	4559	4821	4771



THE THIRTIES VERSUS THE EIGHTHIES

A DRYNESS COMPARISON IN WESTERN CANADA

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INTRODUCTION

he reputation of the 1930's as the driest period in the history of western Canadian agriculture is well documented. Terms such as "the dustbowl" and the "dirty thirties" characterize this period and are well fixed in people's minds. For this reason, it has become the norm to measure the severity of any dry spell in terms of what was experienced in the 1930's. Recent observations, however, show that the 1980's may be rivalling the 1930's for the title of the driest period in recent history, if not in the minds of men, at least in the recorded data.

In an attempt to resolve this dispute, this study compared the annual precipitation at nine observing stations spread across the Prairie region for selected intervals around the 1930's and the 1980's. Since drought on the Prairies has a pronounced effect on agriculture, the annual precipitation was tabulated from September to August for each year, a period better suited to the agricultural calendar. For example, in the study 1930 begins in September 1929.

It should be noted that it is not the object of this study to compare the severity of the "droughts" experienced in the thirties and eighties as the definition of drought can be based on many different criteria, such as climatological, sociological or economic factors. This study focuses on the frequency, intensity and areal extent of the precipitation shortfalls during these two dry periods. It is on this basis that the 1930's and the 1980's were compared.

Frequency of Dry Years

In order to compare these two dry "decades", certain guidelines had to be set out as the frequency of dry years for any station depends on the year in which the study begins. The arbitrary selection of 1930 and 1980 as the first years of the study periods could affect the frequency of dry years in each decade and thus produce misleading results. To minimize this effect for each station, the periods of study were selected so that they began with two consecutive years of normal or below normal precipitation occurring around the beginning of each decade. Similarly, the thirties dry periods were terminated on a year followed by two consecutive years with normal or above normal precipitation near the end of the decade. Due to the unavailability of data for 1988, 1987 marks the end of the study period for all stations in the 1980's.

In order to determine which "decade" had a greater percentage of dry years, the frequency of dry years in each period was calculated for each station. The results were summarized by calculating the average frequency of dry periods for each "decade" considering all nine stations. For this comparison, a dry year at a station was defined as any year in the study period with total precipitation more than 25 mm below the normal for that station. The normal annual precipitation for any station was taken as its average annual precipitation for the years 1951-1980. The frequency of dry years is indicated in Table 1.

In the thirties, the average frequency of dry years in the Prairie region was 50.6%, slightly higher than 46.6% for the 1980's. On an individual station basis, the frequency of dry years in the thirties was higher than that in the eighties at all locations but two. The exceptions were Winnipeg

TABLE 1. Frequency of Dry Years

Station	Study Period	Frequency (%)	Study Period	Frequency (%)
Prince Albert	1928-39	36.4	1980-87	25.0
Swift Current	1929-39	60.0	1977-87	54.5
Saskatoon	1929-39	50.0	1977-87	45.5
Regina	1930-42	46.2	1977-87	45.5
Edmonton	1929-37	33.0	1975-87	38.5
Calgary	1929-38	60.0	1979-87	44.5
Lethbridge	1930-42	61.5	1976-87	58.0
Brandon	1933-42	50.0	1976-87	33.0
Winnipeg	1931-42	58.0	1980-87	75.0
Average		50.6		46.6

and Edmonton. Lethbridge and Regina had very nearly the same frequency of dry years in each "decade".

Intensity of the Dry Periods

The method indicated earlier for selecting the study periods resulted in time intervals which differ from station to station. A period of years common to all stations was selected for use in assessing the intensity of the dry periods of the 30's and 80's. The years 1933-37 and 1981-85 were found to be the most suitable. For each station the accumulative precipitation shortfall (APS_j) was determined for these two periods and was expressed as a fraction of the normal annual precipitation for the station. That is,

$$APS_j = \frac{\sum_{i=1}^n (A_{ij} - N_j)}{N_j}$$

where: - A_{ij} is the total precipitation at station j for the year i
 - N_j is the normal for station j
 - $n=5$ years

The APS_j values are given in Table 2. The precipitation shortfall (PS_j) for those years which were particularly dry across the entire region are also tabulated.

In order to compare the average intensity of the drought for each of the "decades" and for each of the dry years, the average precipitation shortfalls across all nine stations were calculated. Since the intent was to determine the intensity of the dryspell, without regard for its areal extent, this calculation excluded those stations which didn't show a deficit for the period or year of interest. For example, in the calculation of the average precipitation shortfall for 1984, Prince Albert ($PS_j = +0.34$) was excluded.

