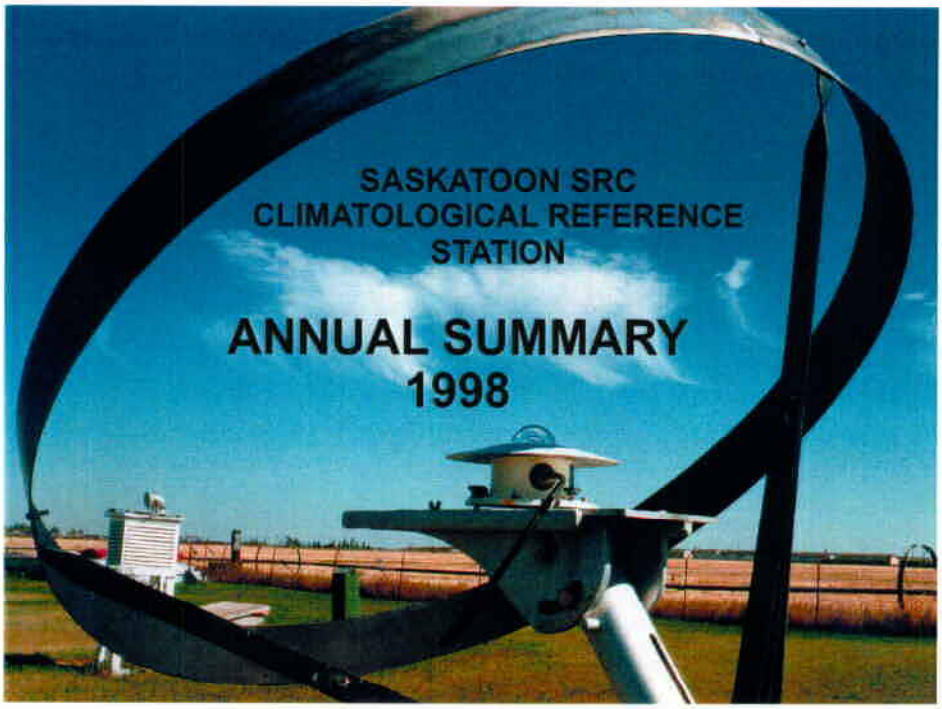
technology is our business

Resource & Environment Group
Environment Branch
Climatology Section



ANNUAL SUMMARY 1998

C. Beaulieu
V. Wittrock

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The 1998 data was compiled and recorded by Carol Beaulieu with assistance from Virginia Wittrock. Ms Stacey Carmichael provided data entry for the long term climate trends. Miss Beaulieu maintained the site while instrument maintenance was carried out by the Instrumentation, Certification and Testing Branch of the Saskatchewan Research Council. Elaine Wheaton and Virginia Wittrock assisted with the proofreading and editing. Consultations with Larry Flysak and Don Rybak of the Saskatchewan Environmental Services Centre, Saskatoon, SK, were most helpful in verifying and comparing data. Although every caution was taken to ensure the accuracy of data and information presented, errors may have occurred. If errors are noticed, we would appreciate being informed so they can be corrected.

Enquiries concerning the SRC Climatological Reference Station (CRS), its data, measurement programs and publications are most welcome. For further information contact:

Elaine Wheaton
Lead Scientist
306-933-8179
e-mail wheaton@src.sk.ca

Virginia Wittrock
Research Scientist
306-933-8122
e-mail wittrock@src.sk.ca

Carol Beaulieu
Research Technician
306-933-8182
e-mail beaulieu@src.sk.ca

Climatology Section
Fax 306-933-7817
Saskatchewan Research Council
Web Site Home Page
http://www.src.sk.ca

SASKATCHEWAN RESEARCH COUNCIL
CLIMATE REFERENCE STATION SUPPORTERS 1998-1999

PFRA Prairie Farm Rehabilitation Administration
University of Saskatchewan
SAF Saskatchewan Agriculture and Food
SaskPower Generation to Generation
Ducks Unlimited Canada
Dow AgroSciences
Bioriginal Clean Air. Clean Earth. Pure Products.

Cover photograph
Diffuse radiation recorder,
Climate Reference Station, Saskatoon , 1998
photo credit C.R. Beaulieu.

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WHAT IS THE CLIMATE REFERENCE STATION?

The Saskatchewan Research Council's Climate Reference Station (SRC CRS) at Saskatoon is classified as a principal climatological station with supplementary climatological observations (Atmospheric Environment Service 1992). A reference climatological station is where the data are intended for the purpose to determine climatic trends. This requires long periods (not less than thirty years) of homogeneous records, where man-made environmental changes have been and/or are expected to remain at a minimum. Ideally the records should be of sufficient length to enable the identification of secular changes of climate. (WMO 1996) At our principal station hourly readings are taken of elements which include temperature, precipitation amount, humidity, wind and atmospheric pressure. Our supplemental observations include rate of rainfall, soil temperature, bright sunshine and solar radiation. High quality and consistent climatological observations are maintained providing data sets to meet the current concerns of the effects of climatic change and increased variability.

Purpose and Benefits

The purpose of the SRC CRS is to provide a record of the observed meteorological elements so that the climate of the area and its changes can be accurately documented and described. Climatological data have assumed new importance as a result of social and environmental issues in which climate is a dominant factor. Climatological information assists in realizing new technological opportunities and social changes. Climate information is necessary and valuable for use in areas such as agriculture, forestry, land use and facility placement, water resources, health and comfort.

The CRS also allows us to:

- evaluate long term climate trends - early warning system for increased frequencies of extreme events such as drought, floods, *etc.*
- determine the impacts of climate events on society, economy, health, and ecosystems. Examples include intense rainfall causing flooding and property damage and heat stress with its implications on health
- do value added research
- be part of regional, national and global networks in an important agricultural and ecological area
- facilitate development of new programs - *e.g.* air quality, biodiversity, the Boreal Ecosystem Atmosphere Study (BOREAS) project, and climate change monitoring
- have roles in various programs within SRC including spray drift work, BOREAS, and collaborative research (*e.g.* Western College of Veterinary Medicine and the College of Agriculture, University of Saskatchewan).
- provide climate data to governments, university research groups, insurance agencies, lawyers, agricultural sectors, chemical companies, schools, building science, constructions, media, transportation studies, accident studies, wildlife studies and interested individuals.

The goal of the Climate Reference Station is first, to maintain the high quality of data gathered over its more than thirty years of existence at its current location. Second, to continue to monitor a large variety of elements. These various elements combined with the long-term collection period as well as the stable location allows CRS to be a very valuable climate information collection station.

SUMMARY

Data concerning temperature, precipitation, soil temperature, wind speed and direction, bright sunshine, and solar radiation recorded at the Saskatchewan Research Council (SRC) Climatological Reference Station (CRS), (52°09'N, 106°36'W, 497 m asl) are presented for the year 1998 and compared with the long-term (*circa* 1900-1997) and standard-period (1961-1990) records.

The year 1998 will probably be one of the warmest years globally of this century. The monthly maximum mean temperatures exceeded their normals nine out of the twelve months for a yearly average of 2.2°C above normal. For the monthly minimum temperatures, only June failed to rise above its normal. The yearly average for the mean minimum temperature was 2.4°C above normal. January and June were the only months to show a drop below the overall temperature normals. This phenomena of above normal temperatures was most evident for the spring and summer months with the exception of June. However, the greatest deviation from the normals occurred in February with temperatures soaring between 7.6°C to 10.1°C above their normal values.

Cold spells (less than or equal to -30°C) occurred three times for a total of three days in January and for one day in each March and December. Hot spells (greater than or equal to 30°C) occurred fourteen times for a total of twenty-two days, twelve of these days occurred in August and three in September. The longest hot spell was five days in August ending on the 6th with a record temperature for the year of 39.7°C exceeding last year's record temperature by 0.4°C. 1893 and 1949 had held the August record with 38.8°C until 1997.

The yearly total for growing degree-days (5°C base) was above average with all the relevant months (May - September), above their normals with the exception of June.. The frost free period began on May 14th (six days earlier than usual), and lasted for 138 days ending on September 29th (fifteen days later than usual). Growing degree-days value for the frost free period was 1723.1 (40.2 higher than last year).

Annual precipitation was under the 30-year average by 98.1 mm (72.8% of normal). This is 30 mm drier than last year. The cumulative precipitation value was well below normal throughout the year. Only August and October had above average precipitation. The August 17 rainfall of 33.8 mm in 24 hours set a new record for the month. Most of October's precipitation occurred during the Thanksgiving weekend blizzard. June regained all precipitation honours for 1998. It was the rainiest month (51.46 mm) with the rainiest day (34.4 mm) and had the heaviest rainfall (41.4 mm). However, the total monthly amount was 80.8% of normal for the month. Eleven of thirty days in June recorded precipitation with a trace of snow noticed on the 1st. On October 10th, the first snow and blizzard occurred for the winter season. It rained in February, late November and in December.

1998 was a very dull year with the annual bright sunshine 215.5 hours less than the 30-year average. The months of March, April, May, September and December were the only months slightly above normal. June especially lacked bright sunshine with 111.7 hours (62.4% of normal) less than normal. The overall value was unexpected with the combination of very high temperatures and limited precipitation.

Saskatoon experienced a slightly windier than normal year. *Near Gale* winds (51-62 km/h) occurred in all months except January, February, March and November. *Gale* winds (63-75 km/h) blew during April, June, July, and December while *Strong Gale* winds (76-87 km/h) were recorded once in May.

WEATHER EVENTS

Temperature

Cold Spells (<=-30°C)		Hot Spells (>=+30°C)	
Month	Day	Month	Day
January	3, 12, 13	July	9-11, 17, 25, 27, 31
March	10	August	2-6, 9-11, 15, 26, 29-30
December	21	September	2, 8, 9
Total	5	Total	22

Coldest day = January 3rd & 13th at -33.2°C
Hottest day =August 6th at 39.7°C

Precipitation

Wettest Months	Wettest Days	Greatest Events
June 51.4 mm	June 19/ 34.4 mm	June 19-20/ 41.4 mm
August 45.2 mm	August 17/ 33.8 mm	August 17-18/ 39.8 mm

Tipping Bucket engaged from April 29 to November 3

Frost Free Season

Year	Last Spring Frost	First Fall Frost	Length of Season (days)
1993	May 17	Sept 14	119
1994	May 9	Oct 4	147
1995	May 22	Sept 19	119
1996	May 12	Sept 29	139
1997	May 14	Oct 5	143
1998	May 13	Sept 30	138
Normal	May 19	Sept 15	118

Unusual Occurrences

February - Freezing rain on the 4-6 & 17
June 1 - Trace of snow
16 - Rainfall - Airport = 25.1 mm; CRS = 0.4mm.
August 6 - all time extreme temperature set for August at 39.7°C.
17 - record rainfall for August at 33.8 mm
Forest fire smoke noted on August 11, 12, 19, 31 and September 1
October 10 - First snowfall of the winter
- First blizzard of the winter
-29.6 mm water equivalent
November 24 - rain
December 17 - Freezing rain and snow

Wind

Near Gale 51- 62 km/h		Gale 63 - 75 km/h	Strong Gale 76-87 km/h
April 23 - 51.3 - E	Aug 15 - 52.6 - N	April 24 - 64.6 - SE	May 3 - 90.6 - NNW
25 - 52.8 - ESE	18 - 54.4 - ESE	30 - 63.4 - WNW	
May 5 - 56.8 - NW	28 - 52.9 - NW	June 30 - 61.1 - S	
31 - 59.0 - SW	Sept 7 - 51.9 - SE	July 30 - 63.7 - SW	
June 19 - 51.2 - N	Oct 2 - 59.8 - SE	Dec. 18 - 68.0 - NNE	
25 - 51.4 - ESE	18 - 58.1 - NW		
July 12 - 53.7 - W	Dec 2 - 51.2 - ESE		
13 - 62.7 - W	14 - 60.5 - WNW		
20 - 62.9 - WNW	17 - 62.5 - NNE		
	22 - 53.3 - NW		

CLIMATE REFERENCE STATION HISTORY

Meteorological observations were first taken at or near Saskatoon by the Royal Northwest Mounted Police in 1889 beginning with only temperatures recorded. There is some disagreement in the early records as to the exact location of the weather observing point, but the majority of the evidence indicates 52°15'N and 106°20'W, elevation 480 m above sea level as the most probable location. This would place it at Clark's Crossing on the South Saskatchewan River, approximately 16 km northeast of the centre of the City of Saskatoon. There was a settlement at Clark's Crossing at that time as well as ten to fifteen families on either side of the river at present day Saskatoon.

Little is known about the very early observers; however, the records do show that Major T.H. Keenan took the observations from March 1892 until March 1895, and Mr. George Will was the observer from January 1897 until April 1897. It is thought that Thomas H. Copeland was involved in the observational program from 1895 to May 1, 1901, at which time it was taken over by Mr. Eby, Sr. Mr. Eby, Sr. recorded the observations until his death in 1921, at which time his daughter, Miss E.S. Eby, continued to record the observations. Her brother, Mr. J.M. Eby, recorded the observations beginning in April 1931 until the station was closed October 31, 1942. The Eby station recorded temperature, precipitation and weather notes on fog, thunderstorms, winds and any unusual weather phenomena. Reports were made twice daily, morning and evening.

In 1916 a climatological station was established by the Physics Department of the University of Saskatchewan and continuous observations were kept twice daily until January 15, 1965. The long-time observer at this site was Mr. Sidney Cox. The Saskatchewan Research Council took over the program in the fall of 1963 at the newly established Climatological Reference Station. The location of the Saskatchewan Research Council's Climatological Reference Station is latitude 52°09'N and longitude 106°36'W and the elevation is 497 m asl[1].

The long-time observer (16 years) at this present site was Mr. Joe Calvert, who retired from the program in August, 1983. Ray Begrand succeeded Mr. Calvert until September 1988 when Virginia Wittrock became the primary observer. Carol Beaulieu became the primary observer in 1992.

In the summer of 1992, the CRS began to be converted to an automated system of data collection with the installation of a Campbell Scientific Data Logger and automatic sensors. The following manual data collection duties were turned over to Environment Canada: evaporation, bright sunshine (Campbell-Stokes), snow survey, snow cover, and manual temperature and precipitation programs. Manual temperature, precipitation and snow cover readings at the site are still possible in the event of total, extended power failure.

[1]From various sources including the *Physical Environment of Saskatoon, Canada* (E.A. Christiansen (ed.) 1970) and 1974 *Annual Meteorological Summary, Saskatoon, Saskatchewan,* (Environment Canada, Atmospheric Environment Service).

SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

www.src.sk.ca Latitude 52°09' N Saskatoon Longitude 106°36' W

	Annual Summary 1998	1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE (1892-1998)
TEMPERATURE	Annual Average (°C)	4.3	3.5	2.0
	Extreme Annual Maximum (°C)/Date	39.7°C/Aug 06	39.3/Aug 07	41.0/Jun 1988
	Annual Average Maximum (°C)	10.1	9.5	7.9
	Extreme Annual Minimum (°C)/Date	-33.2°C/Jan 03 & 13	-39.0/Jan 26	-50.0/Feb 1893
	Annual Average Minimum (°C)	-1.5	-2.5	-3.9
	Days with Frost	184	191	198
	Heating Degree-Days (18°C base)	5219.0	5441.6	5954.0
	Growing Degree-Days (5°C base)	1977.2	1824.5	1648.4
	Cooling Degree-Days (18°C base)	229.7	177.7	117.5
PRECIPITATION	Annual total (mm)	262.7	293.0	360.8
	Greatest 24-h (mm)/Date	34.4/June 19	22.0/Apr 23	99.4/Jun 1983
	Days with Precipitation	101	99	113
WIND	Average Speed (km/h)	17.5	13.3	16.6
	Peak Gust Speed (km/h)/Date	90.6/May 03	86.3/Aug 01	151/Aug 1967/14
SUNSHINE	Total Bright Sunshine (h)	2165.3	2224.9	2380.8
	% Possible Bright Sunshine	48.3	49.9	53.8
	Number of days with Bright Sun	312	325	320
	Total Global Radiation (MJ/m²)	4590.6	4544.6	4391.9
	Total Diffuse Radiation (MJ/m²)	1753.6	1707.7	1729.6

FOR YOUR INFORMATION

1998

Precipitation - October 10 & 11 snow fall value is combined because the belfort gauge was not winterized and the collected snow was dumped into the gauge the morning of the 11th.

