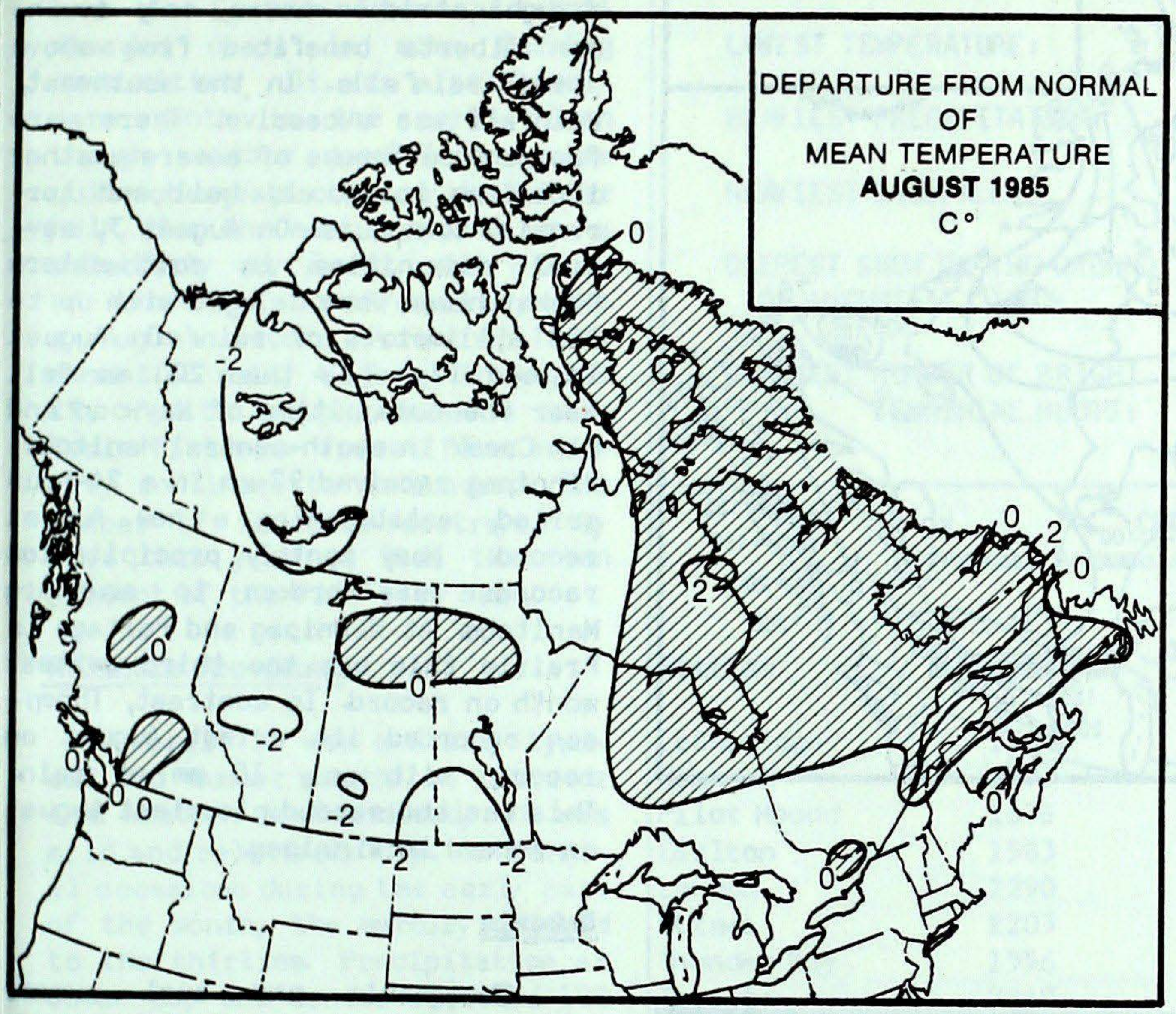
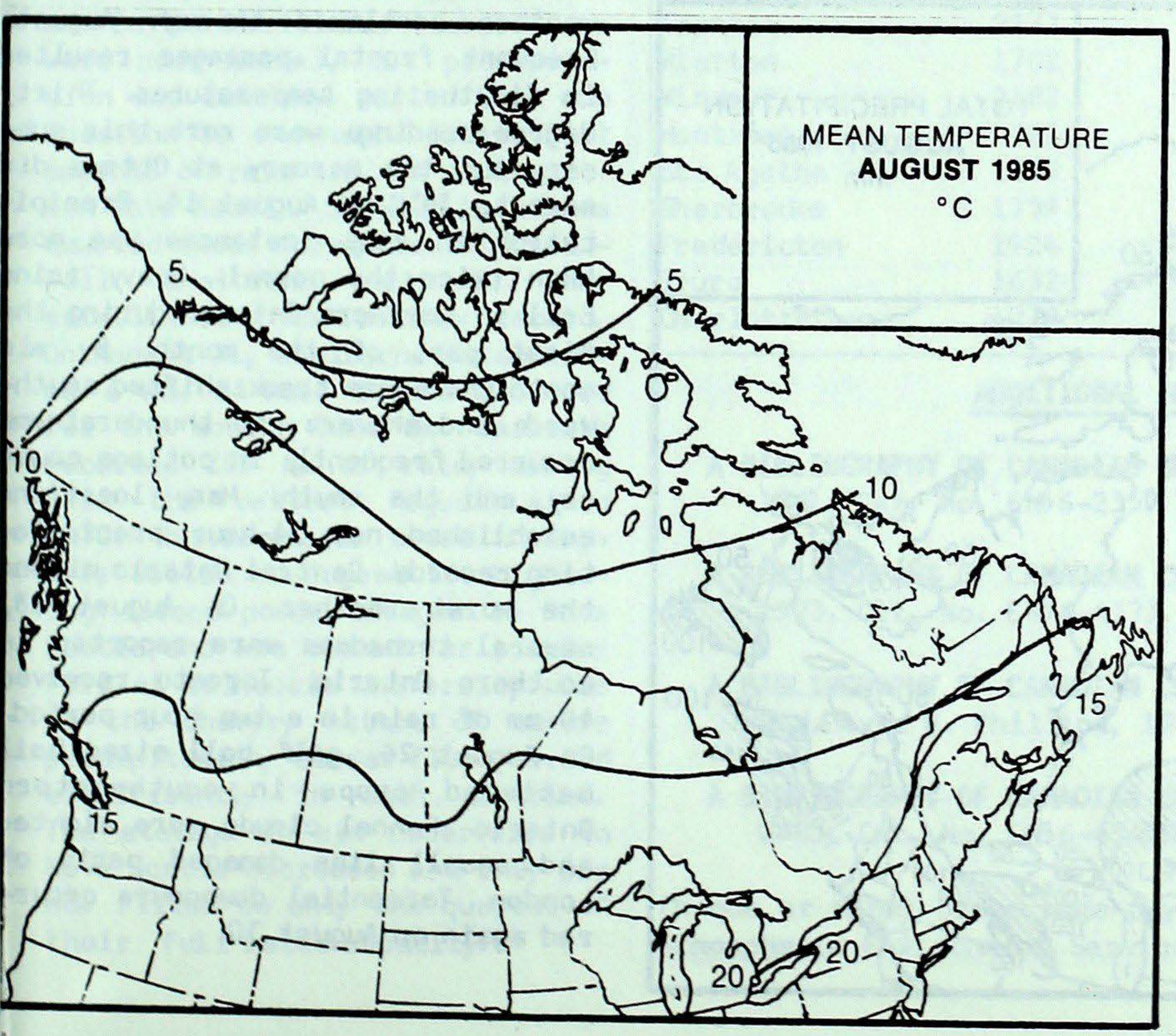
Environment Canada Environnement Canada