The average accumulative precipitation shortfall in the 1933-37 interval for the dry region was -0.41 compared to -0.37 for the 1981-85 interval. Therefore, it was concluded that, in general, the intensity of the dry period was greater in the thirties than in the eighties. There was, however, a few notable exceptions. Edmonton, Lethbridge and Brandon were all drier in the eighties than in the thirties while Swift Current was nearly as dry. Calgary was the driest station in the thirties while Lethbridge has this distinction in the eighties. Edmonton was the wettest station in the thirties and Prince Albert in the eighties.

The driest year in the period studied was 1937 while 1984 was a close second and 1936 a close third. It is interesting to note that the intense dryness of the

1933-37 interval can be attributed to two consecutive dry years, 1936 and 1937. The other years of this period are not significantly dry. In fact, the average PS_j values are actually near zero or even positive in the remaining years of the 1933-37 interval.

Areal Extent of the Dry Periods

The proportion of the area affected by dry conditions in each "decade" was determined by plotting and analyzing the APS_j and selected PS_j values. Due to the relative scarcity of stations, only the approximate areal extent of each dry period could be delineated.

In general, 1981-85 (Figure 1) had negative accumulative precipitation shortfalls south of a line from Grande Prairie, south of Saskatoon to Brandon. This area is slightly larger than the comparable area in the thirties (i.e., 1933-37; Figure 2) which takes in the southwest and the northeast portion of the Prairies but excludes a band from Grande Prairie, through Edmonton and the Brandon area. However, the area with accumulative precipitation shortfalls below -0.50 encompasses more stations in the thirties than in the eighties. Thus the area that was extremely dry was a little larger in the 1930's than in the eighties.

An analysis of the driest years (1936, 1937 and 1984) indicated that the dryspell of 1936 affected virtually all of the Prairie agricultural land with the exception of the area lying north of Edmonton. It was most severe through the southern regions of all three provinces. Calgary was the driest of the nine stations. In 1937 the dry conditions were centered in south central Saskatchewan and only penetrated the southeastern corner of Alberta and parts of southern Manitoba. Areas south of Regina were the hardest hit with shortfalls below -0.50. Virtually all of the Agricultural land in Saskatchewan was affected to some extent. The year 1984 saw all of Alberta, southern Saskatchewan and Manitoba suffering from a precipitation deficit with the

TABLE 2. Accumulative Precipitation Shortfall

Station	1933-37	1981-85	1936	1937	1984	Normal
Prince Albert	-0.39	+0.41	-0.33	-0.13	+0.34	400.5
Swift Current	-0.55	-0.49	-0.20	-0.50	-0.39	378.8
Saskatoon	-0.16	+0.09	-0.05	-0.19	-0.24	351.8
Regina	-0.41	-0.33	-0.16	-0.53	-0.34	385.4
Edmonton	+0.45	-0.29	+0.05	+0.01	-0.32	466.9
Calgary	-0.66	-0.45	-0.37	+0.01	-0.32	423.4
Lethbridge	-0.56	-0.64	-0.30	0.00	-0.33	424.4
Brandon	+0.31	-0.02	-0.31	+0.35	-0.06	462.3
Winnipeg	-0.11	+0.01	-0.26	-0.06	-0.06	525.4
Average	-0.41	-0.37	-0.25	-0.28	-0.26	

