Environment Canada Environnement Canada

Climatic Perspectives

Monthly Review **APRIL – 1988** *Vol. 10*

CLIMATIC HIGHLIGHTS

P.Scholefield, Monitoring and Prediction Division

Another Dry Month Across the Prairies and Northwestern Ontario

As can be seen on the map on page 3, large areas across the Prairies and northwestern Ontario received less than 25% of their normal April precipitation which further intensified the drought concerns of those involved in managing agriculture, water, forestry and wildlife resources. According to a recent PFRA* report, early loss of snow cover over much of the plains, high temperatures and dry surface soil conditions have led to widespread wind erosion on many fields. A significant number of smaller rural communities are reporting projected water shortages or are experiencing heavy demands for on-farm water hauling. Forest and prairie fires have been occurring with greater frequency and there have already been some major fires in northwestern Ontario.

The Scientific Service Division of AES in Winnipeg has produced some statistics that give an historical perspective to this dry spell. Looking at the total precipitation for the November through April period, there has only been two drier periods in the 103-year record at Calgary, three drier periods in the 105-year record at Edmonton, one drier period in the 50-year record at Estevan, two drier periods in the 113-year record at Winnipeg and only one drier period in the 46-year record at Thunder Bay. Only two (22%) of the total nine of these previous drier periods were subsequently followed by a wet spring

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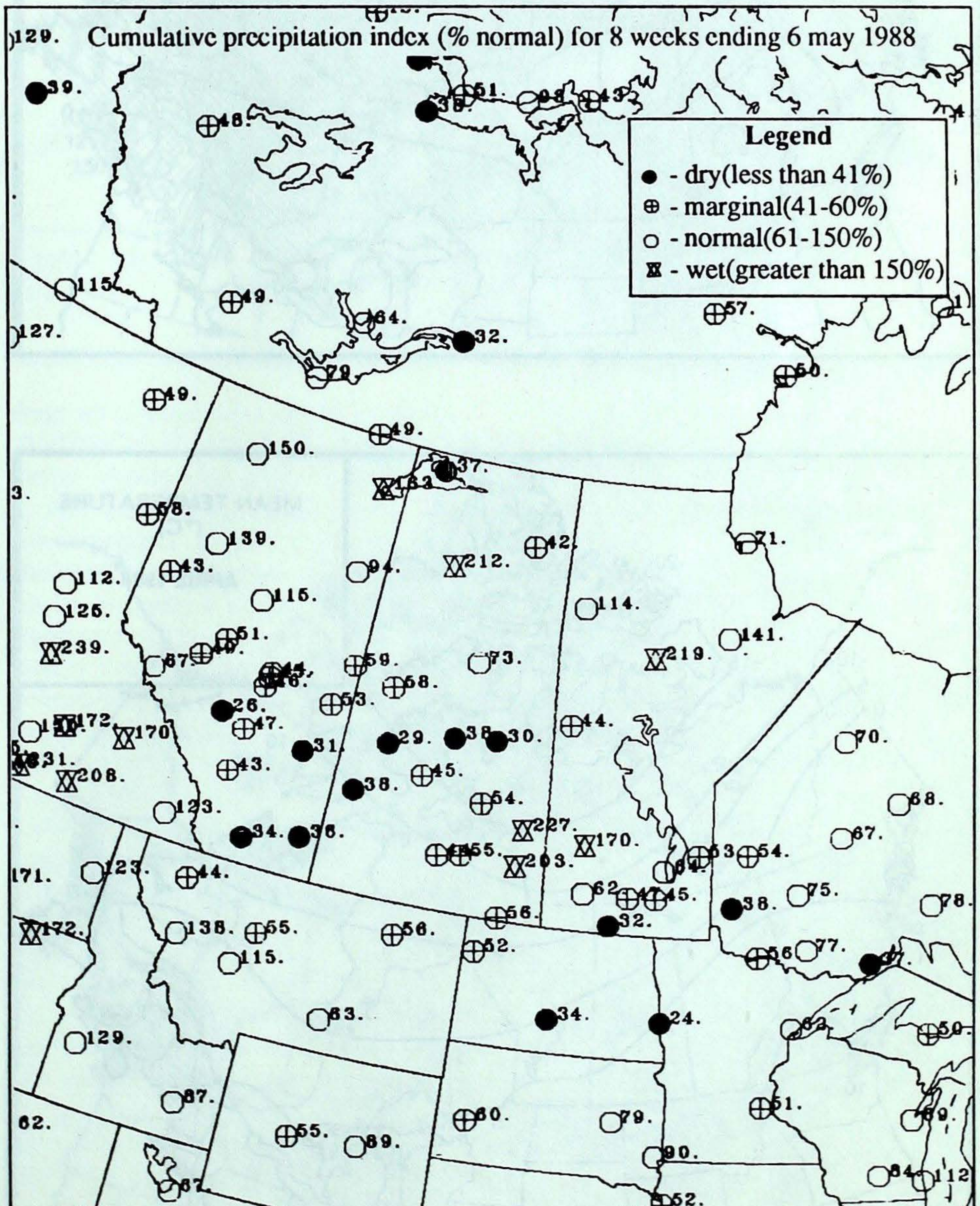
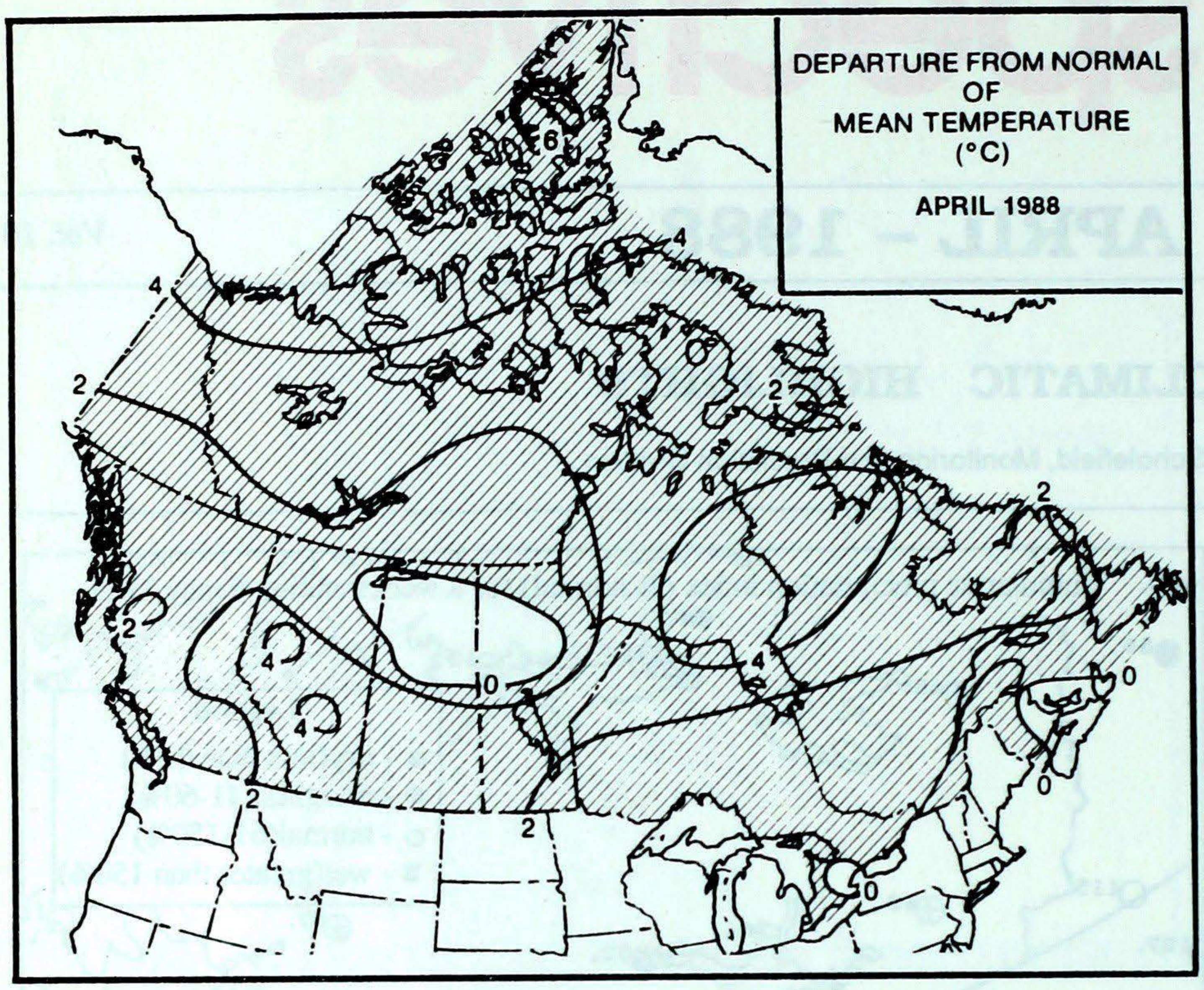
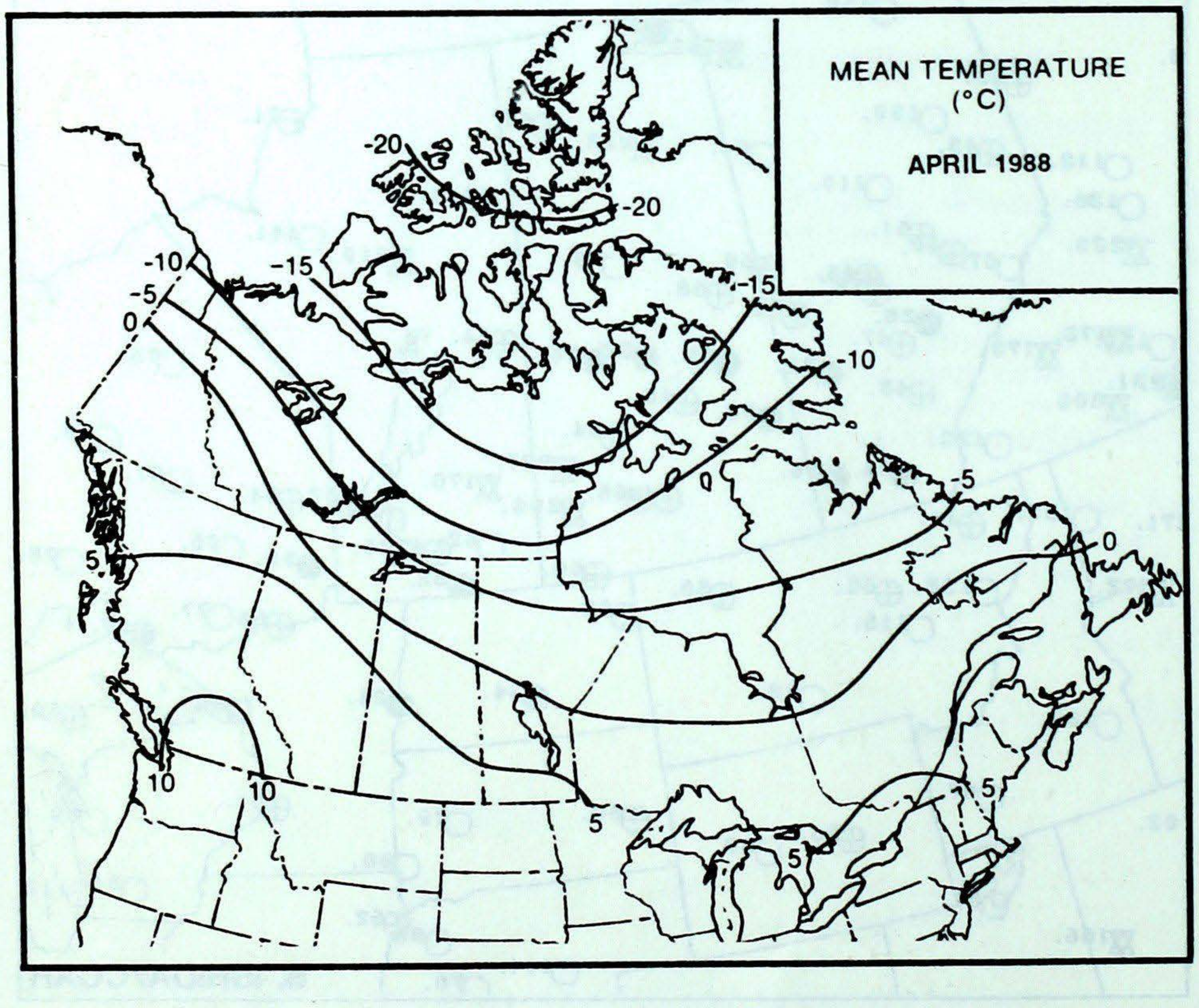


Canada





Across the country

Yukon and Northwest Territories

April was dry and mild in the Yukon and Northwest Territories with above-normal temperatures during most of the month. This was the second consecutive month of pleasant weather which brought on an early spring to the Yukon. A quasi-stationary ridge of high pressure over the Territories was responsible for the fine spring weather. An all-time high surface pressure of 104.4 kPa was reported at Iqaluit on the 10th. Over the high Arctic Islands, temperatures were particularly cold during the first two weeks of April. Further south, however, daily maximums began rising above the freezing point in the Yukon during the second week and reached as high as 19° C at Dawson on the 29th. On this same day, all daily maximum records in the western Arctic were broken while further east, blizzard advisories were being issued for regions north of Hudson Bay.

The heaviest precipitation occurred at the end of the month and only southernmost stations reported monthly amounts exceeding the normal.

