Environment Canada Environnement Canada

Climatic Perspectives

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

CLIMATIC HIGHLIGHTS

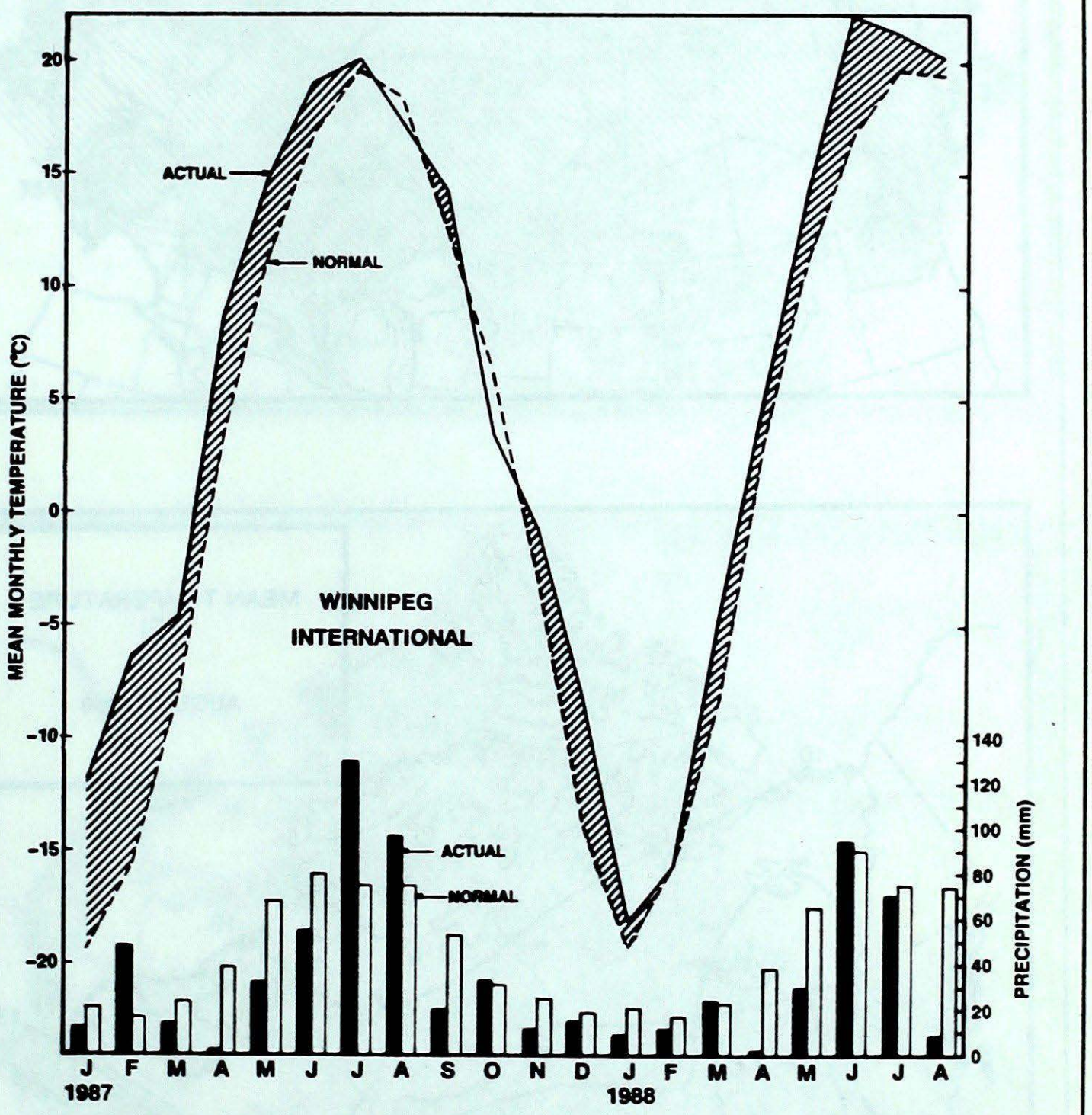
P.Scholefield, Monitoring and Prediction Division

Another Warm Month Across Most of Canada

As can be seen on the temperature anomaly map on page 2, mean August temperatures were above normal across most of the country with the highest anomalies over central sections. Warm temperatures over the southeastern Prairies, which when combined with the record warmth of June and above-normal temperatures in July, helped establish new record summer warmth for several locations in southern Manitoba (eg. Winnipeg mean of 21.1°C) and southeastern Saskatchewan (eg. Estevan mean of 21.5°C). Significantly above-normal August temperatures also occurred in southern Ontario which also experienced one of the warmest summers on record (Toronto City's summer mean temperature of 22.2°C tied 1973 as being the warmest summer since 1959 and the 4th warmest since records began in 1840).

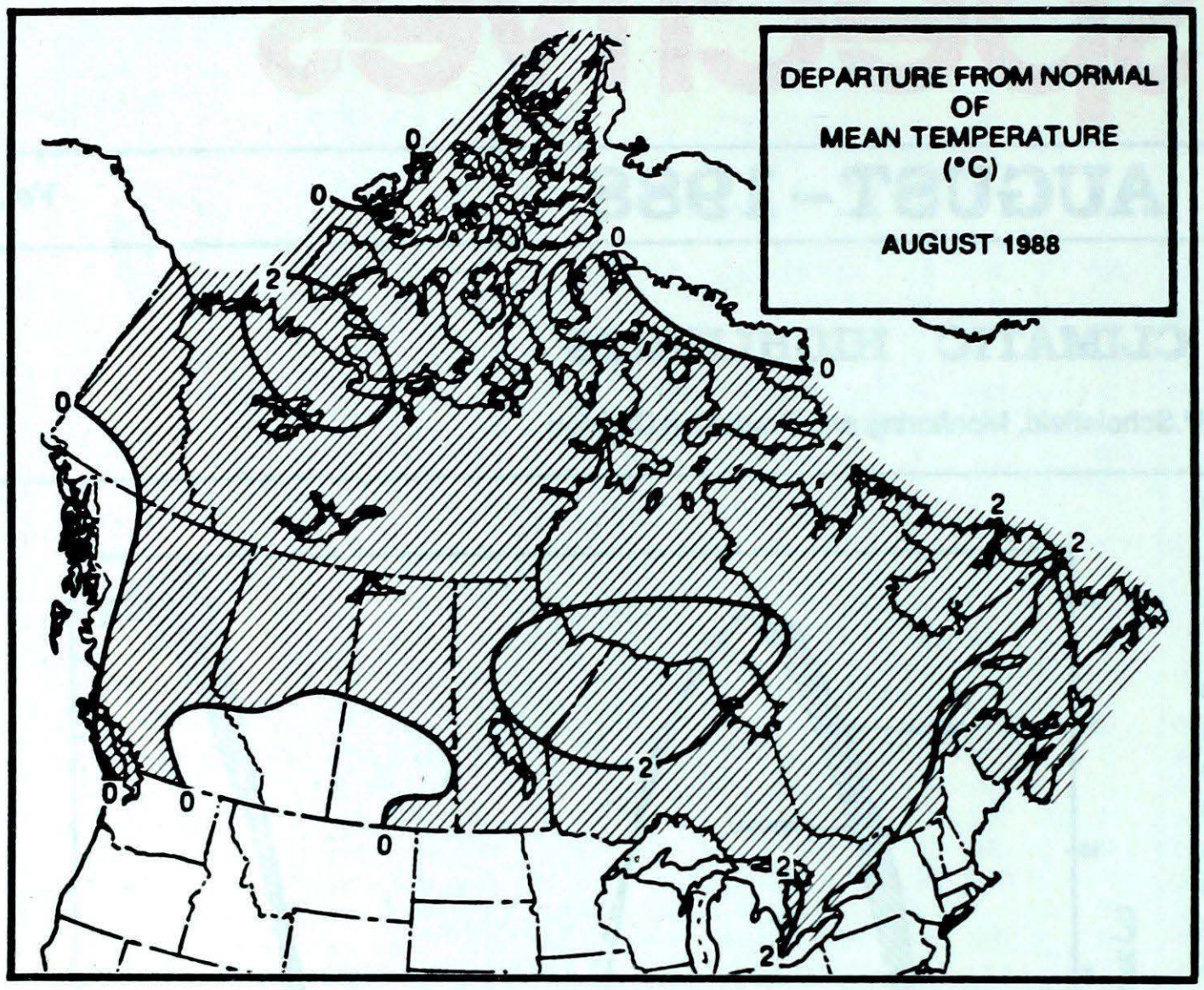
Kelowna, is an isolated location in B.C. that has now experienced 21 consecutive months of above-normal temperatures. Parts of central Alberta have had 12 consecutive months of above-normal temperatures, southwestern Ontario, 10 consecutive months and the southeastern part Saskatchewan and southwestern Manitoba, 7 consecutive months.

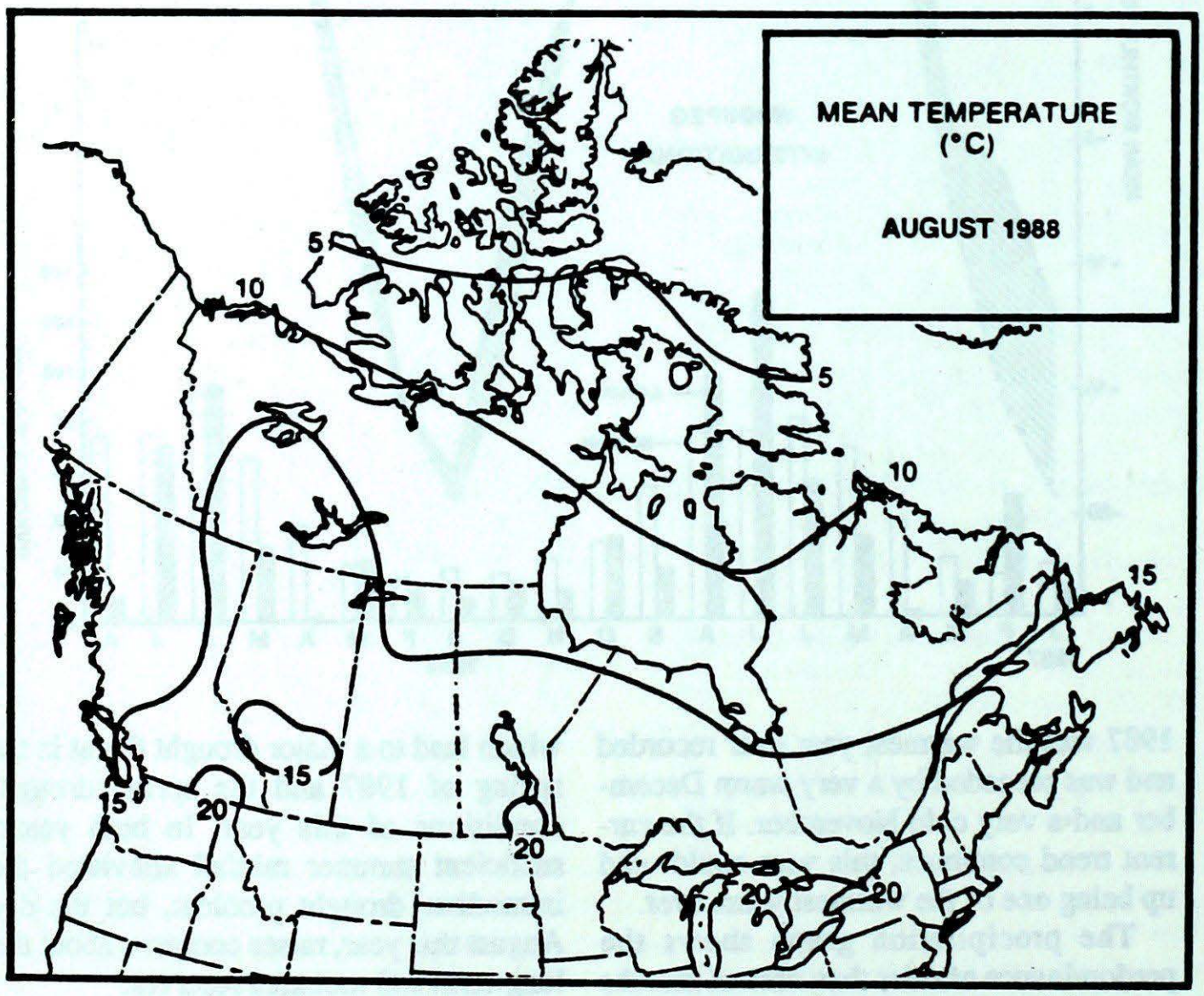
Winnipeg has been close to the centre of dramatic temperature and precipitation anomalies over the past two years, so it is of interest to examine the accompanying graphs which display the the month to month anomalies since January, 1987.