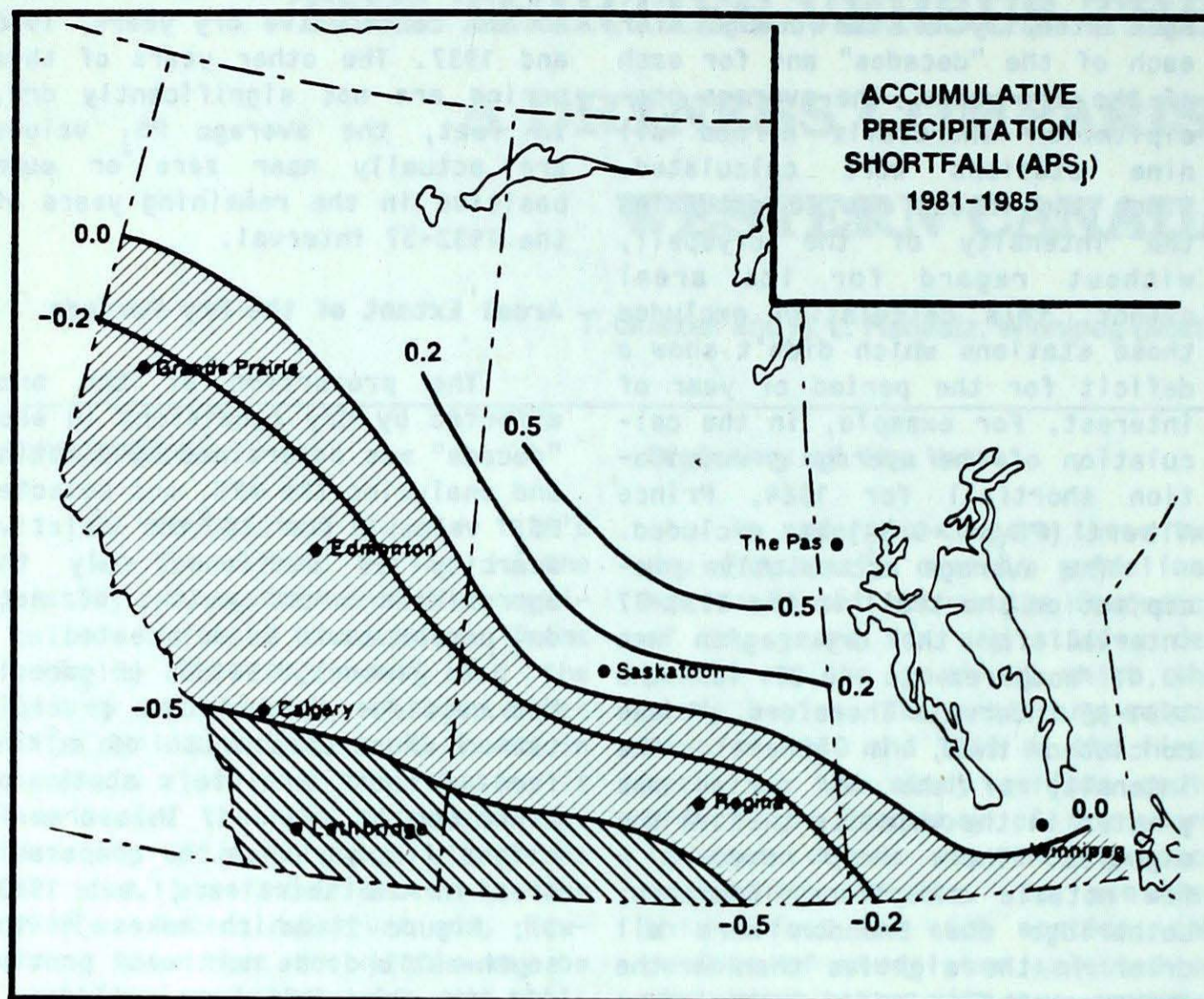


FIGURE 1

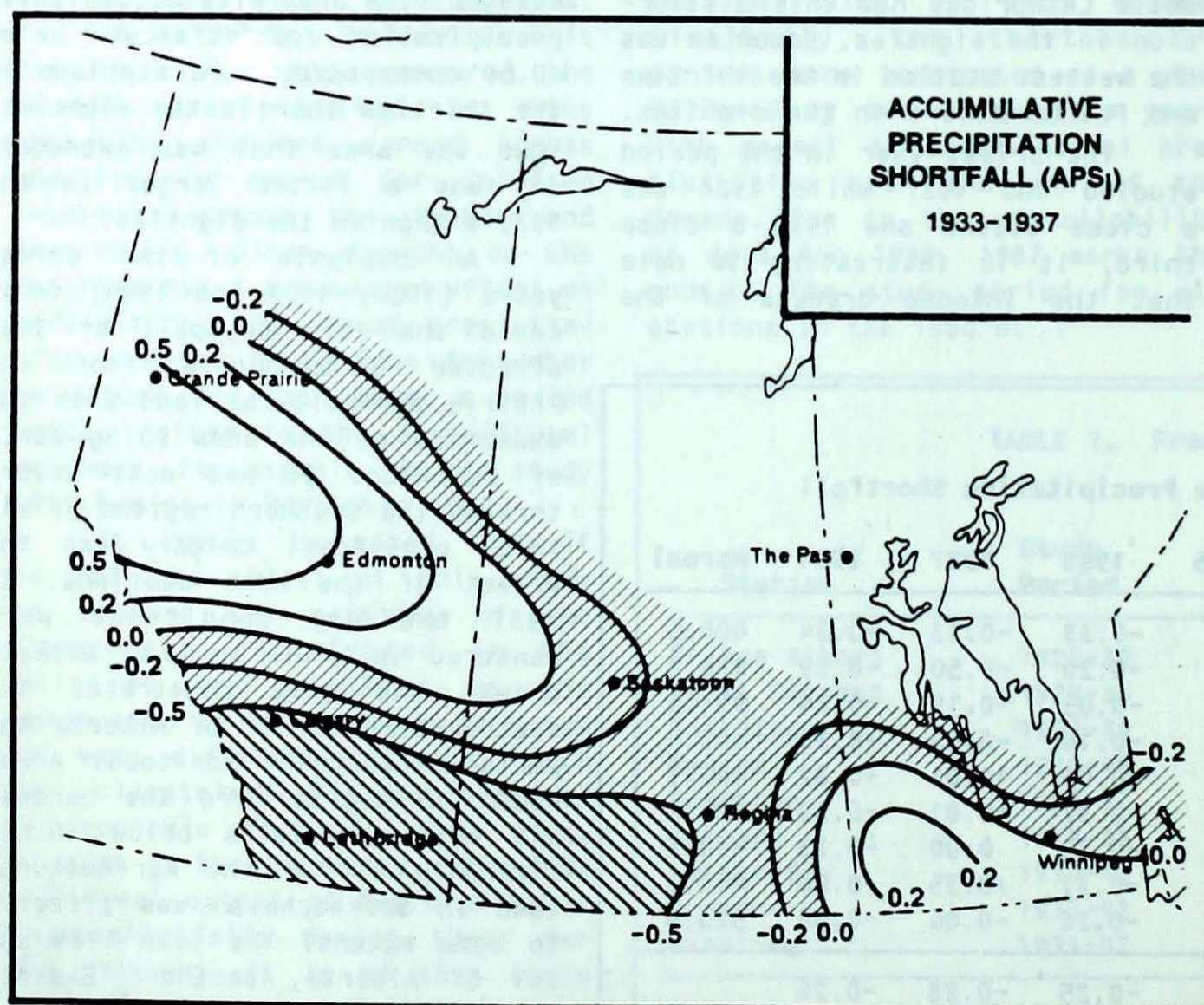


FIGURE 2

exception of a small area near Estevan. Although the intensity of the dryness in 1984 was not as great as in some other years (i.e., no shortfalls below -0.50), the dry conditions extended across the entire region qualifying 1984 as one of the driest years.

Conclusion

Suggestions that the 1980's have been drier than the 1930's are not completely unfounded. In fact, at two stations, Edmonton and Lethbridge, the eighties have been drier on the basis of duration and intensity. It is interesting to note that Calgary, which is situated between these two stations, does not follow the same pattern. In Calgary, both the thirties and the eighties were dry; the thirties were, however, slightly drier. The situation in Calgary very much typifies the rest of the Prairies. On the basis of intensity, duration of the dryspell, and the extent of the extremely dry area, the 1930's were slightly drier than the 1980's have been to date. The margin of difference however, is small in all aspects of the comparison.

It remains to be seen how the decade of the 1980's will end, and how 1988 and 1989's weather will influence the comparison with the thirties.

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1988													
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													
DAWSON	9.0	1.6	23.1	-3.9	0.0		56.8	378	0	11	246	96	251.0
MAYO	9.9	2.4	22.6	-0.1	0.0		37.6	192	0	11	246	96	300.9
WATSON LAKE	6.3	1.4	21.8	-2.2			51.5	175	0	11	256	98	337.1
