Monthly review

Violent storms bring deaths and destruction from the Rockies to

disaster in 30 years strikes Edmonton. Record deluge in Montreal. Scorching heat wave in southern Ontario. Flash flood in Winnipeg. Hail damage in Saskat-

Canada's worst natural

These are some of the events

Montreal. Main

that highlighted July's weather across Canada. A persistent ridge of high pressure over the eastern United States allowed hot and humid air to reach the Great Lakes and the St. Lawrence Valley. On a number of occasions, a clash between this tropical brand of air from the south and cooler and drier air from the north resulted in the outbreak of severe thunderstorms in southern Ontario and southern Quebec. On July 14, intense thunderstorm cells accompanied by strong winds dropped over 100 mm of rain in a 2-hour

the St. Lawrence Valley.

chewan.

period

lion.

over

Expressways were flooded with nearly 4 meters of water causing motorists to abondon their cars. One man drowned and another was electrocuted. At least 40.000 residences were flooded and damage was estimated at over \$100 mil-

Ontario had its hottest July

in 33 years as two separate heat waves covered southern Ontario. The maximum temperatures exceeded 30°C on 14 occasions in Toronto -

the greatest number of "hot days"

Cont'd on 4B....Severe Weather

Climatic

Perspectives

JULY

CLIMATIC HIGHLIGHTS

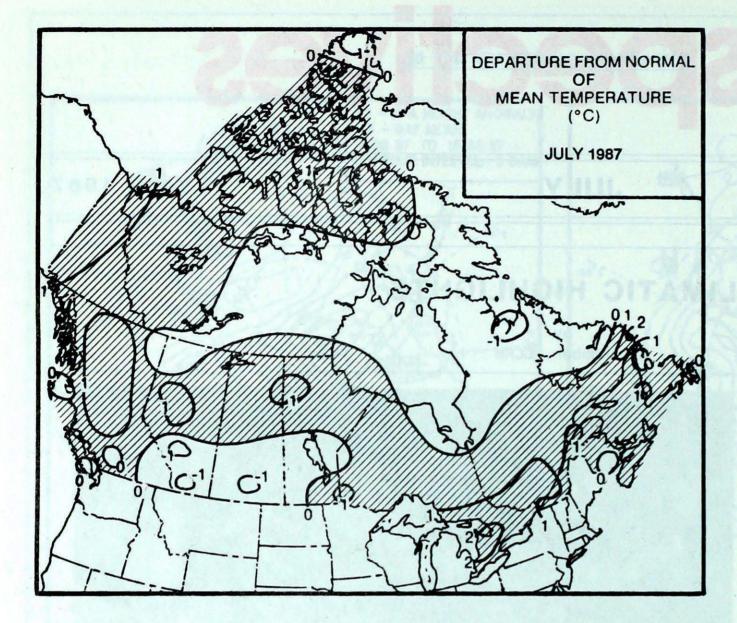
A. Shabbar, CCRM

Fireman lends a helping hand to a motorist on Décarie Expressway

in Montréal after July 14, 1987 flash flood. Photo courtesy The

Gazette, Pierre Obendrauf.

Vol.9 1987



# MEAN TEMPERATURE (°C) JULY 1987

## ACROSS THE COUNTRY

## Yukon and Northwest Territories

The Keewatin district of the Territories continued to endure below normal temperatures. The remainder of the North had warmer than normal July. The Yukon and the Mackenzie Valley were especially warm; on a few occasion, the mercury climbed near the 30°C mark.

With the exception of the eastern Keewatin district and northern Ellesmere Island, precipitation was below normal throughout the Territories.

Owing to the prevailing easterly winds, ice conditions in the
Beaufort Sea were favourable and the
breakup of ice was well ahead of
normal. In contrast, the eastern
Arctic experienced severe ice conditions. However, towards the end of
the month, gale force winds opened
up the ice flows in the Hudson Bay.
With 486 hours of bright sunshine,
Eureka was the sunniest location in
Canada this month.

## British Columbia

Most of British Columbia experienced changeable weather in July. Low pressure systems more normally seen in June persisted for significant periods during July. Extreme southern portions of the province and coastal areas had near to below normal temperatures. This was also true in the Fort Nelson region. The remainder of the province had above normal readings.

Rainfall was highly localized due to the showery nature of the precipitation. Coastal areas were dry, receiving from 35 to 80% of normal precipitation. Below normal amounts also fell over the Chilcotin-Cariboo district. interior valley stretching to the eastern Fraser valley received 170 to 330% of normal with Hope reporting a whopping 370% of normal. Heavy rains near the end of the month flooded the Peace River region, initial damage estimate exceeded one million dollars. Heavy rains also damaged cherry crop in the Okanagan early in the month.

TOTAL PRECIPITATION

(mm)

**JULY 1987** 

PER CENT OF NORMAL

PRECIPITATION

**JULY 1987** 

ed by strong winds caused extensive property damage on a number of occasions in southern Ontario.

ing the warmest July since 1983.

northern Ontario with several locations receiving over 100 mm. Timmins with 145 mm recorded its wettest July since 1968. Central and southern Ontario were dry, rainfalls in the 40 to 70 mm range were 30 to 80%

Precipitation was heavy in

Severe thunderstorms accompani-

of normal.

Prairie Provinces

of the month.

\$250 million.

Ontario

After months of above normal

The agricultural districts of

Numerous tornadoes, flash

Ontario's July was hot. One of

the warmest months in recent history brought back memories of the heat waves in the 1940's and 50's. In

addition, July 1987 also marks the 8th consecutive month with above normal temperatures across Ontario. Southern Ontario had the highest mean temperature for any July since 1955. The maximum readings topped 30°C on 14 occasions in Toronto, which is the greatest number of "hot days" since 1921. Hot weather also penetrated northern Ontario, produc-

floods and hail storms were reported throughout the Prairies. On July 31, a devastating tornado tracked northward from Leduc Alberta through eastern subdivisions of Edmonton. Twenty seven people were killed and property damage was estimated near

Manitoba and Saskatchewan received 70 to 100 mm of rain - well above normal. At Prince Albert, 176 mm proved to be the highest for any July. Deluges of rain in the 200 to 300 mm range inundated the Grande Prairie and Edson forest districts during the last 2 days of the month. Rain swollen rivers washed out roads and bridges and flooded farmlands.

temperatures, most of the Prairies experienced cooler than normal July. During mid-month, several cool tem-

peratures were reported including a record minimum of 3°C at Swift Current on the 11th. However, summery weather returned as the mercury soared into the 30's towards the end

## CLIMATIC EXTREMES IN CANADA - JULY 1987 **MEAN TEMPERATURE:** WARMEST WINDSOR, ONT 24.0°C COLDEST ALERT, NWT 2.5°C HIGHEST TEMPERATURE: KAMLOOPS, BC 37.5°C LOWEST TEMPERATURE: POND INLET, NWT - 3.1°C HEAVIEST PRECIPITATION: SCHEFFERVILLE, QUE 189.2 mm HEAVIEST SNOWFALL: ALERT, NWT 25.3 cm DEEPEST SNOW ON THE GROUND ON JULY 31, 1987: GREATEST NUMBER OF BRIGHT SUNSHINE HOURS: EUREKA, NWT 486 hours

## ... Severe Weather (Continued from the front page)

67 years. Moreover, extensive use of air conditioners set one-day electrical consumption record in the city. On July 24, a wave of destructive thunderstorms lashed southern Ontario. Lightning hit a YMCA camp near Bala (north of Orillia) where 15 campers were sent to hospital. Tornadoes at Sebright and Mississauga caused extensive structural damages the same day (More on Ontario's Severe Weather on page 10B).