Diffuse - October 22-November 3 values are high because of shade ring maladjustment.

1997

Temperature - July 25-29 supplied by AES - Saskatoon

Precipitation - July 25-29 supplied by AES - Saskatoon

Wind - Value excludes July 25 -29

Sunshine - July 25-29 supplied by Kernan Farm, U of S

Global - Feb 1.25 h missing
July 25-29 power outage

Diffuse - Jan 18 value may be in error due to frost build-up on instrument
Feb 1.5 h missing
April 4-7 value may be in error due to instrument problems

Normal and Extreme Values

For this year, the normals for CRS are taken from the normals published by Environment Canada for the standard period 1961-1990. Normals used in SRC CRS Annual Summaries 1990 -1996 were hand-calculated values determined before the official normals were published.

Extreme values are from the Saskatoon area weather stations and extend back to 1892. The earlier records from 1882 to 1901 have major gaps.

SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

www.src.sk.ca

Latitude 52°09' N Saskatoon Longitude 106°36' W

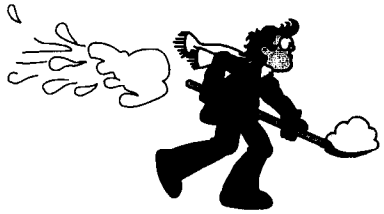
	JANUARY 1998	1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE FOR CRS	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Monthly Average (°C)	-17.8	-20.1	-17.4	
	Extreme Monthly Maximum (°C)/Date	-0.1/27	4.3/31	7.0/1986/11	10.0/1931/30
	Monthly Average Maximum (°C)	-13.5	-14.1	-12.4	
	Number of recording years			28	100
	Extreme Monthly Minimum (°C)/Date	-33.2/3&13	-39.0/26	-43.9/1966/22&1969/29	-48.9/1893/31
	Monthly Average Minimum (°C)	-22.2	-26.1	-22.6	
	Number of recording years			28	100
	Days with Frost	31	31	31	
	Heating Degree-Days (18°C base)	1111.2	1192.4	11114.8	
	Growing Degree-Days (5°C base)	0.0	0.0	0.0	
	Cooling Degree-Days (18°C base)	0.0	0.0	0.0	
PRECIPITATION	Monthly total (mm)	16.0	17.0	20.5	
	Greatest 24-h (mm)/Date	2.1/2	4.0/21	15.4/1989/30	30.5/1893 /23
	Number of recording years			28	100
	Days with Precipitation	16	10	11	
	Total Year - to - Date (mm)	16.0	17.0	20.5	
WIND	Average Speed (km/h)	14.2	14.9	16.0	
	Peak Gust Speed (km/h)/Date	47.1/03	67.7/15	111.0/1986/11	
SUNSHINE	Total Bright Sunshine (h)	87.0	100.1	104.6	
	% Possible Bright Sunshine	33.6	39.1	40.4	
	Number of days with Bright Sun	21	24		
	Total Global Radiation (MJ/m²)	133.3	125.9	129.9	
	Total Diffuse Radiation (MJ/m²)	74.1	67.3	71.4	
SOIL	Average Temperature (°C) @ 0900 h — 5 cm /10 cm	-7.8/-7.2	-10.0/-9.9	-8.8/-8.3	
	20 cm / 50 cm	-5.5/-3.1	-8.1/-3.8	-7.6/-3.8	
	100cm /150 cm	0.8/2.4	0.1/1.8	-0.2/1.8	
	300 cm	4.7	4.2	4.5	

FOR YOUR INFORMATION

The New Year began with a return to seasonal temperatures for January but even they did not feel all that cold. We only had three days below -30°C. The average temperatures for the mean, maximum and minimum were within a degree of the 30 year normal. Precipitation for the month was 4.5 mm below normal. Snow cover, by the end of the month, averaged only 8 cm. This shallow coverage could have forced the frost deeper into the soil if we had had a spell of extreme cold temperatures. As it was, the frost was only recorded to the 100 cm level by month's end. We had 13 days of less than 1 hour of sunshine with the total for the month being 17.6 hours less than usual.

What a change this January is from last year. Last January's monthly average temperature was 2.3°C colder than this year and 1996 was 5.3°C colder than this year due to a near record breaking 18 day cold spell. During 1936 when the temperature in Winnipeg dropped to -41°C, the weather service's liquid-mercury thermometers froze solid. Now-a-days, when thermometers are used to record low temperatures, they are alcohol filled which has a considerable lower freezing point.[1]

[1] Phillips, 1997



SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

www.src.sk.ca Latitude 52°09' N Saskatoon Longitude 106°36' W

	FEBRUARY 1998	1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE FOR CRS	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Monthly Average (°C)	-4.9	-10.0	-13.7	
	Extreme Monthly Maximum (°C)/Date	5.5/21	4.3/24	7.5/ 1988/26	12.8/1931/19
	Monthly Average Maximum (°C)	-1.0	-5.1	-8.6	
	Number of recording years			27	102
	Extreme Monthly Minimum (°C)/Date	-23.2/02	-25.6/23	-41.1/1972/6	-50.0 /1893/1
	Monthly Average Minimum (°C)	-8.8	-15.0	-18.9	
	Number of recording years			27	102
	Days with Frost	28	28	28	
	Heating Degree-Days (18°C base)	641.9	784.5	909.9	
	Growing Degree-Days (5°C base)	0.0	0.0	0.0	
	Cooling Degree-Days (18°C base)	0.0	0.0	0.0	
PRECIPITATION	Monthly total (mm)	5.2	8.0	14.6	
	Greatest 24-h (mm)/Date	2.5/17	2.0/13	14.2/1979/13	20.3/1918 /7
	Number of recording years			28	102
	Days with Precipitation	9	7	10	
	Total Year - to - Date (mm)	21.2	25.0	35.1	
WIND	Average Speed (km/h)	35.4	12.4	16.0	
	Peak Gust Speed (km/h)/Date	50.8/13	55.3/25	106.0/1988/22	
SUNSHINE	Total Bright Sunshine (h)	93.3	112.3	134.1	
	% Possible Bright Sunshine	33.5	41.0	48.1	
	Number of days with Bright Sun	17	21	25	
	Total Global Radiation (MJ/m²)	176.2	359.6[1]	210.1	
	Total Diffuse Radiation (MJ/m²)	92.9	107.4[2]	105.3	
SOIL	Average Temperature (°C) @ 0900 h — 5 cm /10 cm	-3.6/-2.6	-7.5/-5.5	-7.7/-7.3	
	20 cm / 50 cm	-1.2/-1.9	-4.5/-2.5	-6.8/-4.1	
	100cm /150 cm	0.1/1.2	-0.5/0.5	-1.0/0.8	
	300 cm	3.3	2.5	3.3	

FOR YOUR INFORMATION

February continued mild with the average temperature 8.8°C above normal. The maximum and minimum temperatures were above normal by 7.6°C and 10.1°C respectfully. Ten days recorded temperatures above freezing with only 9 days recording temperatures below -10°C. The mild temperatures influenced the soil temperatures especially in the upper levels with warmer than usual values. The good news for home owners was 30% less than normal heating degree-days. There were 12 days with less than 1 hour of bright sunshine making February a very dull month. So dull in fact that we received a call asking us when "this Vancouver weather was going to stop"; in other words "Do something!" February was very dry with only 5.2 mm recorded. This came in the form of rain, freezing drizzle, heavy hoarfrost and traces of snow. In the middle of the month, Saskatoon experienced many days of thick fog.

On the 2nd of February, sunshine was absent, therefore, if any self-respecting ground hog was out of his burrow, he would not have seen his shadow. According to tradition, this signals the impending end of winter. How accurate is the ground hog forecast? Only 37% which is nothing to brag about since 33% accuracy can be achieved by guessing.[a] How about seeing a robin in a crab apple tree on the 3rd of February? Does this mean spring is here or did the robin forget to book his flight south for the winter?

[a] Phillips, 1993

[1] 1.25 h missing data

[2] 1.5 h missing data

SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

www.src.sk.ca

Latitude 52°09' N Saskatoon Longitude 106°36' W

MARCH 1998

		1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE FOR CRS	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Monthly Average (°C)	-6.6	-8.4	-7.0	
	Extreme Monthly Maximum (°C)/Date	14.2/31	13.5/31	15.0/1973/24&1981/16	22.8/1910/23
	Monthly Average Maximum (°C)	-1.2	-3.0	-2.1	
	Number of recording years			28	101
	Extreme Monthly Minimum (°C)/Date	-30.1/10	-28.3/06	-38.9/1972/2	-43.3/1897/14
	Monthly Average Minimum (°C)	-12.0	-13.8	-12.1	
	Number of recording years			28	101
	Days with Frost	31	31	30	
	Heating Degree-Days (18°C base)	763.4	818.6	784.1	
	Growing Degree-Days (5°C base)	1.7	1.1	1.2	
	Cooling Degree-Days (18°C base)	0.0	0.0	0.0	
PRECIPITATION	Monthly total (mm)	5.9	14.0	19.9	
	Greatest 24-h (mm)/Date	3.3/18	3.0/08&28	32.0/1967/30	32.0/1967/30
	Number of recording years			28	96
	Days with Precipitation	8	9	9	
	Total Year - to - Date (mm)	27.1	39.0	55.0	
WIND	Average Speed (km/h)	11.6	13.6	17.0	
	Peak Gust Speed (km/h)/Date	50.6/12	57.7/08	93.0/1959/18	
SUNSHINE	Total Bright Sunshine (h)	202.9	205.8	174.6	
	% Possible Bright Sunshine	55.0	56.2	47.9	
	Number of days with Bright Sun	28	30		
	Total Global Radiation (MJ/m²)	416.6	832.4	362.4	
	Total Diffuse Radiation (MJ/m²)	159.0	174.6	173.9	
SOIL	Average Temperature (°C) @ 0900 h — 5 cm /10 cm	-4.5/-3.2	-4.9/-4.1	-3.4/-3.1	
	20 cm / 50 cm	-1.8/-1.9	-3.2/-2.3	-2.8/-1.8	
	100cm /150 cm	0.2/1.1	-0.8/0.4	-0.6/0.4	
	300 cm	2.6	2.3	2.5	

FOR YOUR INFORMATION

Like last year, March fulfilled the old folklore rhyme of "in like a lion; out like a lamb." Minimum temperatures, up until the 11th, ranged from -10°C to -30°C. After the 11th, minimum temperatures were in the minus mid-teens to near 0°C. The end of the month produced very warm maximum temperatures with six days recording temperatures above 9°C. Growing and heating degree-days were near normal as the cold temperatures at the beginning of the month offset the warm month-end temperatures. There were 10 days of above 0°C temperature with 8 occurring in the last days of the month. Precipitation was 70% below normal. With the warm month-end temperatures, the snow cover had quickly disappeared by the 31st. At the 100 cm level, the average soil temperatures were above 0°C. The 150 cm and 300 cm levels did not record frost. March, with 7 days of less than 1 hour of sunshine, recorded a total bright sunshine value of 28.3 hours above normal.

March can be a very variable month with rapid changes in the weather. In 1902, following a week of springlike weather in Winnipeg, with temperatures between 8 and 12°C , it started to snow again. Three days later, the city had 30 cm of snow, but drifts were 3 to 4 m deep along Portage Avenue covering many store fronts. The 100 km/h winds howled for 48 successive hours. By the time the blizzard blew away the temperature had plummeted to -30°C.[1]

[1]Phillips, 1997

SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

www.src.sk.ca Latitude 52°09' N Saskatoon Longitude 106°36' W

APRIL 1998

		1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE FOR CRS	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Monthly Average (°C)	7.8	2.9	4.0	
	Extreme Monthly Maximum (°C)/Date	29.2/29	22.4/16	30.6/1977/26	33.0/1952/28
	Monthly Average Maximum (°C)	15.3	8.3	9.9	
	Number of recording years			28	101
	Extreme Monthly Minimum (°C)/Date	-7.4/15	-15.4/07	-27.8/1979/1	-28.3/1893/5&1954/2
	Monthly Average Minimum (°C)	0.2	-2.4	-2.0	
	Number of recording years			28	101
	Days with Frost	16	17	20	
	Heating Degree-Days (18°C base)	306.3	452.0	420.9	
	Growing Degree-Days (5°C base)	106.5	54.1	54.8	
	Cooling Degree-Days (18°C base)	1.0	0.0	0.0	
PRECIPITATION	Monthly total (mm)	13.1	54.6	20.3	
	Greatest 24-h (mm)/Date	4.6/09	22.0/23	24.6/1985/19	30.2/1955/19
	Number of recording years			28	101
	Days with Precipitation	5	15	7	
	Total Year - to - Date (mm)	40.2	93.6	75.3	
WIND	Average Speed (km/h)	14.8	16.6	18.0	
	Peak Gust Speed (km/h)/Date	64.6/24	64.7/28	108.0/1959/06	108.0/1959/06
SUNSHINE	Total Bright Sunshine (h)	249.7	205.9	229.4	
	% Possible Bright Sunshine	59.7	49.6	54.8	
	Number of days with Bright Sun	29	28		
	Total Global Radiation (MJ/m²)	526.4	488.8	492.2	
	Total Diffuse Radiation (MJ/m²)	160.1	266.0	178.5	
SOIL	Average Temperature (°C) @ 0900 h — 5 cm /10 cm	4.5/6.8	1.7/3.2	2.8/3.2	
	20 cm / 50 cm	8.0/4.3	3.8/1.4	3.5/2.5	
	100cm /150 cm	2.6/2.3	0.8/0.8	1.2/1.2	
	300 cm	2.6	1.8	2.2	

FOR YOUR INFORMATION

April was an extremely warm month with the average temperature 3.8°C above normal. The last third of the month had seven days with maximum temperatures above 20°C and only two days of minimum temperature below zero. April was very dry with only 13.1 mm of rain recorded; 36% of normal. This is vastly different than 270% recorded last year. Instead of flood worries, the farmers are now concerned with dry field conditions and blowing soil. Winds reach 'Gale' (63-75 kph) and 'Near Gale' (51-62 kph) conditions twice each during the month. Frost was absent from the soil at all seven levels during the 0900h and 1600h readings for April. The average soil temperatures were well above normal. The bright sunshine value was 20.3 hours above normal with only three days recording less than one hour.