WHITEHORSE	7.1	0.4	19.1	-6.7	3.6	124	27.4	212	0	7			
NORTHWEST TERRITORIES													
ALERT	-10.4	1.3	-1.4	-21.3	4.0	31	1.0	9	31	0	373	90	880.7
BAKER LAKE	-8.5	-2.1	1.8	-12.6	38.5	611	18.4	153	42	6	136	52	820.1
CAMBRIDGE BAY	-9.7	-0.3	2.5	-23.7	11.4	120	7.1	74	32	2			858.5
CAPE DYER	-6.0	0.0	7.3	-21.3	53.2	99	54.0	109	87	10	X		742.5
CAPE PARRY	-7.6	-0.6	2.0	-20.7	17.0	141	11.6	127	10	2	X		794.7
CLYDE	-7.2	0.1	4.5	-26.2	30.4	177	33.6	200	46	7	195	77	781.2
COPPERMINE	-7.8	-2.5	12.6	-22.0	2.6	32	17.1	142	7	2	236	104	799.3
CORAL HARBOUR	-8.4	-2.1	3.5	-22.1	13.2	*	14.2	84	15	5	255	*	818.5
EUREKA	-7.0	3.7	6.0	-20.6	8.8	162	41.2	305	3	7	538	103	774.5
FORT RELANCE	-3.7	-5.7	12.7	-18.7	17.4		64.8	208	0	8	166	60	671.5
FORT SIMPSON	6.9	-1.0	22.9	-4.4	17.4	341	68.1	244	0	7	233	81	343.3
FORT SMITH	5.5	-2.4	18.1	-8.0	16.4	341	39.0	154	18	12	138	69	390.6
IGALUIT	-4.4	-1.2	19.2	-19.2	33.4	141	11.9	73	31	6	X		804.2
HALL BEACH	-8.0	1.1	1.4	-25.2	13.4	82	57.8	287	0	6	X		486.0
HAY RIVER	2.4	-3.2	18.2	-10.9	13.1	335	39.2	222	1	5	336	113	540.3
INUVIK	0.6	1.4	19.3	-18.7	10.8	83	5.4	78	13	2	220	66	832.7
MOULD BAY	-8.8	2.4	3.0	-21.5	6.8	111	25.4	149	0	6	220	77	308.0
NORMAN WELLS	5.6	0.2	19.3	-7.7	3.6	42	5.0	54	0	3	X		737.7
POND INLET	-5.8	3.5	10.5	-14.8	6.2	51	5.2	64	2	1	262	82	612.3
RESOLUTE	-8.4	2.5	4.8	-21.2	5.2	56							
YELLOWKNIFE	0.9	-4.1	15.4	-15.0	0.8	21	20.1	116	0	5	348	104	533.0
ALBERTA													
BAFF	8.8	1.1	27.0	-3.5	16.0	111	46.2	87	0	5	X		173.8
CALGARY INT'L	12.4	3.0	29.6	-2.7	0.2	2	16.0	32	0	4	288	113	175.2
COLD LAKE	12.4	2.0	29.4	-1.6			41.4	104	0	5	262	96	171.7