On July 6, severe thunderstorms produced at least two tornadoes in southern Winnipeg. The winds caused considerable property damage and over 40 mm of rain in 2½ hours caused flash flood.

The most destructive weather event during July was a killer tornado that struck Edmonton on July 31. The second worst tornado disaster in Canada (Regina cyclone in 1912 killed 38 people) laid

vicious trial of death and destruction in the agricultural, industrial and resedential areas of the county of Strathcona and Edmonton's eastern subdivisions. The Evergreen Mobile Home Park in northeastern Edmonton received the majority of the storm's force, as the tornado ripped through the park turning it into a field of chipwood. In all, 27 people lost their lives, hundreds were injured and damage estimates reached near \$250 million.

In terms of deaths and destruction, Edmonton's tornado was Canada's worst natural disaster in 30 years (Hurricane Hazel in 1954 claimed 81 lives in Toronto). Before the July 31 tornado, in 108 years of record 22 deaths were attributed to tornadoes in Alberta - and none of them in Edmonton.

## Quebec

It was generally a warm month across the provinces except in the north. The highest positive month-

ly temperature anomalies occurred in the southern half of the province where 2°C at Blanc Sablon established a new record for July. The mercury soared to extremely high values at several locations: 35°C at Bagotville on the 12th, 34°C at Ottawa on the 23rd, 32°C or higher for 5 consecutive days between the 9th and 12th at Dorval.

Severe thunderstorms occurred mainly over the southeastern parts of the province. Trees were uprooted in the Ottawa Valley on the 10th and 11th and in Abitibi on the 12th. Electricity was cut off in 35,000 Montreal homes on the 24th due to a severe thunderstorm. On another occasion, lightning killed a young girl and a church bell was pulverized in Hull.

The worst damage occurred in Montreal on the 14th when severe thunderstorms dumped more than 100 mm of rain at McGill University, 86 mm fell in one hour, a new record for Montreal Island. A new monthly record 189.2 mm of rain was recorded at Schefferville.

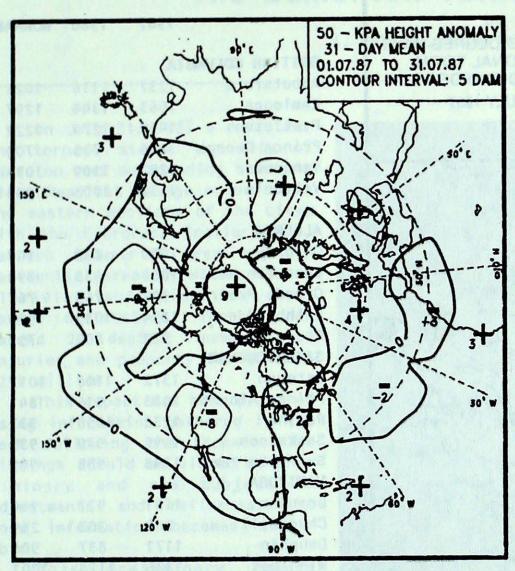
## **Atlantic Provinces**

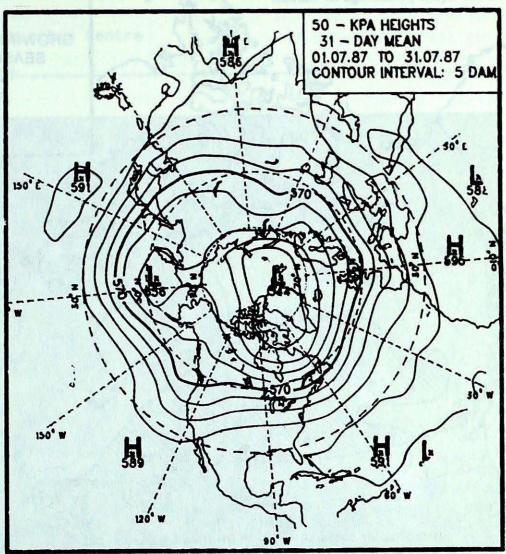
July was generally sunny and dry in the Atlantic Provinces. Temperatures climbed above 30°C at the beginning of the month in New Brunswick and Newfoundland. Record daily maximum values near 30°C were set at mid-month in Summerside. Charlo and Stephenville set a monthly record of 30.6°C.

Precipitation amounts were generally below normal. Record monthly minimum amounts were recorded at Charlo, Moncton and Fredericton. Charlottetown and Gander received meagre amounts of 8.9 and 10.5 mm respectively, the lowest amounts since 1968 and 1961. At Sydney it was the driest July since 1937.

This unusually dry weather created problems in several regions as wells dried up and water levels in rivers and lakes lowered. In Newfoundland, 1500 workers were laid off in the forestry industry as forest fire hazards rose to extreme levels. The sunny dry weather was beneficial to agriculture but a continuation of the drought could drastically reduce yields.

CHVIRONMEN





Mean 50 kPa height anomaly (dam)
July 1987

Mean 50 kPa heights (dam) July 1987

# MEAN 50 kPa CIRCULATION JULY 1987

Amir Shabbar, CCRM

Major changes occurred in the longwave features of the 50 kPa circulation during July. After 7 consecutive months of persistent ridge over southern Prairies, a trough and its associated negative anomaly developed east of the Rockies and the monthly temperatures fell below seasonable values for the first time this year on the Prairies.

A longwave ridge covering most of the eastern United States extended into the Great Lakes allowing oppersively hot and humid southwesterly air flow to reach southern Ontario and southern Quebec. The stagnant tropical air mass produced one of the worst

heat wave in southern Ontario (temperatures in the low thirties). A clash between this hot and humid air from the south and cooler and drier air from the north resulted in numerous outbreaks of violent thunderstorms and flash floods over the Great Lakes and the St. Lawrence Valley.

