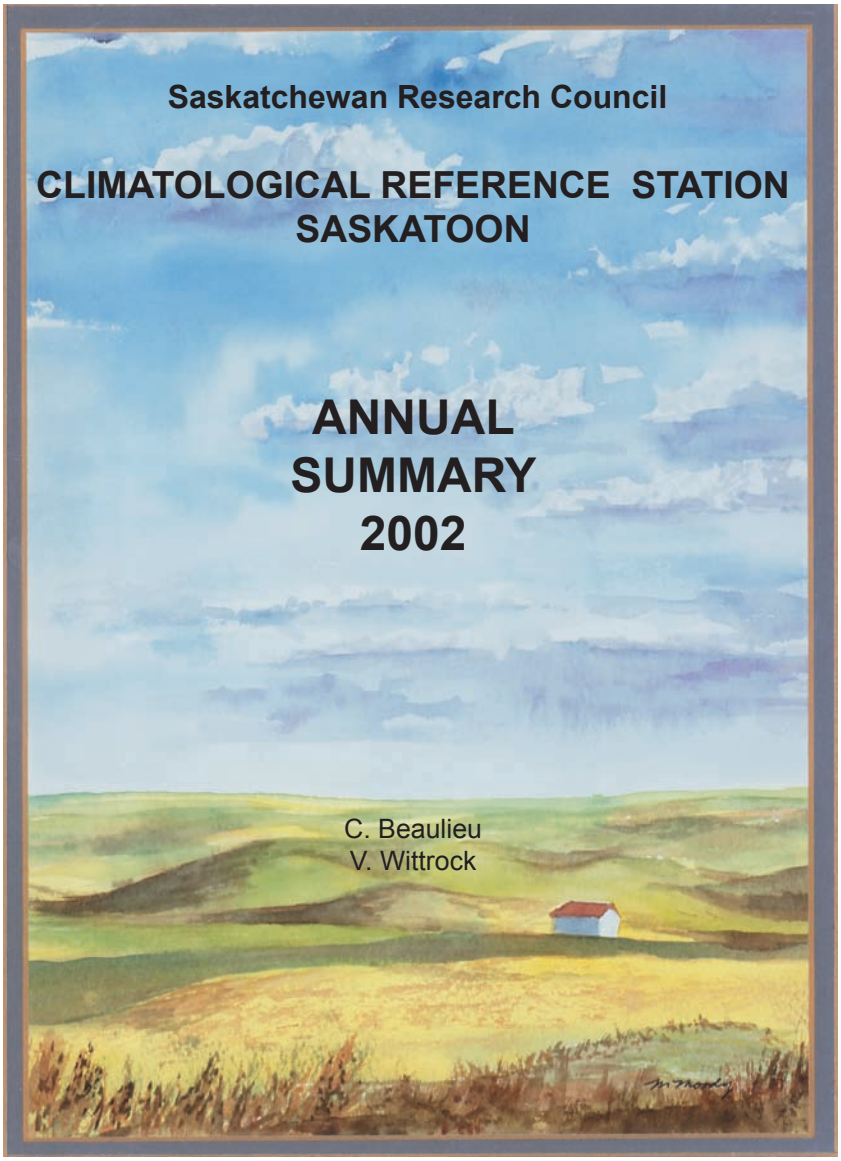
technology is our business

Environment/Minerals Division
Climatology/Aquatic Ecology Section



SRC Publication No. 10440-1E03

June 2003

Saskatchewan
Research Council

CLIMATOLOGICAL REFERENCE STATION

SASKATOON

ANNUAL SUMMARY 2002

C. Beaulieu
V. Wittrock

Environment/Minerals Division
Climatology/Aquatic Ecology Section

Saskatchewan Research Council
125 - 15 Innovation Boulevard
Saskatoon, SK S7N 2X8

SRC Publication No. 10440-1E03

June 2003

ACKNOWLEDGEMENTS

The 2002 data was compiled and recorded by Carol Beaulieu with assistance from Virginia Wittrock. Charlene Hudym and Leanne Crone assisted in the archiving of data. Miss Beaulieu maintained the site while instrument maintenance was carried out by the Instrumentation and Electronics Section of the Saskatchewan Research Council (SRC). Elaine Wheaton and Virginia Wittrock assisted with the proofreading and editing. Consultations with Larry Flysak and Don Rybak of the Meteorological Service of Canada (MSC), Saskatoon, SK, were most helpful in verifying and comparing data. Although every caution has been taken to ensure the accuracy of data and information presented, errors may occur. 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, or becoming a sponsor are most welcome. For further information contact:

Elaine Wheaton
Senior Research 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 Technologist
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 SPONSORS, 2002

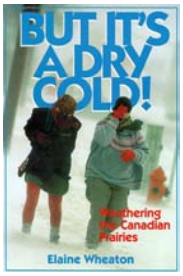
Saskatchewan Agriculture, Food and Rural Revitalization

University of Saskatchewan

Ducks Unlimited Canada
CANADA'S CONSERVATION COMPANY

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

Kipp & Zonen



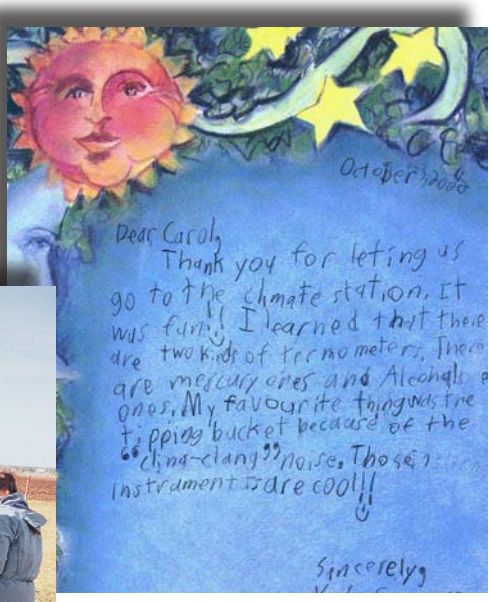
SaskPower

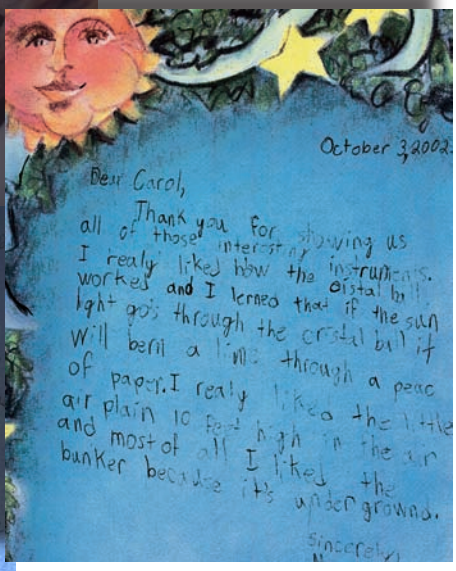
COVER ART
Untitled
by Mary Moody, Aquatic Research Scientist, SRC
From the collection of C.R. Beaulieu

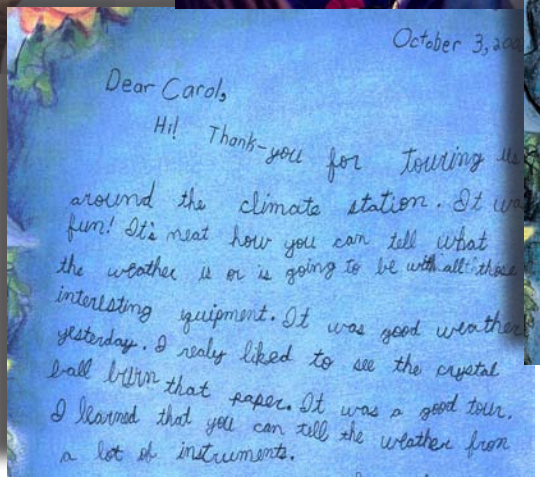
TABLE OF CONTENTS

Grade 4 Warman Elementary School Tour

photo credit: Ms Marg Epp







CLIMATE REFERENCE STATION HISTORY

photo credit: SRC

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 datalogger 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 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-eight 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 2002

The Climate Reference Station (CRS) staff were active in outreach activities in 2002. Presentations on *'Weather Instruments and How They Work'* were conducted at the Climate Reference Station and as well as in classes. The presentations were well received by students and staff with positive post-presentation feedback. Approximately 254 children from 9 urban and rural schools, grades K to 7 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*

SUMMARY FOR 2002

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 2002 and compared with the long-term (*circa* 1900-2001) and standard-period (1971-2000) records.

Drought conditions continued into 2002 with late winter and spring moisture well below normal. May received only a token 0.2mm of precipitation. It was not until July, after 22 months of below normal precipitation, that relief finally arrived. Above normal precipitation amounts continued during August and September. Unfortunately, October, November and December saw the return to below normal precipitation conditions. Even with nine months of below normal monthly precipitation, the annual total was only 8.1% below normal due to twice normal precipitation amounts in August and September. Six daily precipitation records were set during July, August and September. For a 32.4mm deluge on 30th, September had the greatest daily total while August had the greatest monthly total of 81.8mm. 2002 had a 35 day period from May 2 to June 5 when no measurable precipitation occurred. This extreme dryness is further illustrated by May having only 0.5% of normal precipitation. May ranked as the 16th driest year since 1964.

January and February temperatures soared above normal then plunged into the deep freeze for March. They took all spring to recover but by June were above monthly averages. The mean monthly temperatures remained above average for the rest of the year except for August and October. December was notable in its 6.2°C above normal mean temperature. Nineteen hot spell days of above 30°C were recorded with the longest spell occurring from July 11 to 15; a short pause on the 16th with a temperature of 29.2°C then concluding with two more hot days. The hottest days occurred on June 27 and 28 with temperatures over 37°C. Fourteen daily maximum temperatures were set of which six occurred in January, February and November. There were also 15 daily minimum temperatures broken, 10 of which occurred in the spring months of March, April and May. Minimum temperatures dipped to new record lows on the August 2 and 4. Although CRS did not record frost, the Saskatoon Airport came very close with a minimum temperature of 0.4°C on August 2.[1] 2002 ranked as the 15th warmest year since 1964.

Monthly growing degree-days were above average for the months of June to September. With 122 days, 2002 ranked 13th for its frost-free period. The frost-free season began on May 23 (five days earlier than the 1971-2000 average), and ended on September 23 (nine days later than the 1971-2000 average). Growing degree-days for the frost-free period were 1572.2; for the year there were 1699.9 growing degree-days, just slightly above normal. Heating degree-days were below normal for late winter, early summer and early winter. Cooling degree-days were more than 100 higher than normal due mainly to June and July hot spells.

The monthly bright sunshine values for 2002 ended the year with a cumulative total just slightly above normal. Of the 4482.8 hours of possible bright sunshine, the station recorded 2313.6 hours or 51.6%. This is reflected in the global radiation value of 4857.0 MJ/m^2 being slightly higher than normal.

January was the calmest month with no 'Near Gale' winds recorded. May was the windiest month with 13 days of wind speeds greater than 51 km/h. It was the only month to record a 'Strong Gale' wind of 78.2 km/h from the west on the 29th. All other months reported average or lower than average wind speeds. Extreme daily maximum winds of over 51 km/h occurred 53 times. The winds of May caused soil drifting in the Saskatoon area.[2]

[1] *Environment Canada, 2002b*
[2] *Wittrock, 2003*

Weather Events Summary, 2002

NEW 2002 DAILY TEMPERATURE AND PRECIPITATION RECORDS			
TYPE	**DAY**	**NEW RECORD**	**OLD RECORD/year**
Maximum Daily Temperature °C	Jan 07	6.1	4.0 / 1990
	Jan 08	6.8	6.5 / 1986
	Feb 11	3.4	2.9 / 1991
	Feb 15	5.2	4.4 / 1971
	Feb 17	7.9	4.0 / 1988
	Jun 27	37.1	31.1 / 1964
	Jun 28	37.2	31.7 / 1966 & 1978
	Jul 13	36.3	33.3 / 1964
	Jul 14	37.0	34.9 / 2000
	Jul 17	33.9	33.9 / 1967
	Jul 18	36.1	33.3 / 1967
	Jul 25	33.8	32.0 / 1998
	Sep 16	31.3	31.1 / 1979
	Nov 28	9.6	5.0 / 1987
Minimum Daily Temperature °C	Mar 11	-25.0	-23.0/1998
	Mar 20	-27.6	-25.6/1974
	Apr 24	-7.2	-5.0/1967
	Apr 25	-10.5	-8.5/1994
	Apr 27	-7.1	-4.5/1989
	May 01	-7.0	-4.8/1998
	May 04	-6.7	-5.0/1967
	May 05	-9.4	-6.7/1976
	May 07	-7.9	-6.0/1980
	May 23	-3.5	-1.0/1981
	Aug 02	2.6	3.3/1978
	Aug 04	2.6	6.1/1975
	Sep 27	-7.1	-3.5/1984
	Oct 19	-7.4	-6.1/ 1968 & 1969
	Oct 20	-8.9	-8.3/1976
Daily Precipitation mm	Jun 11	12.8	10.7 / 1972
	Jul 09	26.6	13.2 / 1986
	Aug 11	18.0	5.8 / 1982
	Aug 30	7.2	6.2 / 1982
	Sep 07	9.6	7.7 / 1984
	Sep 22	2.4	1.3 / 1977
	Sept 30	32.4	4.6 / 1964
	Dec 29	9.5	3.8 / 1992

COLD SPELL (less than or equal to -30°C)		
MONTH	**DAY**	**TEMPERATURE °C**
January	23	-31.0
	28	-31.9
	30	-30.4
	31	-32.2
Extreme	Jan 31	-32.2

HOT SPELL (greater than or equal to 30°C)		
MONTH	**DAY**	**TEMPERATURE °C**
June	26	34.4
	27	37.1
	28	37.2
July	4	31.2
	6	30.5
	11	30.7
	12	34.9
	13	36.3
	14	37.0
	15	30.9
	17	33.9
	18	36.1
	24	31.4
	25	33.8
	26	30.1
August	24	32.8
	25	31.1
	28	30.3
Sept	16	31.3
Extreme	June 28	37.2

GREATEST EXTREME PRECIPITATION EVENTS (mm)*		
PERIOD	**DATE**	**AMOUNT**
0.5 hour	July 26	12.6
0.5 hour	July 17	8.6
1 hour	July 17	15.8
1 hour	July 26	12.8
2 hours	July 17	20.6
2 hours	June 17	15.2
24 hours	Sept 30	32.4
24 hours	July 9	26.6

**recorded by tipping bucket June 1st to September 30th*

Climatic Element: Dryness

RANKING OF DRIEST MONTHS FOR 2002									
Driest Month by % of Normal		Rank	Driest Month by Precipitation Amount (mm)		Driest Month by % of Normal		Rank	Driest Month by Precipitation Amount (mm)	
May	0.5	1	0.2	May	October	66.5	7	12.0	April
January	15.9	2	2.9	January	December	76.0	8	13.9	December
February	24.8	3	3.3	February	June	91.1	9	54.2	June
November	25.0	4	3.7	November	July	122.1	10	58.2	September
April	50.8	5	8.1	March	September	198.0	11	70.8	July
March	61.4	6	10.9	October	August	226.0	12	81.8	August