British Columbia

It was a typical spring month in B.C. with variable but pleasant weather. The month began and ended with cool, wet weather, but overall temperatures averaged well-above normal for the month. Temperatures soared to near 30°C over the southern interior at mid month when a high pressure ridge along the coast moved inland. Port Alberni and Smithers both registered new record mean monthly temperatures of 9.2 and 6.7°C respectively

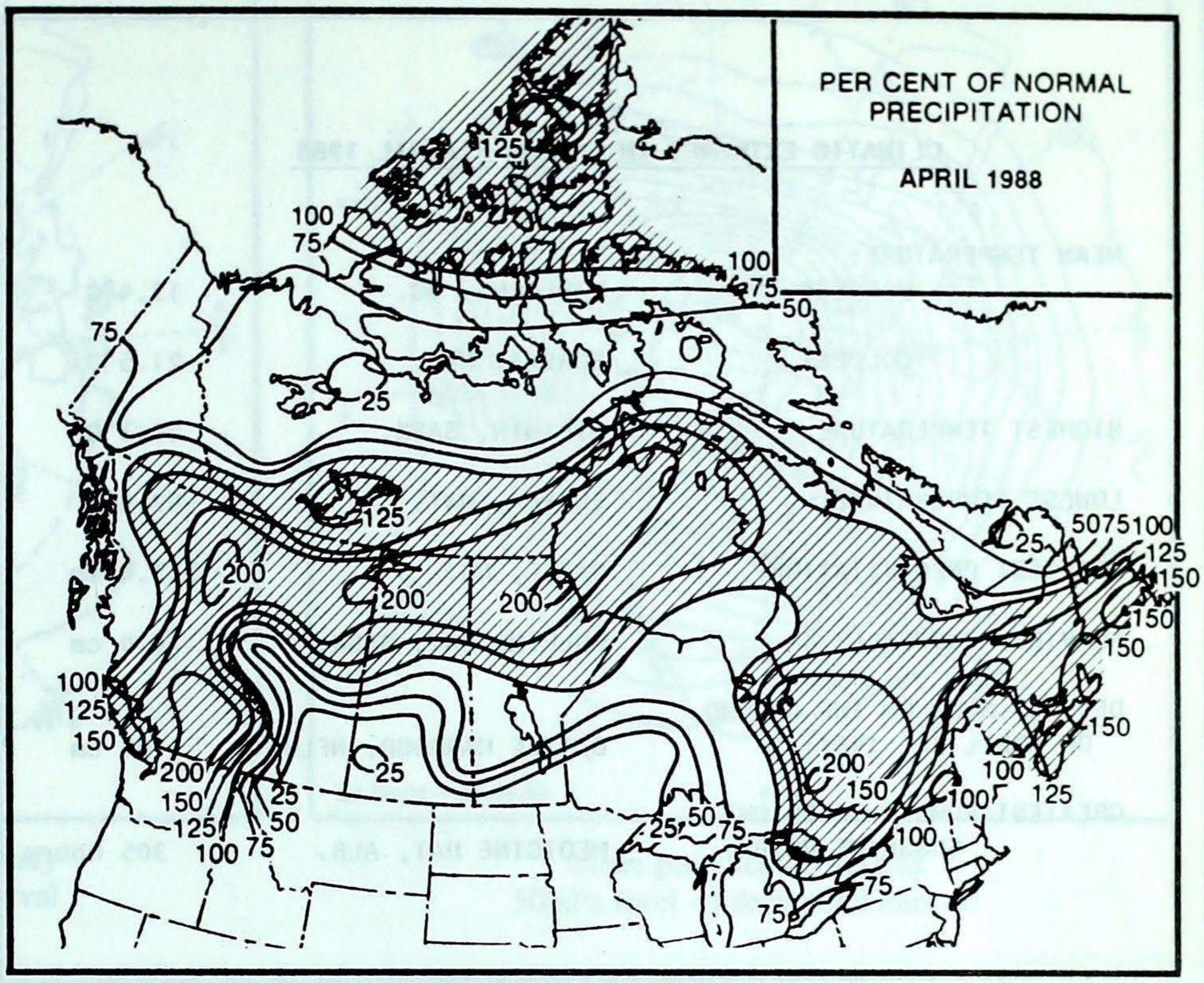
The drought-stricken areas of the southern interior received some relief with some significant precipitation which began at mid month. In the Okanagan-Similkameen region, monthly totals reached 300-400% of the monthly normals and new record amounts were established at Kelowna and up north at Fort Nelson. The mountain snowpacks were also substantially increased which should improve runoff pospects and help replenish irrigation reservoirs in the coming weeks.

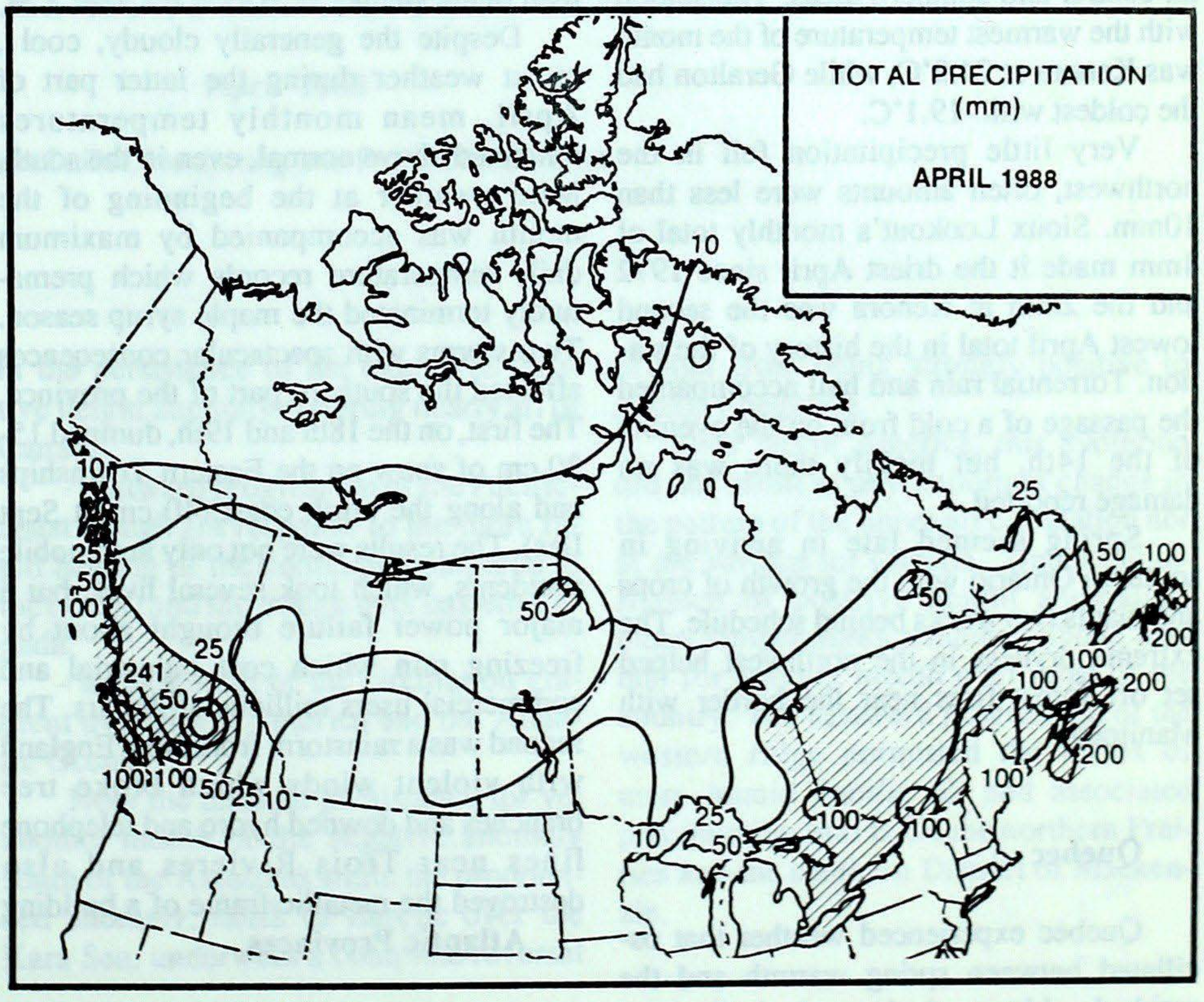
Prairie Provinces

It was yet another month with above-normal temperatures across the Prairies. The warmest areas were in the south where it was also the driest. This further aggravated drought conditions in agricutural regions which had persisted from the previous month. Except in the north, there were some extreme fluctuations in temperature, with extreme maximum values more frequent than minimum values. Numerous daily records were set at the middle of the month in all three provinces. On the 15th, Medicine Hat's temperature climbed to 26.8°C, the highest value recorded anywhere during the month.

The precipitation patterns again left the southern areas in a deficit situation as the position of the Pacific ridge further to the east (see page 5) diverted weather systems to the northern areas which experienced some significant snowfalls. Some locations in the south received only 10 - 20% of their normal precipitation with Winnipeg receiving as little as 0.8mm (2%). The agricultural research station at Lethbridge received only a trace.This was a new monthly record for the station which has been in operation since 1902.

Not only farmers are worried about the lack of moisture which threatens the spring seeding and the eventual harvest, but the onset of the thunderstorm season has set off numerous forest fires - more than 20 in the Edmonton area.





Ontario

There was little character to the April weather, although there was considerable variability across the province thoughout the month. Overall, a rather cool, dry regime doiminated in the south while warm weather predominated in northern regions.

Right at the beginning of the month, daily maximum temperature records were broken in southern and central sectors - 20°C at North Bay, 24°C at Windsor. The following week, after an active cold frontal passage, the mercury struggled to climb above the freezing point. Later in the month, on the 19th and 20th, minimum

CLIMATIC EXTREMES IN CANADA - APRIL 1988

MEAN TEMPERATURE: WARMEST	KAMLOOPS, BC.	11.4°C
COLDEST	EUREKA, NWT.	-21.5°C
HIGHEST TEMPERATURE:	NIPAWIN, SASK.	29.3°C
LOWEST TEMPERATURE:	EUREKA, NWT.	-42.4°C
HEAVIEST PRECIPITATION:	SABLE, NS.	273.4 mm
HEAVIEST SNOWFALL:	COLLINS BAY, SASK.	78.0 cm
DEEPEST SNOW ON THE GROUND ON APRIL 30, 1988:	BATTLE HARBOUR, NFLD.	91 cm
GREATEST NUMBER OF BRIGHT SUNSHINE HOURS:	MEDICINE HAT, ALB.	305 hours

daily temperature records were broken in all central and southern areas. The station with the warmest temperature of the month was Kenora at 24.2°C, while Geralton had the coldest with -19.1°C.

Very little precipitation fell in the northwest, often amounts were less than 10mm. Sioux Lookout's monthly total of 4mm made it the driest April since 1972 and the 2mm at Kenora was the second lowest April total in the history of the station. Torrential rain and hail accompanied the passage of a cold front on the evening of the 14th, but luckily there was no damage reported.

Spring seemed late in arriving in southern Ontario with the growth of crops and plants two weeks behind schedule. The extreme dryness in the northwest helped set off forest fires near the border with Manitoba.

Quebec

Quebec experienced weather that oscillated between spring warmth and the residual coldness of winter. As in Ontario, weather conditions were better in the north than in the south.

Despite the generally cloudy, cool , moist weather during the latter part of April, mean monthly temperatures remained above normal, even in the south. Mild weather at the beginning of the month was accompanied by maximum daily temperature records which prematurely terminated the maple syrup season. Two storms with spectacular conseqences affected the southern part of the province. The first, on the 18th and 19th, dumped 15-20 cm of snow on the Eastern Townships and along the north coast (40 cm at Sept Iles). The results were not only automobile accidents, which took several lives, but a major power failure brought about by freezing rain which cost industrial and commercial users millions of dollars. The second was a rainstorm from New England with violent winds which broke tree branches and downed hydro and telephone lines near Trois Rivieres and also destroyed the metallic frame of a building

Atlantic Provinces

Over the Atlantic Provinces, the movement of the Polar vortex towards Europe and the deepening of the upper level trough over eastern Canada (see page 5) benefitted only Labrador. Basically, the weather conditions in the Maritimes and Newfoundland were highly variable with often cloudy skies and abundant precipitation, while Labrador enjoyed sunny weather, above normal temperatures and little precipitation.

Despite dramatic temperature fluctuations, the monthly highlight was precipitation which was well-above normal over the Maritimes and Newfoundland. New April accumulation records were established at Sydney, Sable Island and Halifax. At CFB Shearwater, the 179.8 mm of rain recorded was an all-time record for the month. In most cases, this precipitation was attributed to violent storms: on the 10th and 11th, winds, rain and freezing rain resulted in accidents (1 dead in N.S.) and the closing of ferry traffic between N.S and P.E.I.; on the 12-14th, the same storm dumped 43 cm of snow on Gander and the Avalon peninsula was without electricity for nearly 8 hours.; on the 20th, snow, hail, thunder and wind disrupted traffic in N.S;. and some commercial industries were affected by power failures. In Newfoundland, winds gusting to 140 Km/h overturned tractor-trailers on the Trans Canada Highway, and on the 25th, another late spring storm caused automobile accidents and school closures.