1987 was the warmest year ever recorded and was preceded by a very warm December and a very cold November. If the current trend continues, this year could end up being one of the warmest years ever.

The precipitation graph shows the predominance of drier than normal months which lead to a major drought threat in the spring of 1987 and the spring drought conditions of this year. In both years, sufficient summer rainfall alleviated the immediate drought problem, but the dry August this year, raises concerns about the long-term soil moisture reserves.





Across the country

Yukon and Northwest Territories

Above-normal temperatures continued through August in most areas of the Yukon and Northwest Territories, though the positive anomalies were much smaller than in preceding months, and the brilliant colour of the changing leaves clearly announced the arrival of fall. In theYukon, the first two weeks of August saw dreary, wet weather, with snow at Old Crow on the 9th. In the Arctic, the weather was windy but maximums over 15°C were recorded.

Under the combined influence of a southerly flow and a ridge of high pressure, the second half of the month began with temperatures well above normal. However, despite maximums of over 25°C in the Yukon (29°C at Old Crow on the 17th) and 20°C in the eastern Arctic, in northern areas the mercury remained below the freezing point.

British Columbia

August saw generally fine summer weather in British Columbia, with a ridge of high pressure protecting most of the province from weather systems coming in from the Pacific. Those which managed to penetrate this barrier affected the southern two-thirds of the province only briefly.

Mean monthly temperatures were near normal, with negative anomalies restricted to the northwest and a few locations in the south. No records were set. Precipitation was above normal in the northern part of Vancouver Island and the northern interior, as well as along the northern part of the coast. Up to 200% of normal precipitation occurred. Elsewhere, precipitation was slightly below normal, except at Victoria,

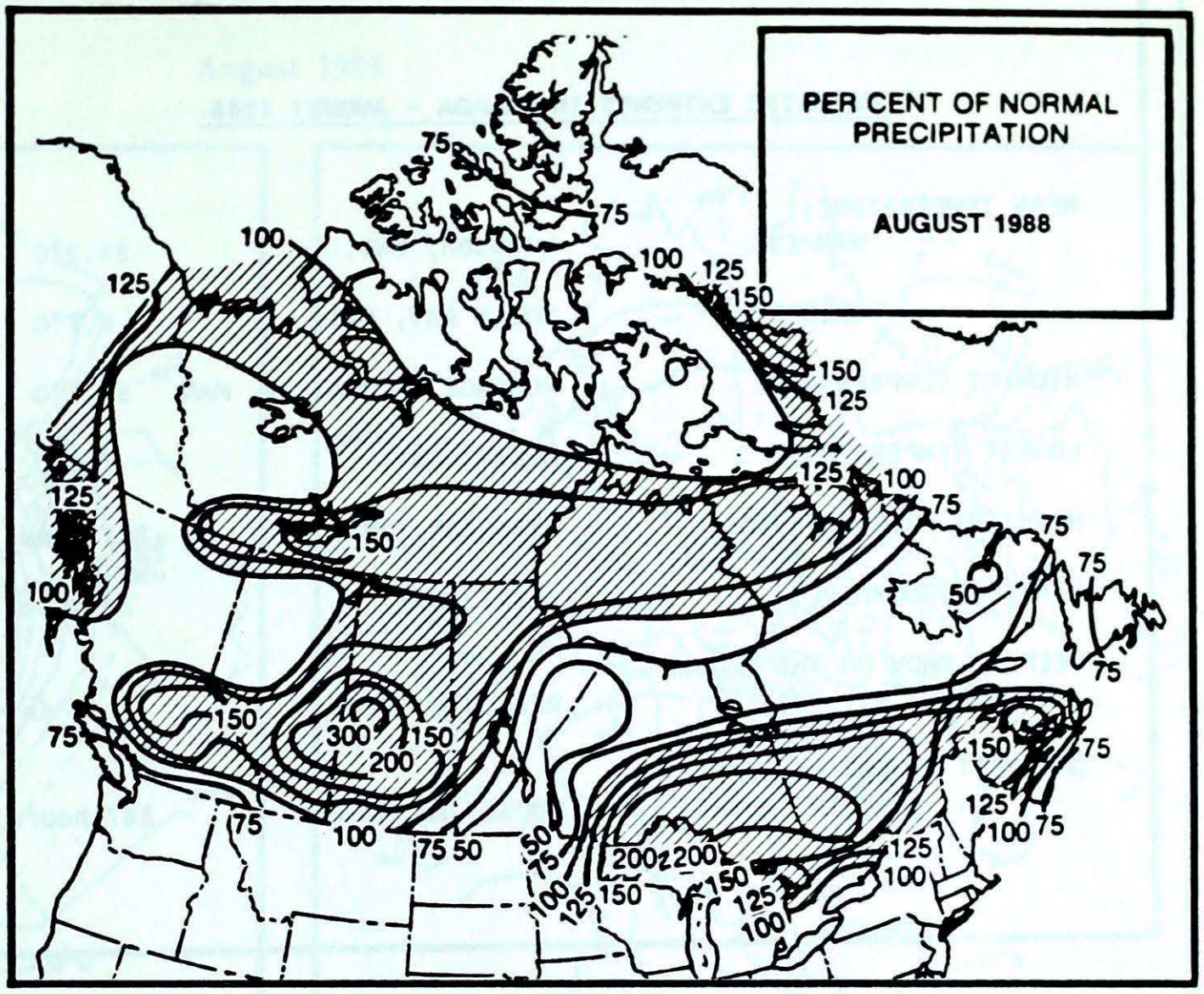
where the first significant rainfall in 35 days occurred on the 15th.

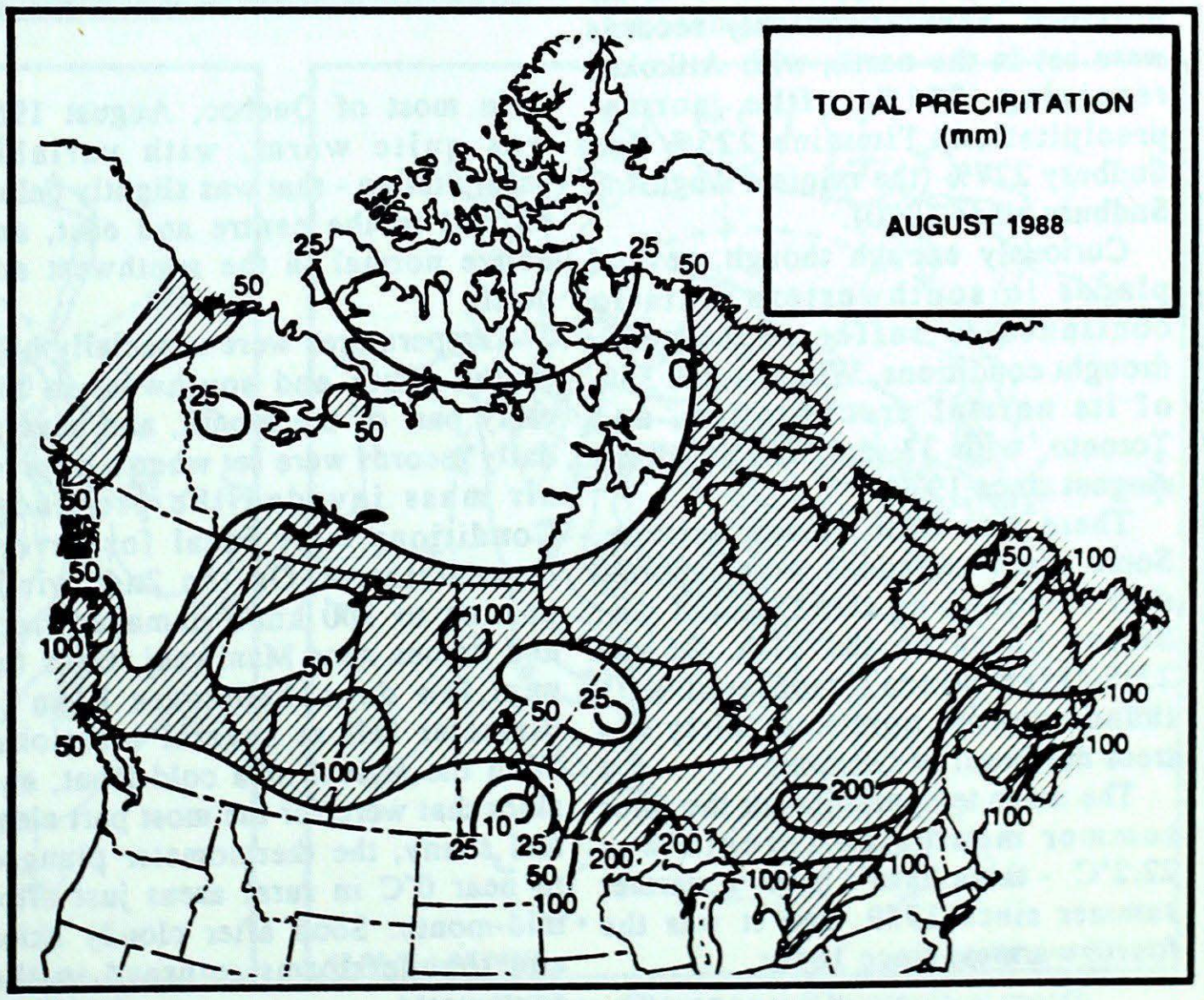
On the 25th, a disturbance brought severe thunderstorms to the Okanagan. Several boats capsized on Lake Okanagan. Sunshine was near normal. No records were set. Prairies

In Alberta and Saskatchewan, most of August was dreary, rainy and cool. Skies did not clear until the end of the month. Further east, the weather was more pleasant, especially in southeastern Manitoba. The northern and eastern Prairies had one more month of temperatures well above normal. In Alberta, daily temperatures were highly variable, ranging from -1°C at High Level on the 6th to 33°C at Lethbridge and Medicine Hat on the 29th.

