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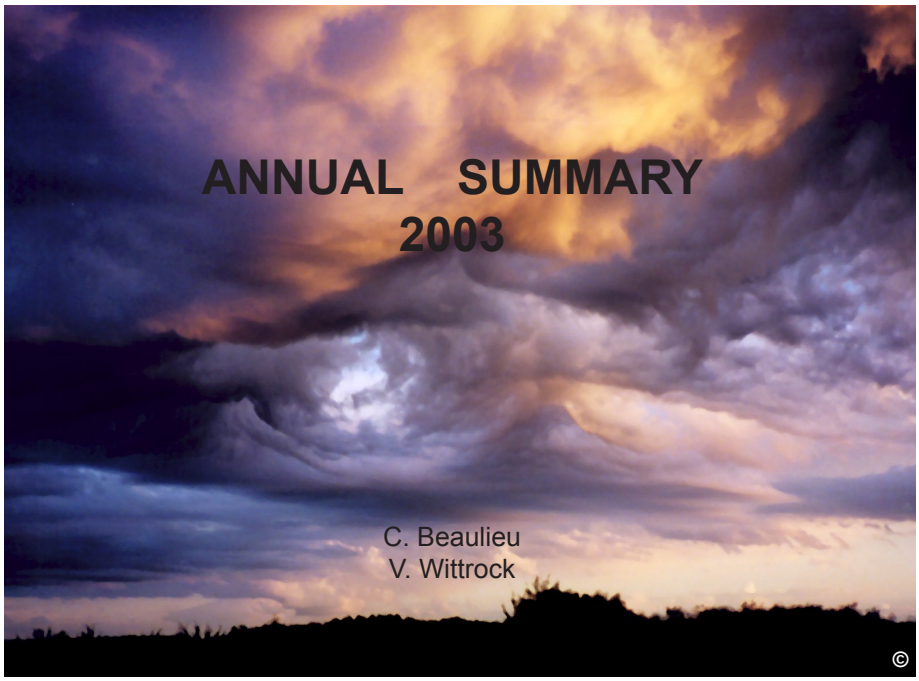
CLIMATOLOGICAL REFERENCE STATION SASKATOON



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February 2004

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CLIMATOLOGICAL REFERENCE STATION

SASKATOON

ANNUAL SUMMARY 2003

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Environment/Minerals Division
Climatology/Aquatic Ecology Section

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

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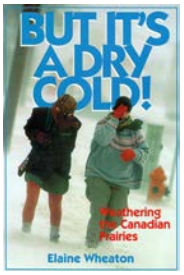

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Grade 2/3 Riverheights Elementary School Tour, September 30, 2003

photo credit: Ms Rita Johannsson

CLIMATE REFERENCE STATION HISTORY

Cloud formation looking NE from CRS, July 2003. photo credit: CR Beaulieu

Meteorological observations were first taken at or near Saskatoon by the Royal Northwest Mounted Police in 1889 with temperature only being 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, 106°20'W, elevation 480m 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 10 to 15 families on either side of the river where Saskatoon is now located.

Little is known about the very early observers; however, the records do show that Major T.H. Keenan took observations from March 1892 until March 1895, and Mr. George Will was the observer from January 1897 until April 1897. It is thought that T. 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 longtime observer was Mr. Sidney Cox. The Saskatchewan Research Council took over the programme in the fall of 1963 at the newly established Climatological Reference Station at latitude 52°09'N, longitude 106°36'W and elevation 497 m asl[1]. The first observer was Terry Beck followed three years later by Orville Olm.[2] In 1967, Joe Calvert became the primary observer until his retirement in 1983. Ray Begrand succeeded Mr. Calvert until 1988 when Virginia Wittrock became the primary observer. Since 1992, the primary observer has been Carol Beaulieu assisted by Virginia Wittrock, Leanne Crone and Charlene Hudym.

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. Elements presently recorded at the site are temperature, precipitation, wind, solar radiation, relative humidity, barometric pressure, soil temperature and snow-on-the-ground (manual recordings). Temperature, precipitation and radiation data are submitted to Environment Canada.

[1]*Christiansen 1970; Environment Canada 1975*
[2]*Olm 2001*

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.[1] A reference climatological station's data are intended for the purpose of determining climatic trends. This requires long periods (not less than thirty years) of homogeneous records, where man-made environmental changes have been 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[2]. At our 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. It is necessary and valuable for use in areas such as agriculture, forestry, land use and facility placement, water and energy 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 - *e.g*. intense rainfall causing flooding and property damage and heat stress with its implications for health;
- do value-added research;
- be part of regional, national and global networks in an important agricultural and ecological area;
- facilitate development of additional programs - *e.g*. air quality, biodiversity, and climate change monitoring;
- have roles in various programs within SRC including spray drift work, The Boreal Ecosystem - Atmosphere Study (BOREAS), and collaborative research with the Western College of Veterinary Medicine and the College of Agriculture, University of Saskatchewan, for example; and
- provide climate data to governments, universities, insurance agencies, lawyers, agricultural sectors, chemical companies, schools, building science, construction firms, media, transportation studies, accident studies, wildlife studies, tourism groups and interested individuals.

The goals of the Climate Reference Station are first, to maintain the high quality of data gathered over its more than thirty-nine years of existence at its current location and, 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 allow CRS to be a very valuable climate information collection station.

CLIMATE REFERENCE STATION OUTREACH 2003

Outreach activities continued in 2003 at the Climate Reference Station. Presentations on *'Weather Instruments and How They Work'* which were presented were well received by students and staff with positive post-presentation feedback. Approximately 60 children from 2 urban schools, grades 2 to 4 participated in the demonstrations. With the help of enthusiastic volunteers, students received hands-on experience with instruments used to measure temperature, precipitation, wind and solar radiation.

[1]*Environment Canada 1992*
[2]*World Meteorological Organization 1988*

SUMMARIES FOR 2003

Overview

Data concerning temperature, precipitation, wind speed and direction, bright sunshine, solar radiation, and soil temperature, 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 2003 and compared with the long-term (*circa* 1900-2002) and standard-period (1971-2000) records.

The 2003 annual temperatures were almost one degree above normal for the minimum and average while the maximum temperature was a full degree. The warmth of 2003 is reflected in its ranking when compared to the previous forty years at the Climate Reference Station. The annual minimum temperature (-2.5°C) tied for 30th place for the coldest temperature in 40 years while the annual maximum temperature (9.3°C) ranked as the 9th warmest. 2003 ranked overall as 8th warmest year.

The year's beginning gave no indication of the ultimate warm rankings for the year. February and March were colder than normal with each recording four daily minimum temperature of below -30°C. Surprisingly, March was also notable for producing the year's coldest temperature of -33.9°C. The major influences of the above normal annual temperatures were a very hot August and a warm December. Fifteen days in August recorded temperatures above 30°C including three continuous days over 32°C to constitute a heat wave. Out of the nine maximum daily records set for the year, three were in August and one was in December.

The above average temperatures are reflected in the degree-days. Heating degree-days were above normal for the cool months of February, March and November. This was easily offset by the rest of the year resulting in an annual total almost 5% less than normal. Cooling degree-days came close to doubling in July and tripling in August to create an annual total over twice the normal. Annual extreme cooling degree-days (base 24°C) quadrupled due to the high August temperatures. The frost-free season's length continued above average for the 11th year in a row due to a late first fall frost date. Annual growing degree-days were up 21% while the frost-free growing season was 26% above normal.

Drought-like conditions persisted into 2003. By March, only 42% of normal precipitation had been measured at CRS. April saw a recovery with an 80% more monthly precipitation than normal but May and June precipitation were well below normal dashing hopes for good soil moisture for crop production. July and August saw near normal rainfall. Unfortunately, it was not evenly distributed but came as three downpours; one of which produced a daily record for July 6th. November and December closed the year with extreme dry conditions resulting in 2003 being the third driest year since 1964. Only 2001 (165.8mm) and 1987 (232.4mm) were drier.

A bright highlight in the year was the slightly above average bright sunshine hours. The first eight months seesawed from being above normal to below. From October to the end of the year, bright sunshine hours were well above average completing the year with 4% more hours of bright sunshine than normal. The number of days with bright sunshine was near normal.

During April, May, June, July and October, CRS recorded 'Strong Gale' force wind between 76 km/h and 88 km/h which, with the exception of one from the west, blew from the west-northwest. June recorded the most wind gusts (6) of over 51 km/h including one measured at 82.8 km/h. The strongest wind of the year was 87.8 km/h recorded on May 16th.

Hawk using perch on the 10m tower, Summer 2003.
photo credit: CR Beaulieu

Weather Events Summaries, 2003

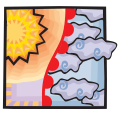
NEW 2003 DAILY TEMPERATURE AND PRECIPITATION RECORDS			
TYPE	**DAY**	**NEW RECORD**	**OLD RECORD/ year**
Maximum Daily Temperature °C	June 19	35.5	33.0/1989
	July 17	35.2	33.91967&2002
	July 23	31.0	30.6/1978
	August 15	34.4	33.3/1973
	August 16	38.9	34.4/1973
	August 19	35.8	33.9/1972
	October 5	26.0	25.0/1980
	October 21	21.6	20.0/1985
	December 20	6.6	6.6/1994
Minimum Daily Temperature °C	February 22	-32.2	-30.6/1972
	February 24	-33.5	-30.6/1972
	March 4	-30.8	-30.6/1972
	March 7	-33.9	-31.1/1974
Daily Precipitation mm	February 17	4.1	2.5/1998
	April 13	8.4	3.0/1979
	June 2	16.4	8.9/1976
	July 6	28.4	24.2/2000
	July 13	7.2	4.6/1976&1999
	August 8	22.4	21.8/1995
	September 9	27.4	20.0/1983
	October 15	1.6	1.0/1968&1983

GREATEST EXTREME PRECIPITATION EVENTS (mm)*		
PERIOD	**DATE**	**AMOUNT**
0.5 hour	September 9	8.8
0.5 hour	June 2	8.4
1 hour	September 9	13.8
1 hour	June 2	10.2
2 hours	September 9	20.6
2 hours	August 8	12.8
24 hours	July 6	28.4
24 hours	September 9	27.4

**recorded by tipping bucket April 22nd to September 30th*

COLD SPELL (less than or equal to -30°C)		
MONTH	**DAY**	**TEMPERATURE °C**
January	22	-31.1
	25	-30.9
	26	-31.6
February	21	-32.9
	22	-32.2
	23	-31.9
	24	-33.5
March	1	-31.3
	4	-30.8
	7	-33.9
	8	-33.2
Extreme	March 7	-33.9

HOT SPELL (greater than or equal to 30°C)		
MONTH	**DAY**	**TEMPERATURE °C**
June	19	35.5
	30	31.7
July	1	30.4
	12	33.9
	17	35.2
	18	30.0
	22	32.0
	23	31.0
	27	32.4
August	1	30.4
	2	31.2
	7	30.9
	10	32.9
	11	31.3
	12	31.5
	13	35.6
	14	32.1
	15	34.4
	16	38.9
	18	33.7
	19	35.8
	21	30.2
	22	32.9
	23	30.7
Sept	4	33.6
	6	30.4
	7	30.5
Extreme	August 16	38.9


Ranking of Precipitation and Temperature for 2003

DRIEST MONTH BY % OF NORMAL PRECIPITATION		RANKING	DRIEST MONTH BY PRECIPITATION AMOUNT (mm)	
December	17.5	1	3.2	December
November	26.4	2	3.9	November
March	29.6	3	4.8	March
May	30.2	4	7.2	January
January	39.6	5	8.1	February
June	52.8	6	11.5	October
February	60.9	7	13.4	May
October	70.1	8	31.4	June
August	99.4	9	35.8	September
July	101.4	10	36.0	August
September	121.8	11	43.6	April
April	184.7	12	58.8	July

September 7, 2003 Thunderstorm photo credit: A Sherdahl

WARMEST ANNUAL MAXIMUM TEMPERATURE °C		COLDEST ANNUAL MINIMUM TEMPERATURE °C		WARMEST ANNUAL AVERAGE TEMPERATURE °C		RANKING
1987	11.6	1966	-5.5	1987	5.4	1
2001	10.8	1979	-5.3	2001	4.6	2
1981	10.5	1982	-5.3	1981	4.5	3
1988	10.1	1965	-5.3	1998	4.3	4
1998	10.1	1996	-5.2	1999	4.2	5
1999	9.8	1975	-5.1	1988	3.9	6
1976	9.5	1972	-4.8	1997	3.5	7
1997	9.5	1985	-4.8	2003	3.4	8
2003	9.3	1967	-4.7	1991	3.2	9
1986	9.0	1974	-4.7	1986	3.2	10
1991	8.9	1971	-4.6	1976	3.0	11
2000	8.8	1969	-4.6	1992	3.0	12
1984	8.7	1978	-4.6	2000	3.0	13
1990	8.7	1970	-4.0	1984	2.9	14
1977	8.6	1973	-4.0	1993	2.8	15
1980	8.6	1980	-3.8	2002	2.8	16
1992	8.5	1989	-3.8	1964	2.7	17
2002	8.5	1977	-3.6	1994	2.7	18
1994	8.5	1990	-3.6	1990	2.6	19
1989	8.3	1976	-3.5	1977	2.5	20

Dates and Duration of the Frost-free Season

YEAR	DATE OF LAST SPRING FROST	DATE OF FIRST FALL FROST	LENGTH OF SEASON (days)
1964	May 31	Sept 26	117
1965	May 27	Sept 05	100
1966	May 19	Sept 13	116
1967	Jun 06	Sept 23	108
1968	May 19	Sept 25	128
1969	Jun 14	Sept 15	92
1970	May 19	Sept 12	115
1971	May 18	Sept 20	124
1972	May-08	Sept 04	118
1973	May 06	Sept 14	120
1974	May 25	Sept 02	99
1975	May 21	Sept 11	112
1976	May 06	Aug 28	113
1977	May 01	Aug 31	121

YEAR	DATE OF LAST SPRING FROST	DATE OF FIRST FALL FROST	LENGTH OF SEASON (days)
1978	May 30	Sept 30	112
1979	May 30	Aug 13	74
1980	May 14	Aug 26	103
1981	May 24	Sept 03	101
1982	May 29	Aug 27	89
1983	May 24	Sept 13	111
1984	May 24	Aug 31	98
1985	Jun 04	Sept 06	93
1986	May 17	Sept 06	111
1987	May 21	Oct 06	137
1988	May 02	Sept 19	139
1989	May 28	Sept 10	104
1990	May 13	Sept 21	130
1991	May 27	Sept 18	113

YEAR	DATE OF LAST SPRING FROST	DATE OF FIRST FALL FROST	LENGTH OF SEASON (days)
1992	May 23	Sept 14	113
1993	May 17	Sept 14	119
1994	May 09	Oct 04	147
1995	May 22	Sept 18	118
1996	May 12	Sept 29	139
1997	May 14	Oct 05	143
1998	May 13	Sept 30	139
1999	May 09	Sept 27	140
2000	May 17	Sept 23	128
2001	May 10	Oct 04	146
2002	May 23	Sept 23	122
2003	May 18	Sept 29	133
1971 - 2000 Normal	May 18	Sept 14	117

Extreme Winds for 2003[1]

Wind Speeds	JANUARY			FEBRUARY			MARCH		
	Day	Speed	Direction	Day	Speed	Direction	Day	Speed	Direction
>=51 but <63	17	56.0	NW	07	57.2	N			
NEAR GALE	26	51.4	SSE	11	57.7	N			
>=63 but <76	08	65.5	WNW				23	73.3	W
GALE									
Wind Speeds	**APRIL**			**MAY**			**JUNE**		
	Day	Speed	Direction	Day	Speed	Direction	Day	Speed	Direction
>=51 but <63	02	55.5	E	17	56.0	W	03	55.8	SW
NEAR GALE	03	55.5	E	21	52.4	N	05	51.7	NW
				25	55.8	ESE	19	54.9	S
							23	53.3	WSW
>=63 but <76				29	67.2	NNW	20	72.6	WSW
GALE									
>=76 but <88	09	77.6	WNW	16	87.8	WNW	27	82.8	WNW
STRONG GALE									
Wind Speeds	**JULY**			**AUGUST**			**SEPTEMBER**		
	Day	Speed	Direction	Day	Speed	Direction	Day	Speed	Direction
>=51 but <63	03	57.7	NW	11	51.2	ESE	09	57.0	SW
NEAR GALE	10	54.5	NW	24	57.1	WNW	25	55.0	NW
				27	55.1	ESE			
>=63 but <76	02	72.9	W	08	64.8	WNW	10	67.7	SW
GALE							23	67.7	WNW
>=76 but <88	13	78.5	W						
STRONG GALE									
Wind Speeds	**OCTOBER**			**DECEMBER**					
	Day	Speed	Direction	**Day**	**Speed**	**Direction**			
>=51 but <63	09	57.9	W	05	54.1	SSE			
NEAR GALE	24	60.4	WNW						
>=63 but <76	27	75.9	NW						
GALE									
>=76 but <88	23	79.0	WNW						
STRONG GALE									

[1] *Beaufort Wind Scale Designation*

10m tower, October 2003. photo credit: CR Beaulieu

Windchill Calculation Chart[1] (revised 2001)

V \ T	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	**-63**
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	**-60**	**-66**
20	1	-5	-12	-18	-24	-31	-37	-43	-49	-56	**-62**	**-68**
25	1	-6	-12	-19	-25	-32	-38	-45	-51	-57	**-64**	**-70**
30	0	-7	-13	-20	-26	-33	-39	-46	-52	-59	**-65**	**-72**
35	0	-7	-14	-20	-27	-33	-40	-47	-53	**-60**	**-66**	**-73**
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	**-61**	**-68**	**-74**
45	-1	-8	-15	-21	-28	-35	-42	-48	-55	**-62**	**-69**	**-75**
50	-1	-8	-15	-22	-29	-35	-42	-49	-56	**-63**	**-70**	**-76**
55	-2	-9	-15	-22	-29	-36	-43	-50	-57	**-63**	**-70**	**-77**
60	-2	-9	-16	-23	-30	-37	-43	-50	-57	**-64**	**-71**	**-78**
65	-2	-9	-16	-23	-30	-37	-44	-51	-58	**-65**	**-72**	**-79**
70	-2	-9	-16	-23	-30	-37	-44	-51	-59	**-66**	**-73**	**-80**
75	-3	-10	-17	-24	-31	-38	-45	-52	-59	**-66**	**-73**	**-80**
80	-3	-10	-17	-24	-31	-38	-45	-52	**-60**	**-67**	**-74**	**-81**

where T = Air temperature (°C) and V = Observed wind speed at 10m elevation (km/h).