Climatic Perspectives

Monthly Supplement

Vol.7 August, 1985





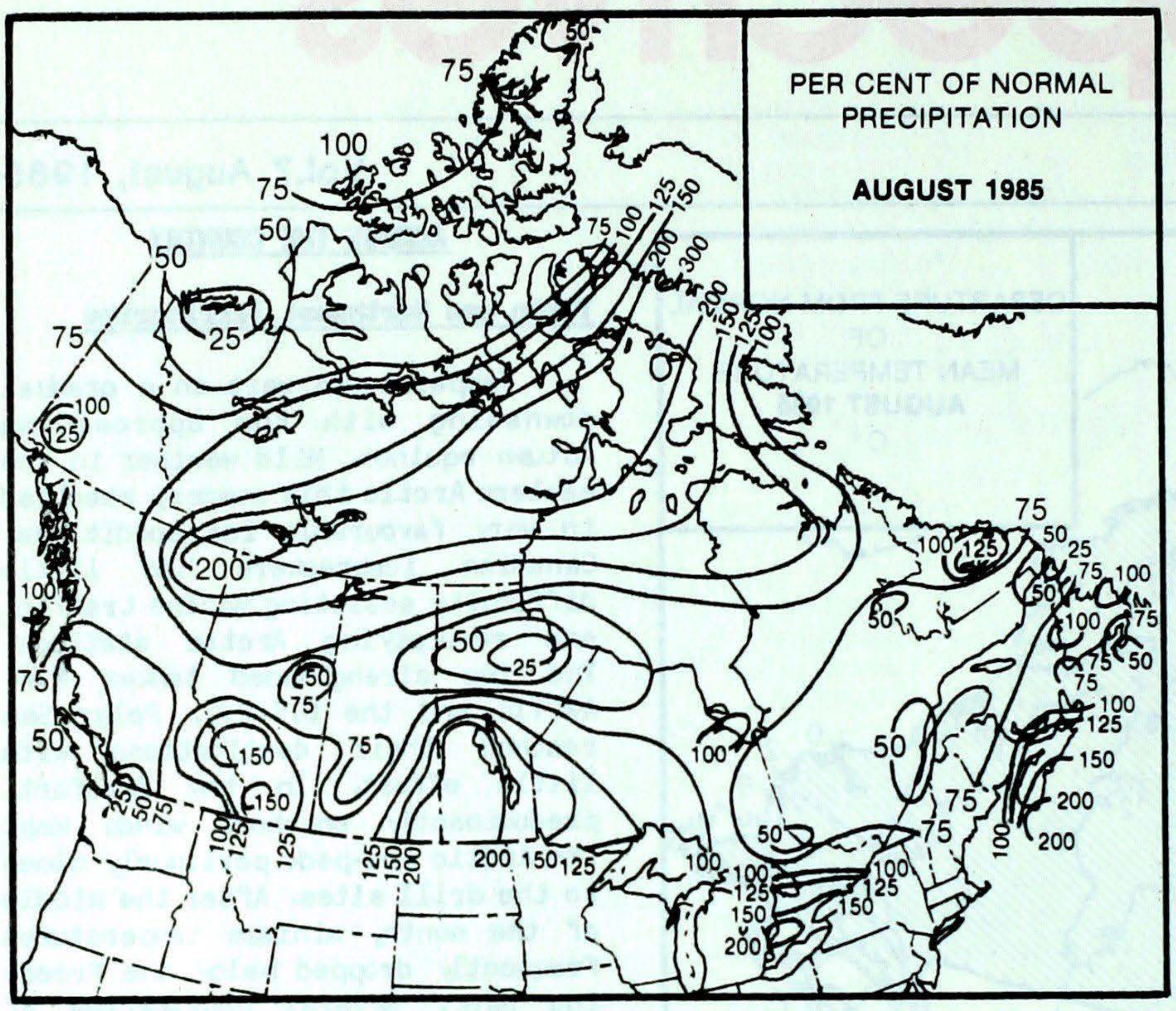
ACROSS THE COUNTRY

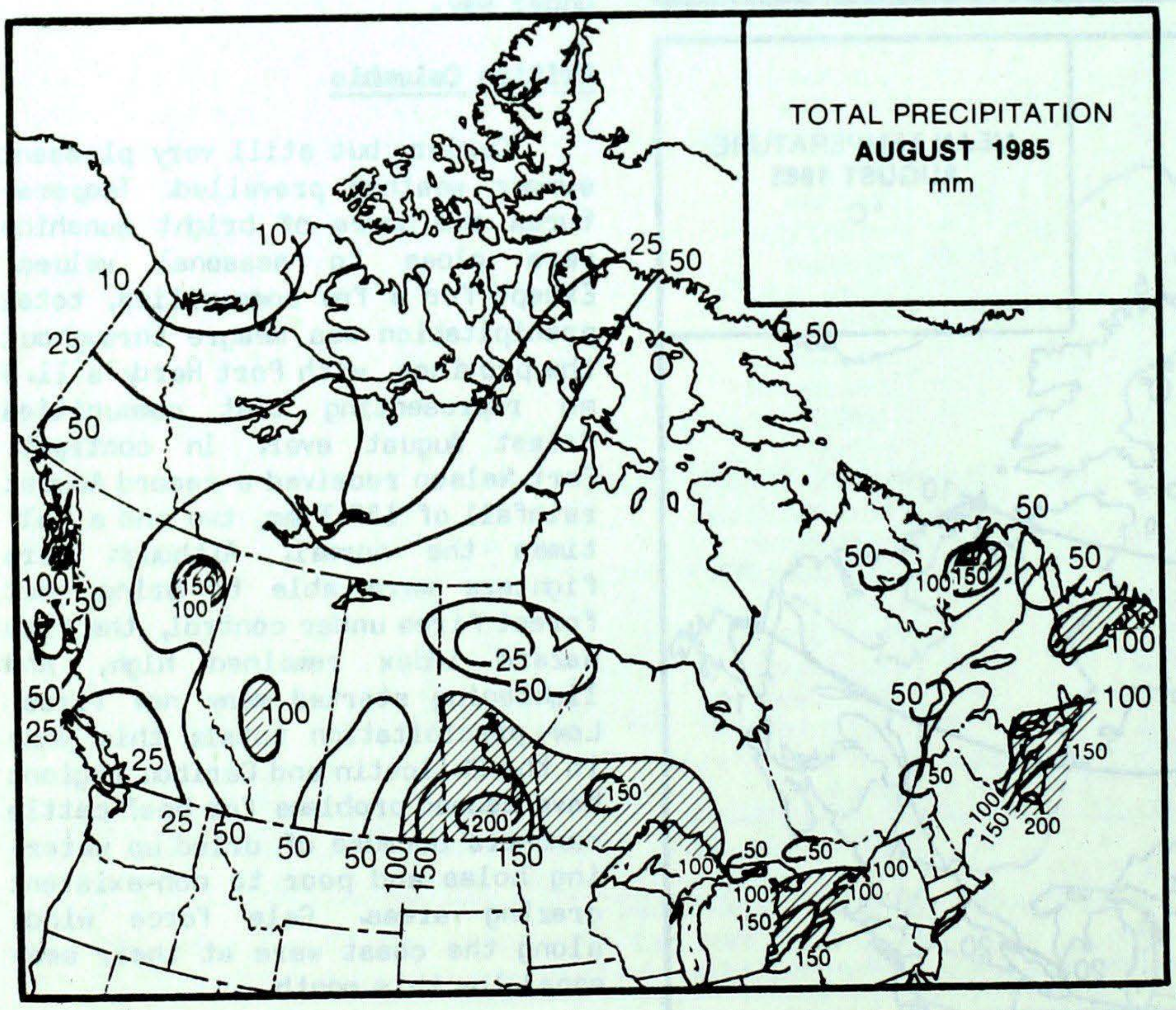
Yukon and Northwest Territories

Temperatures were on a gradual downswing with the approaching Autumn equinox. Mild weather in the eastern Arctic this summer, resulted in very favourable ice conditions. Canadian icebreakers had little difficulty assisting marine traffic, and resupplying Arctic stations. The ice strengthened tanker M.V. ARCTIC and the U.S.C.G. Polar Sea reached their destinations with little effort. In the Beaufort, predominantly on-shore winds kept the Arctic ice-pack perilously close to the drill sites. After the middle of the month, minimum temperatures frequently dropped below the freezing mark. Several centimetres of fresh snow blanketed the high Arctic and the mountainous regions of the Yukon. By month's end a killing frost had occurred in most areas and the autumn color change was well under way.

British Columbia

Cooler, but still very pleasant summer weather prevailed. Temperatures and hours of bright sunshine were close to seasonal values. Except for a few communities, total precipitation was meagre throughout the province, with Port Hardy's 11.8 mm representing that communities driest August ever. In contrast, Fort Nelson received a record August rainfall of 159.3 mm, two and a half times the normal. Although fire fighters were able to bring most forest fires under control, the fire hazard index remained high, and lightening started many new fires. Low precipitation totals this year in the Chilcotin and Caribou regions have caused problems for beef cattle ranchers because of dried up watering holes and poor to non-existent grazing areas. Gale force winds along the coast were at their seasonal low this month.


PER CENT OF NORMAL PRECIPITATION
AUGUST 1985


TOTAL PRECIPITATION
AUGUST 1985
mm

The Prairies

It was a cool, wet month especially in the east. Warmest temperatures, climbing to the low thirties, were recorded during the first half of the month. Patchy ground frost was reported in agricultural districts and the foot hills. In the drought stricken areas, only southern Alberta benefited from above normal rainfalls. In the southeast, rainfall was excessive. There were frequent outbreaks of severe weather including tornadoes, hail and torrential downpours. On August 3, several communities in southwestern Saskatchewan were deluged with up to 350 millimetres of rain. On August 16 and 17, more than 200 mm fell near the communities of Haywood and Elm Creek in south-central Manitoba; Winnipeg received 97 mm in a 24-hour period, establishing a new August record. Many monthly precipitation records were broken in southern Manitoba. At Winnipeg and Portage La Prairie this was the third wettest month on record. In contrast, Thompson recorded its driest August on record, with only 10 mm of rain. This was the second cloudiest August on record in Winnipeg.

Ontario

Changeable and cool summer weather continued through August. Frequent frontal passages resulted in fluctuating temperatures. Thirty degree readings were rare this summer, but the mercury at Ottawa did soar to 34°C on August 14. Precipitation in many instances was more than twice the normal. Heavy rains fell in northern Ontario during the first part of the month. By mid month the storm track shifted southwards and showers and thunderstorms occurred frequently in cottage country and the south. Many locations established new 24-hour precipitation records. Central Ontario missed the worst weather. On August 18, several tornadoes were reported in southern Ontario. Toronto received 40 mm of rain in a two hour period. On August 26, golf ball sized hail battered crops in southwestern Ontario. Funnel clouds were sighted and squall line damaged parts of London. Torrential downpours occurred again on August 30.

Quebec

Warm and dry weather dominated the southern portion of the province during the first half of the month, followed by a relatively more cool and damp weather regime. On August 8, heavy thunderstorms moved through the Ottawa Valley and the Eastern Townships. Hail damaged crops in some farming communities. It was a relatively warm month in the north. Even though weather conditions became quite changeable during the latter half, for the most part, it was a relatively dry month, with plenty of sunshine. Schefferville broke a August record for the least amount of rain, 42.9 mm. On August 29, frost damaged tobacco near Trois Rivières. Forest fire activity continued to be subdued. The number of hectares destroyed by fire this year is less than ten percent of the five-year mean.

Atlantic Provinces

Overall it was a fairly typical mid summer month. In Labrador and western Newfoundland, it was mild and relatively dry. On several occasions during the early part of the month, the mercury climbed to the thirties. Precipitation at Goose Bay and Gander exceeded 100 mm. In the Maritimes, temperatures were near normal, but precipitation and sunshine varied from one location to the next. Substantial amounts of rain fell in southwestern Nova Scotia. Several locations doubled their normal monthly rainfall. Shelburne, with 217 mm, established a new monthly record. On August 31, Shelburne established a new 24-hour rainfall record for the month, 70.6 mm. Yarmouth recorded 205 mm of rain, making this the wettest August since 1970. Thunderstorms moved through Nova Scotia on August 16. Lightning caused power outages in Nova Scotia and was blamed for a major fire at Dalhousie University. Due to the showery nature of summer precipitation, stream flows varied significantly in each district. The storage in six reservoirs in Nova Scotia decreased and they are now filled to only one quarter of their full rated capacity.

CLIMATIC EXTREMES IN CANADA - JULY 1985

MEAN TEMPERATURE:			
	WARMEST	Windsor, ONT	20.9°C
	COLDEST	Alert, NWT	- 0.3°C
HIGHEST TEMPERATURE:		Kamloops, BC	34.5°C
LOWEST TEMPERATURE:		Resolute, NWT	- 9.0°C
HEAVIEST PRECIPITATION:		Portage la Prairie, MAN	222.2 mm
HEAVIEST SNOWFALL:		Alert, NWT	12.8 cm
DEEPEST SNOW ON THE GROUND ON AUGUST 31, 1985:		Alert, NWT	6.0 cm
GREATEST NUMBER OF BRIGHT SUNSHINE HOURS:		Victoria Gonzales Hts. BC	345 hrs

CORN HEAT UNITS

Seasonal Accumulation to the end of August

Station	August 1985	August 1984	Normal	Per cent of Normal
Lethbridge	1644	1733	1561	105
Brandon	1579	1988	1971	80
Pilot Mound	1678	2141	1932	87
Earlton	1583	1808	1551	102
London	2290	2336	2391	96
Ottawa	2203	2351	2375	93
Thunder Bay	1556	1835	1497	104
Toronto	2240	2332	2372	94
Trenton	2177	2307	2465	88
Wiarton	1782	2058	2022	88
Windsor	2682	2736	2713	99
Montréal	2325	2379	2498	93
Ste Agathe	1797	1851	1896	95
Sherbrooke	1759	1824	2280	77
Fredericton	1924	1958	1996	96
Truro	1632	1658	1618	101
Charlottetown	1778	1765	1834	97

ADDITIONAL AES CLIMATE PUBLICATIONS

A BIBLIOGRAPHY OF CANADIAN CLIMATE 1763 - 1957 - Morley K. Thomas 1961. Cat. No. EN56-2357 — $1.00

A BIBLIOGRPAHY OF CANADIAN CLIMATE 1958 - 1971 - Morley K. Thomas 1973. Cat. No. EN56-4373 — $2.00

A BIBLIOGRAPHY OF CANADIAN CLIMATE 1972 - 1976 - Morley K. Thomas and David W. Phillips, 1979. Cat. No. EN56-43/1976 — $4.00

A BIBLIOGRAPHY OF CANADIAN CLIMATE 1977 - 1981 - David W. Phillips, 1983. Cat. No. EN56-43/1981 — $5.00

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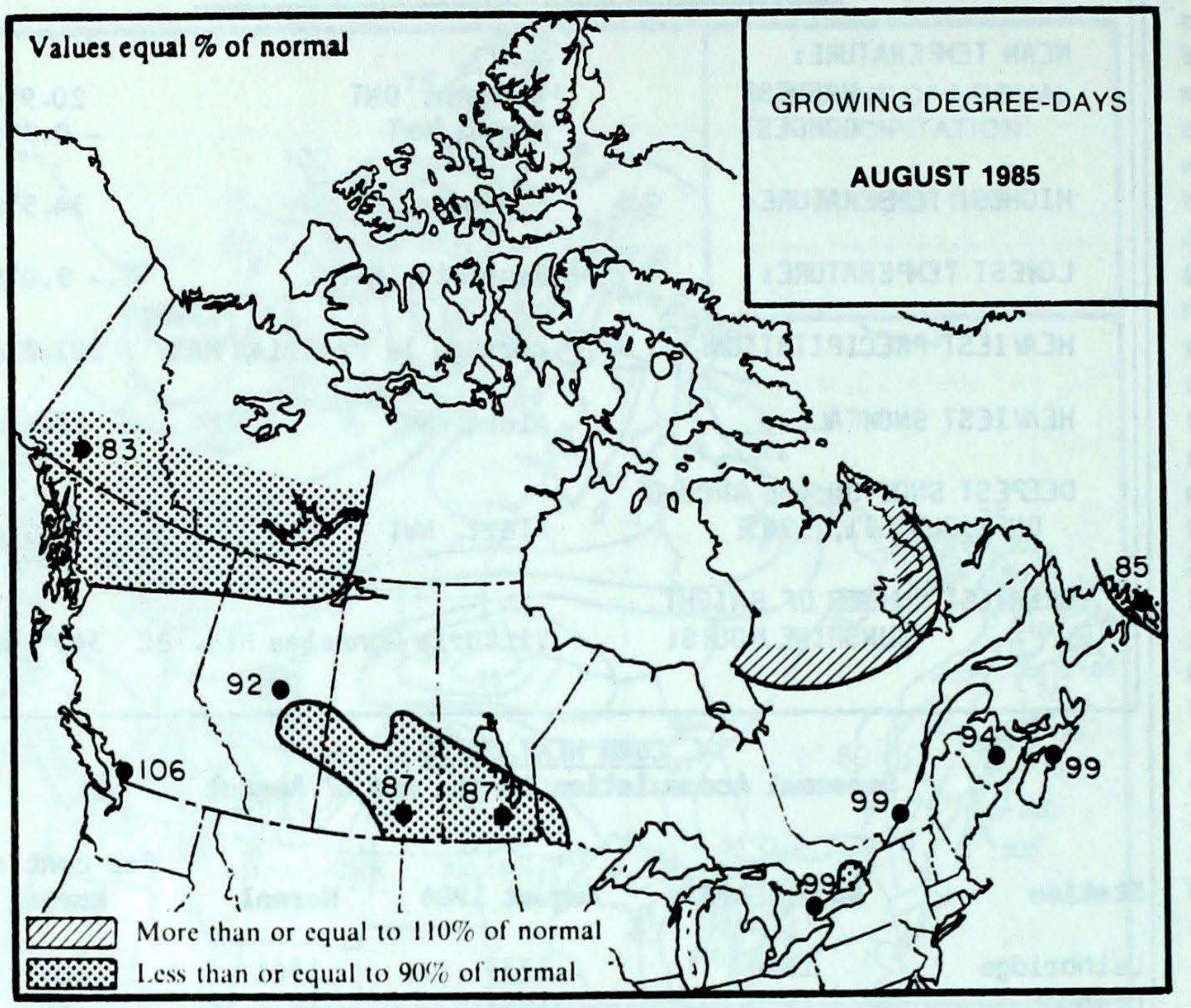
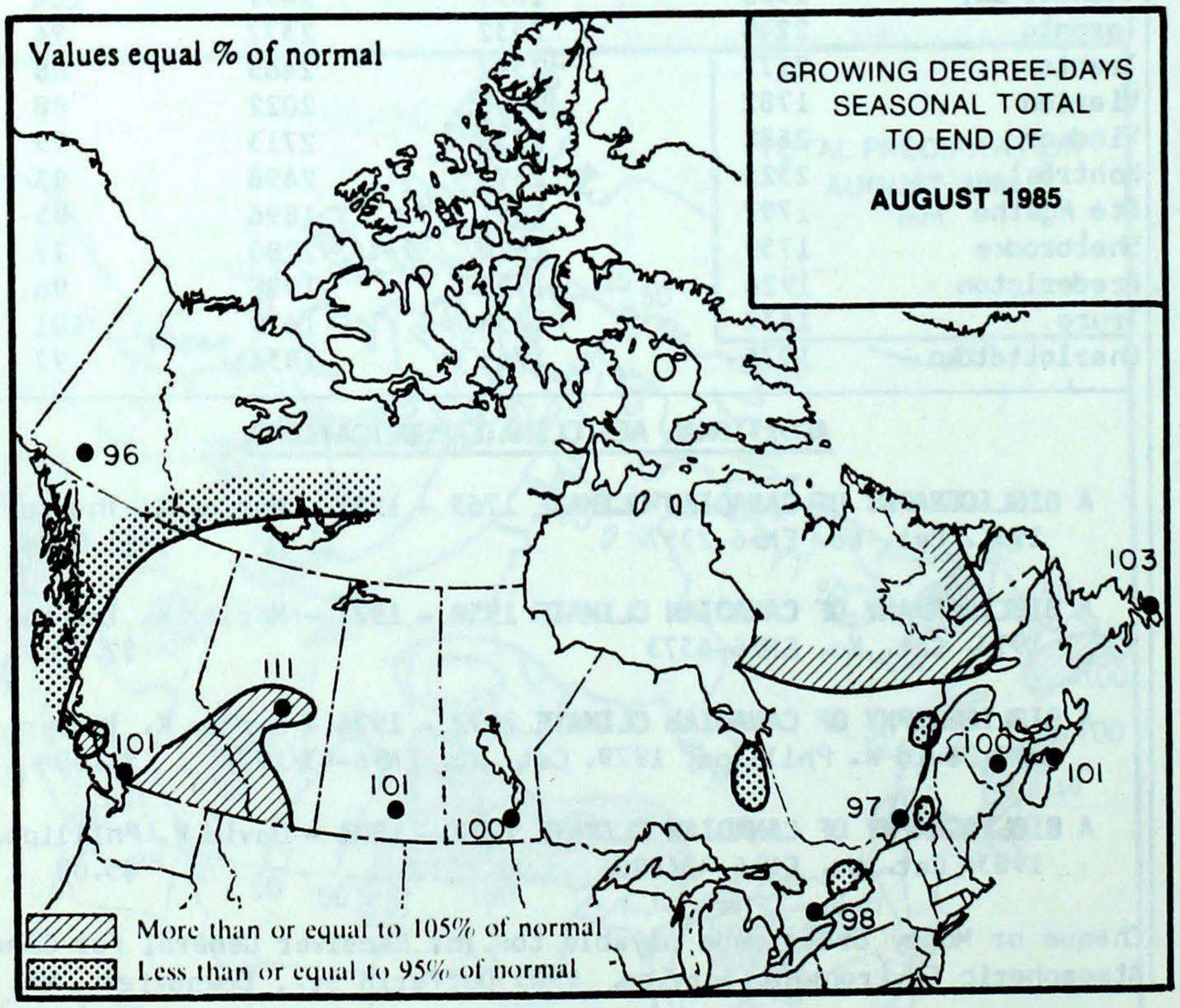
GROWING DEGREE DAYS