The highest temperatures on the Prairies were in Manitoba-- where the mercury climbed to ashigh as 40°C in the middle of the month. Several stations, including Winnipeg, Gimli, Portage la Prairie and Estevan set records for the summer (June to August) mean. Precipitation was generally above normal, except in northwestern Alberta and eastern and southeastern Manitoba, where Winnipeg and Portage la Prairie received only 10% of thenormal August precipitation.

Beneficial rains helped whereever crops that were not already withering for lack of water. However heavy showers in Calgary on the 16th caused serious damage and flooding. The fall harvest has already begun.





Ontario

August in Ontario featured a sharp break between the first and second halves of the month. Hot and humid weather was followed by two weeks of cool weather with variable skies. On the whole, though, August was hot. Indeed, in southern Ontario it was one of the hottest Augusts in 20 years.

CLIMATIC EXTREMES IN CANADA - AUGUST 1988

MEAN TEMPERATURE:		
WARMEST	WINDSOR, ONT.	24.2°C
COLDEST	MOULD BAY, NWT.	0.7°C
HIGHEST TEMPERATURE:	PORTAGE LA PRAIRIE, MAN.	39.6°C
LOWEST TEMPERATURE:	ALERT, NWT.	- 7.6°C
HEAVIEST PRECIPITATION:	ATIKOKAN, ONT.	263.8 mm
HEAVIEST SNOWFALL:	ALERT, NWT.	24.9 cm
DEEPEST SNOW ON THE GROUND ON AUGUST 31, 1988:	RESOLUTE, NWT.	11 cm
GREATEST NUMBER OF BRIGHT SUNSHINE HOURS:	MOOSE JAW, SASK.	387 hours

There was also generous precipitation throughout most of the province. Several monthly records were set in the north, with Atikokan receiving 271% ofthe normal precipitation, Timmins 225% and Sudbury 227% (the rainiest August at Sudbury since 1970).

Curiously enough though, several places in southwestern Ontario continued to suffer under near-drought conditions. Windsor had 36% of its normal precipitation, and Toronto, with 37 mm, had its driest August since 1974.

There was little storm activity. Some small tornadoes were reported near Petawawa on the 12th and near Stoney Creek on the 11th. On the 25th, high winds associated with thunderstorms uprooted thirty big trees northeast of Ottawa.

The mean temperature for the three summer months at Toronto was 22.2°C - there hasn't been a warmer summer since 1959, and it was the fourth warmest since 1840.

Quebec

In most of Quebec, August 1988 was quite warm, with variable precipitation - that was slightly below normal in the centre and east, and above normal in the southwest and north.

Temperatures were especially high in the south and southwest in the early part of the month, and several daily records were set when a tropical air mass invaded the province. Conditions were ideal for severe thunderstorms. On the 2nd, winds gusting to 100 km/h damaged trees and homes near Maniwaki. Over the next few days, hailstones 1 cm in diameter fell at several locations. With the arrival of a cold front, and skies that were for the most part clear and sunny, the thermometer plunged to near 0°C in rural areas just after mid-month. Soon after cloudy skies and thunderstorms returned in the southwest.

Three records for monthly total precipitation were set, at Matagami, Maniwaki, and at Sainte-Agathe, which received about 200% of their normal precipitation.

Atlantic Provinces

In Atlantic Canada, August was rather warm, with variable precipitation, above-normal sunshine in Newfoundland and Labrador, and below-normal sunshine in the Maritimes. The first half of the month was particularly cloudy, hot and humid for the Maritimes, with several daily maximum temperatures records being set, whereas at month's end, record minimum temperatures occurred.

A number of thunderstorms brought heavy precipitation, especially in Prince Edward Island, and in northern Nova Scotia (40 mm in 6 hours on the 16th), and at Chatham N.B. (50 mm in 6 hours on the 25th). On the 14th, 29 days of continuous fog came to an end at Yarmouth N.S.

The month ended pleasantly in Newfoundland and Labrador, with maximums of around 20°C and 30°C respectively.

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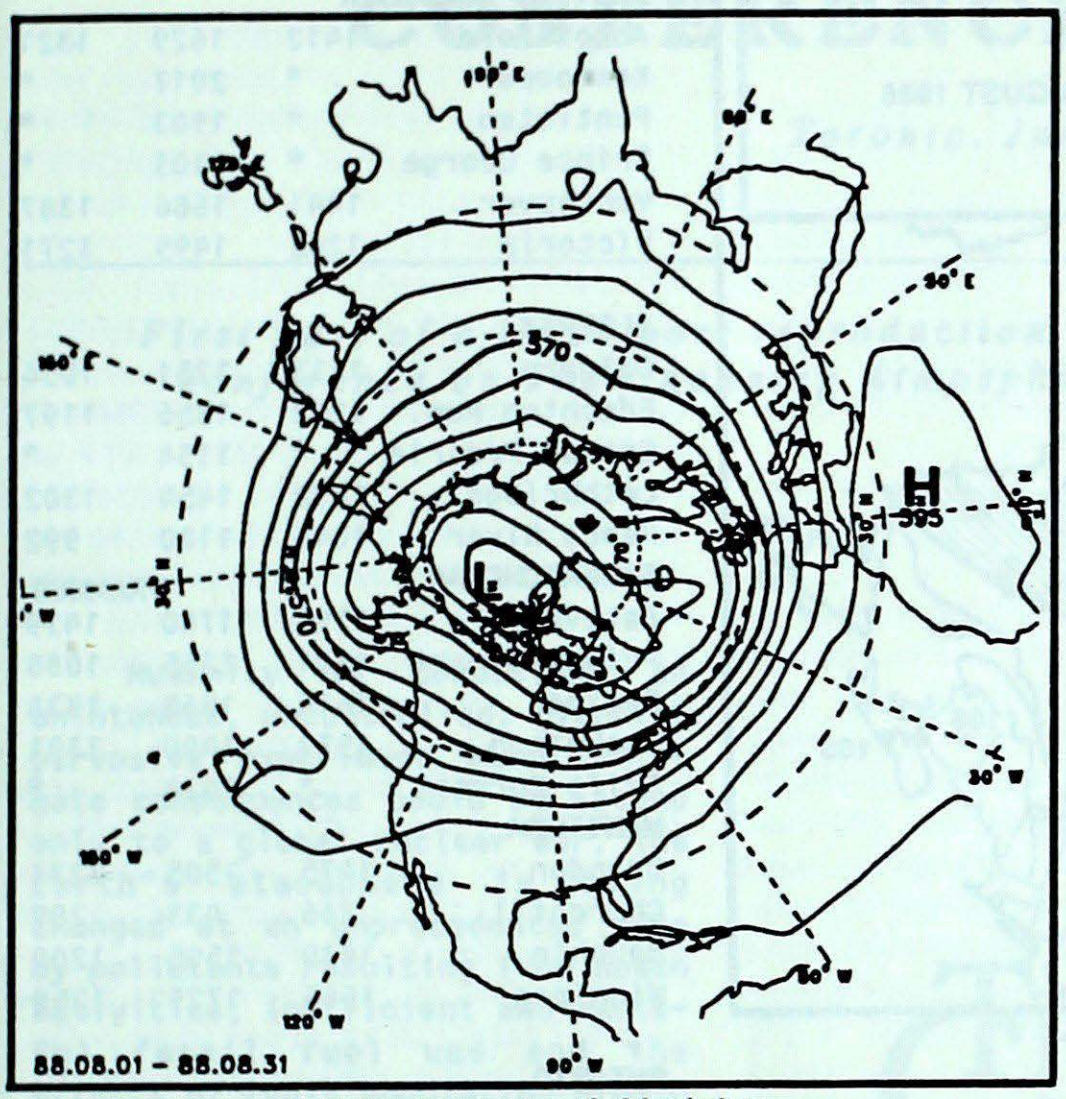
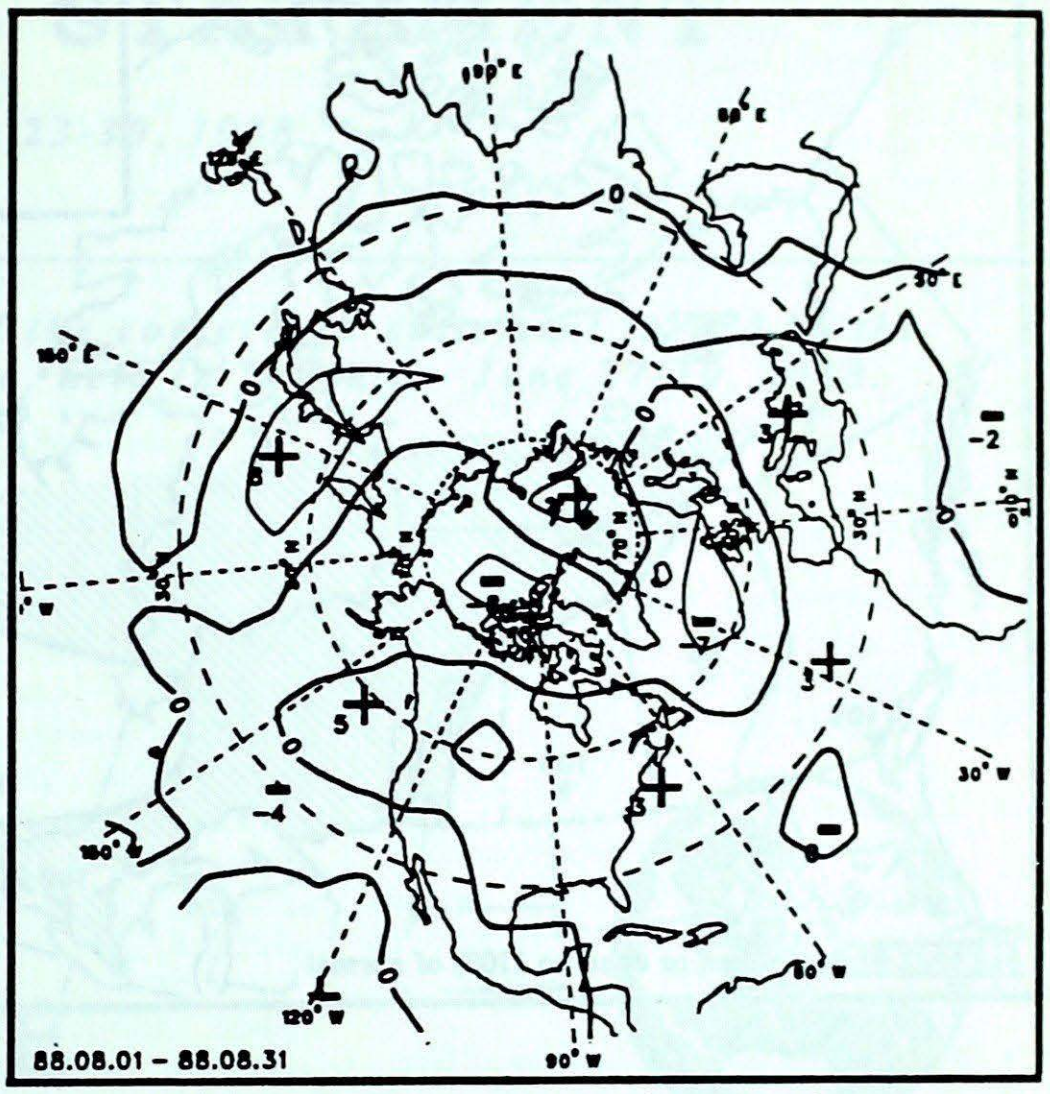
50 kPa ATMOSPHERIC CIRCULATION