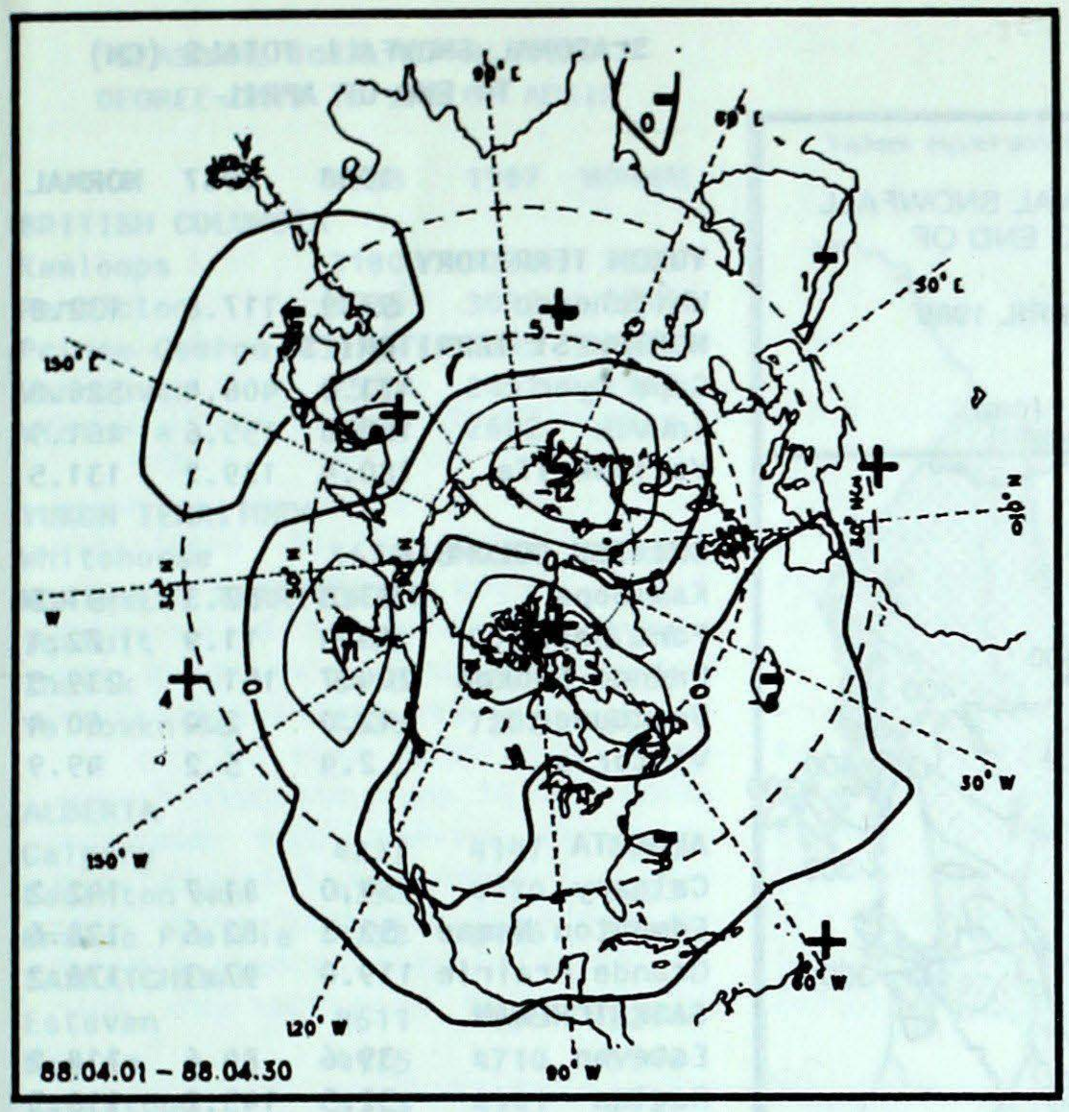
There was a positive ride to this unsavory weather: there were less brush fires than usual and maple syrup production in N.S. was better than normal.

continued from page 1, Highlights...

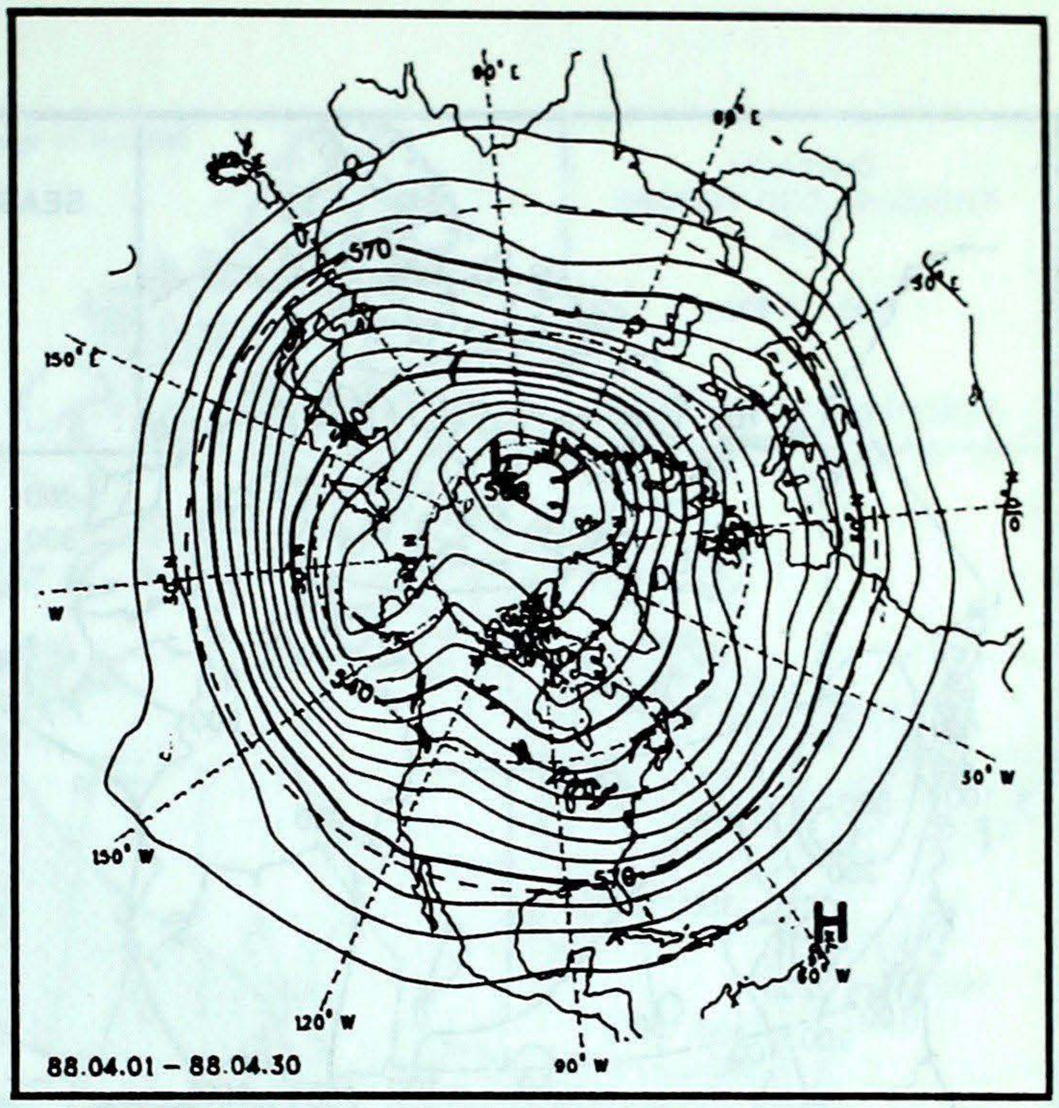
(at least 10 mm greater than normal precipitation).

On the brighter side, above-normal monthly precipitation fell in the drought sticken southern interior valleys of B.C. and in a region encompassing Lake Winnipegosis and extending into southeastern Saskatchewan. The B.C. precipitation also significantly increased the mountain snowpacks which raised eastern slope runoff projections to near 80% of normal.

(PFRA: Prairie Farm Rehabilitation Administration.)



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

With the passage of the spring equinox, the general circulation at the 50-kPa level undergoes a significant transition in response to the changing solar radiation regime, which is the atmoshperic engine for air mass movement. The following changes can normally be expected: a slackening of the contour gradient; a decrease in the intensity of the eastern Canadian trough; and a general eastward progression of the position of the long waves. Several of these changes can be detected in examining the mean 50-kPa April flow:

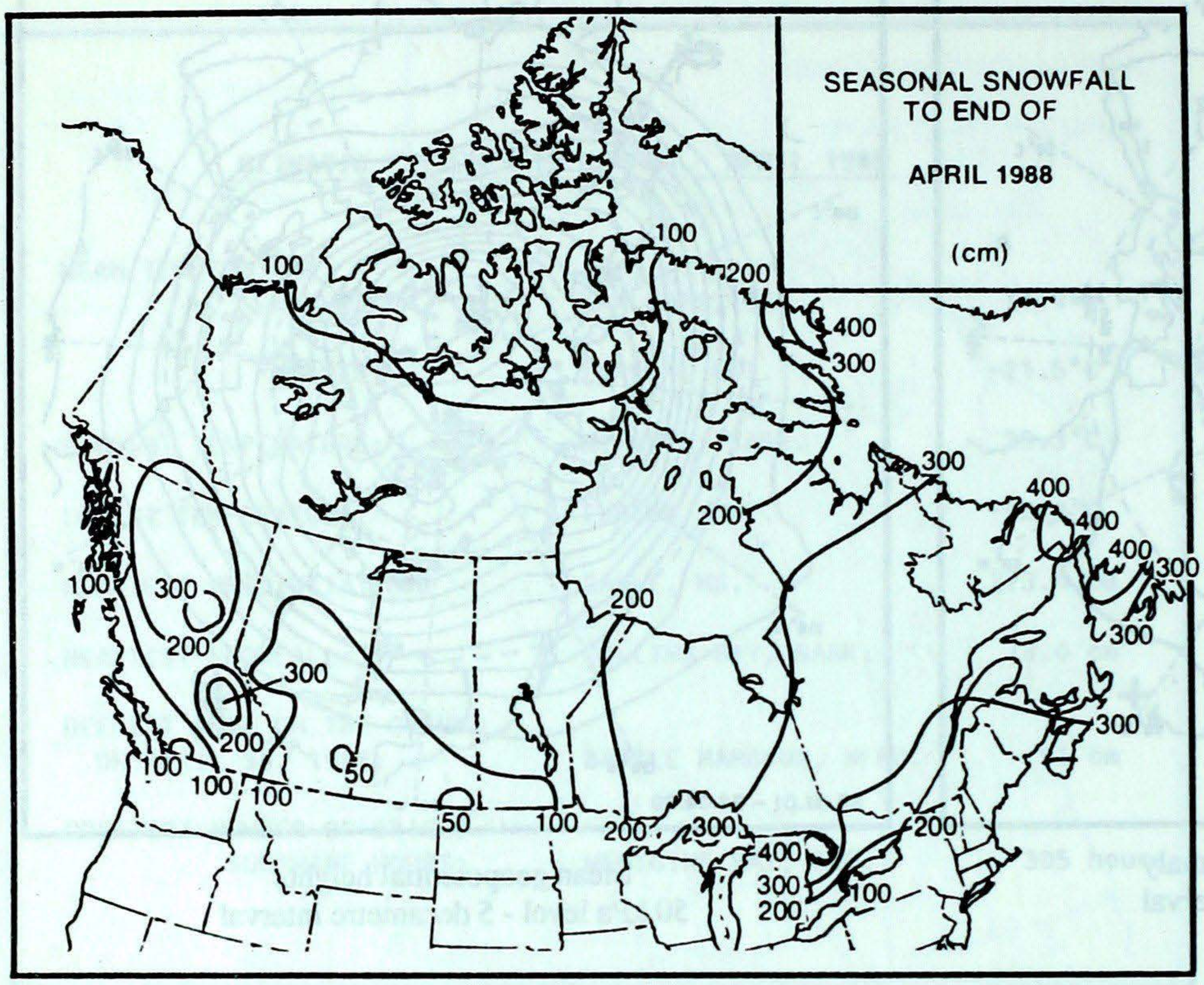
- a warming of the atmosphere over all of North America which is manifested in the persistence of the extensive positive height anomaly covering nearly all of Canada.