This mild winter and early spring may result in unwanted pests. The mild winter of 1987 combined with an early fall snow stopped harvest prematurely north of Calgary. In the spring they were plagued with the worst infestation of field mice in more than 40 years.[1]

[1]Phillips, 1997.

www.src.sk.ca

SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

Latitude 52°09' N Saskatoon Longitude 106°36' W

MAY 1998

		1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE FOR CRS	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Monthly Average (°C)	13.7	10.7	11.6	
	Extreme Monthly Maximum (°C)/Date	29.1/26	30.2/31	35.0/1988/30	37.2/1936/27
	Monthly Average Maximum (°C)	21.8	17.5	18.5	
	Number of recording years			28	101
	Extreme Monthly Minimum (°C)/Date	-4.8/01	-3.6/14	-10.0/1967/2	-19.8/1907/6
	Monthly Average Minimum (°C)	5.6	3.8	4.5	
	Number of recording years			28	101
	Days with Frost	3	5	6	
	Heating Degree-Days (18°C base)	144.1	231.3	206.9	
	Growing Degree-Days (5°C base)	270.0	180.0	209.4	
	Cooling Degree-Days (18°C base)	11.1	4.1	7.0	
PRECIPITATION	Monthly total (mm)	10.4	19.6	43.7	
	Greatest 24-h (mm)/Date	5.8/18	7.4/07	39.9/1985/4	51.3/1909/30
	Number of recording years			28	101
	Days with Precipitation	5	8	9	
	Total Year - to - Date (mm)	50.6	113.2	119.0	
WIND	Average Speed (km/h)	14.8	16.7	18.0	
	Peak Gust Speed (km/h)/Date	90.6/03	69.2/10	132.0/1965/17	
SUNSHINE	Total Bright Sunshine (h)	295.0	219.1	285.7	
	% Possible Bright Sunshine	60.5	45.2	58.6	
	Number of days with Bright Sun	31	29		
	Total Global Radiation (MJ/m²)	693.9	625.3	586.3	
	Total Diffuse Radiation (MJ/m²)	203.1	237.9	222.2	
SOIL	Average Temperature (°C) @ 0900 h — 5 cm /10 cm	11.8/13.9	7.8/9.2	10.1/10.6	
	20 cm / 50 cm	15.1/10.2	10.5/6.8	10.9/8.9	
	100cm /150 cm	7.3/5.8	5.4/4.2	5.9/4.4	
	300 cm	3.9	2.7	3.1	

FOR YOUR INFORMATION

This May was the warmest since 1988 when the mean temperature was 15.5°C. Maximum temperatures over 25°C occurred 10 times. The average maximum temperature was 3.3°C higher than normal. Three frost days were recorded with the last one occurring on the 13th. The average minimum temperature was 1.1°C higher than normal. The above normal temperatures are reflected in the degree-day totals. Heating degree-days are 62.8 below normal; cooling degree-days were 4.1 above normal and growing degree-days are 60.6 above normal. Growing degree-days for the frost free season stood at 191.7 at the end of the month. The warm month is also evident for soil temperatures. The temperatures range from 4.2°C to 0.8°C above normal with the 10 and 20 cm levels showing the greatest deviation. Precipitation was extremely low with only 23.8% of the normal amount recorded. This is the least amount in May since the climate station began officially recording precipitation data in 1964. Surprisingly, the bright sunshine for the month was only 9.3 hours greater than normal. The winds for May averaged below normal. There were *Near Gale* winds on the 5th and 31st and *Storm* winds on the 3rd which resulted in broken trees, downed power poles and light damage to some buildings.[1]

Thank goodness it was not as dry in Saskatoon this May as it was in Grande Prairie, Alberta in 1972 when only a trace of rain was recorded. That, coupled with a heat wave with 40°C temperatures, had residents gobbling up enormous amounts of water. Then a pump at the treatment plant broke. The city engineer's solution to the crisis: "Drink beer."[2]

[1] Warick, 1998 [2] Phillips, 1997

SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

www.src.sk.ca Latitude 52°09' N Saskatoon Longitude 106°36' W

	JUNE 1998	1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE FOR CRS	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Monthly Average (°C)	15.1	17.4	15.9	
	Extreme Monthly Maximum (°C)/Date	28.7/25	30.3/26	41.0/1988/5	41.0/1988/5
	Monthly Average Maximum (°C)	21.3	23.4	22.6	
	Number of recording years			28	102
	Extreme Monthly Minimum (°C)/Date	0.5/02	6.4/24	-3.3/1967/6	-3.9/1903/9&1917/2
	Monthly Average Minimum (°C)	8.8	11.3	9.2	
	Number of recording years			28	102
	Days with Frost	0	0	0	
	Heating Degree-Days (18°C base)	106.8	42.1	84.0	
	Growing Degree-Days (5°C base)	302.8	371.8	327.3	
	Cooling Degree-Days (18°C base)	19.6	23.9	21.2	
PRECIPITATION	Monthly total (mm)	51.4	50.8	63.6	
	Greatest 24-h (mm)/Date	34.4/19	14.6/08	99.4/1983/24	99.4/1983/24
	Number of recording years			28	102
	Days with Precipitation	11	16	12	
	Total Year - to - Date (mm)	102.0	164.2	182.6	
WIND	Average Speed (km/h)	36.5	15.8	17.0	
	Peak Gust Speed (km/h)/Date	61.1/30	58.2/02	117.0/1986/10	
SUNSHINE	Total Bright Sunshine (h)	185.5	245.2	297.2	
	% Possible Bright Sunshine	37.1	49.3	59.4	
	Number of days with Bright Sun	28	30		
	Total Global Radiation (MJ/m²)	572.5	661.5	638.7	
	Total Diffuse Radiation (MJ/m²)	251.1	219.6	228.1	
SOIL	Average Temperature (°C) @ 0900 h — 5 cm /10 cm	14.1/15.9	15.1/16.7	15.3/15.7	
	20 cm / 50 cm	17.0/12.7	17.7/12.7	16.2/14.0	
	100cm /150 cm	9.9/8.3	9.8/7.8	10.4/8.2	
	300 cm	5.8	4.6	5.2	

FOR YOUR INFORMATION

June was a cool, cloudy, dry month. Average temperatures were all slightly below normal; 0.8°C for the monthly average, 1.3°C for the average maximum and 0.4°C for the average minimum. By the end of June, 48 continuous frost free days had produced 302.8 growing degree-days. Frost was not recorded at the station for the month of June but was recorded at the airport on June 3rd.[1] Even though there were 111.7 hours less bright sunshine, the amount of rain was 12.2 mm below the monthly normal. 80.5% of the monthly total fell over a 24 hour period on the 19th and 20th. Precipitation total for the year was well below normal at 80.6 mm less than normal. The station recorded 3 days with "Near Gale" (51-62 km/h) force winds.

During June, severe storms are common and they may include tornadoes. Funnel clouds are classified as tornadoes only when they descend to the ground. For the brave at heart who have the dubious opportunity to photograph a tornado, here are a few tips to consider when trying to get it on film. •Are you safe? •Will you be able to judge accurately the distance, speed and direction of movement of the tornado? • Do you have a ***very*** quick, clear escape route to take you to safety? •Can you really take a good picture without shaking while watching your property or your neighbours' being torn to pieces? •Does your family need you more than you need the picture?[2]

[1] Environment Canada, 1998 [2] Verkaik, 1997.

SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

www.src.sk.ca

Latitude 52°09' N Saskatoon Longitude 106°36' W

JULY 1998

		1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE FOR CRS	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Monthly Average (°C)	19.8	19.2[a]	18.3	
	Extreme Monthly Maximum (°C)/Date	36.3/10	34.7/22	38.5/1984/27	40.0/1919/17&1941/19
	Monthly Average Maximum (°C)	26.6	26.8[a]	25.1	
	Number of recording years			28	102
	Extreme Monthly Minimum (°C)/Date	6.8/23	3.6/01	1.7/1967/2	-0.6/1918/25
	Monthly Average Minimum (°C)	12.9	11.6[a]	11.5	
	Number of recording years			28	102
	Days with Frost	0	0	0	
	Heating Degree-Days (18°C base)	20.3	24.8[a]	32.0	
	Growing Degree-Days (5°C base)	458.2	441.3[a]	414.8	
	Cooling Degree-Days (18°C base)	75.5	63.1[a]	43.9	
PRECIPITATION	Monthly total (mm)	36.8	22.0[a]	55.7	
	Greatest 24-h (mm)/Date	15.0/01	8.4/06	45.5/1968/29	79.2/1946/3
	Number of recording years			27	102
	Days with Precipitation	9	8[a]	12	
	Total Year - to - Date (mm)	138.8	186.2[a]	238.3	
WIND	Average Speed (km/h)	12.6	12.7[b]	16.0	
	Peak Gust Speed (km/h)/Date	63.7/11	63.0/04[b]	113.0/1955/05	
SUNSHINE	Total Bright Sunshine (h)	289.4	306.5[c]	330.3	
	% Possible Bright Sunshine	57.7	61.2[c]	66.9	
	Number of days with Bright Sun	31	31	30	
	Total Global Radiation (MJ/m²)	681.4	626.4[b]	633.5	
	Total Diffuse Radiation (MJ/m²)	240.2	182.4[b]	216.5	
SOIL	Average Temperature (°C) @ 0900 h — 5 cm /10 cm	17.9/20.0	16.6[b]/18.6[b]	17.6/18.0	
	20 cm / 50 cm	21.3/16.5	19.8[b]/14.9[b]	18.8/16.8	
	100cm /150 cm	13.0/10.9	12.0[b]/10.2[b]	13.2/11.1	
	300 cm	7.5	6.8[b]	7.5	

FOR YOUR INFORMATION

Like last year, July was a very warm month with 15 days of +27ºC temperatures; 7 of which were over 30ºC. The longest duration of +30°C temperature was from July 9-11 creating a 3 day hot spell. The average temperature was 1.4ºC above normal with the maximum average 1.5ºC and minimum average 1.3°C above normal. By the end of July, the frost-free period was at 78 days, with the frost free growing degree days (FFGDD) at 952.7. This is an increase of 25.3 FFGDD over last year. The bright sunshine value was 40.9 hours less than normal but this did not translate into much needed precipitation. The rainfall was 42% less than normal by the end of the month for the year. Heavy rainfall came on the 1st with 15 mm and on the 11th with 13.4 mm. This was over three-quarters of the monthly total. The above average temperatures and low precipitation have pushed crops about a week ahead of the 5 year average.[1] *Near gale* winds of 51-62 kph occurred thrice while *gale* winds of 63-75 kph occurred once during the month.

Although Saskatchewan residents will boast of some wicked lightning storms, the foothills of southern Alberta are one of the most lightning-prone regions in Canada. That area receives over 1/2 million strikes a year.[2]

[1] Karwandy, 1998 [2] Phillips, 1997

[a] Values for July 25-29 supplied by AES - S'toon [b] Values exclude July 25-29

[c] Values for July 25-29 supplied by Kernan Farm, U of S

SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

www.src.sk.ca Latitude 52°09' N Saskatoon Longitude 106°36' W

	AUGUST 1998		1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE FOR CRS	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Monthly Average (°C)		21.0	19.0	17.2	
	Extreme Monthly Maximum (°C)/Date		39.7/06	39.3/07	39.7/1998/06	39.7/1998/06
	Monthly Average Maximum (°C)		28.9	26.5	24.3	
	Number of recording years				28	101
	Extreme Monthly Minimum (°C)/Date		8.2/20	5.1/12	-2.8/1976/28	-2.8/1976/28
	Monthly Average Minimum (°C)		13.1	11.4	10.1	
	Number of recording years				28	101
	Days with Frost		0	0	0	
	Heating Degree-Days (18°C base)		6.8	40.5	62.4	
	Growing Degree-Days (5°C base)		497.4	434.1	379.6	
	Cooling Degree-Days (18°C base)		101.2	71.6	39.0	
PRECIPITATION	Monthly total (mm)		45.2	45.0	35.3	
	Greatest 24-h (mm)/Date		33.8/17	13.0/14	33.8/1998/17	73.7/1945/3
	Number of recording years				28	101
	Days with Precipitation		8	9	9	
	Total Year - to - Date (mm)		184.0	231.2	273.6	
WIND	Average Speed (km/h)		14.1	12.8	16.0	
	Peak Gust Speed (km/h)/Date		54.4/18	86.3/01	151.0/1967/14	
SUNSHINE	Total Bright Sunshine (h)		294.9	286.6	295.2	
	% Possible Bright Sunshine		65.1	63.3	65.2	
	Number of days with Bright Sun		31	31	30	
	Total Global Radiation (MJ/m²)		595.7	586.5	529.0	
	Total Diffuse Radiation (MJ/m²)		189.1	154.9	185.6	
SOIL	Average	5 cm /10 cm	17.9/20.1	16.2/18.2	16.4/16.8	
	Temperature (°C)	20 cm / 50 cm	21.7/17.6	19.8/16.1	17.9/16.8	
	@ 0900 h	100cm /150 cm	14.5/12.6	13.4/11.8	14.1/12.4	
		300 cm	9.3	8.5	9.1	

FOR YOUR INFORMATION

August was a hot one! An extreme temperature record was set exceeding last year's record by 0.3°C. The previous record of 37.8°C had been set in 1893 and 1949. The month continued a trend, started in the last 2 days of July, of over 27°C temperatures until the13th. There were 19 days in August of above 27°C temperatures, 12 were above 30°C and 3 of those were above 35°C. The averages were well above normal; 3.8° for the mean, 4.6° for the average maximum and 3.0° for the average minimum. The degree-day totals reflected the high temperatures long duration. The extreme cooling degree-day value (base 24) was 10.6 above normal. By the end of the month, the frost free period was 109 days with a growing degree-day value of 1450.1; 88.6 more than last year with a frost free period of 109 days. The top three soil levels were also considerably warmer than usual. Bright sunshine was near normal for the month. Smoke from northern forest fires was noted on 11, 12, 19 and 31. Rainfall total was above normal but the majority, 40.4mm, fell on the 17 and 18. This produced a station record for August for the most rain in a 24 hour period. For the rest of the month the station recorded only 4.6 mm.

We can be thankful for the dry weather. The mosquitoes are scarce unlike 1993. Then, children came to Winnipeg health clinics with their eyes swollen shut from mosquito bites. Heavy rains during the week had caused the mosquito population to explode to 6 times the average.[1] The dry weather has allowed harvesting to be one of the earliest on record. With two-thirds of combining complete, the southern grainbelt leads harvest activity. The central and northern regions are not far behind, having already passed the halfway mark well ahead of the five year provincial average of 16%.[2]

[1] Phillips, 1995 [2]Star Phoenix, Sept 1, 1998

SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

www.src.sk.ca

Latitude 52°09' N Saskatoon Longitude 106°36' W

	SEPTEMBER 1998		1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE FOR CRS	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Monthly Average (°C)		14.1	14.6	11.3	
	Extreme Monthly Maximum (°C)/Date		31.3/08&09	31.3/11	35.6 /1978 /04	35.6 /1978 /4
	Monthly Average Maximum (°C)		21.0	21.6	17.7	
	Number of recording years				28	101
	Extreme Monthly Minimum (°C)/Date		-2.3/30	0.9/19	-7.8 /1974 /30	-11.1/1908/28
	Monthly Average Minimum (°C)		7.1	7.5	4.9	
	Number of recording years				28	101
	Days with Frost		1	0	5	
	Heating Degree-Days (18°C base)		138.6	116.7	206.8	
	Growing Degree-Days (5°C base)		273.0	288.2	197.1	
	Cooling Degree-Days (18°C base)		21.3	14.3	6.2	
PRECIPITATION	Monthly total (mm)		26.0	39.4	32.9	
	Greatest 24-h (mm)/Date		11.6/19	14.8/15&16	29.6/1980/03	44.2 /1931/12
	Number of recording years				28	101
	Days with Precipitation		8	5	9	
	Total Year - to - Date (mm)		210.0	270.6	306.5	
WIND	Average Speed (km/h)		13.0	16.5	17.0	
	Peak Gust Speed (km/h)/Date		51.9/07	74.8/28	148/1967/22	
SUNSHINE	Total Bright Sunshine (h)		200.1	220.3	184.4	
	% Possible Bright Sunshine		52.8	58.1	48.6	
	Number of days with Bright Sun		27	27	27	
	Total Global Radiation (MJ/m²)		381.5	395.2	351.8	
	Total Diffuse Radiation (MJ/m²)		119.9	112.5	127.6	
SOIL	Average	5 cm /10 cm	11.8/13.9	11.4/13.4	10.5/11.2	
	Temperature (°C)	20 cm / 50 cm	16.1/14.5	15.0/13.3	12.5/13.3	
	@ 0900 h	100cm /150 cm	13.5/12.6	12.4/11.7	12.5/11.9	
		300 cm	10.3	8.8	9.9	

FOR YOUR INFORMATION

Summer temperatures of 26°C or greater, were recorded until September 13th. This warm half of the month boosted the mean maximum 3.3°C; the mean minimum 2.2°C and the mean average 2.8°C above normal.. Frost was recorded on the 30th ending the frost free growing season with 138 days. (Our last spring frost was on May 13th.) This is 20 days more than usual. Normally the frost free period is between May 19 and September 15. The frost free growing degree-day total was 1723.1. Precipitation was below normal by 6.9 mm or 21%. Most of the rain fell on the 18 and 19 with 17.4 mm. Bright sunshine was above average by 8.5% with the bright sunshine absent for only 3 days. It was a very calm month for wind with *strong winds*[a] occurring only on the 7th.