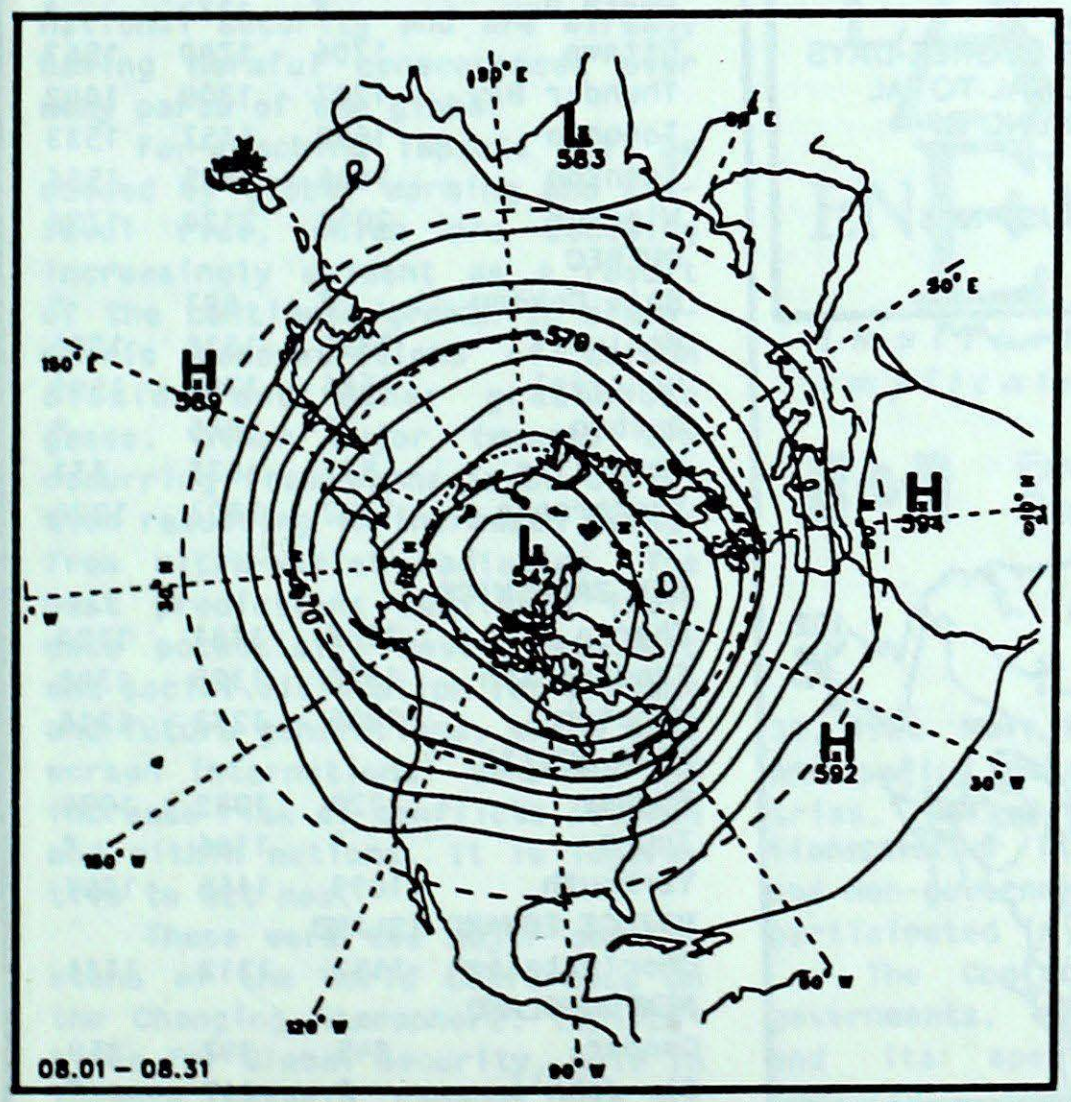
August 1988



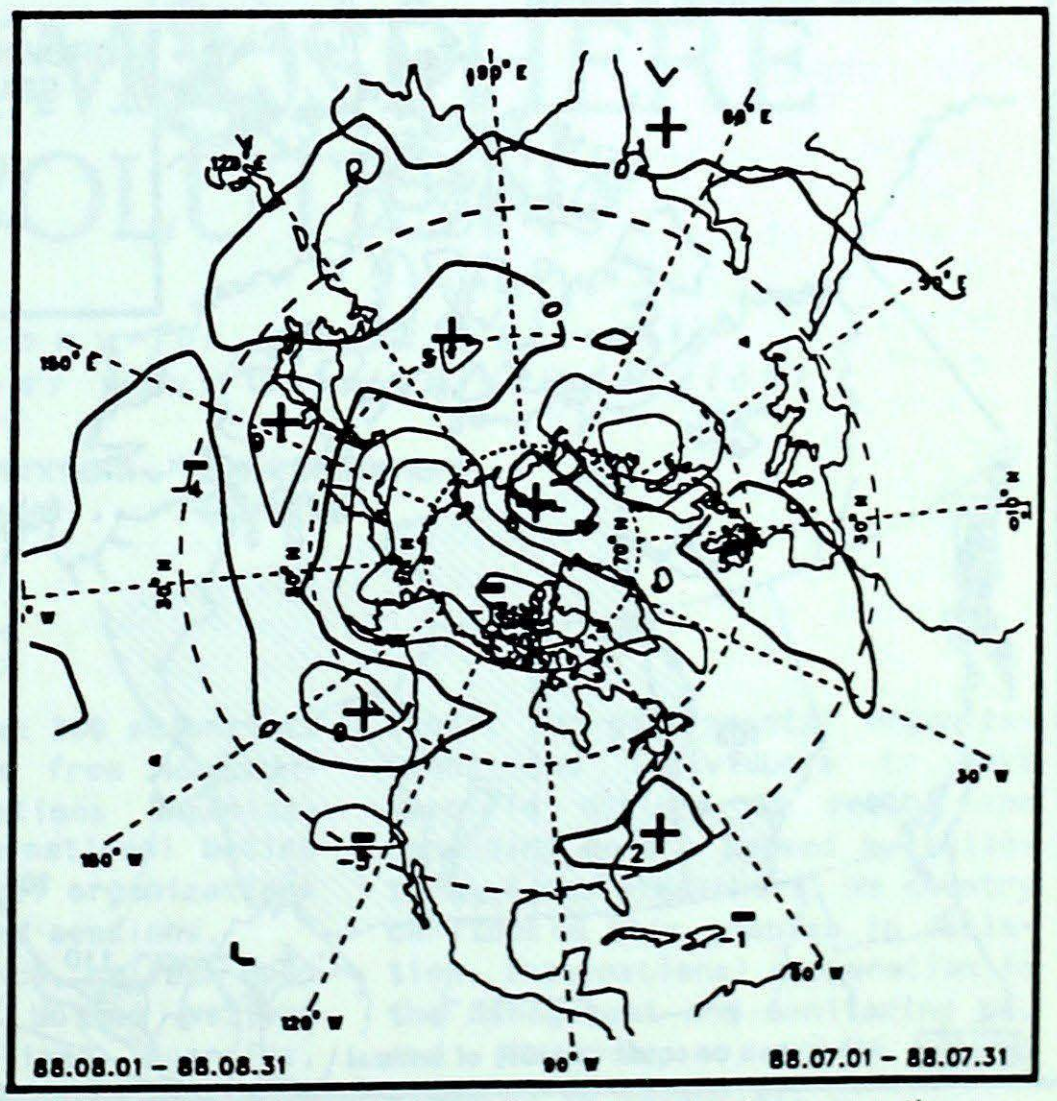
Mean geopotential heights
- 5 decametre interval -