TIME AND DURATION OF PERIODS WITH 15 DAYS OR MORE WITH NO MEASURABLE PRECIPITATION

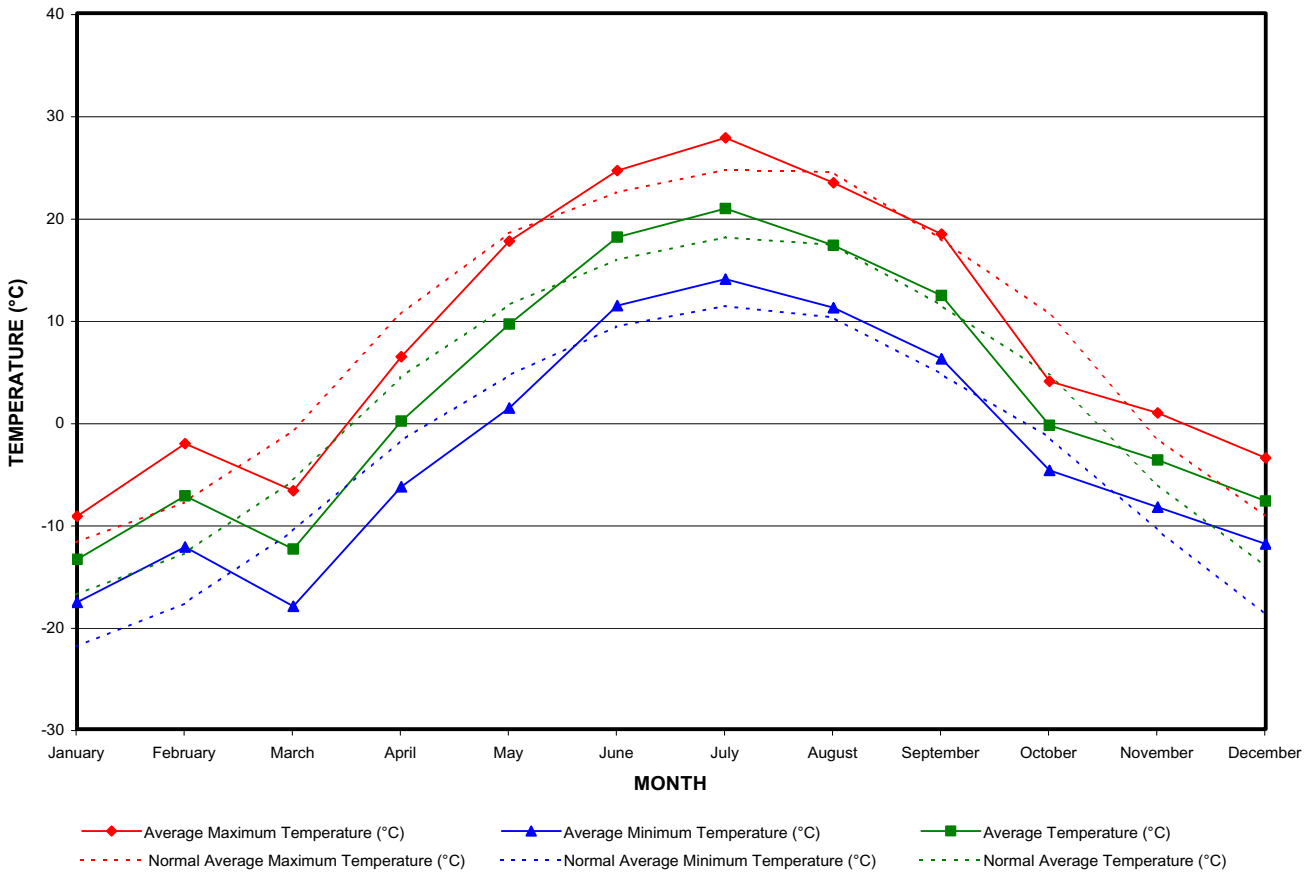
Year	Period	Duration (days)	Year	Period	Duration (days)	Year	Period	Duration (days)	Year	Period	Duration (days)
1993	Jan 13 - Feb 09	28	1974	Apr 02 - Apr 18	17	1994	Apr 24 - May 11	18	1964	Mar 22 - Apr 21	31
	May 28 - Jun 11	15		Oct 14 - Nov 07	25		Sep 05 - Sep 19	15		Oct 04 - Oct 20	17
	Sep 16 - Oct 25	40		Nov 14 - Dec 11	28		Nov 03 - Nov 20	18		Oct 27 - Nov 12	17
	Nov 17 - Dec 04	18	1967	May 02 - May 20	19		Dec 13 - Dec 27	15	1981	Feb 15 - Mar 05	19
1976	Mar 26 - Apr 15	21		May 26 - Jun 09	15	2001	Jan 16 - Jun 30	15		May 10 - May 27	18
	Apr 24 - May 10	17		Aug 15 - Sep 01	18		May 04 - May 18	15		Sep 03 - Sep 19	17
	Oct 12 - Nov 28	48		Oct 07 - Oct 23	17		Aug 15 - Sep 04	21	1979	Aug 09 - Aug 12	15
1986	Jan 02 - Jan 16	15	1988	Apr 07 - Apr 22	16		Nov 10 - Nov 24	15		Oct 03 - Oct 17	15
	Aug 10 - Aug 29	20		Jly 16 - Jly 30	15	2002	Jan 03 - Jan 18	16		Dec 15 - Dec 31	17
	Oct 08 - Oct 27	20		Sep 28 - Oct 13	16		May 02 - Jun 05	35	1984	Jan 27 - Feb 25	30
	Dec 11 - Dec 29	19		Nov 18 - Dec 06	19		Nov 17 - Dec 01	15		Sep 26 - Oct 12	17

Dates of 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
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
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
1971 - 2000 Normal	May 18	Sept 14	116.9
1961 - 1990 Normal	May 21	Sept 11	110.6

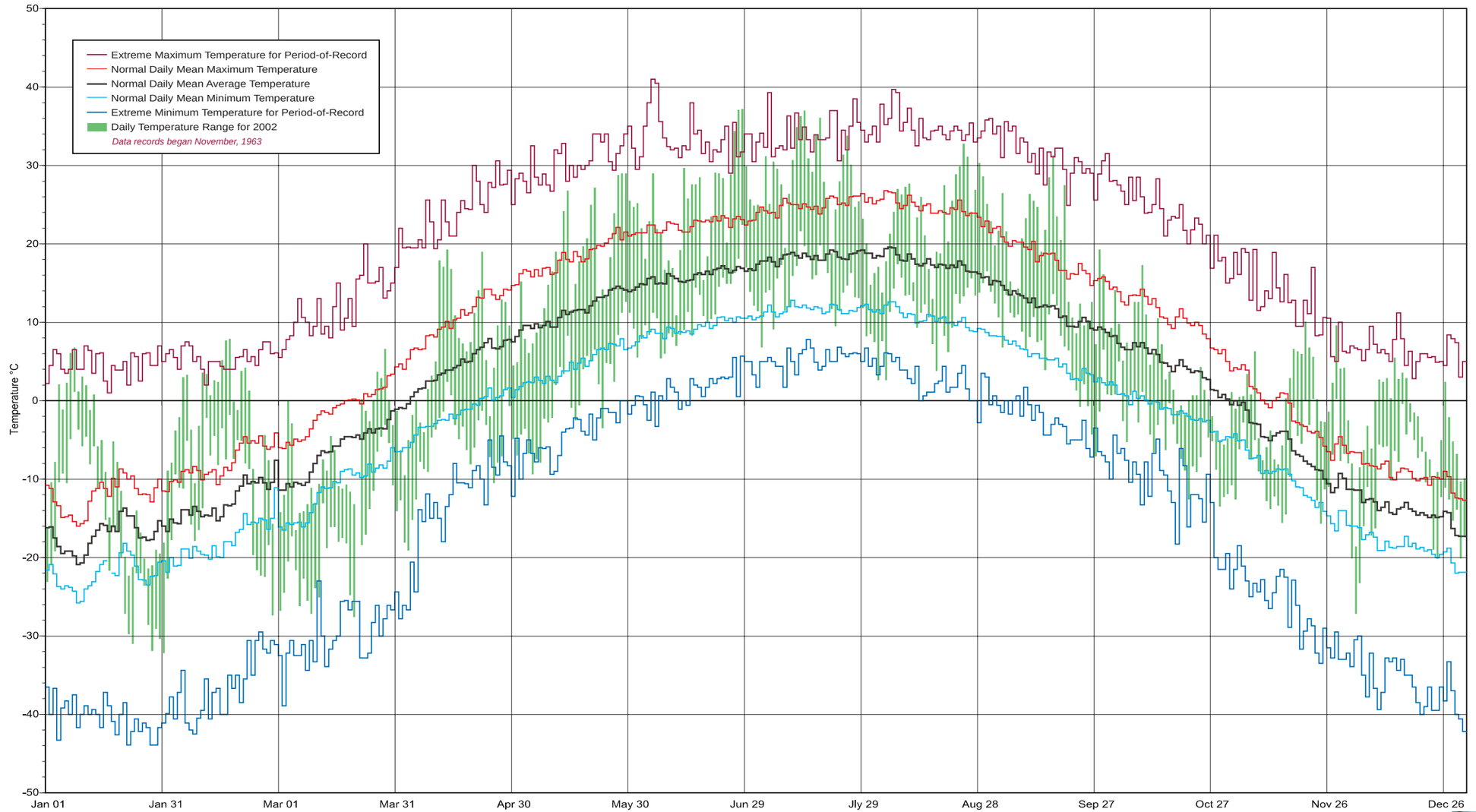
Monthly Average Temperatures, 2002

MONTH	AVERAGE MAXIMUM TEMPERATURE (°C)		AVERAGE MINIMUM TEMPERATURE (°C)		AVERAGE TEMPERATURE (°C)		EXTREME VALUES FOR TEMPERATURE (°C)	
	2002	Normal	2002	Normal	2002	Normal	Maximum/Date	Minimum/Date
January	-9.2	-11.6	-17.6	-21.8	-13.4	-16.7	6.8/08	-32.2/31
February	-2.1	-7.7	-12.2	-17.6	-7.2	-12.7	7.9/17	-27.4/28
March	-6.7	-0.7	-18.0	-10.5	-12.4	-5.6	6.6/28	-27.6/20
April	6.4	10.7	-6.3	-1.7	0.1	4.5	19.3/13	-19.1/03
May	17.7	18.6	1.4	4.7	9.6	11.6	29.0/28&29	-9.4/05
June	24.6	22.6	11.4	9.5	18.1	16.0	37.2/28	5.4/07
July	27.8	24.8	14.0	11.5	20.9	18.2	37.0/14	6.8/03
August	23.4	24.6	11.2	10.4	17.3	17.5	32.8/24	2.6/02&04
September	18.4	18.1	6.2	4.9	12.4	11.6	31.3/16	-7.1/27
October	4.0	10.8	-4.7	-1.3	-0.3	4.8	17.3/09	-13.5/29
November	0.9	-1.4	-8.3	-10.3	-3.7	-5.9	10.1/20	-15.7/24
December	-3.5	-9.0	-11.9	-18.6	-7.7	-13.9	5.5/13	-27.2/03
Average	8.5	8.3	-2.9	-3.4	2.8	2.5		



technology is our business

SRC Climate Reference Station Temperature Record for 2002



Saskatchewan Agriculture, Food and Rural Revitalization

Ducks Unlimited Canada
CANADA'S CONSERVATION COMPANY

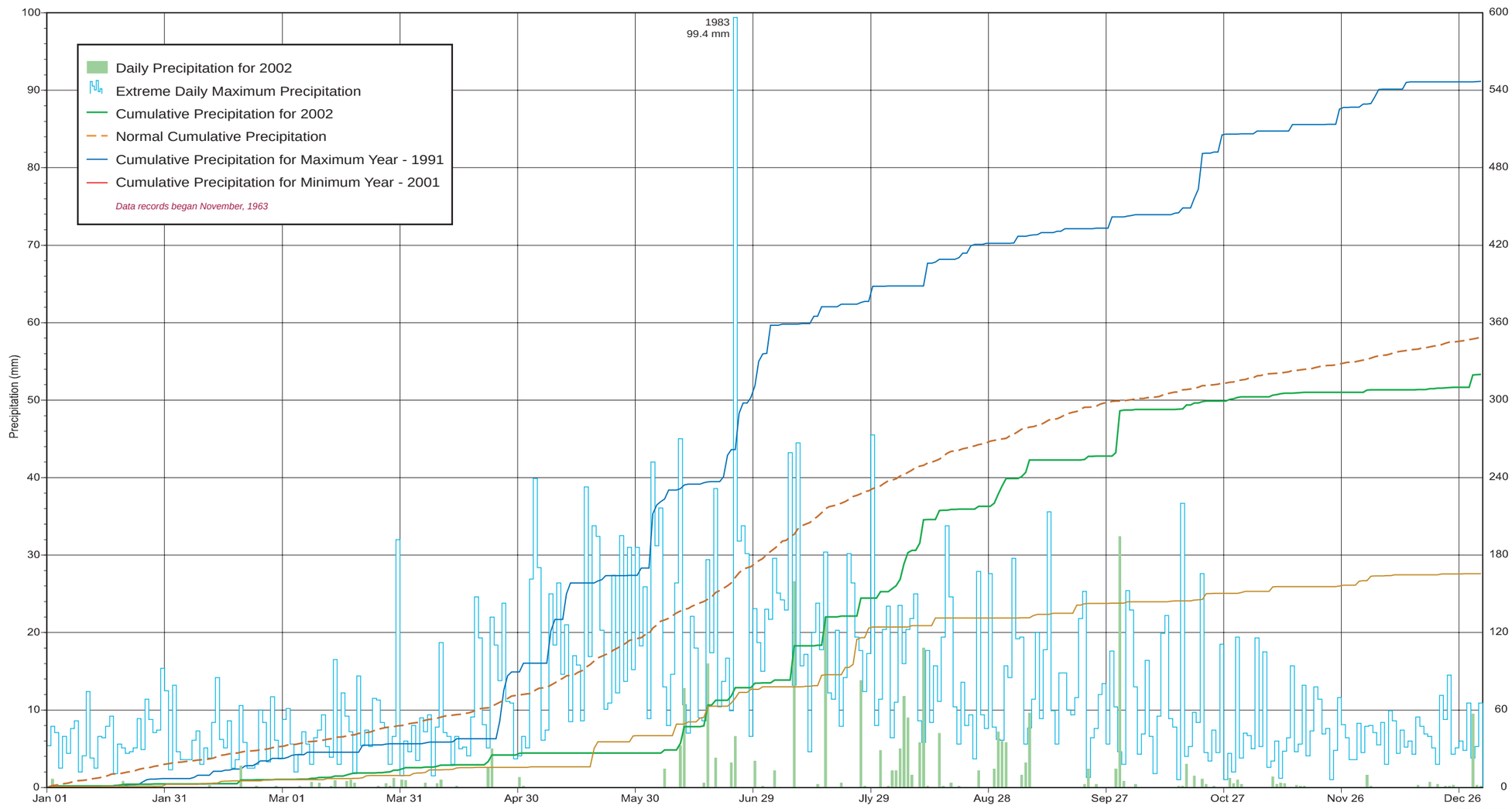
Kipp & Zonen

SaskPower

Agriculture and Agri-Food Canada

Agriculture et Agroalimentaire Canada

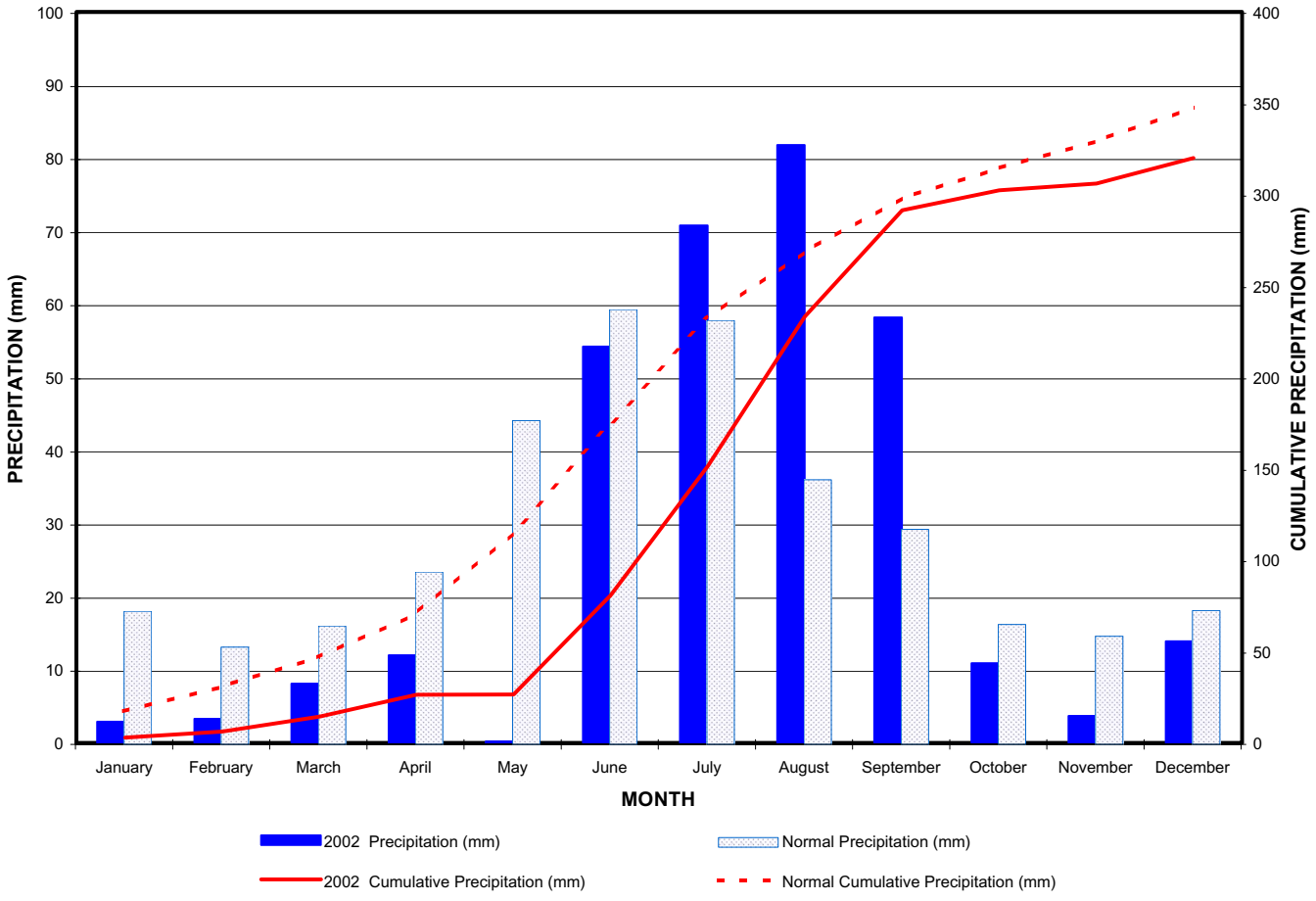
SRC Climate Reference Station Precipitation Record for 2002