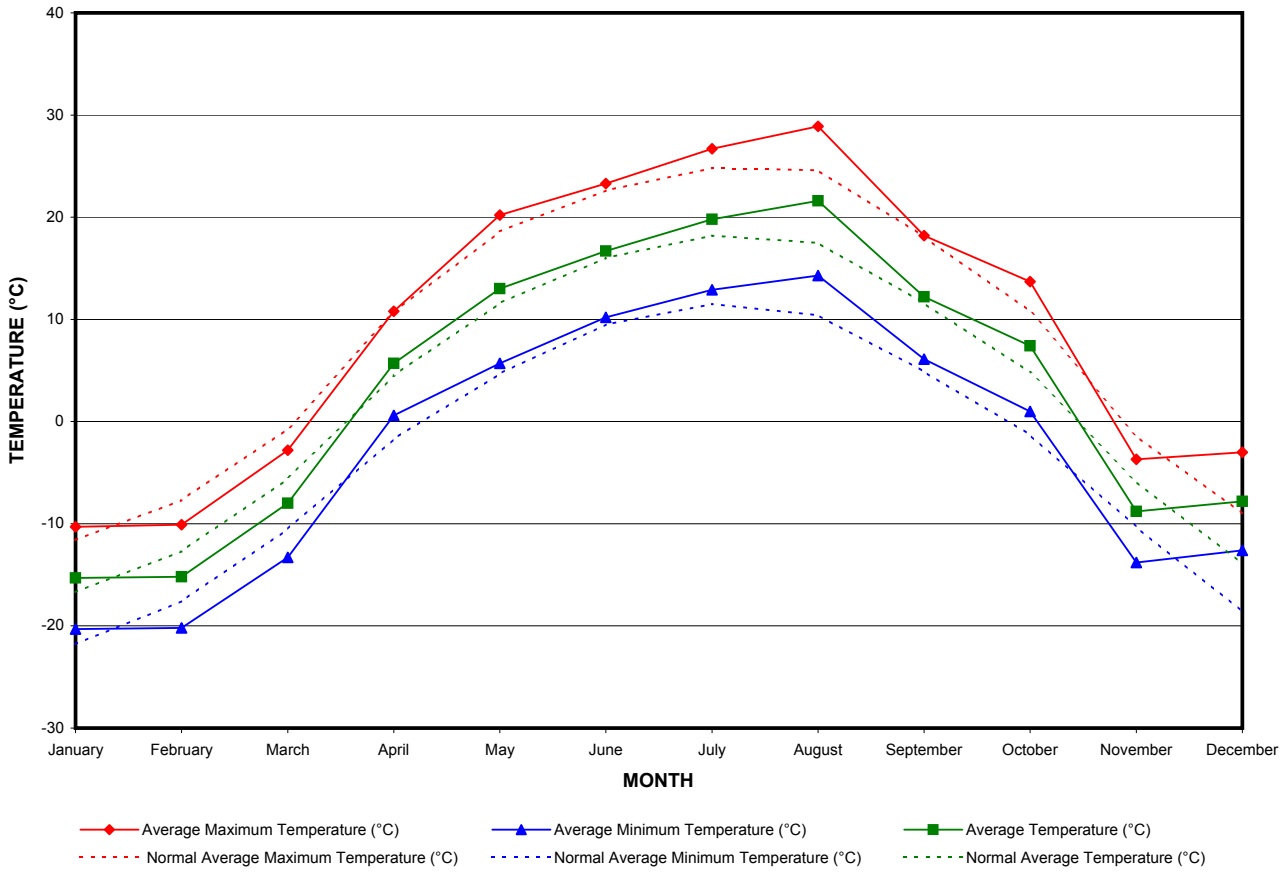
Approximate Thresholds:

Risk of frostbite in prolonged exposure: wind chill below	**-25**	
Frostbite possible in 10 minutes at	**-35**	Warm skin, suddenly exposed. Shorter time if skin is cool at the start.
Frostbite possible in less than 2 minutes at	**-60**	Warm skin, suddenly exposed. Shorter time if skin is cool at the start.

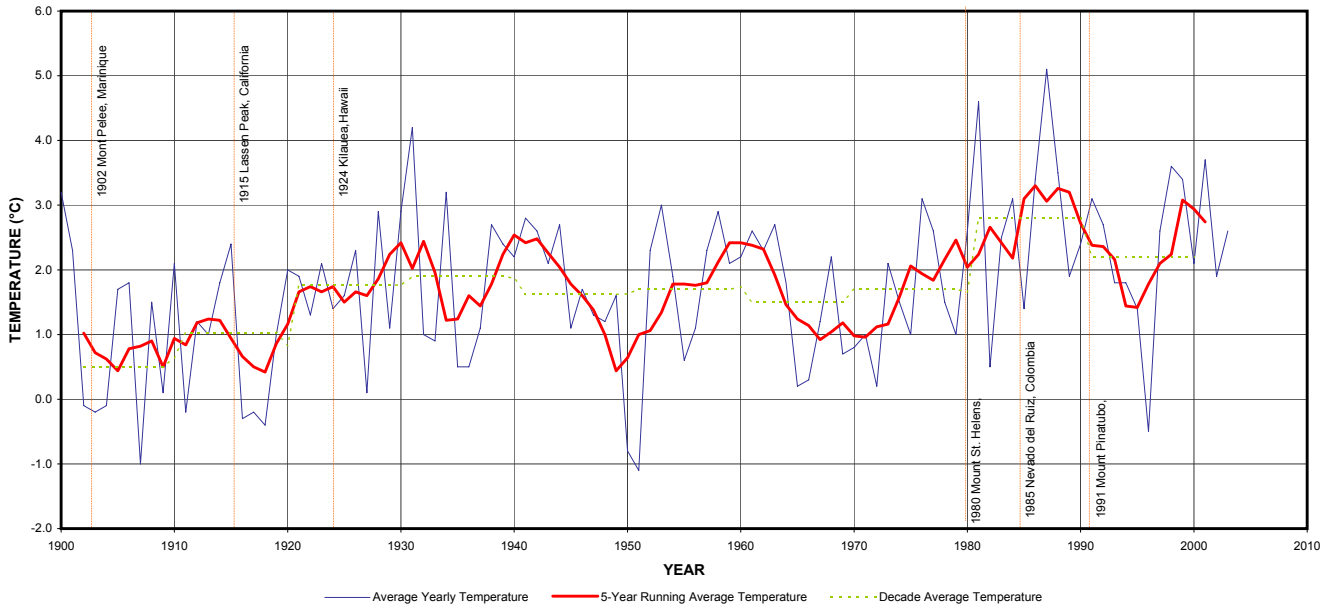
Source: Environment Canada, 2001b

Monthly Average Temperatures and Extreme Values, 2003

MONTH	AVERAGE MAXIMUM TEMPERATURE (°C)		AVERAGE MINIMUM TEMPERATURE (°C)		AVERAGE TEMPERATURE (°C)		EXTREME VALUES FOR TEMPERATURE (°C)	
	2003	Normal	2003	Normal	2003	Normal	Maximum/Date	Minimum/Date
January	-10.3	-11.6	-20.3	-21.8	-15.3	-16.7	5.4/08	-31.6/26
February	-10.1	-7.7	-20.2	-17.6	-15.2	-12.6	-1.5/07	-33.5/24
March	-2.8	-0.7	-13.3	-10.5	-8.0	-5.6	12.9/30	-33.9/07
April	10.8	10.7	0.6	-1.7	5.7	4.5	23.7/22	-10.9/04
May	20.2	18.6	5.7	4.7	13.0	11.6	28.5/25	-2.0/11
June	23.3	22.6	10.2	9.5	16.7	16.0	35.5/19	4.0/10&24
July	26.7	24.8	12.9	11.5	19.8	18.2	35.2/17	8.6/03
August	28.9	24.6	14.3	10.4	21.6	17.5	38.9/16	7.1/26
September	18.2	18.1	6.1	4.9	12.2	11.6	33.6/04	-4.3/30
October	13.7	10.8	1.0	-1.3	7.4	4.8	26.0/05	-11.7/31
November	-3.7	-1.4	-13.8	-10.3	-8.8	-5.9	5.4/16	-24.4/22
December	-3.0	-9.0	-12.6	-18.6	-7.8	-13.9	6.6/20	-25.6/11
Average	9.3	8.3	-2.5	-3.4	3.4	2.5		

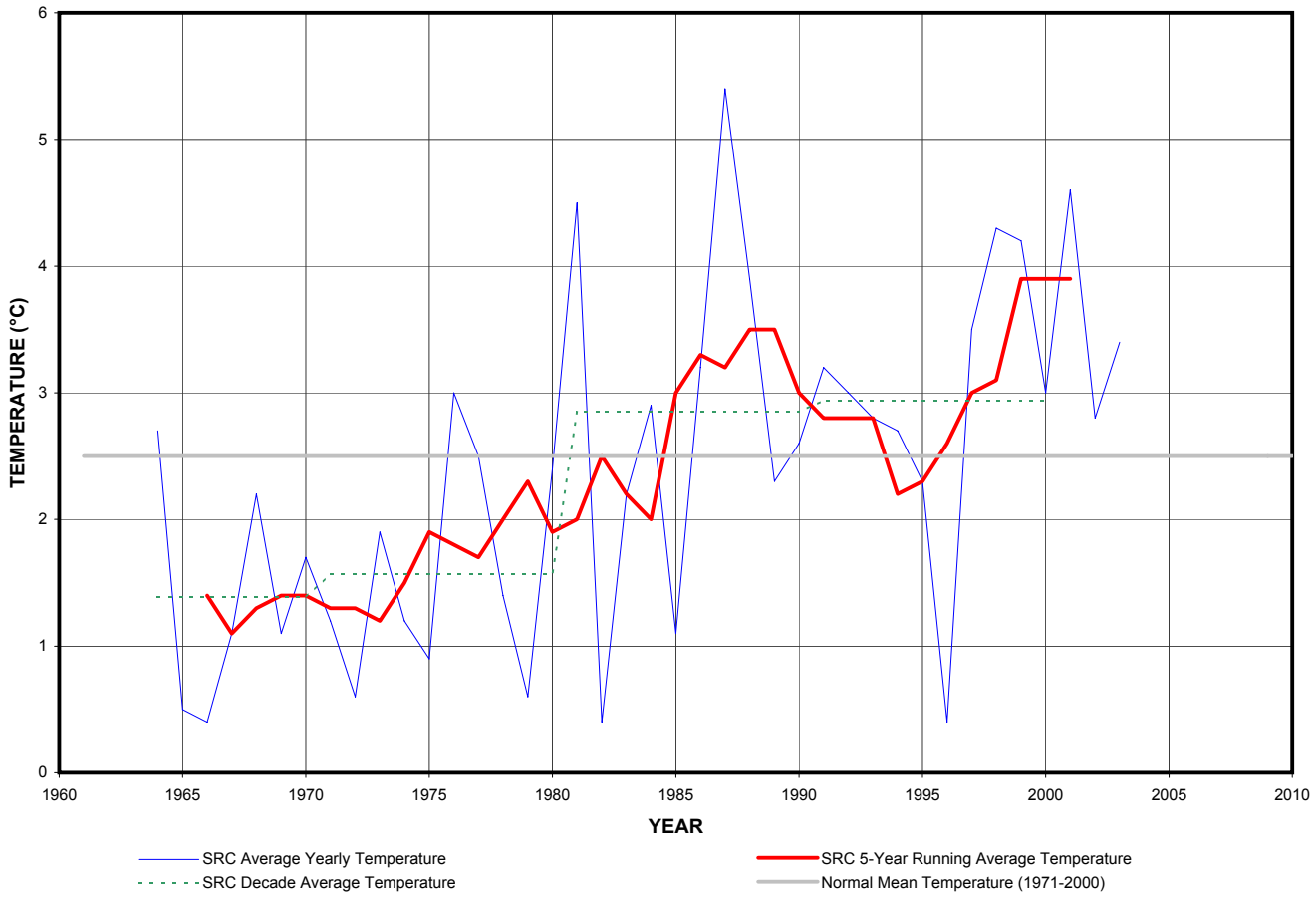


Average Annual Temperature Time Series for Saskatoon 'A'. 1900 - 2003

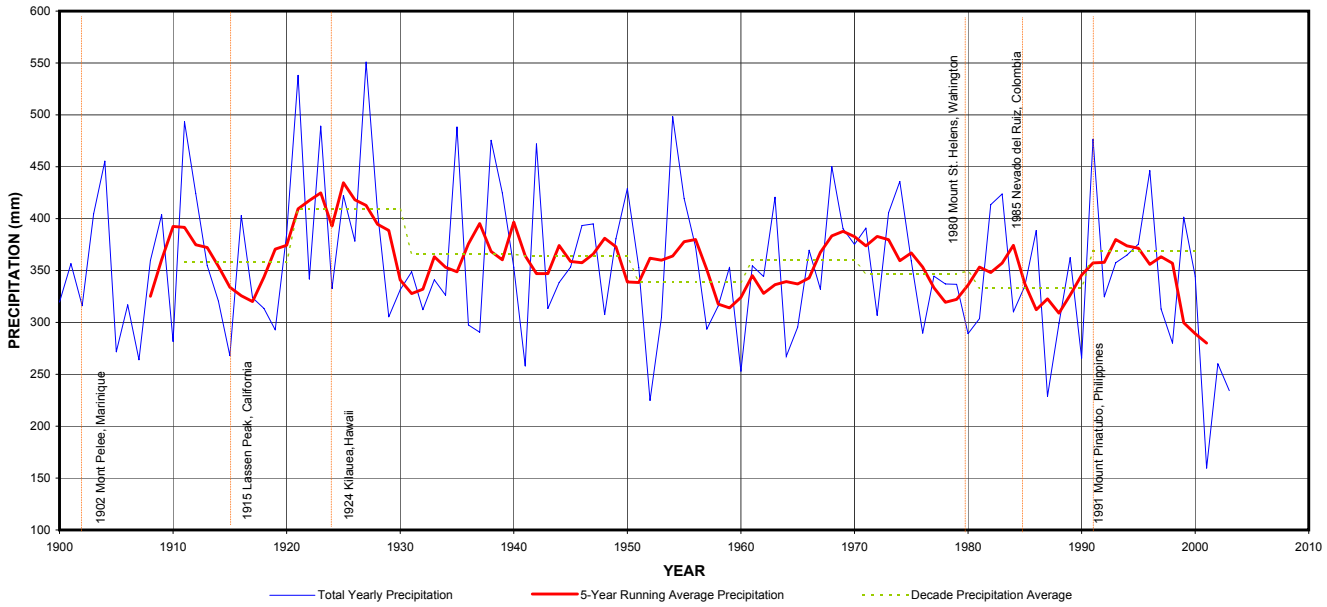


data source: Environment Canada, 2002a, 2002b 2003. Goble 2002. U.S. Geological Survey, n.d.