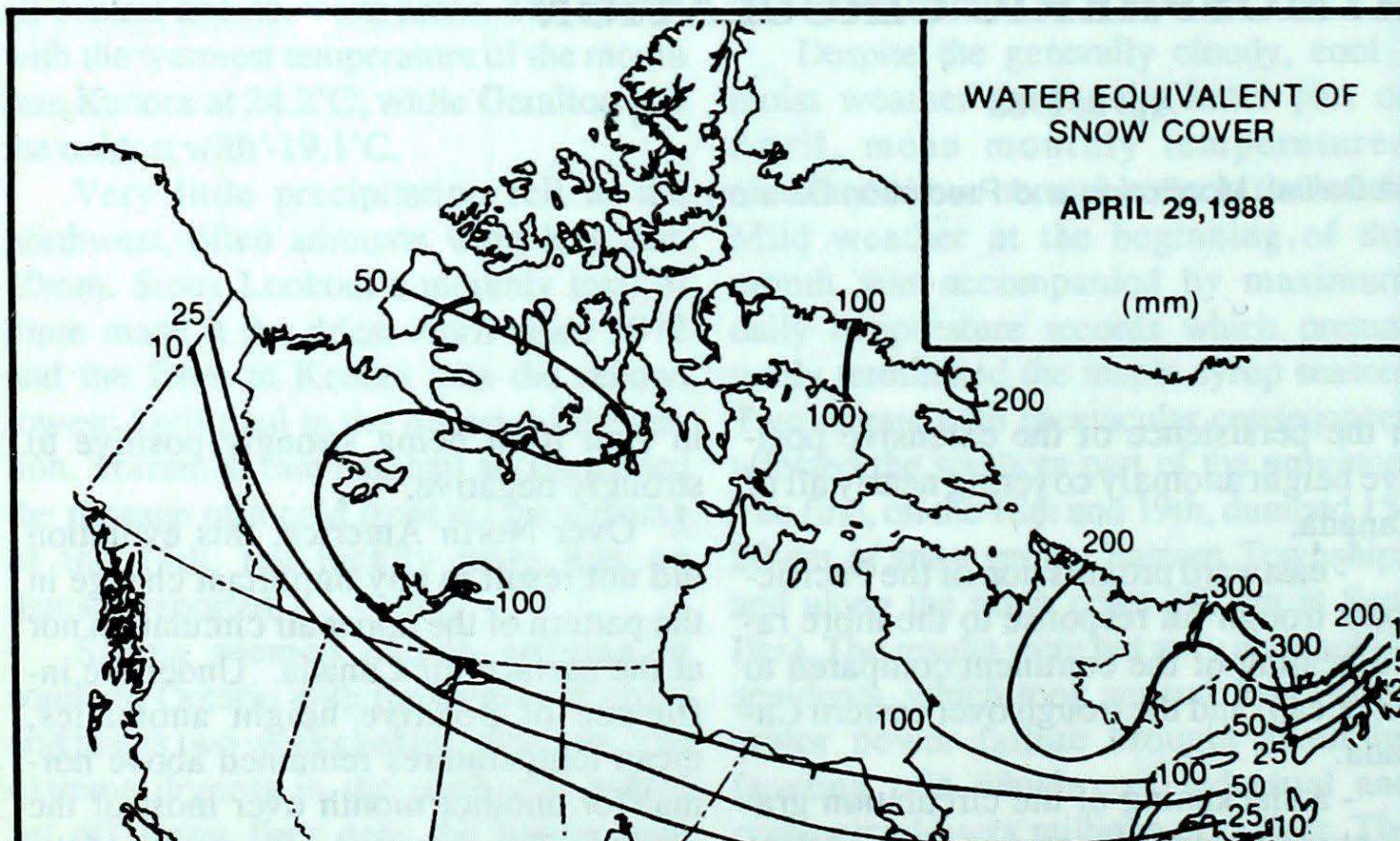
- eastward progression of the Pacific-coast trough (in response to the more rapid heating of the continent compared to the ocean) and the trough over eastern Canada.

- a slackening of the circulation gradient over North America and the Atlantic Ocean.

Note the unusual persistance for yet another month of the negative anomaly south of the Aleutians while the pronounced anomaly, north of Europe over the Kara Sea, underwent a complete reversal in sign from being strongly positive to strongly negative.

Over North America, this evolution did not result in any important change in the pattern of the upper air circulation nor at the surface for Canada. Under the influence of positive height anomalies, mean temperatures remained above normal for another month over most of the country. The eastward progression of the western ridge permitted the influx of more humid Pacific air and associated precipitation into B.C., the northern Prairies and the southern District of Mackenzie.



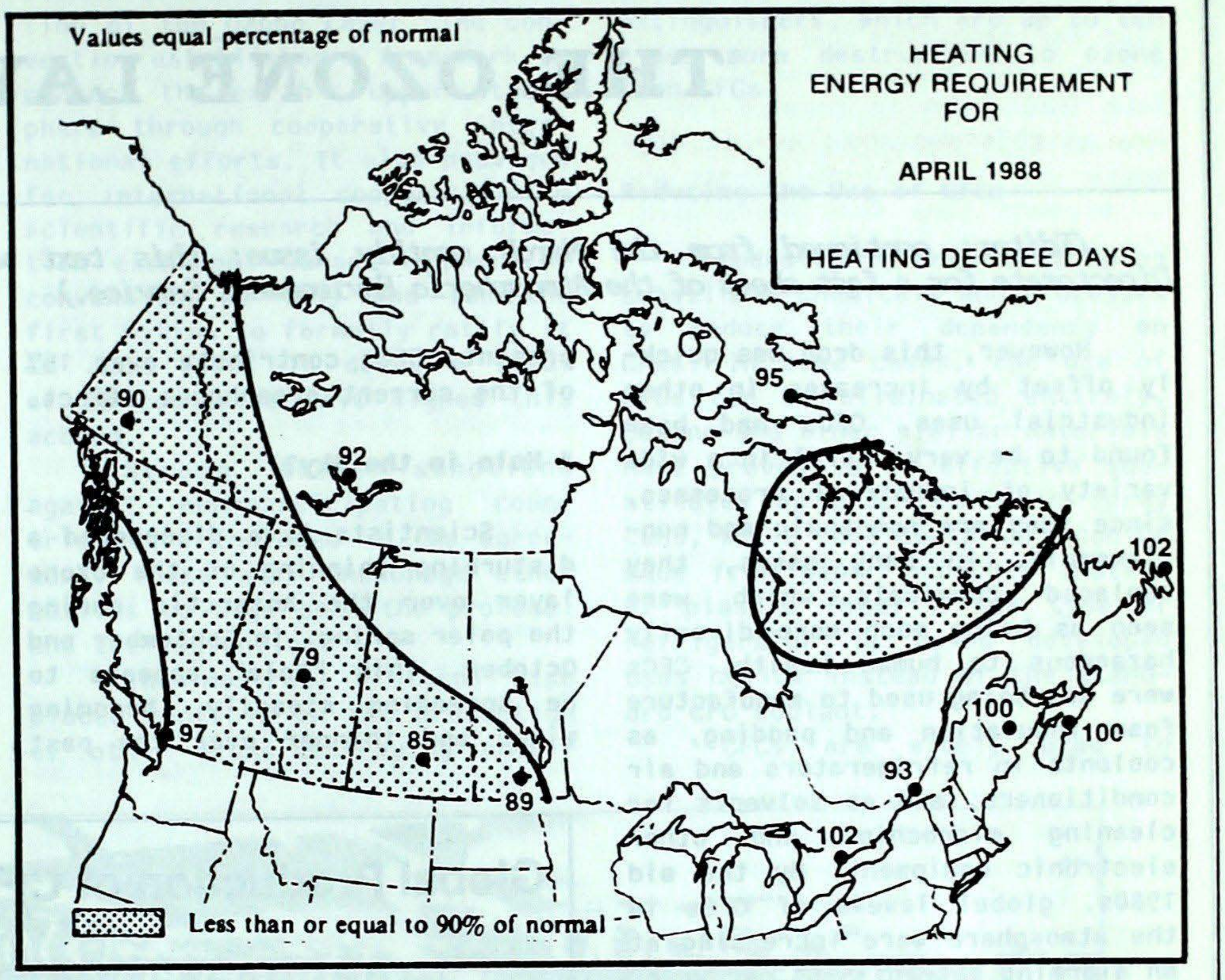


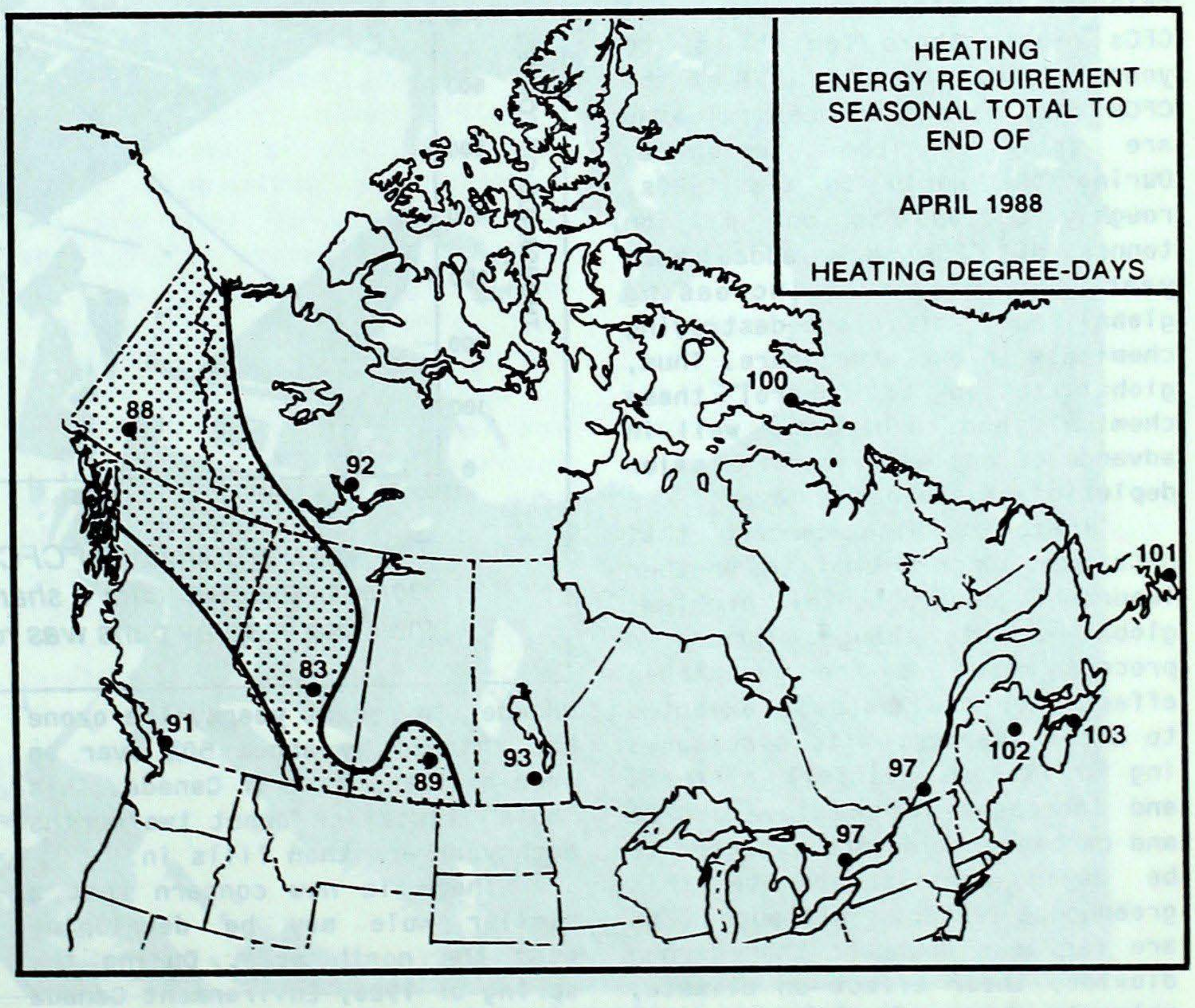
SEASONAL SNOWFALL TOTALS (CM) TO END OF APRIL

	1988	1987	NORMAL
YUKON TERRITORY			
Whitehorse	97.9	117.8	132.8
NORTHWEST TERRITORIES			
Cape Dyer	471.0	406.4	526.8
Inuvik	152.8	155.6	161.9
Yellowknife	180.4	139.2	131.5
BRITISH COLUMBIA			
Kamloops	33.3	57.3	91.5
Port Hardy	13.4	11.9	72.1
Prince George	204.7	151.1	239.5
Vancouver	12.0	2.0	60.4
Victoria	2.4	5.2	49.9
ALBERTA			
Calgary	54.0	81.7	142.2
Edmonton Namao	52.3	82.6	128.6
Grande Prairie	119.0	97.3	176.2
SASKATCHEWAN			
Estevan	39.6	84.6	114.2
Regina	52.5	145.2	118.5
Saskatoon	73.3	69.4	111.1
MANITOBA			
Brandon	59.8	106.3	114.8
Churchill	178.1	188.9	172.5
The Pas	157.1	127.8	164.0
Winnipeg	65.3	120.1	123.0
ONTARIO			
Kapuskasing	330.6	251.9	309.7
London	189.7	178.9	208.5
Ottawa	206.2	172.4	226.1
Sudbury	333.0	243.1	245.0
Thunder Bay	120.7	112.6	208.8
Toronto	78.4	124.0	131.1
Windsor	115.4	121.7	117.4
QUEBEC			
Baie Comeau	396.4	238.6	368.3
Montréal	165.6	201.0	233.4
Quebec	292.2	221.2	342.5
Sept-Iles	350.2	228.5	420.9
Sherbrooke	263.8	295.8	290.8
Val-d'Or	305.8	283.0	306.6
NEW BRUNSWICK			
Charlo	380.6	271.7	411.4
Fredericton	283.3	313.1	289.3
Moncton	431.7	*	339.0
NOVA SCOTIA			
Shearwater	197.6	200.6	196.8
Sydney	322.8	359.9	312.6
Yarmouth	164.0	234.8	207.4
PRINCE EDWARD ISLAND			
Charlottetown	411.1	307.5	328.5
NEWFOUNDLAND			
Gander	558.4	505.0	389.0
St. John's	257.8	431.4	346.8

SEASONAL TOTAL OF HEATING DEGREE-DAYS TO END OF APRIL

	1988	1987	NORMAL
BRITISH COLUMBIA			
Kamloops	3180	3076	3588
Penticton	3035	3032	3316
Prince George	*	4335	4972
Vancouver	2521	2451	2761
Victoria	2667	2602	2783
YUKON TERRITORY			
Whitehorse	5629	5654	6366
NORTHWEST TERRITORIES			
Iqaluit	8778	9511	8768
Inuvik	8418	9071	9336
Yellowknife	7338	7203	7941
ALBERTA			
Calgary	4237	4147	4928
Edmonton Mun	4353	4470	5223
Grande Prairie	4758	5166	5740
SASKATCHEWAN			
Estevan	4611	4296	5214
Regina	4975	4710	5566
Saskatoon	5173	4941	5737
MANITOBA			
Brandon	5307	5138	5688
Churchill	8108	7959	8193
The Pas	*	5678	6399
Winnipeg	5152	4935	5577
ONTARIO			
Kapuskasing	5899	5507	5924
London	3710	3599	3843
Ottawa	4301	4143	4435
Sudbury	4941	4636	5093
Thunder Bay	5144	4736	5310
Toronto	3733	3618	3850
Windsor	3336	3117	3420
QUEBEC			
Baie Comeau	5405	5333	5430
Montréal	4127	4169	4268
Quebec	4774	4690	4785
Sept-Iles	5509	5507	5548
Sherbrooke	4660	4667	4878
Val-d'Or	5680	5432	5711
NEW BRUNSWICK			
Charlo	4964	4996	4878
Fredericton	4472	4528	4387
Moncton	4418	4572	4347
NOVA SCOTIA			
Halifax	*	3907	3615
Sydney	4094	4340	3993
Yarmouth	3650	3710	3610
PRINCE EDWARD ISLAND			
Charlottetown	4304	4470	4205
NEWFOUNDLAND			
Gander	4544	4726	4481
St. John's	4249	4492	4192





THE OZONE LAYER

(Editor: continued from the March monthly issue; this text was prepared by the Communication Directorate for a fact sheet of the Atmospheric Environment Service.)