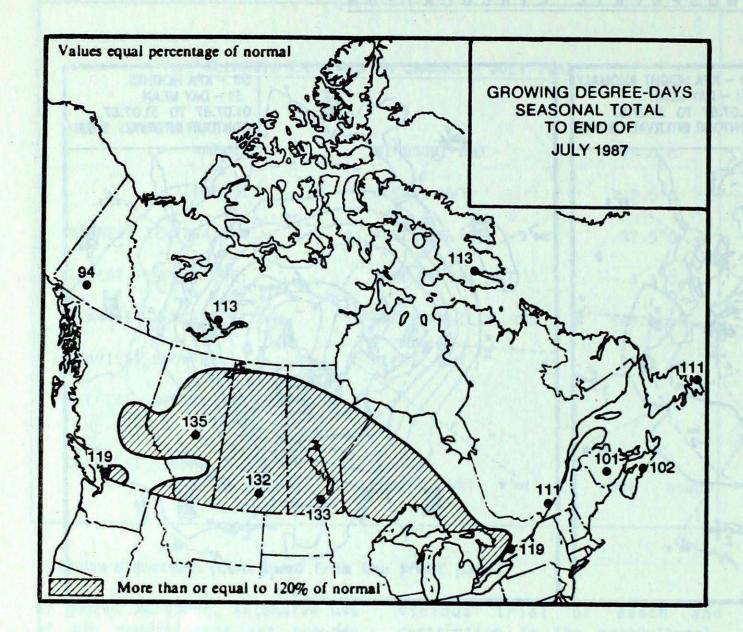
Over the Gulf of Alaska, June's negative anomaly was replaced by an elongated ridge which extended from the Gulf of Alaska to western Arctic Ocean. After a month of blocking episode over northeastern Arctic, Baffin low became re-established.

Pacific ocean temperatures remained 1 to 2°C above normal

near the Equator from 170 W to 90 W longitude, and atmospheric circulation in northeastern Pacific continues to be affected by the persistent warm ocean temperatures. A negative 9 decameters centre was located at 50 N latitude at the Dateline.

Warmer than normal temperatures were recorded from the Great Lakes through the St. Lawrence Valley to the Atlantic Provinces. The temperatures were also warmer than normal over British Columbia, the Yukon and the High Arctic. After 7 consecutive months, warm temperatures came to an end over the Prairies.

## GROWING DEGREE DAYS



# Values equal percentage of normal GROWING DEGREE-DAYS JULY 1987 106 108 109 Less than or equal to 90% of normal More than or equal to 110% of normal

## SEASONAL TOTAL OF GROWING

## DEGREE-DAYS TO END OF JULY

	1987	1986	NORMAL
BRITISH COLUMB	IA		
Abbotsford	1237	1116	1021
Kamloops	1563	1344	1297
Penticton	1459	1274	1222
Prince George	836	735	700
Vancouver	1292	1109	1078
Victoria	1137	1005	991
ALBERTA			
Calgary	1000	833	747
Edmonton Mun.	1084	933	794
Grande Prairie	907	765	767
Lethbridge	1154	1035	925
Peace River	923	804	757
SASKATCHEWAN			
Estevan	1372	1108	1017
Prince Albert	1083	916	841
Regina	1238	1050	933
Saskatoon	1198	979	935
Swift Current	1148	955	909
MANITOBA			
Brandon	1181	977	944
Churchill	282	303	269
Dauphin	1171	837	906
Winnipeg	1336	1128	1001
ONTARIO			
London	1448	1223	1176
Mount Forest	1112	1093	923
North Bay	1007	961	943
Ottawa	1315	1247	1150
Thunder Bay	949	886	778
Toronto	1404	1257	1176
Trenton	1358	1242	1162
Windsor	1681	1514	1381
QUÉBEC			
Baie Comeau	638	571	628
Maniwaki	989	968	919
Montréal	1319	1202	1180
Quebec	991	927	962
Sept-Iles	579	527	549
Sherbrooke	962	987	1033
NEW BRUNSWICK			
Charlo	836	732	801
Fredericton	947	999	960
Moncton	895	807	862
NOVA SCOTIA	715	75 (1)	707
Sydney	715	754 630	707
Truro Yarmouth	820 819	795	779 755
	SLAND	133	133
Charlottetown	836	787	787
NEWFOUNDLAND	330		N ESTER ST
Gander	669	597	602
St. John's	570	527	512
Stephenville	657	627	608

The Edmonton Tornado - July 31, 1987

Edmonton Tornado - July 31, 1987 "Touchdown" North-

Tornadoes

east of Leduc Photo: T. Taylor

intensities.

are classified using the Fujita

Tornado Intensity Scale (Table 1).

Recent major tornadoes to strike

Alberta were: Athabasca, June 29, 1984; Lloydminster, July 8, 1983;

and, Rocky Mountain House, June

been hot with temperatures at or

near record values. Humidities had

been increasing with dewpoints,

a measure of humidity, reaching

near 20 degrees (10 degrees above

normal). Thunderstorms had been

frequent during this period. Dam-

aging winds, large hail, heavy

downpours and record lightning

activity were associated with the

thunderstorms. On July 30, 2 lines

of severe thunderstorms had cross-

ed the Edmonton region accompanied

by damaging winds.

The last 10 days of July had

Meteorological Conditions

A. Wallace, Alberta Weather Centre

On July 31, 1987 a devastat-

ing tornado struck the City of Edmonton and surrounding communities. Heaviest damage occurred in the eastern sections of the city, with the Evergreen Trailer Park,

eastern industrial area and the residential areas of Millwoods and Clareview suffering the most severe destruction. The tornado caused 27 deaths, hundreds of injuries and property damage over

This report has been prepared

This preliminary report

The City of Edmonton,

During the period between

and other

varying

30, 1982.

describes the weather conditions that generated the storm and describes the physical dimensions of

agencies concerned with public safety will be coordinating a more

in-depth review of all matters related to the July 31, tornado.

1960 and 1982 there was an annual

average of 8.3 tornado sightings

in Alberta. In the years 1983

through 1986, the number of sight-

ings of tornadoes in Alberta were

17, 12, 15 and 21 respectively.

The increase in the numbers of

tornado sightings in recent years

is believed to stem from a greater

awareness of the public and the

enhanced reporting network brought

about by the recruitment of volun-

teer weather watchers. In the

period 1889 - 1986 there have been

seven other documented cases of

tornadoes in Edmonton City but

these touchdowns were brief and

Alberta's tornadoes are of

intermittent. (Hage, 1982).

Alberta Tornado Climatology

using information gathered in the week following the tornado. The findings should be viewed as preliminary and are subject to adjustments and refinements as more information becomes avail-

\$250 million.

able.

the tornado.

Environment Canada,

Friday July 31 dawned sunny,

and although surface temperatures

and humidities were lower than the previous days the airmass

continued to have the potential

for strong thunderstorms. The circulation maintained a souther-

ly flow of warm, moist air. As

the day progressed, surface tem-

peratures and dewpoints rose.