SEASONAL TOTAL OF GROWING DEGREE-DAYS TO END OF AUGUST

	1985	1984	NORMAL
BRITISH COLUMBIA			
Abbotsford	1556	1476	1453
Kamloops	1941	1838	1854
Penticton	1866	1695	1766
Prince Rupert	808	895	933
Vancouver	1536	1576	1517
Victoria	1389	1424	1389
ALBERTA			
Calgary	1251	1219	1156
Edmonton Mun.	1363	1449	1230
Grande Prairie	1203	1060	1154
Lethbridge	1512	1477	1421
Peace River	1167	1085	1130
SASKATCHEWAN			
Estevan	1585	1755	1537
Prince Albert	1230	1387	1257
Regina	1436	1598	1426
Saskatoon	1413	1558	1407
Swift Current	1432	1485	1391
MANITOBA			
Brandon	1334	1519	1434
Churchill	525	717	521
Dauphin	1284	1485	1376
Winnipeg	1509	1596	1509
ONTARIO			
London	1778	1712	1717
Mount Forest	1419	1462	1390
North Bay	1365	1400	1401
Ottawa	1714	1767	1698
Thunder Bay	1209	1318	1212
Toronto	1696	1686	1731
Trenton	1685	1655	1725
Windsor	2112	1992	1984
QUEBEC			
Baie Comeau	949	976	1005
Maniwaki	1395	1408	1379
Montreal	1700	1796	1747
Quebec	1459	1550	1453
Sept-Iles	946	950	900
Sherbrooke	1396	1404	1489
NEW BRUNSWICK			
Charlo	1232	1331	1245
Fredericton	1471	1561	1473
Moncton	1343	1462	1349
NOVA SCOTIA			
Sydney	1212	1385	1188
Truro	1265	1422	1252
Yarmouth	1197	1290	1193
PRINCE EDWARD ISLAND			
Charlottetown	1318	1460	1281
NEWFOUNDLAND			
Gander	1027	1165	1016
St. John's	927	1158	904
Stephenville	1079	1255	1033

FEATURE

WEATHER SATELLITES

Information Directorate
Atmospheric Environment Service

Many of us are unaware of the satellites that watch the skies above us, both day and night, and send back pictures of cloud cover and other information about the earth's atmosphere. Scientists use this information to alert us to nature's untameable force: the weather.

Before the satellite

In the past, weather forecasters based their predictions on measurements of air temperature, air pressure, humidity, precipitation, cloud cover and wind speed and direction. The forecasters then laboriously drew up weather maps and analyzed their observations. By repeating this process every 6 to 12 hours they could estimate the speed and direction of movement of weather systems.

Since the atmosphere is like a fluid, in constant motion, the air masses are always moving; cool, dry, Arctic air moves south and warm, moist, tropical air moves north. At the boundary, or front, where these two air masses meet, there are rapid temperature and humidity changes. Low pressure areas develop and move along the boundary, bringing rain or snow and wind. Using the available weather observations, forecasters try to follow movements of these fronts and thereby predict the weather.

Because weather stations are relatively far apart, it is sometimes difficult to locate weather systems such as fronts and to follow their precise movements. This problem is especially serious over oceans, deserts, and polar regions, from which conventional reports are sparse.

The benefits of weather satellites

The advent of weather satellites completely changed the picture. For the first time, meteorologists were able to observe cloud formations over large areas of the globe. This enabled them to locate more accurately large scale features such as storm systems, fronts, jet streams, fog and to determine upper level wind directions and speeds.

Although weather station observers still take the standard atmospheric measurements such as temperature, humidity and pressure, satellites provide additional information on what is happening between weather stations. For example, thunderstorms, which are usually less than 80 kiliometres across, can occur between weather stations and therefore, may not be detected by conventional means. However, these thunderstorms can be seen by satellites. Furthermore, successive satellite pictures provide precise information on the movement of and changes in weather systems over a period time. Thus, the accuracy of short and long term forecasts is increased.

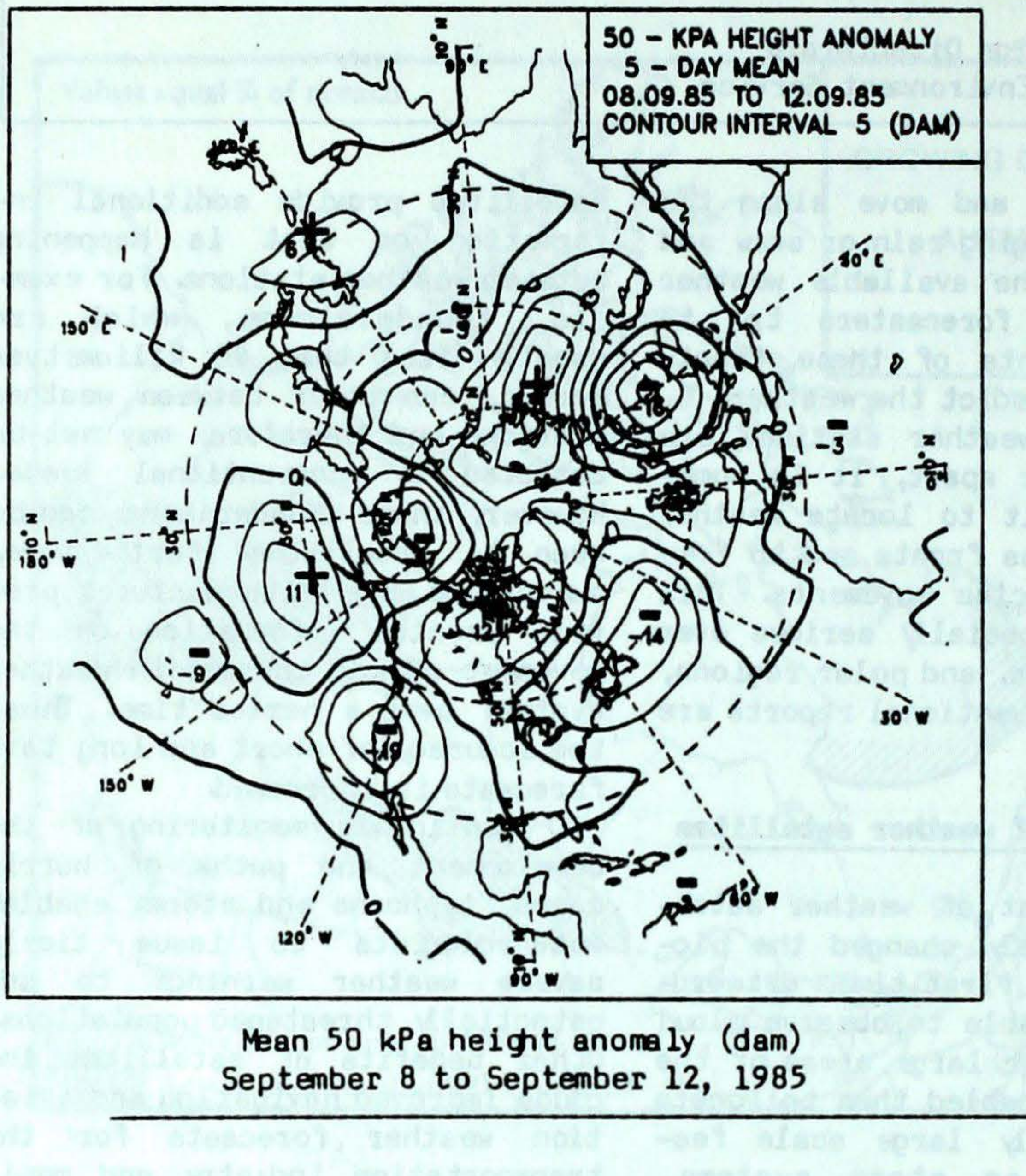
Continuous monitoring of the development and paths of hurricanes, typhoons and storms enables meteorologists to issue timely severe weather warnings to any potentially threatened populations. Other benefits of satellites include improved navigation and aviation weather forecasts for the transportation industry and monitoring of ice conditions in the Arctic, the Great Lakes and the Antarctic. Accurate information about ice conditions is especially useful for oil and gas field development in Canadian Arctic. Scientists also use satellite informa-