However, this drop was quickly offset by increases in other industrial uses. CFCs had been found to be very useful in a wide variety of industrial processes, since they are non-toxic and non-flammable. In many cases, they replaced chemicals which were seen as being much more directly hazardous to human health. CFCs were now being used to manufacture foam insulation and padding, as coolants in refrigerators and air conditioners, and as solvents for cleaning microchips and other electronic equipment. By the mid 1980s, global levels of CFCs in the atmosphere were increasing at an alarming rate of 5-6% per year.

The problem was further compounded by the fact that, once released in the atmosphere, most CFCs remain there for 75 to 100 years. Thus, virtually all of the CFCs that have ever been released are still in the atmosphere. During the early to mid 1980s, roughly 800,000 to one million tonnes of CFCs were added each year to this ever-increasing global pool of ozone-destroying chemicals in our atmosphere. Thus, global action to control these chemicals had to be taken well in advance of any evidence of a major depletion of the ozone layer.

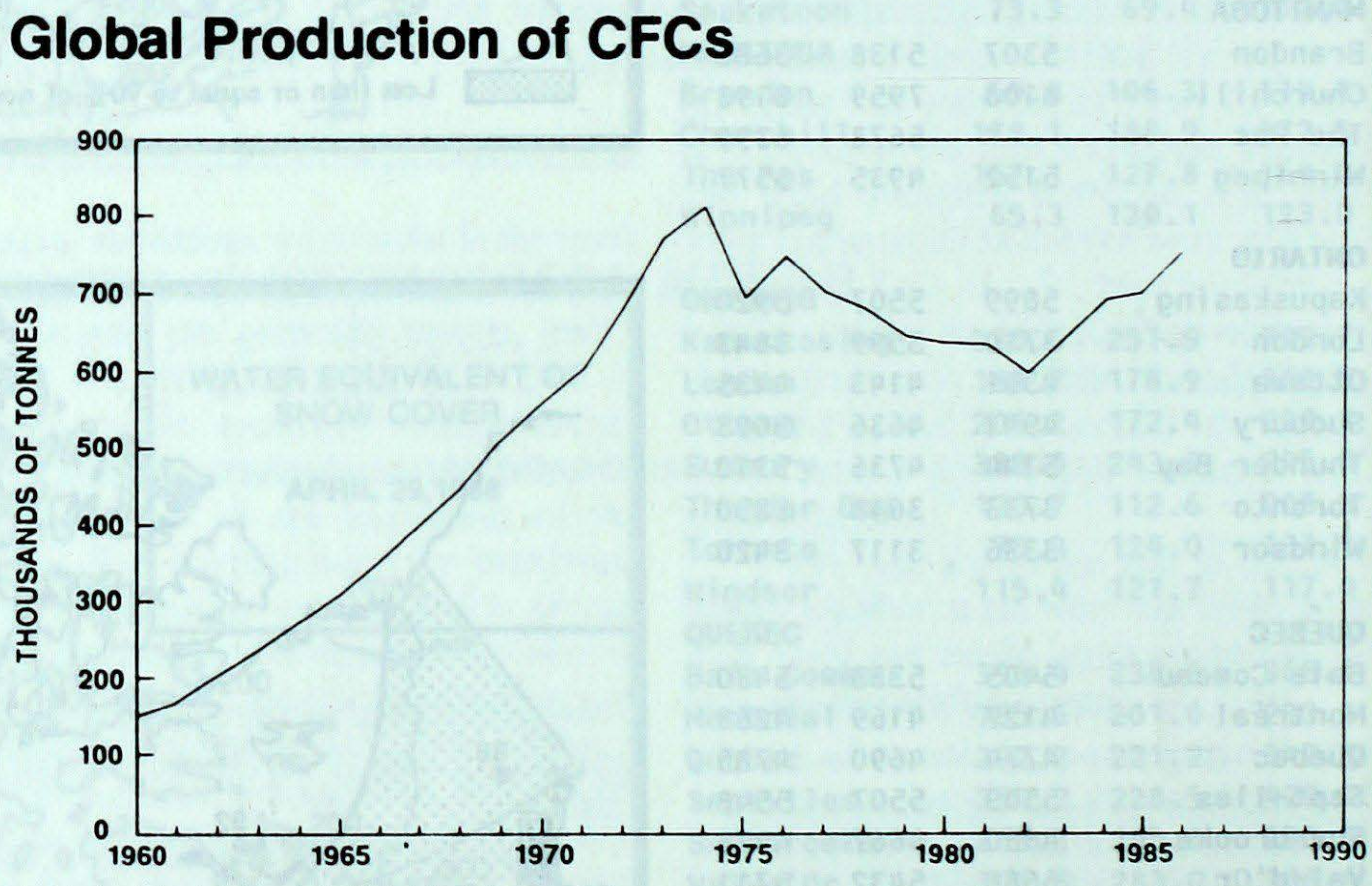
There is also concern that CFCs are contributing to another important environmental problem: global climate change. Through a process known as the greenhouse effect, world climate is expected to become warmer, with accompanying shifts in rainfall patterns and increases in sea level. CFCs and carbon dioxide are expected to be major contributors to this greenhouse effect. Although CFCs are far less abundant than carbon dioxide, their effect on climate, molecule for molecule, is about 10,000 times more powerful. At present, CFCs contribute over 15% of the current greenhouse effect.

A Hole in the Sky?

Scientists have discovered a disturbing thinning of the ozone layer over the Antarctic during the polar spring, in September and October. This "hole" appears to be spreading steadily, becoming wider and thinner over the past decade. In recent years, the ozone has thinned by about 50% over an area half the size of Canada. This "hole" lasts for about two months each year and then fills in.

There is now concern that a similar hole may be developing over the north pole. During the spring of 1986, Environment Canada scientists discovered a large thin area in the ozone over the Arctic which lasted for at least six weeks during March and April. Unlike the Antarctic hole, which remains relatively stationary, the Arctic hole was observed to shift about the north pole, being observed first over northern Europe and then moving over northern Canada, apparently following the movements of the cold polar air. The depleted area appears similar to the ozone hole over the Antarctic, but lesser in extent, being only about one third the size and one third the depth.

These ozone holes are of serious concern to scientists, as they were totally unexpected and remain unexplained. Although many theories have been proposed, increasing evidence is now pointing to CFCs as the cause of these depletions.



The world production of CFCs, which threaten the ozone layer, is increasing again, after a sharp decrease in the early 1970s, when their use in spray cans was restricted.

A Global Commitment

Rising concern over the ozone holes and the apparent steady loss of global ozone prompted the recent signing of an international accord to reduce the use of CFCs. In September 1987, 24 nations, including Canada, pledged to reduce the use of these chemicals by 50% by 1999. The agreement, known as the Montreal Protocol on Substances that Deplete the Ozone Layer, is the first accord of its kind and sets a global precedent for the safeguarding of both the environment and human health. The accord was developed under the United Nations Environment Programme and marks the cummulation of over five years of intensive international negotiations, in which Canada played a key role.

The Montreal Protocol was signed as an addition to the 1985 Vienna Convention for the Protection of the Ozone Layer. The convection established a framework to protect the earth's upper atmosphere through cooperative international efforts. It also provides for international cooperation in scientific research and information exchange. Canada signed the convention in 1985 and was the first nation to formally ratify it in June 1986. To date, a total of 28 countries have signed this accord.

Strong trade sanctions against non-participating countries were included in the agreement. These will encourage other nations to sign both the protocol and the convention.

The Montreal Protocol also placed controls on the production of other ozone-destroying chemicals. These include halons, a group of chemicals used in fire extinguishers, which are up to ten times more destructive to ozone than CFCs.

Reducing the Use of CFCs

Industry is now developing substitute chemicals and processes to reduce their dependency on CFCs. In some cases, the use of CFCs can be eliminated entirely. Butane and other similar materials have proven to be effective substitutes as propellants in spray cans, while food containers can be made from paper products instead of plastic foam. A new type of refrigerator is being developed uses helium instead of the standard CFC coolant.

CFCs are widely used to

Marc Garneau, Canada's first astronaut, studies the ozone layer from outer space during his historic flight in the U.S. space shuttle. He is taking readings with a "sunphotometer", an instrument designed by Environment Canada.

manufacture foam products - both soft foam padding, and rigid foam used for packaging and home insulation. The manufacture of rigid foam insulation is growing rapidly, as this material is now commonly used to insulate homes and to produce foam food containers, including egg cartons, meat trays and fast food containers. Industry is now developing ways to manufacture these products without the use of CFCs.

Subsitute chemicals have been developed for CFCs which present little or no threat to the ozone layer. These include fluorocarbon (CFC-like chemicals which contain no chlorine) and certain CFCs which are not as damaging to the ozone layer.

At present, the Montreal Protocol covers only those CFCs which are very stable and persist for long periods of time in the atmosphere. Other types of CFCs (known as HCFCs) break down rapidly in the lower atmosphere before they can reach the stratosphere. Since these do not pose as great a risk. They may be used on an interim basis as substitutes for the more damaging CFCs. Industry is now considering the use of a less damaging CFC in air conditioners and certain plastic foams.

While the protocol focuses on chemicals which threaten the ozone layer, there is also a sensitivity not to replace ozone-depleting CFCs with substances which will have a major impact as greenhouse gases.

Under the terms of the Montreal Protocol, industry must reduce the use of CFCs by 20% by 1994 and a further 30% by 1999. Will these actions fully protect the ozone layer? Unfortunately, scientists cannot yet answer this question. The earth's atmosphere is an extremely complex system which is not yet fully understood. For this reason, the protocol includes a provision to review scientific findings on the ozone layer every four years and to accelerate the reduction of ozone-destroying chemicals if necessary. The first review meeting is scheduled for 1990. Such flexibility is a very important feature of the protocol.

Keeping Watch on the Ozone Layer

The international scientific community is keeping close watch on our protective shield through a world-wide network of measuring stations, co-ordinated by the World Meteorological Organization. Environment Canada plays a leading role in this system by operating the World Ozone Data Centre. For over 20 years, this Canadian centre has collected data from the global network and distributed it to the world's scientists. Such information is essential for understanding long term change in the ozone layer.

Keeping tabs on a layer of invisible gases 25 km above the earth's surface is no easy task. Scientists at Environment Canada use a variety of techniques to study our protective shield. Huge helium-filled ballons - some as tall as 28 metres - carry measuring instruments to heights of up to 40 km. High altitude rockets are used as well. Measuring instruments have also been developed that are so sensitive they can take readings of the gases in the stratosphere from the surface of the earth, or from outer space.

Marc Garneau, Canada's first astronaut, studied the ozone layer from outer space during his historic flight on the U.S. space shuttle in 1984. He used a "sunphotometer" - a small compact instrument developed by Environment Canada to measure haze and gases in the atmosphere.

In recent years, satellite measurements have proved to be a most useful tool, by providing a comprehensive global overview of the ozone layer. Maps, developed from satellite data, clearly show fluctuations in the layer and could be a key factor in understanding the Antarctic ozone hole.

The global ozone measuring network relies mainly on ground-based instruments which measure the height and thickness of the ozone layer from the surface of the earth. As part of this network, Environment Canada operates stations at Toronto, Edmonton, Churchill, Goose Bay (Labrador) and Resolute (N.W.T.).

Environment Canada's Atmospheric Environment Service has perfected the design for a modern ground-based ozone measuring instrument - the Brewer Ozone Spectro-photometer. This is a unique, state-of-the-art instrument which is now being used to upgrade the global network of measuring stations. The new instrument has proved to be the world's most accurate ozone-measuring device, making measurements easier and more precise. In the future, this instrument is scheduled to fly on board the U.S. space shuttle, to measure the ozone layer from outer space.

Climatic factors affecting the survival and growth of winter wheat in Canada

Isaac Savdie, Application and imlact Division

Winter wheat, sometimes referred to fall wheat because it is planted in the fall, has traditionally been a major crop in southern Ontario. In 1986, 92% of all wheat production in this province was derived from winter wheat. In recent years, it is becoming increasingly prevalent on the southern Prairies where climatic conditions are the restrictive factor in further expansion of this valuable crop. It is produced as a minor crop in most other provinces. On a worldwide basis, 75% of wheat production is derived from winter wheat. Due to the severity of our climate only 6% of Canadian wheat crop is derived from winter wheat, but this proportion is gradually increasing as more climate tolerant varieties and new crop management techniques are developed.

Winter wheat has several distinct advantages over spring wheat, in fact, spring wheat is planted only as a second choice to winter wheat. Winter wheat is a high yielding crop, is an efficient user of snow melt, starts growing when spring crops are not even planted, is less likely to suffer from droughts (because of its earlier maturity), and protects the soil against wind and water erosion.