Early Autumn is the time for vicious storms in the Atlantic Ocean. One such storm on September 19, 1582, sunk the frigate *Squirrel* carrying Sir Humphrey Gilbert, founding father of Newfoundland. Before the ship sank, Sir Gilbert was spotted calmly reading a book on the tossing deck. He waved to the captain of the passing ship and nonchalantly called out " We are as near to heaven by sea as by land!"[1]

[a] 51-62 kph
[1] Phillips, 1997

SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

www.src.sk.ca Latitude 52°09' N Saskatoon Longitude 106°36' W

	OCTOBER 1998	1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE FOR CRS	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Monthly Average (°C)	5.3	4.7	4.8	
	Extreme Monthly Maximum (°C)/Date	23.6/07	28.1/02	28.5 /1984 /8	32.2 /1943 /5
	Monthly Average Maximum (°C)	10.2	10.1	10.9	
	Number of recording years			28	99
	Extreme Monthly Minimum (°C)/Date	-6.5/31	-7.5/20	-19.5/1984/30&31	-25.6/1919/26
	Monthly Average Minimum (°C)	0.4	-0.8	-1.3	
	Number of recording years			28	99
	Days with Frost	14	19	19	
	Heating Degree-Days (18°C base)	393.7	414.4	406.5	
	Growing Degree-Days (5°C base)	67.6	57.9	61.5	
	Cooling Degree-Days (18°C base)	0.0	0.0	0.0	
PRECIPITATION	Monthly total (mm)	37.7	20.8	17.5	
	Greatest 24-h (mm)/Date	29.1[a]	16.4/07	36.7/1984/16	36.7/1984 /16
	Number of recording years			28	99
	Days with Precipitation	10	8	6	
	Total Year - to - Date (mm)	247.7	291.4	324.0	
WIND	Average Speed (km/h)	14.0	16.4	17.0	
	Peak Gust Speed (km/h)/Date	59.8/02	67.2/13	138/1967/16	
SUNSHINE	Total Bright Sunshine (h)	121.0	144.2	160.7	
	% Possible Bright Sunshine	36.7	43.8	48.8	
	Number of days with Bright Sun	22	26		
	Total Global Radiation (MJ/m²)	203.3	223.0	239.1	
	Total Diffuse Radiation (MJ/m²)	143.5[b]	92.4	92.6	
SOIL	Average Temperature (°C) @ 0900 h — 5 cm /10 cm	3.6/5.0	3.7/5.5	4.1/4.5	
	20 cm / 50 cm	7.1/7.8	7.3/8.0	6.0/8.0	
	100cm /150 cm	9.5/10.2	9.5/9.8	9.2/9.7	
	300 cm	10.0	9.2	9.5	

FOR YOUR INFORMATION

There was frost on the pumpkins not to mention a whole lot of snow this Thanksgiving holiday. On the Thanksgiving long weekend temperatures dipped to the minus side causing most of the 30.5 mm of precipitation to be in the form of snow. The snow storm represented all but 7.2 mm of the month's total precipitation. The monthly total of 37.7 mm is more than twice the normal amount. The snow was so heavy and deep, the access road to the climate station was impassable. The temperatures were within a degree of the expected normal temperatures but with five days less frost than normal. The bright sunshine was 39.7 hours less than expected with 13 days of less than one hour of bright sunshine. Soil temperatures at all levels were within a degree of normal.

"Surprise" snow falls in October are really not that unusual. This year, farmers were very fortunate to have an early harvest. In many previous years, they have not been so lucky. In 1985, 28 cm of snow fell on the southern Prairies ending a very bad year of floods, drought , grasshoppers and dust storms. In 1989 farmers put caterpillar tracks or 4-wheel drives on their combines in an attempt to salvage their snow and rain dampened crops. 36.7 cm of wet snow fell in 1994 causing an early end to harvest as it stayed until spring. Parts of Alberta and Saskatchewan, including what was supposed to be a record crop, were buried under more than 15 cm of snow in 1996. In 1955, Hallowe'en ushered in the beginning of one of the worst winters on record, with a total of nearly 200 cm of snow falling in successive snowfalls and blizzards. By mid-March roads were covered with 1 to 2 m of snow making them impassable even for horses.[1]

[a]Greatest 24 hour total is the combined snow/rain fall for the 10 &11 [b]Value maybe high due to diffuse shade ring maladjustment [1] Phillips 1997

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SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

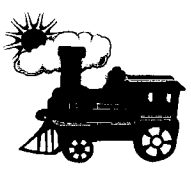
Latitude 52°09' N Saskatoon Longitude 106°36' W

NOVEMBER 1998		1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE FOR CRS	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Monthly Average (°C)	-3.6	-3.1	-6.0	
	Extreme Monthly Maximum (°C)/Date	10.5/26	12.3/06	19.4/1975 /4	21.7 /1903 /3
	Monthly Average Maximum (°C)	0.0	1.4	-1.5	
	Number of recording years			29	100
	Extreme Monthly Minimum (°C)/Date	-19.7/17	-15.3/21	-33.5/1985/24	-39.4 /1893/30
	Monthly Average Minimum (°C)	-7.2	-7.5	-10.6	
	Number of recording years			29	100
	Days with Frost	29	29	29	
	Heating Degree-Days (18°C base)	648.5	631.8	721.5	
	Growing Degree-Days (5°C base)	0.0	0.4	2.8	
	Cooling Degree-Days (18°C base)	0.0	0.0	0.0	
PRECIPITATION	Monthly total (mm)	6.1	1.6	15.5	
	Greatest 24-h (mm)/Date	2.3/16	1.0/22	19.3/1978/4	27.9/1938 /1
	Number of recording years			29	100
	Days with Precipitation	5	2	8	
	Total Year - to - Date (mm)	253.8	293.0	339.5	
WIND	Average Speed (km/h)	13.9	12.3	16.0	
	Peak Gust Speed (km/h)/Date	50.6/26	54.1/29	100.0/1976/17	
SUNSHINE	Total Bright Sunshine (h)	57.2	97.2	100.9	
	% Possible Bright Sunshine	21.7	37.0	38.6	
	Number of days with Bright Sun	22	24		
	Total Global Radiation (MJ/m²)	110.1	126.2	123.7	
	Total Diffuse Radiation (MJ/m²)	72.1	59.8	73.6	
SOIL	Average Temperature (°C) @ 0900 h — 5 cm /10 cm	-0.7/0.3	-2.1/-0.6	-2.2/-1.7	
	20 cm / 50 cm	2.4/3.0	1.3/2.8	-0.5/2.8	
	100cm /150 cm	5.9/7.1	5.7/6.8	5.4/6.8	
	300 cm	8.5	8.0	8.1	

FOR YOUR INFORMATION

November 1998, while not as warm as November 1997, was still warmer than normal. The average monthly minimum was the most predominant factor pushing the average monthly mean temperature 2.4°C above normal. Lower level soil temperatures were slightly warmer than usual with the upper levels being 1.5° to 2.0° higher than normal. Monthly precipitation was less than 40% of normal. Snow-on-the-ground at the site by month's end was near zero, the same as last year. The remnants of snow we had received earlier in the month, remained only in shaded areas. The Bright Sunshine values were extremely reduced for November. Fifteen days received less than 1 hour of bright sunshine which is reflected in the low monthly total. The site recorded 44.7hours less bright sunshine than normal for the month.

Although organizers prefer bright sunshine for outdoor events, it is not something that can be relied upon. At 9:22 am, November 7, 1885, Donald Smith drove in the ceremonial last spike of the CPR at Craigellachie, BC under cloudy skies but relatively warm temperatures at 10°C. Had the organizers waited just an hour, the historic event could have taken place under sunny skies.[1]



[1] Phillips, 1997

SASKATCHEWAN RESEARCH COUNCIL

MONTHLY WEATHER SUMMARY

www.src.sk.ca Latitude 52°09' N Saskatoon Longitude 106°36' W

	DECEMBER 1998	1998 VALUE	1997 VALUE	NORMAL (1961 - 1990) OR EXTREME VALUE FOR CRS	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Monthly Average (°C)	-12.2	-4.5	-14.5	
	Extreme Monthly Maximum (°C)/Date	7.8/13	11.2/14	9.5/1987/7	13.3/1939 /5
	Monthly Average Maximum (°C)	-8.1	0.1	-9.8	
	Number of recording years			29	100
	Extreme Monthly Minimum (°C)/Date	-30.5/21	-18.5/04	-42.2/ 1973/31	-43.9 / 1892/ 22
	Monthly Average Minimum (°C)	-16.3	-9.1	-19.3	
	Number of recording years			29	100
	Days with Frost	31	31	31	
	Heating Degree-Days (18°C base)	937.4	697.9	1004.8	
	Growing Degree-Days (5°C base)	0.0	0.4	0.0	
	Cooling Degree-Days (18°C base)	0.0	0.0	0.0	
PRECIPITATION	Monthly total (mm)	8.9	1.2	21.3	
	Greatest 24-h (mm)/Date	3.0/18	0.9/29	14.5/1973/23	20.6/1936 /24
	Number of recording years			29	100
	Days with Precipitation	7	2	13	
	Total Year - to - Date (mm)	262.7	294.2	360.8	
WIND	Average Speed (km/h)	15.1	13.4	16.0	
	Peak Gust Speed (km/h)/Date	68.0/18	62.3/29	121/1955/12	
SUNSHINE	Total Bright Sunshine (h)	89.3	82.9	83.7	
	% Possible Bright Sunshine	36.8	34.7	34.5	
	Number of days with Bright Sun	25	24		
	Total Global Radiation (MJ/m²)	99.7	86.2	95.2	
	Total Diffuse Radiation (MJ/m²)	48.5	40.3	54.3	
SOIL	Average Temperature (°C) @ 0900 h — 5 cm /10 cm	-6.7/-5.9	-5.0/-3.8	-7.1/-6.5	
	20 cm / 50 cm	-3.7/-1.2	-2.2/-0.6	-5.5/-1.6	
	100cm /150 cm	3.0/4.8	2.5/4.1	1.9/3.9	
	300 cm	6.8	6.3	6.3	

FOR YOUR INFORMATION

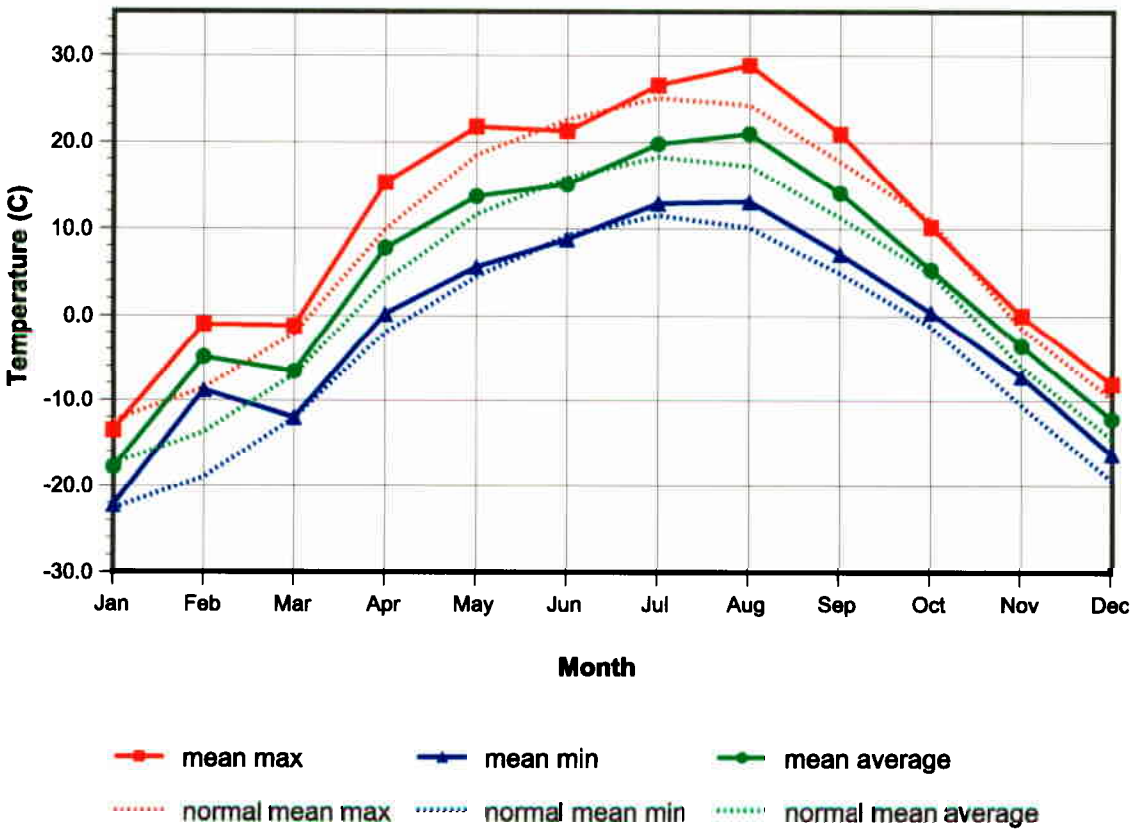
This December concluded one of the warmest years on record for Canada[1]. The monthly temperature values were all above normal. The minimum value at 3.0°C above normal combined with the monthly maximum value at 1.7°C above normal produced an overall monthly average of 2.3°C above normal. The above average temperatures are reflected in the lower heating degree-days and the higher soil temperatures. The soil temperatures range from 0.5°C to 1.8°C above their normal values. With 25 days of bright sunshine, the monthly value was 5.6 hours above normal. Ten days received less than one hour of bright sunshine. The December winds averaged normal values with *near gale* (51-62 kph) force winds occurring four times and *gale* (63075 kph) force winds occurring once. Precipitation, at 8.9 mm, was 12.4 mm (58.2%) below normal. It occurred as snow and freezing rain during the first two-thirds of the month. The cumulative precipitation was 97.6 mm (27.9%) below normal by year end.