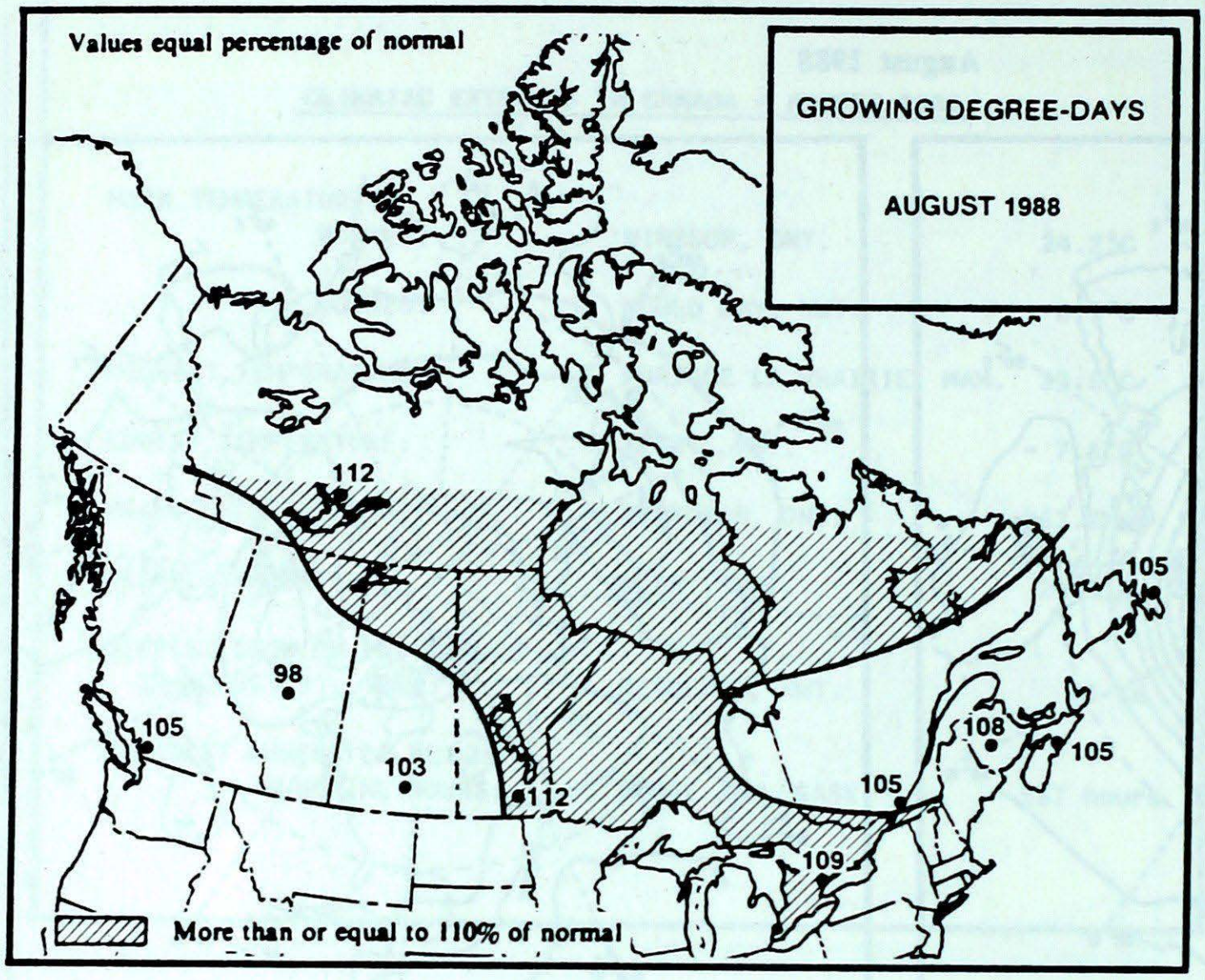
Mean geopotential height anomaly
- 5 decametre interval-

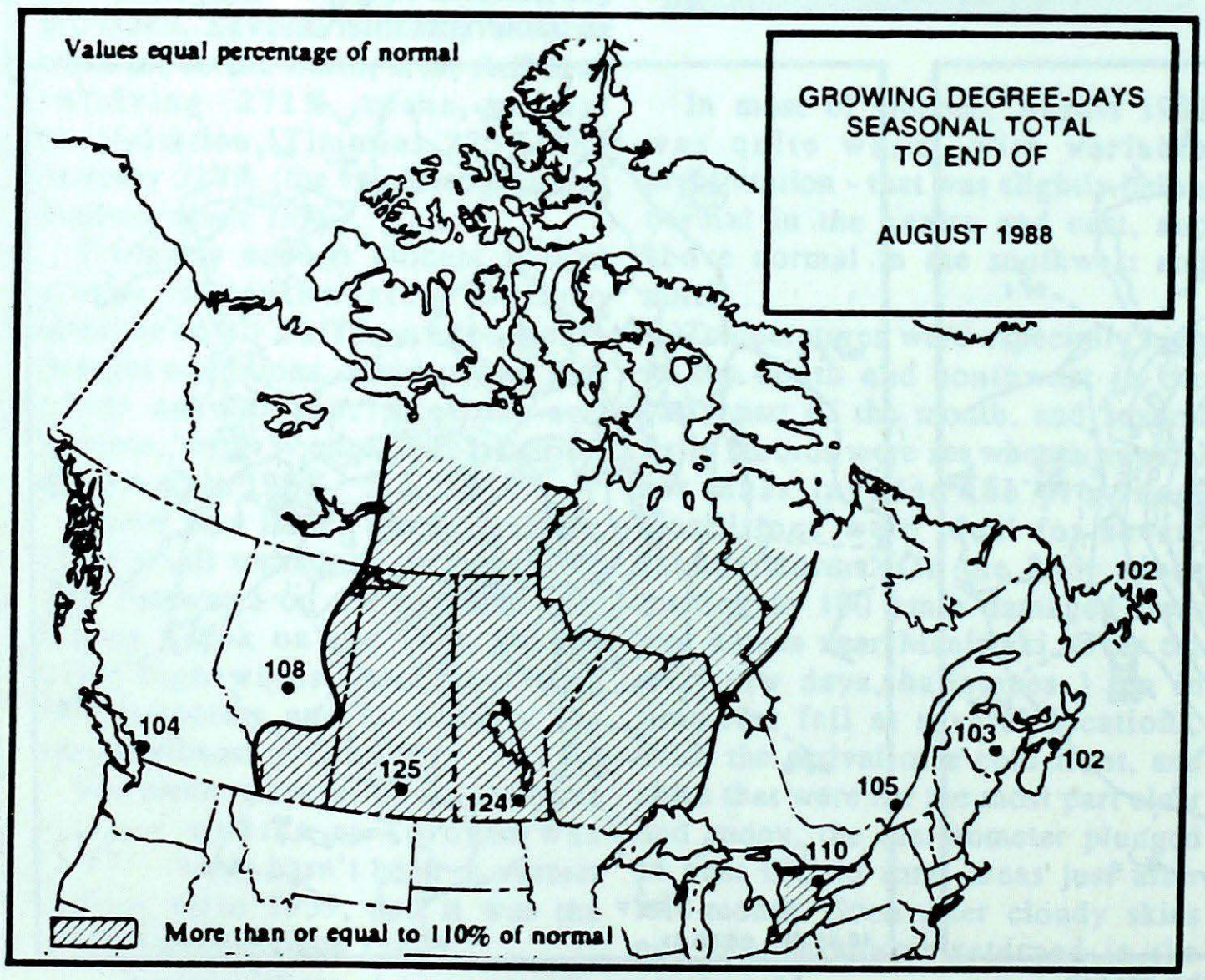


Normal geopotential heights for the month
- 5 decametre interval -



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





SEASONAL TOTAL OF GROWING DEGREE-DAYS TO END OF AUGUST

	1988	1987	NORMAL
BRITISH COLUMBIA			
Abbotsford	1412	1629	1321
Kamloops	*	2017	*
Penticton	*	1903	*
Prince George	*	1103	*
Vancouver	1441	1686	1387
Victoria	1262	1495	1271
ALBERTA			
Calgary	1213	1251	1056
Edmonton Mun.	1292	1356	1197
Grande Prairie	*	1154	*
Lethbridge	1492	1454	1302
Peace River	1048	1180	992
SASKATCHEWAN			
Estevan	1793	1740	1419
Prince Albert	1301	1355	1088
Regina	1676	1568	1338
Saskatoon	1573	1490	1301
Swift Current	*	1434	*
MANITOBA			
Brandon	1475	1505	1231
Churchill	366	433	289
Dauphin	1439	1505	1200
Winnipeg	1565	1729	1259
ONTARIO			
London	1724	1896	1540
Mount Forest	*	1486	*
North Bay	*	1373	*
Ottawa	1706	1749	1567
Thunder Bay	1207	1309	1042
Toronto	1692	1857	1533
Trenton	1656	1805	1536
Windsor	2018	2124	1796
QUEBEC			
Baie Comeau	*	891	*
Maniwaki	1390	1338	1285
Montréal	1686	1745	1599
Quebec	*	1365	*
Sept-Iles	832	838	831
Sherbrooke	1342	1303	1224
NEW BRUNSWICK			
Charlo	1157	1181	1124
Fredericton	1390	1325	1348
Moncton	1245	1273	1218
NOVA SCOTIA			
Sydney	1124	1082	1094
Truro	*	1166	*
Yarmouth	1099	1165	1041
PRINCE EDWARD ISLAND			
Charlottetown	1197	1212	1181
NEWFOUNDLAND			
Gander	845	997	850
St. John's	*	867	*
Stephenville	962	1007	942

THE CHANGING ATMOSPHERE : CONFERENCE STATEMENT

Toronto, June 23-30, 1988

First part of a three part reproduction of the conference statement issued by the conference on The Changing Atmosphere, held in Toronto - June 27/30, 1988.

SUMMARY

Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war. The Earth's atmosphere is being changed at an unprecedented rate by pollutants resulting from human activities, inefficient and wasteful fossil fuel use and the effects of rapid population growth in many regions. These changes represent a major threat to international security and are already having harmful consequences over many parts of the globe.

Far-reaching impacts will be caused by global warming and sea-level rise, which are becoming increasingly evident as a result of the continued growth in atmospheric concentrations of carbon dioxide and other greenhouse gases. Other major impacts are occurring from ozone-layer depletion resulting in increased damage from ultra-violet radiation. The best predictions available indicate potentially severe economic and social dislocation for present and future generations, which will worsen international tensions and increase risk of conflicts between and within nations. It is imperative to act now.

These were the major conclusions of the World Conference on the Changing Atmosphere: Implications for Global Security, held in Toronto, Ontario, Canada, June 27-30, 1988. More than 300 scientists and policy makers from 46 countries, United Nations organizations, other international bodies and non-governmental organizations participated in the sessions.

The Conference called upon governments, the United Nations and its specialized agencies, industry, educational institutions, non-governmental organizations and individuals to take specific actions to reduce the impending crisis caused by pollution of the atmosphere. No country can tackle this problem in isolation. International cooperation in the management and monitoring of, and research on, this shared resource is essential.

THE CHANGING ATMOSPHERE
L'ATMOSPHÈRE EN ÉVOLUTION

Implications for Global Security
Implications pour la sécurité du globe

Canada

Environment Canada
Environnement Canada

The Conference called upon governments to work urgently towards an Action Plan for the Protection of the Atmosphere. This should include an international framework convention, while encouraging other standard-setting agreements along the way, as well as national legislation to provide for protection of the global atmosphere. The Conference also called upon governments to establish a World Atmosphere Fund financed in part by a levy on the fossil fuel consumption of industrialized countries to mobilize a substantial part of the resources needed for these measures.

THE ISSUE

Continuing alteration of the global atmosphere threatens global security, the world economy, and the natural environment through:

- Climate warming, rising sea-level, altered precipitation patterns and changed frequencies of climatic extremes induced by the "heat trap" effects of greenhouse gases;
- Depletion of the ozone layer;
- Long-range transport of toxic chemicals and acidifying substances.

These changes will:

- Imperil human health and well-being;
- Diminish global food security, through increases in soil erosion and greater shifts and uncertainies in agricultural production, particularly for many vulnerable regions;
- Change the distribution and seasonal availability of freshwater resources;
- Increase political instability and the potential for international conflict;
- Jeopardize prospects for sustainable development and the reduction of poverty;
- Accelerate the extinction of animal and plant species upon which human survival depends;
- Alter yield, productivity and biological diversity of natural and managed ecosystems, particularly forests.