Thunderstorms began developing in

the late morning along the Rocky

Mountain Foothills and by early

afternoon were moving northward

across central Alberta. A cold

front was sweeping eastward

across Alberta providing an addi-

tional lift mechanism for the

formation of severe thunder-

storms. A line of thunderstorms

southwest of Edmonton intensified

rapidly and moved toward the city

at about 70 kmh. A new thunder-

storm cell developed explosively

ahead of the line, in the Leduc

area, and moved northward. This

would prove to be the storm that produced the tornado. The line overtook the cell and together they moved northward through eastern Edmonton. In addition to the tornado, hail as large as softballs, strong winds and rain amounts of 40 - 50 millimetres were reported in the city. Approximately 2 hours after the first thunderstorms a second line moved through the city, again producing heavy rain, hail and damaging winds (greater than 110 kmh).

### The Tornado

The information on the physical aspects of the tornado is based on a synthesis of eyewitness reports, ground surveys and an aerial survey by Brain Smith of University of Chicago. Adjustments may be made to the conclusions regarding timing and damage path as more information is received.

A tornado was sighted near Leduc at 2:55 P.M. by a member of the public when a funnel cloud was seen to touch down and then retract. According to eyewitness accounts, the tornado reformed southeast of Beaumount at 3:01 P.M. The tornado then followed a generally northward track moving to the east of Beaumont, across the eastern fringes of Millwoods, northward to the Sherwood Park Industrial Estates, then to the North Saskatchewan River Valley. It followed the river northward, exiting the valley where it curves eastwards. The tornado crossed the northeastern fringes of Clareview. As it crossed 153rd Avenue it moved northeast to the Evergreen Trailer Park, then continued northeastward for about 5 km before dissipating.

The tornado was on the ground for over an hour, from its touchdown at 3:01 P.M., to its dissipation northeast of the Trailer Park just after 4:05 P.M. (Table 2). Based on the damage surveys, there was only one tornadic event with a path length of approximately 40 km and an average speed of near 35 kmh. The damage path varied in width from less than 100 metres (m) to over 1000 m. In the most



Map 1. Tornado damage path, Edmonton Tornado July 31, 1987. Based on aerial and ground surveys.

severely damaged areas, the width of the severe destruction varied from 200 m (Evergreen Trailer Park) to about 700 m (industrial sections). Surveys of the damage led to this tornado being tentatively classified as a strong F3 on the Fujita Tornado Intensity Scale (Table 1). Along the path of the tornado (Map 1) varying scales of damage were visible, ranging from F0 to occasionally approaching F4. Occurrences of missile damage were evident in many areas.

## Other Severe Weather Phenomena

Very large hail, up to soft-ball size, was reported in south Edmonton and the eastern sections of Edmonton south of the River. Torrential rains accompanied the storm complex across all parts of the City and produced local flooding. Strong and gusty winds together with downbursts from the thunderstorm also caused some

damage near to, but not within, the tornado path.

A second line of thunderstorms moved across the city in the early evening. This was accompanied by strong wind gusts (110 kmh reported) and hail.

## Summary

Tornadoes occur every year in Alberta. The tornado that devastated portions of eastern Edmonton on July 31, 1987 was however a rare event.

Surveys of the damage led to this tornado being tentatively classified as a strong F3 on the Fujita Tornado Intensity Scale. Along the path of the tornado varying scales of damage were visible, ranging from F0 to occasionally as high as F4.

The damage path extended from southeast of Beaumont to northeastern Edmonton over a length of nearly 40 kms. Damage

ERIC ENVIRONMENT

over half of the path indicates a tornado of intensity F2 or stronger. The width of severe destruction varied from 200 m to as much as 700 m.

Continued investigations of this tornado and comparisons with other tornadic events in Canadian history, will further define the magnitude of this event.

## Reference

Hage, K.D., 1982, Preliminary List of Tornadoes in Alberta 1960 - 1982, Unpublished manuscript.

## WHAT TO DO IF A TORNADO STRIKES

- 1. Head for the basement. Fast!
- No basement? Seek shelter, under the stairs, under a sturdy table, or in a closet or small room.
- In a school auditorium or shopping mall - seek shelter in an interior corridor.
- If caught outside, abandon your car and lie flat in a ditch or depression.

Table 1. The Fujita Tornado Intensity Scale

	Surface Wind Speed (kmh)	Expected Damage
FO	64 - 116	Light
F1 (6)	117 - 180	Moderate
F2	181 - 252	Considerable
F3	253 - 330	Severe
F4	331 - 417	Devastating
F5	418 - 509	Incredible

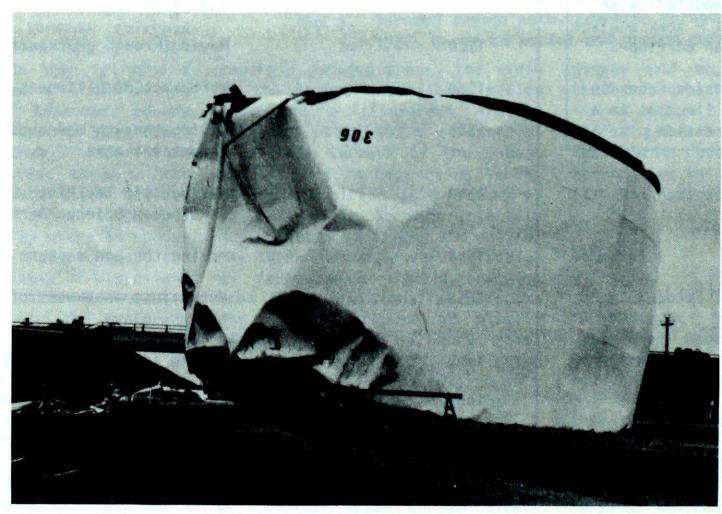
Table 2. Tornado Chronology. Based on eyewitness accounts.

Times are best estimates available.

local time	Location
1455	First known touchdown in the vicinty of Leduc.
1501	Beginning of the 40 km track, 3-4 km southeast of Beaumount.
1507	1-2 km northeast of Beaumount.
1515	Crossed Ellerslie Road between 34 St. and 17 St.
1520	Moved through southeastern Millwoods.
1530	Northeast of Millwoods.
1535	Moving through Sherwood Park Industrial area.
1540	Moving into the River Valley near the Strathcona Science Park.
1550	Moving through eastern Clareview.
1553	Farms just southwest of Trailer Park hit.
1555	Moving into Evergreen Trailer Park.
1605	Dissipates 5 km northeast of Trailer Park.



Edmonton Tornado - July 31, 1987 Evergreen Trailer Court Photo: L. Wojliw



Edmonton Tornado - July 31, 1987 Industrial Area "Refinery Row" Photo: L. Wojliw

## Severe Weather in Ontario - July 1987

July 3

Windsor: Winds damage trees

Bracebridge: Tornado

Kitchener: Heavy rains, tree

damage

Sudbury: Golfball size hail

July 7

Kitchener, north and east of

Toronto: Flooding

July 8

Jackson point: Tree damage

Aurora: Flooding

July 9

West Toronto: Minor flooding,

power lines down

July 11

Sault Ste. Marie: 3 planes damaged by winds, 108 kmh

gust down trees & power lines

July 12

Sault Ste. Marie: Trees down,

boats overturned

July 13

Toronto: Trees and power lines

downed.