SRC Publication No. 10440-1E03

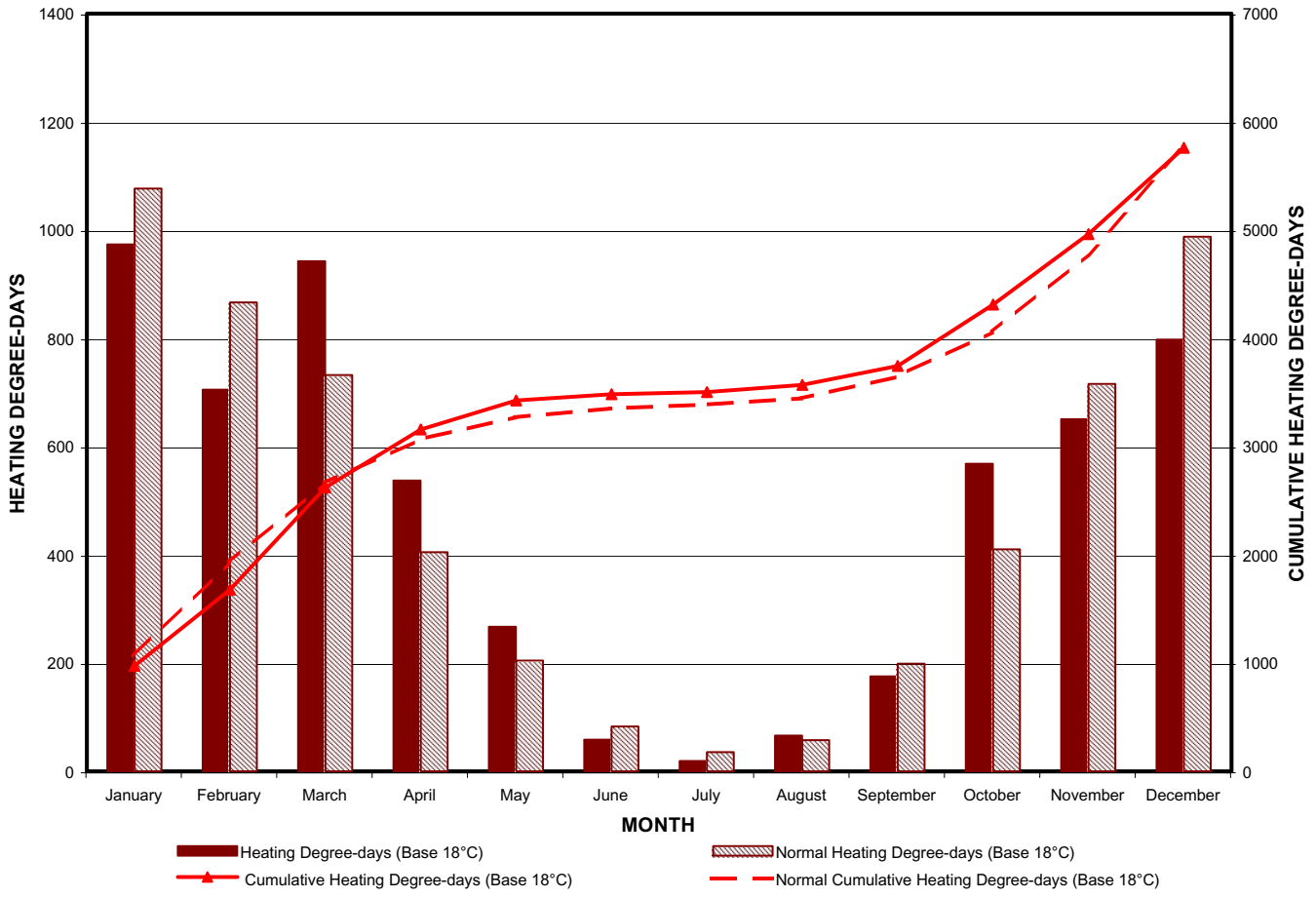
Monthly Precipitation, 2002

MONTH	PRECIPITATION (mm)			CUMULATIVE PRECIPITATION (mm)			EXTREME VALUE (mm)
	2002	Normal	%	2002	Normal	%	Value/Date
January	2.9	18.2	15.9	2.9	18.2	15.9	1.1/02
February	3.3	13.3	24.8	6.2	31.5	19.7	2.8/19
March	8.1	16.2	50.0	14.3	47.7	30.0	1.2/29
April	12.0	23.6	50.8	26.3	71.3	36.9	5.0/23
May	0.2	44.3	0.5	26.5	115.6	22.9	0.2/01
June	54.2	59.5	91.1	80.7	175.1	46.1	16.0/17
July	70.8	58.0	122.1	151.5	233.1	65.0	26.6/09
August	81.8	36.2	226.0	233.3	269.3	86.6	18.0/11
September	58.2	29.4	198.0	291.5	298.7	97.6	32.4/30
October	10.9	16.4	66.5	302.4	315.1	96.0	3.0/17
November	3.7	14.8	25.0	306.1	329.9	92.8	1.4/08
December	13.9	18.3	76.0	320.0	348.2	91.9	9.5/29
Total	320.0	348.2	91.9				



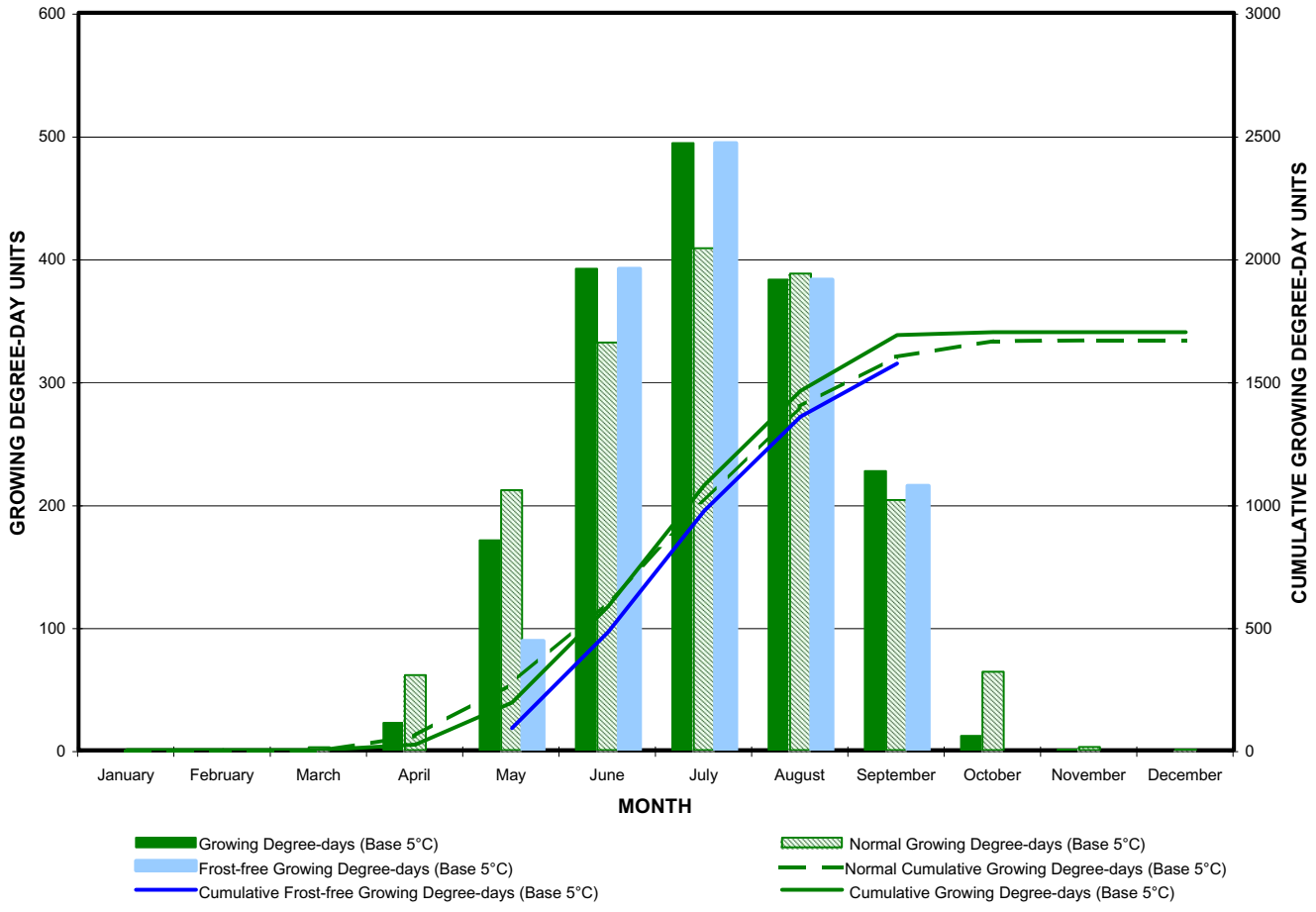
Monthly Heating and Cooling Degree-days, 2002

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	
	2002	Normal	2002	Normal	2002	Normal	2002	Normal
January	973.3	1076.5	973.3	1076.5	0.0	0.0	0.0	0.0
February	705.1	866.3	1678.4	1942.8	0.0	0.0	0.0	0.0
March	942.5	732.1	2620.9	2674.9	0.0	0.0	0.0	0.0
April	537.4	405.0	3158.3	3079.9	0.0	0.3	0.0	0.3
May	267.2	204.4	3425.5	3284.3	5.9	7.4	5.9	7.7
June	58.4	82.8	3483.9	3367.1	60.1	22.3	66.0	30.0
July	19.0	35.3	3502.9	3402.4	109.9	40.7	175.9	70.7
August	65.8	57.7	3568.7	3460.1	45.6	42.5	221.5	113.2
September	175.5	198.9	3744.2	3659.0	6.4	5.8	227.9	119.0
October	568.1	410.2	4312.3	4069.2	0.0	0.1	227.9	119.1
November	650.8	715.8	4963.1	4785.0	0.0	0.0	227.9	119.1
December	797.8	987.7	5760.9	5772.7	0.0	0.0	227.9	119.1
Total	5760.9	5772.7	41192.4	5772.7	227.9	119.1	1380.9	119.1

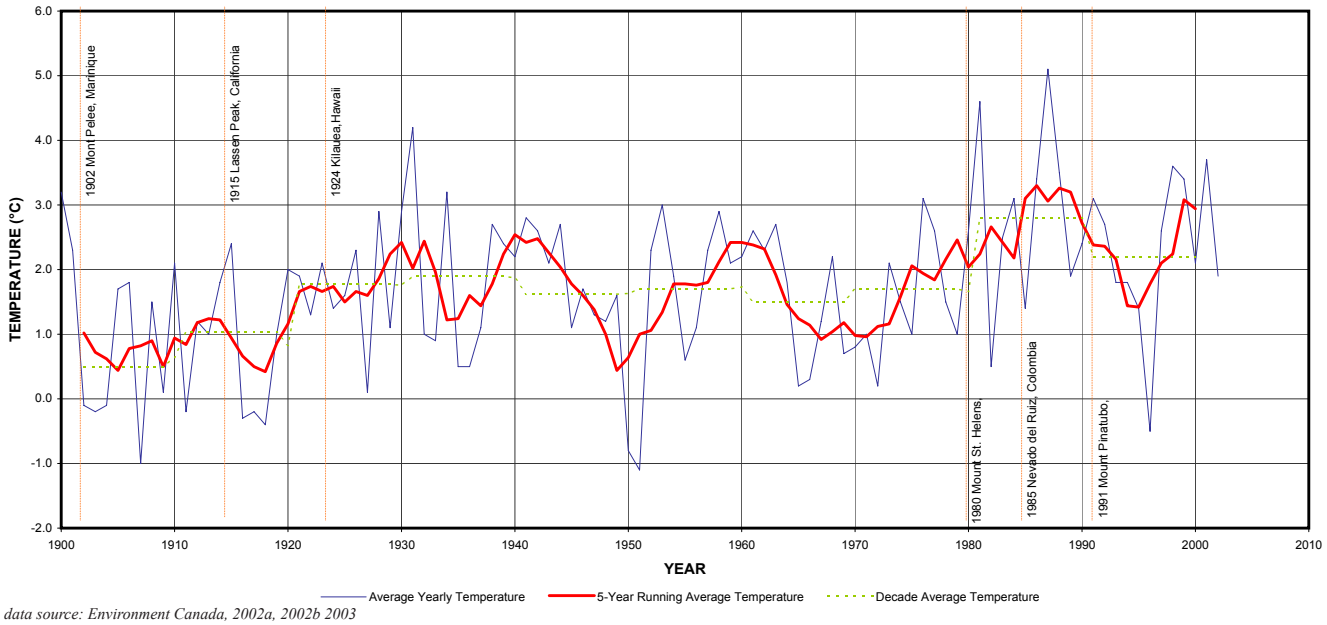


Monthly Growing Degree-days, 2002

MONTH	GROWING DEGREE-DAYS Base 5°C		CUMULATIVE GROWING DEGREE-DAYS Base 5°C		FROST-FREE GROWING DEGREE-DAYS Base 5°C	
	2002	Normal	2002	Normal	2002	Cumulative
January	0.0	0.0	0.0	0.0		
February	0.0	0.0	0.0	0.0		
March	0.0	2.3	0.0	2.3		
April	22.2	61.0	22.2	63.3		
May	170.7	211.6	192.9	274.9	88.8	88.8
June	391.7	331.5	584.6	606.4	391.7	480.5
July	493.9	408.4	1078.5	1014.8	493.9	974.4
August	382.8	387.8	1461.3	1402.6	382.8	1357.2
September	227.0	203.5	1688.3	1606.1	215.0	1572.2
October	11.5	63.7	1699.8	1669.8		
November	0.1	2.6	1699.9	1672.4		
December	0.0	0.1	1699.9	1672.5		
Total	1699.9	1672.5			1572.2	