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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									
FORT McMURRAY	10.7	1.0	26.2	-6.6	3.6	133	16.8	46	0	4	226	81	230.1
GRANDE PRAIRIE	11.5	1.5	26.5	-3.1			31.1	86	0	8	283	*	203.1
HIGH LEVEL	8.4	-0.9	21.4	-7.8	14.0	325	55.2	155	0	11	207	73	296.4
JASPER	9.7	1.0	25.2	-5.2			10.0	30	0	5	248	*	256.4
LETHBRIDGE	14.0	3.0	31.6	-0.9	0.0		17.3	34	0	7	302	114	126.2
MEDICINE HAT	15.8	3.5	33.8	-1.6	0.0		12.6	31	0	3	330	121	89.8
PEACE RIVER	10.4	0.8	27.7	-4.0	2.9	90	66.9	222	0	6	X		237.0
RED DEER	11.9	2.1	30.3	-7.4	0.0		9.9	20	0	2	X		193.4
ROCKY MTH HOUSE	10.5	1.3	29.1	-7.2			25.0	41	0	3	X		237.9
SLAVE LAKE	10.5	1.5	27.5	-5.7	1.0	21	54.2	123	0	6	266	94	233.0
SUFFIELD	15.4	3.7	33.4	0.1	0.0		5.2	13	0	3	305	109	102.9
WHITECOURT	11.5	2.3	24.2	-3.9			43.1	79	0	7	X		201.3
SASKATCHEWAN													
BROADVIEW	13.1	3.1	32.2	-2.4	0.6	9	118.6	308	0	10	279	100	174.7
COLLINS BAY	3.8	-0.3	21.0	-12.9	16.4	14	32.9	71	0	4	287	*	439.2
CREE LAKE	6.8	0.7	20.3	-7.8	0.6		29.8	115	0	5	284	97	347.7
ESTEVAN	15.1	3.7	36.5	-0.8	0.0		59.8	108	0	9	297	102	126.2
KINDERSLEY	14.7	3.8	32.3	-2.9	0.0		25.2	74	0	3	X		118.6
LA RONGE	10.9	2.9	24.9	-2.2	0.0		20.1	49	0	5	X		221.1
MEADOW LAKE	12.5	1.8	29.5	-4.3	0.0		68.2	176	0	8	275	*	204.8
MOOSE JAW	15.5	4.0	36.2	-2.2	0.0		10.4	23	0	4	313	112	110.8
NIPAWIN	13.2	*	31.5	-2.3	0.0	*	12.0	*	0	4	278	*	170.5
NORTH BATTLEFORD	14.7	3.5	32.5	-0.6	0.0		33.1	94	0	5	X		120.0
PRINCE ALBERT	13.9	3.9	31.2	-2.7	0.0		30.6	77	0	5	296	109	146.7
REGINA	14.8	3.7	34.7	-2.7	0.0		25.7	55	0	6	298	107	131.0
SASKATOON	15.1	4.0	34.6	-3.0	0.0		11.0	27	0	3	X		113.2
SWIFT CURRENT	14.6	4.1	37.3	-1.8	0.0		46.2	116	0	4	296		123.8
WYNYARD	13.6	3.2	33.3	-1.8	0.0		43.4	83	0	6	X		160.9
YORKTON	12.9	2.5	32.6	-2.3			102.3	229	0	11	271	96	177.9
MANITOBA													
BRANDON	13.3	2.6	35.2	-4.8	0.0		48.1	101	0	8	X		175.1
CHURCHILL	-3.4	-1.9	10.3	-16.7	10.8	55	24.3	76	2	7	183	93	662.7
DAUPHIN	12.9	2.6	33.0	-2.7	0.3	6	122.3	258	0	12	245	92	190.5
GILLAM	3.5	0.8	21.3	-11.4	55.0	314	129.8	387	0	13	X		445.6
GIMLI	12.5	3.3	32.9	-4.7			29.6	48	0	8	284	100	193.8
ISLAND LAKE	8.6	3.1	30.2	-7.5	1.0	1	56.4	166	0	9	X		295.9
LYNN LAKE	5.9	1.0	21.2	-11.3	1.0	*	14.8	33	0	4	299	110	373.7
NORWAY HOUSE	8.8	*	31.3	-6.4	1.0	*	111.2	*	0	8	X		292.5
PORTAGE LA PRAIRIE	14.3	3.1	35.3	-3.0	0.6	42	49.2	78	0	7	X		151.5