Average Annual Temperature Time Series for CRS, 1964 - 2003

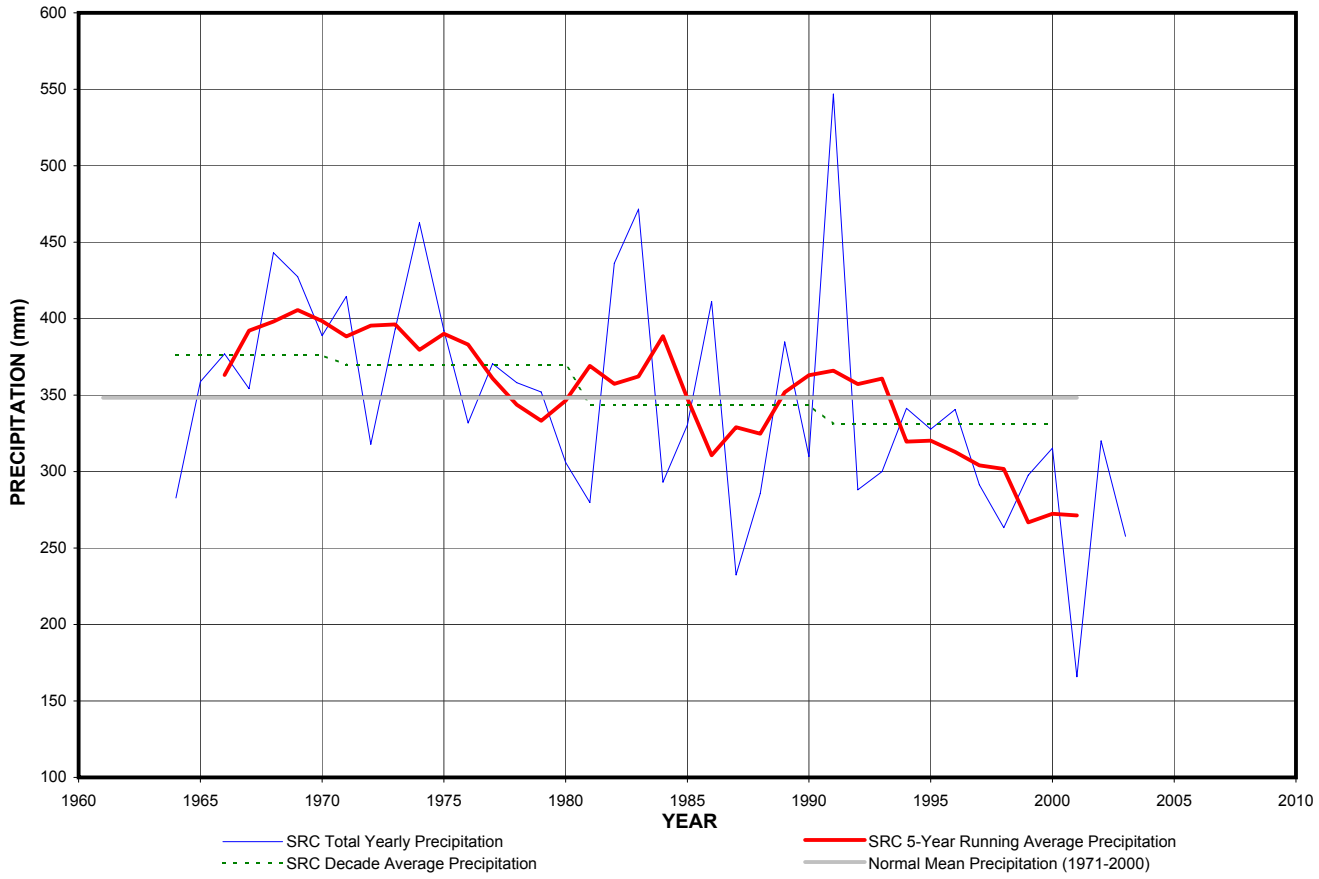


Total Annual Precipitation Time Series for Saskatoon 'A', 1900 - 2003



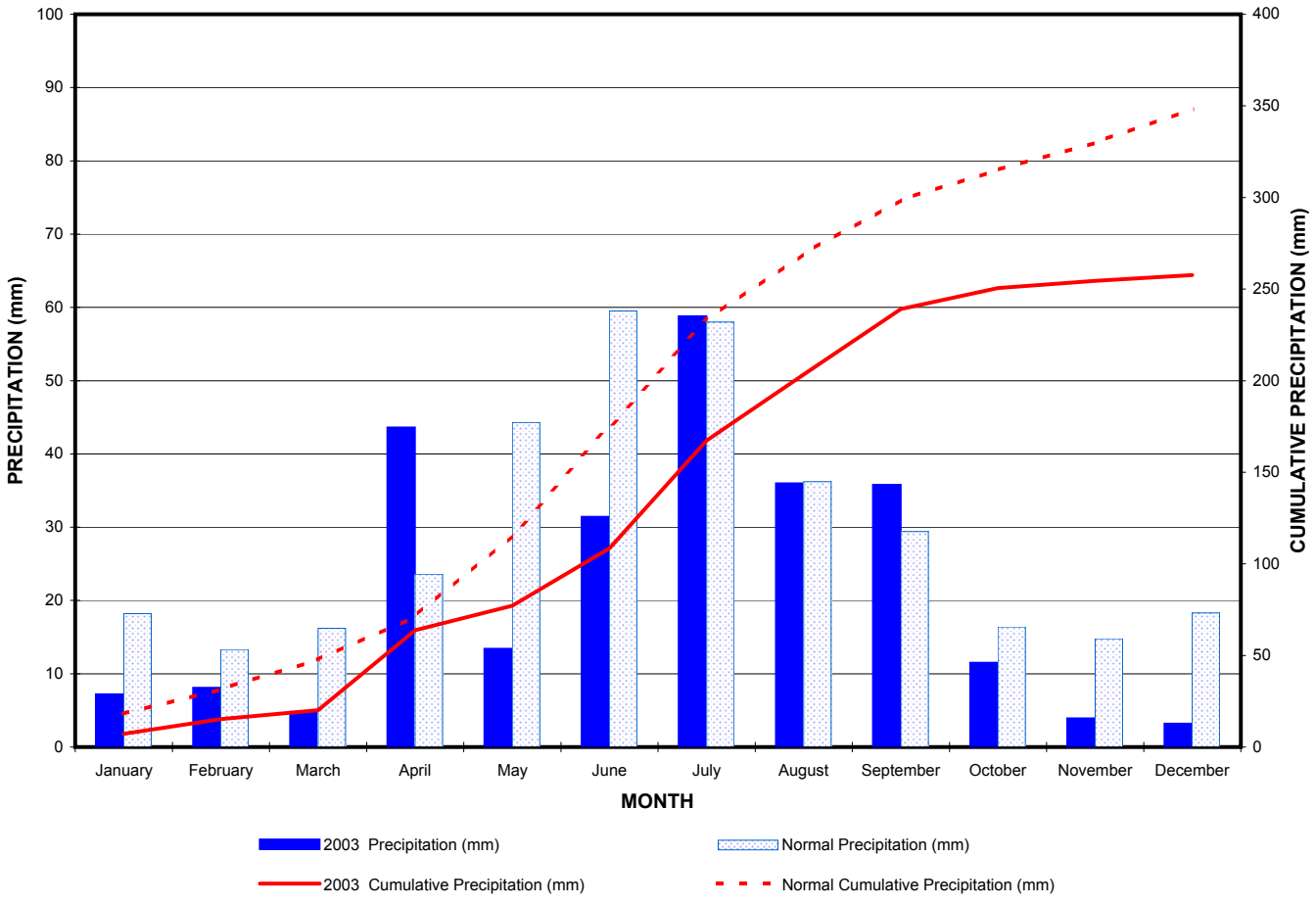
data source: Environment Canada, 2002a, 2002b, 2003. Goble 2002. U.S. Geological Survey n.d.

Total Annual Precipitation Time Series for CRS, 1964 - 2003



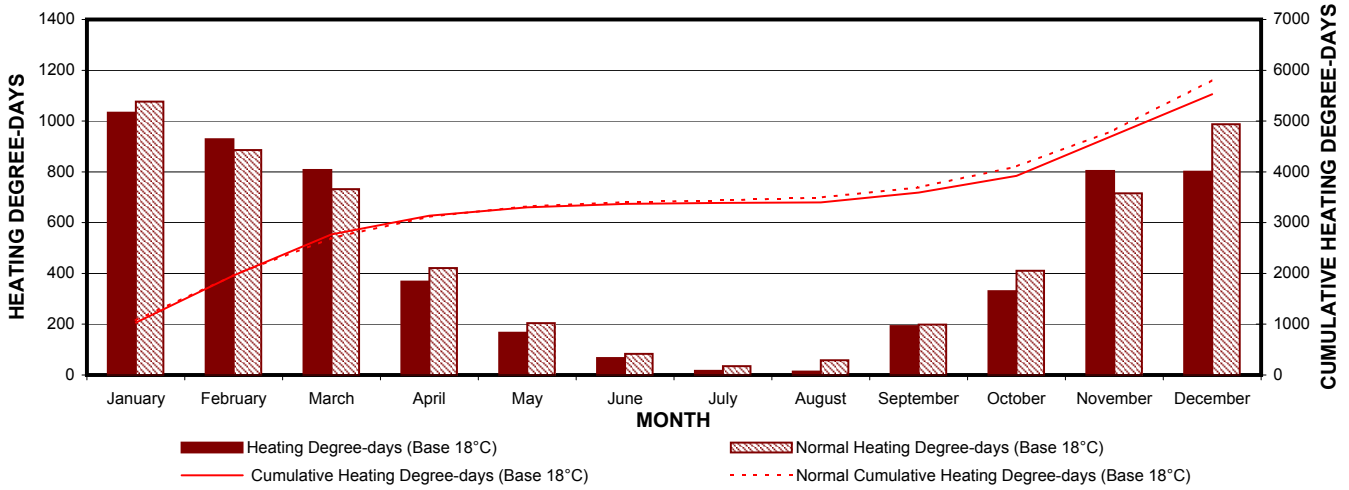
Monthly Precipitation and Extreme Values, 2003

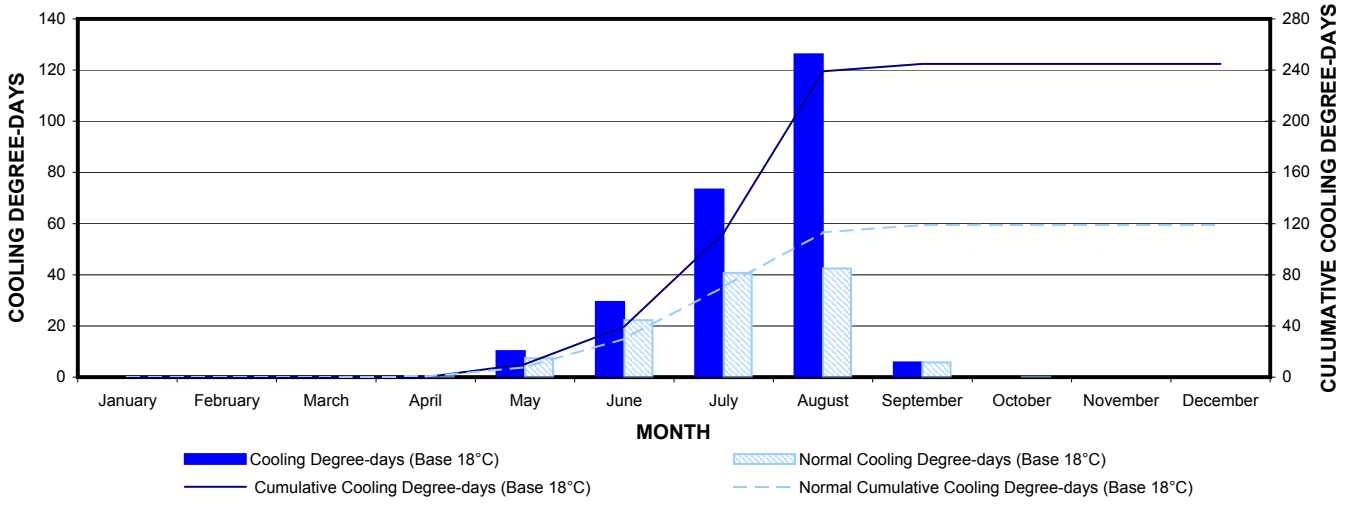
MONTH	PRECIPITATION (mm)			CUMULATIVE PRECIPITATION (mm)			EXTREME VALUE (mm)
	2003	Normal	% of Normal	2003	Normal	% of Normal	Value/Date
January	7.2	18.2	39.6	7.2	18.2	39.6	2.1/26
February	8.1	13.3	60.9	15.3	31.5	48.6	4.1/17
March	4.8	16.2	29.6	20.1	47.7	42.1	1.5/23
April	43.6	23.6	184.7	63.7	71.3	89.3	14.7/26
May	13.4	44.3	30.2	77.1	115.6	66.7	6.4/16
June	31.4	59.5	52.8	108.5	175.1	62.0	16.4/02
July	58.8	58.0	101.4	167.3	233.1	71.8	28.4/06
August	36.0	36.2	99.4	203.3	269.3	75.5	22.4/08
September	35.8	29.4	121.8	239.1	298.7	80.0	27.4/09
October	11.5	16.4	70.1	250.6	315.1	79.5	7.7/26
November	3.9	14.8	26.4	254.5	329.9	77.1	1.8/04
December	3.2	18.3	17.5	257.7	348.2	74.0	0.7/29
Total	257.7	348.2	74.0				



Monthly Heating and Cooling Degree-days, 2003

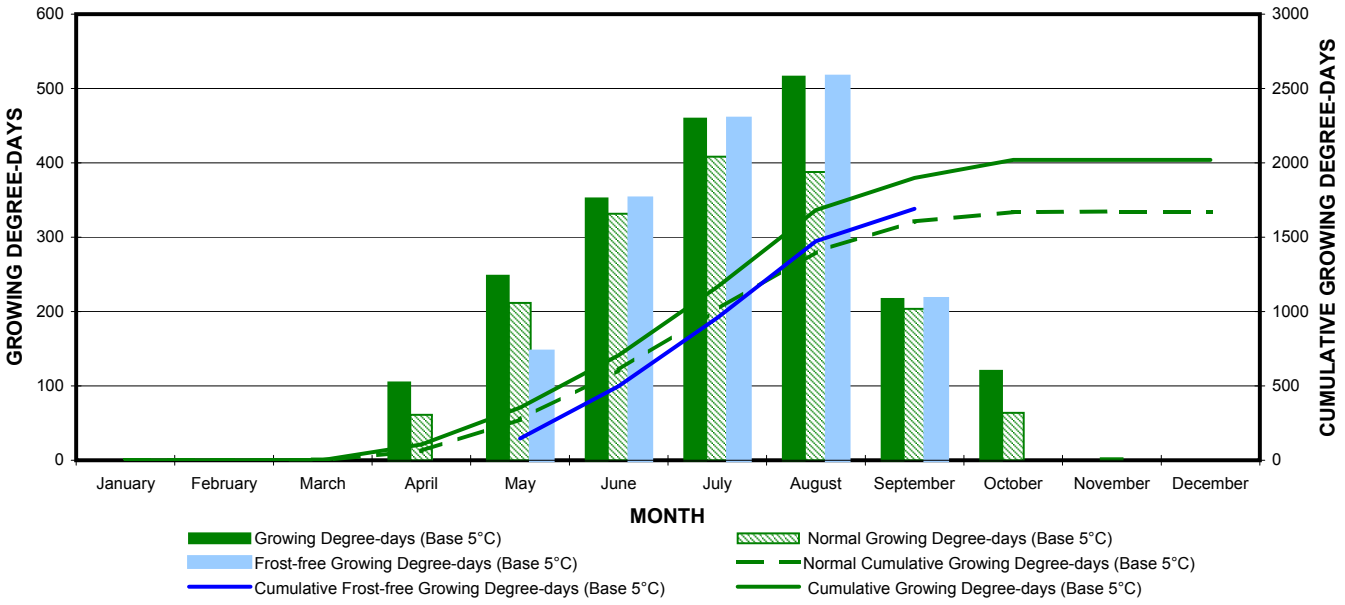
MONTH	HEATING DEGREE-DAYS Base 18°C		CUMULATIVE HEATING DEGREE-DAYS Base 18°C		COOLING DEGREE-DAYS Base 18°C		CUMULATIVE COOLING DEGREE-DAYS Base 18°C	
	2003	Normal	2003	Normal	2003	Normal	2003	Normal
January	1033.1	1076.9	1033.1	1076.9	0.0	0.0	0.0	0.0
February	928.7	886.3	1961.8	1963.2	0.0	0.0	0.0	0.0
March	807.0	732.1	2768.8	2695.3	0.0	0.0	0.0	0.0
April	368.0	420.7	3136.8	3116.0	0.0	0.3	0.0	0.3
May	166.2	204.4	3303.0	3320.4	10.2	7.4	10.2	7.7
June	67.1	82.8	3370.1	3403.2	29.4	22.3	39.6	30.0
July	16.8	35.3	3386.9	3438.5	73.3	40.7	112.9	70.7
August	13.2	57.7	3400.1	3496.2	126.2	42.5	239.1	113.2
September	192.7	198.9	3592.8	3695.1	18.3	5.8	257.4	119.0
October	329.7	410.2	3922.5	4105.3	0.0	0.1	257.4	119.1
November	804.0	715.8	4726.5	4821.1	0.0	0.0	257.4	119.1
December	800.7	987.7	5527.2	5808.8	0.0	0.0	257.4	119.1
Total	5527.2	5808.8			257.4	119.1		

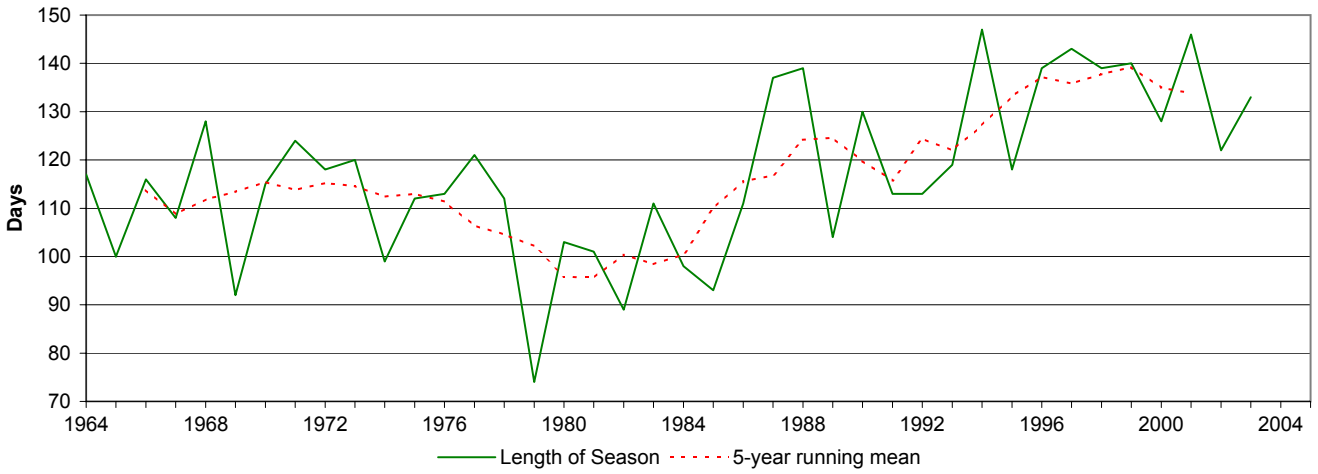




Monthly Growing Degree-days, 2003

MONTH	GROWING DEGREE-DAYS Base 5°C		CUMULATIVE GROWING DEGREE-DAYS Base 5°C		FROST-FREE GROWING DEGREE-DAYS Base 5°C	
	2003	Normal	2003	Normal	2003	Cumulative
January	0.0	0.0	0.0	0.0		
February	0.0	0.0	0.0	0.0		
March	1.6	2.4	1.6	2.4		
April	104.8	61.3	106.4	63.7		
May	248.1	211.6	354.5	275.3	146.1	146.1
June	352.3	331.5	706.8	606.8	352.3	498.4
July	459.5	408.4	1166.3	1015.2	459.5	957.9
August	516.0	387.8	1682.3	1403.0	516.0	1473.9
September	217.1	203.5	1899.4	1606.5	217.1	1691.0
October	120.1	63.7	2019.5	1670.2		
November	0.0	2.6	2019.5	1672.8		
December	0.0	0.1	2019.5	1672.9		
Total	2019.5	1672.9			1691.0	

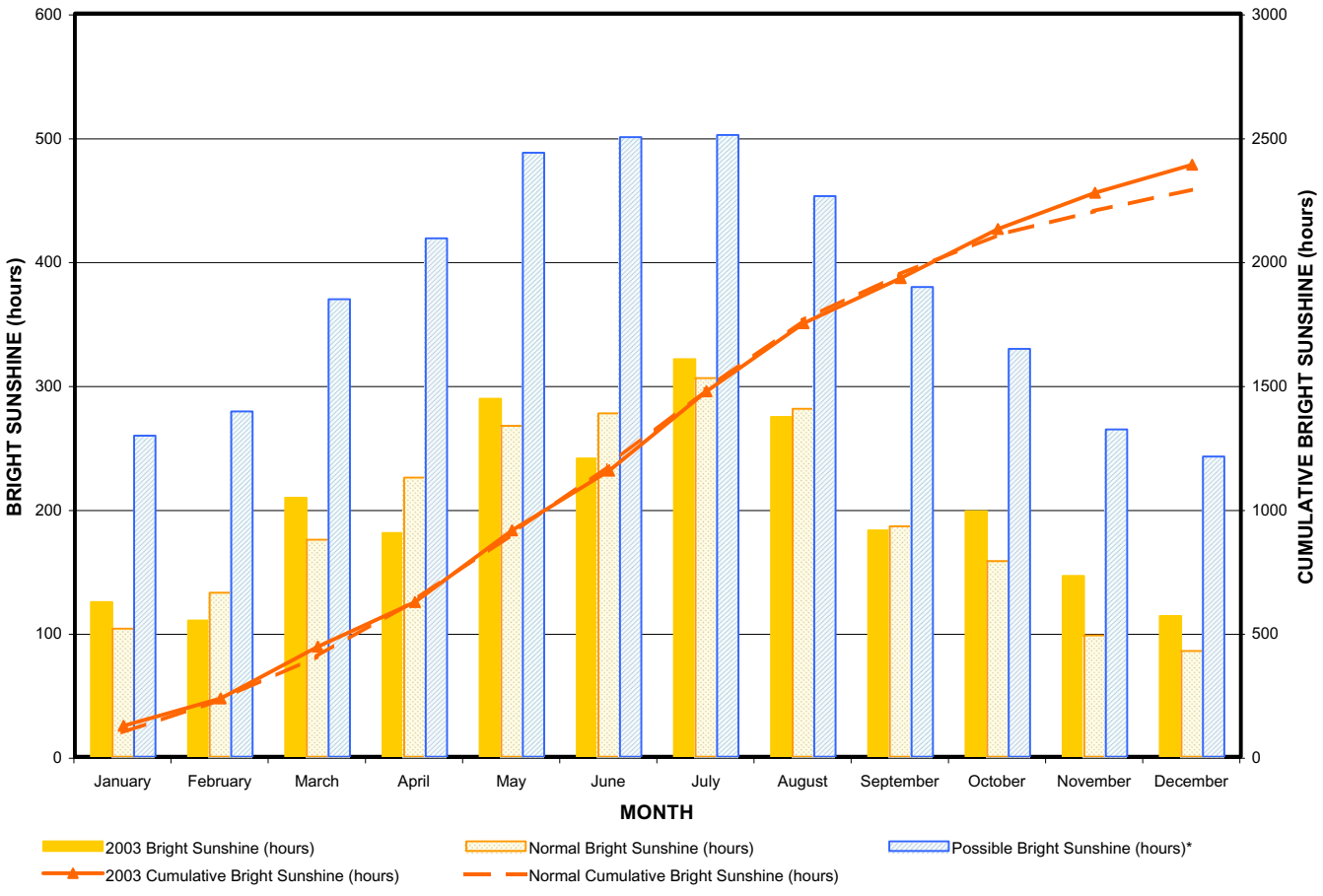




Monthly Bright Sunshine, 2003

MONTH	BRIGHT SUNSHINE (hours)					CUMULATIVE BRIGHT SUNSHINE (hours)		NUMBER OF BRIGHT SUNSHINE DAYS	
	2003	Normal	% of Normal	Possible*	% of Possible	2003	Normal	2003	Normal
January	124.9	103.3	120.9	258.9	48.2	124.9	103.3	26	23.8
February	110.0	132.3	83.1	278.5	39.5	234.9	235.6	19	24.2
March	209.0	175.2	119.3	368.8	56.7	443.9	410.8	29	27.1
April	180.5	225.2	80.2	417.9	43.2	624.4	636.0	19	27.3
May	289.0	267.1	108.2	487.1	59.3	913.4	903.1	31	29.5
June	240.7	277.2	86.8	500.0	48.1	1154.1	1180.3	30	28.5
July	321.0	305.7	105.0	502.1	63.9	1475.1	1486.0	30	30.3
August	274.2	280.8	97.7	453.1	60.5	1749.3	1766.8	29	30.1
September	182.7	186.0	98.2	379.7	48.1	1932.0	1952.8	29	27.0
October	198.2	157.9	125.5	329.8	60.1	2130.2	2110.7	28	27.0
November	146.0	98.0	149.0	264.5	55.2	2276.2	2208.7	27	22.2
December	113.6	85.4	133.0	242.4	46.9	2389.8	2294.1	25	22.8
Total	2389.8	2294.1	104.2	4482.8	53.3			322	319.8