...continued on page 8B

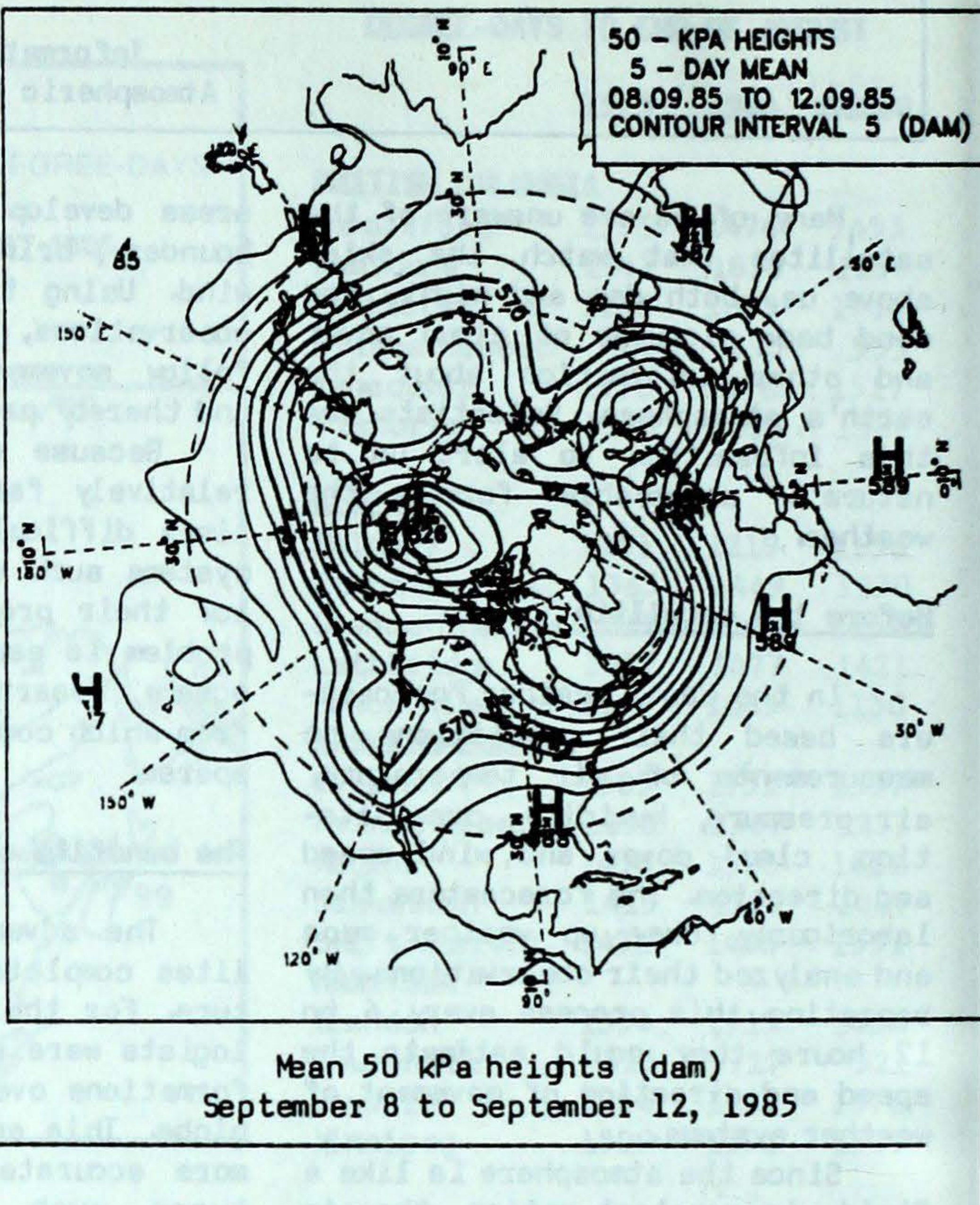
MEAN AUGUST 50 kPa CIRCULATION (see page 7B)

The circulation pattern saw certain adjustments during the month of August. In the north, the planetary trough over the eastern part of the country pivoted westward over the Gulf of Boothia, some 20° west of its normal position. South of Alaska, the upper trough over the Pacific was replaced by a ridge which is shown with a value of +40 dam on the height anomalies analysis chart. An anomalous ridge was also located over Greenland. It oscillated over the course of the month; at high latitudes it moved west, as can be seen on the time-longitude diagrams for 45° and 65°N. While the quasi-stationary Pacific ridge is more easily identifiable, the positive height anomaly in the east did have a notable effect at the surface: temperatures were above normal in New Quebec, Labrador and Northern Ontario, and on Baffin Island.

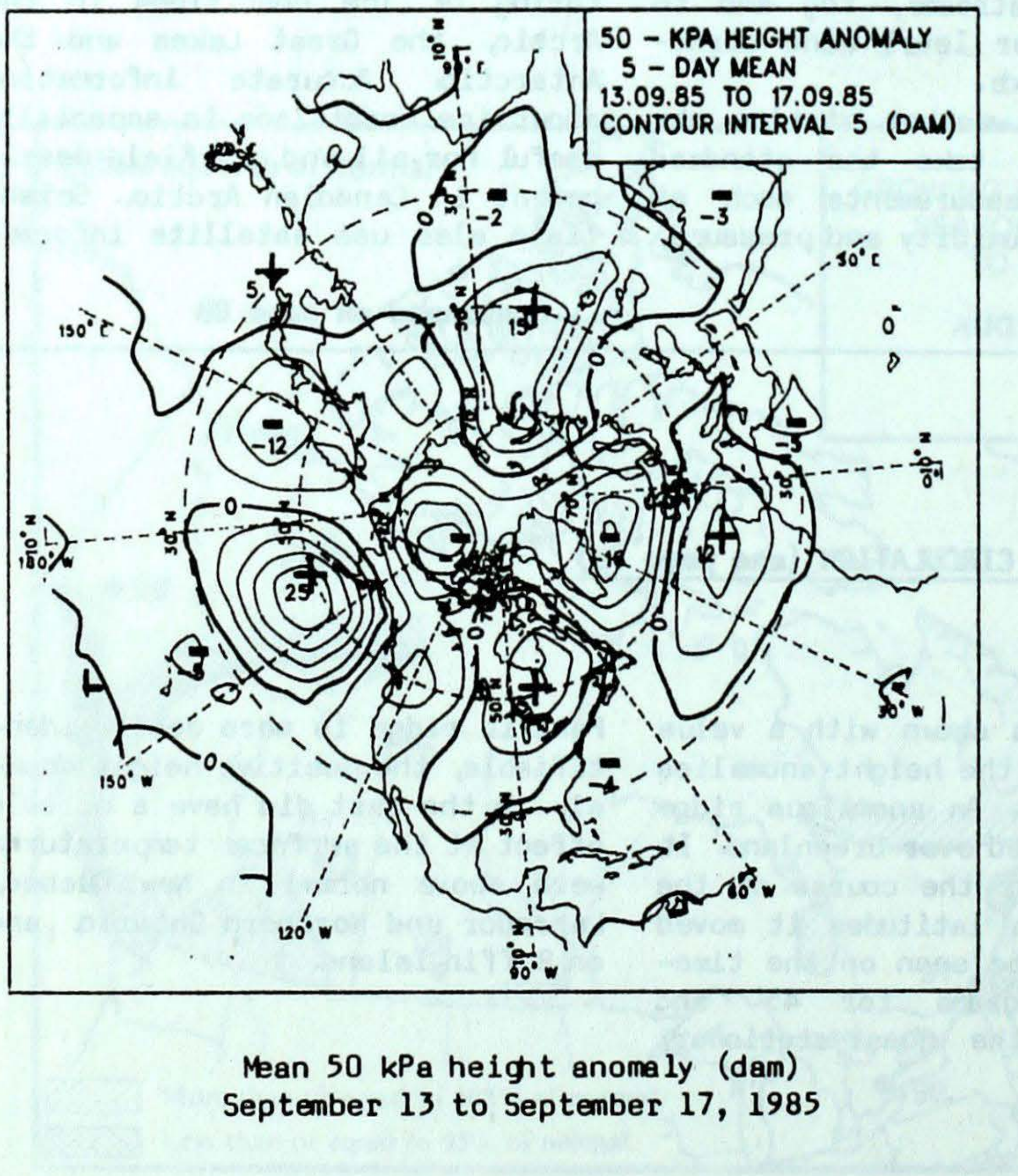
ATMOSPHERIC CIRCULATION



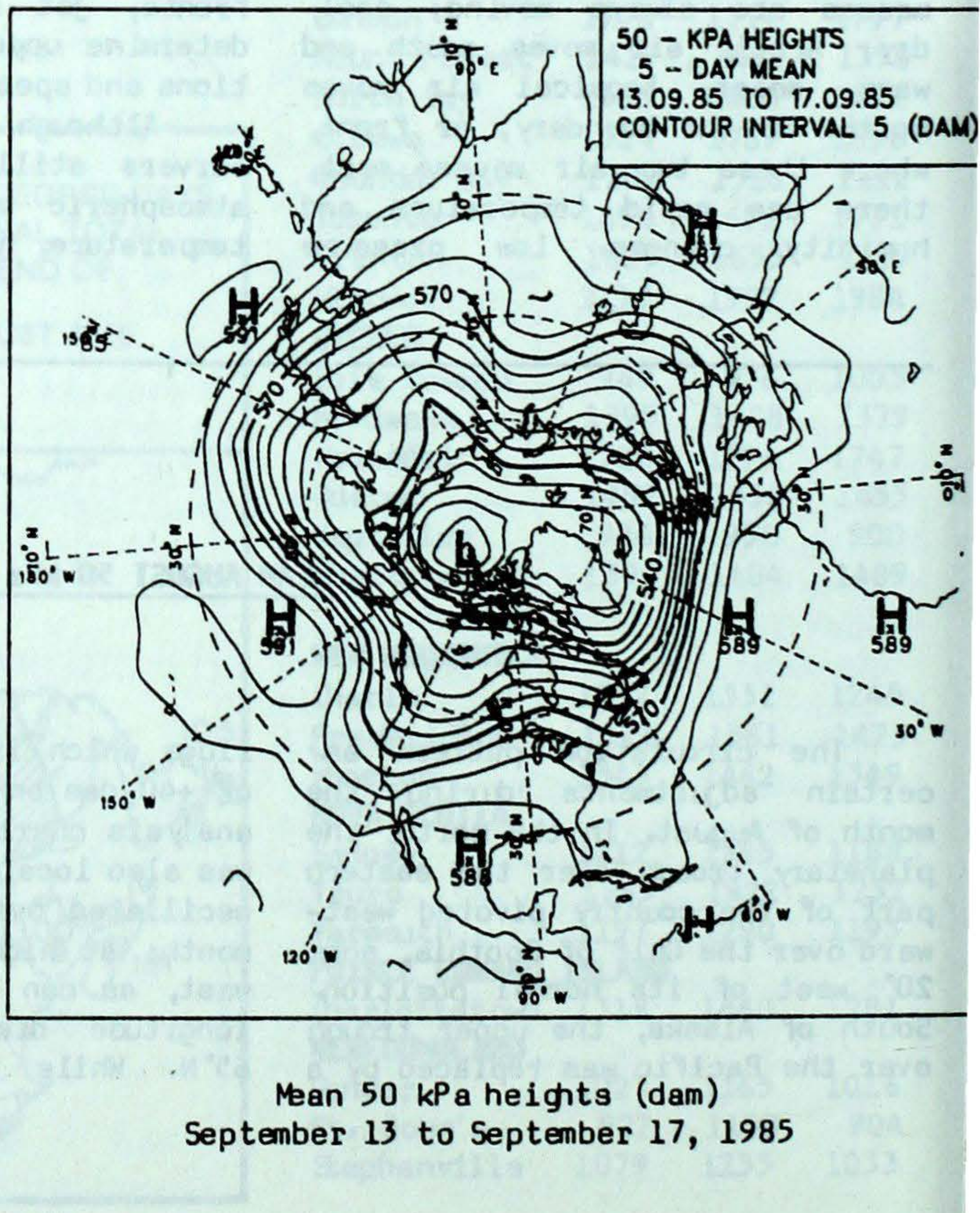
Mean 50 kPa height anomaly (dam)
September 8 to September 12, 1985