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									
THE PAS	10.7	2.3	32.5	-4.7	0.2	3	33.5	89	0	3	274	98	237.9
THOMPSON	6.6	1.6	22.0	-9.3	46.2	195	88.6	202	0	9	265	102	354.6
WINNIPEG INT'L	14.6	3.3	35.2	-4.2	0.0		29.9	45	0	7	288	108	146.5
ONTARIO													
ATIKOKAN	12.9	3.7	31.4	-2.3			71.0	97	0	7	309	129	172.4
BIG TROUT LAKE	6.5	2.0	24.5	-9.5	2.2	*	49.1	109	0	9	227	*	397.5
EARLTON	11.8	2.0	30.9	-3.9			63.4	103	0	10	X		197.9
GERALDTON	10.0	2.3	29.2	-5.4	6.4	52	65.0	102	0	8	X		259.1
GORE BAY	12.1	1.9	29.5	-0.1	0.0		36.1	59	0	7	X		185.0
HAMILTON RBG	14.6	1.5	32.8	2.0	0.0		46.6	66	0	6	281	*	140.3
HAMILTON	14.0	1.4	31.0	2.2	0.0		40.1	61	0	7	X		242.4
KAPUSKASING	10.2	1.9	27.7	-5.3	10.6	110	69.8	93	0	9	X		142.1
KENORA	14.5	4.0	32.5	-2.5	0.0		26.6	46	0	5	X		162.9
KINGSTON	13.1	1.7	30.5	3.6	0.0		36.8	51	0	6	244	106	284.4
LANSDOWNE HOUSE	8.9	3.0	27.8	-7.4	2.0	14	51.6	93	0	9	X		123.7
LONDON	14.5	2.1	31.2	1.7	0.0		73.5	109	0	8	259	112	339.1
MOOSONEE	7.2	1.5	29.4	-6.1	8.6	93	79.6	128	0	11	228	115	152.5
MUSKOKA	12.2	1.3	28.3	-0.7	0.0		62.6	80	0	6	X		170.2
NORTH BAY	12.7	2.1	28.9	-0.8			76.0	109	0	10	265	108	172.8
OTTAWA INT'L	14.9	2.1	29.7	3.6	0.0		32.4	47	0	6	249	*	143.2
PETAWAWA	13.7	2.2	32.5	-2.8	0.0		40.0	66	0	9	X		141.7
PETERBOROUGH	13.7	1.6	30.6	-0.4	0.0		60.4	105	0	8	X		208.8
PICKLE LAKE	11.4	4.0	31.5	-6.6	4.4	42	66.2	89	0	8	X		178.8
RED LAKE	12.9	3.7	32.7	-4.9			28.3	58	0	9	289	*	127.4
ST. CATHARINES	14.6	1.6	32.1	1.7	0.0		36.0	48	0	7	X		170.1
SARNIA	13.1	0.7	32.6	-0.1	0.0		23.0	34	0	3	283	113	216.4
SAULT STE. MARIE	11.3	2.2	31.2	-5.3	0.0		36.9	43	0	8	300	116	173.1
SIoux LOOKOUT	13.0	3.8	32.7	-4.3	1.4	15	44.1	67	0	8	X		166.6
SUDBURY	12.9	2.4	32.2	-0.4	0.2	8	90.6	135	0	10	267	108	250.1
THUNDER BAY	10.0	1.2	30.3	-3.9			59.7	81	0	10	305	120	220.6
TIMMINS	11.0	2.0	29.6	-4.6	2.0	30	44.5	63	0	6	X		110.7
TORONTO	15.3	1.7	32.6	4.2	0.0		37.2	56	0	7			146.0
TORONTO INT'L	13.9	1.6	31.0	0.7	0.0		39.6	60	0	4	X		152.3
TORONTO ISLAND	13.5	1.9	34.1	4.2	0.0		39.4	62	0	6	X		135.8
TRENTON	14.1	1.6	31.4	1.2	0.0		32.7	44	0	6	X		144.8
WATERLOO-WELL	13.7	1.4	30.5	0.0	0.0		48.1	67	0	6	X		267.0
WAWA	9.4	*	27.0	-4.0	1.2	*	98.0	*	0	10	*		189.8
WIARTON	12.6	2.2	27.1	-0.4	0.0		39.0	63	0	6	284	110	90.2
WINDSOR	16.6	2.4	34.0	4.2	0.0		30.0	42	0	7	X		