The past two Decembers have been exceptional mild, especially if you compared them to reports by the early explorers. David Thompson, on his journey across northern Saskatchewan and Manitoba in 1795, reported "It was a day (Dec. 18th) of most intense cold, the ice on the lake was splitting in all directions, the smoke from the chimney fell in lumps to the ground." As the day progressed it actually had warmed up from -49°C at 8am to -44.5°C by 9 that evening.[2]

[1] Adam, 1999 [2] Phillips, 1998

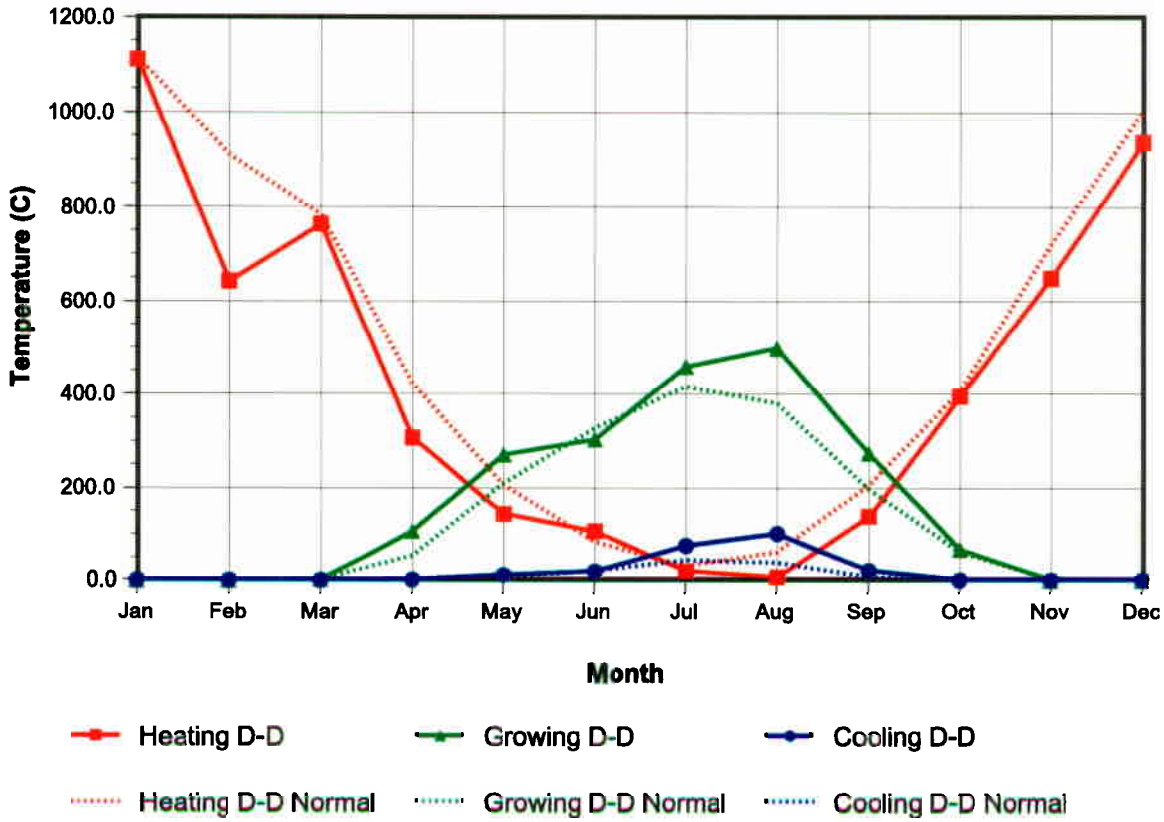
Monthly Average Temperatures, 1998

Month	Maximum Mean Temperature (°C)		Minimum Mean Temperature (°C)		Average Mean Temperature (°C)	
	1998	Normal	1998	Normal	1998	Normal
January	-13.5	-12.4	-22.2	-22.6	-17.8	-17.4
February	-1.0	-8.6	-8.8	-18.9	-4.9	-13.7
March	-1.2	-2.1	-12.0	-12.1	-6.6	-7.0
April	15.3	9.9	0.2	-2.0	7.8	4.0
May	21.8	18.5	5.6	4.5	13.7	11.6
June	21.3	22.6	8.8	9.2	15.1	15.9
July	26.6	25.1	12.9	11.5	19.8	18.3
August	28.9	24.3	13.1	10.1	21.0	17.2
September	21.0	17.7	7.1	4.9	14.1	11.3
October	10.2	10.9	0.4	-1.3	5.3	4.8
November	0.0	-1.5	-7.2	-10.6	-3.6	-6.0
December	-8.1	-9.8	-16.3	-19.3	-12.2	-14.5
Average	10.1	7.9	-1.5	-3.9	4.3	2.0



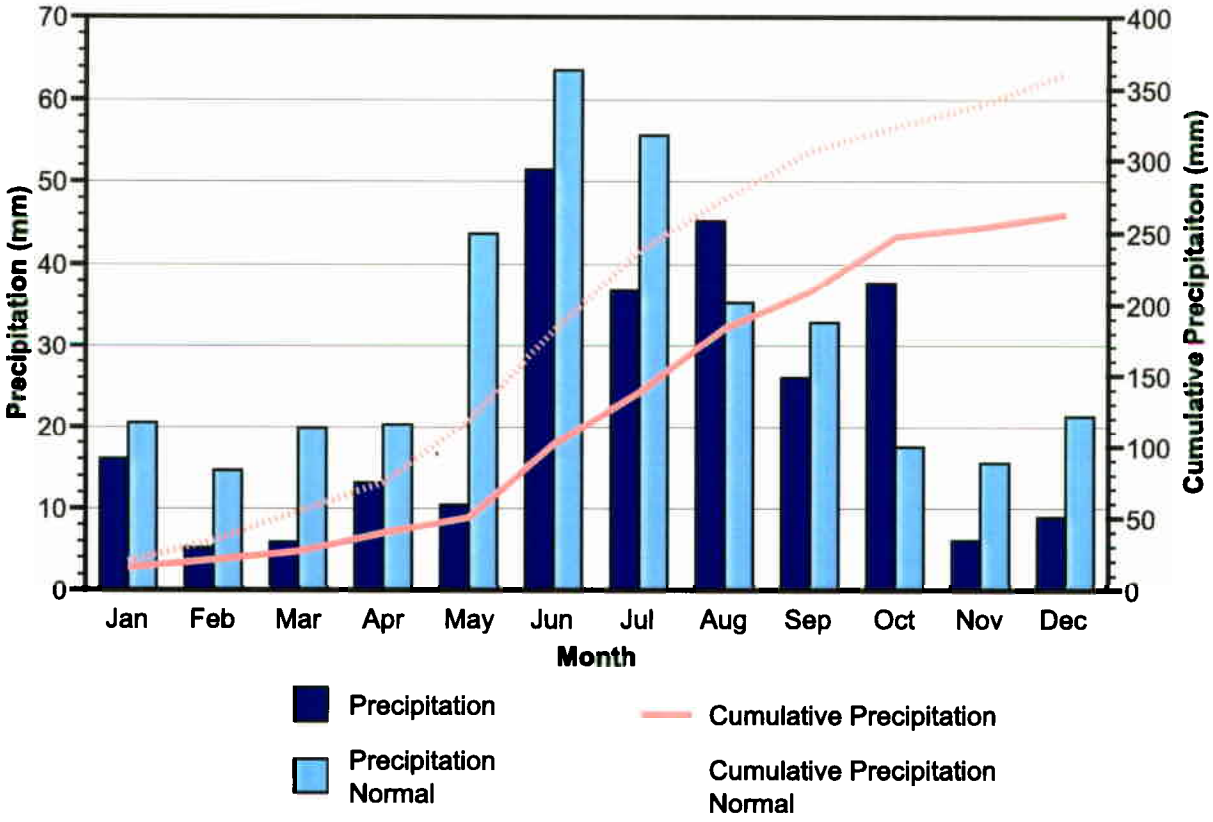
Monthly Degree-Days (D-D), 1998

Month	Heating Degree-Days Base 18°C		Growing Degree-Days Base 5°C		Cooling Degree-Days Base 18°C		Extreme Cooling D-D Base 24°C	
	1998	Normal	1998	Normal	1998	Normal	1998	Normal
January	1111.2	1114.8	0.0	0.0	0.0	0.0	0.0	0.0
February	641.9	909.9	0.0	0.0	0.0	0.0	0.0	0.0
March	763.4	784.1	1.7	1.2	0.0	0.0	0.0	0.0
April	306.3	420.9	106.5	54.8	1.0	0.0	0.0	0.0
May	144.1	206.9	270.0	209.4	11.1	7.0	0.0	0.2
June	106.8	84.0	302.8	327.3	19.6	21.2	0.0	1.3
July	20.3	32.0	458.2	414.8	75.5	43.9	4.3	1.7
August	6.8	62.4	497.4	379.6	101.2	39.0	12.1	1.5
September	138.6	206.2	273.0	197.1	21.3	6.2	0.0	0.1
October	393.7	406.5	67.6	61.5	0.0	0.0	0.0	0.0
November	648.5	721.5	0.0	2.7	0.0	0.0	0.0	0.0
December	937.4	1004.8	0.0	0.0	0.0	0.0	0.0	0.0
Total	5219.0	5954.0	1977.2	1648.4	229.7	117.5	16.4	4.8



Monthly Precipitation, 1998

Month	Precipitation (mm)		Cumulative Precipitation (mm)	
	1998	Normal	1998	Normal
January	16.0	20.5	16.0	20.5
February	5.2	14.6	21.2	35.1
March	5.9	19.9	27.1	55.0
April	13.1	20.3	40.2	75.3
May	10.4	43.7	50.6	119.0
June	51.4	63.6	102.0	182.6
July	36.8	55.7	138.8	238.3
August	45.2	35.3	184.0	273.6
September	26.0	32.9	210.0	306.5
October	37.7	17.5	247.7	324.0
November	6.1	15.5	253.8	339.5
December	8.9	21.3	262.7	360.8
Total	262.7	360.8		

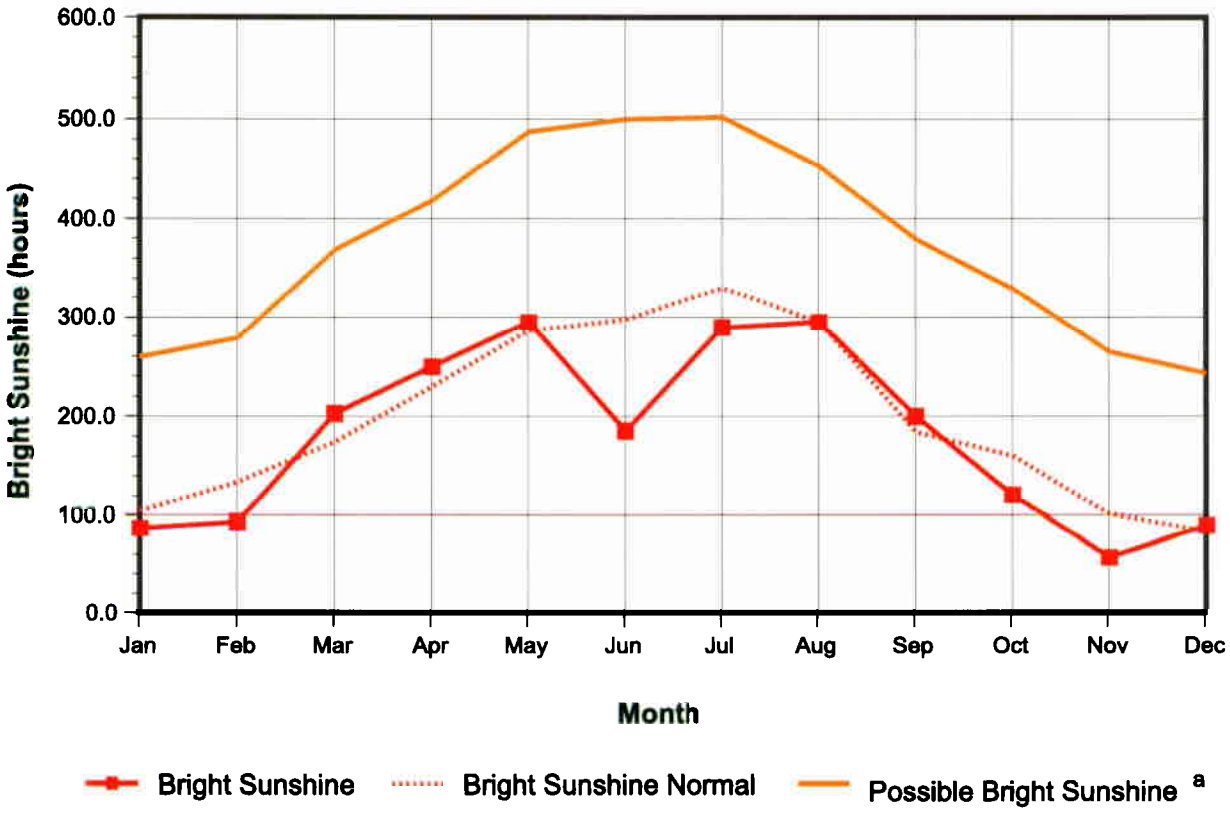


Monthly Solar Radiation, 1998

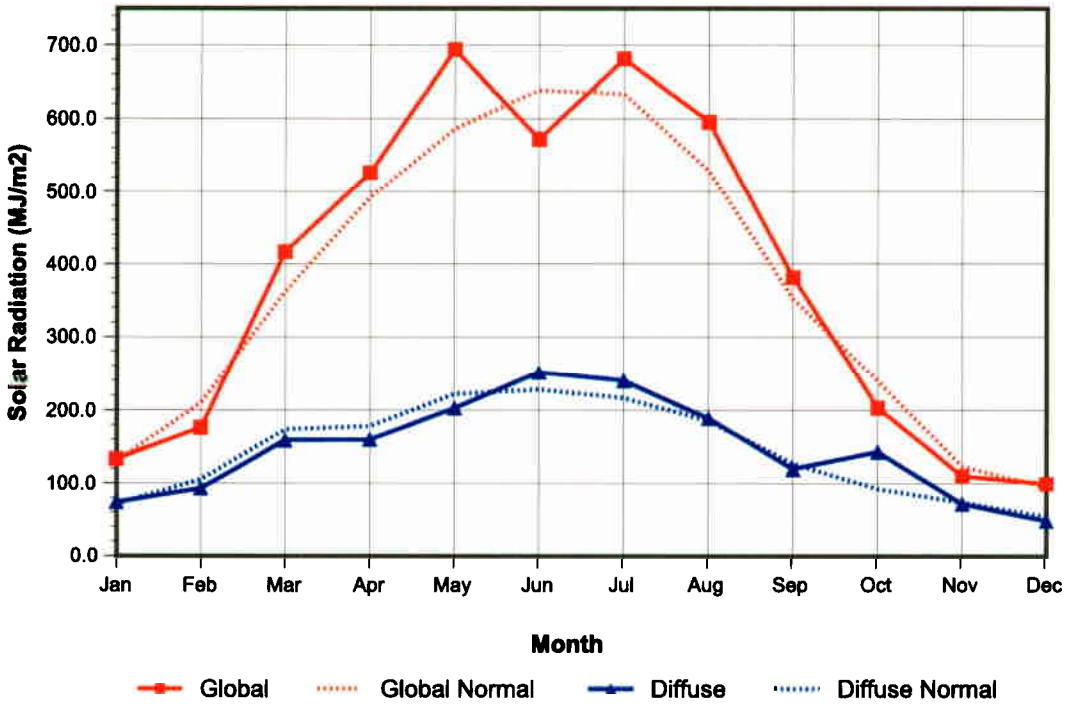
Month	Bright Sunshine (hours)			Global Radiation (MJ/m^2)		Diffuse Radiation (MJ/m^2)	
	1998	Normal	Possible[a]	1998	Normal	1998	Normal
January	87.0	104.6	259.2	133.3	129.9	74.1	71.4
February	93.3	134.1	278.8	176.2	210.1	92.9	105.3
March	202.9	174.6	369.2	416.6	362.4	159.0	173.9
April	249.7	229.4	418.3	526.4	492.2	160.1	178.5
May	295.0	285.7	487.5	693.9	586.3	203.1	222.2
June	185.5	297.2	500.1	572.5	638.7	251.1	228.1
July	289.4	330.3	501.9	681.4	633.5	240.2	216.5
August	294.9	295.2	452.7	595.7	529.0	189.1	185.6
September	200.1	184.4	379.3	381.5	351.8	119.9	127.6
October	121.0	160.7	329.3	203.3	239.1	143.5	92.6
November	57.2	100.9	264.2	110.1	123.7	72.1	73.6
December	89.3	83.7	242.4	99.7	95.2	48.5	54.3
Total	2165.3	2380.8	4482.9	4590.6	4391.9	1753.6	1729.6

[a] possible Bright Sunshine hours calculated from National Research Council of Canada, Hertzberg Institute of Astrophysics sunrise/sunset table for 1998