If rapid action is not taken now by the countries of the world, these problems will become progressively more serious, more difficult to reverse, and more costly to address.

Scientific Basis for Concern

The Conference calls for urgent work on an Action Plan for the Protection of the Atmosphere. This Action Plan, complemented by national action, should address the problems of climate warming, ozone layer depletion, long-range transport of toxic chemicals and acidification.

Climate Warming

1 - There has been an observed increase of globally-averaged temperature of 0.7°C in the past century which is consistent with theoretical greenhouse gas predictions. The accelerating increase in concentrations of greenhouse gases in the atmosphere, if continued, will probably result in a rise in the mean surface temperature of the Earth of 1.5 to 4.5°C before the middle of the next century.

2 - Marked regional variations in the amount of warming are expected. For example, at high latitudes the warming may be twice the global average. Also, the warming would be accompanied by changes in the amount and distribution of rainfall and in atmospheric and ocean circulation patterns. The natural variability of the atmosphere and climate will continue and be superimposed on the long-term trend, forced by human activities.

3 - If current trends continue, the rates and magnitude of climate change in the next century may substantially exceed those experienced over the last 5000 years. Such high rates of change would be sufficiently disruptive that no country would likely benefit in toto from climate change.

4 - The climate change will continue so long as the greenhouse gases accumulate in the atmosphere.

5 - There can be a time lage of the order of decades between the emission of gases into the atmosphere and their full manifestation in atmospheric and biological consequences. Past emissions have already committed planet Earth to a significant warming.

6 - Global warming will accelerate the present sea-level rise. This will probably be of the roder of 30 cm but could possibly be as much as 1.5 m by the middle of the next century. This could inundate low-lying coastal lands and islands, and reduce coastal water supplies by increased salt water intrusion. Many densely populated deltas and adjacent agricultural lands would be threatened. The frequency of tropical cyclones may increase and storm tracks may change with consequent devastating impacts on coastal areas and islands by floods and storm surges.

7 - Deforestation and bad agricultural practices are contributing to desertification and are reducing the biological storage of carbon dioxide, thereby contributing to the increase of this most important greenhouse gas. Deforestation and poor agricultural practices are also contributing additional greenhouse gases such as nitrous oxide and methane.

Ozone Layer Depletion

1 - Increased levels of damaging ultra-violet radiation, while the stratospheric ozone shield thins, will cause a significant rise in the occurrence of skin cancer and eye damage, and will be harmful to many biological species. Each 1% decline in ozone is expected to cause a 4 to 6% increase in certain kinds of skin cancer. A particular concern is the possible combined effects on unmanaged ecosystems of both increased ultraviolet radiation and climate changes.

2 - Over the past decade, a decline of 3% in the ozone layer has occurred at mid-latitudes in the Southern Hemisphere, possible accompanying the appearance of the Antarctic ozone hole; although there is more meteorological variability, there are indications that a smaller decline has occurr-

ed in the Northern Hemisphere. Changes of the ozone layer will also change the climate and the circulation of the atmosphere.

Acidification

In improving the quality of the air in their cities, many industrialized countries unintentionally sent increasing amounts of pollution across national boundaries in Europe and North America, contributing to the acidification of distant environments. This was manifested by increasing damage to lakes, soils, plants, animals, forests and fisheries. Failure to control automobille pollution in some regions has seriously contributed to the problem. The principal damage agents are oxides of sulphur and nitrogen as well as volatile hydrocarbons. The resulting acids can also corrode buildings and metallic structures causing voerall, billions of dollars of damage annually.

The various issues arising from the pollution of Earth's atmosphere by a number of substances are often closely interrelated, both through chemistry and through potential control strategies. For example, chlorofluorocarbons (CFCs) both destroy ozone and are greenhouse gases; conservation of fossil fuels would contribute to addressing both acid rain and climate change problems.

Security: Economic and Social Concerns

As the UN Report On The Relationship Between Disarmament And Development states: "The world can either continue to pursue the arms race with characteristic vigour or move consciously and with deliberate speed toward a more stable and balanced social and economic development within a more sustainable international economic and political order. It cannot do both. It must be knowledged that the arms race and development are in a competitive relationship, particularly in terms of resources, but also in the vital dimension of attitudes and perceptions." The same consideration applies to the vital issue of protecting the global atmospheric changes. Unanticipated and unplanned change may well become the major non-military threat to international security and the future of the global economy.

There is no concern more fundamental than access to food and water. Currently, levels of global food security are inadequate but even those will be most difficult to maintain into the future, given projected agricultural production levels and population and income growth rates. The climate changes envisaged will aggravate the problem of uncertainty in food security. Climate change is being induced by the prosperous, but its effects are suffered most acutely by the poor. It is imperative for governments and the international community to sustain the agricultural and marine resource base and provide development opportunities for the poor in light of this growing environmental threat to global food security.

The countries of the industrially developed world are the main source of greenhouse gases and therefore bear the main responsibility to the world community for ensuring that measures are implemented to address the issues posed by climate change. At the same time, they must see that the developing nations of the world, whose problems are greatly aggravated by population growth, are assisted in and not inhibited from improving their economies and the living conditions of their citizens. This will necessitate a wide range of measures, including significant additional energy use in those countries and compensating reductions in the industrialized countries. The transition to a sustainable future will require investments in energy efficiency and non-fossil energy sources. In order to ensure that these investments occur, the global community must not only halt the current net transfer of resources from developing countries, but actually reverse it. This reversal should embrace the technologies involved, taking into account the implications for industry.

A coalition of reason is required, in particular, a rapid reduction of both North-South inequalities and East-West tensions, if we are to achieve the understanding and agreements needed to secure a sustainable future for planet Earth and its inhabitants.

It takes a long time to develop an international consensus on complex issues such as these, to negotiate, sign, and ratify international environmental instruments and to begin to implement them. It is therefore imperative that serious negotiations start now. (to be continued)

AUGUST 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	17.6	0.7	31.0	5.7	0.0		32.2	57	0	8	278	113	33.8
ALERT BAY	14.2	-0.1	24.9	8.6	0.0		87.3	131	0	11	X		117.1
AMPHITRITE POINT	14.2	-0.1	23.5	9.9	0.0		30.0	26	0	5	X		117.3
BLUE RIVER	15.3	-0.3	30.9	2.9	0.0		95.9	128	0	13	201	89	*
BULL HARBOUR	13.3	-0.2	19.6	8.0	0.0		94.3	114	0	11	X		148.3
CAPE SCOTT	13.2	-0.7	17.9	9.3	0.0		98.1	92	0	15	X		149.7
CAPE ST.JAMES	13.5	-0.3	22.8	9.9	0.0		76.4	97	0	10	148	*	137.4
CASTLEGAR	20.1	0.4	33.7	6.1	0.0		6.3	13	0	2	286	104	9.0
COMOX	17.8	0.8	28.9	9.2	0.0		17.1	38	0	6	X		23.4
CRANBROOK	17.9	0.5	32.8	3.7	0.0		25.1	77	0	3	304	*	41.2
DEASE LAKE	10.9	-0.7	25.1	-1.4	0.0		64.6	123	0	13	150	74	219.2
PORT NELSON	15.2	0.4	23.9	2.0	0.0		77.8	127	0	9	X		
FORT ST.JOHN	15.2	0.8	27.9	4.4	0.0		51.9	86	0	7	252	*	86.1
HOPE	18.4	0.0	34.1	9.4	0.0		35.9	71	0	6	X		90.5
KAMLOOPS	19.7	-0.1	34.5	8.0	0.0		34.7	126	0	7	240	108	23.0
KELOWNA	18.4	0.6	33.7	4.5	0.0		43.6	141	0	5	235	83	7.8
LANGARA	13.0	-0.2	20.0	10.0	0.0		121.2	117	0	16	289	111	26.7
LYTTON	21.0	0.1	38.2	8.8	0.0		33.0	194	0	4	X		161.2
MACKENZIE	14.0	0.2	27.3	1.2	0.0		56.0	95	0	10	237	98	4.2
MCINNES ISLAND											241	100	225.7
PENTICTON	19.4	-0.1	34.4	6.4	0.0		29.7	112	0	5	X		
PORT ALBERNI	17.9	*	32.2	4.2	0.0	*	18.2	*	0	3	292	107	11.4
PORT HARDY	14.2	0.4	22.6	7.0	0.0		70.4	102	0	9	275	*	22.4
PRINCE GEORGE	14.4	0.3	29.2	1.5	0.0		58.4	85	0	11	186	101	117.3
PRINCE RUPERT	13.4	0.3	22.2	6.1	0.0		178.3	112	0	15	245	97	114.8
PRINCETON	17.0	-0.1	35.6	2.7	0.0		30.4	119	0	5	129	93	142.4
QUESNEL	16.4	0.8	31.3	2.8	0.0		58.3	90	0	8	294	*	*
REVELSTOKE	17.5	-0.1	29.6	6.8	0.0		61.6	146	0	12	X		62.7
SANDSPIT	14.8	0.1	23.2	8.2	0.0		46.9	94	0	8	236	97	37.1
SMITHERS	14.2	0.1	28.9	2.0	0.0		41.8	95	0	11	150	85	98.7
TERRACE	15.6	-0.2	29.0	7.5	0.0		46.0	72	0	9	220	94	119.4
VANCOUVER INT'L	17.7	0.6	27.3	10.9	0.0		27.2	66	0	2	173	85	78.0
VICTORIA INT'L	16.2	0.1	27.6	6.6	0.0		27.8	104		3	X		
VICTORIA MARINE	14.3	0.1	23.5	6.0	0.0		16.9	63	0	4	319	116	68.1
WILLIAMS LAKE	15.0	0.0	30.5	2.5	0.0		80.0	187	0	9	X		115.0
											252	90	101.8