* Possible Bright Sunshine hours calculated from Nat. Res. Council of Canada, Hertzberg Institute of Astrophysics sunrise/set table for 2003



Sunrise[1] and Sunset[1] at Saskatoon, 2003 and 2004[2]

(local time in hours and minutes)

2003	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	9:15	17:05	8:47	17:54	7:53	18:46	6:42	19:40	5:37	20:32	4:52	21:17	4:50	21:30	5:27	20:57	6:18	19:54	7:07	18:45	8:01	17:38	8:53	16:58
2	9:15	17:06	8:45	17:56	7:51	18:48	6:39	19:42	5:35	20:33	4:51	21:18	4:51	21:30	5:29	20:56	6:19	19:52	7:09	18:42	8:03	17:36	8:54	16:58
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4	9:15	17:08	8:42	17:59	7:46	18:51	6:35	19:45	5:31	20:37	4:50	21:21	4:52	21:29	5:32	20:52	6:23	19:48	7:12	18:38	8:07	17:33	8:57	16:57
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22	9:01	17:36	8:08	18:33	7:05	19:23	5:55	20:16	5:03	21:05	4:46	21:31	5:13	21:12	6:01	20:17	6:52	19:06	7:43	17:58	8:39	17:06	9:13	16:57
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31	8:49	17:52			6:44	19:39			4:53	21:16			5:26	20:59	6:16	19:57			8:00	17:40			9:15	17:04

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

[2]National Research Council, Canada, Hertzberg Institute of Astrophysics

2004	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	9:15	17:05	8:47	17:53	7:51	18:47	6:40	19:42	5:35	20:33	4:51	21:18	4:51	21:30	5:29	20:56	6:19	19:53	7:08	18:43	8:03	17:37	8:54	16:58
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13	9:10	17:20	8:26	18:16	7:24	19:09	6:13	20:02	5:14	20:52	4:45	21:28	5:02	21:22	5:48	20:34	6:38	19:25	7:29	18:16	8:24	17:17	9:08	16:54
14	9:09	17:22	8:25	18:18	7:22	19:10	6:11	20:04	5:13	20:54	4:45	21:29	5:03	21:21	5:49	20:32	6:40	19:23	7:31	18:13	8:26	17:16	9:09	16:54
15	9:09	17:24	8:23	18:20	7:19	19:12	6:08	20:06	5:11	20:56	4:45	21:29	5:04	21:20	5:51	20:30	6:42	19:20	7:32	18:11	8:28	17:14	9:09	16:55
16	9:08	17:25	8:21	18:21	7:17	19:14	6:06	20:07	5:10	20:57	4:45	21:30	5:06	21:19	5:53	20:28	6:43	19:18	7:34	18:09	8:30	17:13	9:10	16:55
17	9:07	17:27	8:19	18:23	7:15	19:16	6:04	20:09	5:08	20:59	4:45	21:30	5:07	21:18	5:54	20:26	6:45	19:16	7:36	18:07	8:31	17:11	9:11	16:55
18	9:06	17:28	8:17	18:25	7:12	19:17	6:02	20:11	5:07	21:00	4:45	21:30	5:08	21:16	5:56	20:23	6:47	19:13	7:38	18:05	8:33	17:10	9:12	16:55
19	9:05	17:30	8:15	18:27	7:10	19:19	6:00	20:13	5:06	21:02	4:45	21:31	5:10	21:15	5:58	20:21	6:48	19:11	7:39	18:03	8:35	17:09	9:12	16:56
20	9:04	17:32	8:13	18:29	7:08	19:21	5:58	20:14	5:04	21:03	4:45	21:31	5:11	21:14	5:59	20:19	6:50	19:08	7:41	18:01	8:36	17:08	9:13	16:56
21	9:03	17:34	8:10	18:31	7:05	19:23	5:55	20:16	5:03	21:04	4:46	21:31	5:12	21:13	6:01	20:17	6:52	19:06	7:43	17:58	8:38	17:07	9:13	16:57
22	9:01	17:35	8:08	18:33	7:03	19:24	5:53	20:18	5:02	21:06	4:46	21:31	5:14	21:11	6:02	20:15	6:53	19:04	7:45	17:56	8:40	17:06	9:14	16:57
23	9:00	17:37	8:06	18:34	7:01	19:26	5:51	20:19	5:00	21:07	4:46	21:31	5:15	21:10	6:04	20:13	6:55	19:01	7:47	17:54	8:41	17:04	9:14	16:58
24	8:59	17:39	8:04	18:36	6:58	19:28	5:49	20:21	4:59	21:08	4:47	21:31	5:17	21:09	6:06	20:11	6:57	18:59	7:48	17:52	8:43	17:03	9:15	16:58
25	8:58	17:41	8:02	18:38	6:56	19:30	5:47	20:23	4:58	21:10	4:47	21:31	5:18	21:07	6:07	20:08	6:58	18:57	7:50	17:50	8:45	17:02	9:15	16:59
26	8:56	17:42	8:00	18:40	6:54	19:31	5:45	20:24	4:57	21:11	4:48	21:31	5:19	21:06	6:09	20:06	7:00	18:54	7:52	17:48	8:46	17:02	9:15	17:00
27	8:55	17:44	7:58	18:42	6:52	19:33	5:43	20:26	4:56	21:12	4:48	21:31	5:21	21:04	6:11	20:04	7:02	18:52	7:54	17:46	8:48	17:01	9:15	17:01
28	8:53	17:46	7:56	18:44	6:49	19:35	5:41	20:28	4:55	21:14	4:49	21:31	5:22	21:03	6:12	20:02	7:03	18:50	7:56	17:44	8:49	17:00	9:15	17:02
29	8:52	17:48	7:53	18:45	6:47	19:36	5:39	20:30	4:54	21:15	4:49	21:31	5:24	21:01	6:14	19:59	7:05	18:47	7:57	17:42	8:51	16:59	9:15	17:03
30	8:51	17:50			6:45	19:38	5:37	20:31	4:53	21:16	4:50	21:30	5:26	20:59	6:16	19:57	7:07	18:45	7:59	17:41	8:52	16:58	9:15	17:03
31	8:49	17:51			6:42	19:40			4:52	21:17			5:27	20:58	6:17	19:55			8:01	17:39			9:15	17:05

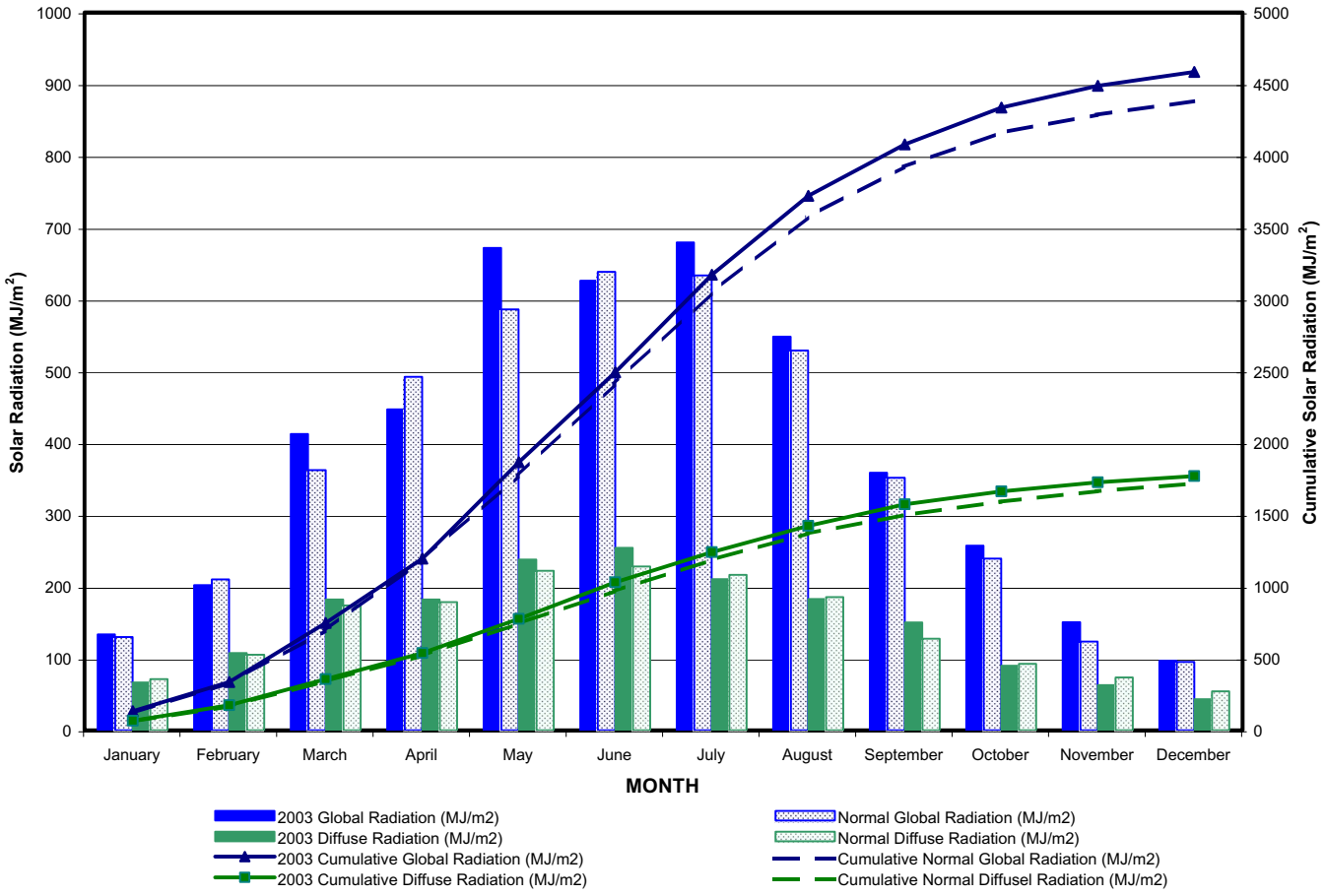
[1]Sunrise/set = corresponds to the upper limb of the sun appearing at the horizon

[2]National Research Council, Canada, Hertzberg Institute of Astrophysics

Monthly Global and Diffuse Solar Radiation, 2003

MONTH	GLOBAL RADIATION (MJ/m²)		CUMULATIVE GLOBAL RADIATION (MJ/m²)		DIFFUSE RADIATION (MJ/m²)		CUMULATIVE DIFFUSE RADIATION (MJ/m²)	
	2003	Normal	2003	Normal	2003	Normal	2003	Normal
January	133.7	129.9	133.7	129.9	66.6	71.4	66.6	71.4
February	202.1	210.1	335.8	340.0	107.6	105.3	174.2	176.7
March	412.8	362.4	748.6	702.4	182.3	173.9	356.5	350.6
April	447.2	492.2	1195.8	1194.6	182.1	178.5	538.6	529.1
May	671.8	586.3	1867.6	1780.9	237.8	222.2	776.4	751.3
June	626.1	638.7	2493.7	2419.6	254.3	228.1	1030.7	979.4
July	679.7	633.5	3173.4	3053.1	210.4	216.5	1241.1	1195.9
August	548.4	529.0	3721.8	3582.1	182.8	185.6	1423.9	1381.5
September	358.8	351.8	4080.6	3933.9	150.1	127.6	1574.0	1509.1
October	257.2	239.1	4337.8	4173.0	90.1	92.6	1664.1	1601.7
November	150.6	123.7	4488.4	4296.7	63.1	73.6	1727.2	1675.3
December	96.8	95.2	4585.2	4391.9	43.3	54.3	1770.5	1729.6
Total	4585.2	4391.9			1770.5	1729.6		

Normals = 1961- 1990



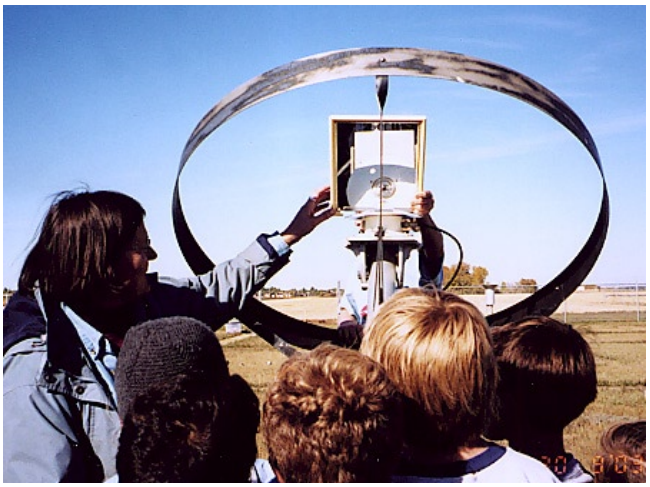
Daily Global and Diffuse Solar Radiation, 2003

(MJ/m²)

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	5.6	1.7	2.8	2.8	15.0	2.4	9.7	9.5	18.1	8.4	21.7	9.4	28.4	3.9	23.9	5.9	8.5	6.4	13.1	2.5	3.1	2.8	4.4	1.2
2	4.7	2.2	3.6	3.6	7.8	7.3	9.6	9.0	21.3	8.7	9.8	7.9	24.6	9.2	21.8	7.2	18.6	3.5	10.5	5.7	8.2	1.5	4.2	1.2
3	2.1	1.8	4.4	3.8	12.4	4.6	7.7	7.2	24.9	3.9	23.7	7.3	22.2	8.7	8.2	7.1	19.9	2.3	12.6	1.7	5.3	4.5	2.9	1.7
4	4.9	1.2	4.1	4.1	14.9	3.2	13.7	12.3	19.9	8.7	17.7	10.4	15.8	11.7	12.3	7.3	17.1	5.5	12.6	1.9	4.2	4.0	3.8	1.0
5	1.8	1.8	5.1	3.8	8.3	7.5	7.4	7.4	17.5	11.3	21.5	8.5	9.6	7.0	23.0	6.8	15.2	6.1	12.5	1.7	5.4	4.0	1.3	1.3
6	3.4	2.2	6.1	2.6	15.0	4.1	8.0	7.5	17.4	10.6	9.8	8.6	6.7	6.1	17.2	9.4	16.8	4.4	12.2	1.7	4.7	3.7	3.0	1.3
7	4.0	2.2	4.1	3.5	15.8	3.0	17.6	8.2	11.4	8.4	13.2	11.1	19.4	10.9	12.4	5.6	11.3	8.2	11.7	1.9	6.5	2.4	2.0	1.2
8	4.2	1.1	8.3	1.6	15.6	2.8	19.9	4.7	21.7	7.5	19.7	11.5	24.1	9.5	20.6	7.9	9.1	6.4	9.8	3.8	8.6	1.4	3.8	1.1
9	4.4	1.2	7.9	1.7	14.3	3.6	18.0	3.8	16.3	8.1	9.0	8.3	19.4	10.0	22.2	6.0	2.2	2.2	11.6	1.8	8.0	1.5	3.0	1.7
10	5.5	1.1	5.0	4.4	11.0	8.6	20.3	4.2	25.9	5.2	20.7	12.7	24.7	6.2	22.7	4.5	9.6	3.3	10.8	2.0	6.0	2.6	1.6	1.6
11	5.0	1.4	8.8	1.5	13.0	6.9	13.9	9.2	26.7	3.9	10.9	9.2	27.2	5.4	21.2	5.4	12.7	6.1	8.3	3.9	4.6	2.4	3.1	1.2
12	4.7	1.9	3.9	3.8	13.5	5.3	18.8	5.6	26.8	3.9	24.0	8.5	27.4	4.8	17.5	7.6	13.6	4.6	8.9	4.1	6.2	2.3	4.2	1.2
13	2.9	2.9	3.7	3.7	13.7	5.4	4.2	4.2	17.2	10.5	28.5	4.7	22.3	7.1	22.0	5.3	10.9	5.7	10.1	2.1	5.3	1.5	3.0	1.7
14	5.9	1.3	8.6	1.9	11.7	7.7	4.3	4.1	25.9	6.0	23.9	7.4	19.3	8.6	23.1	2.6	11.2	7.6	7.7	3.4	5.5	1.2	2.6	2.1
15	5.8	1.4	3.5	3.5	15.0	2.7	3.4	3.4	21.5	9.8	27.5	7.0	25.9	2.0	22.8	2.6	6.8	5.5	3.3	3.0	5.9	2.1	1.2	1.2
16	4.3	1.8	5.3	5.2	10.9	8.4	7.6	6.8	16.5	9.3	25.9	6.3	21.4	6.3	19.1	6.9	7.8	6.4	9.3	3.4	4.7	1.5	2.1	1.7
17	3.7	1.6	4.5	4.4	13.1	7.4	13.7	7.1	18.8	6.6	30.4	2.9	27.5	2.9	7.7	6.2	8.2	7.1	9.0	2.1	4.7	1.3	3.7	0.9
18	5.4	2.5	7.9	4.2	12.2	8.2	22.5	2.7	18.3	10.7	29.5	4.0	28.4	2.8	21.5	4.4	11.4	6.4	9.2	2.8	1.4	1.3	3.5	1.2
19	3.3	3.2	5.4	5.3	12.9	5.0	20.9	3.7	27.8	3.6	27.0	6.5	16.2	10.6	20.7	5.4	15.5	4.4	8.4	3.8	0.4	0.4	2.9	1.6
20	4.4	3.5	6.7	6.3	14.3	3.4	19.9	4.6	23.2	7.9	18.8	9.8	25.9	5.6	13.0	5.5	15.1	3.5	6.6	3.6	4.6	2.0	3.1	2.2
21	4.3	2.8	11.3	3.8	13.9	4.1	18.2	8.4	23.5	6.6	11.2	8.9	15.2	9.1	21.1	4.0	12.5	4.6	8.8	2.3	6.5	1.3	3.7	1.0
22	5.8	1.4	11.9	4.2	14.9	3.1	22.5	3.5	22.7	10.3	16.4	11.7	26.7	3.8	16.7	8.1	11.5	6.5	7.3	3.8	5.0	2.0	4.0	0.9
23	3.3	2.9	12.6	3.1	8.8	8.0	19.7	6.1	21.0	8.7	13.8	11.0	25.2	8.4	15.3	7.1	11.2	4.1	7.2	2.6	6.4	1.9	4.3	0.9
24	4.4	3.0	12.5	3.4	12.0	14.9	17.0	7.9	26.8	4.8	23.4	10.2	25.1	6.4	11.6	7.0	9.4	6.6	3.2	3.2	3.9	2.5	2.5	1.7
25	5.9	1.8	12.1	5.1	18.8	10.0	18.1	5.9	27.7	2.8	19.8	9.7	9.8	8.2	20.7	6.3	13.3	2.7	6.1	3.2	5.3	1.2	2.2	1.9
26	2.4	2.4	10.2	3.5	13.9	5.8	8.2	5.9	15.9	9.9	23.1	8.3	26.0	4.0	18.9	7.4	8.1	5.2	3.3	3.0	3.8	2.4	4.8	1.1
27	2.7	2.6	11.9	5.9	9.8	7.4	8.4	7.6	23.6	8.8	23.9	6.6	24.9	5.6	7.8	7.0	10.8	5.7	5.7	2.9	4.0	2.2	1.6	1.6
28	4.8	3.1	9.9	6.9	18.7	3.1	24.8	3.3	24.7	7.6	25.0	6.7	19.4	8.9	7.5	4.3	11.6	5.5	6.6	2.7	2.8	2.7	2.4	1.9
29	7.0	2.3			17.6	3.3	24.9	3.4	23.3	7.7	28.7	2.8	23.7	6.7	17.4	5.1	14.3	1.8	2.2	2.1	5.5	1.5	2.0	1.7
30	4.0	3.2			8.1	7.2	24.3	4.9	21.2	8.5	27.6	7.4	24.7	4.7	18.2	4.4	14.6	1.8	3.4	3.4	4.1	1.0	4.6	1.0
31	3.1	3.1			15.9	7.9			24.3	9.1			22.6	5.3	20.3	2.5			5.2	4.0			5.3	1.3
TOTAL	133.7	66.6	202.1	107.6	412.8	182.3	447.2	182.1	671.8	237.8	626.1	245.3	679.7	210.4	548.4	182.8	358.8	150.1	257.2	90.1	150.6	63.1	96.8	43.3