Winter wheat is planted in the fall and is harvested around mid to late July. The planting date is one of the most critical factors affecting its yield or even survival. If planted too early, the crop may be subjected to diseases that could devastate it. An early planting could result in an abundant growth which would get smothered under a heavy snow cover during the winter. On the other hand, a late planting date might not produce a strong enough plant with a well developed root system that would enable it to withstand the vagaries of winter and soil heaving during the freezing and thawing cycles. Figure 1 illustrates the impact of planting date on the survival and yield of winter wheat at Agriculture Canada research station at Lethbridge. Seeding depth is also an important factor in establishing the crop. Figure 2 illustrates the impact of three seeding depths on crop growth. Sometimes seeding into another crop, or in stubble, is used as a management technique to provide both additional insulation and promote snow catchment.

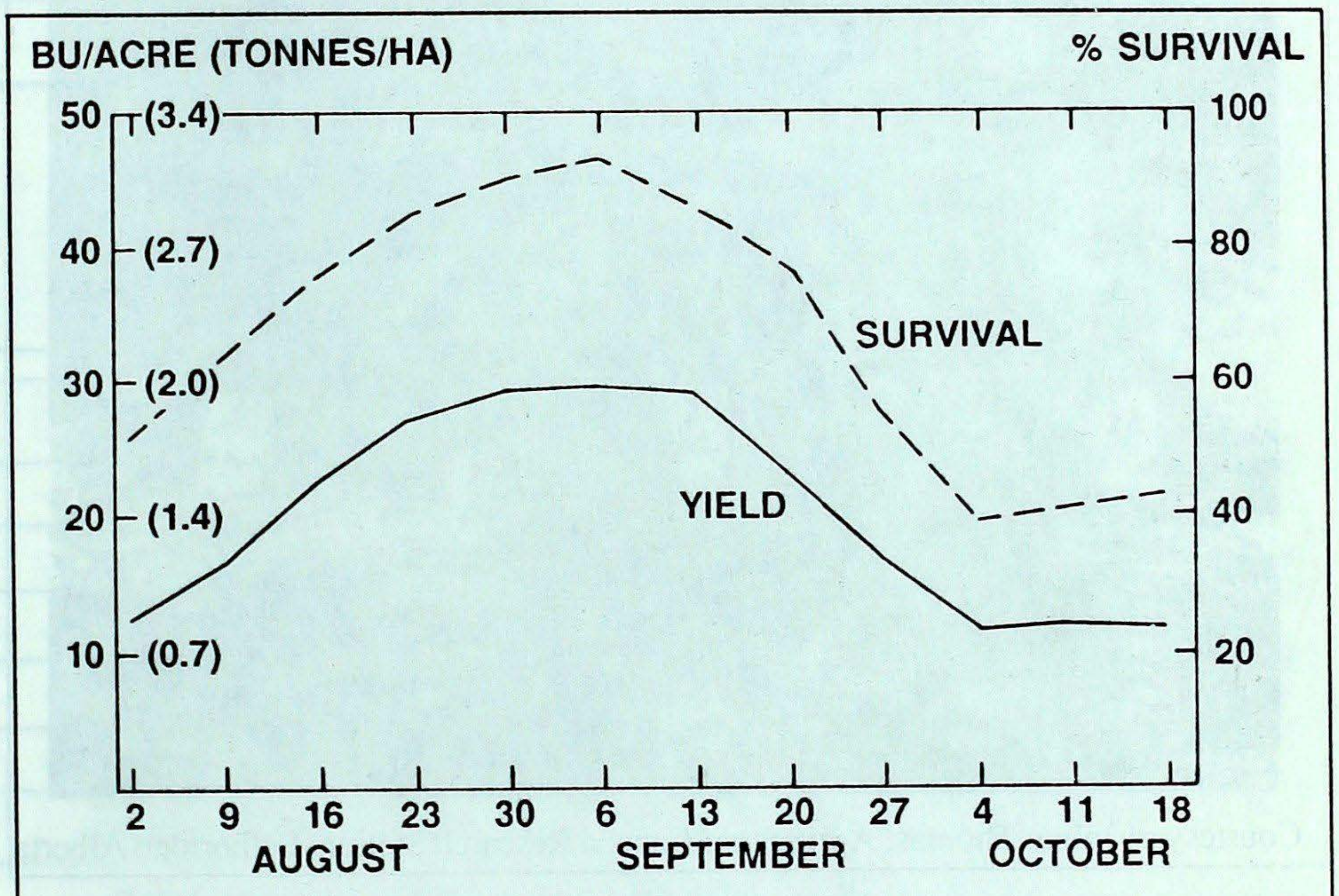


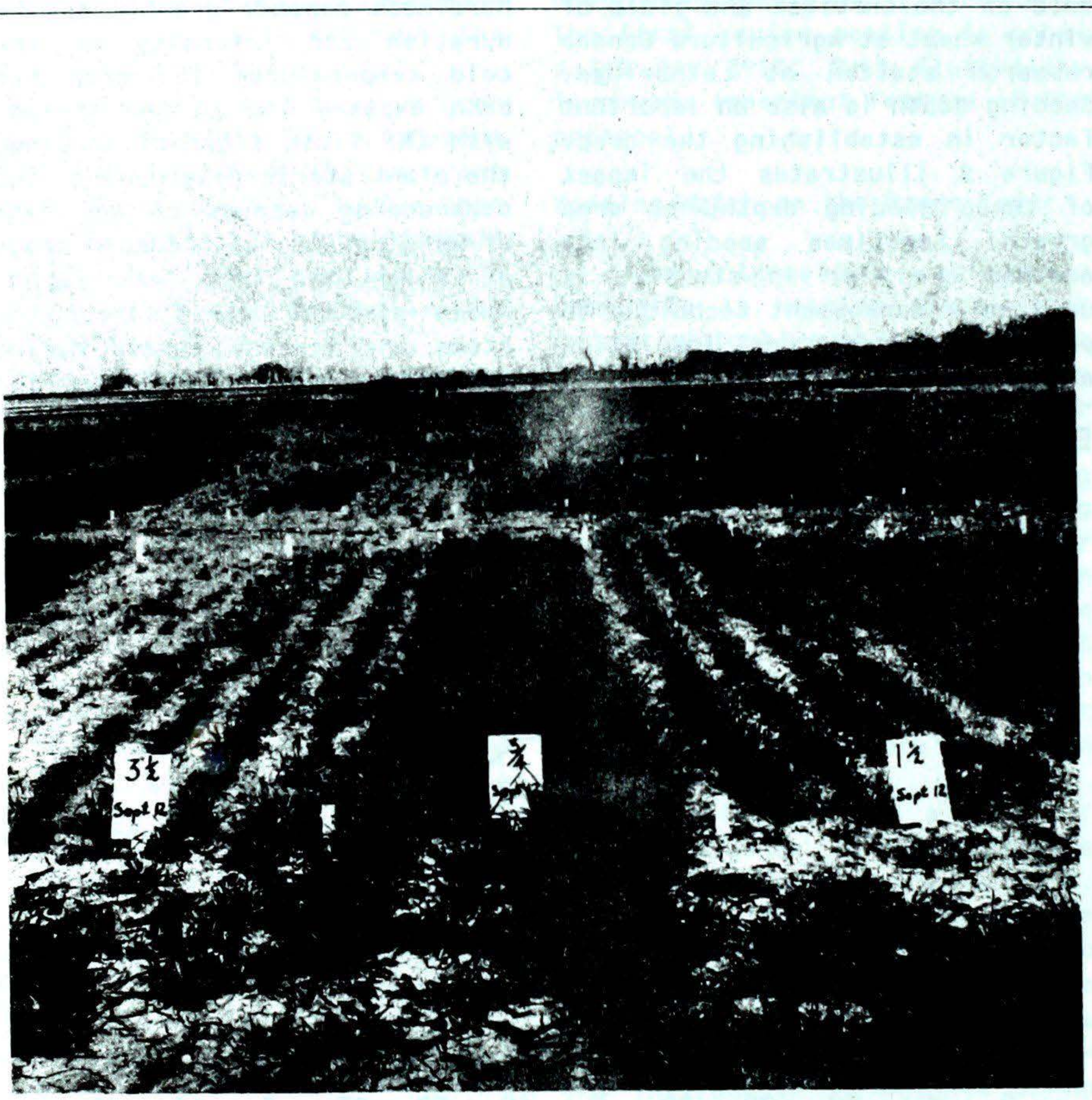
Figure 1

This crop will not reach maturity unless its vernalization requirement is met. Vernalization is a period during which the temperature must drop below 10°C during several days to promote floral induction. If this requirement is not met, the plant does not go beyond the vegetative stage. Vernalization is certainly not a problem in Canada, since winter temperatures in all major growing regions drop well below this threshold during the winter.

Late in the fall, winter wheat will harden and become dormant when gradually exposed to cold temperatures. The degree of hardiness depends greatly on the duration and intensity of the cold temperatures the crop has been exposed to. In the spring, with the first signs of warming, the plant starts dehardening. The dehardening depends on the rate of warming and the hardened stage at which the crop was found. While most of the tillers (the stems and leaves) formed during the fall die in the winter, the crown (the base of the plant which is rich in nutrients) becomes dormant and its survival during the winter in Canada depends on the protection it receives from the snow cover.

Snow, however, is a mixed blessing, for while it provides the badly needed protection the plant needs during the cold winter months, it promotes and fosters diseases during a protracted season. Snow mold, a disease which occurs under different forms, will develop when the temperature at the crown level is around freezing. The damage from snow mold could be devastating. Further south, snow is not needed for insulation because of the milder winters.

On the Canadian Prairies, winter wheat (which constitutes 3% of all wheat production in Western Canada) is produced primarily in Saskatchewan and southern Alberta, not only because of its good yield, but also to alleviate the soil erosion problem which is caused by strong winds eroding the most productive layer of the soil. However, strong winds can also blow snow and expose the winter wheat crop to the bitter cold winters of the Prairies which have no natural physical barriers against direct invasions of arctic air. On the local scale, this is evident at the top of hills which tend to be more exposed to higher winds. Strong winds can also desiccate young winter wheat growth during the early spring.



Courtesy of Julian Thomas, Agriculture Canada Research Station, Lethbridge Alberta

In Ontario, where winter wheat is mostly grown around the Lakes because of their moderating effect, the problem of soil freezing and thawing remains a serious one. Ice sheets that may form, particularly in low lying and poorly drained areas, after a mild spell followed by a cold arctic invasion, can smother the crop and cause its total loss if the sheet remains on the ground too long. A prolonged warm spell during the winter, or early spring, followed by a strong cold-air invasion can devastate the dehardened crop.

Winter wheat performs best in cool weather therefore its yield (per unit area) in Canada exceeds that of the United States. When mean monthly temperatures are above 18°C the rate of grain filling is reduced. Untimely precipitation during the reproductive stage will delay maturity and reduce yield. Excessive precipitation at maturity will degrade the quality of the crop. Excessive precipitation during the fall can delay seeding, although seeding from aircraft has been attempted in 1986 in Ontario during an abnormally wet fall.

There are essentially two types of winter wheat. Soft wheat which is used in pastry, requires a seasonal rainfall between 760 and 1200 mm, whereas precipitation for hard winter wheat, from which bread is made, should not exceed 760 mm. Both varieties require a minimum growing season of 90 days and an accumulated growing degree value of 1200 units. The mean temperature in January should not drop below -12°C, and the mean monthly temperature of at least one month during the winter should be less than 5°C in order to satisfy the vernalization requirement. Winter wheat requires in excess of 12 hours of daily sunshine. Long hours of sunshine are necessary for the photosynthesis process which generates the carbohydrates necessary for the crop development.

While precipitation is essential for the growth and development of the crop, long periods of high humidity with temperatures in the 15 to 22°C range can foster many leaf diseases such as powdery mildew, leaf rust, septoria leaf spot, and tan spot, all caused by fungi which become active when these conditions are met.

Statistics obtained recently from the Crop Insurance Commission of Ontario revealed that the most important cause of crop losses is due to winter kill (28% of all claims), followed by untimely excessive rain (20%), and drought (17%). Plant diseases account for about 4% of all losses. Hail and strong winds account together for about 1%.

In summary, winter wheat illustrates the intrinsic intimate relationship between crop yield, survival and climate. In spite of the risks involved, an understanding of the crop/climate interactions can help develop the crop management techniques and planning strategies needed to maximize yield and minimize damage. The growing of winter wheat in marginal regions such as the Canadian Prairies during the last ten years illustrates the success of such techniques.