July 18

Perth: Walnut size hail

Uxbridge: Trees uprooted,

houses damaged by winds

July 19

Orillia, Stratford, Huronia:

heavy rains, trees and power

lines down.

July 20

Strathroy, London - trees

damaged.

July 22

Hornepayne: Tornado cause

structural damage

Matheson: wind damage (possible

tornado)

July 23

Sault Ste. Marie: wind damage

(possible tornado)

July 24

Bala: Lightning injuries

Lake St. John: small tornado,

planes damaged, numerous trees

uprooted.

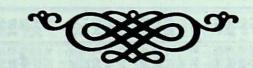
Mississauga: small tornado

July 31

Niagara Falls: funnel cloud.

- M. Leduc

Ontario Weather Centre



	Tog	peratur	• C		<u> </u>				-		7	<del></del>	JULY	1987	T 7					_	<b></b>	_			_		
STATION	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	STATION	Mean	Difference from Normal	Maximum	Minimum	Snowfall (cm)	% of Normal Snowfall	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of month (cm)	No. of days with Precip 1.0 mm or more	Bright Sunshine (hours)	% of Normal Bright Sunshine	Degree Days below 18 C
BRITISH COLUMBIA  ABBOTSFORD ALERT BAY AMPHITRITE POINT BLUE RIVER BULL HARBOUR  CAPE SCOTT CAPE ST.JAMES	17.1 14.3 13.9 16.7 13.1 13.2	0.1 0.3 0.0 0.3 0.0	28.4 25.8 20.6 32.6 20.3	7.8 9.0 9.7 2.0 5.9	0.0 0.0 0.0 0.0 0.0		51.2 42.8 52.8 104.2 25.7 37.5	124 81 72 138 41	0 0 0 0	7 7 7 10 11 8	259 X X 224 X	89	40.8 112.1 127.1 MSG 152.7	YUKON TERRITORY  BURWASH DAWSON MAYO WATSON LAKE WHITEHORSE  NORTHWEST TERRITORIES	14.0 15.6 16.3 15.2 15.0	1.7 0.9 1.1 0.3 0.9	27.3 27.4 27.1 27.6 27.4	1.9 3.0 4.2 6.5 3.8	0.0 0.0 0.0 0.0		32.6 54.6 33.0 65.3 29.8	53 161 63 112 87	0 0 0 0 0	8 11 8 12 10	X X X 213 265	81 105	123.9 71.9 56.6 89.4 99.5
CASTLEGAR COMOX CRANBROOK  DEASE LAKE ETHELDA BAY FORT NELSON FORT ST.JOHN HOPE  KAMLOOPS KELOWNA LANGARA	12.9 19.8 17.6 18.3 14.2 12.8 16.2 16.0 18.0 21.3 19.8 11.9	0.2 -0.5 0.2 -0.1 1.7 -0.4 -0.4 -0.5 0.5 1.1 -0.3	21.9 36.2 29.8 34.6 28.2 22.9 28.7 29.4 29.3 37.5 36.9 16.9	8.7 9.1 9.7 6.3 -0.1 4.2 6.6 6.5 10.3 10.3 6.5 8.1	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0		59.2 45.0 125.6 155.6	95	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	8 9 5 11 11 9 14 12 9 4 7 7 7	199 248 X 273 277 X 201 X 218 276 272 X	139 * 84 87	158.3 19.8 33.3 49.8 117.7 161.8 66.0 74.2 29.5 5.0 10.0 188.5	ALERT BAKER LAKE CAMBRIDGE BAY CAPE DYER CAPE PARRY  CLYDE COPPERMINE CORAL HARBOUR EUREKA FORT RELIANCE	2.5 10.3 7.6 5.0 6.6 3.6 10.0 8.3 6.0 13.9	-1.1 -0.7 -0.3 -0.1 0.9 -0.5 0.3 -0.4 0.6 0.0	14.1 24.0 17.5 13.4 16.6 16.9 27.2 19.9 15.2 29.5	-2.1 1.5 0.1 -2.0 0.4 -2.8 1.7 0.7 -1.8 4.8	25.3 0.0 1.0 0.2 3.8 0.0 0.0 0.4 0.0	227 14 28 50 36	48.1 46.8 46.5 8.0 43.4 6.2 24.0 58.5 15.2 12.1	246 120 236 18 255 27 93 143 125 35	0 0 0 0 0 0	11 6 8 3 6 2 5 8 1	181 338 348 X X 302 355 208 486 X	60 112 114 116 111 72 142	481.9 238.3 322.3 403.3 354.2 447.1 249.5 301.6 370.4 140.4
LYTTON MACKENZIE  MCINNES ISLAND PENTICTON PORT ALBERNI PORT HARDY PRINCE GEORGE  PRINCE RUPERT PRINCETON QUESNEL	21.2-15.9 14.4 20.7 16.9 14.1 16.5 13.0 17.3 18.1	0.4 1.0 0.7 0.4 2 0.5 1.4 0.2 -0.5 1.7	35.7 32.1 20.4 36.6 29.9 26.1 31.8 18.1 32.0 32.0	9.9 0.0 9.2 9.7 5.5 7.5 2.1 7.0 5.5 4.6	0.0 0.0 0.0 0.0 0.0 0.0 0.0	•	33.8	307	0 0 0 0 0 0 0	7 10 10 8 6 7 8	228 291 X 262 238 238 295 176 264 X	77 107 84 * 120 100	8.0 75.8 111.7 5.6 48.2 122.4 57.6 154.3 MSG 27.5	FORT SIMPSON FORT SMITH IQALUIT HALL BEACH HAY RIVER INUVIK MOULD BAY NORMAN WELLS POND INLET RESOLUTE	17.0 16.4 7.5 6.0 15.1 14.5 4.8 17.1 5.5 5.2	0.4 0.4 0.0 0.6 -0.7 1.0 0.9 0.8 1.1	29.3 30.3 18.3 16.5 29.7 29.6 14.6 27.6 15.1 14.0	1.9 1.1 0.8 0.4 3.0 2.3 -0.8 1.5 -3.1 -1.4	0.0 0.0 0.0 0.0 0.0 0.0 0.0	30	26.2 24.8 55.6 26.8 60.4 20.6 2.1 11.8 12.8 7.2	44 43 87 77 125 61 14 21 23 32	00000 00000	4 6 13 7 6 7 1 4 4 2	312 309 257 X X 419 350 336 X 359	107 102 127 123 126 116	31.5 78.4 321.5 372.3 98.1 117.9 409.5 51.8 387.5 396.5
REVELSTOKE SANDSPIT  SMITHERS TERRACE VANCOUVER HARBOUR VANCOUVER INT'L VICTORIA GONZ. HTS  VICTORIA INT'L VICTORIA MARINE WILLIAMS LAKE	19.2 14.1 16.1 17.2 17.6 17.5 15.4 16.2 14.3 16.6	0.8 0.1 1.4 1.1 0.0 0.2 0.0 -0.1 0.3 1.2	32.5 21.5 30.1 31.3 26.4 25.5 25.6 29.2 25.9 30.8	8.5 8.9 2.9 6.4 11.3 10.7 8.8 6.9 7.3 5.4	0.0 0.0 0.0 0.0 0.0 0.0 0.0		106.6 34.6 77.4 43.2 50.7 36.2 11.6 13.0 29.3 46.5	167 80 168 76 142 113 86 71 129 96	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	8 8 7 5 8 7 3 7 7	238 205 272 297 X 276 288 293 X 269	88 109 112 170 89 84 89 86	22.3 122.2 66.4 50.7 27.6 27.4 81.7 60.4 115.8 59.1	YELLOWKNIFE ALBERTA  BANFF BROOKS CALGARY INT'L COLD LAKE CORONATION	14.6 17.9 15.8 17.3 16.5	-0.2 -0.6 -0.6 -0.4 -0.8	27.5 32.5 34.0 31.0 30.8 33.0	7.2 3.0 6.0 3.9 6.4 4.3	0.0 0.0 0.0 0.0 0.0			187 108 193 128 207	0 00000	14 12 12 12 12	X 296 271 256 297	* 84 81 88	93.0 59.6 91.3
									*					EDMONTON INT'L EDMONTON MUNI. EDMONTON NAMAO EDSON FORT CHIPEWYAN	15.8 17.5 16.9 14.8 16.8	0.0 0.1 0.0 0.4 0.8	30.3 31.7 31.1 29.2 31.0	3.9 6.5 5.3 2.1 3.0	0.0 0.0 0.0 0.0		120.2 121.4 116.9 114.2 83.2	131 136 153 127 110	00000	13 15 12 13	260 282 X 219 X	83 92 77	88.0 58.8 68.7 108.8