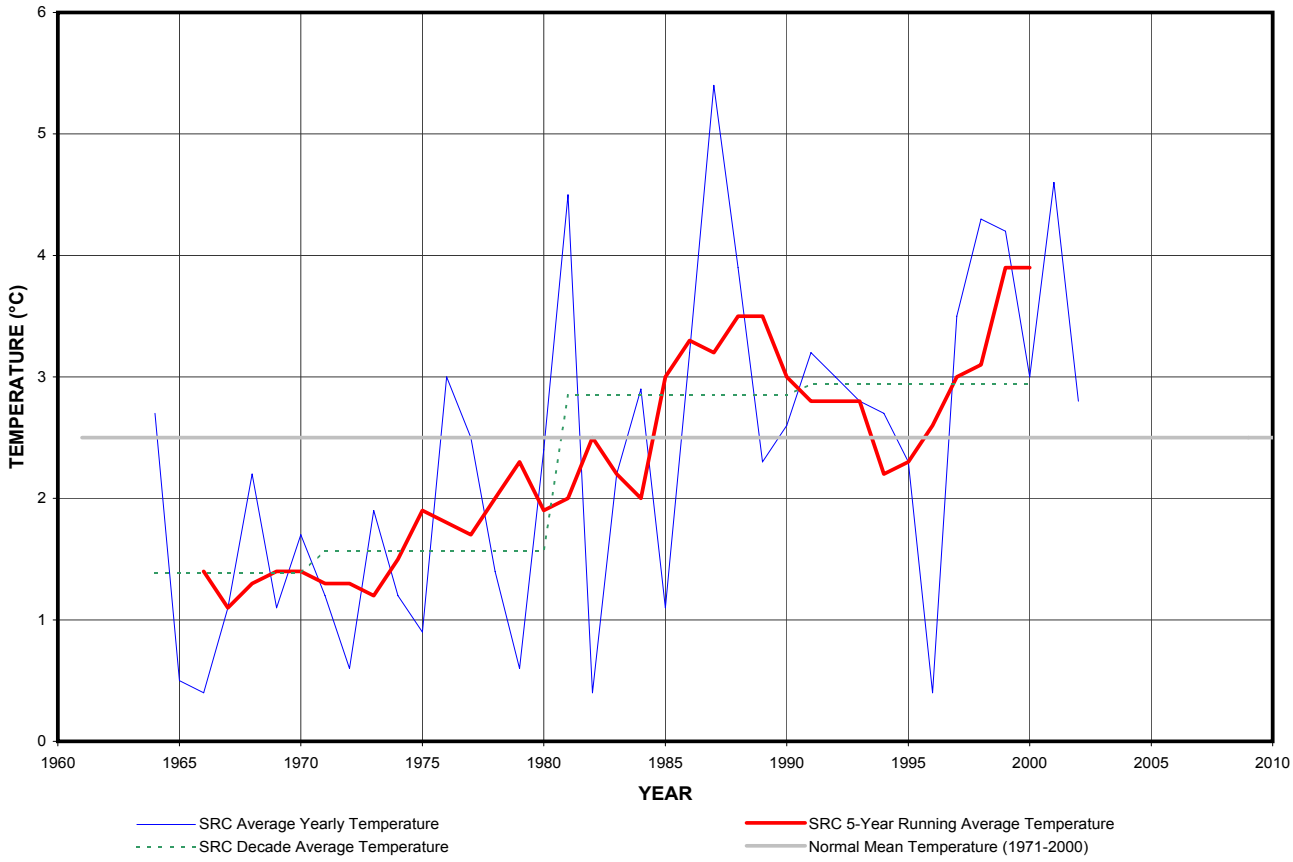


Average Annual Temperature Time Series for Saskatoon 'A'. 1900 - 2002

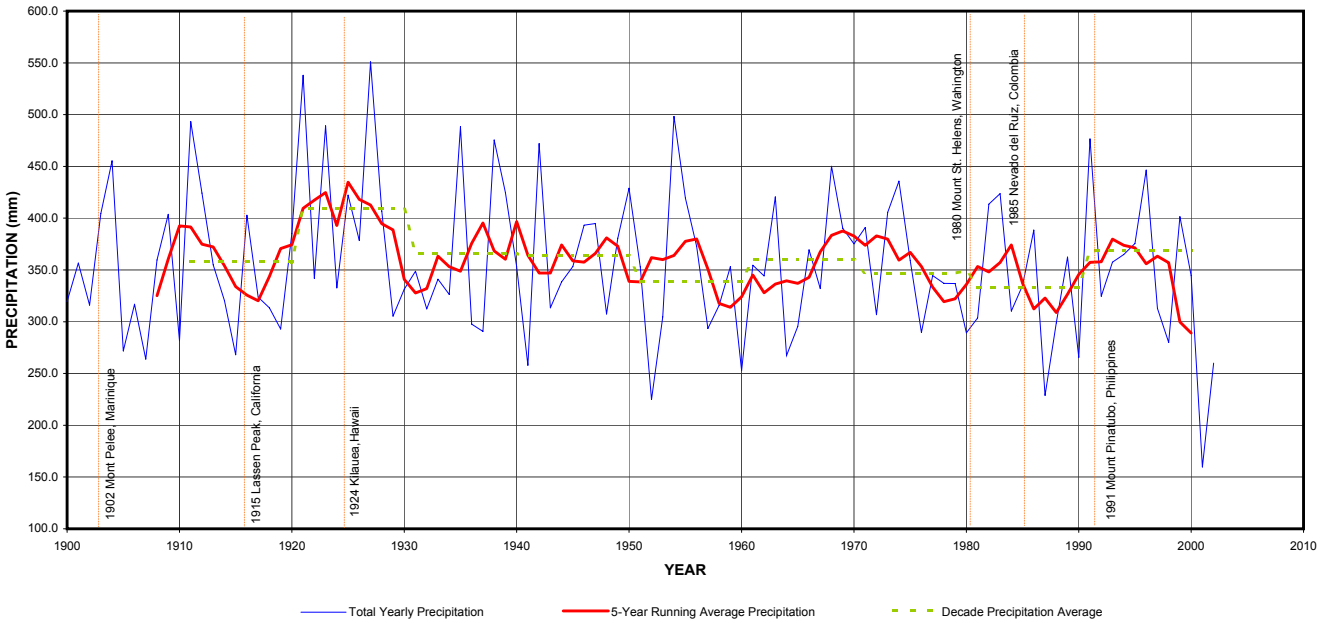


data source: Environment Canada, 2002a, 2002b 2003

Average Annual Temperature Time Series for CRS, 1964 - 2002

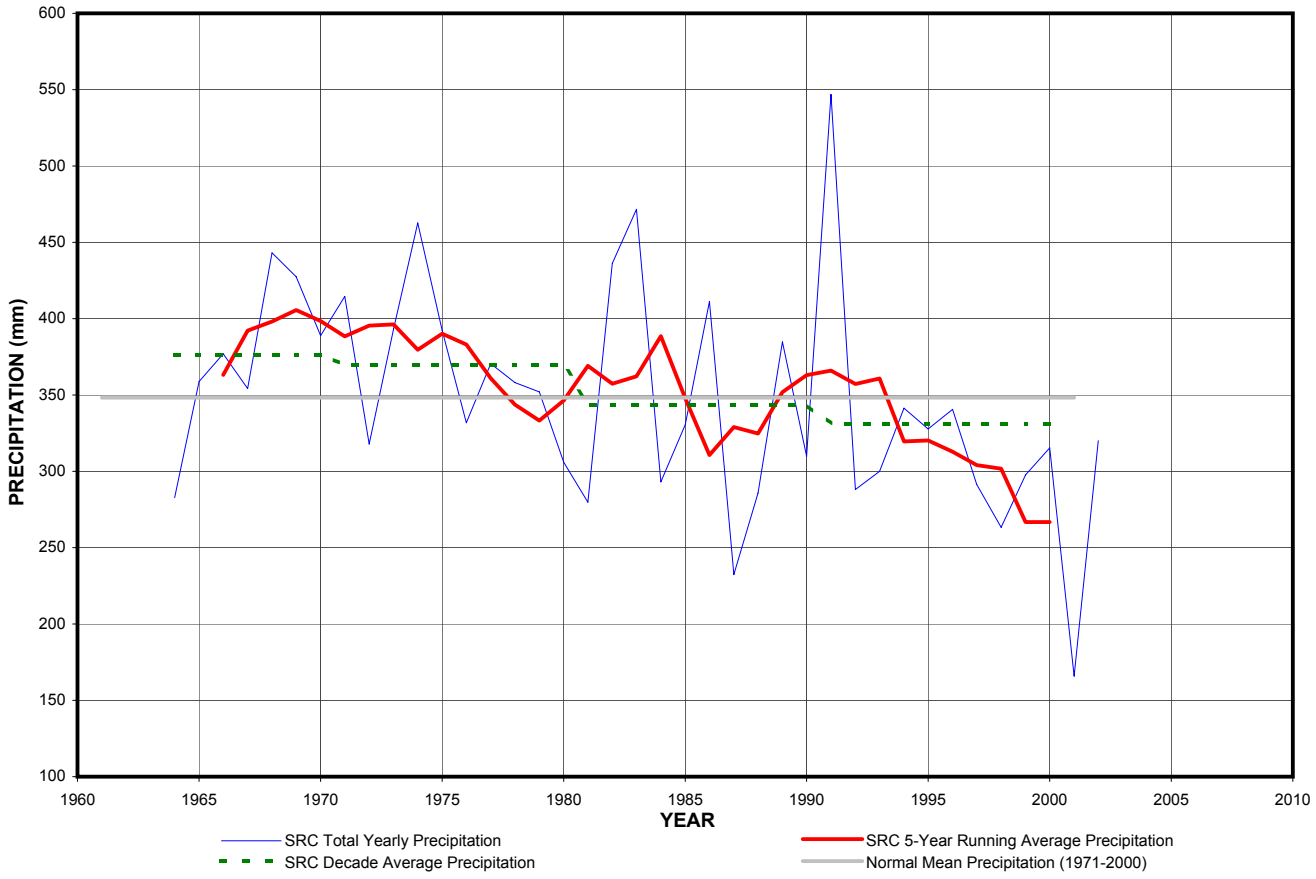


Total Annual Precipitation Time Series for Saskatoon 'A', 1900 - 2002



data source: Environment Canada, 2002a, 2002b, 2003

Total Annual Precipitation Time Series for CRS, 1964 - 2002

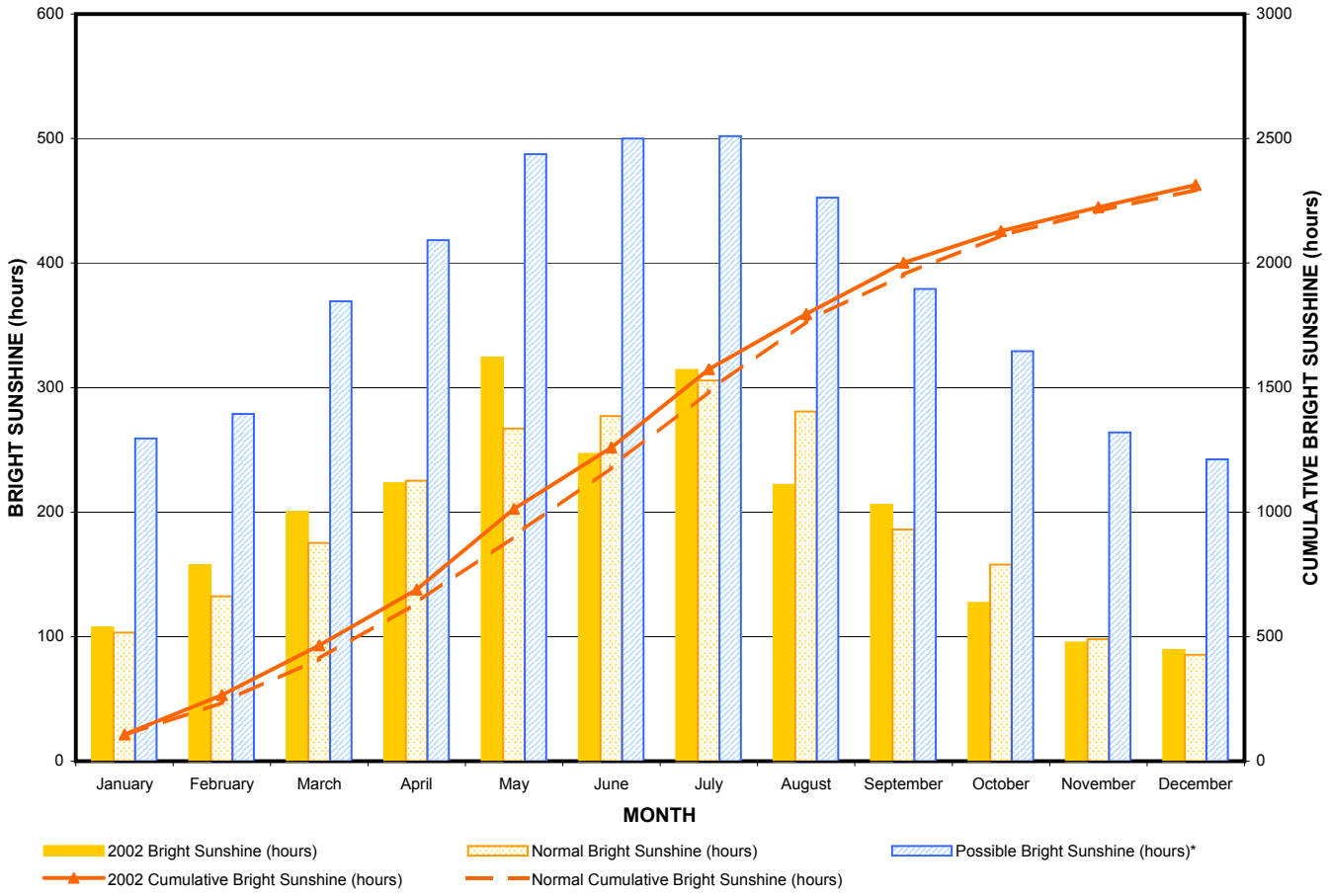


Monthly Bright Sunshine, 2002

MONTH	BRIGHT SUNSHINE (hours)				CUMULATIVE BRIGHT SUNSHINE (hours)	
	2002	Normal	Possible*	% of Possible	2002	Normal
January	107.5	103.3	259.2	41.5	107.5	103.3
February	157.4	132.3	278.8	56.5	264.9	235.6
March	200.4	175.2	369.3	54.3	465.3	410.8
April	223.2	225.2	418.4	53.3	688.5	636.0
May	324.3	267.1	487.5	66.5	1012.8	903.1
June	246.9	277.2	500.1	49.4	1259.7	1180.3
July**	314.1	305.7	501.9	62.6	1573.8	1486.0
August	221.9	280.8	452.6	49.0	1795.7	1766.8
September	206.2	186.0	379.2	54.4	2002.0	1952.8
October	127.2	157.9	329.3	38.6	2128.9	2110.7
November	95.4	98.0	264.1	36.1	2224.3	2208.7
December	89.3	85.4	242.4	36.8	2313.6	2294.1
Total	2313.6	2294.1	4482.8	51.6		

* Possible Bright Sunshine hours calculated from National Research Council of Canada, Hertzberg Institute of Astrophysics sunrise/set table for 2002

**July 3, re-calibrated instrument installed with maximum of .6 h loss. July 4 datalogger down for 1 hour; minimum loss of data due to cloudy sky



Sunrise[1] and Sunset[1] at Saskatoon, 2002[2]

(local time in hours and minutes)