COMMENTS: G= Global Radiation D= Diffuse Radiation

March 23, 24 Maladjustment of shade ring
July 15, diffuse repaired



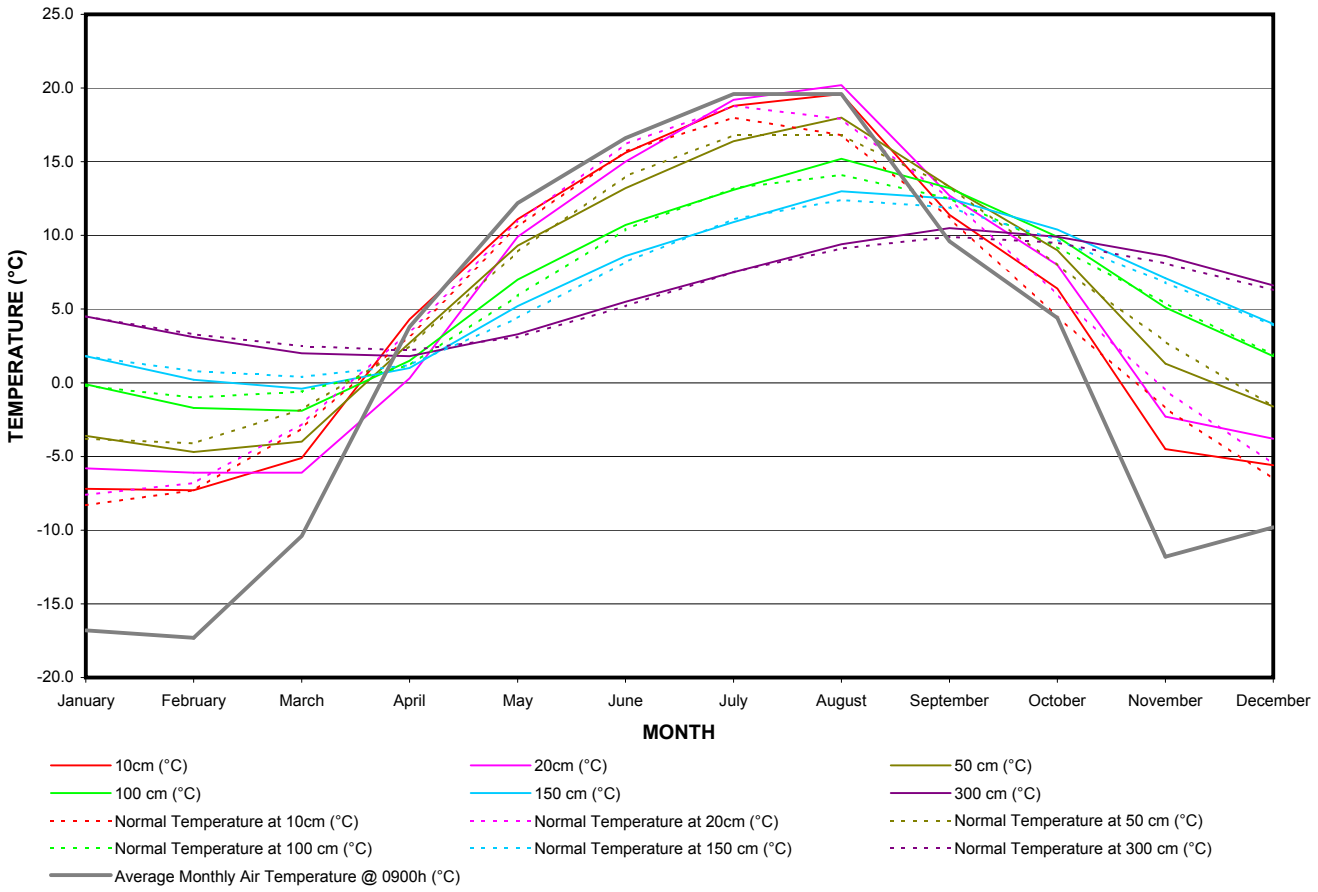
Diffuse Radiation Sensor, September 30, 2003. photo credit: Rita Johannsson

Monthly Average Soil Temperatures at 0900 hrs, 2003

(10 to 300cm depths)

MONTH	Average Air Temperature	10cm (°C)		20cm (°C)		50cm (°C)		100cm (°C)		150cm (°C)		300cm (°C)	
	@0900h	2003	Normal	2003	Normal	2003	Normal	2003	Normal	2003	Normal	2003	Normal
January	-16.8	-7.2	-8.3	-5.8	-7.6	-3.6	-3.8	-0.1	-0.2	1.8	1.8	4.5	4.5
February	-17.3	-7.3	-7.3	-6.1	-6.8	-4.7	-4.1	-1.7	-1.0	0.2	0.8	3.1	3.3
March	-10.4	-5.1	-3.1	-6.1	-2.8	-4.0	-1.8	-1.9	-0.6	-0.4	0.4	2.0	2.5
April	3.8	4.3	3.2	0.3	3.5	2.7	2.5	1.5	1.2	1.0	1.2	1.8	2.2
May	12.2	11.1	10.6	9.9	10.9	9.3	8.9	7.0	5.9	5.2	4.4	3.3	3.1
June	16.6	15.6	15.7	15.0	16.2	13.2	14.0	10.7	10.4	8.6	8.2	5.5	5.2
July	19.6	18.8	18.0	19.2	18.8	16.4	16.8	13.1	13.2	10.9	11.1	7.5	7.5
August	19.6	19.6	16.8	20.2	17.9	18.0	16.8	15.2	14.1	13.0	12.4	9.4	9.1
September	9.6	11.4	11.2	12.7	12.5	13.3	13.3	13.2	12.5	12.5	11.9	10.5	9.9
October	4.4	6.4	4.5	8.0	6.0	9.0	8.0	9.9	9.2	10.4	9.7	9.9	9.5
November	-11.8	-4.5	-1.7	-2.3	-0.5	1.3	2.8	5.1	5.4	7.1	6.8	8.6	8.1
December	-9.8	-5.6	-6.5	-3.8	-5.5	-1.6	-1.6	1.8	1.9	4.0	3.9	6.6	6.3

Normals = 1961-1990

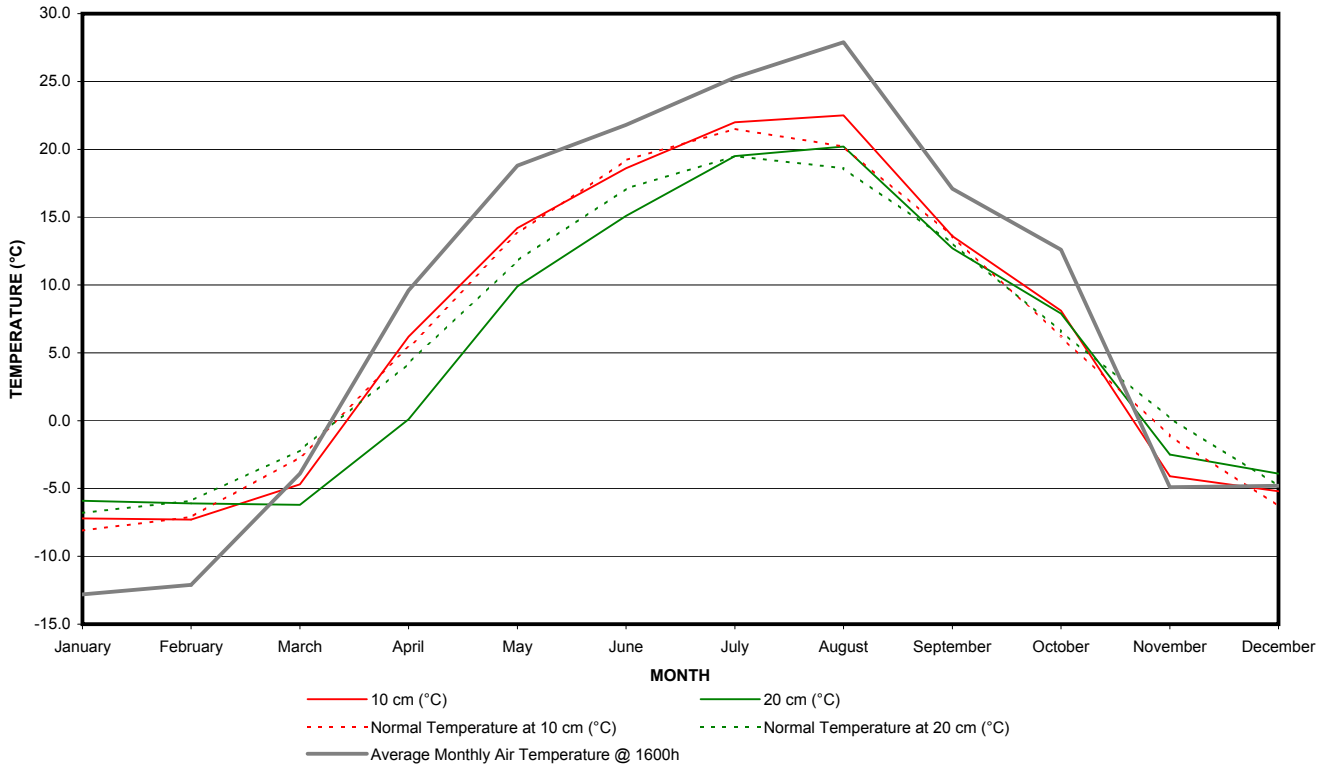


Monthly Average Soil Temperatures at 1600 hrs, 2003

(10 to 20cm depths)

MONTH	Average Monthly Air Temperature	10 cm (°C)		20 cm (°C)	
	@ 1600h	2003	Normal	2003	Normal
January	-12.8	-7.2	-8.1	-5.9	-6.8
February	-12.1	-7.3	-7.1	-6.1	-5.9
March	-3.9	-4.7	-2.7	-6.2	-2.2
April	9.6	6.2	5.4	0.1	4.2
May	18.8	14.2	13.8	9.9	11.8
June	21.8	18.6	19.2	15.1	17.1
July	25.3	22.0	21.5	19.5	19.5
August	27.9	22.5	20.2	20.2	18.6
September	17.1	13.6	13.6	12.7	13.1
October	12.6	8.1	6.2	7.9	6.6
November	-4.9	-4.1	-1.1	-2.5	0.2
December	-4.8	-5.2	-6.3	-3.9	-4.8

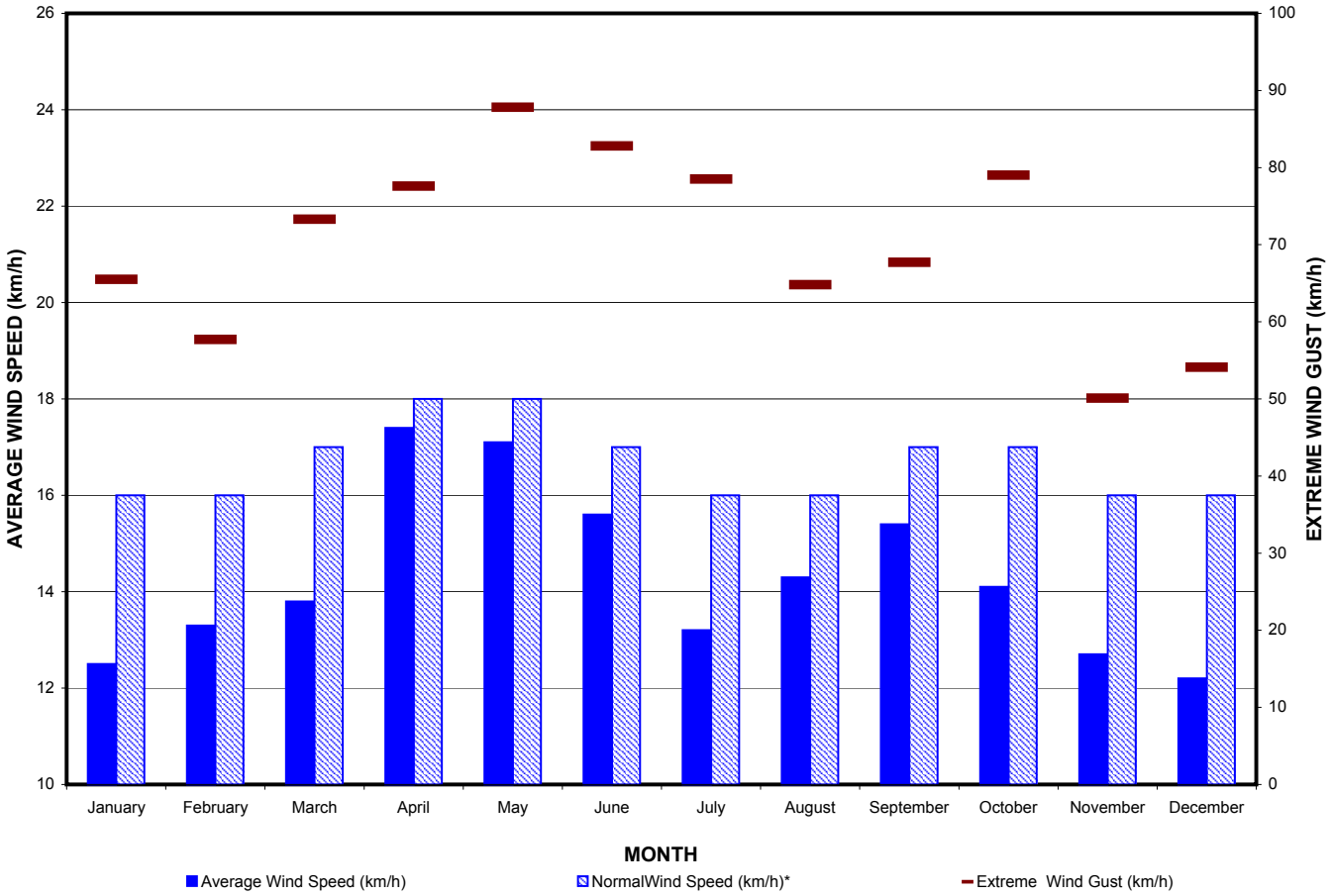
Normal = 1961-1990



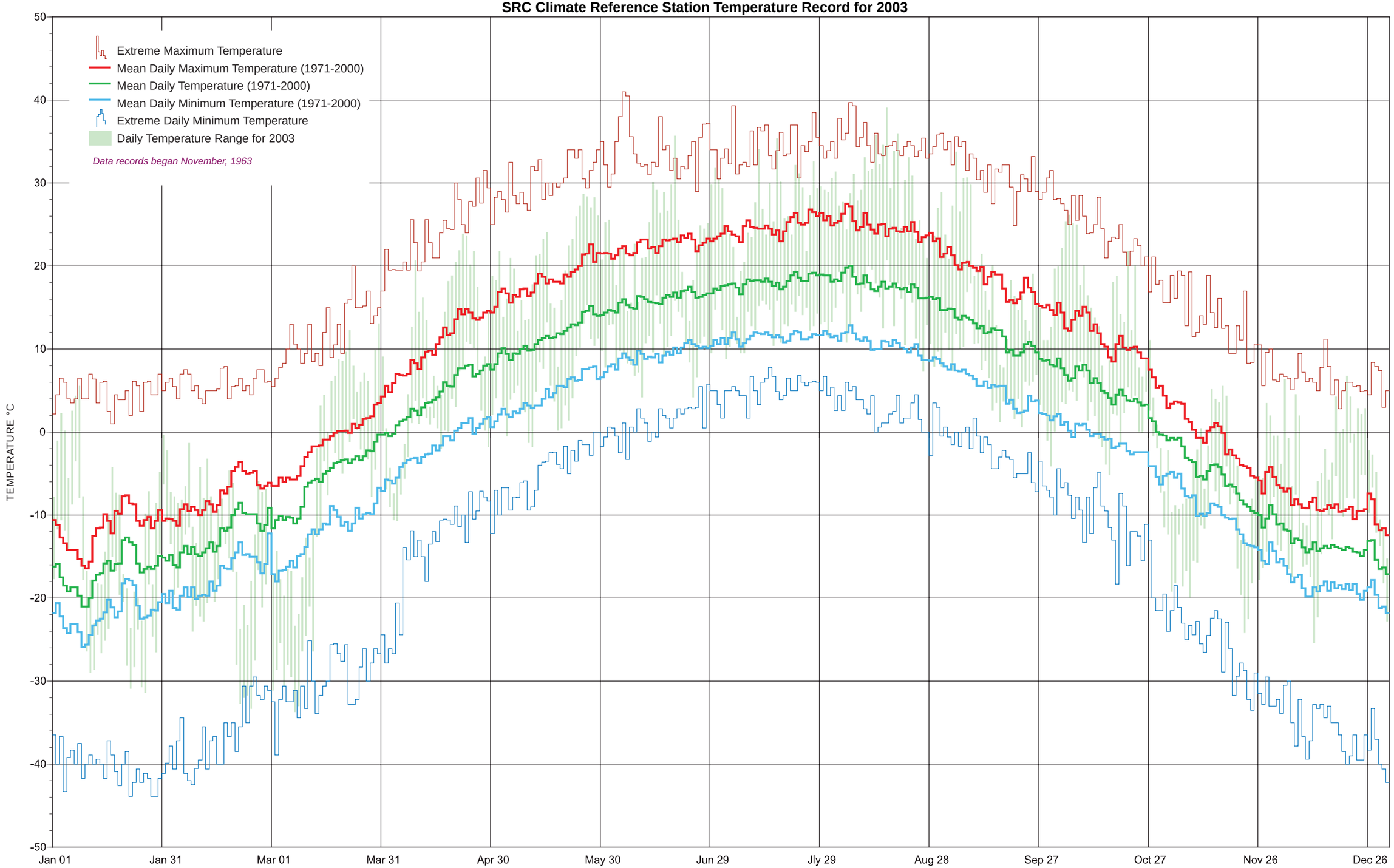
Monthly Average Wind Speed and Extreme Gusts, 2003