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	12.5	0.7	28.8	-1.8	0.0		65.3	118	0				
MAYO	12.7	0.1	28.2	1.0	0.0		23.8	57	0				
WATSON LAKE	13.1	0.0	25.2	0.5	0.0		30.3	72	0				
WHITEHORSE	12.2	-0.3	23.6	1.9	0.0		53.0	139	0	12	216	93	181.6
NORTHWEST TERRITORIES													
ALERT	1.2	0.3	14.9	-7.6	24.9	119	17.7	63	8	4	385	185	522.2
BAKER LAKE	10.6	0.9	24.5	-0.3	0.0		43.3	116	0	7	212	100	229.9
CAMBRIDGE BAY	7.3	0.8	18.9	-1.2			23.4	83	0	6	140	79	330.0
CAPE DYER	4.4	-0.2	14.7	-1.1	18.6	175	85.8	167	0	10	X		419.6
CAPE PARRY	7.4	2.0	20.1	0.7			28.3	102	0	5	X		330.2
CLYDE	3.2	-0.8	13.7	-1.8	13.6	172	74.0	283	0	14	87	46	457.3
COPPERMINE	11.0	2.3	27.7	2.8	0.0		71.4	184	0	13	199	104	220.5
CORAL HARBOUR	8.3	0.9	19.3	-1.0	0.0		31.5	70	0	4	245	108	301.9
EUREKA	3.8	0.5	15.6	-4.4	5.5	203	5.9	50	1	2	310	129	440.3
FORT RELIANCE	14.0	1.1	28.1	5.6	0.0		43.7	108	0	5	X		128.3
PORT SIMPSON	15.8	1.4	26.7	0.9	0.0		38.6	86	0	7	270	109	69.2
PORT SMITH	15.2	1.0	27.8	0.9	0.0		65.0	152	0	8	263	100	90.4
IQALUIT	7.8	0.9	19.9	2.0	0.0		55.0	93	0	10	132	81	315.1
HALL BEACH	5.5	0.9	18.2	-1.0	0.0		34.6	84	0	9	X		387.9
HAY RIVER	15.5	1.1	29.5	5.7	0.0		57.4	152	0	3	X		90.9
INUVIK	10.7	0.0	29.2	-0.1	3.0	90	51.1	117	0	15	172	79	227.1
MOULD BAY	0.7	-0.7	8.5	-7.6	11.6	128	20.6	95	3	9	93	70	537.6
NORMAN WELLS	14.7	1.3	27.7	3.1	0.0		21.8	37	0	8	226	95	108.8
POND INLET	7.6	2.9	12.2	-2.7	0.0		22.6	58	0	8	X		409.7
RESOLUTE	2.8	0.4	12.6	-6.2	19.4	289	43.1	138	11	12	215	134	482.4
YELLOWKNIFE	15.2	1.1	25.6	6.1	0.0		15.4	35	0	5	282	98	88.1
ALBERTA													
BANFF	13.7	-0.1	29.0	2.0	0.0		70.0	143	0	15	X		
CALGARY INT'L	15.0	-0.2	30.1	3.6	0.0		163.9	295	0	11	270	95	98.6
COLD LAKE	15.1	-0.4	27.0	3.5	0.0		114.7	150	0	8	262	102	100.7
CORONATION	14.8	-1.3	29.6	2.0	0.0		147.2	285	0	13	277	96	103.8
EDMONTON INT'L	15.1	0.3	29.4	3.9	0.0		103.3	132	0	10	266	93	93.0
EDMONTON MUNI.	16.2	0.0	28.3	7.4	0.0		97.4	125	0	7	270	97	64.4
EDMONTON NAMAO	15.5	-0.1	28.7	6.7	0.0		109.4	149	0	7	X		82.0
EDSON	13.6	0.4	28.8	1.0	0.0		84.5	90	0	11	234	95	136.8
FORT CHIPEWYAN	15.7	1.2	28.5	2.5	0.0		35.4	73	0		X		

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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
FORT MCMURRAY	15.7	0.9	29.7	0.5	0.0		98.8	128	0	9	229	92	79.3
GRANDE PRAIRIE	15.2	0.4	30.0	0.3	0.0		29.2	48	0	6	260	M	91.6
HIGH LEVEL	14.3	0.3	26.3	-0.8	0.0		50.0	86	0	10	268	105	115.7
JASPER	14.3	0.1	29.0	3.5	0.0		84.0	173	0	12	213	M	117.0
LETHBRIDGE	17.3	-0.3	33.0	3.2	0.0		51.0	108	0	7	316	105	46.2
MEDICINE HAT	18.3	-0.6	33.3	3.6	0.0		60.0	164	0	8	340	113	29.9
PEACE RIVER	14.9	0.7	28.7	2.7	0.0		33.2	66	0	7	X		102.5
RED DEER	14.6	-0.3	30.3	2.5	0.0		124.8	189	0	12	X		106.7
ROCKY MTN HOUSE	13.3	-1.0	28.4	0.6	0.0		89.2	115	0	10	X		144.0
SLAVE LAKE	14.9	0.5	27.7	3.9	0.0		28.6	40	0	7	253	103	96.3
SUFFIELD	18.0	M	33.6	5.9	0.0		48.6	M	0	7	309		28.7
WHITECOURT	14.6	0.7	26.9	4.6	0.0		109.8	124	0	13	X		108.4
SASKATCHEWAN													
BROADVIEW	17.2	0.8	38.0	1.4	0.0		42.6	70	0	7	281	94	58.3
COLLINS BAY	14.3	1.7	26.5	2.8			75.8	113	0	9	277	M	117.1
CREE LAKE	14.8	0.4	26.5	3.7	0.0		82.2	135	0	9	252	101	103.9
ESTEVAN	19.6	1.0	39.2	2.7	0.0		44.6	84	0	5	313	100	25.6
KINDERSLEY	16.2	-1.2	31.8	5.2	0.0		92.2	247	0	10	X		71.9
LA RONGE	15.7	0.5	29.8	0.0	0.0		89.3	143	0	10	X		81.2
MEADOW LAKE	15.0	-0.7	29.6	2.4	0.0		197.6	267	0	10	247	M	92.7
MOOSE JAW	20.7	2.1	38.4	7.7	0.0		23.8	59	0	5	387	130	7.3
NIPAWIN	16.7	M	31.8	3.6	0.0	M	80.4	M	0	9	275	M	56.2
NORTH BATTLEFORD	15.5	-1.3	30.2	3.9	0.0		123.4	270	0	10	X		78.7
PRINCE ALBERT	15.8	-0.1	28.8	1.1	0.0		132.7	254	0	11	256	95	75.0
REGINA	18.2	0.4	37.0	3.0	0.0		72.8	162	0	7	298	101	39.8
SASKATOON	16.5	-0.7	30.4	3.2	0.0		89.5	234	0	11	X		62.3
SWIFT CURRENT	17.3	-0.2	31.8	3.6	0.0		49.6	115	0	5	320	107	53.2
WYNYARD	16.6	-0.2	30.5	2.0	0.0		91.0	166	0	9	X 274	97	65.8
YORKTON	16.7	-0.2	34.4	3.0	0.0		96.7	158	0	7	264	92	62.3
MANITOBA													
BRANDON	18.0	0.5	28.5	2.5	0.0		32.0	49	0	6	X		44.1
CHURCHILL	12.9	1.6	27.5	3.1			83.5	143	0	8	253	109	160.2
DAUPHIN	17.7	0.6	36.5	3.8	0.0		68.7	110	0	7	244	88	45.2
GILLAM	15.3	1.5	29.0	2.8	0.0		43.9	72	0	10	X		96.6
GIMLI	18.7	1.6	34.0	5.9	0.0		23.8	41	0	7	252	95	31.6
ISLAND LAKE	17.9	1.6	20.1	6.5	0.0		39.8	63	0	10	X		39.8
LYNN LAKE	15.2	1.1	28.7	4.0	0.0		121.4	208	0	12	288	123	90.4
NORWAY HOUSE	16.7	M	28.3	5.2	0.0	M	46.8	M	0	7	X	M	58.0
PORTAGE LA PRAIRIE	20.0	1.6	39.6	7.0	0.0		8.3	10	0	3	X		17.1

STATION	Temperature C Mean	Difference from Normal	Maximum	Minimum	Snowfall (cm)	% of Normal Snowfall	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of month (cm)	No. of days with Precip 1.0 mm or more	Bright Sunshine (hours)	% of Normal Bright Sunshine	Degree Days below 18 C
THE PAS	17.2	1.1	31.9	5.1	0.0		74.3	129	0	9	276	106	48.3
THOMPSON	15.5	1.6	29.0	2.5	0.0		66.6	92	0	1	253	110	89.8
WINNIPEG INT'L	20.1	1.8	38.7	7.5	0.0		8.5	11	0	3	257	90	17.4
ONTARIO													
ATIKOKAN	17.0	1.2	31.0	3.1	0.0		263.8	269	0	14	196	80	70.3
BIG TROUT LAKE	16.3	2.0	28.5	5.8	0.0		21.2	25	0	7			78.4
EARLTON	17.6	1.4	31.7	3.3	0.0		155.5	186	0	11	X		64.8
GERALDTON	16.1	1.5	28.1	2.8	0.0		158.6	237	0	12	X		80.4
GORE BAY	19.9	1.7	31.6	7.9	0.0		86.8	115	0	13	X		28.4
HAMILTON RBG	22.5	1.7	35.3	9.7	0.0		86.8	107	0	10	292	M	
HAMILTON	21.2	1.2	32.9	8.9	0.0		98.7	131	0	12	X		13.1
KAPUSKASING	15.7	0.4	30.1	0.6	0.0		179.2	193	0	12	X		89.7
KENORA	19.5	1.9	33.5	8.4	0.0		25.7	29	0	7	X		29.5
KINGSTON	21.4	2.0	33.9	5.6	0.0		70.2	92	0	12	246	96	20.1
LANSDOWNE HOUSE	16.9	1.7	32.1	8.0	0.0		97.2	111	0	10	X		65.0
LONDON	21.2	1.7	34.5	7.4	0.0		114.7	142	0	9	253	102	15.3
MOOSONEE	14.4	0.1	30.0	-0.6	0.0		75.3	95	0	9	186	86	118.3
MUSKOKA	18.6	1.2	32.6	4.0	0.0		97.0	108	0	18	X		49.4
NORTH BAY	18.1	1.1	32.8	5.1	0.0		205.6	208	0	17	222	94	61.4
OTTAWA INT'L	20.3	1.1	34.3	6.9	0.0		121.2	137	0	13	236	M	32.7
PETAWAWA	18.9	1.3	37.1	2.9	0.0		161.9	202	0	13	X		80.8
PETERBOROUGH	19.4	1.3	35.2	1.8	0.0		43.4	58	0	8	X		46.2
PICKLE LAKE	17.2	2.1	32.3	4.8	0.0		80.6	77	0	10	X		58.7
RED LAKE	17.8	0.9	34.3	4.9	0.0		94.2	120	0	7	251	M	53.6
ST. CATHARINES	22.2	1.2	34.2	9.8	0.0		66.0	81	0	9	X		8.8
SARNIA	22.2	1.9	35.6	7.3	0.0		51.4	100	0	9	290	116	11.4
SAULT STE. MARIE	18.2	1.3	33.7	5.3	0.0		137.8	166	0	14	252	101	53.2
SIOUX LOOKOUT	17.9	1.3	32.1	8.0	0.0		77.2	87	0	10	X		50.2
SUDBURY	19.0	1.7	35.3	6.7	0.0		188.1	226	0	15	241	96	47.9
THUNDER BAY	17.6	1.2	32.2	6.2	0.0		170.4	205	0	14	214	83	48.7
TIMMINS	16.5	1.0	31.5	2.3	0.0		202.0	225	0	14	X		81.5
TORONTO	22.7	1.5	33.5	12.2	0.0		53.2	72	0	10			2.0
TORONTO INT'L	21.4	1.7	35.0	6.2	0.0		37.2	48	0	7	X		20.6
TORONTO ISLAND	22.2	2.1	35.7	12.5	0.0		55.2	77	0	8			1.5
TRENTON	21.6	1.9	33.5	5.5	0.0		59.1	82	0	7	X		21.8
WATERLOO-WELL	19.8	0.9	33.6	5.5	0.0		92.5	104	0	10	X		36.7
WAWA	16.4	M	29.5	4.2	0.0	M	178.5	M	0	11		M	73.1
WIARTON	20.3	2.2	33.5	8.1	0.0		157.4	180	0	12	279	109	43.4
WINDSOR	24.2	2.9	37.7	10.7	0.0		35.8	42	0	10	X		0.4