APRIL 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									
BRITISH COLUMBIA													
ABBOTSFORD	9.9	1.2	24.6	-0.4	0.0		161.8	158	0	13	137	83	246.5
ALERT BAY	7.5	0.1	17.9	-0.8	3.0	272	114.2	136	0	13	X		316.1
AMPHITRITE POINT	8.6	0.6	14.9	1.0	0.8	100	243.9	119	0	12	X		280.7
BLUE RIVER	6.0	2.1	23.5	-8.4	5.6	62	78.8	173	0	13	160	95	*
BULL HARBOUR	6.7	-0.1	17.9	-0.8	0.8	32	127.8	101	0	13	X		338.0
CAPE SCOTT	7.3	0.1	13.9	12.1	11.0	314	151.9	81	0	13	X		323.8
CAPE ST.JAMES	7.0	0.5	13.5	0.1	7.4	296	94.8	89	0	15	174	*	329.2
CASTLEGAR	10.0	1.9	24.8	-4.4	0.0		43.4	98	0	9	167	96	240.7
COMOX	9.0	1.0	20.0	0.8			68.4	119	0	8	X		270.1
CRANBROOK	8.3	2.5	25.9	-4.8	3.0	30	18.0	70	0	6	230	*	289.8
DEASE LAKE	2.3	2.0	15.1	-11.9			12.6	102	0	5	186	97	469.9
ETHELDA BAY	6.1	-0.3	14.7	-2.6	1.0	16	216.0	89	0	14	X		355.8
FORT NELSON	3.3	1.7	21.0	-10.9	67.8	421	62.6	374	1	7	172	*	439.9
FORT ST.JOHN	5.4	2.5	20.8	-6.1	15.0	91	38.6	179	0	6	X		378.5
HOPE	9.8	0.5	24.5	-0.1	1.4	100	241.1	230	0	15	134	83	245.2
KAMLOOPS	11.4	2.3	28.4	-5.0			17.4	167	0	3	220	110	198.9
KELOWNA	9.8	2.3	26.2	-6.1	0.8	80	62.7	354	0	9	205	100	245.5
LANGARA	5.9	0.1	11.7	0.5	3.8	82	168.2	139	0	20	X		362.1
LYTTON	10.7	1.4	26.5	-2.1			27.2	146	0	5	180	88	219.6
MACKENZIE	3.7	1.3	18.3	-10.8	18.2	170	35.0	132	0	7	203	98	428.3
MCINNES ISLAND	7.5	0.3	14.8	0.7	4.0	81	125.5	71	0	13	X		313.6
PENTICTON	10.4	1.8	25.3	-4.6	1.0	500	65.6	306	0	7	197	93	227.2
PORT ALBERNI	9.2	*	24.2	-1.8	2.0	*	182.7	*	0	10	153	*	262.0
PORT HARDY	6.8	0.2	17.2	-0.5			128.3	119	0	13	140	97	333.3
PRINCE GEORGE	6.1	1.8	19.8	-6.7	13.6	137	39.5	144	0	7	218	107	356.3
PRINCE RUPERT	5.8	0.4	14.4	-2.6	12.1	165	134.2	70	0	14	177	131	362.9
PRINCETON	8.1	1.9	26.9	-5.5	4.2	120	59.6	402	0	6	208	*	*
QUESNEL	7.6	2.2	22.9	-5.6	14.4	351	40.0	172	0	9	X		313.8
REVELSTOKE	8.4	2.0	22.8	-4.1	15.0	84	110.5	186	0	13	170	95	288.5
SANDSPIT	6.5	0.5	12.7	-0.4	4.4	209	122.6	145	0	14	164	105	345.4
SMITHERS	6.7	2.5	20.3	-6.4	10.6	151	16.6	94	0	7	210	118	372.1
TERRACE	6.5	0.8	18.3	-3.2	8.0	66	34.2	55	0	10	188	126	344.3
VANCOUVER HARBOUR											X		
VANCOUVER INT'L	9.6	0.8	19.1	1.2	0.0		91.2	153	0	9	167	92	251.4
VICTORIA GONZ. HTS	9.9	0.8	19.4	2.5	0.0		46.5	152	0	8	209	103	241.4
VICTORIA INT'L	8.9	0.5	20.0	-0.2	0.0		63.4	161	0	8	196	108	271.8
VICTORIA MARINE	8.5	0.5	17.7	0.9			123.5	174	0	12	X		286.6
WILLIAMS LAKE	6.4	2.0	22.6	-6.1	33.0	340	59.5	276	0	10	189	90	345.3

1988

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	Mean	Difference from Normal	Maximum	Minimum									
YUKON TERRITORY													
DAWSON	0.4	2.3	19.1	-21.7	1.1	11	6.9	73			X X		
MAYO	3.0	3.4	18.0	-13.3	3.2	42	4.0	46	0	1	X		451.3
WATSON LAKE	1.1	1.7	15.4	-19.8	17.6	127	20.7	137		5	215	99	505.3
WHITEHORSE	2.0	1.7	14.3	-13.3	0.2	1	3.5	36	0	1	227	98	480.0
NORTHWEST TERRITORIES													
ALERT	-19.6	5.3	-4.3	-39.7	15.4	197	8.2	107	39	4	268	68	1129.2
BAKER LAKE	-15.7	1.6	0.4	-28.9	27.6	202	8.6	62	75	4	222	94	1011.9
CAMBRIDGE BAY	-19.0	2.9	-2.7	-36.7	3.4	41	2.2	30	35	1	275	109	1111.7
CAPE DYER	-12.7	2.7	-1.4	-30.3	13.2	26	11.8	26	71	5	X		921.7
CAPE PARRY	-13.4	5.3	-0.8	-33.3	6.0	45	3.6	37	9	0	X		941.7
CLYDE	-15.8	2.6	-0.6	-34.3	21.4	156	14.2	104	34	4	233	93	1017.4
COPPERMINE	-13.6	3.9	1.8	-37.6	1.0	9	1.0	9	36	0	254	117	948.2
CORAL HARBOUR	-13.1	3.2	0.4	-27.3	22.4	155	22.4	163	17	9	219	78	938.4
EUREKA	-21.5	6.1	-6.3	-42.4	7.0	241	4.0	148	14	1	297	83	1184.3
FORT RELIANCE	-8.9	0.7	8.9	-23.7	22.5	170	15.7	124	40	2	X		807.6
FORT SIMPSON	0.6	3.1	17.6	-16.3	6.0	51	6.2	42	0	3	181	81	522.2
FORT SMITH	-0.8	1.4	16.2	-16.5	8.9	65	10.9	67		5	237	97	562.9
IQALUIT	-12.7	1.6	3.0	-30.5	13.0	45	12.2	46	36	4	224	95	920.1
HALL BEACH	-17.2	3.7	-1.9	-36.1	6.8	59	5.2	47	38	1	X		1056.4
HAY RIVER	-2.1	2.1	14.9	-16.6	12.2	93	17.2	108	7	4	X		601.2
INUVIK	-10.3	4.0	11.8	-35.3	8.3	51	7.9	53	17	3	253	101	849.4
MOULD BAY	-19.0	5.1	-5.0	-36.3	6.6	113	5.4	108	19	1	217	75	1109.2
NORMAN WELLS	-4.0	3.2	15.6	-27.3	8.2	53	5.4	35		1	242	102	658.2
POND INLET	-17.5	4.5	-1.6	-35.5	9.2	55	7.8	59	12	4	X		1065.3
RESOLUTE	-18.6	4.5	-5.8	-38.1	7.6	116	6.9	116	17	2	263	95	1100.0
YELLOWKNIFE	-4.7	2.2	9.9	-18.3	23.2	236	21.6	209	14	4	220	82	685.1
ALBERTA													
BANFF	5.0	2.6	24.0	-10.5	15.2	48	47.0	125	0	12	X		
CALGARY INT'L	6.4	3.1	23.6	-7.1	0.6	2	1.5	4	0	0	278	135	349.8
COLD LAKE	5.2	2.3	25.0	-6.8	0.4	3	23.9	110	0	4	278	121	383.4
CORONATION	5.4	2.4	23.4	-9.8			0.2	0	0	0	281	121	377.4
EDMONTON INT'L	6.0	2.8	23.4	-11.0	0.4	3	22.1	109	0	3	295	126	360.6
EDMONTON MUNI.	7.3	3.1	23.5	-6.0			14.6	67	0	3	296	129	321.2
EDMONTON NAMAO	6.4	2.5	23.5	-8.3			18.2	101	0	3	X		349.0
EDSON	5.4	3.5	23.5	-10.5			8.0	30	0	2	265	129	377.3
FORT CHIPEWYAN	-1.4	-0.1	18.5	-19.0	37.8	161	47.6	244	1		X		

APRIL 1988

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FORT MCMURRAY	3.9	1.8	25.6	-12.7	28.7	212	28.0	136	0	6	261	112	424.2
GRANDE PRAIRIE	6.5	3.8	23.4	-5.7	0.7	5	4.2	21	0	2	249	*	343.9
HIGH LEVEL	2.7	1.9	21.2	-13.5	21.3	146	26.9	154	3	6	205	83	458.2
JASPER	6.0	2.7	25.0	-8.0	8.2	75	27.5	121	0	9	215	*	359.5
LETHBRIDGE	7.7	2.8	25.7	-7.8			0.3	0	0	0	289	146	310.5
MEDICINE HAT	8.3	2.7	26.8	-7.9	0.9	4	0.9	2	0	0	305	151	291.2
PEACE RIVER	6.3	4.2	24.1	-5.9	5.4	56	20.7	144	0	5	X		350.8
RED DEER	7.3	4.2	23.0	-8.8	1.0	5	5.0	18	0	2	X		364.6
ROCKY MTN HOUSE	5.1	2.1	22.3	-8.1	1.4	4	11.4	33	0	2	X		387.8
SLAVE LAKE	6.5	4.0	21.9	-5.5	8.8	95	28.2	161	0	3	266	114	378.6
SUFFIELD	7.6	2.4	26.6	-7.8	0.2	1	0.4	1	0	0	302	144	313.4
WHITECOURT	6.1	3.4	23.0	-6.6			13.1	48	0	2	X		339.0
SASKATCHEWAN													
BROADVIEW	5.0	2.5	27.5	-8.6	9.6	67	22.9	82	0	3	285	136	389.7
COLLINS BAY	-4.6	-0.7	*	-10.2	78.0	237	65.7	224	21	13	172	*	693.6
CREE LAKE	-3.4	-1.6	18.2	-23.3	39.1	207	38.4	176	5	7	230	95	642.1
ESTEVAN	6.5	2.4	28.1	-8.9	1.0	6	9.3	26	0	3	30	14	344.3
HUDSON BAY													
KINDERSLEY	5.7	1.9	24.7	-8.1	13.6	124	7.2	33	0	2	X		938.5
LA RONGE	0.4	0.0	25.3	-16.4	12.2	88	13.0	65		1	X		530.6
MEADOW LAKE	3.8	0.2	26.5	-8.5	0.8	8	8.0	36	0	2	279	*	425.8
MOOSE JAW	6.0	1.8	26.9	-9.5			5.7	19	0	2	290	132	360.0
NIPAWIN	5.6	*	29.3	-9.2	2.0	*	1.0	*	0	0	256	*	452.6
NORTH BATTLEFORD	5.6	2.6	25.0	-9.0			1.2	5	0	0	X		373.2
PRINCE ALBERT	4.0	2.1	28.1	-8.6	3.7	33	4.3	19	0	1	269	120	422.3
REGINA	5.5	2.2	26.5	-10.4	0.4	3	15.6	65	0	3	291	139	374.4
SASKATOON	5.1	1.8	26.4	-9.4	1.2	12	1.8	8	0	1	X		388.5
SWIFT CURRENT	5.6	2.1	24.8	-9.7	2.6	16	4.6	16	0	1	281	134	376.3
											X		
WYNYARD	4.8	2.3	26.9	-9.2	3.0	21	10.5	43	0	4	288	125	395.8
YORKTON	4.1	1.9	27.4	-12.0	19.4	148	34.2	154	0	4	263	117	409.9
MANITOBA													
BRANDON	4.7	1.9	28.3	-12.2			5.2	15	0	2	X		400.6
CHURCHILL	-8.8	1.3	6.7	-23.9	66.8	299	65.2	284	43	10	140	68	759.9
DAUPHIN	4.4	2.1	27.8	-12.6	18.9	115	31.0	97	0	4	248	111	413.2
GILLAM	-4.2	2.4	21.3	-20.2	38.6	100	31.4	84	2	10	X		666.1
GIMLI	3.4	2.0	23.0	-10.3	1.8	11	9.0	23	0	5	287	115	438.3
ISLAND LAKE	-0.6	2.6	24.0	-17.9	24.6	88	27.4	66		8	X		556.1
LYNN LAKE	-3.8	-0.3	20.9	*	47.4	200	27.9	120	3	7	190	82	653.0
NORWAY HOUSE	-0.2	*	23.3	-18.4	12.9	*	19.4	*	0	3		*	544.6
PILOT MOUND											X		
PORTAGE LA PRAIRIE	5.8	2.6	27.5	-10.0	2.8	24	3.4	7	0	1	X		368.8
THE PAS	1.1	1.1	24.6	-16.2	22.9	118	22.6	82	0	4	194	85	508.5
THOMPSON	-2.3	1.4	25.5	-21.8	25.4	83	40.1	119	0	9	165	71	607.0
WINNIPEG INT'L	5.1	1.7	26.0	-13.2	0.4	3	0.8	2	0	0	298	135	389.3
ONTARIO													
ATIKOKAN	2.7	0.6	22.2	-17.5	2.4	11	9.4	20	0	2	254	122	460.0
BIG TROUT LAKE	-1.2	2.6	22.4	-16.9	24.4	*	24.0	85		7	173	*	576.9
EARLTON	2.3	0.4	17.7	-9.1	13.9	71	110.5	221	0	12	X		471.4
GERALDTON	0.7	1.2	22.4	-19.1	19.2	123	32.8	75		5	X		519.3
GORE BAY	4.4	0.7	18.0	-5.6	4.6	42	69.2	105	0	12	X		408.3
HAMILTON RBG	6.5	-0.5	17.5	-1.7			59.6	77	0	11	188	*	
HAMILTON	5.9	-0.2	18.0	-4.4	1.0	15	54.4	68	0	9	X		361.6
KAPUSKASING	1.4	0.9	19.0	-12.3	17.4	69	42.8	80		8	X		499.1
KENORA	3.9	1.2	24.2	-9.4	1.8	8	3.0	7	0	1	X		243.0
KINGSTON	6.0	0.5	20.7	-2.4	1.4	18	79.6	113	0	12	130	64	360.1
LANSDOWNE HOUSE	0.6	2.9	23.6	-17.5	17.7	54	17.3	42		5	X		524.4
LONDON	6.6	0.2	19.7	-3.4	6.4	70	62.9	77	0	12	173	103	342.6
MOOSONEE	-1.2	1.1	15.2	-16.4	32.6	153	64.5	152	2	8	159	91	576.0
MUSKOKA	4.8	0.3	15.9	-5.0	9.9	82	92.4	126	0	17	X		394.3
NORTH BAY	3.9	0.7	18.4	-9.7	12.0	72	77.0	123	0	14	158	80	422.2
OTTAWA INT'L	6.0	0.4	15.6	-2.6	2.4	29	91.6	132	0	14	142	*	360.7
PETAWAWA	4.9	0.7	18.8	-5.7	20.2	336	88.0	147	0	13	X		396.5
PETERBOROUGH	5.9	-0.1	18.0	-4.3	0.4	6	70.8	98	0	10	X		364.6
PICKLE LAKE	1.4	1.9	23.5	-15.7	1.8	6	1.9	4		1	X		510.4
RED LAKE	2.5	1.1	23.9	-11.2	4.6	24	9.4	27	0	2	237	*	465.0
ST. CATHARINES	6.7	-0.5	17.2	-2.2	1.6	48	59.2	78	0	8	X		339.2
SARNIA	6.6	-0.5	21.8	-2.7	0.8	13	60.0	66	0	12	195	101	341.6
SAULT STE. MARIE	3.4	0.3	16.9	-5.5	14.1	141	63.1	97	0	11	200	102	438.9
											X		
SIOUX LOOKOUT	2.5	1.1	23.1	-13.0	3.6	14	4.0	8	0	2	X		465.2
SUDBURY	3.3	0.6	17.2	-10.4	12.0	76	77.1	126	0	10	148	71	440.9
THUNDER BAY	3.8	1.3	21.4	-10.1	4.4	27	13.4	26	0	4	253	117	425.8
TIMMINS	1.7	0.7	17.9	-9.8	17.6	77	46.2	94	0	6	X		489.5
TORONTO	7.2	-0.4	16.6	-1.0			60.2	82	0	10			322.7
TORONTO INT'L	5.9	-0.3	18.0	-3.0			55.2	78	0	10	X		362.7
TORONTO ISLAND	6.4	0.2	15.1	-1.0	0.2	2	61.3	92	0	10			346.9
TRENTON	6.3	-0.1	18.4	-5.1			58.8	77	0	11	X		350.5
WATERLOO-WELL	5.8	-0.2	18.6	-4.1	1.0	14	58.9	76	0	9	X		365.9
WAWA	2.1	*	18.6	-9.4	9.6	*	48.6	*	0	7		*	476.6
WIARTON	4.6	-0.1	17.9	-4.1	7.7	71	93.0	134	0	9	190	98	386.8
WINDSOR	8.5	0.4	24.1	-1.5	1.0	23	54.1	65	0	11	X		284.2