MONTH	AVERAGE (km/h)		EXTREME GUST (km/h)		
	2003	Normal*	Direction	2003	Date
January	12.5	16.0	WNW	65.5	08
February	13.3	16.0	N	57.7	11
March	13.8	17.0	W	73.3	23
April	17.4	18.0	WNW	77.6	09
May	17.1	18.0	WNW	87.8	16
June	15.6	17.0	WNW	82.8	27
July	13.2	16.0	W	78.5	13
August	14.3	16.0	WNW	64.8	08
September	15.4	17.0	SW&WNW	67.7	10&23
October	14.1	17.0	WNW	79.0	23
November	12.7	16.0	NW	50.1	05
December	12.2	16.0	SSE	54.1	05

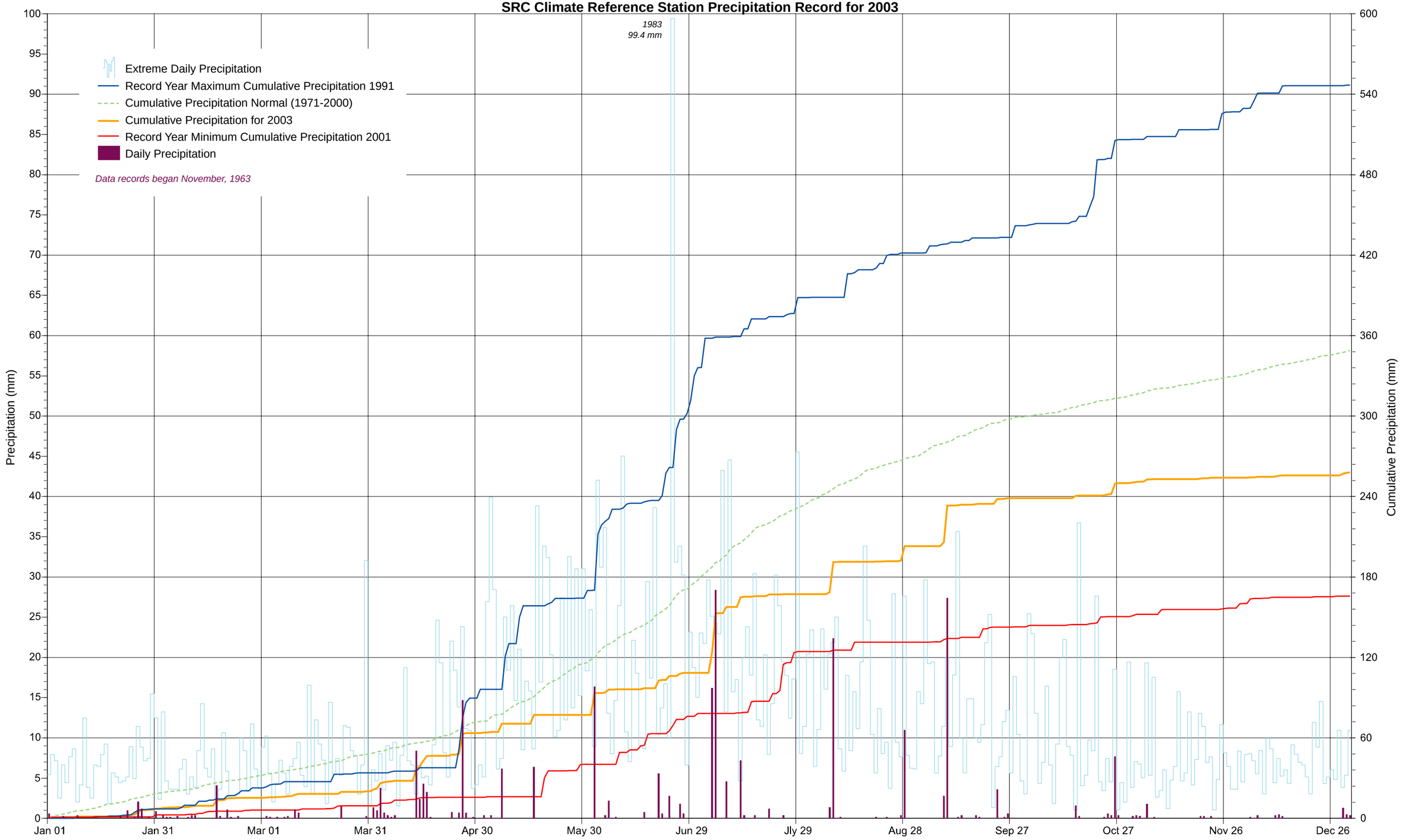
*1961-90 Normals used are from the Environment Canada, Saskatoon Airport station



SRC Climate Reference Station Temperature Record for 2003



SRC Climate Reference Station Precipitation Record for 2003



Saskatchewan Research Council

Annual Weather Summary

latitude 52°09'N Longitude 106°36W asl 497 m Saskatoon

CRS estab. 1963

		2003 VALUE	2002 VALUE	NORMAL (1971-2000) OR EXTREME (1892-2002)
TEMPERATURE	Average annual maximum (°C)	9.3	8.5	8.3
	Extreme annual maximum (°C/date)	38.9 August 16	37.2 June 28	41.0 June 1988
	Average annual minimum (°C)	-2.5	-2.9	-3.4
	Extreme annual minimum (°C/date)	-33.9 March 07	-32.2 Jan. 31	-50.0 Feb. 1893
	Annual average (°C)	3.4	2.8	2.5
	No.of Frost days (Temperature ≤ 0°C)	179	219	197.1
DEGREE-DAYS	Annual growing (5°C base)	2019.5	1699.9	1672.9
	Annual frost-free growing (5°C base)	1691.0	1572.2	1691.0
	Annual heating (18°C base)	5527.2	5760.9	5808.8
	Annual cooling (18°C base)	257.4	227.9	119.1
PRECIPITATION	Annual total (mm)	257.7	320.0	348.2
	Greatest 24-hr (mm/date)	28.4/July 06	32.2 July 09	99.4 June 24, 1983
	Measurable precipitation days (≥ 0.2mm)	110	107	115.7
WIND	Average monthly speed (km/h)	14.9	14.5	16.6*
	Peak gust (direction/speed/date)	87.8^{WNW}May 16	78.2^{W}May 29	151.0 ^{W}Aug 14, 1967*
RADIATION	Total annual bright sunshine (hours)	2389.8	2313.6	2294.1
	% possible bright sunshine	53.3	51.6	51.2
	% normal bright sunshine	104.2		
	Bright Sunshine days	322	319	319.8
	Total annual global radiation(MJ/m^2)	4585.2	4857.0	4391.9**
	Total annual diffuse radiation (MJ/m^2	1770.5	1705.9	1729.6**

For Your Information

2003

July 16 - Diffuse repaired (½ hour of loss data)

Oct 22 - 23. Stevenson screen repaired
RM Young Anenommeter lower for routine inspection. (1½ hrs at noon loss data)
Grass temperature calibrated
Soil temperatures checked and evaluated

Normal and Extreme Values

The 1971-2000 normals for CRS have been calculated from original data entered on computerized spreadsheets and checked for correctness. Where suitable, missing data has been replaced with data from the University of Saskatchewan, Kernen Farm station (2.5 km E of CRS) and the Meteorological Service of Canada Airport station (10 km WNW of CRS). Wind normals marked with '*' are from the MSC airport station. Global and Diffuse radiation normals marked by '**' are from 1961-1990 period.

Extreme values are from the Saskatoon area weather stations extending back to 1882. The earlier records from 1882 to 1901 have several large gaps.

Saskatchewan Research Council

Monthly Weather Summary

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CRS estab. 1963

	January 2003		2003 VALUE	2002 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)		-10.3	-9.2	-11.6 (-12.4)	
	Extreme monthly maximum (°C/date)		5.4/08	6.8/08	7.0/1986/11	10.0/1931/30
	Average monthly minimum (°C)		-20.3	-17.6	-21.8 (-22.6)	
	Extreme monthly minimum (°C/date)		-31.6/26	-32.2/31	-43.0/1966/22&1969/29	-48.9/1893/31
	Monthly average (°C)		-15.3	-13.4	-16.7 (-17.4)	
	No.of Frost days (Temperature ≤ 0°C)		31	30	31(31)	
DEGREE-DAYS	Monthly growing (5°C base)		0.0	0.0	0.0 (0.0)	
	Yearly total-to-date growing		0.0	0.0	0.0 (0.0)	
	Monthly heating (18°C base)		1033.1	973.3	1076.9 (1114.8)	
	Yearly total-to-date heating		1033.1	973.3	1076.9 (1114.8)	
	Monthly cooling (18°C base)		0.0	0.0	0.0 (0.0)	
	Yearly total-to-date cooling		0.0	0.0	0.0 (0.0)	
PRECIPITATION	Monthly total (mm)		7.2	2.9	18.2(20.5)	
	Yearly total-to-date (mm)		7.2	2.9	18.2(20.5)	
	Greatest 24-hr (mm/date)		2.1/26	1.1/02	15.4/1989/30	30.5/1893/23
	Measurable precipitation days (≥ 0.2mm)		10	6	11(11)	
WIND	Average monthly speed (km/h)		12.5	12.2		16.0
	Peak gust (speed/direction/date)		65.5^{WNW}08	42.0^{NW}13		111.0^{W}1986/11
RADIATION	Monthly bright sunshine (hours)		124.9	107.5	103.3(104.6)	
	% possible bright sunshine		48.2	41.5	39.9(40.4)	
	% normal bright sunshine		120.9			
	Bright Sunshine days		26	21	23.8(24)	
	Monthly global radiation(MJ/m^2)		133.7	113.7	(129.9)	
	Monthly diffuse radiation (MJ/m^2)		66.6	61.7	(71.4)	
SOIL	Average temperature (°C) @ 9:00am	grass level	-10.2			
		10 cm/20 cm	-7.2/-5.8	-7.6/-5.3	(-8.3/-7.6)	
		50 cm/100cm	-3.6/-0.1	-2.8/0.8	(-3.8/-0.2)	
		150 cm/300cm	1.8/4.5	2.7/5.4	(1.8/4.5)	

For Your Information

Surprisingly, overall January 2003 was above the normal mean temperature. Ranging from an extreme maximum of 5.4° to an extreme minimum of -31.6°C, the temperature mean was 1.4°C above the normal mean value. Heating degree-days reflected the warmer temperatures with a slight decrease in the monthly value. The precipitation, 39.6% of normal, fell as snow and unfortunately, rain, creating very slippery streets and sidewalks. Soil temperatures ranged between normal and 1.8°C above normal. Frost was recorded during the last half of the month at the 100 cm level but has yet to be recorded at either the 150 cm or the 300 cm level. The station recorded two days more bright sunshine than normal translating into an increase of 21.6 hours. The wind only reached above 50 kph on three days with a daily average of 12.5 kph. Overall, for a January, the month was pleasant.

How does one define pleasant? Environment Canada has devised the **climate severity index** to rate a locale's climate in terms of human comfort and well-being. A score of 50 points and above is deemed as an uncomfortable place to live weather-wise. The scoring is based on four areas: *Discomfort* (50 points), *Psychological state* (20 points), *Hazardousness* (20 points) and *Outdoor mobility* (10 points). *Winter Discomfort*, a sub-component of *Discomfort,* is the biggest contributor with 35 points. Using this index, the only places in the prairie provinces with an airport that are considered uncomfortable are Cree Lake, (51), Brochet, (57), Churchill (82), Gimli (52), The Pas (52), Thompson (53) and Winnipeg (51). Saskatoon (42) does not make it but Regina (49) comes very close. The best place is Medicine Hat (29).[1]

[1] Phillips, 1998

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CRS estab. 1963

	February 2003		2003 VALUE	2002 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)		-10.1	-2.1	-7.7(-8.6)	
	Extreme monthly maximum (°C/date)		-1.5/07	7.9/17	7.5/1988/26 & 1991/06	12.8/1931/19
	Average monthly minimum (°C)		-20.2	-12.2	-17.6(-18.3)	
	Extreme monthly minimum (°C/date)		-33.5/24	-27.4/28	-41.1/1972/06	-50.0/1893/01
	Monthly average (°C)		-15.2	-7.2	-12.6(-13.7)	
	No. of Frost days (Temperature ≤ 0°C)		28	28	28(28)	
DEGREE-DAYS	Monthly growing (5°C base)		0.0	0.0	0.0(0.0)	
	Yearly total-to-date growing		0.0	0.0	0.0(0.0)	
	Monthly heating (18°C base)		928.7	705.1	866.3(909.9)	
	Yearly total-to-date heating		1961.8	1678.4	1963.2(2024.7)	
	Monthly cooling (18°C base)		0.0	0.0	0.0(0.0)	
	Yearly total-to-date cooling		0.0	0.0	0.0(0.0)	
PRECIPITATION	Monthly total (mm)		8.1	3.3	13.3(14.6)	30.0/1962/03
	Yearly total-to-date (mm)		15.3	6.2	31.5(35.1)	
	Greatest 24-hr (mm/date)		4.1/17	2.8/19	14.2/1979/13	
	Measurable precipitation days (≥ 0.2mm)		12	3	10(10)	
WIND	Average monthly speed (km/h)		13.3	14.1		16.0
	Peak gust (speed/direction/date)		57.7^{N}11	66.3^{NW}11		106.0^{N}1988/22
RADIATION	Monthly bright sunshine (hours)		110.0	157.4	132.3(134.1)	
	% possible bright sunshine		39.5	56.4	47.4(48.2)	
	% normal bright sunshine		83.1			
	Bright Sunshine days		19	26	24.2(25)	
	Monthly global radiation(MJ/m^2)		202.1	200.1	(210.1)	
	Monthly diffuse radiation (MJ/m^2)		107.6	90.6	(105.3)	
SOIL	Average temperature (°C) @ 9:00am	grass level	-7.5			
		10 cm/20 cm	-7.3/-6.1	-6.2/-4.3	(-7.3/-6.8)	
		50 cm/100cm	-4.7/-1.7	-3.4/-0.8	(-4.1/-1.0)	
		150 cm/300cm	0.2/3.1	0.9/3.9	(0.8/3.3)	

For Your Information

February was dull, dry and dispiriting cold. The latter portion of February was the coldest. On the 20th, temperatures slipped to -28°C, lingered below -30°C for the next four days, rose to -28°C on the 25th then recovered to near seasonable values for the remainder of the month. You know it has been cold when people comment '*how nice and warm it is*' and the temperature is hovering around -20°C. With the cold temperatures, it was fortunate wind speed values were low for the month. Precipitation was 61% of normal with 19cm of snow measured on the ground. February lacked 5 days of bright sunshine as compared to normal. Twelve days recorded less than one hour of bright sunshine lowering the monthly total 22.3 hours below normal. At 150cm level, soil temperatures remained steady around 0°C with the 300cm level temperatures slowly falling to 2.5°C by month's end.

How cold can it get? Ask the meteorologists who manned the Snag weather station in the Yukon on February 3rd, 1947 when North America's official coldest temperature was recorded. They had to wait until May for the official temperature as the alcohol in the thermometer had fallen below the last marking of -80°C. After calibration, a value of -81.4°C was accepted. Water tossed into the air froze into wheat-kennel-size pellets before hitting the ground.[1]

[1]Phillips, 1998.