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	Tem	peratur	e C						(cm)	more					Tem	perature	C						(cm)	more			
STATION	Mean	Difference from Normal	Maximum	Minimum	Snowfall (cm)	Z of Normal Snowfall	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of month (c	No. of days with Precip 1.0 mm or n	Bright Sunshine (hours)	% of Normal Bright Sunshine	Degree Days below 18 C	STATION  AVERAGE EVER  ENDATE E	Mean	Difference from Normal	Maximum	Minimum	Snowfall (cm)	% of Normal Snowfall	Total Precipitation (mm)	Z of Normal Precipitation	Snow on ground at end of month (	No. of days with Precip 1.0 mm or	Bright Sunshine (hours)	7, of Normal Bright Sunshine	Degree Days below 18 C
FORT MCMURRAY GRANDE PRAIRIE HIGH LEVEL ASPER ETHBRIDGE	17.3 16.2 15.7 15.8 17.6	0.9 0.3 0.0 0.7	33.8 31.0 29.9 31.4 33.7	3.6 4.4 2.6 4.4 4.1	0.0 0.0 0.0 0.0		31.1 73.6 66.7 67.2 103.4	41 113 96 135 237	0 0 0 0	9 7 11 13 6	295 267 308 234 308	103 * 104 * 89	68.8 61.6 87.5 86.1 58.7	THE PAS THOMPSON WINNIPEG INT'L	17.2 15.5 20.0	-0.5 -0.1 0.4	33.2 31.8 33.3	4.1 2.7 9.0	0.0 0.0 0.0		53.4 42.8 130.1	76 45 171	0 0 0	11 9 13	234 264 267	77 103 84	62.5 94.0 13.8
MEDICINE HAT PEACE RIVER ROCKY MTN HOUSE SLAVE LAKE	19.4 17.0 15.5 14.3 16.6	-1.0 -0.5 1.3 -0.6 -1.0 1.0	36.6 32.6 30.7 28.9 30.7	6.2 4.8 2.1 0.5 4.4	0.0 0.0 0.0 0.0 0.0		40.4 71.8 86.4 133.5 70.6	100 118 111 143 91	0 0 0	8 9 14 17 9	339 X X X 295	97	41.6 59.9 96.6 126.4 69.6	ONTARIO  ATIKOKAN BIG TROUT LAKE EARLTON GERALDTON	18.3 16.1 18.7 16.7	1.1 0.1 1.0 0.4	31.2 28.0 34.1 28.6	1.7 5.3 5.3 4.9	0.0		138.6 51.3 100.1 94.2	54 123 115	0000	16 7 10 16	239 252 X X	83	32.7 70.1 36.8 65.0 14.8
UFFIELD HITECOURT ASKATCHEWAN	19.1	1.0	37.4 29.9	8.7 4.4	0.0		44.2	59	0	10	310 X		49.9	HAMILTON RBG HAMILTON KAPUSKASING KENORA	20.5 23.5 22.4 7.6 20.3	1.7 1.8 1.9 0.8 1.1	31.2 35.0 32.4 31.6 32.4	7.2 11.1 11.1 3.8 6.9	0.0 0.0 0.0 0.0		99.4 188.3 140.5 101.4	148 267 145 110	00000	9 10 14 9	327 X X X 288	102	4.6 54.8 22.5 6.
ROADVIEW COLLINS BAY CREE LAKE STEVAN IUDSON BAY	17.2 14.9 15.7 19.6 15.7	-0.5 0.8 0.1 -0.3 -0.6	33.1 26.4 30.1 36.0 31.5	4.6 4.1 4.9 7.9 5.0	0.0 0.0 0.0 0.0 0.0	2	107.8 36.7 49.4 96.3 94.8	211 42 62 178 118	0 0 0 0 0	12 8 9 10 13	284 332 250 276 236	85 * 89 77 *	55.6 113.1 92.2 25.0 68.6	LANSDOWNE HOUSE LONDON MOOSONEE	21.7 17.0 22.8 15.1	1.6 0.0 2.5 -0.2	31.6 28.6 35.3 31.3	6.5 11.6 -0.1	0.0		47.7 115.0 34.8 102.0	120 48 106	0 0	7 4 13	X 267 217	97	53.3 3.4 112.3
INDERSLEY A RONGE MEADOW LAKE MODSE JAW IIPAWIN	17.9 16.7 16.6 18.7 16.7	-0.4 0.0 -0.6 -1.0	36.0 31.6 30.8 34.2 31.0	4.5 4.5 4.7 5.0 6.6	0.0 0.0 0.0 0.0		58.6 54.6 143.2 128.5 83.0	173 240	0 0 0 0	11 15 15 15	X X 239 277 204	* 80 *	57.9 71.2 69.4 38.7 67.9	MUSKOKA  NORTH BAY OTTAWA INT'L PETAWAWA PETERBOROUGH	19.9 21.9 20.3 21.3	1.6 1.3 1.6 2.1	33.6 31.4 34.3 34.9 34.1	7.1 9.2 5.0 6.0	0.0 0.0 0.0 0.0	344	73.0 117.1 68.2 44.4	71 136 80 56	0 0000	9 9 5 8	283 X X	103	16. 21. 6. 22.
ORTH BATTLEFORD PRINCE ALBERT REGINA SASKATOON SWIFT CURRENT	17.7 17.3 18.2 18.4 18.1	-0.4 -0.1 -0.7 -0.1 -0.2	33.9 32.1 34.4 34.8 33.5	6.0 6.1 7.2 4.3 2.8	0.0 0.0 0.0 0.0		108.9 175.8 90.3 37.2 66.6	269 169 68	0 0 0	15 15 12 8 7	X 224 276 X 285	75 80 83	54.1 57.0 46.5 43.4 69.0	PICKLE LAKE  RED LAKE  ST. CATHARINES  SARNIA  SAULT STE. MARIE	17.3 18.2 23.6 22.8 19.4	0.2 0.0 1.9 1.9 2.1	32.5 33.3 36.6 31.3	5.1 3.1 12.3 9.7 3.7	0.0 0.0 0.0 0.0		88.0 89.4 46.8 95.2	101 129 77	0 0 0 0	12 13 9 8	258 X 316 272	107 94	21.5 40.1 1.5.29.4
TYNYARD ORKTON	17.1	-0.9 -0.9	32.9 32.8	4.5 6.2	0.0	*	74.2 97.8	131 172	0	8 10	252 271	77 82	65.1 52.9	SIOUX LOOKOUT SUDBURY THUNDER BAY TIMMINS	18.9 20.3 18.2 17.5	0.6 1.6 0.6 0.3 1.7	31.4 32.3 32.7 32.9 34.1	4.5 5.7 3.4 3.9	0.0 0.0 0.0 0.0		112.2 46.4 85.9 144.5	113 159	0 0 0 0	10 8 13 15	X 272 245 X	94 80	32. 16. 38. 55.
AANITOBA														TORONTO INT'L	23.7			13.3	0.0		108.1	1 151	0	11	x		4.
RANDON CHURCHILL SAUPHIN GILLAM GIMLI	18.3 12.1 18.1 15.0 19.0	-0.5 0.3 -0.4 0.0 0.4	32.7 30.2 32.5 30.8 31.5	5.1 1.6 5.0 3.0 7.5	0.0 0.0 0.0 0.0	No. No. No.	108.5 37.0 78.5 30.4 127.5	122	0 0 0	11 8 10 5 12	X 340 247 X 263	119 76 80	27.5 188.3 103.0 23.4	TORONTO ISLAND TRENTON WATERLOO-WELL WAWA WIARTON	22.5 22.5 22.1 21.4 16.4	1.9 2.2 1.5 1.6	33.5 33.8 32.9 31.5 27.6	12.4 8.7 9.1 3.8 7.3	0.0 0.0 0.0 0.0		101.2 33.4 195.4 93.0	143 54 258	0000	8 5 11 11 7	X X	* 113	7 9 64
SLAND LAKE YNN LAKE YORWAY HOUSE	17.1 17.4 16.5	0.0 1.6	31.7 30.5 32.2	6.7 4.8 4.6	0.0 0.0 0.0		101.6 62.1 114.0	75	0	10	X 285	102	56.8 86.7 73.7	WINDSOR	21,1 24.0	2.6	32.2 34.5	11.0	0.0	Jens Jens	89.0	106	ō	ii.	X		2
PORTAGE LA PRAIRIE	19.7	0.0	32.4	7.0	0.0	*	92.7	121	0	10	X		14.6			Letel	8 (						R	1 6			