Mean 50 kPa heights (dam)
September 8 to September 12, 1985

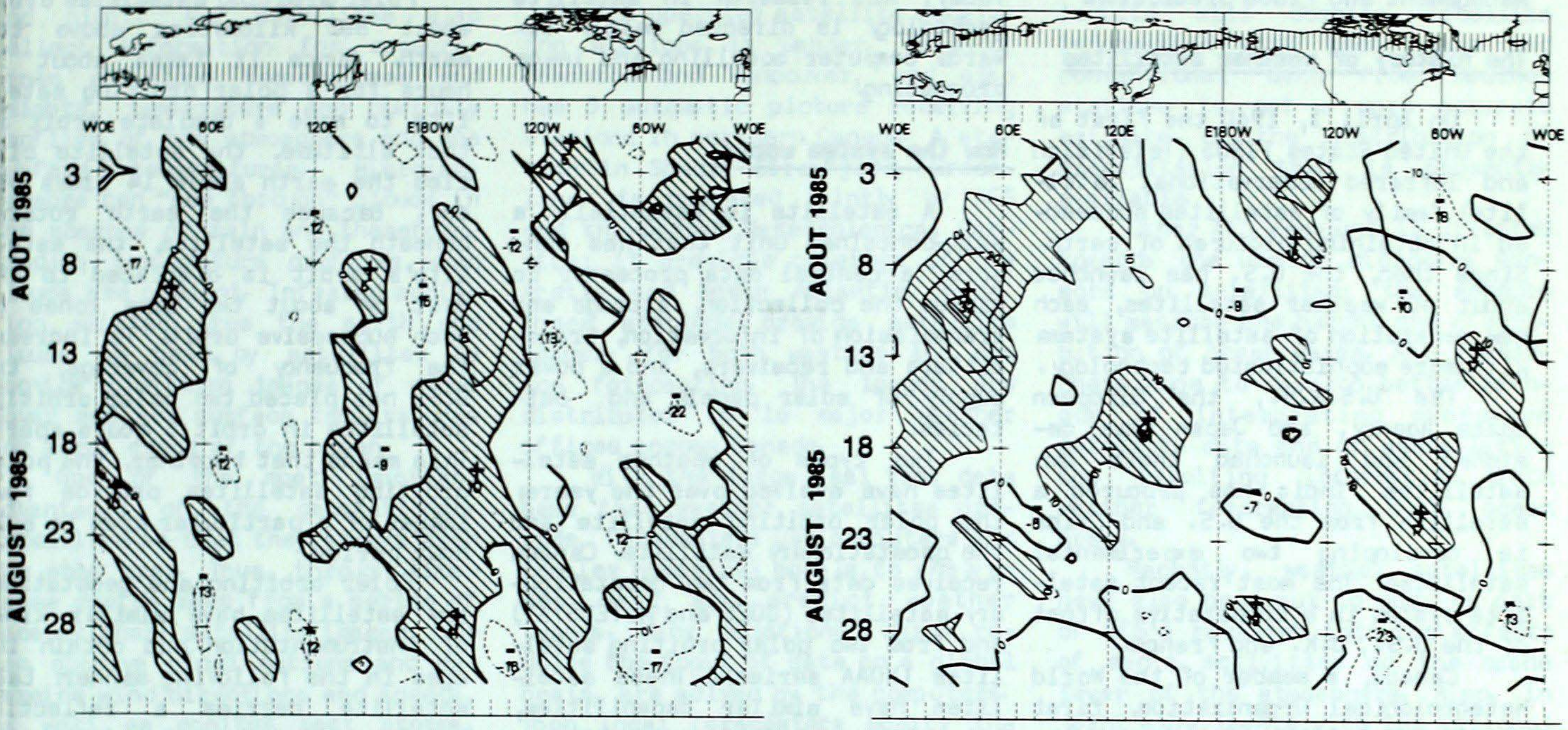


Mean 50 kPa height anomaly (dam)
September 13 to September 17, 1985

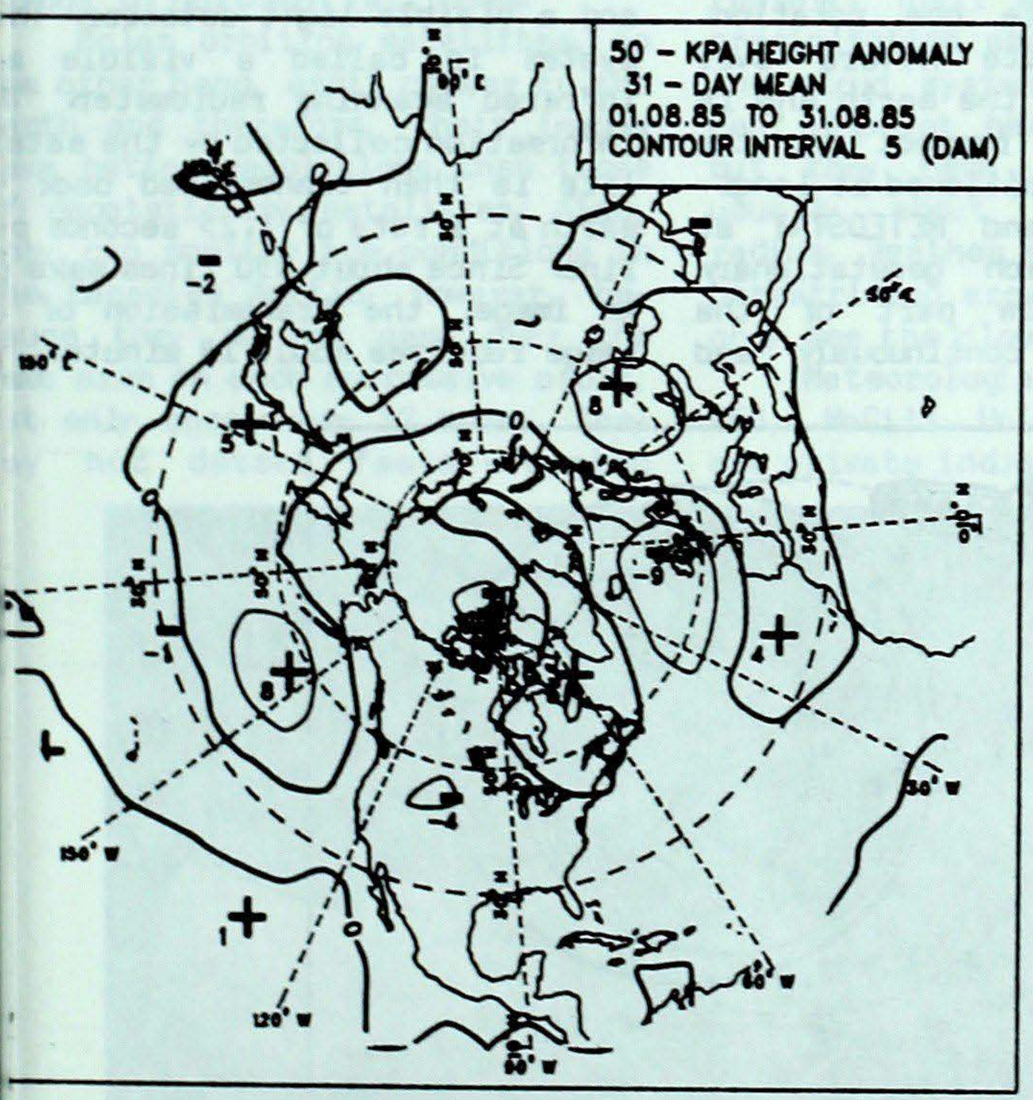


Mean 50 kPa heights (dam)
September 13 to September 17, 1985

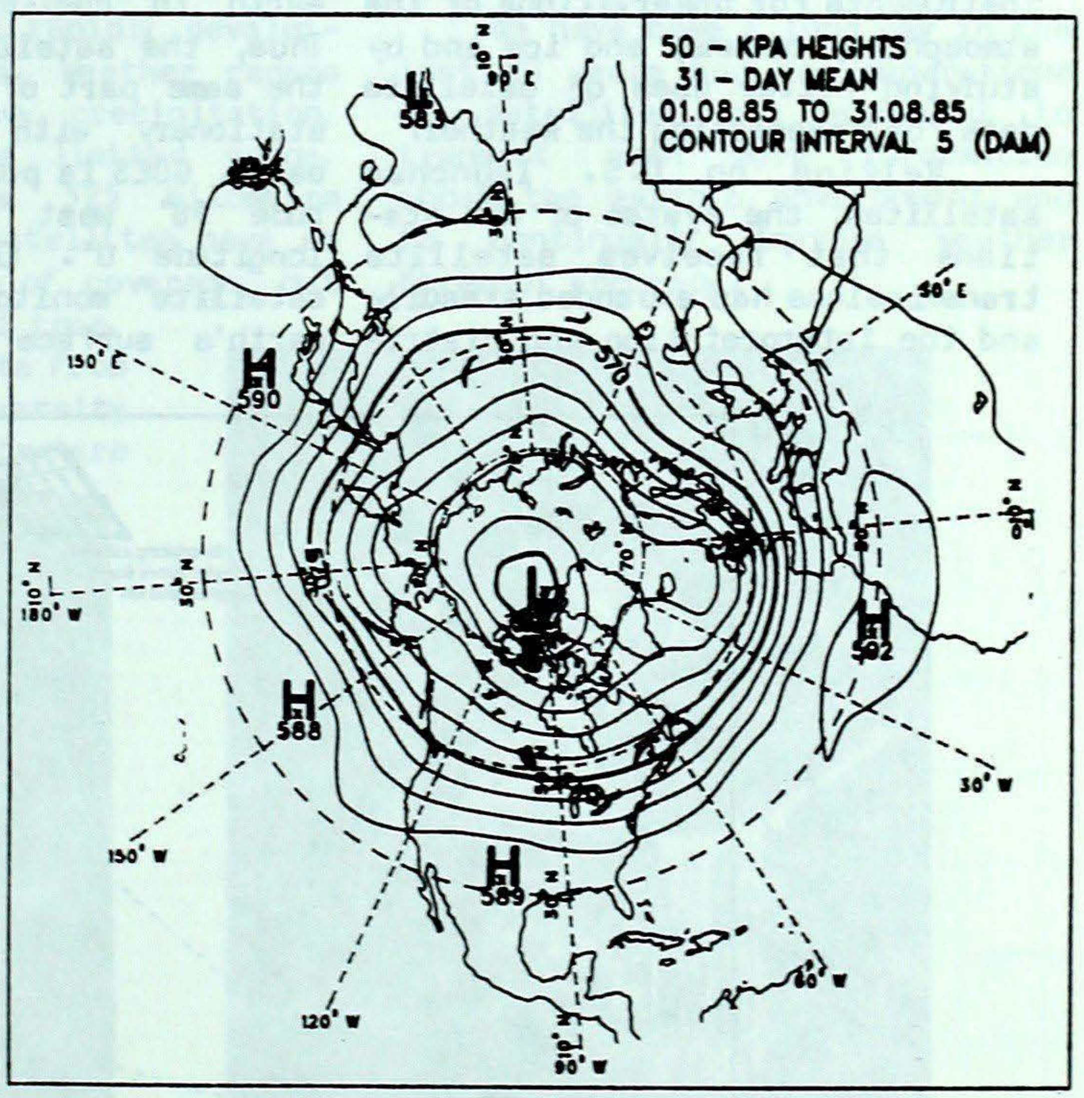
ATMOSPHERIC CIRCULATION



Time-longitude Hovmöller diagrams of 50 kPa heights at latitudes 45°N and 65°N



Mean 50 kPa height anomaly (dam)
August 1985



Mean 50 kPa heights (dam)
August 1985

...Satellites cont'd from page 5B

tion to monitor changes in seasonal snow cover for water management and flood prediction.

The history of weather satellites

On April 1, 1960 the first of the United States TIROS (Television and Infrared Observational Satellite) family of satellites succeeded in obtaining pictures of earth. Since then, the U.S. has launched about 40 weather satellites, each new generation of satellite systems with more sophisticated technology.

The U.S.S.R., the European Space Agency, and Japan have designed and launched their own satellites. India has procured a satellite from the U.S. and China is developing two experimental satellites. The most recent satellite system is a cooperative effort of the U.S., U.K. and France.

Canada, a member of the World Meteorological Organization, first received satellite pictures at the Atmospheric Environment Service (AES) station in Toronto in December 1963. Since then, the AES has contributed significantly to international weather satellites by participating in the development and testing of satellite-borne instruments for observations of the atmosphere, oceans, and ice and by studying better uses of satellite data for forecasting the weather.

Relying on U.S. launched satellites, the system of AES stations that receives satellite transmissions has expanded steadily and the interpretation and distribution of weather information has become increasingly sophisticated. Today, AES research in satellite technology is directed mainly towards computer modelling and image processing.

How the system works

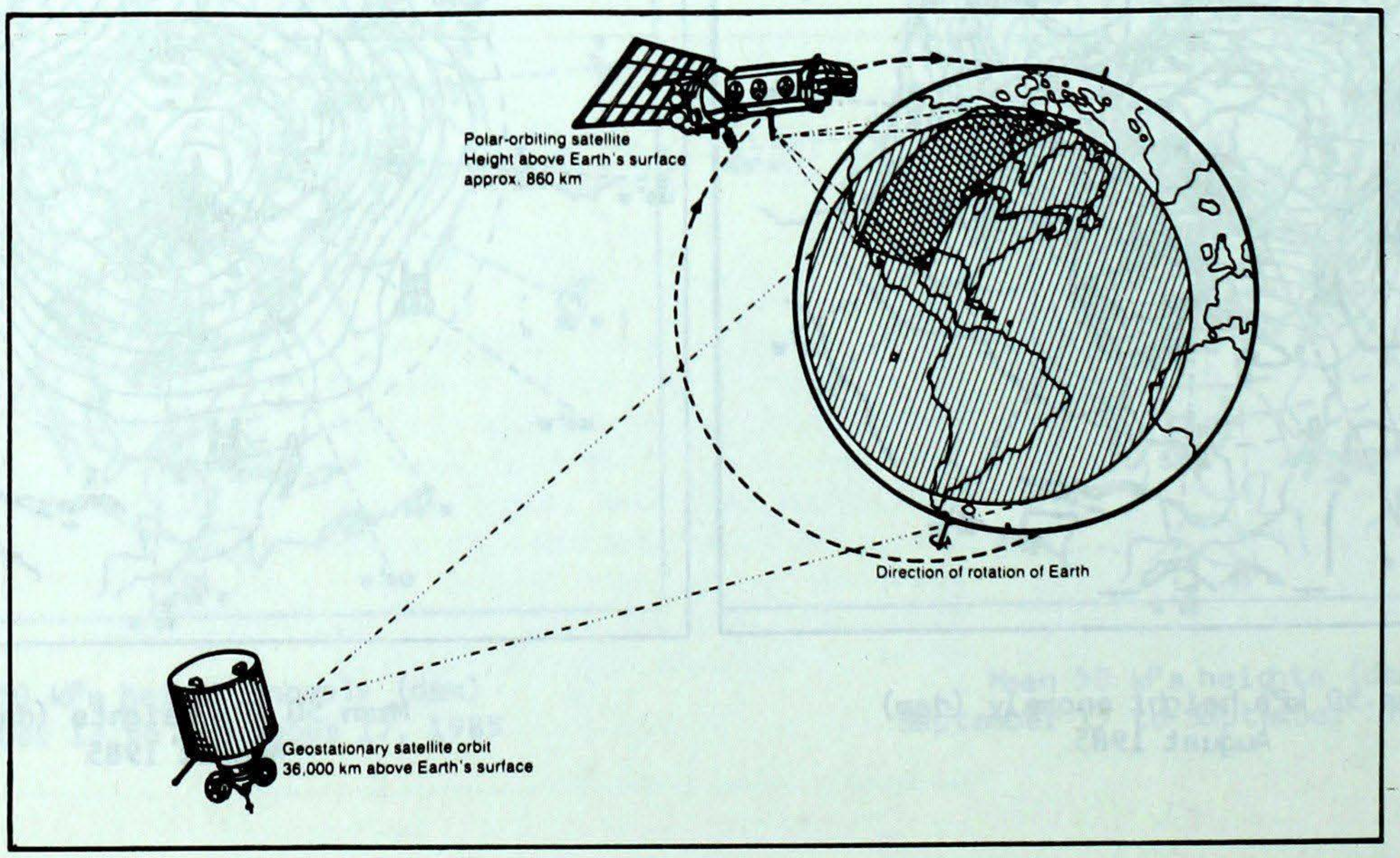
A satellite is essentially a self-contained unit that has sensors, a central data processor to manage the collection, storage and transmission of information, transmitters and receivers, and a power supply of solar panels and batteries.