SUNRISE AND SUNSET AT SASKATOON SK. 2002

2002	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	7:52	18:46	6:41	19:41	5:36	20:32	4:52	21:18	4:50	21:30	5:28	20:57	6:18	19:54	7:07	18:44	8:02	17:38	8:53	16:58
2	9:15	17:06	8:45	17:56	7:50	18:48	6:39	19:42	5:34	20:34	4:51	21:19	4:51	21:30	5:29	20:55	6:20	19:52	7:09	18:42	8:04	17:36	8:55	16:57
3	9:15	17:08	8:43	17:58	7:48	18:50	6:37	19:44	5:33	20:35	4:50	21:20	4:52	21:29	5:31	20:53	6:21	19:49	7:11	18:39	8:05	17:34	8:56	16:57
4	9:15	17:09	8:42	18:00	7:46	18:52	6:34	19:46	5:31	20:37	4:50	21:21	4:52	21:29	5:32	20:52	6:23	19:47	7:13	18:37	8:07	17:32	8:57	16:56
5	9:14	17:10	8:40	18:02	7:43	18:54	6:32	19:48	5:29	20:39	4:49	21:22	4:53	21:28	5:34	20:50	6:25	19:45	7:14	18:35	8:09	17:31	8:59	16:56
6	9:14	17:11	8:38	18:04	7:41	18:55	6:30	19:49	5:27	20:40	4:48	21:23	4:54	21:28	5:36	20:48	6:26	19:42	7:16	18:32	8:11	17:29	9:00	16:56
7	9:14	17:13	8:37	18:05	7:39	18:57	6:27	19:51	5:25	20:42	4:48	21:24	4:55	21:27	5:37	20:46	6:28	19:04	7:18	18:30	8:13	17:27	9:01	16:55
8	9:13	17:14	8:35	18:07	7:37	19:59	6:25	19:53	5:24	20:44	4:47	21:24	4:56	21:27	5:39	20:44	6:29	19:38	7:19	18:28	8:15	17:26	9:02	16:55
9	9:13	17:15	8:33	18:09	7:34	19:01	6:23	19:54	5:22	20:45	4:47	21:25	4:57	21:26	5:40	20:42	6:31	19:35	7:21	18:26	8:16	17:24	9:03	16:55
10	9:12	17:17	8:31	18:11	7:32	19:02	6:21	19:56	5:20	20:47	4:46	21:26	4:58	21:25	5:42	20:41	6:33	19:33	7:23	18:23	8:18	17:22	9:04	16:54
11	9:11	17:18	8:29	18:13	7:30	19:04	6:18	19:58	5:18	20:48	4:46	21:27	4:59	21:24	5:44	20:39	6:34	19:31	7:24	18:21	8:20	17:21	9:05	16:54
12	9:11	17:20	8:27	18:15	7:27	19:06	6:16	20:00	5:17	20:50	4:46	21:27	5:00	21:23	5:45	20:37	6:36	19:28	7:26	18:19	8:22	17:19	9:06	16:54
13	9:10	17:21	8:26	18:17	7:25	19:08	6:14	20:01	5:15	20:52	4:46	21:28	5:01	21:22	5:47	20:35	6:38	19:26	7:28	18:17	8:23	17:18	9:07	16:54
14	9:09	17:23	8:24	18:19	7:23	19:09	6:12	20:03	5:14	20:53	4:45	21:29	5:03	21:21	5:48	20:33	6:39	19:24	7:30	18:15	8:25	17:16	9:08	16:54
15	9:08	17:24	8:22	18:20	7:21	19:11	6:09	20:05	5:12	20:55	4:45	21:29	5:04	21:20	5:50	20:31	6:41	19:21	7:31	18:12	8:27	17:15	9:09	16:54
16	9:07	17:26	8:20	18:22	7:18	19:13	6:07	20:06	5:11	20:56	4:45	21:30	5:05	21:19	5:52	20:29	6:43	19:19	7:33	18:10	8:29	17:13	9:10	16:55
17	9:06	17:28	8:18	18:24	7:16	19:15	6:05	20:08	5:09	20:58	4:45	21:30	5:06	21:18	5:53	20:27	6:44	19:17	7:35	18:08	8:30	17:12	9:11	16:55
18	9:05	17:29	8:16	18:26	7:14	19:16	6:03	20:10	5:08	20:59	4:45	21:30	5:08	21:17	5:55	20:25	6:46	19:14	7:37	18:06	8:32	17:11	9:11	16:55
19	9:04	17:31	8:14	18:28	7:11	19:18	6:01	20:12	5:06	21:01	4:45	21:31	5:09	21:16	5:57	20:22	6:47	19:12	7:39	18:04	8:34	17:10	9:12	16:55
20	9:03	17:33	8:12	18:30	7:09	19:20	5:59	20:13	5:05	21:02	4:45	21:31	5:10	21:15	5:58	20:20	6:49	19:10	7:41	18:02	8:36	17:08	9:13	16:56
21	9:02	17:34	8:09	18:32	7:07	19:22	5:57	20:15	5:04	21:04	4:46	21:31	5:12	21:13	6:00	20:18	6:51	19:07	7:42	18:00	8:37	17:07	9:13	16:56
22	9:00	17:36	8:07	18:33	7:04	19:23	5:54	20:17	5:02	21:05	4:46	21:31	5:13	21:12	6:02	20:16	6:52	19:05	7:44	17:57	8:39	17:06	9:14	16:57
23	9:00	17:38	8:05	18:35	7:02	19:25	5:52	20:18	5:01	21:06	4:46	21:31	5:14	21:10	6:03	20:14	6:54	19:03	7:46	17:55	8:41	17:05	9:14	16:57
24	8:58	17:40	8:03	18:37	7:00	19:27	5:50	20:20	5:00	21:08	4:46	21:31	5:16	21:09	6:05	20:12	6:56	19:00	7:47	17:53	8:42	17:04	9:14	16:58
25	8:57	17:41	8:01	18:39	6:57	19:29	5:48	20:22	4:59	21:09	4:47	21:31	5:17	21:08	6:07	20:10	6:57	18:58	7:49	17:51	8:44	17:03	9:15	16:59
26	8:56	17:43	7:59	18:41	6:55	19:30	5:46	20:24	4:58	21:10	4:47	21:31	5:19	21:06	6:08	20:07	6:59	18:56	7:51	17:49	8:45	17:02	9:15	16:59
27	8:54	17:45	7:57	18:43	6:53	19:32	5:44	20:25	4:56	21:12	4:48	21:31	5:20	21:05	6:10	20:05	7:01	18:53	7:53	17:47	8:47	17:01	9:15	17:00
28	8:53	17:47	7:54	18:45	6:50	19:34	5:42	20:27	4:55	21:13	4:48	21:31	5:22	21:03	6:11	20:03	7:02	18:51	7:55	17:45	8:49	17:00	9:15	17:01
29	8:51	17:49			6:48	19:36	5:40	20:29	4:54	21:14	4:49	21:31	5:23	21:02	6:13	20:01	7:04	18:49	7:56	17:43	8:50	17:00	9:15	17:02
30	8:50	17:50			6:46	19:37	5:38	20:30	4:54	21:15	4:50	21:31	5:25	21:00	6:15	19:58	7:06	18:46	7:58	17:42	8:51	16:59	9:15	17:03
31	8:48	17:52			6:43	19:39			4:53	21:17			5:26	20:59	6:16	19:56			8:00	17:40			9:15	17:04

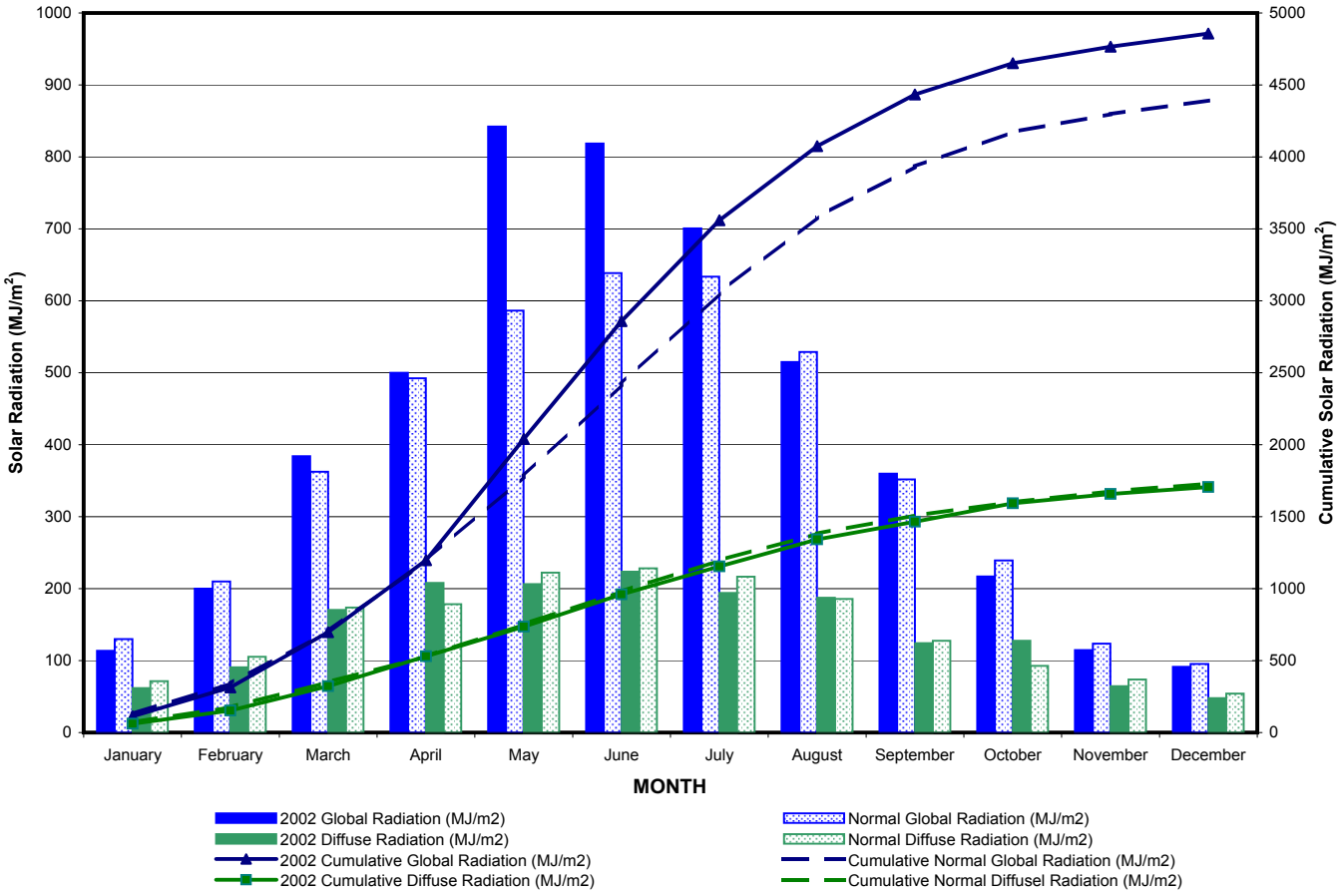
[1]Sunrise/set = corresponds to the upper limb of the sun appearing at the horizon

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

Monthly Global and Diffuse Solar Radiation, 2002

MONTH	GLOBAL RADIATION (MJ/m^2)		CUMULATIVE GLOBAL RADIATION (MJ/m^2)		DIFFUSE RADIATION (MJ/m^2)		CUMULATIVE DIFFUSE RADIATION (MJ/m^2)	
	2002	Normal	2002	Normal	2002	Normal	2002	Normal
January	113.7	129.9	113.7	129.9	61.7	71.4	61.7	71.4
February	200.1	210.1	313.8	340.0	90.6	105.3	152.3	176.7
March	384.1	362.4	697.9	702.4	170.3	173.9	322.6	350.6
April	500.1	492.2	1198.0	1194.6	207.9	178.5	530.5	529.1
May	842.3	586.3	2040.3	1780.9	206.2	222.2	736.7	751.3
June	818.5	638.7	2858.8	2419.6	223.7	228.1	960.4	979.4
July	700.8	633.5	3559.6	3053.1	193.9	216.5	1154.3	1195.9
August	514.8	529.0	4074.4	3582.1	187.4	185.6	1341.7	1381.5
September	359.9	351.8	4434.3	3933.9	124.2	127.6	1465.9	1509.1
October	216.8	239.1	4651.1	4173.0	127.6	92.6	1593.5	1601.7
November	114.7	123.7	4765.8	4296.7	64.5	73.6	1658.0	1675.3
December	91.2	95.2	4857.0	4391.9	47.9	54.3	1705.9	1729.6
Total	4857.0	4391.9			1705.9	1729.6		

Normals = 1961- 1990



Daily global and Diffuse Solar Radiation, 2002

(MJ/m²)

DATE	JAN		FEB		MAR		APR		MAY		JUN		JULY		AUG		SEPT		OCT		NOV		DEC	
2002	**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	3.1	1.2	3.9	3.8	12.0	1.9	12.3	10.9	24.8	2.6	35.9	7.2	30.6	5.7	15.2	6.4	6.7	6.3	10.7	4.4	7.7	1.5	1.3	1.2
2	3.5	1.9	5.0	3.6	12.7	1.8	18.8	5.1	12.6	10.4	18.7	11.1	39.9	3.8	18.8	6.5	19.1	2.9	12.5	4.1	8.1	2.2	1.0	1.0
3	2.9	1.2	6.1	1.9	5.4	5.2	19.0	6.1	12.2	7.4	26.9	13.5	31.9	4.2	12.0	10.0	16.1	7.0	7.9	4.5	2.7	2.6	5.8	1.3
4	3.4	2.5	6.3	2.6	6.1	6.1	19.5	6.9	16.8	8.5	25.6	8.1	17.7	7.9	17.3	8.3	13.4	6.6	4.6	4.0	3.6	3.5	4.9	2.3
5	1.5	1.3	6.4	3.4	9.4	6.3	14.5	10.0	25.0	4.1	33.1	6.7	28.9	3.7	13.2	7.6	3.7	3.6	8.2	4.7	3.7	3.3	5.1	1.1
6	3.1	2.3	7.2	1.4	13.3	2.1	7.7	7.5	25.2	4.3	20.3	9.1	29.1	4.8	14.0	8.2	3.5	3.1	7.0	5.3	2.6	2.5	2.2	2.0
7	3.5	1.4	6.1	3.3	9.7	6.0	10.0	9.6	25.0	4.3	36.6	5.5	29.1	2.8	17.4	6.2	2.4	2.2	4.1	3.5	4.1	2.0	2.0	1.9
8	2.8	1.5	3.9	3.4	11.8	4.9	15.3	8.7	17.4	11.9	17.3	10.9	21.5	13.2	19.3	7.0	12.4	6.6	12.8	2.1	1.7	1.7	3.4	2.0
9	3.0	1.7	5.3	3.5	13.9	3.0	19.3	5.3	20.6	7.4	10.9	7.0	5.3	4.3	21.8	6.1	18.6	2.2	11.5	2.3	1.8	1.8	3.6	1.3
10	4.4	1.3	4.6	4.4	6.6	6.6	6.7	6.3	23.0	7.0	11.9	7.7	23.1	9.6	16.8	5.4	18.2	2.0	7.7	4.9	2.7	2.7	3.9	1.3
11	3.9	1.4	4.8	3.5	11.9	7.1	19.1	5.7	18.0	10.1	8.1	5.2	27.7	3.7	3.9	3.4	17.6	2.3	6.0	5.0	2.6	2.3	1.8	1.5
12	1.7	1.8	7.9	2.4	10.7	7.8	17.6	5.8	26.2	3.5	17.0	7.7	27.0	4.7	22.8	5.3	16.8	3.2	9.6	3.9	5.3	2.4	4.8	1.2
13	1.0	1.1	5.5	5.1	9.0	8.6	14.9	7.5	24.8	5.3	36.0	6.1	27.0	3.9	16.2	9.8	14.7	4.5	6.6	4.7	3.8	3.1	2.6	1.9
14	1.1	1.2	8.2	2.8	13.4	6.1	9.3	7.3	23.5	7.5	37.5	7.2	19.1	9.8	17.2	9.2	16.5	2.8	9.9	5.0	3.0	2.9	2.6	1.8
15	2.5	1.9	6.3	4.5	13.6	5.0	17.4	6.4	28.5	6.3	37.8	6.9	27.9	3.0	8.7	6.8	15.7	2.8	5.8	4.8	4.0	2.2	1.3	1.3
16	2.1	2.2	9.4	1.7	10.8	8.2	15.7	9.7	38.0	3.3	31.3	8.8	25.0	5.9	9.2	7.9	13.7	4.9	3.2	3.0	5.4	2.4	3.8	1.5
17	4.3	2.4	8.3	1.6	13.0	8.3	16.3	6.6	37.3	4.6	28.6	11.2	15.2	6.0	22.7	3.1	11.4	7.5	2.7	2.6	3.1	1.8	1.9	1.9
18	2.6	2.7	4.4	4.4	12.0	7.8	21.0	5.1	35.8	6.6	10.4	6.9	24.8	6.4	15.1	7.0	15.3	3.0	4.0	3.8	4.8	1.1	2.4	1.8
19	2.6	2.6	3.2	3.4	14.1	5.7	22.0	5.6	35.3	7.6	22.4	7.5	13.4	8.3	21.4	3.7	14.3	4.0	4.6	3.8	3.3	2.2	1.0	1.0
20	2.6	2.8	9.8	2.0	16.9	3.8	22.2	3.8	37.7	4.4	36.8	6.5	25.0	5.0	18.6	7.4	7.5	5.9	6.3	5.9	4.4	1.4	1.5	1.5
21	2.8	2.8	8.0	3.5	16.9	2.6	22.4	3.3	28.1	11.1	37.1	7.0	12.4	8.8	22.0	2.8	8.2	5.6	10.0	8.5	4.3	1.4	2.2	2.2
22	4.6	3.2	7.9	2.8	17.0	2.2	15.9	9.1	16.2	8.8	39.9	5.4	27.1	4.0	17.9	6.6	5.6	4.8	4.9	4.5	3.2	2.0	2.0	1.9
23	4.7	2.0	8.9	4.6	16.8	3.3	14.2	10.1	34.4	4.0	22.7	12.0	26.4	3.7	20.4	3.4	14.1	4.7	9.7	9.4	5.0	1.1	2.3	2.0
24	4.4	2.4	11.2	2.9	15.0	6.6	13.1	10.7	19.6	10.2	6.7	4.3	22.2	8.2	21.2	2.1	13.3	4.5	8.8	2.6	5.1	1.7	3.9	1.8
25	3.1	3.3	9.7	3.8	12.8	7.9	23.7	2.6	27.9	9.7	38.2	4.7	26.1	4.0	19.2	4.4	14.0	3.4	2.0	2.0	3.4	2.3	4.1	1.0
26	3.1	3.2	9.2	6.5	14.7	7.0	23.6	4.3	37.9	4.0	39.2	4.2	16.1	8.5	13.3	7.0	11.8	5.8	3.5	3.3	2.9	2.3	2.9	1.8
27	6.1	2.3	10.9	2.0	7.6	6.3	22.2	4.2	33.3	5.7	38.7	4.9	24.0	6.2	17.4	5.1	14.8	2.3	3.4	3.4	2.7	2.6	3.2	1.0
28	7.3	1.5	11.7	1.8	16.1	4.2	14.5	7.9	36.7	5.4	32.9	8.9	17.8	9.7	20.5	2.4	13.4	3.2	7.3	3.9	2.9	2.1	3.6	1.6
29	7.7	1.6			13.1	6.9	18.7	7.4	30.6	8.0	21.3	8.4	18.1	9.2	18.9	4.2	5.4	4.9	4.7	4.2	3.3	2.3	1.3	1.3
30	6.6	1.5			17.0	4.4	13.2	8.4	36.9	4.2	38.7	3.1	14.9	9.6	9.8	8.0	1.7	1.6	8.5	2.0	3.5	1.1	4.9	1.1
31	7.7	1.5			10.8	6.6			33.0	8.0			6.5	5.3	12.6	6.1			8.3	1.5			3.9	1.4
TOTAL	113.7	61.7	200.1	90.6	384.1	170.3	500.1	207.9	842.3	206.2	818.5	223.7	700.8	193.9	514.8	187.4	359.9	124.2	216.8	127.6	114.7	64.5	91.2	47.9