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CRS estab. 1963

	March 2003	2003 VALUE	2002 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	-2.8	-6.7	-0.7(-2.1)	
	Extreme monthly maximum (°C/date)	12.9/30	6.6/28	17.0/1986/27	22.8/1910/23
	Average monthly minimum (°C)	-13.3	-18.0	-10.5(-12.1)	
	Extreme monthly minimum (°C/date)	-33.9/07	-27.6/20	-38.9/1972/02	-43.3/1897/14
	Monthly average (°C)	-8.0	-12.4	-5.6(-7.0)	
	No.of Frost days (Temperature ≤ 0°C)	29	31	30(30)	
DEGREE-DAYS	Monthly growing (5°C base)	1.6	0.0	2.4(1.2)	
	Yearly total-to-date growing	1.6	0.0	2.4(1.2)	
	Monthly heating (18°C base)	807.0	942.5	732.1(784.1)	
	Yearly total-to-date heating	2768.8	2620.9	2695.3(2808.8)	
	Monthly cooling (18°C base)	0.0	0.0	0.0(0.0)	
	Yearly total-to-date cooling	0.0	0.0	0.0(0.0)	
PRECIPITATION	Monthly total (mm)	4.8	8.1	16.2(19.9)	
	Yearly total-to-date (mm)	20.1	14.3	47.7(55.0)	
	Greatest 24-hr (mm/date)	1.5/23	1.2/29	32.0/1967/30	32.0/1967/30
	Measurable precipitation days (≥ 0.2mm)	9	13	9(9)	
WIND	Average monthly speed (km/h)	13.8	13.9		17.0
	Peak gust (speed/direction/date)	73.3^{W}23	60.3^{NNW}29		93.0^{W}1959/18
RADIATION	Monthly bright sunshine (hours)	209.0	200.4	175.2(174.6)	
	% possible bright sunshine	56.7	54.3	47.4(47.4)	
	% normal bright sunshine	119.3			
	Bright Sunshine days	29	30	27.1(27)	
	Monthly global radiation(MJ/m^2)	412.8	384.1	(362.4)	
	Monthly diffuse radiation (MJ/m^2)	182.3	170.3	(173.9)	
SOIL	Average temperature (°C) @ 9:00am grass level	-4.8			
	10 cm/20 cm	-5.1/-6.1	-8.4/-5.8	(-3.1/-2.8)	
	50 cm/100cm	-4.0/-1.9	-4.6/-1.4	(-1.8/-0.6)	
	150 cm/300cm	-0.4/2.0	0.3/2.8	(0.4/2.5)	

For Your Information

If March comes in like a lion, it arrived wearing long underwear and its teeth chattering instead of roaring. The first one third of the month was marked by unseasonably low minimum temperatures dipping below -30°C on four occasions. Even the maximum daily temperatures did not rise above -10°C until the 13th. Although the rest of the month experienced springlike temperatures, they could not offset the bone chilling beginning. Precipitation, remaining below normal for the month and the year, fell as snow, rain, pellets and even, on the 27th, as graupel during a brief thunderstorm. Gale (63-75 kph) force winds were recorded 23rd. Bright sunshine was above normal with only three days recording less than one hour of bright sunshine. The geese arrived back from their winter vacation around the 15th along with a bald eagle. The gophers were up out of their holes by at least the 19th.

For every disaster, there is an entrepreneur who sees an opportunity. A year after southern Manitoba's "1997 Flood of the Century," a Letellier hotelier advertised 'flood theme' rooms complete with rubber boots by the warm, dry bed, sandbags on the floor, and evacuation instructions on the wall. Customers from as far away as Switzerland took advantage of the offer[1].

[1] Phillips, 2002.

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CRS estab. 1963

April 2003

		2003 VALUE	2002 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	10.8	6.4	10.7 (9.9)	
	Extreme monthly maximum (°C/date)	23.7/22	19.3/13	31.5/2001/28	33.3/1952/28
	Average monthly minimum (°C)	0.6	-6.3	-1.7 (-2.0)	
	Extreme monthly minimum (°C/date)	-10.9/04	-19.1/03	-27.8/1979/01	-28.3/1893/05&1954/02
	Monthly average (°C)	5.7	0.1	4.5 (4.0)	
	No. of Frost days (Temperature ≤ 0°C)	12	27	21(20)	
DEGREE-DAYS	Monthly growing (5°C base)	104.8	22.2	61.3 (54.8)	
	Yearly total-to-date growing	106.4	22.2	63.7 (55.7)	
	Monthly heating (18°C base)	368.0	537.4	420.7 (420.9)	
	Yearly total-to-date heating	3136.8	3136.8	3116.0. (3196.9)	
	Monthly cooling (18°C base)	0.0	0.0	0.3 (0.2)	
	Yearly total-to-date cooling	0.0	0.0	0.3 (0.2)	
PRECIPITATION	Monthly total (mm)	43.6	12.0	23.6(20.3)	30.2/1955/19
	Yearly total-to-date (mm)	63.7	26.3	71.3(75.3)	
	Greatest 24-hr (mm/date)	14.7/26	5.0/23	24.6/1985/19	
	Measurable precipitation days (≥ 0.2mm)	17	8	8(7)	
WIND	Average monthly speed (km/h)	17.4	15.9		18.0
	Peak gust (speed/direction/date)	77.6^{WNW}09	74.0^{WSW}15		108.0^{W}1959/06
RADIATION	Monthly bright sunshine (hours)	180.5	223.2	225.2(229.4)	
	% possible bright sunshine	43.2	53.3	53.8(54.9)	
	% normal bright sunshine	80.2			
	Bright Sunshine days	19	28	27.3(27)	
	Monthly global radiation(MJ/m^2)	447.2	500.1	(492.2)	
	Monthly diffuse radiation (MJ/m^2)	182.1	207.9	(178.5)	
SOIL	Average temperature (°C) @ 9:00am grass level	8.7			
	10 cm/20 cm	4.3/0.3	1.9/3.3	(3.2/3.5)	
	50 cm/100cm	2.7/1.5	1.0/0.6	(2.5/1.2)	
	150 cm/300cm	1.0/1.8	0.9/2.2	(1.2/2.2)	

For Your Information

If '*April showers bring forth May flowers*' then this May will be an exceptional month for blossoms. The station recorded precipitation on 17 days (twice the normal) producing 43.6 mm or 85% more than normal precipitation. The number of precipitation days is reflected in only 19 days of bright sunshine (8 days less than normal) for a total 180.5 hours (44.7 hours less than normal). The average temperatures were below freezing for the first six days of April and then remained above freezing for the remainder of the month. The above average minimum temperatures were the major contributor to the 1.2°C above normal mean monthly temperature. Winds were relatively low with 'Near Gale' (51-62 km/h) winds occurring twice and 'Strong Gale' (76-87 km/h) winds occurring once.

By convention, winds are named from the direction they are coming from. A 'north' wind blows from the north. This was not always so. In the Middle Ages, the names of the winds were known throughout the Mediterranean countries as *tramontana* (N), *greco* (NE), *levante* (E), *siroco* (SE), *ostro* (S), *libeccio* (SW), *ponente* (W) and *maestro* (NW). On maps of this era you can see the initials of these winds labelled as *T, G, L, S, O, L, P*, and *M*.[1]

[1] Thoen, 2001.

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CRS estab. 1963

May 2003		2003 VALUE	2002 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	20.2	17.7	18.6 (18.5)	
	Extreme monthly maximum (°C/date)	28.5/25	29.0/28&29	35.0/1988/30	37.2/1936/27
	Average monthly minimum (°C)	5.7	1.4	4.7(4.5)	
	Extreme monthly minimum (°C/date)	-2.0/11	-9.4/05	-10.0/1967/02	-12.8/1907/06
	Monthly average (°C)	13.0	9.6	11.6 (11.5)	
	No.of Frost days (Temperature ≤ 0°C)	4	14	6(7)	
DEGREE-DAYS	Monthly growing (5°C base)	248.1	170.7	211.6(209.0)	
	Yearly total-to-date growing	354.5	192.9	275.3(265.4)	
	Monthly heating (18°C base)	166.2	267.2	204.4(206.9)	
	Yearly total-to-date heating	3303.0	3425.5	3320.4 (3436.6)	
	Monthly cooling (18°C base)	10.2	5.9	7.4 (7.0)	
	Yearly total-to-date cooling	10.2	5.9	7.7 (7.2)	
PRECIPITATION	Monthly total (mm)	13.4	0.2	44.3(43.7)	
	Yearly total-to-date (mm)	77.1	26.5	115.6(119.0)	
	Greatest 24-hr (mm/date)	6.4/16	0.2/01	39.9/1985/04	51.3/1909/30
	Measurable precipitation days (≥ 0.2mm)	4	1	9(10)	
WIND	Average monthly speed (km/h)	17.1	19.0		18.0
	Peak gust (speed/direction/date)	87.8^{WNW}16	78.2^{W}29		132.0^{SW}1965/17
RADIATION	Monthly bright sunshine (hours)	289.0	324.3	267.1(285.7)	
	% possible bright sunshine	59.3	66.5	54.8(58.7)	
	% normal bright sunshine	108.2			
	Bright Sunshine days	31	31	29.5(29)	
	Monthly global radiation(MJ/m^2)	671.8	842.3	(586.3)	
	Monthly diffuse radiation (MJ/m^2)	237.8	206.2	(222.2)	
SOIL	Average temperature (°C) @ 9:00am — grass level	20.8			
	10 cm/20 cm	11.1/9.9	9.8/10.8	(10.6/10.9)	
	50 cm/100cm	9.3/7.0	6.9/4.8	(8.9/5.9)	
	150 cm/300cm	5.2/3.3	3.8/3.0	(4.4/3.1)	

For Your Information

May was a gardeners' month with average temperatures about 1°C above normal. The last frost occurred on 18th, right on the normal date. Growing degree-days were above average along with the below average heating degree-days. Everyday contributed to the above average monthly total for bright sunshine. The only disappointment was the lack of precipitation. Three events had occurred by the 7th but the next rain and, as it turned out, the last rain did not occur until the 16th. Most gardeners resorted to sprinklers to supply the needed water for emerging plants. During the last half of the month, along with the lack of rain, the winds were very strong with speeds ranging from 52 km/h to 87.8 km/h.

With dry conditions and high winds, situations known as black blizzards can occur as was the case two years ago between Red Deer and Calgary. Eighty-five km/h winds whipped topsoil off farmers' fields causing a 15-car pile-up. Two hours later the blackout changed to whiteout conditions as a freak snowstorm pounded the region with winds snapping lamp posts, uprooting trees and ripping out fences[1].

[1]Phillips, 2002.

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CRS estab. 1963

June 2003		2003 VALUE	2002 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	23.3	24.6	22.6 (22.6)	
	Extreme monthly maximum (°C/date)	35.5/19	37.2/28	41.0/1988/05	41.0/1988/05
	Average monthly minimum (°C)	10.2	11.4	9.5 (9.2)	
	Extreme monthly minimum (°C/date)	4.0/10&24	5.4/07	-3.3/1967/06	-3.9/1903/09&1917/02
	Monthly average (°C)	16.7	18.1	16.0 (15.9)	
	No. of Frost days (Temperature ≤ 0°C)	0	0	1 (0)	
DEGREE-DAYS	Monthly growing (5°C base)	352.3	391.7	331.5 (327.3)	
	Yearly total-to-date growing	706.8	584.6	606.8 (592.7)	
	Monthly heating (18°C base)	67.1	58.4	82.8 (84.0)	
	Yearly total-to-date heating	3370.1	3483.9	3403.2 (3520.6)	
	Monthly cooling (18°C base)	29.4	60.1	22.3 (21.2)	
	Yearly total-to-date cooling	39.6	66.0	30.0 (28.4)	
PRECIPITATION	Monthly total (mm)	31.4	54.2	59.5 (63.6)	
	Yearly total-to-date (mm)	108.5	80.7	175.1 (182.6)	
	Greatest 24-hr (mm/date)	16.4/02	16.0/17	99.4/1983/24	99.4/1983/24
	Measurable precipitation days (≥ 0.2mm)	10	9	12 (12)	
WIND	Average monthly speed (km/h)	15.6	15.3		17.0
	Peak gust (speed/direction/date)	82.8WNW27	73.2WNW17		117.0S1986/01
RADIATION	Monthly bright sunshine (hours)	240.7	246.9	277.2 (297.2)	
	% possible bright sunshine	48.1	49.4	55.4 (59.4)	
	% normal bright sunshine	86.8			
	Bright Sunshine days	30	25	28.5 (29)	
	Monthly global radiation(MJ/m²)	626.1	818.5	(638.7)	
	Monthly diffuse radiation (MJ/m²)	254.3	223.7	(228.1)	
SOIL	Average temperature (°C) @ 9:00am grass level	21.5			
	10 cm/20 cm	15.6/15.0	16.9/17.6	(15.7/16.2)	
	50 cm/100cm	13.2/10.7	12.8/9.4	(14.0/10.4)	
	150 cm/300cm	8.6/5.5	7.4/4.8	(8.2/5.2)	

For Your Information

June average temperatures were just slightly above normal. The maximum temperatures ranged from a low of 13.2°C on the 21st to 35.5°C on the 19th. Thirteen days recorded temperatures above 25°C but only two were above 30°C. Precipitation was very spotty with virga observed on many occasions. This station received 31.4mm while Saskatoon Airport station noted only 19 mm[1]. Over half the monthly total poured from the skies during a midday storm on June 2nd raising false hopes of things to come. Even though every day recorded bright sunshine, the month was 86.8% of normal. During the morning of June 20th, the sun was obscured by smoke drifting southward from northern forest fires. Winds were strong during the latter half of the month culminating in 'Strong Gale' winds (82.8 kph) from the WNW on the 27th.

Weather records are set when least expected. On June 29th, 1963 a remarkable 1-day snowfall of 111.8 cm occurred at the Livingston Ranger Station (north of Frank, AB). For several years this stood as the greatest all-time 1-day snowfall ever recorded in Canada. The record was broken on the 17th January 1974 at Lakelse, BC and again on 11th February 1999, at Tahtsa Lake West, BC (both SE of Terrace, BC)[2,3].

[1] Environment Canada, 2003 [2]Phillips, 2002 [3]American Automobile Association, 1996.

Saskatchewan Research Council

Monthly Weather Summary

latitude 52°09'N Longitude 106°36W asl 497 m Saskatoon

CRS estab. 1963

	July 2003		2003 VALUE	2002 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)		26.7	27.8	24.8 (25.1)	
	Extreme monthly maximum (°C/date)		35.2/17	37.0/14	39.3/ 2001/05	40.0/1919/17&1941/19&1946/30
	Average monthly minimum (°C)		12.9	14.0	11.5 (11.5)	
	Extreme monthly minimum (°C/date)		8.6/03	6.8/03	1.7/1967/02&1978/09	-0.6/1918/25
	Monthly average (°C)		19.8	20.9	18.2 (18.3)	
	No.of Frost days (Temperature ≤ 0°C)		0	0	1(0)	
DEGREE-DAYS	Monthly growing (5°C base)		459.5	493.9	408.4 (414.8)	
	Yearly total-to-date growing		1166.3	1078.5	1015.2(1007.5)	
	Monthly heating (18°C base)		16.8	19.0	35.3 (32.0)	
	Yearly total-to-date heating		3386.9	3502.9	3438.5(3552.6)	
	Monthly cooling (18°C base)		73.3	109.9	40.7 (43.9)	
	Yearly total-to-date cooling		112.9	175.9	70.7(72.3)	
PRECIPITATION	Monthly total (mm)		58.8	70.8	58.0 (55.7)	
	Yearly total-to-date (mm)		167.3	151.5	233.1 (238.3)	
	Greatest 24-hr (mm/date)		28.4/06	26.6/09	45.5/1968/29	79.2/1946/03
	Measurable precipitation days (≥ 0.2mm)		8	9	12(11)	
WIND	Average monthly speed (km/h)		13.2	16.0		16.0
	Peak gust (speed/direction/date)		78.5^{W}13	75.6^{WNW}05		113.0^{E}1955/05
RADIATION	Monthly bright sunshine (hours)		321.0	314.1	305.7(329.1)	
	% possible bright sunshine		63.9	62.6	60.9(65.8)	
	% normal bright sunshine		105.0			
	Bright Sunshine days		30	30	30.3(30)	
	Monthly global radiation(MJ/m^2)		679.7	700.8	(633.5)	
	Monthly diffuse radiation (MJ/m^2)		210.4[1]	193.9	(216.5)	
SOIL	Average temperature (°C) @ 9:00am	grass level	24.4			
		10 cm/20 cm	18.8/19.2	19.6/20.7	(18.0)/(18.8)	
		50 cm/100cm	16.4/13.1	16.7/13.0	(16.8)/(13.2)	
		150 cm/300cm	10.9/7.5	10.5/6.9	(11.1)/(7.5)	

For Your Information

Hot! describes July 2003. Of the 16 days which were above 27°, seven were above 30°. New daily station records were set on the 17th (35.2°:old 33.9°/1967&2002) and 23rd (31.0°:old 30.6°/1978). The monthly maximum average was 1.9° above normal with the monthly minimum average 1.4° above normal. The high temperatures are reflected in the above normal growing degree-days. By month's end, harvesting of canola and peas had begun with other crops rated as advanced for this time of year.[2] Any energy saving costs, due to heating degree-days being less than half, were offset by the cost of cooling. Cooling degree-days were 80% above normal. Precipitation was near normal with 76% of the rain occurring over a 32 hour period on the 5th and 6th. The 6th also saw a new daily precipitation record set with 28.4mm; 4.2mm more than the old record set in 2000. 'Gale' and 'Strong Gale' winds occurred on the 2nd and 13th.

Lightning has been the cause of some strange responses. Up to 1786, church bells were rung in France in an effort to prevent lightning strikes from hitting the spires. After 103 bell ringers were killed between 1753 and 1786, the French government outlawed the practice.[3] Fashionable women, during the 1770's, sported lightning rods from their hats complete with a silver chain to trail on the ground, similar to those seen nowadays on oil trucks.[4]

[1] ½ day missing due to maintenance. [2] SAFRR, 2003 [3] Canadian Geographic 2000 [4] Phillips, 1996.

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Monthly Weather Summary

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CRS estab. 1963

August 2003		2003 VALUE	2002 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	28.9	23.4	24.6(24.3)	
	Extreme monthly maximum (°C/date)	38.9/16	32.8/24	39.7/1998/06	39.7/1998/06
	Average monthly minimum (°C)	14.3	11.2	10.4(10.1)	
	Extreme monthly minimum (°C/date)	7.1/26	2.6/02&04	-2.8/1976/28	-2.8/1976/28&1901/23
	Monthly average (°C)	21.6	17.3	17.5(17.2)	
	No. of Frost days (Temperature ≤ 0°C)	0	0	1(0)	
DEGREE-DAYS	Monthly growing (5°C base)	516.0	382.8	387.8(379.6)	
	Yearly total-to-date growing	1682.3	1461.3	1403.0 (1387.1)	
	Monthly heating (18°C base)	13.2	65.8	57.7(62.4)	
	Yearly total-to-date heating	3400.1	3568.7	3496.2(3615.0)	
	Monthly cooling (18°C base)	126.2	45.6	42.5(39.0)	
	Yearly total-to-date cooling	239.1	221.4	113.2 (111.3)	
PRECIPITATION	Monthly total (mm)	36.0	81.8	36.2(35.3)	84.3/1945/03
	Yearly total-to-date (mm)	203.3	233.3	269.3(273.6)	
	Greatest 24-hr (mm/date)	22.4/08	18.0/11	33.8/1998/17	
	Measurable precipitation days (≥ 0.2mm)	8	18	10 (9)	
WIND	Average monthly speed (km/h)	14.3	12.5		16.0
	Peak gust (speed/direction/date)	64.8^{WNW}08	62.2^{E}25		151.0^{W}1967/14
RADIATION	Monthly bright sunshine (hours)	274.2	221.9	280.8(295.2)	
	% possible bright sunshine	60.5	49.0	62.0 (65.2)	
	% normal bright sunshine	97.6			
	Bright Sunshine days	29	30	30.1(30)	
	Monthly global radiation(MJ/m^2)	548.4	514.8	(529.0)	
	Monthly diffuse radiation (MJ/m^2)	182.8	187.4	(185.6)	
SOIL	Average temperature (°C) @ 9:00am — grass level	23.4			
	10 cm/20 cm	19.6/20.2	15.0/16.3	(16.8)/(17.9)	
	50 cm/100cm	18.0/15.2	14.5/12.9	(16.8)/(14.1)	
	150 cm/300cm	13.0/9.4	11.6/8.8	(12.4)/(9.1)	

For Your Information

July was hot; but August was hotter. Six temperature records were tied or set starting with a new average monthly temperature of 21.6°; 0.6° higher than the previous 1998 and 2001 record. The average monthly maximum temperature of 28.9° tied the 1998 record while the average monthly minimum of 14.3° surpassed the old 1991 record of 13.4°. Three daily extreme maximum temperature records were set on the 15th (34.4°), 16th (38.9°) and 19th (35.8°). August experienced 15 days with temperatures above 30°, 8 above 32° and 3 above 35°. A heat wave, defined as three days or more with temperatures of at least 32°, occurred from the 13th to the 16th. The extreme temperatures are reflected in the various degree-days monthly totals with the extreme cooling degree-days (base 24 °C) the most notable at 7 times the normal. Temperature was not the only record breaking weather element. August 8th saw the 1995 daily precipitation record of 21.8mm replaced by 22.4mm which was almost two-thirds of the monthly total.