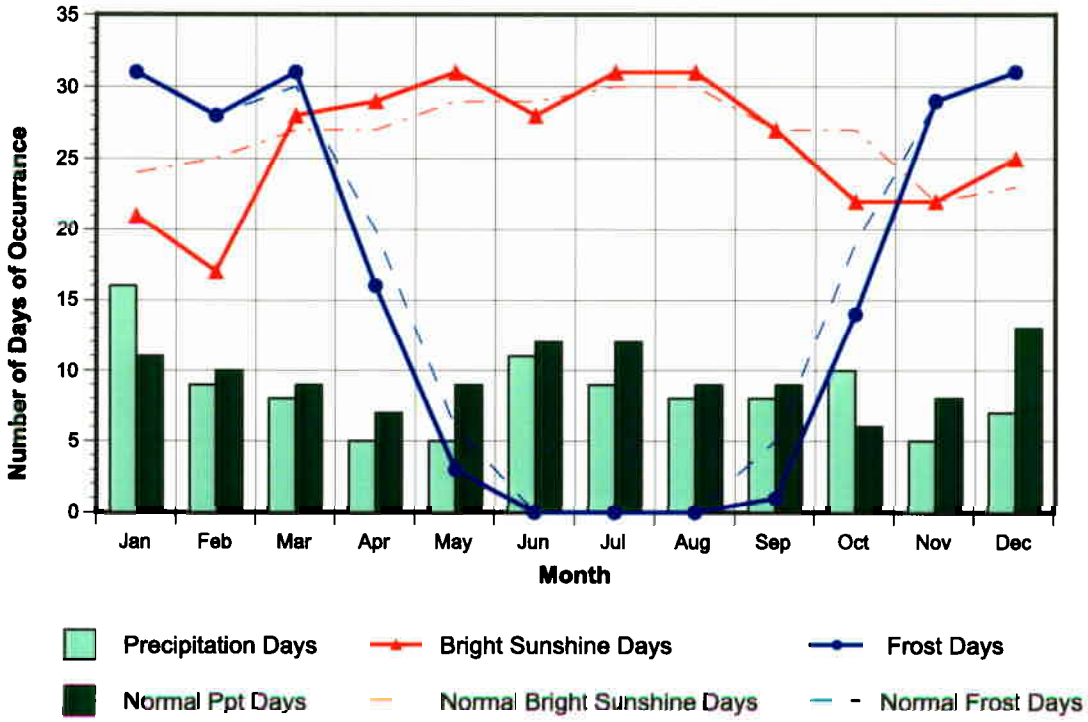
Monthly Bright Sunshine, 1998



Monthly Global and Diffuse Solar Radiation, 1998



Number of Days of Occurrance for Precipitation, Bright Sunshine & Frost



Daily Global and Diffuse Solar Radiation (MJ/m²), 1998

DATE	JAN		FEB		MAR		APR		MAY		JUN		JULY		AUG		SEPT		OCT		NOV		DEC	
	G	D	G	D	G	D	G	D	G	D	G	D	G	D	G	D	G	D	G	D	G	D	G	D
1	0.9	0.9	6.6	1.9	8.3	7.0	17.8	3.2	26.8	2.6	4.4	3.9	11.9	8.6	20.3	6.9	17.2	4.2	14.0	1.9	5.2	4.6	1.3	1.2
2	2.9	1.9	3.4	3.1	6.9	6.5	14.0	7.0	24.6	5.1	14.2	8.7	11.9	10.7	21.8	7.5	18.8	3.8	7.4	6.1	1.5	1.5	2.2	2.2
3	4.2	2.2	5.2	3.5	5.4	5.1	16.3	4.2	19.1	5.9	24.8	8.5	25.0	7.9	22.7	7.0	19.3	3.0	3.1	2.9	3.7	3.6	1.1	1.1
4	5.4	1.4	2.4	2.2	14.9	2.7	17.3	5.9	23.2	5.8	12.9	11.0	8.3	8.3	25.0	4.5	18.7	3.5	2.4	2.2	4.9	4.2	3.4	2.5
5	3.4	1.6	1.7	1.6	13.5	2.5	7.4	5.6	17.5	7.3	13.8	8.2	11.2	10.3	24.6	3.9	17.5	3.6	5.6	4.6	6.3	3.4	2.0	1.7
6	2.8	2.3	2.3	2.3	10.3	8.3	21.2	2.2	24.0	4.8	18.4	12.9	20.0	11.3	23.5	5.1	16.4	5.7	12.4	2.0	1.9	1.8	5.5	1.3
7	2.1	2.1	3.0	3.0	9.4	7.3	20.1	3.2	26.3	3.3	12.7	10.3	26.4	6.6	16.1	8.8	17.7	3.7	11.9	2.2	3.8	3.2	3.4	1.4
8	2.3	2.3	2.8	2.6	16.6	2.6	14.7	6.6	25.4	4.9	20.6	10.1	23.9	8.6	18.2	7.7	10.8	7.6	11.8	2.1	1.0	1.0	3.1	1.1
9	2.2	2.2	3.3	3.1	15.1	4.5	10.7	5.6	23.7	6.6	25.8	6.1	27.6	4.9	23.2	4.3	16.4	3.0	1.5	1.4	4.8	3.8	5.0	1.3
10	3.3	3.0	7.1	3.2	16.4	2.6	17.2	3.3	15.4	10.5	25.0	6.9	24.9	7.4	23.2	4.6	8.5	5.1	1.0	1.0	2.4	2.1	2.9	2.2
11	4.0	2.7	9.8	2.9	12.0	7.6	15.4	6.4	27.2	3.5	29.1	4.6	20.2	9.5	20.7	7.5	17.4	2.7	5.1	4.8	4.2	2.6	3.8	0.9
12	6.4	1.2	3.2	3.1	12.8	4.5	18.2	6.3	19.5	10.2	14.7	9.1	19.2	10.1	15.5	9.1	17.7	2.2	7.9	6.9	5.0	2.6	5.5	1.2
13	2.6	2.3	6.9	4.6	15.2	2.0	7.0	6.0	27.0	4.7	17.6	7.7	25.7	5.6	16.7	5.2	15.0	5.0	10.4	7.5	2.7	2.6	2.6	2.0
14	3.8	3.1	7.1	2.4	10.5	8.2	9.2	7.3	23.5	4.7	24.6	7.7	24.3	9.0	20.5	6.9	14.2	6.5	4.4	4.3	3.2	2.3	3.1	1.1
15	2.6	2.6	10.2	2.7	16.0	4.5	23.0	2.6	7.5	6.6	12.7	10.7	21.0	12.6	17.9	8.4	16.0	2.2	3.9	3.9	2.9	2.8	2.0	1.7
16	2.6	2.6	3.0	2.8	14.2	5.0	21.8	4.3	20.5	10.2	11.4	9.5	24.5	9.1	16.5	9.0	5.4	4.7	5.9	5.0	2.9	2.8	2.1	1.4
17	4.9	2.0	3.3	3.2	12.8	7.6	22.5	4.9	19.1	8.5	20.1	13.0	23.0	7.3	13.3	7.3	11.1	4.8	6.8	5.1	3.2	3.0	1.8	1.2
18	6.1	2.0	3.0	2.8	11.0	9.7	23.1	2.4	12.4	8.4	19.0	11.4	27.3	6.8	18.9	5.3	2.4	2.1	4.4	3.9	4.0	3.7	3.6	1.3
19	6.8	4.2	5.0	5.0	8.7	8.1	21.9	3.8	22.6	7.4	3.9	3.1	27.4	5.6	20.9	5.1	2.4	2.2	5.5	2.6	2.2	2.2	2.5	2.2
20	3.7	2.9	8.3	2.6	12.4	6.5	22.7	3.0	27.3	4.0	7.9	6.8	19.9	10.4	21.2	5.7	10.4	6.4	8.9	6.6	5.6	1.4	5.5	1.2
21	3.9	3.5	8.3	5.0	9.0	8.1	21.7	5.9	24.6	8.9	25.6	7.8	17.3	10.9	6.9	5.8	14.9	3.4	8.1	7.0	4.2	2.0	5.8	1.3
22	5.9	2.2	10.0	2.3	14.8	6.7	21.7	5.7	24.5	6.8	25.9	3.5	19.3	9.3	13.2	9.0	14.5	2.5	9.2	9.0	2.9	2.3	3.2	1.4
23	3.8	3.0	9.9	4.0	19.4	3.4	18.2	8.9	27.9	4.2	26.9	6.0	24.6	6.2	20.3	4.9	10.7	6.5	8.9	8.7	5.3	1.1	3.5	1.6
24	2.9	2.9	12.9	2.8	7.3	6.5	22.0	6.4	18.3	8.7	20.9	10.5	26.1	5.3	18.5	6.4	4.9	4.2	8.4	8.3	3.3	1.8	4.6	1.1
25	5.0	2.8	8.2	5.8	18.4	2.7	3.6	3.3	24.6	6.0	25.7	5.9	17.1	10.3	20.0	6.6	4.0	3.9	2.0	1.9	2.5	2.0	3.6	2.1
26	4.0	3.6	9.4	5.7	15.9	5.0	10.7	8.9	26.2	6.4	23.2	7.3	27.4	3.7	20.7	4.1	10.1	5.0	6.4	6.1	2.8	2.2	2.1	1.8
27	7.5	1.9	11.2	2.7	15.6	4.4	23.2	6.7	23.2	8.8	19.2	9.8	25.0	4.7	18.2	5.8	14.0	2.1	8.0	8.0	4.0	1.3	1.8	1.7
28	7.7	1.7	8.7	6.2	18.9	2.2	23.0	5.2	21.3	6.5	17.3	11.6	23.8	6.8	20.5	2.8	8.6	5.0	2.8	2.8	3.9	1.9	3.0	1.8
29	7.1	1.9			18.8	2.4	22.3	7.7	21.2	9.4	26.3	8.5	26.1	5.0	20.6	2.7	11.9	3.5	2.8	2.8	5.4	1.1	4.4	1.7
30	4.9	3.7			18.1	2.6	18.5	7.6	27.1	5.9	27.9	10	25.7	3.5	19.7	3.7	14.6	2.0	5.0	4.8	4.4	1.2	2.1	2.0
31	7.6	1.4			18.0	2.2			22.4	6.5			25.4	3.9	16.4	7.5			7.4	7.1			3.2	1.8
TOTAL	133.3	74.1	176.2	92.9	416.6	159.0	526.4	160.1	693.9	203.1	572.5	251.1	681.4	240.2	595.7	189.1	381.5	119.9	203.3	143.5	110.1	72.1	99.7	46.5

COMMENTS:
G= Global Radiation D= Diffuse Radiation
October 22 - November 3 values are high for the diffuse due to shade ring maladjustment

Sunrise and Sunset at Saskatoon, 1998

(local time in hours and minutes)

1998	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
Date	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
1	09:15	17:05	08:47	17:54	07:52	18:46	06:41	19:41	05:36	20:32	04:52	21:18	04:50	21:30	05:28	20:57	06:16	19:54	07:07	18:44	08:02	17:38	08:53	16:58
2	09:15	17:06	08:45	17:56	07:50	18:48	06:39	19:42	05:34	20:34	04:51	21:19	04:51	21:30	05:29	20:56	06:20	19:52	07:09	18:42	08:04	17:36	08:54	16:58
3	09:15	17:06	08:44	17:58	07:48	18:50	06:37	19:44	05:33	20:35	04:50	21:20	04:52	21:29	05:31	20:53	06:21	19:49	07:11	18:39	08:05	17:34	08:56	16:57
4	09:15	17:09	08:42	18:00	07:46	18:52	06:34	19:46	05:31	20:37	04:50	21:21	04:52	21:29	05:32	20:52	06:23	19:47	07:12	18:37	08:07	17:32	08:57	16:56
5	09:14	17:10	08:40	18:02	07:43	18:53	06:32	19:48	05:29	20:39	04:49	21:22	04:53	21:28	05:34	20:50	06:24	19:45	07:14	18:35	08:09	17:31	08:58	16:56
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8	09:13	17:14	08:35	18:07	07:37	18:59	06:25	19:53	05:24	20:44	04:47	21:24	04:56	21:27	05:39	20:44	06:29	19:38	07:19	18:28	08:14	17:26	09:02	16:55
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18	9:05	17:29	08:16	18:26	07:14	19:16	06:03	20:10	05:08	20:59	04:45	21:30	05:08	21:17	05:55	20:25	06:46	19:14	07:37	18:06	08:32	17:11	09:11	16:55
19	09:04	17:31	08:14	18:28	07:11	19:18	06:01	20:12	05:06	21:01	04:45	21:31	05:09	21:16	05:57	20:22	06:47	19:12	07:38	18:04	08:34	17:10	09:12	16:55
20	09:03	17:33	08:12	18:30	07:09	19:20	05:59	20:13	05:05	21:02	04:45	21:31	05:10	21:15	05:58	20:20	06:49	19:10	07:40	18:02	08:36	17:08	09:13	16:56
21	9:02	17:34	08:10	18:32	07:07	19:22	05:57	20:15	05:04	21:04	04:46	21:31	05:12	21:13	06:00	20:18	06:51	19:07	07:42	18:00	08:37	17:07	09:13	16:56
22	09:01	17:36	08:07	18:33	07:04	19:23	05:55	20:17	05:02	21:05	04:46	21:31	05:13	21:12	06:02	20:16	06:52	19:05	07:44	17:58	08:39	17:06	09:14	16:57
23	09:00	17:38	08:05	18:35	07:02	19:25	05:52	20:18	05:01	21:06	04:46	21:31	05:14	21:11	06:03	20:14	06:54	19:03	07:46	17:55	08:41	17:05	09:14	16:57
24	08:58	17:40	08:03	18:37	07:00	19:27	05:50	20:20	05:00	21:08	04:46	21:31	05:16	21:09	06:05	20:12	06:56	19:00	07:47	17:53	08:42	17:04	09:14	16:58
25	08:57	17:41	08:01	18:39	06:57	19:29	05:48	20:22	04:59	21:09	04:47	21:31	05:17	21:08	06:06	20:10	06:57	18:58	07:49	17:51	08:44	17:03	09:15	16:59
26	08:56	17:43	07:59	18:41	06:55	19:30	05:46	20:24	04:58	21:10	04:47	21:31	05:19	21:06	06:08	20:07	06:59	18:56	07:51	17:49	08:45	17:02	09:15	16:59
27	08:54	17:45	07:57	18:43	06:53	19:32	05:44	20:25	04:57	21:12	04:48	21:31	05:20	21:05	06:10	20:05	07:01	18:53	07:53	17:47	08:47	17:01	09:15	17:00
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29	08:51	17:49			06:48	19:35	05:40	20:29	04:55	21:14	04:49	21:31	05:23	21:02	06:13	20:01	07:04	18:49	07:58	17:44	08:50	17:00	09:15	17:02
30	08:50	17:50			06:46	19:37	05:38	20:30	04:54	21:15	04:50	21:31	05:25	21:00	06:15	19:58	07:06	18:46	07:58	17:42	08:51	16:59	09:15	17:03
31	08:48	17:52			06:43	19:39			04:53	21:16			05:26	20:59	06:16	19:56			08:00	17:40			09:15	17:04

Source: National Research Council, Canada, Hertzberg Institute of Astrophysics

Sunrise/set = corresponds to the upper limb of the sun appearing at the horizon

Sunrise and Sunset at Saskatoon, 1999

(local time in hours and minutes)

1998	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
Date	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
1	09:15	17:05	08:47	17:54	07:53	18:46	06:42	19:40	05:37	20:32	04:52	21:17	04:50	21:30	05:27	20:57	06:18	19:55	07:07	18:45	08:01	17:38	08:52	16:58
2	09:15	17:06	08:46	17:56	07:51	18:48	06:39	19:42	05:35	20:33	04:51	21:18	04:51	21:30	05:29	20:56	06:19	19:52	07:09	18:42	08:03	17:36	08:54	16:58
3	09:15	17:07	08:44	17:57	07:48	18:49	06:37	19:44	05:33	20:35	04:50	21:19	04:51	21:30	05:30	20:54	06:21	19:50	07:10	18:40	08:05	17:35	08:55	16:57
4	09:15	17:08	08:42	17:59	07:46	18:51	06:35	19:45	05:31	20:37	04:50	21:20	04:52	21:29	05:32	20:52	06:22	19:48	07:12	18:38	08:07	17:33	08:57	16:57
5	09:14	17:10	08:41	18:01	07:44	18:53	06:33	19:47	05:29	20:38	04:49	21:21	04:53	21:29	05:34	20:50	06:24	19:45	07:14	18:35	08:09	17:31	08:58	16:56
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7	09:14	17:12	08:37	18:05	07:40	18:57	06:28	19:51	05:26	20:42	04:48	21:23	04:55	21:27	05:37	20:47	06:27	19:41	07:17	18:31	08:12	17:28	09:00	16:55
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21	09:02	17:34	08:10	18:31	07:07	19:21	05:57	20:15	05:04	21:03	04:46	21:31	05:11	21:14	05:59	20:19	06:50	19:08	07:42	18:00	08:37	17:08	09:13	16:56
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31	08:49	17:52			06:44	19:39			04:53	21:16			05:26	20:59	06:16	19:57			08:00	17:40			09:15	17:04