COMMENTS: G= Global Radiation D= Diffuse Radiation

January Diffuse shaded cells - diffuse radiation greater than global radiation related to instrument standard error and/or instrument maladjustment

May 23 Global and Diffuse down for servicing for 1 hour

July 4 Sensors off line for 1 hour while new calibration numbers entered into programme

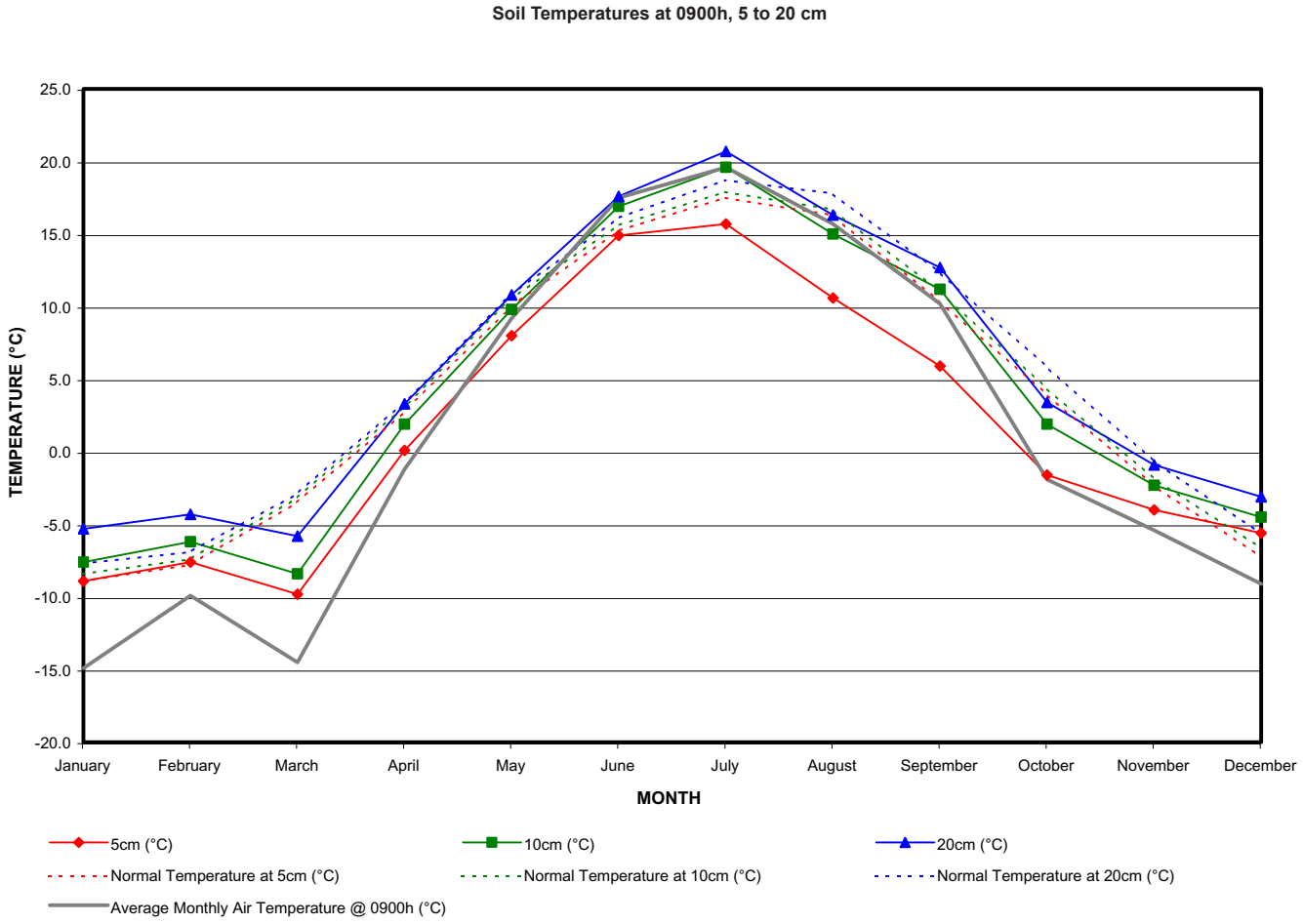
Oct. 21-23 Diffuse shadow band maladjusted

Monthly Average Soil Temperatures at 0900 hrs, 2002

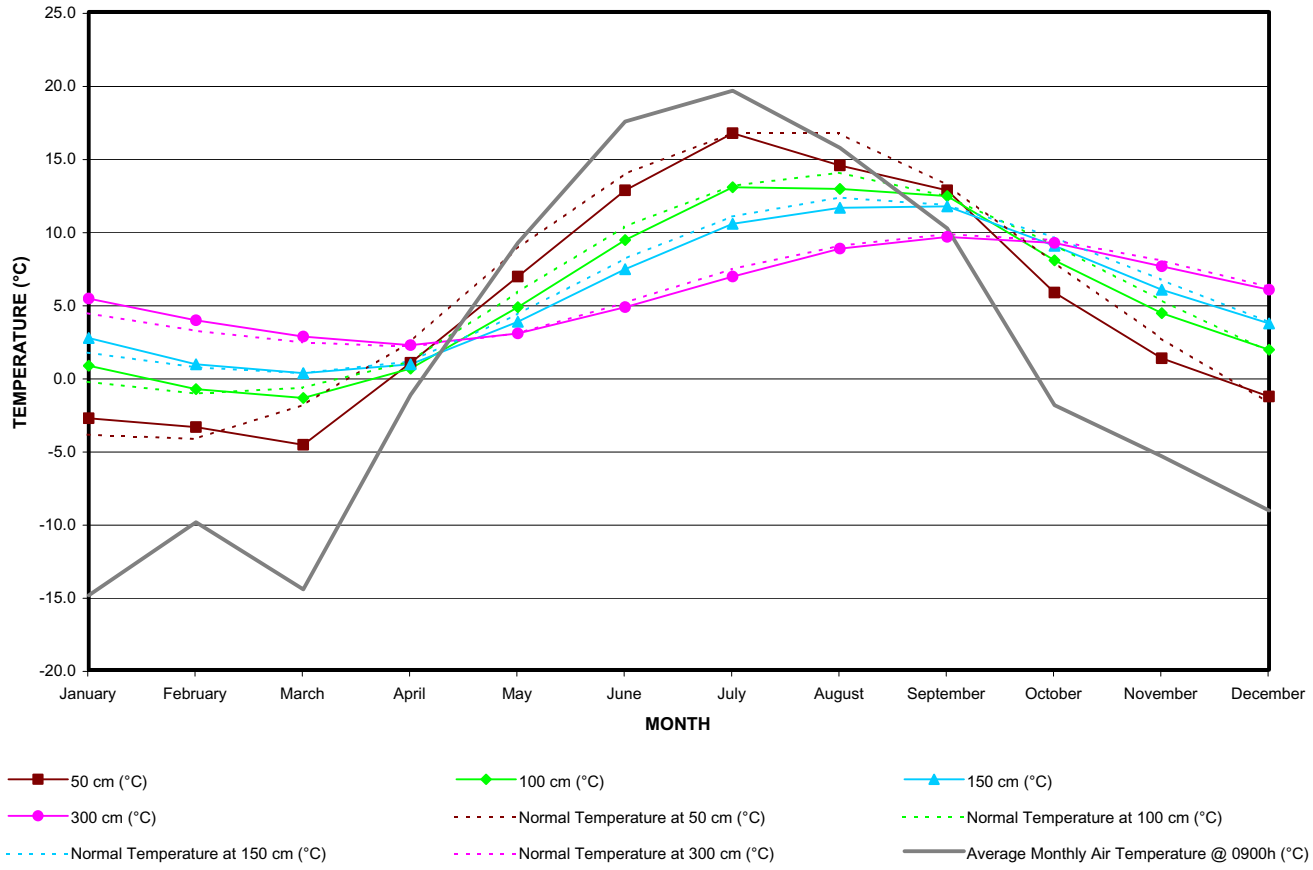
(5 to 300cm depths)

MONTH	Average Air Temp.	5cm (°C)		10cm (°C)		20cm (°C)		50cm (°C)		100cm (°C)		150cm (°C)		300cm (°C)	
	@0900h	2002	Normal	2002	Normal	2002	Normal	2002	Normal	2002	Normal	2002	Normal	2002	Normal
January	-14.9	-8.9	-8.8	-7.6	-8.3	-5.3	-7.6	-2.8	-3.8	0.8	-0.2	2.7	1.8	5.4	4.5
February	-9.9	-7.6	-7.7	-6.2	-7.3	-4.3	-6.8	-3.4	-4.1	-0.8	-1.0	0.9	0.8	3.9	3.3
March	-14.5	-9.8	-3.4	-8.4	-3.1	-5.8	-2.8	-4.6	-1.8	-1.4	-0.6	0.3	0.4	2.8	2.5
April	-1.2	0.1	2.8	1.9	3.2	3.3	3.5	1.0	2.5	0.6	1.2	0.9	1.2	2.2	2.2
May	9.2	8.0	10.1	9.8	10.6	10.8	10.9	6.9	8.9	4.8	5.9	3.8	4.4	3.0	3.1
June	17.5	14.9	15.3	16.9	15.7	17.6	16.2	12.8	14.0	9.4	10.4	7.4	8.2	4.8	5.2
July	19.6	15.7	17.6	19.6	18.0	20.7	18.8	16.7	16.8	13.0	13.2	10.5	11.1	6.9	7.5
August	15.7	10.6	16.4	15.0	16.8	16.3	17.9	14.5	16.8	12.9	14.1	11.6	12.4	8.8	9.1
September	10.2	5.9	10.5	11.2	11.2	12.7	12.5	12.8	13.3	12.4	12.5	11.7	11.9	9.6	9.9
October	-1.9	-1.6	4.1	1.9	4.5	3.4	6.0	5.8	8.0	8.0	9.2	9.0	9.7	9.2	9.5
November	-5.4	-4.0	-2.2	-2.3	-1.7	-0.9	-0.5	1.3	2.8	4.4	5.4	6.0	6.8	7.6	8.1
December	-9.1	-5.6	-7.1	-4.5	-6.5	-3.1	-5.5	-1.3	-1.6	1.9	1.9	3.7	3.9	6.0	6.3