Two types of weather satellites have evolved over the years: the polar orbiting satellite and the geostationary satellite. Canada receives data from two geostationary satellites (GOES and METEOSTAT) and from two polar orbiting satellites (NOAA series). These satellites have similar capabilities, but they occupy different orbits.

The geostationary satellites are positioned over the earth's equator at an altitude of about 36,000 kilometres. Here, the time it takes for a satellite to complete one west-east orbit is identical to the time it takes the earth to complete one rotation. Thus, the satellite "hovers" over the same part of the earth and is stationary with respect to the earth. GOES is positioned at longitude 98° west and METEOSTAT at longitude 0°. Each geostationary satellite monitors part of the earth's surface continuously and produces images about every 18 minutes.

Polar orbiting satellites orbit about 860 kilometres above the earth. Since it takes about $1\frac{3}{4}$ hours for a polar orbiting satellite to make a complete orbit at that altitude, the satellite circles the earth about 14 times per day. Because the earth rotates beneath the satellite, the satellite's orbit is displaced to the west by about two time zones on each successive orbit. To increase the frequency of coverage, the U.S. has placed two polar orbiting satellites in orbit 6 hours apart. This means that together, the polar orbiting satellites provide four images of a particular area in a 24 hour period.

Polar orbiting and geostationary satellites have similar kinds of instrumentation and obtain images in the following manner: Each satellite carries a reflecting telescope that is pointed directly at the earth. As the satellite moves in orbit, a mirror on the telescope scans the earth and space in the east-west direction. The visible and infrared radiation reflected from this mirror are focussed on an infrared detector and a visible light detector. This system is called a visible and infrared scanning radiometer. The information collected by the satellite is then transmitted back to earth at a rate of 1.25 seconds per line. Since about 850 lines make up an image, the transmission of an image requires about 18 minutes.



Schematic illustration showing how the earth is viewed from polar and geostationary orbiting satellites

Both geostationary and polar ırbiting satellites transmit images ıf the earth and cloud cover day ınd night. The satellites also ollect information for measure- ıents of cloud temperatures and ıeights, temperature and humidity rofiles of the atmosphere and sea urface temperatures. Microwave ensors can "see through" clouds in he absence of rain and therefore, roduce temperature profiles when louds are present. Infrared radia- ion emitted from the earth and louds is used by satellites to rovide nighttime images of cloud over and sea surface temperatures or large areas of the ocean.

One of the most important dvantages of the geostationary atellites is that they always scan he same area. Thus, through time- apse movies made from a series of eostationary satellite images, one an observe cloud motions and de- ermine wind directions and speeds, s well as monitor most storms, hich may form, wreak havoc and isappear quickly. However, geosta- ionary satellites do not provide ccurate information about northern anada above 60°N because they are ositioned at the equator and, from hat angle, see only the sides of louds in northern latitudes.

Polar orbiting satellites, on he other hand, orbit closer to the arth and therefore, their images ave better resolutions than those f geostationary satellites. Also, hey can monitor ice conditions in he Canadian Arctic. However, be- ause they do not pass over the ame area on each successive orbit, ut only once every 12 hours, they ay not detect faster-forming storms nor can they provide accur- ate information on the movements of clouds.

AES operates satellite receiv- ing stations in Gander, Toronto, Edmonton and Vancouver, and also has 5 automatic picture receiving stations in northern Canada. A sta- tion in Sondre Stromfjord, Green- land, is operated jointly by AES and the Danish Meteorological Ser- vice; it provides coverage of the Arctic and North Atlantic Ocean. These stations provide satellite imagery for both weather and sea ice forecasting. The images are distributed to 16 major weather offices across Canada.

With the large real time data base that weather satellites pro- vide, forecasters use computers and complex numerical models to analyze the data and predict weather trends. Many equations, which re- quire the input of data on a global basis, are solved by the computers. Then local forecasters modify the results of general predictions on the basis of local weather observa- tions and topography.

The Future

Severe weather systems develop rapidly. Their key indicators are precipitation and rapidly develop- ing cloud systems. Weather radars can pinpoint heavy precipitation, but they have a limited range, usually about a 325 kilometre radius. Weather satellites have an unrestricted area of coverage, but only see the cloud tops.

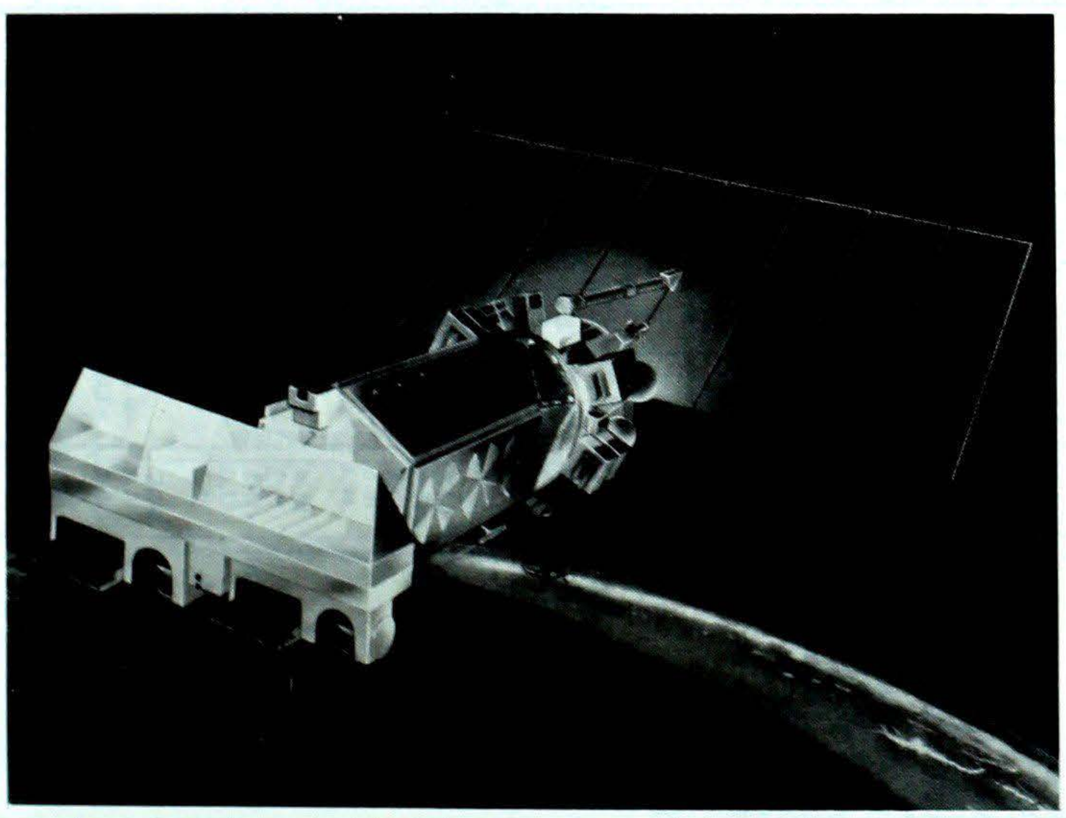
Meteorologists from AES, McGill University and private industry are working on a joint project called the Automated Radar Satellite Ex- periment (RAINSAT). The meteoro- logists will combine satellite information with radar data and conventional data from weather stations to get a more accurate estimate of the distribution of precipitation than is presently available.

Other AES research is directed towards the use of microwave sen- sors on satellites; the sensors will measure the height and distri- bution of ocean waves. AES resear- chers hope to develop better meth- ods of interpreting microwave satellite data and of assimilating the resulting information into weather forecasting over ocean areas.

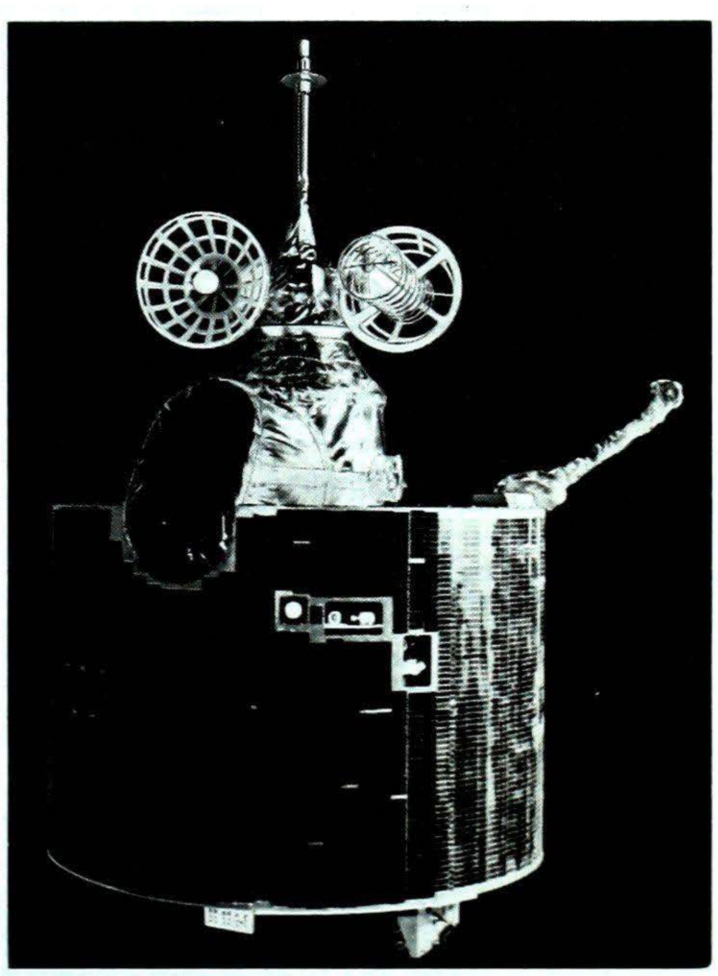
Recently, weather satellites have also been put to work as part of AES's research into the effects of man's activities on the ozone layer of the atmosphere. Also, in joint experiments with the National Aeronautics and Space Administra- tion (NASA), AES has used satel- lites to monitor trace gases in the upper atmosphere.

Finally, AES is always working on better methods of presenting weather satellite images both to forecasters and to the public.

We have come a long way in the last 20 years and new generations of satellites are expected to transmit even more information about the earth's environment and to continually improve weather forecast accuracy.



Polar-orbiting satellite



Geostationary satellite

AUGUST 1985

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	17.3	0.0	31.0	5.9	0.0		11.6	20	0	4	284	115	MSG
ALERT BAY	13.7	−1.0	23.9	6.8	0.0		20.6	30	0	6	X		131.7
AMPHITRITE POINT	14.1	−0.6	22.8	9.4	0.0		23.0	20	0	5	X		120.3
BLUE RIVER	15.4	−0.6	30.5	1.0	0.0		85.9	114	0	12	228	100	MSG
BULL HARBOUR	12.5	−1.4	20.4	6.1	0.0		22.3	26	0	7	X		161.6
CAPE SCOTT	MSG		MSG	9.1	0.0		32.9	30	0	7	X		MSG
CAPE ST.JAMES	13.1	−1.1	22.6	9.6	0.0		68.1	86	0	11	175	*	151.5
CASTLEGAR	18.6	−1.5	32.7	6.5	0.0		37.5	82	0	9	242	88	25.5
COMOX	17.1	−0.3	29.4	8.5	0.0		14.1	31	0	4	X		41.0
CRANBROOK	16.5	−1.3	30.0	3.1	0.0		37.4	115	0	6	242	*	71.7
DEASE LAKE	10.5	−1.5	23.9	−1.0	0.0		41.4	78	0	13	181	89	232.8
ETHELDA BAY	12.6	−1.5	26.1	3.6	0.0		110.5	64	0	10	X		167.4
FORT NELSON	13.6	−1.6	28.2	1.0	0.0		159.3	260	0	12	222	*	141.3
FORT ST.JOHN	14.1	−0.7	29.9	0.4	0.0		43.2	71	0	9	X		129.4
HOPE	18.7	−0.1	32.4	7.8	0.0		22.2	44	0	7	266	119	22.2
KAMLOOPS	19.8	−0.4	34.5	7.5	0.0		31.0	112	0	5	284	101	9.0
KELOWNA	18.1	−0.1	32.6	4.1	0.0		36.6	118	0	5	268	103	28.6
LANGARA	12.5	−1.1	17.5	8.5	0.0		107.4	104	0	17	X		169.6
LYTTON	20.8	−0.5	34.1	9.4	0.0		11.4	67	0	4	245	101	8.1
MACKENZIE	13.5	−0.7	28.9	0.0	0.0		49.8	85	0	8	233	97	139.8
MCINNES ISLAND	13.3	−1.4	25.3	9.0	0.0		54.2	36	0	10	X		145.2
PENTICTON	19.0	−0.9	32.4	5.8	0.0		22.4	84	0	6	254	93	17.9
PORT ALBERNI	17.2	*	32.7	3.6	0.0	*	21.2	*	0	6	264	*	40.1
PORT HARDY	13.6	−0.6	22.5	5.1	0.0		11.8	17	0	4	232	126	136.8
PRINCE GEORGE	14.2	−0.3	28.0	−1.9	0.0		49.0	71	0	10	260	102	118.8
PRINCE RUPERT	12.6	−0.9	20.5	5.2	0.0		98.0	61	0	14	141	101	169.0
PRINCETON	16.6	−0.9	31.7	2.1	0.0		7.8	30	0	3	276	*	MSG
QUESNEL	15.9	−0.1	30.8	0.6	0.0		46.0	71	0	6	X		70.3
REVELSTOKE	16.5	−1.5	30.7	6.3	0.0		72.5	171	0	10	234	96	56.8
SANDSPIT	14.1	−0.6	22.4	9.2	0.0		46.3	93	0	12	153	87	95.9
SMITHERS	13.4	−1.1	25.8	1.2	0.0		33.0	75	0	3	203	86	142.4
TERRACE	15.2	−1.0	27.5	4.8	0.0		33.7	52	0	6	175	86	93.8
VANCOUVER HARBOUR	17.6	0.0	27.2	10.1	0.0		23.5	43	0	3	X		30.4
VANCOUVER INT'L	17.0	−0.5	27.8	9.5	0.0		31.5	76	0	5	294	114	39.3
VICTORIA GONZ. HTS	16.1	0.4	28.8	9.0	0.0		4.7	22	0	2	345	119	77.1
VICTORIA INT'L	MSG		28.7	6.0	0.0		12.8	47	0	4	330	120	60.3
VICTORIA MARINE	14.0	−0.6	25.1	5.9	0.0		21.6	81	0	6	X		115.0
WILLIAMS LAKE	14.4	−1.0	28.2	1.5	0.0		24.9	58	0	6	259	92	115.8