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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	11.3	2.0	27.9	-3.3	0.0	185	59.3	85	0	11	272	70	185.2
	7.8	1.0	22.5	-5.8	0.0	53	50.3	64	0	11	272	70	220.1
	4.7	1.8	14.5	-4.2	0.0	20	60.4	83	0	10	169	84	314.9
	8.9	2.5	26.4	-7.9	3.8	20	60.2	69	0	13	246	102	261.2
	8.9	1.8	28.7	-4.0	0.0	185	67.8	96	0	10	262	102	252.0
	-1.7	-0.1	7.3	-9.1	20.6	185	23.2	99	5	7	104	89	244.6
	1.5	1.3	19.9	-7.5	8.2	53	29.6	93	0	8	118	89	277.5
	2.2	1.0	24.8	-10.1	14.2	73	46.6	109	0	9	146	103	243.9
	6.9	2.0	29.7	-10.7	15.6	23	67.6	81	0	10	209	103	277.5
	12.8	2.0	29.8	-2.0	0.0	23	51.5	73	0	10	251	103	243.9
NOVA SCOTIA	8.5	1.5	27.2	-7.8	3.4	23	60.2	73	0	10	264	103	277.5
	9.8	1.7	25.2	-0.3	0.0	23	55.4	88	0	8	262	103	243.9
	14.8	1.8	26.9	2.0	0.0	23	50.2	76	0	7	221	103	277.5
	13.9	1.5	26.6	0.0	0.0	23	38.4	80	0	6	240	103	277.5
	6.4	1.5	17.5	-3.7	0.0	23	73.4	80	0	7	240	103	277.5
	12.9	2.1	28.2	0.1	0.0	23	49.2	56	0	6	220	103	277.5
	11.4	1.9	27.7	-3.0	0.0	23	49.0	70	0	9	276	103	277.5
	2.6	1.4	22.8	-10.1	8.4	33	48.6	98	0	8	180	103	277.5
	7.5	1.6	21.1	-4.1	0.0	33	55.9	66	0	10	247	103	277.5
	12.6	2.0	26.3	-1.5	0.0	33	73.5	84	0	7	206	103	277.5
NEW BRUNSWICK	12.4	2.6	25.4	-1.5	0.0	9	55.0	67	0	7	272	103	277.5
	14.3	1.5	26.5	0.6	0.0	9	34.8	47	0	7	253	103	277.5
	10.6	1.8	28.9	-5.2	0.2	9	74.2	116	0	12	253	103	277.5
	10.5	2.6	26.5	-2.6	0.0	127	56.3	69	0	10	258	103	277.5
	11.6	2.1	27.1	-1.6	1.4	127	62.4	100	0	9	234	103	277.5
	10.5	1.1	26.9	-1.4	8.8	400	98.2	118	0	8	211	103	277.5
	9.8	0.8	23.6	-0.3	0.6	30	84.7	101	0	9	216	103	277.5
	10.5	2.6	26.9	-1.4	8.8	400	84.7	101	0	9	216	103	277.5
	9.8	0.8	23.6	-0.3	0.6	30	106.4	100	0	8	186	103	277.5
	10.5	2.6	26.5	-2.6	0.0	127	56.3	69	0	10	258	103	277.5
NEWFOUNDLAND	10.5	2.0	25.3	0.1	2.6	123	113.0	135	0	9	213	103	277.5
	10.1	1.1	23.5	0.2	1.2	86	76.8	94	0	10	213	103	277.5
	4.2	2.2	24.5	-6.9	0.2	2	72.2	114	0	13	209	103	277.5
	7.8	3.3	25.0	-3.3	11.0	159	63.8	94	0	12	209	103	277.5
	6.6	0.9	19.7	-0.5	0.0	50	135.4	108	0	15	209	103	277.5
	4.3	1.4	24.1	-6.0	8.7	50	62.6	99	0	10	209	103	277.5
	4.7	1.8	25.2	-7.3	4.6	25	67.2	117	0	5	249	103	277.5
	8.7	2.7	27.0	-2.9	12.2	70	99.1	134	0	13	249	103	277.5
	6.3	1.4	17.1	-2.1	0.0	20	69.1	100	0	1	126	103	277.5
	9.2	2.6	25.2	-3.5	1.2	20	80.5	121	0	12	193	103	277.5
PRINCE EDWARD ISLAND	9.3	3.1	26.5	-3.0	0.0	36	14.7	21	0	15	193	103	277.5
	7.2	2.2	30.4	-5.5	6.8	36	63.0	98	0	8	212	103	277.5
	7.0	2.3	16.8	0.0	0.0	36	140.6	118	0	10	185	103	277.5
	3.5	0.9	17.2	-6.0	11.2	13	88.8	93	0	11	179	103	277.5
	8.8	3.4	24.6	-1.3	1.5	13	87.6	86	0	10	179	103	277.5
	8.1	3.6	18.9	0.0	0.0	13	128.5	116	0	13	179	103	277.5
	9.6	2.7	19.4	-0.5	0.0	13	103.0	128	0	14	179	103	277.5
	5.4	2.7	26.5	-6.5	6.5	13	69.9	117	0	8	238	103	277.5
	9.6	2.7	19.4	-0.5	0.0	13	103.0	128	0	14	179	103	277.5
	5.4	2.7	26.5	-6.5	6.5	13	69.9	117	0	8	238	103	277.5