The continental wide heat wave of 1936 stands as one of the worst on record. At its July peak, southern Saskatchewan and Manitoba experienced 13 consecutive days of unbearable temperatures. By September, nationally 780 deaths were directly attributed to the heat while another 400, including several drownings, were indirectly attributed. At Kingston, police chose not to enforce bylaws prohibiting topless male bathing suits but drew the line at male students wearing exposed suspenders. Frying eggs on sidewalks was tried everywhere.[1]

[1] Phillips,1993.

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CRS estab. 1963

	September 2003	2003 VALUE	2002 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	18.2	18.4	18.1(17.7)	
	Extreme monthly maximum (°C/date)	33.6/04	31.3/16	35.6/1978/04	35.6/1978/04
	Average monthly minimum (°C)	6.1	6.2	4.9(4.8)	
	Extreme monthly minimum (°C/date)	-4.3/30	-7.1/27	-7.8/1974/30	-11.1/1908/28
	Monthly average (°C)	12.2	12.4	11.6(11.3)	
	No.of Frost days (Temperature ≤ 0°C)	2	5	6(5)	
DEGREE-DAYS	Monthly growing (5°C base)	217.1	227.0	203.5(196.9)	
	Yearly total-to-date growing	1899.4	1688.3	1606.5(1584.2)	
	Monthly heating (18°C base)	192.7	175.5	198.9(206.6)	
	Yearly total-to-date heating	3592.8	3744.2	3695.1(3821.2)	
	Monthly cooling (18°C base)	18.3	6.4	5.8(6.2)	
	Yearly total-to-date cooling	257.4	227.9	119.0(117.5)	
PRECIPITATION	Monthly total (mm)	35.8	58.2	29.4(32.9)	
	Yearly total-to-date (mm)	239.1	291.5	298.7(307.3)	
	Greatest 24-hr (mm/date)	27.4/09	32.4/30	29.6/1980/03	44.2/1931/12
	Measurable precipitation days (≥ 0.2mm)	9	9	8(9)	
WIND	Average monthly speed (km/h)	15.4	15.1		17.0
	Peak gust (speed/direction/date)	67.7^{SE}10&^{WNW}23	^{NW}63.2/19		^{W}148/1967/22
RADIATION	Monthly bright sunshine (hours)	182.7	206.0	186.0(188.0)	
	% possible bright sunshine	48.1	54.3	49.1(49.6)	
	% normal bright sunshine	98.2			
	Bright Sunshine days	29	25	27.0(26)	
	Monthly global radiation(MJ/m^2)	358.8	359.9	(351.8)	
	Monthly diffuse radiation (MJ/m^2)	150.1	124.2	(127.6)	
SOIL	Average temperature (°C) @ 9:00am — grass level	12.5			
	10 cm/20 cm	11.4/12.7	11.2/12.7	(11.2)/(12.5)	
	50 cm/100cm	13.3/13.2	12.8/12.4	(13.3)/(12.5)	
	150 cm/300cm	12.5/10.5	11.7/9.6	(11.9)/(9.9)	

For Your Information

If there is such a thing as a stereotypical autumn month, than this September was it with its bright colours, clear days and warm weather. Frost was not recorded at the climate station until the 29th. With the last spring frost occurring on May 18th, the frost-free growing season lasted 133 days, 16 days more than normal. Growing degree-days during the frost-free period were 1691.0; 348.6 more than normal. Since 1964, the earliest fall frost occurred on August 13, 1979 with the latest on October 6, 1987. From the 3rd to the 8th, the maximum temperatures were unseasonably high with 3 days above 30°C. The rest of the month's seasonable temperatures coupled with normal bright sunshine made finishing fall work a pleasure rather than a chore. Winds were relatively low throughout the month.

With the passing of September, weather prognosticators look for omens indicating a cold winter. For those who do not have access to high powered computers and sophisticated climate models, nature provides the signs. From beavers adding an extra thick layer of mud to their lodges, to geese booking early travel plans and squirrels stocking up extra winter food, all are noticed and assessed but none more so than the woolly bear caterpillar. At a sighting of the little beasties, rulers and callipers are whipped out to determine whether the brown stripes are narrower than the black, indicating a cold and blustery winter.[1]

[1] Phillips , 1998.

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CRS estab. 1963

	October 2003		2003 VALUE	2002 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)		13.7	4.0	10.8(10.9)	
	Extreme monthly maximum (°C/date)		26.0/05	17.3/09	28.5/1984/08	32.2/1943/05
	Average monthly minimum (°C)		1.0	-4.7	-1.3(-1.3)	
	Extreme monthly minimum (°C/date)		-11.7/31	-13.5/29	-21.5/1984/30&31	-25.6/1919/26
	Monthly average (°C)		7.4	-0.3	4.8(4.8)	
	No. of Frost days (Temperature ≤ 0°C)		12	25	20(19)	
DEGREE-DAYS	Monthly growing (5°C base)		120.1	11.5	63.7(61.5)	
	Yearly total-to-date growing		2019.5	1699.8	1670.2(1645.7)	
	Monthly heating (18°C base)		329.7	568.1	410.2(406.5)	
	Yearly total-to-date heating		3922.5	4312.3	4105.3(4227.7	
	Monthly cooling (18°C base)		0.0	0.0	0.1(0.0)	
	Yearly total-to-date cooling		257.4	227.9	119.1(117.5)	
PRECIPITATION	Monthly total (mm)		11.5	10.9	16.4(17.5)	
	Yearly total-to-date (mm)		250.6	302.4	315.1(324.0)	41.7/1969/03
	Greatest 24-hr (mm/date)		7.7/26	3.0/17	36.7/1984/16	
	Measurable precipitation days (≥ 0.2mm)		8	13	6(6)	
WIND	Average monthly speed (km/h)		20.8	12.7		17.0
	Peak gust (speed/direction/date)		79.0WNW23	SSW56.4/02		NW138/1967/16
RADIATION	Monthly bright sunshine (hours)		198.2	127.2	157.9(160.7)	
	% possible bright sunshine		60.1	38.6	47.9(48.8)	
	% normal bright sunshine		125.5			
	Bright Sunshine days		28	26	27.0(27)	
	Monthly global radiation(MJ/m²)		257.2	216.8	(239.1)	
	Monthly diffuse radiation (MJ/m²)		90.1	127.6	(92.6)	
SOIL	Average temperature (°C) @ 9:00am	grass level	6.4			
		10 cm/20 cm	6.4/8.0	1.9/3.4	(4.5/6.0)	
		50 cm/100cm	9.0/9.9	5.8/8.0	(8.0/9.2)	
		150 cm/300cm	10.4/9.9	9.0/9.2	(9.7/9.5)	

For Your Information

Two daily maximum temperature records were broken this October. On the 5th, the maximum daily temperature of 26°C edged out the 1980 record by one degree. On the 21st, 21.6°C superseded the 1985 maximum daily temperature of 20.0°C. The minimum temperatures generally stayed above freezing until the 13th and even then, did not fall below -10°C until the last day of the month. Frost days were eight less than normal. This month's average temperature of 7.4°C, tied the 1965 October average temperature. These are the highest average October temperatures recorded at the station. With the warm weather, there were clear skies and a quarter more bright sunshine hours than normal. Below normal precipitation amounts fell as snow, rain and ice pellets during the latter half of the month.

This year, All-hallows eve was cold and snowy for the trick-or-treaters and anything else prowling around. However, the cold and snow were preferable to the wind experienced on this date in 1999 when an Alberta clipper raced through Saskatchewan producing 70 km/h winds with snow. Trees were knocked down, siding and eaves troughs were tore off houses and parked cars were moved.[1] It appeared Mother Nature got into the spirit of the night with pranks of her own.

[1] Phillips 2000.

Saskatchewan Research Council

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latitude 52°09'N Longitude 106°36W asl 497 m Saskatoon

CRS estab. 1963

November 2003		2003 VALUE	2002 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	-3.7	0.9	-1.4(-1.5)	
	Extreme monthly maximum (°C/date)	5.4/16	10.1/20	19.4/1975/04	21.7/1903/03
	Average monthly minimum (°C)	-13.8	-8.3	-10.3(-10.6)	
	Extreme monthly minimum (°C/date)	-24.4/22	-15.7/24	-33.5/1985/24	-39.4/1893/30
	Monthly average (°C)	-8.8	-3.7	-5.9(-6.0)	
	No.of Frost days (Temperature ≤ 0°C)	30	28	29(29)	
DEGREE-DAYS	Monthly growing (5°C base)	0.0	0.1	2.6(2.7)	
	Yearly total-to-date growing	2019.5	1699.9	1672.8(1648.4)	
	Monthly heating (18°C base)	804.0	650.8	715.8(721.5)	
	Yearly total-to-date heating	4726.5	4963.1	4821.1(4949.2)	
	Monthly cooling (18°C base)	0.0	0.0	0.0(0.0)	
	Yearly total-to-date cooling	257.4	227.9	119.1(117.5)	
PRECIPITATION	Monthly total (mm)	3.9	3.7	14.8(15.5)	
	Yearly total-to-date (mm)	254.5	306.1	329.9(339.5)	
	Greatest 24-hr (mm/date)	1.8/04	1.4/08	19.3/1978/04	27.9/1938/01
	Measurable precipitation days (≥ 0.2mm)	8	7	8(8)	
WIND	Average monthly speed (km/h)	12.7	13.9		16.0
	Peak gust (speed/direction/date)	50.1NW05	NW72.8/22		W100.0/1976/17
RADIATION	Monthly bright sunshine (hours)	146.0	95.4	98.0(101.2)	
	% possible bright sunshine	55.2	36.1	37.1(38.3)	
	% normal bright sunshine	149.0			
	Bright Sunshine days	27	23	22.2(22)	
	Monthly global radiation(MJ/m²)	150.6	114.7	(123.7)	
	Monthly diffuse radiation (MJ/m²)	63.1	64.5	(73.6)	
SOIL	Average temperature (°C) @ 9:00am — grass level	-11.4			
	10 cm/20 cm	-4.5/-2.3	-2.3/-0.9	-1.7/-0.5	
	50 cm/100cm	1.3/5.1	1.3/4.4	2.8/5.4	
	150 cm/300cm	7.1/8.6	6.0/7.6	6.8/8.1	

For Your Information

Cold and bright are the two best adjectives to describe November 2003. The -13.8°C average monthly minimum temperature contributed the lion's share to the average monthly temperature being 3°C below normal. Every day recorded frost even though eight days managed to struggle above freezing. Five of those days occurred mid-month offering a welcome respite. Bright sunshine hours were unusually high despite six days where less than one hour was recorded. With 146 hours recorded, the bright sunshine was 49% above normal for November. Unfortunately, with the clear skies, precipitation was minimal raising the yearly deficit to 75.4mm. Below normal upper soil temperatures reflected the cold air temperatures while the lower soil temperatures were near normal.

November occasionally brings out the pessimist as it did 200 years ago for Thomas Hood, an English satirist.

No warmth, no cheerfulness, no healthful ease, No comfortable feel in any member,
No shade, no shine, no butterflies, no bees, No fruits, no flowers, no leaves , no birds --
No-vember. T.Hood[1]

[1]Inwards, 1994.

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CRS estab. 1963

	December 2003	2003 VALUE	2002 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	-3.0	-3.5	-9.0(-9.8)	
	Extreme monthly maximum (°C/date)	6.6/20	5.5/13	9.5/1987/07	14.4/1939/05
	Average monthly minimum (°C)	-12.6	-11.9	-18.6(-19.3)	
	Extreme monthly minimum (°C/date)	-25.6/11	-27.2/03	-42.2/1973/31	-43.9/1892/22
	Monthly average (°C)	-7.8	-7.7	-13.9(-14.5)	
	No. of Frost days (Temperature ≤ 0°C)	31	31	31(31)	
DEGREE-DAYS	Monthly growing (5°C base)	0.0	0.0	0.1(0.0)	
	Yearly total-to-date growing	2019.5	1699.9	1672.9(1648.4)	
	Monthly heating (18°C base)	800.7	797.8	987.7(1004.8)	
	Yearly total-to-date heating	5527.2	5760.9	5808.8(5954.0)	
	Monthly cooling (18°C base)	0.0	0.0	0.0(0.0)	
	Yearly total-to-date cooling	257.4	227.9	119.1(117.5)	
PRECIPITATION	Monthly total (mm)	3.2	13.9	18.3(21.3)	
	Yearly total-to-date (mm)	257.7	320.0	348.2(360.8)	28.4/1936/02
	Greatest 24-hr (mm/date)	0.7/29	9.5/29	14.5/1973/23	
	Measurable precipitation days (≥ 0.2mm)	7	11	11(12)	
WIND	Average monthly speed (km/h)	12.2	13.9		16.0
	Peak gust (speed/direction/date)	54.1^{SSE}05	54.8^{SE}16		121^{W}1955/12
RADIATION	Monthly bright sunshine (hours)	113.6	89.3	85.4(83.7)	
	% possible bright sunshine	46.9	36.8	35.2(34.5)	
	% normal bright sunshine	133.0			
	Bright Sunshine days	25	23	22.8(23)	
	Monthly global radiation(MJ/m^2)	96.8	91.2	(95.2)	
	Monthly diffuse radiation (MJ/m^2)	43.3	47.9	(54.3)	
SOIL	Average temperature (°C) @ 9:00am grass level	-9.5			
	10 cm/20 cm	-5.6/-3.8	-4.5/-3.1	(-6.5/-5.5)	
	50 cm/100cm	-1.6/1.8	-1.3/1.9	(-1.6/1.9)	
	150 cm/300cm	4.0/6.6	3.7/6.0	(3.9/6.3)	

For Your Information

Dry, bright and warm describes December 2003. With only 3.2mm recorded in seven precipitation events, it was the 3rd driest December at the station since 1963. Only 1986 (2.8mm) and 1997 (1.2mm) were drier. Christmas was very brown with only 4cm of snow on the ground by month's end. Only 1978 (114.4hrs) and 1979 (118.2hrs) recorded more bright sunshine than this December (113.6 hours; 33% above normal). The average maximum and minimum temperatures were 6°C above normal and similar to last year. The above 0°C temperature for Christmas day was the tenth and last occurrence of such temperatures for the month. Not even the wind could make the month feel colder. Winds above 50km/h were only recorded once on the fifth.

Wind chill is the sensation of temperature felt by the face caused by wind. Kugaaruk, Nunavut (formerly Pelly Bay) is the national wind chill capital, while the mildest conditions are found at Victoria. Although January usually records the highest wind chills, there are three notable exceptions. On Dec. 16th, 1964 Edmonton, Calgary and Victoria recorded their coldest wind chills. Edmonton posted -57C (with an air temperature of -35.6°C); Calgary -55C (-33.9°C) and Victoria, a bone chilling -25C (-13.3°C).[1]

[1] Environment Canada, 2004.

INSTRUMENTS USED AT SASKATOON SRC CRS AND GLOSSARY OF TERMS

(Unless otherwise stated, source for definitions of terms is Environment Canada, 1978)

BEAUFORT WIND SCALE was developed by Admiral Sir Francis Beaufort in 1805 and adopted by the British Navy in 1838. It consisted of 13 degrees of wind strength, from calm to hurricane, based upon the effects of various wind strengths upon the amount of canvas carried by the fully rigged frigates of the period. Over the years it has been modified as needed and in 1946 the scale values (Force Numbers) were defined by ranges of wind speed as measured at a height of 10 meters above the surface. In effect, this transformed the 'Beaufort Wind Force Scale' into the 'Beaufort Wind Speed Scale'. This scale is the current standard scale for visual observations of the wind (Heidorn, 1998).

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

Number of Days is defined as 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 the total possible daylight hours in a given period, expressed as a percentage.

Possible daylight hours are taken from the sunrise/set tables provided by the National Research Council of Canada, Herzberg Institute of Astrophysics, Victoria, BC.

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) is 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 less than 18°C, CDD = 0.

Monthly and annual values of CDD are obtained by summing daily values.

Growing (GDD) is 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) is 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 present
Saskatoon, University of Saskatchewan:1916 to 1963
Saskatoon, City:1892 to present
Station locations, exposures and measurement procedures were subject to change during this time period. Data 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 (1971-2000) 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 of thirty years. The current normal period for data analysis is from January 1st, 1971 to December 31st, 2000. Data derived from CRS conform to this standard, except where noted. The normals for CRS have been calculated using the data collected during this standard period. Where gaps existed, data from the nearest climate station were used and referenced as to being used.

PRECIPITATION

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 Environment Canada, record keeping was changed to the 24-hour period of 0000 hours - 2400 hours to conform to their reporting of climatological statistics.

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 Environment Canada publication "*Manual of Climatological Observation's*", 2nd Ed., January, 1978. The notation "T" 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.

SOIL TEMPERATURE under a short grass surface with normal snow accumulation, is measured according to procedures outlined in the Environment Canada publication "*Soil Temperature*" January l, 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. 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 (l975-1990).

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) average over the appropriate time periods. For details concerning measurement procedures, the reader is referred to the Environment Canada 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 CHILL describes a sensation, the way we feel as a result of the combined cooling effect of temperature and wind. This feeling can't be measured using an instrument, so a mathematical formula was developed in 1939 that related air temperature and wind speed to the cooling sensation. This formula was revised in 2001 by a team of scientists and medical experts from Canada and the U.S. with the Canadian Department of National Defence contributing human volunteers. The new index is based on the loss of heat from the face (Environment Canada 2001a).

WIND SPEED

Average 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 Environment Canada, Saskatoon Airport station.

see also **Beaufort Wind Scale**

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