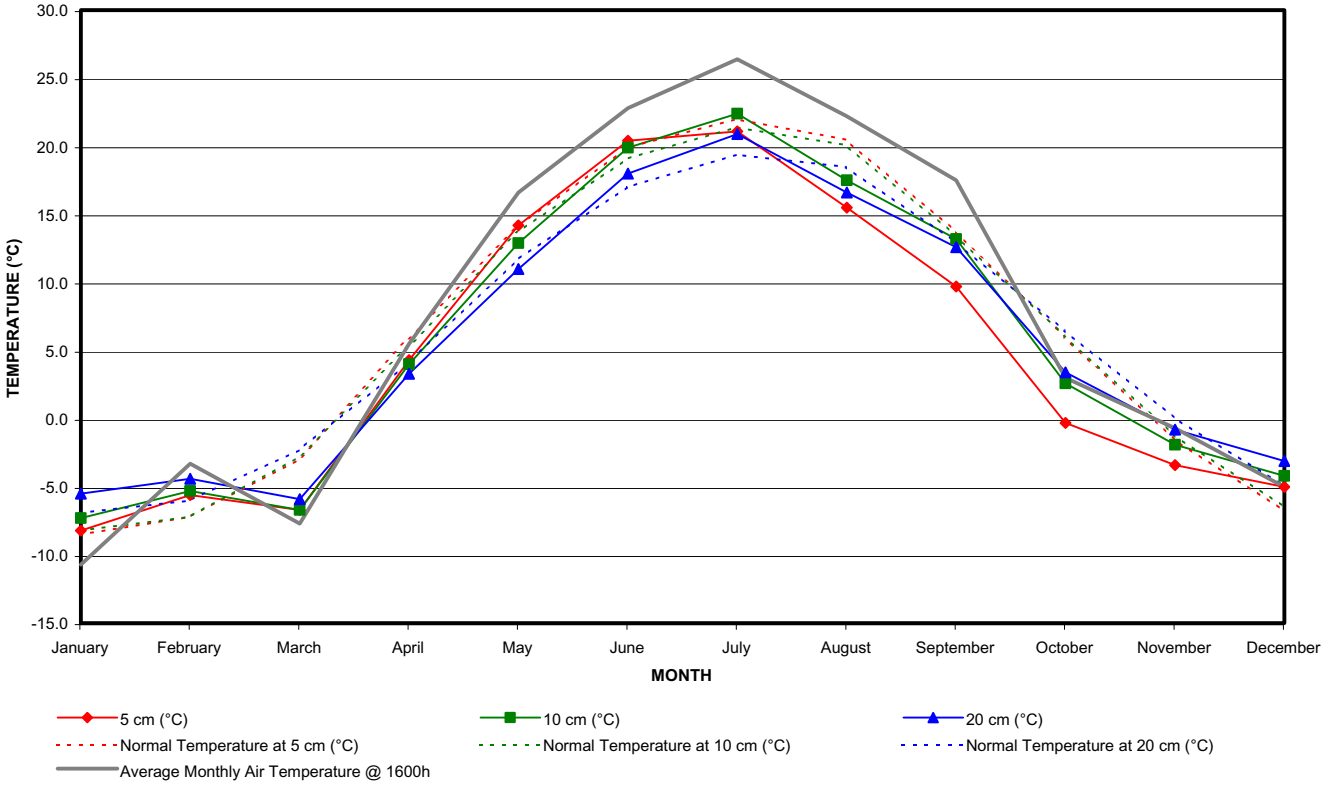
Normal = 1961-1990



Soil Temperatures at 0900h, 50cm to 300cm



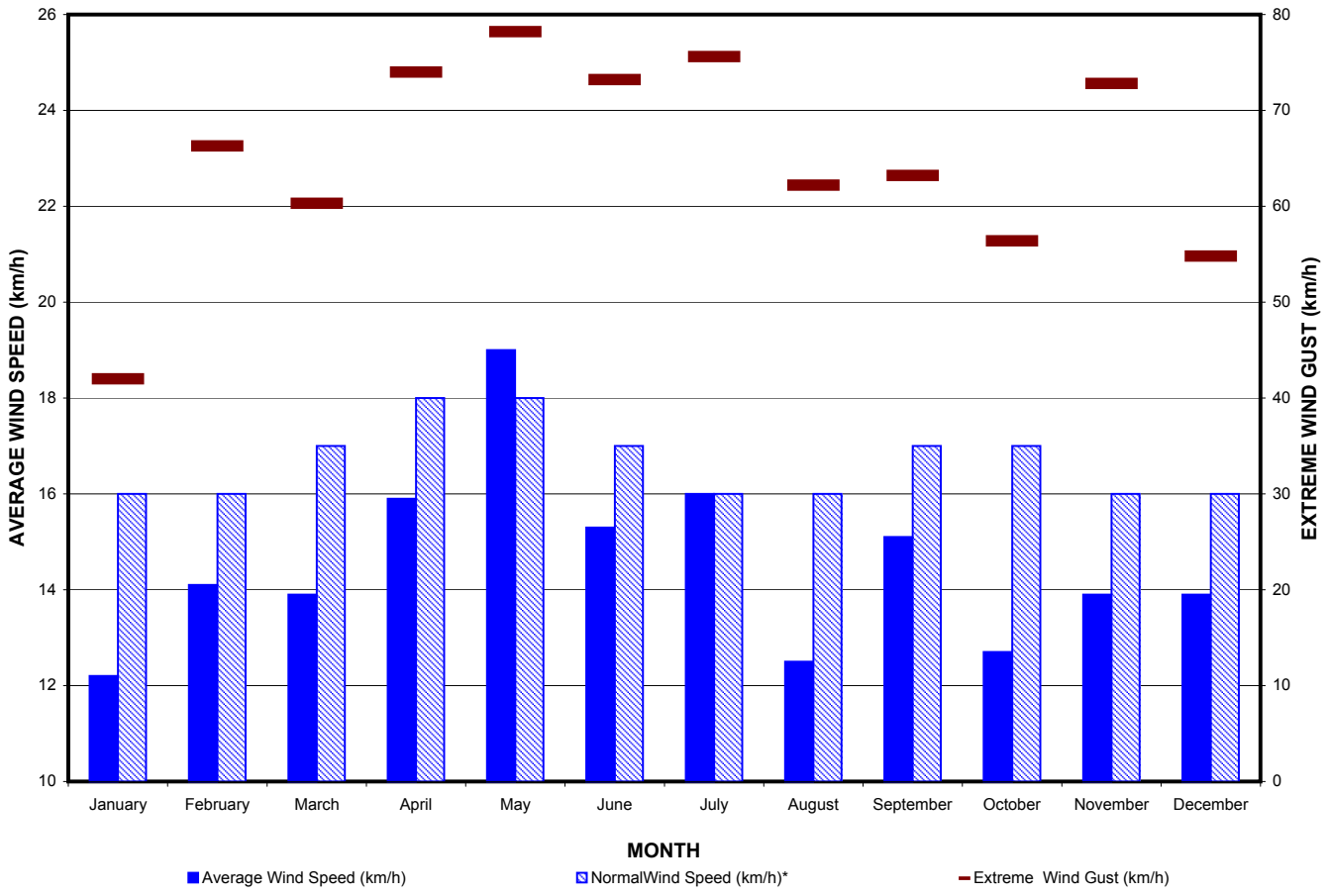
Soil Temperatures at 1600h, 5cm to 20cm



Monthly Average Wind Speed and Extreme Gusts, 2002

MONTH	AVERAGE (km/h)		EXTREME GUST (km/h)		
	2002	Normal*	Direction	2002	Date
January	12.2	16.0	NW	42.0	13
February	14.1	16.0	NW	66.3	11
March	13.9	17.0	NNW	60.3	29
April	15.9	18.0	WSW	74.0	15
May	19.0	18.0	W	78.2	29
June	15.3	17.0	S	73.2	17
July	16.0	16.0	WNW	75.6	05
August	12.5	16.0	E	62.2	25
September	15.1	17.0	NW	63.2	19
October	12.7	17.0	SSW	56.4	02
November	13.9	16.0	NW	72.8	22
December	13.9	16.0	SE	54.8	16

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



Extreme Winds for 2002[1]

No. of days with winds:	FEBRUARY			MARCH			APRIL		
	Day	Speed	Direction	Day	Speed	Direction	Day	Speed	Direction
>=51 but <63 Near Gale	22	52.4	NNW	29	60.3	NNW	22	56.5	NW
				30	53.3	NW	23	56.3	NW
							24	62.0	NW
							28	59.3	NW
							29	62.9	NNW
>=63 but <76 Gale	11	66.3	NW				14	73.9	WSW
							15	74	WSW
No. of days with winds:	**MAY**			**JUNE**			**JULY**		
	Day	Speed	Direction	Day	Speed	Direction	Day	Speed	Direction
>=51 but <63 Near Gale	02	61.5	SE	6	61.9	WNW	02	55.0	WSW
	12	55.0	NW	9	52.2	ENE	17	60.3	SE
	14	60.2	NNE	11	55.1	NNE	21	59.2	NNW
	19	58.2	SE						
	20	60.7	SSE						
	25	58.6	WNW						
	28	61.0	WSW						
	30	61.0	NW						
>=63 but <76 Gale	03	63.7	NNW	5	69.4	S	01	65.3	WSW
	21	74.5	NE	10	72.6	ENE	05	75.6	WNW
	22	74.4	NE	17	73.2	WNW	26	69.4	NW
	27	65.1	SSW	30	63.4	W			
>=76 but <88 Strong Gale	29	78.2	W						
No. of days with winds:	**AUGUST**			**SEPTEMBER**			**OCTOBER**		
	Day	Speed	Direction	Day	Speed	Direction	Day	Speed	Direction
>=51 but <63 Near Gale	05	56.8	SE	13	55.5	NW	02	56.4	SSW
	10	54.5	WSW	20	55.8	WNW	12	55.0	WNW
	25	62.2	E	21	60.0	NW			
				28	52.9	S			
				30	57.2	NE			
>=63 but <76 Gale				19	63.2	NW			
No. of days with winds:	**NOVEMBER**			**DECEMBER**					
	Day	Speed	Direction	Day	Speed	Direction			
>=51 but <63 Near Gale	25	58.1	N	16	54.8	SE			
	28	58.7	WNW						
>=63 but <76 Gale	22	72.8	NW						
	29	63.8	NNW						

[1] *Beaufort Wind Scale Designation*

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, 2001a

technology is our business

Saskatchewan Research Council

Annual Weather Summary

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

CRS estab. 1963

		2002 VALUE	2001 VALUE	NORMAL (1971-2000) OR EXTREME (1892-2002)
TEMPERATURE	Average annual maximum (°C)	8.5	10.8	8.3
	Extreme annual maximum (°C/date)	37.2 June 28	39.3 July 05	41.0 June 1988
	Average annual minimum (°C)	-2.9	-1.6	-3.4
	Extreme annual minimum (°C/date)	-32.2 Jan. 31	-34.0 Jan. 09	-50.0 Feb. 1893
	Annual average (°C)	2.8	4.6	2.5
	No.of Frost days (Temperature ≤ 0°C)	219	189	197.1
DEGREE-DAYS	Annual growing (5°C base)	1699.9	1980.7	1672.5
	Annual frost-free growing (5°C base)	1572.2		
	Annual heating (18°C base)	5760.9	5062.6	5772.7
	Annual cooling (18°C base)	227.9	219.2	119.1
PRECIPITATION	Annual total (mm)	320.0	165.8	348.2
	Greatest 24-hr (mm/date)	32.2 July 09	19.4 July 25	99.4 June 24, 1983
	Measurable precipitation days (≥ 0.2mm)	107	84	115.7
WIND	Average monthly speed (km/h)	14.5	14.4	16.6*
	Peak gust (direction/speed/date)	W78.2 May 29	WNW84.8 July 28	W151.0 Aug 14, 1967*
RADIATION	Total annual bright sunshine (hours)	2313.6	2497.8	2294.1
	% possible bright sunshine	51.6	55.7	51.2
	Bright Sunshine days	319	331	319.9
	Total annual global radiation(MJ/m^2)	4857.0	4540.6	4391.9**
	Total annual diffuse radiation (MJ/m^2	1705.9	1654.6	1729.6**

For Your Information

2002

Grass temperatures are taken from a surface probe whose calibration is unknown at present.

2001

Grass temperatures are taken from a surface probe whose calibration is unknown at present.

October 4th to 10th and 26th to 30th. Power outage resulted in missed Bright Sunshine data. Data for those days is taken from Kernen Farm, University of Saskatchewan.[1]

[1] *University of Saskatchewan, Kernen Farm, 2001*

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.

technology is our business

Saskatchewan Research Council

Monthly Weather Summary

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

CRS estab. 1963

	January 2002	2002 VALUE	2001 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	-9.2	-3.0	-11.6 (-12.4)	
	Extreme monthly maximum (°C/date)	6.8/08	4.6/04	7.0/1986/11	10.0/1931/30
	Average monthly minimum (°C)	-17.6	-12.5	-21.8 (-22.6)	
	Extreme monthly minimum (°C/date)	-32.2/31	-24.0/31	-43.0/1966/22&1969/29	-48.9/1893/31
	Monthly average (°C)	-13.4	-7.8	-16.7 (-17.4)	
	No.of Frost days (Temperature ≤ 0°C)	30	31	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)	973.3	799.4	1076.5 (1114.8)	
	Yearly total-to-date heating	973.3	799.4	1076.5 (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)	2.9	2.5	18.2(20.5)	
	Yearly total-to-date (mm)	2.9	2.5	18.2(20.5)	
	Greatest 24-hr (mm/date)	1.1/02	1.4/31	15.4/1989/30	30.5/1893/23
	Measurable precipitation days (≥ 0.2mm)	6	3	11(11)	
WIND	Average monthly speed (km/h)	12.2	12.7		16.0
	Peak gust (direction/speed/date)	NW42.0/13	WNW51.6/04		W111.0/1986/11
RADIATION	Monthly bright sunshine (hours)	107.5	130.0	103.3(104.6)	
	% possible bright sunshine	41.5	50.1	39.9(40.4)	
	Bright Sunshine days	21	28	24(24)	
	Monthly global radiation(MJ/m²)	113.7	131.3	(129.9)	
	Monthly diffuse radiation (MJ/m²)	61.7	62.6	(71.4)	
SOIL	Average temperature (°C) @ 9:00am grass level*/5 cm	-19.8/-8.9	-15.0/-5.8	(na/-8.8)	
	10 cm/20 cm	-7.6/-5.3	-4.5/-3.0	(-8.3/-7.6)	
	50 cm/100cm	-2.8/0.8	-2.2/-0.5	(-3.8/-0.2)	
	150 cm/300cm	2.7/5.4	2.2/4.8	(1.8/4.5)	

For Your Information

Unseasonably warm temperatures, book ended with more typical ones, characterised January 2002. The 8th remain above freezing and just missed tieing the maximum record by 0.2°. Even with extreme low temperatures during the later third of the month, the monthly mean was 3.3°C above the new 1971-2000 normals. The above average minimum temperatures contributed to the majority of the warming. The warm weather was reflected in the 9.6% decrease in the number of heating degree-days. The drought of 2001 has continued into 2002 with only 2.9 mm of precipitation recorded. Snow-on-the-ground was sparse and evident in the 5cm soil temperatures which was the only depth recording below seasonal normals. Even though bright sunshine was absent for 10 days, the monthly total was just slightly above average.

Today, the ability to measure temperature in a quantitative form is taken for granted but the modern thermometer, invented by Gabriel Fahrenheit, is only 278 years old. In 1603, Galileo used a *thermoscope* to watch the change in temperature. By placing a scale on this device, scientists of the time invented the first thermometer. Unfortunately, the scales between the various thermometers bore no relationship to each other therefore their measurements could not be compared. It was not until Fahrenheit and later Celsius, that universal scales, based on set points such as water boiling and freezing and normal body temperature, were developed and accepted.[1] [1]Helden, 1995

SaskPower

Saskatchewan Agriculture, Food and Rural Revitalization

Agriculture and Agri-Food Canada

Agriculture et Agroalimentaire Canada

Ducks Unlimited Canada

Kipp & Zonen

*Grass temperature is taken from a surface probe whose calibration is unknown at present

technology is our business

Saskatchewan Research Council

Monthly Weather Summary

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

CRS estab. 1963

	February 2002	2002 VALUE	2001 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	-2.1	-4.5	-7.7(-8.6)	
	Extreme monthly maximum (°C/date)	7.9/17	4.0/23	7.5/1988/26 & 1991/06	12.8/1931/19
	Average monthly minimum (°C)	-12.2	-15.0	-17.6(-18.3)	
	Extreme monthly minimum (°C/date)	-27.4/28	-29.9/11	-41.1/1972/06	-50.0/1893/01
	Monthly average (°C)	-7.2	-9.8	-12.7(-13.7)	
	No.of Frost days (Temperature ≤ 0°C)	28	29	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)	705.1	804.9	866.3(909.9)	
	Yearly total-to-date heating	1678.4	1604.3	1942.8(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)	3.3	9.0	13.3(14.6)	30.0/1962/03
	Yearly total-to-date (mm)	6.2	24.3	31.5(35.1)	
	Greatest 24-hr (mm/date)	2.8/19	3.7/29	14.2/1979/13	
	Measurable precipitation days (≥ 0.2mm)	3	6	10(10)	
WIND	Average monthly speed (km/h)	14.1	12.6		16.0
	Peak gust (direction/speed/date)	NW66.3/11	NW42.7/29		N106.0/1988/22
RADIATION	Monthly bright sunshine (hours)	157.4	182.0	132.3(134.1)	
	% possible bright sunshine	56.4	63.0	47.4(48.2)	
	Bright Sunshine days	26	26	24(25)	
	Monthly global radiation(MJ/m²)	200.1	235.4	(210.1)	
	Monthly diffuse radiation (MJ/m²)	90.6	88.3	(105.3)	
SOIL	Average temperature (°C) @ 9:00am — grass level*/5 cm	-14.1/-7.6	-14.5/-4.9	na/(-7.7)	
	10 cm/20 cm	-6.2/-4.3	-6.2/-4.2	(-7.3/-6.8)	
	50 cm/100cm	-3.4/-0.8	-3.2/-0.1	(-4.1/-1.0)	
	150 cm/300cm	0.9/3.9	1.3/3.8	(0.8/3.3)	

For Your Information

February continued drought conditions with only 3.3mm of precipitation enlarging the yearly precipitation deficit to 20% of normal. By month's end, the snow-on-the-ground measurement was nearly negligible. Temperatures, soaring to an average of 5.6°C above normal, set a new monthly extreme maximum temperature, breaking the old record set in 1988 and 1991 by 0.4°C. Not even the cold month-end temperatures could offset the 13 days of above zero weather. The combination of warmer temperatures and no snow cover has produced soil temperatures near normal in all levels except the 10 and 20 cm where temperatures are above normal by 1.1°C and 2.5°C respectively. Bright sunshine, absent for only 2 days, was 19.0% above normal.