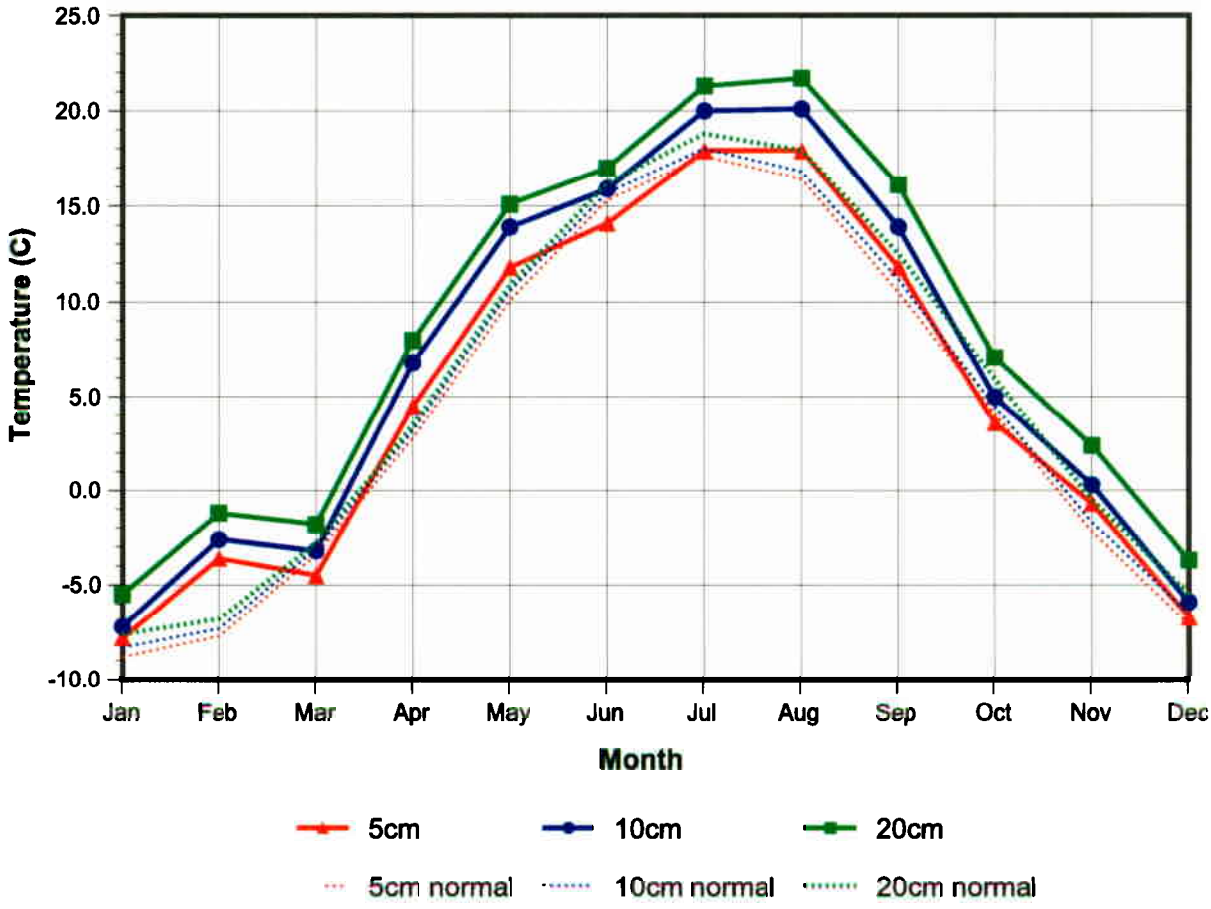
Source: National Research Council, Canada, Hertzberg Institute of Astrophysics

Sunrise/set = corresponds to the upper limb of the sun appearing at the horizon

Soil Temperatures at 0900 hours, 1998

(5 to 20 cm depths)

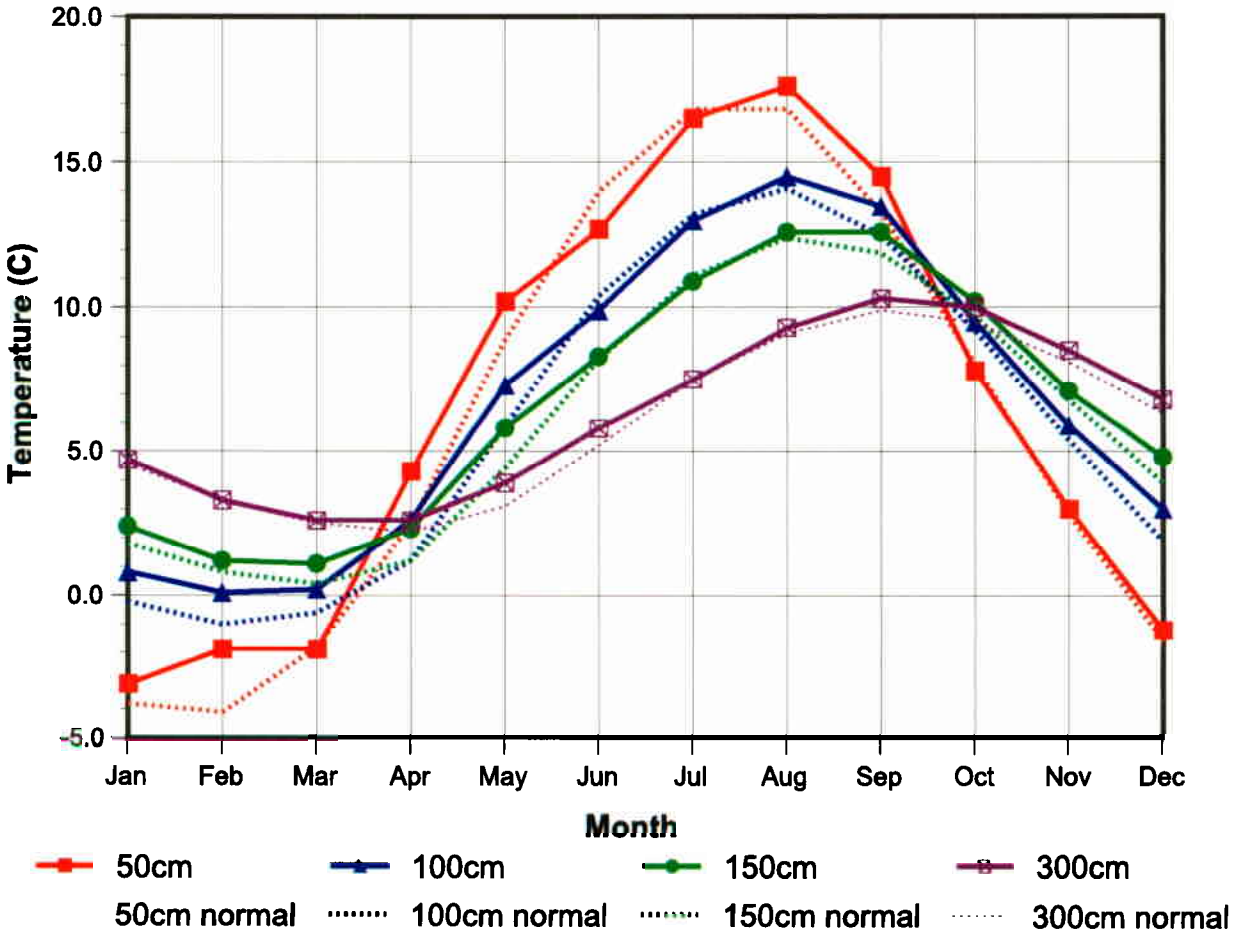
Month	5cm (°C) 0900h		10cm (°C) 0900h		20cm (°C) 0900h	
	1998	Normal	1998	Normal	1998	Normal
January	-7.8	-8.8	-7.2	-8.3	-5.5	-7.6
February	-3.6	-7.7	-2.6	-7.3	-1.2	-6.8
March	-4.5	-3.4	-3.2	-3.1	-1.8	-2.8
April	4.5	2.8	6.8	3.2	8.0	3.5
May	11.8	10.1	13.9	10.6	15.1	10.9
June	14.1	15.3	15.9	15.7	17.0	16.2
July	17.9	17.6	20.0	18.0	21.3	18.8
August	17.9	16.4	20.1	16.8	21.7	17.9
September	11.8	10.5	13.9	11.2	16.1	12.5
October	3.6	4.1	5.0	4.5	7.1	6.0
November	-0.7	-2.2	0.3	-1.7	2.4	-0.5
December	-6.7	-7.1	-5.9	-6.5	-3.7	-5.5



Soil Temperatures at 0900 hours, 1998

(50 to 300 cm depths)

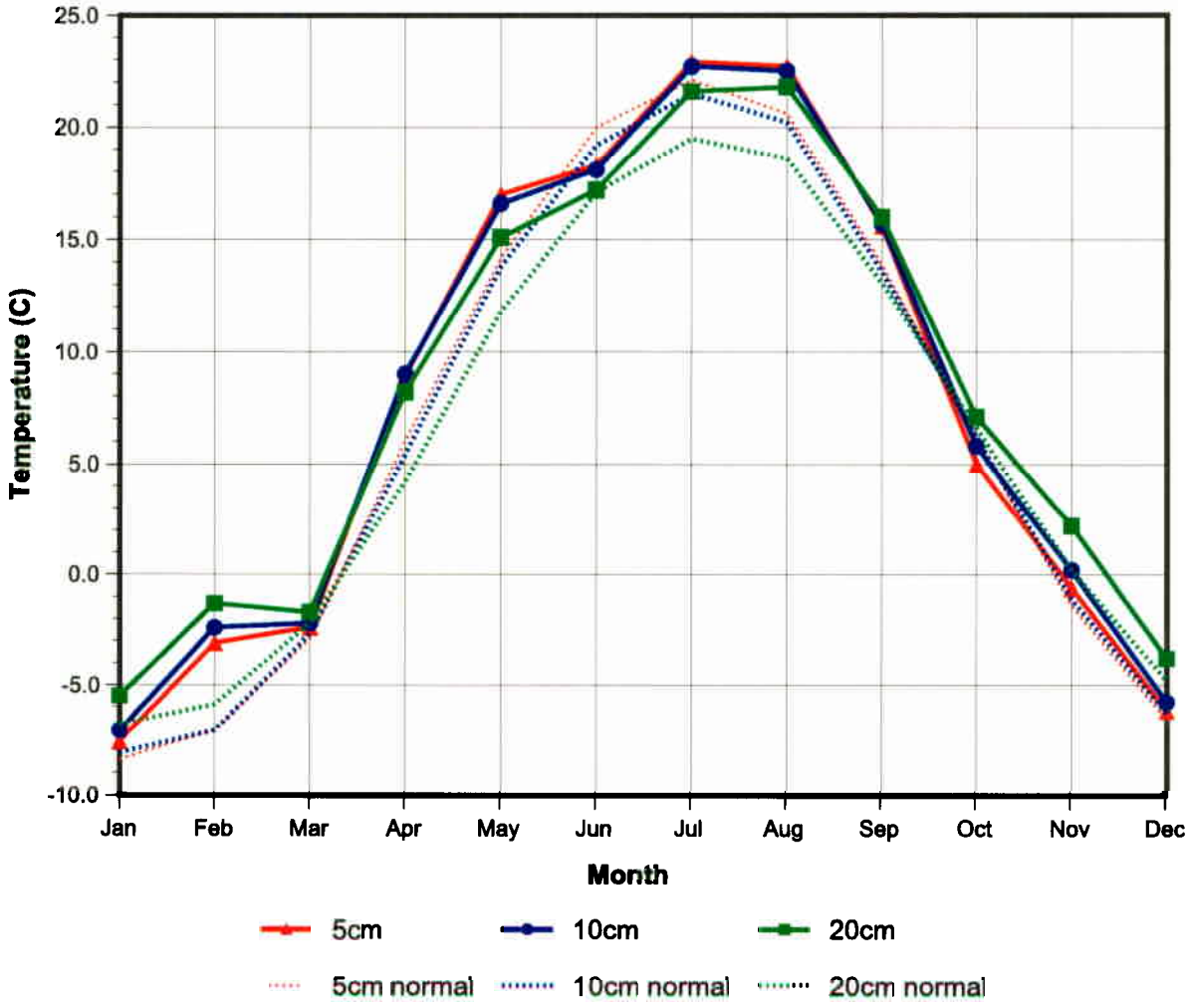
Month	50cm (°C) 0900h		100cm (°C) 0900h		150cm (°C) 0900h		300cm (°C) 0900h	
	1998	Normal	1998	Normal	1998	Normal	1998	Normal
January	-3.1	-3.8	0.8	-0.2	2.4	1.8	4.7	4.5
February	-1.9	-4.1	0.1	-1.0	1.2	0.8	3.3	3.3
March	-1.9	-1.8	0.2	-0.6	1.1	0.4	2.6	2.5
April	4.3	2.5	2.6	1.2	2.3	1.2	2.6	2.2
May	10.2	8.9	7.3	5.9	5.8	4.4	3.9	3.1
June	12.7	14.0	9.9	10.4	8.3	8.2	5.8	5.2
July	16.5	16.8	13.0	13.2	10.9	11.1	7.5	7.5
August	17.6	16.8	14.5	14.1	12.6	12.4	9.3	9.1
September	14.5	13.3	13.5	12.5	12.6	11.9	10.3	9.9
October	7.8	8.0	9.5	9.2	10.2	9.7	10.0	9.5
November	3.0	2.8	5.9	5.4	7.1	6.8	8.5	8.1
December	-1.2	-1.6	3.0	1.9	4.8	3.9	6.8	6.3



Soil Temperatures at 1600 hours, 1998

(5 to 20 cm depths)

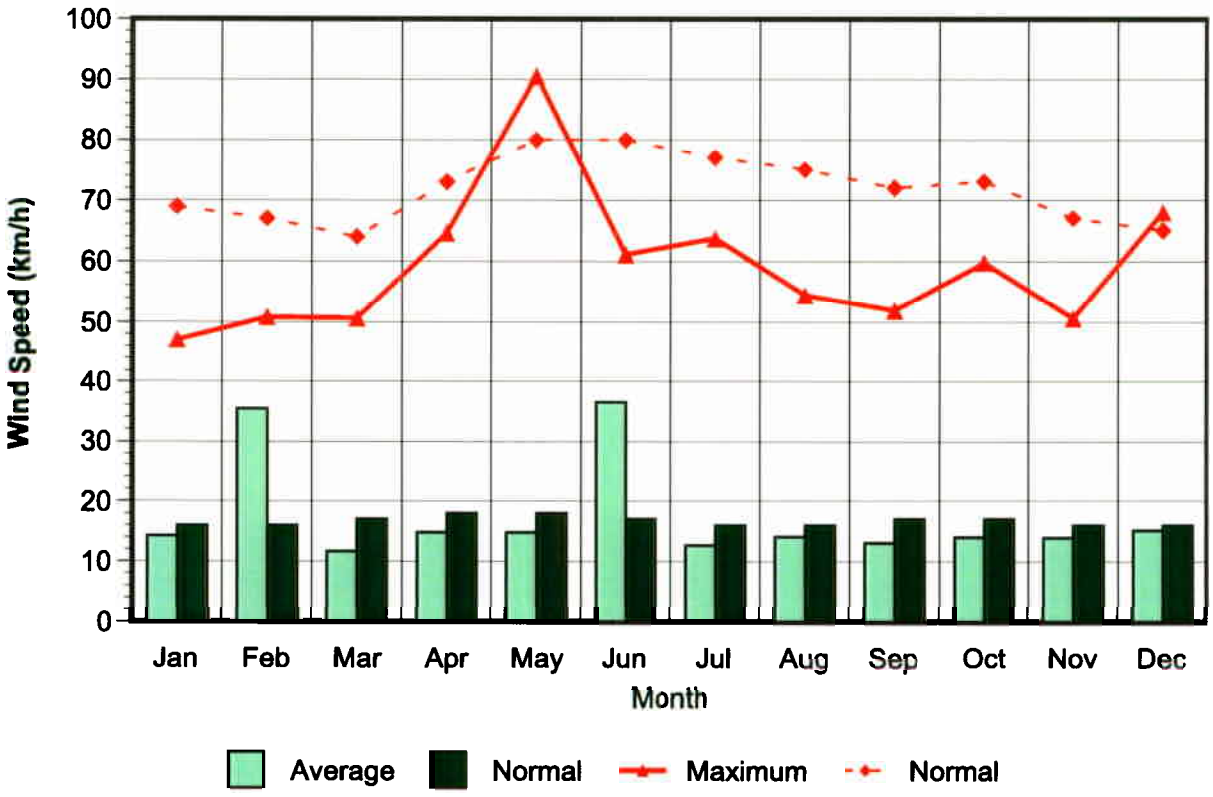
Month	5 cm (°C) 1600h 1998	5 cm (°C) 1600h Normal	10 cm (°C) 1600h 1998	10 cm (°C) 1600h Normal	20 cm (°C) 1600h 1998	20 cm (°C) 1600h Normal
January	-7.6	-8.4	-7.1	-8.1	-5.5	-6.8
February	-3.1	-7.1	-2.4	-7.1	-1.3	-5.9
March	-2.4	-2.9	-2.2	-2.7	-1.7	-2.2
April	8.9	6.0	9.0	5.4	8.2	4.2
May	17.0	14.2	16.6	13.8	15.1	11.8
June	18.3	20.0	18.1	19.2	17.2	17.1
July	22.9	22.1	22.7	21.5	21.6	19.5
August	22.7	20.6	22.5	20.2	21.8	18.6
September	15.6	13.9	15.7	13.6	16.0	13.1
October	5.0	6.1	5.8	6.2	7.1	6.6
November	-0.6	-1.4	0.2	-1.1	2.2	0.2
December	-6.2	-6.6	-5.8	-6.3	-3.8	-4.8