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STATION	Mean	Difference from Normal	Maximum	Minimum	Snowfall (cm)	Z 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	STATION	Ten	Difference from Normal adulated	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
QUEBEC	(1) (1) (2) (2)	-90 -90 -91		13	0/3 (//3 (// 5)		18 1 10 16 1	138. 1 155. 152. 153.	0 0 8		T T	99	64.0	NOVA SCOTIA	11 E	17						A		を表			
BAGOTVILLE BAIE COMEAU BLANC SABLON CHIBOUGAMAU GASPE	18.4 15.9 13.2 16.6 16.9	0.5 0.1 2.1 0.6 -0.3	34.9 29.8 22.0 31.2 33.8	7.0 5.8 3.7 4.1 2.5	0.0 0.0 0.0		138.2 53.7 13.2 146.5 63.8	114 66 13 127 76	00000	12 7 14 15	X 261 224 213 301	85	50.6 80.6 80.4 65.8	GREENWOOD HALIFAX INT'L SABLE ISLAND SHEARWATER SYDNEY	19.2 18.7 15.8 18.3 16.1	0.1 0.5 0.3 0.9 0.4	29.9 27.6 22.5 28.3 30.2	5.4 9.0 6.9 9.8 5.6	6.0 0.0 0.0 0.0 0.0		64.2 61.3 42.8 55.3 17.9	82 65 46 56 21	00000	5 4 8 4 5	X * 217 231 203	132 105 116	16.2 17.9 69.4 21.8 40.2
INUKJUAK KUUJUAQ KUUJUARAPIK LA GRANDE RIVIERE MANIWAKI	8.5 9.6 10.1 13.6 19.7	-0.8 -1.8 -0.4 =	18.7 21.0 24.9 28.4 34.0	0.4 0.0 2.0 2.4 4.0	0.0 0.0 0.0 0.0 0.0		62.6 50.7 76.9 65.8 85.6	115 87 93 2	0 0 0 0	12 12 10 13 8	236 194 217 211 259	114 98 128 2 95	296.6 257.3 266.9 143.8 34.2	YARMOUTH PRINCE EDWARD ISLAND	16,5	0.2	25.8	8.2	0.0		30.4	39	0	7	202	97	55.9
MATAGAMI MONT JOLI MONTREAL INT'L MONTREAL MINT'L NATASHQUAN	16.2 18.6 21.6 19.7 15.1	0.6 1.3 0.7 * 0.9	31.0 32.4 33.6 31.7 24.8	2.5 8.3 8.4 5.1 5.2	0.0 0.0 0.0 0.0 0.0	•	149.2 56.0 131.0 115.6 72.8	141 74 145 * 76	0000	15 8 7 7 7	233 266 296 283 287	93 105 107 *	57.3 53.6 8.7 26.6 97.7	CHARLOTTETOWN SUMMERSIDE NEWFOUNDLAND	19.1 19.2	0.8	28.9 29.8	9.8 9.5	0.0		8.9 19.1	10 24	0	4 5	X 287	108	16.6
QUEBEC ROBERVAL SCHEFFERVILLE SEPT-ILES SHERBROOKE	19.5 19.1 11.9 15.8 18.9	0.4 1.2 -0.7 -0.1 1.1	33.1 34.4 27.6 31.9 32.0	7.4 6.9 4.1 7.9 3.8	0.0 0.0 0.0 0.0 0.0		140.6 82.0 189.2 90.0 84.6	120 68 195 92 72	0 0 0 0	10 11 17 12 8	260 234 169 248 294	105 # 102 #	29.3 42.2 193.1 79.9 45.4	BATTLE HARBOUR BONAVISTA BURGEO CARTWRIGHT	12.9 15.5 14.9 11.7	2.3 0.8 1.4 -1.0	29.8 28.5 23.8 26.9	2.6 6.5 6.2	0.0 0.0 0.0 1.8		82.4 37.0 42.8 81.9	117 60 31 98	0 0 0	12 5 10 17	X X X * 226	113	160.9 95.1 93.9 194.3
STE AGATHE DES MONTS ST-HUBERT VAL D'OR NEW BRUNSWICK	18.6 21.1 17.8	1.4 0.4 0.7	31.7 33.2 31.1	3.2 6.5 1.4	0.0 0.0 0.0		73.0 41.2 108.6	68 42 106	0	10 6 14	249 * 240	90	46.9 14.3 64.6	CHURCHILL FALLS CONFORT COVE DANIEL'S HARBOUR DEER LAKE GANDER INT'L	13.7 17.0 14.3 17.3 17.3	0.0 0.4 -D.1 1.4 0.8	29.0 23.4 23.0 31.6 30.8	0.9 10.5 7.0 2.0 5.1	0.0 0.0 0.0 0.0		173.8 28.9 43.0 28.6 10.5	144 36 48 36 15	00000	18 5 5 9 3	187 X 238 X 302	92 116 140	141.1 63.1 113.8 58.9 52.9