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	Mean	Difference from Normal	Maximum	Minimum									
YUKON TERRITORY													
BURWASH	9.6	−1.2	20.8	−2.8	0.0		55.8	145	0	11	X		260.1
DAWSON	10.8	−1.4	26.2	−3.7	0.0		54.8	99	0	10	X		213.3
MAYO	11.1	−1.9	24.8	−1.4	0.0		31.8	76	0	8	X		212.3
WATSON LAKE	11.9	−1.6	25.3	0.5	0.0		42.2	100	0	14	201	88	188.7
WHITEHORSE	11.2	−1.7	24.4	−0.7	0.0		26.2	69	0	7	220	95	212.3
NORTHWEST TERRITORIES													
ALERT	−0.3	−1.6	12.6	−8.6	12.8	61	11.0	38	6	2	283	136	568.3
BAKER LAKE	9.1	−1.0	23.1	−2.6	7.2		87.7	235	0	11	204	96	277.3
CAMBRIDGE BAY	4.8	−2.1	18.2	−3.5	3.4	566	20.7	73	TR	5	181	102	408.4
CAPE DYER	6.0	1.0	17.3	−0.4	TR		36.5	71	0	6	X		370.9
CAPE PARRY	3.1	−2.7	15.1	−4.3	0.3	18	5.6	20	0	2	X		467.5
CLYDE	5.5	1.1	18.0	0.0	8.6	108	86.0	329	0	10	152	79	386.0
COPPERMINE	6.1	−2.6	24.2	−1.8	TR		71.8	186	0	9	246	129	369.0
CORAL HARBOUR	7.0	−0.8	16.6	−1.2	11.6		124.6	280	0	11	256	113	343.5
EUREKA	1.0	−2.7	9.3	−6.4	9.1	337	10.0	86	TR	3	258	107	527.9
FORT RELIANCE	10.9	−2.4	23.1	0.0	0.0		21.1	52	0	9	X		219.1
FORT SIMPSON	12.3	−2.5	24.5	−0.3	0.0		51.4	114	0	6	267	108	167.1
FORT SMITH	11.9	−2.7	28.7	−1.3	0.0		71.6	168	0	12	229	87	179.2
FROBISHER BAY	8.2	0.9	23.1	0.4	0.0		54.9	93	0	9	218	135	304.3
HALL BEACH	5.2	0.2	19.6	0.1	10.4	577	78.1	191	0	12	X		396.2
HAY RIVER	12.3	−2.5	25.2	0.6	0.0		92.8	246	0	11	X		178.0
INUVIK	9.7	−1.4	24.6	−4.4	0.0		7.6	17	0	3	289	133	257.0
MOULD BAY	0.2	−1.6	7.2	−6.3	12.1	134	22.0	102	TR	5	123	93	551.8
NORMAN WELLS	12.2	−1.6	23.7	0.5	0.0		20.7	35	0	7	MSG		179.8
POND INLET	5.4	0.3	13.8	0.1	7.6	422	80.0	206	0	10	X		391.8
RESOLUTE	0.7	−2.1	9.0	−9.0	7.4	110	19.8	63	TR	6	146	91	536.1
SACHS HARBOUR	2.2	−2.0	11.9	−4.2	5.3	106	9.4	40	0	3	192	101	488.4
YELLOWKNIFE	11.5	−3.0	20.9	2.8	0.0		45.2	102	0	9	240	83	200.0
ALBERTA													
BANFF	12.5	−1.7	27.2	1.0	0.0		77.4	158	0	MSG	X		MSG
BROOKS	16.0	−1.8	30.5	2.5	0.0		53.4	112	0	MSG	252	*	MSG
CALGARY INT'L	14.4	−1.2	29.1	2.2	0.0		66.2	119	0	10	221	78	121.4
COLD LAKE	14.8	−1.1	32.1	1.3	0.0		64.6	84	0	7	286	112	114.4
CORONATION	14.2	−2.3	32.6	0.5	0.0		75.2	145	0	9	272	94	126.7
EDMONTON INT'L	14.0	−1.2	29.4	1.1	0.0		91.4	116	0	13	268	94	135.0
EDMONTON MUNI.	15.3	−1.3	31.4	4.0	0.0		76.0	97	0	10	282	101	106.1
EDMONTON NAMAO	14.0	−2.0	29.7	2.8	0.0		84.3	114	0	9	X		134.7
EDSON	12.9	−0.7	29.2	0.5	0.0		110.2	117	0	12	233	94	160.1
FORT CHIPEWYAN	13.2	−1.7	32.0	−2.0	0.0		54.8	113	0	MSG	X		MSG

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	Mean	Difference from Normal	Maximum	Minimum									
QUEBEC													
BAGOTVILLE	16.0	-0.8	29.8	2.2	0.0		76.8	77	0	9	X		82.1
BAIE COMEAU	14.3	-0.7	26.7	2.2	0.0		43.0	45	0	6	280	*	113.9
BLANC SABLON	12.5	0.3	23.1	4.3	0.0		34.0	31	0	5	169	*	182.5
CHIBOUGAMAU	14.1	-0.3	28.3	-0.3	0.0		47.6	40	0	9	203	98	137.6
GASPE	15.8	-0.6	30.4	1.8	0.0		88.8	102	0	10	261	*	79.8
INUKJUAK	10.9	1.6	21.2	4.1	0.0		67.4	103	0	9	212	145	219.2
KUUJJUAQ	12.2	1.4	28.0	1.2	0.0		80.0	125	0	11	179	107	198.1
KUUJJUARAPIK	11.9	1.1	28.3	1.9	0.0		75.4	80	0	11	172	103	187.3
LA GRANDE RIVIERE	12.5	*	28.4	1.3	0.0	*	98.3	*	0	12	181	*	173.0
MANIWAKI	16.8	-0.6	30.0	2.8	0.0		56.8	62	0	8	226	100	59.5
MATAGAMI	14.4	0.0	28.0	1.2	0.0		85.8	80	0	11	238	116	111.1
MONT JOLI	16.2	-0.2	28.0	4.8	0.0		57.6	72	0	6	284	116	76.3
MONTREAL INT'L	19.3	-0.7	31.6	7.7	0.0		78.3	85	0	7	238	99	20.7
MONTREAL M INT'L	17.6	*	30.5	5.8	0.0	*	70.0	*	0	8	242	*	40.3
NATASHQUAN	14.1	0.4	24.8	4.2	0.0		56.4	53	0	4	219	94	128.0
NITCHEQUON	13.3	1.1	27.2	2.5	0.0		82.4	73	0	15	172	94	150.1
QUEBEC	17.9	0.0	30.5	6.1	0.0		32.2	27	0	6	258	117	39.2
ROBERVAL	16.1	-0.7	29.8	3.3	0.0		62.0	62	0	8	242	*	85.2
SCHEFFERVILLE	12.1	0.9	28.1	0.7	0.0		42.9	43	0	10	193	*	186.2
SEPT-ILES	14.8	0.3	24.8	3.7	0.0		87.2	83	0	9	273	122	100.8
SHERBROOKE	16.5	-0.4	28.4	4.0	0.0		82.6	68	0	10	234	*	65.2
STE AGATHE DES MONTS	16.0	-0.2	29.5	3.4	0.0		73.6	64	0	7	220	93	77.8
ST-HUBERT	18.6	-1.0	31.5	5.8	0.0		71.8	74	0	6	MSG		31.0
VAL D'OR	15.2	-0.7	27.9	1.5	0.0		99.2	98	0	9	239	101	100.7
NEW BRUNSWICK													
CHARLO	16.5	0.0	30.0	4.0	0.0		65.7	60	0	9	281	115	65.4
CHATHAM	17.8	-0.6	32.2	6.2	0.0		56.4	67	0	8	242	101	40.0
FREDERICTON	17.4	-1.2	31.2	1.8	0.0		73.3	84	0	10	255	*	46.0
MONCTON	17.4	-0.6	30.2	3.6	0.0		56.2	71	0	8	239	103	45.0
SAINT JOHN	16.7	-0.3	28.5	4.6	0.0		88.8	87	0	11	235	110	54.3

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	Mean	Difference from Normal	Maximum	Minimum									
NOVA SCOTIA													
GREENWOOD	17.5	-1.2	31.2	5.6	0.0		118.2	131	0	10	X		42.0
HALIFAX INT'L	17.7	-0.8	29.7	8.2	0.0		140.5	126	0	11	MSG		39.2
SABLE ISLAND	17.1	-0.9	22.7	8.5	0.0		193.6	166			179	100	33.2
SHEARWATER	17.7	-0.5	28.7	9.4	0.0		184.2	188	0	12	230	102	36.6
SYDNEY	17.4	-0.6	30.2	8.0	0.0		95.6	94	0	10	205	90	40.6
TRURO	16.2	-1.3	27.0	3.9	0.0		134.4	139	0	9	191	90	63.6
YARMOUTH	16.2	-0.6	25.2	8.2	0.0		205.2	210	0	7	230	109	60.3
PRINCE EDWARD ISLAND													
CHARLOTTETOWN	17.7	-0.5	29.7	8.8	0.0		105.3	119	0	14	X		38.2
SUMMERSIDE	18.3	-0.5	29.5	8.8	0.0		110.1	137	0	12	239	99	26.7
NEWFOUNDLAND													
ARGENTIA	14.6	-1.1	24.2	8.2	0.0		87.2	90	0	11	X		109.3
BATTLE HARBOUR	13.0	1.4	31.5	0.2	0.0		27.2	32	0	7	X		153.9
BONAVISTA	13.9	-1.5	26.1	6.5	0.0		86.4	103	0	9	X		129.3
BURGEO	14.2	-1.1	22.0	7.4	0.0		117.5	79	0	12	176	106	115.7
CARTWRIGHT	11.8	-0.6	29.6	1.0	0.0		63.0	76	0	8	219	125	199.2
CHURCHILL FALLS	13.0	0.2	27.8	0.4	0.0		53.9	56	0	9	213	124	161.0
COMFORT COVE	15.0	-1.0	28.4	4.0	0.0		92.4	85	0	10	X		119.2
DANIEL'S HARBOUR	14.4	-0.5	22.0	5.0	0.0		33.8	29	0	6	221	122	107.5
DEER LAKE	15.7	0.3	31.2	3.0	0.0		60.4	58	0	12	X		88.6
GANDER INT'L	14.9	-1.1	28.4	5.0	0.0		110.0	113	0	10	171	91	116.5
GOOSE	14.6	-0.1	32.1	4.4	0.0		153.3	148	0	17	171	96	121.8
PORT-AUX-BASQUES	15.4	0.3	22.9	8.5	0.0		69.0	60	0	10	203	*	82.4
ST ANTHONY	12.5	-0.5	26.3	0.7	0.0		32.2	24	0	5	X		167.9
ST JOHN'S	13.9	-1.8	26.0	6.8	0.0		100.9	82	0	9	178	95	125.3
ST LAWRENCE	14.6	0.1	25.9	4.8	0.0		69.6	57	0	12	X		
STEPHENVILLE	16.6	0.1	25.7	5.9	0.0		108.3	104	0	16	185	99	58.1
WABUSH LAKE	13.5	1.3	28.2	2.3	0.0		74.9	79	0	15	213	111	139.4