APRIL 1988

STATION	Temperature C: Mean	Temperature C: Difference from Normal	Temperature C: Maximum	Temperature C: 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
QUEBEC													
BAGOTVILLE	3.2	1.0	14.9	-7.8	8.6	43	65.0	135	0	12	X		444.0
BAIE COMEAU	1.6	1.2	8.3	-6.2	63.4	216	96.4	149		14	155	*	491.0
BLANC SABLON	3.9	4.8	10.2	-6.6	17.8	44	27.1	37	0	7	112	*	
CHIBOUGAMAU	1.3	2.4	11.9	-11.0	36.0	162	50.2	97		10	123	65	503.0
GASPE	3.6	2.7	13.8	-9.0	62.6	163	153.6	185		14	122	*	500.1
INUKJUAK	-6.2	4.7	5.0	-26.2	14.6	109	19.0	130	47	5	149	83	726.4
KUUJJUAQ	-4.9	4.3	10.5	-20.8	10.6	48	20.0	86	2	4	170	86	669.4
KUUJJUARAPIK	-2.0	4.8	15.6	-35.7	8.2	37	16.4	60	3	5	138	74	600.6
LA GRANDE RIVIERE	-1.3	*	15.9	-17.0	4.8	*	24.2	*	0	4	159	*	577.5
MANIWAKI	4.5	0.9	16.0	-4.9	19.0	158	92.2	153	0	14	123	64	407.0
MATAGAMI	0.1	1.8	15.5	-13.9	33.6	144	52.1	129	0	7	168	91	538.9
MONT JOLI	1.6	0.0	10.5	-7.7	22.2	79	56.2	100	0	13	135	87	491.4
MONTREAL INT'L	6.7	1.0	17.6	-2.0			78.8	106	0	13	125	66	339.8
MONTREAL M INT'L	5.6	*	16.5	-2.7	0.2	*	84.6	*	0	10	155	*	372.4
NATASHQUAN	1.0	1.5	8.2	-8.2	60.8	203	82.8	109	2	9	167	102	
QUEBEC	3.8	0.5	13.3	-3.8	0.8	4	82.8	113	0	12	121	70	426.0
ROBERVAL	2.7	1.0	13.0	-7.1	14.9	67	84.6	178	0	12	130	*	459.5
SCHEFFERVILLE	-4.8	2.4	9.8	-20.8	55.2	135	57.6	126	71	10	181	*	683.9
SEPT-ILES	1.0	1.0	7.7	-8.3	64.0	193	103.2	131	0	11	148	79	510.9
SHERBROOKE	5.1	1.5	15.2	-5.3	14.9	63	58.5	78	0	13	120	*	387.7
STE AGATHE DES MONTS	3.6	1.4	13.2	-4.9	9.6	47	112.2	134	0	12	141	73	430.8
ST-HUBERT	6.0	0.3	18.9	-4.5	0.4	3	83.2	111	0	14			358.8
VAL D'OR	1.4	0.5	15.4	-10.9	28.8	133	82.6	162	0	10	145	78	497.7
NEW BRUNSWICK													
CHARLO	2.2	0.9	12.0	-7.0	24.6	71	86.7	105	0	15	140	86	473.1
CHATHAM	2.8	-0.2	16.5	-6.6	42.8	129	113.8	134	0	16	91	52	455.4
FREDERICTON	4.2	0.1	15.6	-6.9	31.3	145	76.3	95	0	12	113	*	415.6
MONCTON	2.5	-0.5	16.2	-7.8	70.0	246	182.1	202	0	16	98	61	464.7
SAINT JOHN	3.4	0.2	17.1	-6.8	42.0	202	123.4	115	0	11	119	75	437.5

STATION	Temperature C: Mean	Temperature C: Difference from Normal	Temperature C: Maximum	Temperature C: 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
NOVA SCOTIA													
GREENWOOD	4.4	-0.2	17.9	-7.4	13.5	77	100.8	133	0	14	X		407.9
HALIFAX INT'L	3.4	0.1	14.8	-5.5	23.2	96	227.5	198	0	17	*		438.2
SABLE ISLAND	3.8	0.5	11.2	-0.4	5.0	81	273.4	278	0	16	110	81	425.7
SHEARWATER	3.8	-0.2	14.2	-4.0	7.6	58	190.0	189	0	17	121	73	425.6
SYDNEY	1.9	-0.1	11.6	-6.4	36.6	144	267.2	261	0	16	118	75	482.1
YARMOUTH	4.6	-0.1	16.8	-3.9	4.4	67	118.6	123	0	12	140	78	400.7
PRINCE EDWARD ISLAND													
CHARLOTTETOWN	2.1	-0.2	11.6	-4.9	45.4	166	113.0	138	0	14	X		476.0
SUMMERSIDE	2.4	-0.2	11.7	-4.5	41.0	170	104.7	138	0	13	108	67	469.3
NEWFOUNDLAND													
BATTLE HARBOUR	-0.9	1.4	5.8	-11.0	21.9	49	25.5	46	91	6	X X		568.1
BONAVISTA	1.0	0.4	10.9	-6.1	51.4	229	117.4	181		15	X		511.6
BURGEO	2.9	1.3	10.3	-2.4	0.0		138.7	109	0	10	*		451.2
CARTWRIGHT	-0.9	1.7	10.0	-11.9	34.4	59	32.5	40	90	9	151	117	557.8
CHURCHILL FALLS	-2.4	2.6	11.2	-18.1	40.9	78	40.7	66	60	7	216	139	612.0
COMFORT COVE	0.9	0.0	11.0	-7.2	66.9	144	96.1	106	3	13	X		511.8
DANIEL'S HARBOUR	2.8	2.5	11.5	-6.0	0.8	2	8.0	15	0	0	73	54	605.6
DEER LAKE	2.4	1.6	14.8	-9.9	30.2	101	61.9	104		12	X		467.2
GANDER INT'L	1.3	0.4	11.7	-6.9	73.8	156	111.0	119		13	110	94	499.2
GOOSE	0.4	2.1	15.0	-12.9	7.3	15	7.9	12	4	2	173	123	527.6
PORT-AUX-BASQUES	2.4	1.6	10.2	-4.4	10.8	45	150.6	161	0	11	129	*	467.9
ST ANTHONY	-1.1	0.8	4.2	-6.7	18.4	43	30.8	33	22	6		*	573.4
ST JOHN'S	0.9	-0.3	11.2	-5.2	17.1	49	159.1	137	0	14	102	88	512.5
ST LAWRENCE	2.6	1.5	10.6	-4.2	21.1	114	205.1	196	0	13		*	
STEPHENVILLE	4.1	2.3	13.4	-5.8	2.2	10	44.2	74	0	9	142	*	418.2
WABUSH LAKE	-2.4	3.2	10.8	-18.2	48.3	98	43.5	83	8	8	225	*	652.3

AGROCLIMATOLOGICAL STATIONS APRIL 1988

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	10.2	0.7	23.0	-1.0	0.0	193.9	175	0	16	143	158.9	279.6
SIDNEY	9.3	*	19.5	0.5	0.0	74.9	*	0	11	172	117.8	200.9
SUMMERLAND	10.7	2.0	24.0	-2.5	0.0	56.6	289	0	8	201	171.7	213.3
ALBERTA												
BEAVERLODGE	7.0	5.1	23.0	-6.0	0.0	5.0	26	0	2	240	66.5	71.5
ELLERSLIE												
LACOMBE	6.0	2.9	23.5	-10.0	0.0	3.4	14	0	1	298	48.0	52.6
LETHBRIDGE												
VEGREVILLE	7.5	4.4	24.0	-11.0	0.0	18.3	130	0	3	N/A	56.6	60.4
SASKATCHEWAN												
INDIAN HEAD	5.3	2.2	27.0	-10.0	10.4	40.2	142	0	3		*	58.0
MELFORT	3.2	1.9	29.0	-8.0	2.0	2.0	11	0	1	230	37.5	37.5
REGINA	4.3	1.3	27.0	-12.0	0.0	24.3	102	0	3	N/A	41.0	41.3
SASKATOON	5.7	2.3	28.0	-8.0	3.2	0.3	1	0	1	258	69.0	69.0
SCOTT	4.9	2.2	24.5	-10.0	0.0	0.4	2	0	0	292	42.9	42.9
SWIFT CURRENT SOUTH	6.1	2.1	25.0	-9.0	1.2	1.7	7	0	1	245	*	80.6
MANITOBA												
BRANDON	5.7	2.4	29.0	-13.0	0.0	3.0	8	0	1	N/A	79.1	79.4
GLENLEA	5.3	1.9	26.0	-13.0	0.2	0.2	1	0	0	290	78.5	78.5
MORDEN	6.9	2.9	27.0	-9.0	TR	TR	0	0	0	282	104.5	105.5
ONTARIO												
DELHI	6.9	0.2	20.5	-4.0	5.6	73.4	78	0	11	183	73.3	96.9
ELORA	5.0	-0.1	17.9	-4.3	0.0	68.2	97	0	11	N/A	37.5	48.0
GUELPH	5.7	-0.1	18.1	-5.0	0.0	55.3	75	0	11	161	49.1	64.6
HARROW	8.1	0.3	21.5	-2.5	0.0	49.2	61	0	9	206	100.2	129.3
KAPUSKASING	0.7	0.2	18.0	-14.0	19.7	42.2	87	0	8	184	4.0	4.0
OTTAWA	6.1	0.4	15.5	-1.8	7.1	92.3	142	0	14	142	47.9	56.5
SMITHFIELD	6.5	0.4	16.6	-4.9	0.0	38.5	47	0	10	N/A	65.8	80.3
VINELAND STATION	6.1	0.8	16.9	-2.4	0.6	49.6	69	0	11	160	48.2	78.3
QUEBEC												
LA POCATIERE	3.1	0.3	13.0	-6.0	3.0	89.6	141	0	12	139	3.5	3.5
L'ASSUMPTION	5.8	0.3	17.0	-7.0	0.0	82.8	115	0	17	123	40.3	43.6
LENNOXVILLE												
NORMANDIN	2.0	1.5	13.0	-11.5	12.2	90.6	186	0	14	132	2.5	2.5
ST. AUGUSTIN												
STE CLOTHILDE	6.5	0.8	18.0	-3.0	0.0	95.8	124	0	14	133	56.1	72.8
NEW BRUNSWICK												
FREDERICTON	4.8	0.8	16.0	-6.0	0.0	62.1	75	0	11	113	20.3	28.6
NOVA SCOTIA												
KENTVILLE	4.4	0.0	17.0	-5.5	14.8	137.6	167	0	18	105	23.8	42.4
NAPPAN	3.3	0.0	14.0	-7.5	68.5	147.8	196	0	15	114	15.2	29.5
PRINCE EDWARD ISLAND												
CHARLOTTETOWN	2.6	-0.2	11.0	-5.0	30.0	117.2	150	0	11	115	4.9	7.9
NEWFOUNDLAND												
ST. JOHN'S WEST	1.7	0.1	11.0	-5.0	16.0	186.3	148	0	13	92	5.9	5.9