CHARLO CHATHAM FREDERICTON MONCTON SAINT JOHN	18.4 19.4 18.7 18.7 16.9	1.0 0.2 -0.6 0.2 0.0	31.4 32.1 30.4 29.4 28.1	7.1 7.5 5.9 6.6 6.5	0.0 0.0 0.0 0.0	*	36.7 97.2 28.1 19.1 32.4	42 106 31 20 31	0 0 0	8 7 7 5 7	256 259 237 288 217	100 102 * 118 99	45.2 22.8 24.0 22.8 44.7	GOOSE PORT-AUX-BASQUES ST ANTHONY ST JOHN'S ST LAWRENCE	15.7 14.1 12.3 15.5 15.5	-0.1 0.9 -0.6 0.0 3.4	31.3 21.5 25.5 28.6 27.2	4.3 5.7 2.0 4.5 5.2	0.0 0.0 0.0 0.0 0.0		105.2 56.6 69.6 50.8 44.5	100 52 69 67 45	00000	14 8 9 6 5	197 214 272	100	82.2 99.5 175.2 96.5
						School baroot b				Section Sectio		Charage Reported		STEPHENVILLE WABUSH LAKE	17.0 14.0	1.0	30.6 28.7	5.1 2.9	0.0	Spiritorial comments	42.2 167.7	44 159	00 100 100 100	20	210		57.0 134.9
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AGROCLIMATOLOGIC	AL ST	ATIONS		1								JULY	1987			He'					10				
5 6 6	Tem	peratur	e C			T		3			Degree	days		Tem	peratur	e C					(cm)			Degree d	ave
	9		9 4					onth (c	E		above	5C									month (c	_		obove	S C
STATION	Mean	Difference from Normal	Moximum	Minimum	Snowfall (cm)	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at and of mo	No. of days with Precip 1.0 mi	Bright Sunshine (hours)	This month	Since jan. 1st	STATION	Mean	Difference from Normal	Maximum	Minimum	Snowfall (cm)	Total Precipitation (mm)	% of Normal Precipitation	Snow on ground at end of mo	No. of days with Precip 1.0 mr	Bright Sunshine (hours)	This month	Since jan. 1st
BRITISH COLUMBIA  AGASSIZ KAMLOOPS SIONEY SUMMERLAND  ALBERTA  BEAVERLODGE ELLERSLIE FORT VERMILLION LACOMBE LETHBRIDGE VAUXHALL VEGREVILLE  SASKATCHEWAN  INDIAN HEAD MELFORT REGINA SASKATOON SCOTT SWIFT CURRENT SOUTH  MANITOBA  BRANDON GLENLEA MORDEN  ONTARIO DELHI ELORA	17.6 16.8 20.8 16.0 15.5 16.7 18.2 17.9 18.3 17.1 17.5 19.0 19.6 20.1	-0.3 * -0.1 0.8 -0.6 0.4 -0.2 -0.7 -0.1 0.6 0.2 0.0 -0.1	35.0	10.0 7.0 9.5 3.0 2.0 3.0 6.0 6.0 4.0 5.0 4.5 3.0 9.0 7.6	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	91.0 103.6 66.6 69.8 87.8 77.6 26.3 157.4 77.0 162.3 148.0	155	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	11 2 9 11 13 12 11 14 12 2 15 7	219 276 269 255 260 207 217 277 274 258 250	398.8 416.5 474.0 400.6 432.7 454.2 474.5	1272.6 1177.5 1502.0 859.0 884.5 989.4 1251.0 1070.2 1229.7 1291.2 1292.0 1428.5	GUELPH HARROW KAPUSKASING MERIVALE OTTAWA SMITHFIELD VINELAND STATION WOODSLEE  QUEBEC  LA POCATIERE L'ASSUMPTION LENNOXVILLE NORMANDIN ST. AUGUSTIN STE CLOTHILDE NEW BRUNSWICK FREDERICTON NOVA SCOTIA KENTVILLE NAPPAN PRINCE EDWARD ISLAND CHARLOTTETOWN NEWFOUNDLAND ST. JOHN'S WEST	21.3 23.5 17.4 21.8 22.5 23.2 18.8 20.8 17.8 21.2 18.9	1.4 1.5 0.5 1.2 2.3 0.7 0.1 0.6 0.8 1.0 0.2 0.5 0.6	31.5 33.0 31.5 33.6 32.5 33.0 33.0 31.0 30.0 30.0 29.0	7.5 10.0 3.0 8.2 8.0 12.0 7.0 7.5 4.0 7.0 9.5	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	104.6 102.7 116.2 59.0 50.1 79.2 90.8 90.5 84.2 150.0 36.7 7.8 50.0	129 129 128 69 74 128 95 97 74 165 41 52 21		77712 749 87 11 9 10 56	295 296 246 310 270 276 253 283 237 256 253	504.0 573.5 383.3 520.3 533.5 564.6 429.7 490.0 393.8 495.4 339.3 465.4 426.3	1306.3 1646.9 956.8 1369.4 1456.2 1439.5 986.8 1248.2 878.4 1283.3 939.5 1037.5 942.3

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