X = Not observed * = normal missing MSG = data missing

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FORT MCMURRAY	14.3	-0.9	30.4	-1.8	0.0		27.1	35	0	8	276	111	130.9
GRANDE PRAIRIE	14.2	-1.0	31.7	-1.4	0.0		50.9	84	0	10	244	*	126.0
HIGH LEVEL	12.0	-2.4	28.4	-1.1	0.0		77.9	134	0	11	217	85	190.6
JASPER	13.6	-1.0	31.3	0.7	0.0		52.8	108	0	9	268	*	139.0
LETHBRIDGE	16.4	-1.6	30.9	4.3	0.0		88.4	187	0	8	270	90	78.0
MEDICINE HAT	17.6	-1.7	32.2	2.7	0.0		46.6	128	0	8	297	99	58.7
PEACE RIVER	14.0	-0.6	31.7	1.8	0.0		61.6	122	0	9	X		136.2
RED DEER	12.8	-2.5	29.5	0.7	0.0		123.0	186	0	13	X		149.7
ROCKY MTN HOUSE	12.3	-2.4	27.6	-0.3	0.0		120.6	156	0	16	X		180.3
SLAVE LAKE	13.4	-1.4	29.8	-0.3	0.0		67.9	95	0	10	281	114	146.8
SUFFIELD	17.0	-1.8	32.2	2.8	0.0		62.7	157	0	8	259	84	71.9
WHITECOURT	13.3	-1.0	27.9	0.4	0.0		103.9	117	0	12	X		154.3
SASKATCHEWAN													
BROADVIEW	14.2	-2.6	28.9	2.3	0.0		151.7	252	0	9	216	72	123.3
COLLINS BAY	13.0	0.0	27.8	2.8	0.0		142.9	213	0	11	265	*	157.6
CREE LAKE	14.0	-0.8	29.7	0.9	0.0		65.0	107	0	10	248	100	140.3
ESTEVAN	16.6	-2.4	29.8	5.5	0.0		146.3	277	0	10	209	67	68.3
HUDSON BAY	13.6	-2.6	28.3	0.4	0.0		80.6	136	0	8	269	*	145.0
KINDERSLEY	15.8	-2.0	32.1	1.3	0.0		35.8	96	0	4	X		89.0
LA RONGE	14.8	-0.8	30.4	1.0	0.0		51.4	82	0	6	X		109.0
MEADOW LAKE	13.6	-2.5	31.8	-0.6	0.0		93.0	125	0	11	273	*	143.5
MOOSE JAW	16.8	-2.2	34.4	5.0	0.0		40.9	101	0	8	260	87	68.6
NIPAWIN	13.7	*	28.8	2.1	0.0		68.7	*	0	9	253	95	139.3
NORTH BATTLEFORD	15.3	-1.9	31.4	3.2	0.0		72.4	158	0	5	X		95.1
PRINCE ALBERT	14.6	-1.7	29.6	1.1	0.0		48.2	92	0	9	263	98	123.7
REGINA	15.9	-2.3	33.4	4.0	0.0		70.2	156	0	11	246	83	88.9
SASKATOON	15.8	-1.8	32.1	3.7	0.0		26.7	70	0	6	X		86.4
SWIFT CURRENT	15.4	-2.5	32.5	3.1	0.0		29.4	68	0	8	272	91	89.3
URANIUM CITY	13.6	-1.4	28.4	1.1	0.0		60.4	127	0	9	X		146.9
WYNYARD	17.5	0.3	32.5	2.9	0.0		43.6	79	0	7	271	96	121.7
YORKTON	14.4	-2.9	29.4	2.0	0.0		69.9	114	0	8	251	88	121.6
MANITOBA													
BRANDON	14.9	-3.0	29.4	3.3	0.0		177.9	275	0	10	X		106.8
CHURCHILL	10.9	-0.8	30.7	1.3	TR		43.5	74	0	4	274	118	223.2
DAUPHIN	14.6	-2.9	28.3	1.1	0.0		176.2	283	0	11	212	77	112.4
GILLAM	13.2	-1.0	28.6	-0.4	0.0		18.6	30	0	5	X		156.6
GIMLI	15.4	-2.1	26.1	4.2	0.0		144.6	253	0	8	194	73	95.9
ISLAND LAKE	14.6	-2.1	27.7	3.4	0.0		90.8	145	0	10	X		117.7
LYNN LAKE	14.0	-0.5	28.5	1.9	TR		24.8	42	0	4	MSG		140.1
NORWAY HOUSE	14.5	*	26.7	3.5	0.0	*	148.8	*	0	9	MSG	*	117.6
PILOT MOUND	15.2	-2.8	30.0	1.5	0.0		136.1	212	0	11	X		98.7
PORTAGE LA PRAIRIE	16.2	-2.6	30.8	3.6	0.0		222.2	274	0	9	X		81.3
THE PAS	14.8	-1.7	29.1	3.2	0.0		143.8	250	0	11	273	105	112.0
THOMPSON	13.2	-1.1	29.2	-2.2	0.0		10.0	13	0	3	280	122	156.2
WINNIPEG INT'L	16.3	-2.4	30.0	4.2	0.0		218.0	289	0	9	193	68	79.1
ONTARIO													
ATIKOKAN	14.7	-1.5	28.5	2.3	0.0		102.6	104	0	12	182	75	115.3
BIG TROUT LAKE	13.9	-0.8	26.8	4.4	0.0		55.0	67	0	11	216	*	134.8
EARLTON	16.3	-0.3	29.1	3.7	0.0		56.5	67	0	7	X		65.8
GERALDTON	14.7	-0.3	27.0	3.0	0.0		141.2	211	0	9	X		112.8
GORE BAY	17.9	-0.7	28.8	7.2	0.0		40.0	53	0	8	X		30.6
HAMILTON RBG	20.3	-0.9	32.9	10.5	0.0		99.6	122	0	9	242	*	MSG
HAMILTON	19.7	-0.7	31.1	10.2	0.0		109.6	145	0	8	X		11.4
KAPUSKASING	15.7	0.0	29.1	2.9	0.0		59.6	64	0	10	X		88.6
KENORA	16.1	-1.9	27.9	7.0	0.0		139.8	162	0	12	X		82.6
KINGSTON	18.7	-1.1	27.0	8.6	0.0		100.8	132	0	10	224	87	20.6
LANSDOWNE HOUSE	15.2	-0.4	27.4	10.4	0.0		105.9	120	0	12	X		101.7
LONDON	19.1	-0.8	30.3	9.3	0.0		179.8	223	0	9	212	86	11.8
MOOSONEE	14.5	-0.2	30.2	1.1	0.0		84.9	107	0	12	214	99	123.9
MOUNT FOREST	17.0	-0.9	29.1	4.0	0.0		115.2	133	0	12	MSG		54.2
MUSKOKA	16.6	-1.2	29.0	6.1	0.0		130.2	146	0	MSG	X		12.9
NORTH BAY	16.7	-0.7	27.2	6.5	0.0		42.6	43	0	7	218	92	59.4
OTTAWA INT'L	19.3	-0.3	33.8	7.7	0.0		71.1	80	0	6	MSG		20.7
PETAWAWA	17.4	-0.6	32.8	4.3	0.0		64.1	80	0	8	X		49.8
PETERBOROUGH	17.2	-1.3	30.0	5.8	0.0		131.2	176	0	10	X		46.3
PICKLE LAKE	15.1	-0.4	28.2	5.2	0.0		140.6	135	0	11	X		159.6
RED LAKE	14.6	-2.7	27.2	2.2	0.0		124.0	158	0	11	184	*	114.3
ST. CATHARINES	20.7	-0.7	31.7	9.0	0.0		112.0	138	0	7	X		7.4
SARNIA	19.4	-1.3	31.6	9.9	0.0		160.9	313	0	12	217	86	12.8
SAULT STE. MARIE	16.5	-0.8	28.6	5.1	0.0		122.8	148	0	11	262	105	65.8
SIMCOE	19.5	-0.6	30.0	10.0	0.0		148.8	227	0	8	X		10.4
SIOUX LOOKOUT	15.3	-1.7	27.3	4.3	0.0		162.3	183	0	9	X		100.1
SUDBURY	17.1	-0.6	28.7	6.3	0.0		63.0	75	0	6	262	104	47.1
THUNDER BAY	15.8	-1.0	28.7	2.8	0.0		107.6	129	0	7	245	95	85.9
TIMMINS	15.2	-0.7	30.6	2.4	0.0		67.4	75	0	9	X		94.8
TORONTO	20.5	-1.1	28.7	11.3	0.0		118.0	161	0	11	MSG		6.1
TORONTO INT'L	19.4	-0.7	33.0	9.2	0.0		152.5	198	0	10	X		15.3
TORONTO ISLAND	20.6	0.1	30.1	12.4	0.0		117.5	165	0	10	MSG		4.4
TRENTON	18.7	-1.4	31.1	8.0	0.0		92.4	128	0	9	X		24.2
WATERLOO-WELL	18.2	-1.1	30.5	7.7	0.0		158.8	178	0	7	X		28.5
WAWA	14.1	*	26.8	3.4	0.0	*	112.4	*	0	12	MSG	*	122.8
WIARTON	16.9	-1.6	29.2	6.2	0.0		143.8	165	MSG	12	219	85	57.9
WINDSOR	20.9	-0.8	31.9	12.1	0.0		136.4	162	0	9	X		2.1

X = Not observed * = normal missing MSG = data missing

AUGUST 1985

STATION	Temperature C: Mean	Temperature C: Difference from Normal	Temperature C: Maximum	Temperature C: Minimum	Snowfall (cm)	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of month (cm)	No. of days with Precip 1.0 mm or more	Bright Sunshine (hours)	Degree days above 5 C: This month	Degree days above 5 C: Since jan. 1st
BRITISH COLUMBIA												
AGASSIZ	18.1	0.4	32.0	6.0	0.0	25.8	42	0	8	266	405.5	1630.9
KAMLOOPS												
SIDNEY												
SUMMERLAND	19.4	-0.6	32.0	8.5	0.0	20.6	75	0	5	275	443.0	1836.5
ALBERTA												
BEAVERLODGE	14.1	-0.1	33.0	-3.0	0.0	14.0	22	0	13	248	281.0	1077.5
ELLERSLIE	13.8	-1.1	30.0	1.0	0.0	78.6	118	0	9	273	267.4	1109.7
FORT VERMILLION												
LACOMBE	12.3	-2.6	29.5	1.5	0.0	133.3	195	0	14		255.0	1071.1
LETHBRIDGE												
VAUXHALL												
VEGREVILLE	14.0	-1.1	32.0	-3.5	0.0	43.0	58	0	10		281.8	1090.4
SASKATCHEWAN												
INDIAN HEAD	15.1	-2.3	30.5	3.0	0.0	95.2	170	0	12		323.5	1329.0
MELFORT	14.1	-2.0	30.0	1.5	0.0	56.2	103	0	7	249	282.0	1108.0
REGINA	15.4	-2.0	33.5	2.5	0.0	71.3	161	0	11		332.5	1245.0
SASKATOON	15.1	-2.1	32.5	0.5	0.0	19.3	55	0	4	297	319.5	1259.5
SCOTT	14.8	-1.2	30.5	2.0	0.0	77.6	167	0	9	297	303.0	1173.5
SWIFT CURRENT SOUTH	16.4	-1.3	33.0	3.0	0.0	39.3	103	0	7	236	355.6	1398.3
MANITOBA												
BRANDON	15.5	-2.4	29.5	1.0	0.0	138.3	199	0	13	196	323.9	1352.9
GLENLEA	17.9	-0.4	30.0	3.5	0.0	173.5	287	0	14	199	328.0	1451.1
MORDEN	16.3	-2.7	30.5	5.0	0.0	194.4	273	0	13	192	355.0	1507.5
ONTARIO												
DELHI	19.3	-0.5	29.0	7.5	0.0	153.8	165	0	11	240	443.8	1716.6
ELORA	17.8	-0.3	29.4	8.2	0.0	174.7	242	0	9		396.7	1454.0
GUELPH	18.2	-0.6	30.5	6.2	0.0	182.8	224	0	11	227	410.1	1538.1
HARROW	20.4	-0.8	29.5	10.0	0.0	113.9	144	0	11	212	478.4	1951.3
KAPUSKASING												
MERIVALE												
OTTAWA	19.5	0.1	33.7	7.5	0.0	47.1	56	0	8	239	451.1	1628.6
SMITHFIELD	19.4	0.1	29.5	8.5	0.0			0	10		444.6	1657.5
VINELAND STATION	20.4	-0.4	32.0	11.0	0.0	103.2	120	0	10	219	477.6	1728.2
WOODSLEE												
QUEBEC												
LA POCATIERE	17.5	0.2	29.0	4.0	0.0	16.2	16	0	5	282	388.0	1279.9
L'ASSUMPTION	18.6	-0.2	31.5	6.0	0.0	47.0	49	0	7	226	421.1	1496.5
LENNOXVILLE												
NORMANDIN	15.1	-0.3	28.5	1.0	0.0	58.3	62	0	10	228	321.5	1017.8
ST. AUGUSTIN												
STE CLOTHILDE	18.7	-0.2	31.0	6.5	0.0	63.5	66	0	7	247	423.6	1561.2
NEW BRUNSWICK												
FREDERICTON												
NOVA SCOTIA												
KENTVILLE	18.0	-0.4	31.0	8.0	0.0	121.0	123	0	10	229	402.6	1393.4
NAPPAN	17.0	-0.4	29.5	2.0	0.0	85.2	94	0	8	211	378.5	1265.8
PRINCE EDWARD ISLAND												
CHARLOTTETOWN												
NEWFOUNDLAND												
ST. JOHN'S WEST	14.4	-1.1	27.0	6.5	0.0	113.1	99	0	13		291.5	910.4