Average Monthly Wind Speed, 1998

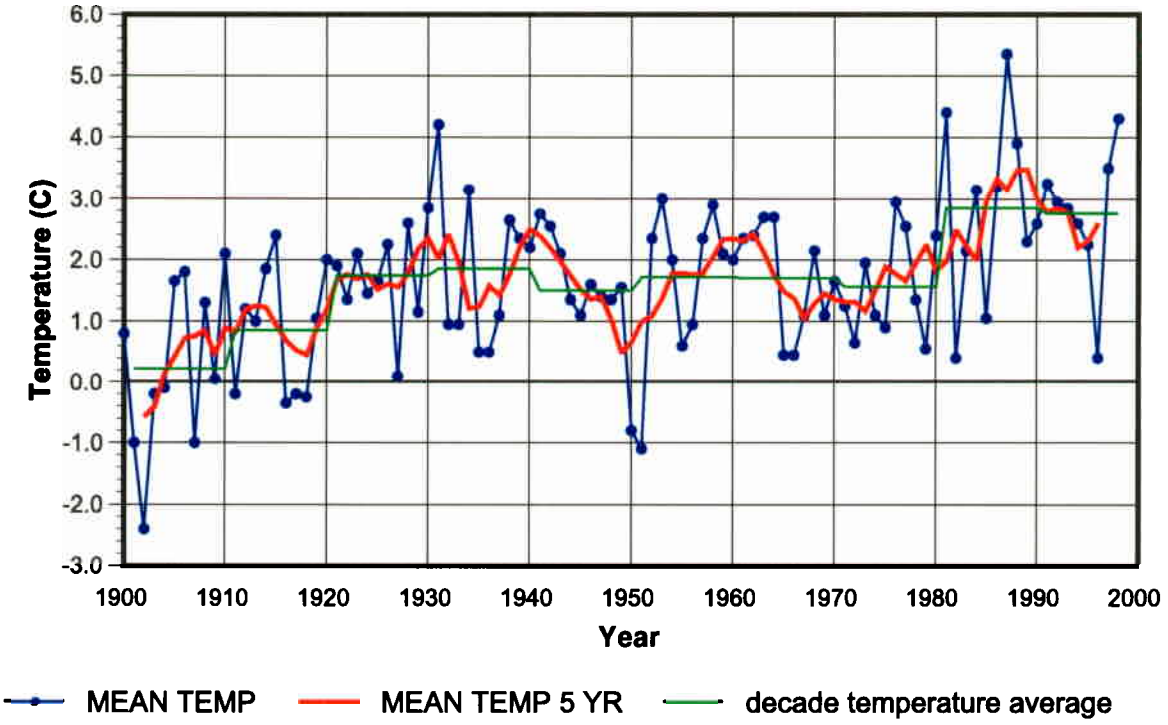
Month	Average (km/h) 1998	Normal[1]	Maximum Gust (km/h) Direction	1998	Normal[1]
January	14.2	16.0	ESE	47.1	69.0
February	35.4	16.0	SE	50.8	67.0
March	11.6	17.0	N	50.6	64.0
April	14.8	18.0	SE	64.6	73.0
May	14.8	18.0	NNW	90.6	80.0
June	36.5	17.0	S	61.1	80.0
July	12.6	16.0	SW	63.7	77.0
August	14.1	16.0	ESE	54.4	75.0
September	13.0	17.0	SE	51.9	72.0
October	14.0	17.0	SE	59.8	73.0
November	13.9	16.0	SW	50.6	67.0
December	15.1	16.0	NNE	68.0	65.0

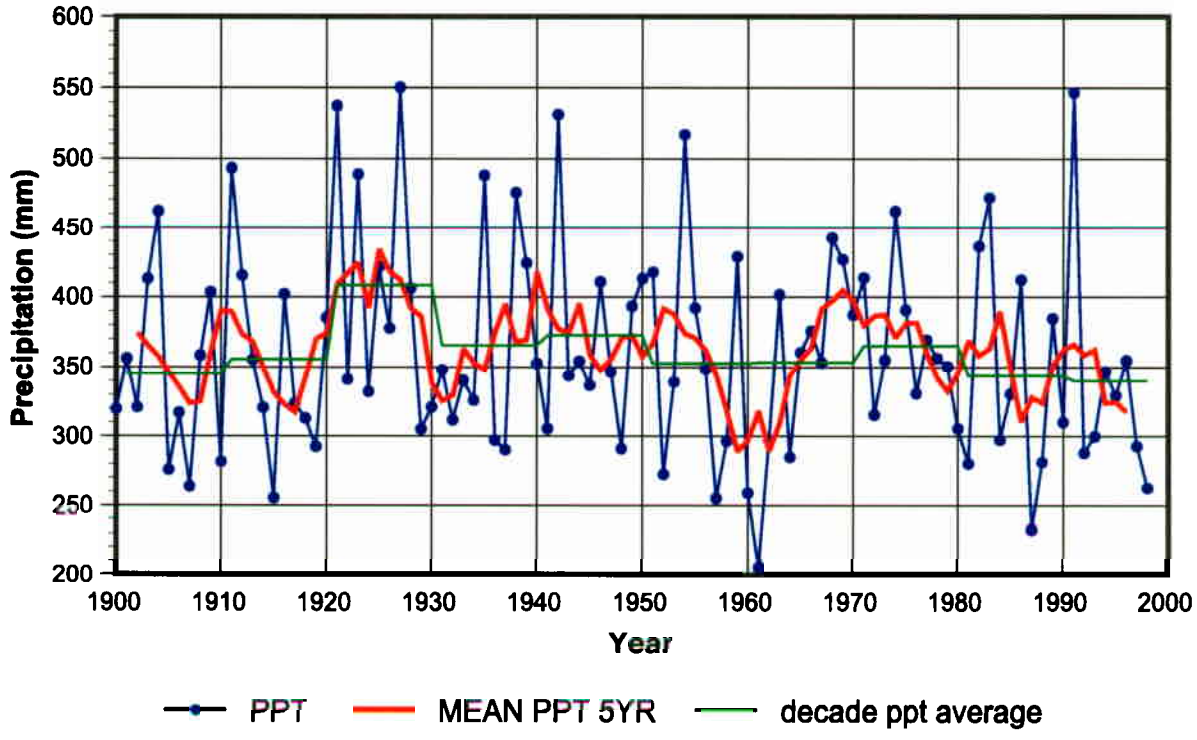
[1]Note: Normals used are for the Saskatoon Airport



Average Annual Temperature and Precipitation Time Series for Saskatoon, 1900-1998

(Provisional)





INSTRUMENTS USED AT SASKATOON SRC CRS AND GLOSSARY OF TERMS

BRIGHT SUNSHINE is the unobstructed direct radiation from the sun, as opposed to the shading of a location by clouds or by other obstructions.

Number of Days is the total number of days when at least 0.1 of an hour of bright sunshine was recorded.

Percentage Possible refers to the ratio of measured bright sunshine hours to total possible daylight hours in a given period, expressed as a percentage.

Total is the sum of the daily bright sunshine values in hours and tenths of hours as measured by an automated sunshine recorder using voltaic cells.

DEGREE-DAY is an index for various temperature related calculations

Cooling (CDD) The cooling requirement to achieve a stipulated comfort value in an indoor environment. For most purposes, a temperature of greater than 18°C is considered uncomfortable and supplementary cooling is required. On a specific day, the amount by which 18°C is less than the daily average temperature defines the number of cooling degree-days for that day.

Mathematically:
CDD = (T - 18°C), for that day, where T = daily mean temperature in °C
if T is equal to or greater than 18°C, CDD = 0.
Monthly and annual values of CDD are obtained by summing daily values.

Extreme Cooling (XCDD) The cooling requirement to achieve a stipulated comfort value in an indoor environment. For most purposes, a temperature of greater than 18°C is considered uncomfortable and supplementary cooling is required. A temperature of greater than 24°C has been used as an index of potential heat stress. On a specific day, the amount by which 24°C is less than the daily average temperature defines the number of extreme cooling degree-days for that day. Mathematically:

XCDD = (T - 24°C), for that day, where T = daily mean temperature in °C
if T is equal to or greater than 24°C, XCDD = 0.
Monthly and annual values of XCDD are obtained by summing daily values.

Growing (GDD) The growing requirement in order for plant growth to proceed. The air temperature must exceed a critical value appropriate to the plant species in question. For many members of the grass family, including most commercial cereals grown on the prairies, a base temperature of 5.0°C has been established. On a specified day, the difference between the daily average temperature and the 5.0°C base temperature defines the number of growing degree-days.

Mathematically:
GDD = (T - 5.0°C), for that day, where T = daily mean temperature in °C
if T is equal to or less than 5.0°C, GDD = 0.
Daily GDD values are summed to provide totals for the appropriate month, growing season or year.

Heating (HDD) The heating requirement to achieve a stipulated comfort value in an indoor environment. For most purposes, a temperature of less than 18°C is considered uncomfortable and supplementary heating is required. On a specific day, the amount by which 18°C exceeds the daily average temperature defines the number of heating degree-days for that day.

Mathematically:
HDD = (18°C - T), for that day, where T = daily mean temperature in °C
if T is equal to or greater than 18°C, HDD = 0.
Monthly and annual values of HDD are obtained by summing daily values.

EXTREME is the highest or lowest value of a particular element recorded during the period in question.

EXTREME ALL YEARS Temporal comparisons at a point are also of value in some types of climatic studies. Therefore, it is desirable to produce the maximum length of reliable climatic record to carry out studies over a period of time. Data are drawn from the following data sets:

Saskatoon, SRC:1963 to 1997
Saskatoon, U of S:1916 to 1963
Saskatoon, City:1892 to 1915.

Station locations, exposures and measurement procedures were subject to change during this time period. Data presented in this column are not adjusted and users are cautioned accordingly.

FROST is recorded on each occasion when the daily minimum temperature is equal to or less than 0°C.

NORMAL VALUE (1961-1990) In climatology it is often useful to make spatial comparisons of particular element values over a common time period. At an interior continental site such as Saskatoon, a period of 30 years is required to produce statistically stable estimates of the more variable elements. To facilitate spatial comparisons, the World Meteorological Organization recommends the standard normal (average) period January 1st, 1961 to December 31st, 1990 for data analysis. Data derived from CRS conform to this standard, except where noted. For this year, the normals for CRS are taken form the normals published by Environment Canada for the standard period. Normals used in SRC CRS annual summaries 1990 - 1996 were hand-calculated values determined before the official normals were published.

NUMBER OF RECORDING YEARS Due to missing observations, faulty instrument calibration, lost records, *etc.*, only partial data are available especially during the period 1892 - 1915. The number of years of useful record is therefore cited.

PRECIPITATION (Ppt)

Total is the sum of the daily recorded precipitation. The snowfall component of precipitation is recorded as an equivalent amount of liquid water. For particulars on precipitation measurement procedures and instruments, the reader is referred to the Atmospheric Environment Service publication "*Manual of Climatological Observation's*", 2nd Ed., January, 1978. The notation "T" in this column refers to a trace of precipitation (less than 0.2 mm water equivalent). As of August 7, 1993, total precipitation was measured using the Belfort weighing gauge for the winter season and the tipping bucket during frost-free period.

Day is recorded on occasions when the amount of precipitation in a 24-hour period equals or exceeds 0.2 mm water. An asterisk (*) appearing in the average column denotes the occurrence of measurable precipitation on one or more occasions, and that the calculated 30-year average amounts to less than a trace. The so-called climatological day, beginning at 9 a.m. standard time on the date of reference and ending at 9 a.m. the next morning, was employed in record keeping up to January 1994. On February 1, 1994, after consultation with AES, record keeping was changed to the 24-hour period of 0000 hours - 2400 hours to conform to their reporting of climatological statistics.

SOIL TEMPERATURE under a short grass surface with normal accumulation, is measured according to procedures outlined in the AES publication "*Soil Temperature*" January 1, 1976. Depths below surface at which soil temperature measurements are made are: 5 cm, 10 cm, 20 cm, 50 cm, 100 cm, 150 cm and 300 cm. The100 cm level is not reported in this report. Since soil temperature is affected by profile structure and water content, extrapolation of the measured data is difficult.

SOLAR RADIATION

Diffuse - Total is radiation reaching the earth's surface after having been scattered from the direct solar beam. The instrument used is an Eppley pyranometer with a shade ring (See SOLAR RADIATION-Global-Total).

Global - Total is the sum of the direct solar and diffuse radiation during the period in question. Measurements are carried out on a horizontal surface near ground level and integrated over the whole celestial dome, summing the diffuse and direct components of the solar beam. The temperature-compensated Eppley pyranometer is used. The standard metric unit of measurement is the megajoule per square metre (MJ/m^2). (To facilitate comparison with past years' data: 1.0 $MJ/m^2 = 23.895$ langleys). Comparison is provided with a provisional average based on 16 years of data (1975-1990).

SPELLS - Temperature spells are defined as a sequence of days when the daily maximum temperature is higher than or equal to 30°C (hot spell) or the daily minimum temperature is lower than or equal to -30°C (cold spell).

SUNRISE/SUNSET times have been included in this report. They have been acquired from the National Research Council, Canada, Herzberg Institute of Astrophysics

TEMPERATURE

Average Annual is the average of the daily average temperatures in degrees Celsius (°C) for one year.

Average Daily is defined as the arithmetic mean of the daily maximum temperature in degrees Celsius (°C) and the daily minimum temperature in degrees Celsius (°C) for the day in question.

Average Maximum is the average of the daily maximum temperatures in degrees Celsius (°C) for one year for the particular month in question. For details concerning measurement procedures, the reader is referred to the AES publication, " *Manual of Climatological Observations*", 2nd Ed., January, 1978.

Average Minimum is the average of the daily minimum temperatures in degrees Celsius (°C) averaged over the appropriate time periods. Refer to TEMPERATURE-Average Maximum concerning measurement procedures.

Average Monthly is the average of the daily average temperatures in degrees Celsius (°C) for the month under consideration.

WIND SPEED

Average (Avg) is the average of the hourly wind speeds for the period in question measured in kilometres per hour (km/h). Average hourly wind speeds are obtained from a RM Young Wind Monitor anemometer at a height of 10 m.

Peak Gust refers to the highest instantaneous value recorded by the anemometer system for the period of reference, irrespective of direction and/or duration. Comparison is with published data for Saskatoon Airport.

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