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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	13.1	0.1	29.0	4.5	0.0	169.1	198	0	16	197	252.3	531.9
SIDNEY	11.2	0	21.5	2.0	0.0	55.3	0	0	13	193	191.5	392.4
SUMMERLAND	13.6	0.1	27.0	3.0	0.0	47.6	173	0	7	247	267.9	481.2
ALBERTA												
BEAVERLODGE	11.0	1.6	27.0	-3.0	0.0	28.0	72	0	7	262	184.3	255.8
ELLERSLIE												
LACOMBE	12.0	2.1	30.5	-8.1	0.0	13.2	27	0	3	311	220.7	273.3
LETHBRIDGE												
VEGREVILLE	13.1	3.0	31.0	-4.0	0.0	18.4	91	0	2	N/A	248.3	305.7
SASKATCHEWAN												
INDIAN HEAD	13.7	3.1	33.0	-2.5	0.0	67.2	136	0	9		283.0	341.0
MELFORT	14.5	4.2	34.0	-1.5	0.0	14.2	37	0	4	274	273.5	311.0
REGINA	14.9	4.1	35.5	-6.0	0.0	14.2	33	0	4	N/A	281.0	322.3
SASKATOON												
SCOTT	14.2	3.9	32.5	-3.0	0.0	27.0	82	0	6	291	285.1	328.0
SWIFT CURRENT SOUTH	15.2	4.6	37.0	-0.5	0.0	35.3	98	0	3	245	297.8	378.4
MANITOBA												
BRANDON	14.4	3.4	36.0	-5.5	0.0	43.0	87	0	8	N/A	295.6	375.0
GLENLEA	15.0	3.6	34.5	-7.0	0.0	43.2	77	0	7	282	232.9	311.4
MORDEN	15.5	3.6	35.0	-4.0	0.0	21.4	32	0	7	285	332.0	437.5
ONTARIO												
DELHI	14.9	2.1	33.0	1.0	0.0	46.2	63	0	9	272	307.6	404.5
ELORA	13.4	2.0	29.0	-1.4	0.0	41.8	54	0	6	N/A	260.7	308.7

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
QUELPH	13.6	1.9	30.1	-2.5	0.0	58.4	80	0	8	256	285.1	329.7
HARROW	15.7	1.5	32.5	2.5	0.0	14.4	20	0	3	271	343.9	473.2
KAPUSKATING	9.9	1.6	27.0	-4.0	12.5	74.3	102	0	9	250	162.2	166.2
OTTAWA	14.9	2.1	29.0	2.4	0.0	25.5	38	0	6	240	303.7	360.2
SMITHFIELD	14.6	2.7	32.1	0.5	0.0	30.0	38	0	7	N/A	297.9	378.2
VINELAND STATION	13.2	0.7	31.7	0.7	0.0	32.8	49	0	8	254	252.6	330.9
QUEBEC												
LA POCAIERE	11.5	1.6	26.5	-1.0	0.0	55.2	80	0	6	237	285.2	288.7
L'ASSUMPTION	14.4	2.1	26.5	-1.0	0.0	29.0	40	0	8	224	292.5	336.1
LENNOXVILLE												
NORMANDIN	10.9	2.2	27.0	-7.0	0.0	40.0	57	0	9	287	184.7	187.2
ST. AUGUSTIN												
STE CLOTHILDE	14.2	1.8	27.0	-0.5	0.0	56.4	75	0	8	248	284.3	356.1
NEW BRUNSWICK												
FREDERICTON	12.5	1.9	28.0	-1.5	0.0	119.4	135	0	9	211	231.9	260.5
NOVA SCOTIA												
KENTVILLE	12.4	2.0	28.5	-1.0	0.0	44.2	57	0	7	220	229.4	271.8
NAPPAN	10.4	1.2	23.0	-1.5	7.0	89.2	118	0	8	203	178.0	207.5
PRINCE EDWARD ISLAND												
CHARLOTTETOWN	10.7	1.7	25.5	-0.5	2.4	112.6	141	0	9	209	185.1	193.0
NEWFOUNDLAND												
ST. JOHN'S WEST	10.0	4.2	23.5	-1.5	0.0	103.6	97	0	11	181	168.9	174.8