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QUEBEC													
BAGOTVILLE	16.7	0.3	30.5	3.5	0.0		99.9	100	0	13	X		78.1
BAIE COMEAU	14.8	0.2	28.0	2.2	0.0		122.0	128	0	10	205	*	111.1
BLANC SABLON	12.8	1.0		2.4	0.0		135.6	125	0	11	194	*	
CHIBOUGAMAU	14.3	0.3	29.8	1.0	0.0		112.8	95	0	16	175	84	130.2
GASPE	16.5	0.5	30.8	2.5	0.0		98.9	113	0	11	236	*	77.2
INUKJUAK	9.8	0.9	22.3	3.8	0.0		81.8	125	0	13	174	119	252.5
KUUJJUAQ	11.6	1.2	25.0	1.9	0.0		85.6	134	0	15	160	96	197.4
KUUJJUARAPIK	12.9	2.5	30.0	4.8	0.0		81.4	86	0	13	198	118	159.8
LA GRANDE RIVIERE	12.9	*	28.7	0.9	0.0	*	57.6	*	0	11	198	*	160.2
MANIWAKI	18.3	1.3	32.3	5.1	0.0		206.5	226	0	16	188	83	58.9
MATAGAMI	14.3	0.3	29.5	1.8	0.0		186.5	174	0	18	178	87	126.6
MONT JOLI	16.3	0.3	29.4	2.1	0.0		109.6	138	0	14	206	84	82.2
MONTREAL INT'L	20.5	0.9	33.3	7.1	0.0		159.0	173	0	15	202	84	27.9
MONTREAL M INT'L	18.8	*	31.7	4.7	0.0	*	146.0	*	0	10	201	*	45.5
NATASHQUAN	13.3	0.0	24.0	4.5	0.0		61.4	58	0	6	256	111	149.5
QUEBEC	18.7	1.2	32.5	5.7	0.0		134.4	114	0	14	181	82	41.3
ROBERVAL	16.9	0.5	30.8	4.5	0.0		152.8	154	0	15	179	*	72.1
SCHEFFERVILLE	11.6	0.8	26.2	2.2	0.0		53.2	54	0	13	203	*	199.1
SEPT-ILES	14.4	0.3	27.8	3.6	0.0		71.3	68	0	10	223	100	116.6
SHERBROOKE	18.4	1.9	31.4	2.1	0.0		190.7	157	0	16	199	*	58.3
STE AGATHE DES MONTS	17.1	1.3	30.9	3.0	0.0		228.8	201	0	14	187	79	77.5
ST-HUBERT	20.3	1.1	34.5	5.0	0.0		106.6	110	0	13	*		32.3
VAL D'OR	16.5	1.0	30.0	3.3	0.0		169.2	167	0	13	163	69	85.2
NEW BRUNSWICK													
CHARLO	16.9	0.8	29.5	3.6	0.0		106.0	98	0	12	207	85	69.9
CHATHAM	19.0	1.0	32.8	4.0	0.0		166.3	199	0	14	197	82	46.2
FREDERICTON	19.3	1.1	33.7	2.9	0.0		128.2	147	0	11	200	*	44.5
MONCTON	18.5	0.9	31.9	4.8	0.0		117.7	149	0	15	187	81	46.6
SAINT JOHN	17.3	0.7	29.4	4.3	0.0		150.4	147	0	14	173	81	49.2

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NOVA SCOTIA													
GREENWOOD	19.8	1.5	32.2	4.0	0.0		58.1	64	0	6	X		28.6
HALIFAX INT'L	19.3	1.2	32.4	8.3	0.0		68.1	61	0	9	*		32.4
SABLE ISLAND	17.7	0.1	23.5	6.0	0.0		75.6	65	0	6	143	80	27.8
SHEARWATER	18.5	0.7	30.2	8.9	0.0		36.9	37	0	10	184	81	25.5
SYDNEY	18.1	0.5	30.6	5.3	0.0		119.7	118	0	10	210	93	52.7
YARMOUTH	17.4	1.0	27.2	5.7	0.0		60.4	62	0	9	153	73	39.1
PRINCE EDWARD ISLAND													
CHARLOTTETOWN	18.5	0.7	28.5	5.0	0.0		115.6	131	0	11	X		47.7
SUMMERSIDE	19.0	0.6	31.1	8.3	0.0		121.0	151	0	14	186	77	35.1
NEWFOUNDLAND													
BATTLE HARBOUR	13.1	1.9	27.9	2.5	0.0		90.6	107	0	10	X		154.2
BONAVISTA	15.7	0.7	27.3	6.3	0.0		26.6	31	0	8	X		79.0
BURGEO	14.8	-0.1	23.8	6.6	0.0		90.1	60	0	13	*		99.9
CARTWRIGHT	14.5	2.5	26.4	2.7	0.0		58.8	71	0	15	208	119	169.5
CHURCHILL FALLS	12.8	0.4	28.0	4.0			70.0	73	0	15	241	140	162.6
COMFORT COVE	15.8	0.2	31.6	5.2	0.0		53.5	49	0	9	X		89.9
DANIEL'S HARBOUR	14.0	-0.5	24.5	4.0	0.0		27.4	23	0	6	137	76	60.7
DEER LAKE	16.2	1.2	31.3	1.2	0.0		80.3	78	0	9	X		81.7
GANDER INT'L	16.1	0.5		5.4	0.0		118.6	121	0	12	236	126	82.7
GOOSE	15.7	1.4	29.0	4.3	0.0		30.6	29	0	9	214	121	82.6
PORT-AUX-BASQUES	15.3	0.6	24.7	7.1	0.0		78.8	69	0	14	206	*	82.2
ST ANTHONY	12.6	0.5	23.2	2.7	0.0		111.6	81	0	12		*	169.7
ST JOHN'S	15.7	0.4	27.2	6.4	0.0		75.9	62	0	7	229	123	85.3
ST LAWRENCE	15.5	1.6	26.4	4.9	0.0		66.1	46	0	7		*	76.6
STEPHENVILLE	16.5	0.4	27.2	5.8	0.0		82.1	79	0	11	228	*	58.0
WABUSH LAKE	12.2	0.4	26.5	9.8	0.0		54.9	58	0	13	217	*	184.1

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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	18.1	0.4	31.0	8.5	0.0	37.7	61	0	7	234	404.8	1644.0
SIDNEY	17.1	s	27.5	9.5	0.0	35.6	s	0	3	288	378.7	1432.9
SUMMERLAND	19.5	0.5	33.5	9.0	0.0	36.2	132	0	6	293	s	1787.5
ALBERTA												
BEAVERLODGE	15.0	0.8	31.0	1.0	0.0	46.0	72	0	8	250	307.0	1110.3
ELLERSLIE												
LACOMBE	14.8	-0.1	29.5	3.0	0.0	87.3	127	0	10	291	301.3	1203.8
LETHBRIDGE												
VEGREVILLE	15.3	0.2	29.5	1.5	0.0	114.2	153	0	9	N/A	317.8	1331.4
SASKATCHEWAN												
INDIAN HEAD	17.5	0.1	37.0	2.0	0.0	70.8	126	0	8		394.2	1691.5
MELFORT	16.6	0.5	28.5	2.0	0.0	79.7	146	0	10	252	368.0	1564.5
REGINA	17.7	0.3	37.0	0.5	0.0	69.6	157	0	7	N/A	392.5	1694.0
SASKATOON												
SCOTT	15.0	-1.0	30.0	4.0	0.0	96.1	206	0	11	265	305.9	1447.2
SWIFT CURRENT SOUTH	17.9	0.2	42.0	4.5	0.0	30.4	79	0	6	301	399.7	1730.0
MANITOBA												
BRANDON	19.0	1.1	40.0	11.0	0.0	22.0	32	0	4	N/A	435.3	1809.1
GLENLEA	20.5	2.2	38.5	5.0	0.0	15.0	25	0	4	238	479.1	1804.6
MORDEN	21.1	2.1	39.5	6.5	0.0	20.8	29	0	3	276	503.0	2012.5
ONTARIO												
DELHI	21.7	1.9	36.0	6.5	0.0	40.4	43	0	8	283	503.0	1857.6
ELORA	19.6	1.5	33.8	5.5	0.0	47.9	66	0	10		452.4	1608.1
GUELPH	20.1	1.3	33.5	3.5	0.0	88.4	108	0	10	268	469.0	1676.9
HARROW	23.0	0.8	36.0	9.5	0.0	96.1	121	0	7	271	556.8	2077.1
KAPUSKASING	15.9	0.4	29.0	0.0	0.0	208.4	233	0	12	170	334.8	1177.1
OTTAWA	20.5	1.4	32.6	7.2	0.0	171.4	202	0	13	223	479.9	1776.6
SMITHFIELD	22.0	2.7	39.1	3.8	0.0	63.6	84	0	6	N/A	538.3	1890.2
VINELAND STATION	21.7	0.9	33.1	10.0	0.0	75.4	88	0	11	268	518.0	1837.7
QUEBEC												
LA POCATIERE	17.9	0.6	31.5	6.0	0.0	79.2	80	0	13	207	399.6	1363.4
L'ASSUMPTION	20.0	0.2	33.0	4.5	0.0	147.2	158	0	15	202	464.3	1683.3
LENNOXVILLE												
NORMANDIN	15.4	1.5	29.5	2.0	0.0	141.6	124	0	14	185	318.4	1168.4
ST. AUGUSTIN												
STE CLOTHILDE	20.4	1.5	34.5	4.5	0.0	78.4	82	0	12	226		
NEW BRUNSWICK												
FREDERICTON	19.8	1.7	33.5	8.5	0.0	120.3	139	0	11	200	466.4	1502.6
NOVA SCOTIA												
KENTVILLE	19.9	1.5	31.5	6.0	0.0	81.2	83	0	10	190	451.4	1460.8
NAPPAN	18.4	1.0	29.0	4.0	0.0	103.5	116	0	12	163	417.2	1396.0
PRINCE EDWARD ISLAND												
CHARLOTTETOWN	19.2	0.8	29.0	7.0	0.0	111.6	126	0	11	173	439.3	1326.4
NEWFOUNDLAND												
ST. JOHN'S WEST	16.7	1.2	26.5	5.0	0.0	78.3	68	0	11	224	371.0	1067.0