Warm winter conditions in February have been recorded historically. In 1802, Peter Fidler, a Hudson's Bay trader, reported unseasonably mild winter temperatures at Chesterfield House near present day Leader, SK. He wrote "Warm weather, thermometer 40°+ (4.5°C). Cleaned the snow off the houses to prevent its melting and running through and spoiling the furs. Several Indians came in with only 20 foxes amongst them all." A warm winter meant poor trapping.[1]

[1] Phillips, 2001

*Grass temperature is taken from a surface probe whose calibration is unknown at present

Saskatchewan Research Council

Monthly Weather Summary

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

CRS estab. 1963

	March 2002	2002 VALUE	2001 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	-6.7	2.9	-0.7(-2.1)	
	Extreme monthly maximum (°C/date)	6.6/28	13.5/19	17.0/1986/27	22.8/1910/23
	Average monthly minimum (°C)	-18.0	-7.5	-10.5(-12.1)	
	Extreme monthly minimum (°C/date)	-27.6/20	-19.4/23	-38.9/1972/02	-43.3/1897/14
	Monthly average (°C)	-12.4	-2.3	-5.6(-7.0)	
	No.of Frost days (Temperature ≤ 0°C)	31	31	30(30)	
DEGREE-DAYS	Monthly growing (5°C base)	0.0	0.6	2.3(1.2)	
	Yearly total-to-date growing	0.0	0.6	2.3(1.2)	
	Monthly heating (18°C base)	942.5	629.4	732.1(784.1)	
	Yearly total-to-date heating	2620.9	2385.4	2674.9(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)	8.1	3.2	16.2(19.9)	
	Yearly total-to-date (mm)	14.3	9.4	47.7(55.0)	
	Greatest 24-hr (mm/date)	1.2/29	1.4/22	32.0/1967/30	32.0/1967/30
	Measurable precipitation days (≥ 0.2mm)	13	5	9(9)	
WIND	Average monthly speed (km/h)	13.9	14.2		17.0
	Peak gust (direction/speed/date)	NNW60.3/29	WSW74.2/29		W93.0/1959/18
RADIATION	Monthly bright sunshine (hours)	200.4	232.0	175.2(174.6)	
	% possible bright sunshine	54.3	62.7	47.4(47.4)	
	Bright Sunshine days	30	28	27(27)	
	Monthly global radiation(MJ/m²)	384.1	394.6	(362.4)	
	Monthly diffuse radiation (MJ/m²)	170.3	124.4	(173.9)	
SOIL	Average temperature (°C) @ 9:00am grass level*/5 cm	-15.9/-9.8	-5.1/-2.3	(na/-3.4)	
	10 cm/20 cm	-8.4/-5.8	-1.5/-0.5	(-3.1/-2.8)	
	50 cm/100cm	-4.6/-1.4	-1.7/-0.3	(-1.8/-0.6)	
	150 cm/300cm	0.3/2.8	0.7/2.7	(0.4/2.5)	

For Your Information

It is a good thing the first day of Spring was marked on the calendar because you certainly could not tell from the weather. With a mean temperature 6.8°C below normal, March was the 4th coldest since the station opened in 1963. Of the 13 days with -20°C minimum temperatures or lower, 6 were lower than -25°C. Only 7 maximum temperatures managed to struggle above 0°C. The cold temperatures are reflected in the 29% increase in heating degree-days which almost erased the cumulative deficit accrued during January and February. With little snow coverage, soil temperatures in the upper levels plunged well below normal. Precipitation was notable by its absence. Only 50% of normal monthly precipitation occurred to add to the yearly deficit of 30%. The only bright spot was the sun with 14% increase in bright sunshine.

I suppose we should not complain; it could be worse. In 1927 a blizzard buried Saskatoon in 1 to 2 metre drifts. Intrepid snowshoe shod citizens tried to walk to work; many collapsing from exhaustion. Even the city's horse-drawn sidewalk snow ploughs struggled to cut lanes through the drifts. The only happy people were downtown restaurateurs who reaped profits from business men electing to eat downtown rather than brave the drifts to go home.[1] Although, on second thought, with the drought, a record blizzard would have been welcomed.

[1] Phillips, 2001

*Grass temperature is taken from a surface probe whose calibration is unknown at present

technology is our business

Saskatchewan Research Council

Monthly Weather Summary

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

CRS estab. 1963

April 2002

		2002 VALUE	2001 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	6.4	12.1	10.7 (9.9)	
	Extreme monthly maximum (°C/date)	19.3/13	31.5/28	31.5/2001/28	33.3/1952/28
	Average monthly minimum (°C)	-6.3	-1.7	-1.7 (-2.0)	
	Extreme monthly minimum (°C/date)	-19.1/03	-13.2/15	-27.8/1979/01	-28.3/1893/05&1954/02
	Monthly average (°C)	0.1	5.2	4.5 (4.0)	
	No.of Frost days (Temperature ≤ 0°C)	27	18	21(20)	
DEGREE-DAYS	Monthly growing (5°C base)	22.2	82.8	61.0 (54.8)	
	Yearly total-to-date growing	22.2		63.3 (55.7)	
	Monthly heating (18°C base)	537.4	387.7	405.0 (420.9)	
	Yearly total-to-date heating	3158.3		3079.9 (3196.9)	
	Monthly cooling (18°C base)	0.0	3.1	0.3 (0.2)	
	Yearly total-to-date cooling	0.0		0.3 (0.2)	
PRECIPITATION	Monthly total (mm)	12.0	6.4	23.6(20.3)	30.2/1955/19
	Yearly total-to-date (mm)	26.3	15.8	71.3(75.3)	
	Greatest 24-hr (mm/date)	5.0/23	2.0/07	24.6/1985/19	
	Measurable precipitation days (≥ 0.2mm)	8	9	8(7)	
WIND	Average monthly speed (km/h)	15.9	15.6		18.0
	Peak gust (direction/speed/date)	WSW74.0/15	WNW66.0/25		W108.0/1959/06
RADIATION	Monthly bright sunshine (hours)	223.2	217.5	225.2(229.4)	
	% possible bright sunshine	53.3	51.9	53.8(54.9)	
	Bright Sunshine days	28	26	27(27)	
	Monthly global radiation(MJ/m^2)	500.1	471.7	(492.2)	
	Monthly diffuse radiation (MJ/m^2)	207.9	178.5	(178.5)	
SOIL	Average temperature (°C) @ 9:00am grass level*/5 cm	-1.0/0.1	6.0/1.3	(na/2.8)	
	10 cm/20 cm	1.9/3.3	4.2/4.9	(3.2/3.5)	
	50 cm/100cm	1.0/0.6	2.6/2.0	(2.5/1.2)	
	150 cm/300cm	0.9/2.2	2.0/2.6	(1.2/2.2)	

For Your Information

If you liked March's 6.8°C below normal temperatures, welcome to April. The mean temperature was 4.4°C below normal with three days in the latter part of the month breaking minimum daily temperature records. April 2002 was the 4th coldest April at CRS with only 1967 (-1.9°C), 1975 (-0.1°C) and 1979 (-2.3°C) having colder mean temperatures. I am sure the pelicans, returning around the 23rd, considered flying back south. Soil temperatures ranged from 2.7° to 0.2° below normal in the upper levels. Growing degree-days were about a third of normal while heating degree-days were about a third more than normal. Drought conditions persisted for the 20th consecutive month. August 2000 was the last month that had above normal precipitation. Precipitation came in typical spring fashion; as snow, rain and everything in between on eight days. In the latter half of the month, *Near Gale* winds (51-62 kph) occurred four times while *Gale* winds (63-75 kph) occurred thrice. These winds began in the WSW shifted to the NW and ended up from the NNW.

Although we grouse about the unseasonable weather, April could have been worse. In 1987, La Ronge was buried under 48 cm of snow. Two years earlier five deaths were attributed to the 40 to 50 cm wet snowfall in central Alberta. In 1757, as recorded in the Hudson's Bay Company archives for York Factory, the factor noted "Severity of weather froze beer in cellar."[1]

[1] Phillips, 1988.

*Grass temperature is taken from a surface probe whose calibration is unknown at present

Saskatchewan Research Council

Monthly Weather Summary

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

technology is our business

CRS estab. 1963

	May 2002	2002 VALUE	2001 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	17.7	20.7	18.6 (18.5)	
	Extreme monthly maximum (°C/date)	29.0/28&29	31.5/13	35.0/1988/30	37.2/1936/27
	Average monthly minimum (°C)	1.4	5.6	4.7(4.5)	
	Extreme monthly minimum (°C/date)	-9.4/05	-1.9/03	-10.0/1967/02	-12.8/1907/06
	Monthly average (°C)	9.6	13.2	11.6 (11.5)	
	No.of Frost days (Temperature ≤ 0°C)	14	3	6(7)	
DEGREE-DAYS	Monthly growing (5°C base)	170.7	253.2	211.6(209.0)	
	Yearly total-to-date growing	192.9	336.6	274.9(265.4)	
	Monthly heating (18°C base)	267.2	155.2	204.4(206.9)	
	Yearly total-to-date heating	3425.5	2928.0	3284.3 (3436.6)	
	Monthly cooling (18°C base)	5.9	5.4	7.4 (7.0)	
	Yearly total-to-date cooling	5.9	8.5	7.7 (7.2)	
PRECIPITATION	Monthly total (mm)	0.2	24.4	44.3(43.7)	
	Yearly total-to-date (mm)	26.5	40.2	115.6(119.0)	
	Greatest 24-hr (mm/date)	0.2/01	14.2/19	39.9/1985/04	51.3/1909/30
	Measurable precipitation days (≥ 0.2mm)	1	5	9(10)	
WIND	Average monthly speed (km/h)	19.0	19.5		18.0
	Peak gust (direction/speed/date)	W78.2/29	SSW69.2/29		SW132.0/1965/17
RADIATION	Monthly bright sunshine (hours)	324.3	276.4	267.1(285.7)	
	% possible bright sunshine	66.5	56.7	54.8(58.7)	
	Bright Sunshine days	31	31	29(29)	
	Monthly global radiation(MJ/m²)	842.3	626.4	(586.3)	
	Monthly diffuse radiation (MJ/m²)	206.2	224.0	(222.2)	
SOIL	Average temperature (°C) @ 9:00am — grass level*/5 cm	11.6/8.0	16.0/8.9	(na/10.1)	
	10 cm/20 cm	9.8/10.8	12.1/13.0	(10.6/10.9)	
	50 cm/100cm	6.9/4.8	9.7/7.1	(8.9/5.9)	
	150 cm/300cm	3.8/3.0	5.5/3.8	(4.4/3.1)	

For Your Information

May 2002, the 21st consecutive month of below normal precipitation, was the driest May (0.2 mm) ever recorded since CRS opened in 1964. It easily beat the 1998 previous low of 10.4 mm. Coupled with the arid conditions were 13 days of 'Near Gale' (51-62 km) or greater winds creating zero visibility conditions due to blowing dust at times. 'Strong Gale' (76-87 km) westerly winds occurred on the 29th to complete a very windy month. While all temperatures were below normal and the average monthly temperature was the 5th coldest since 1964, it was the average minimum temperature that set a new record of 3.3°C below the 1971-2000 normals. The cool temperatures are reflected in 40.9 below normal growing degree-days, the 62.8 above average heating degree-days and below normal soil temperatures at all 7 levels. Gardeners feared it was never going to warm up with 9 days more of frost than usual and the last frost (hopefully) occurring on the 23rd. The only bright spot was every day had bright sunshine with 57.2 hours above normal for the month.

We think enduring a couple of dusty days is bad. When Tamboro erupted in 1815 as the most explosive volcanic eruption in the past 5,000 years, it caused 3 days of total darkness for a distance of 480 km.[1] The ash cloud extended around the world disrupting weather patterns for years. During the following cold, rainy summer, known as the "year without a summer", Mary Shelley and her companions began telling ghost stories to past the time. Her effort resulted in the now classic story of Frankenstein.[2] In Canada, small lakes remained covered with ice and crops failed.[3] [1] Goble, 2002 [2] Phillips, 1998 [3] Luetkemeyer, 2001

*Grass temperature is taken from a surface probe whose calibration is unknown at present

technology is our business

Saskatchewan Research Council

Monthly Weather Summary

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

CRS estab. 1963

	June 2002	2002 VALUE	2001 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	24.6	22.7	22.6 (22.6)	
	Extreme monthly maximum (°C/date)	37.2/28	31.7/21	41.0/1988/05	41.0/1988/05
	Average monthly minimum (°C)	11.4	9.3	9.5 (9.2)	
	Extreme monthly minimum (°C/date)	5.4/07	3.8/13	-3.3/1967/06	-3.9/1903/09&1917/02
	Monthly average (°C)	18.1	16.0	16.0 (15.9)	
	No.of Frost days (Temperature ≤ 0°C)	0	0	1 (0)	
DEGREE-DAYS	Monthly growing (5°C base)	391.7	330.9	331.5 (327.3)	
	Yearly total-to-date growing	584.6	667.5	606.4 (592.7)	
	Monthly heating (18°C base)	58.4	75.5	82.8 (84.0)	
	Yearly total-to-date heating	3483.9	3003.5	3367.1 (3520.6)	
	Monthly cooling (18°C base)	60.1	16.4	22.3 (21.2)	
	Yearly total-to-date cooling	66.0	24.9	30.0 (28.4)	
PRECIPITATION	Monthly total (mm)	54.2	36.0	59.5 (63.6)	
	Yearly total-to-date (mm)	80.7	76.2	175.1 (182.6)	
	Greatest 24-hr (mm/date)	16.0/17	9.0/09	99.4/1983/24	99.4/1983/24
	Measurable precipitation days (≥ 0.2mm)	9	10	12 (12)	
WIND	Average monthly speed (km/h)	15.3	14.3		17.0
	Peak gust (direction/speed/date)	WNW73.2/17	WSW75.1/25		S117.0/1986/01
RADIATION	Monthly bright sunshine (hours)	246.9	245.9	277.2 (297.2)	
	% possible bright sunshine	49.4	49.2	55.4 (59.4)	
	Bright Sunshine days	25	30	28 (29)	
	Monthly global radiation(MJ/m²)	818.5	609.3	(638.7)	
	Monthly diffuse radiation (MJ/m²)	223.7	256.9	(228.1)	
SOIL	Average temperature (°C) @ 9:00am grass level*/5 cm	20.6/14.9	18.8/12.0	(na/15.3)	
	10 cm/20 cm	16.9/17.6	15.2/16.1	(15.7/16.2)	
	50 cm/100cm	12.8/9.4	12.5/9.9	(14.0/10.4)	
	150 cm/300cm	7.4/4.8	8.1/5.7	(8.2/5.2)	

For Your Information

Even though CRS recorded 16 days with maximum temperatures above 25°C, including daily record temperatures on the 27th and 28th, the monthly mean was only 2° above the 1971-2000 normal. A three day hot spell began on the 26th with temperatures reaching 34.4°C and crested on the 28th with the extreme monthly maximum temperature of 37.2°C. This was just slightly higher than the extreme maximum monthly temperature of 36.5°C on the 27th recorded at the Saskatoon Airport station.[1] Precipitation, while not above average, was close at 91% of the current normal. Upper level soil temperatures are beginning to recover from the cool spring but the lower levels are between 0.4° and 1.2°C below average. This was another 'rocks-in-your-pockets' month with 'Near Gale' winds (51-62 km/h) occurring thrice and 'Gale' winds (63-75 km/h) occurring four times. Five of these days happened between the 5th and the 11th.

On Sunday, June 30th, 1912, 90 years ago, after four days of unprecedented sweltering temperatures, the Regina Cyclone roared into the history books. It is estimated the rotational winds were between 160 and 800 km/h; its base 275 to 375m wide and its forward speed 16 to an incredible 80 km/h. It touched down 18km SW of Regina and after cutting a swath of destruction through the centre of the city, lifted off 13km NE. Included in the 28 dead were a newly married couple from England. They had managed to escape one disaster earlier in April of that year by inadvertently missing their ship to their new home in Canada. The missed ship, on its maiden voyage, was sunk by an iceberg. It was The Titanic.[2] [1] Environment Canada, 2002c [2] Anderson, 1964

*Grass temperature is taken from a surface probe whose calibration is unknown at present

Saskatchewan Research Council

Monthly Weather Summary

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

technology is our business

CRS estab. 1963

	July 2002	2002 VALUE	2001 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	27.8	27.6	24.8 (25.1)	
	Extreme monthly maximum (°C/date)	37.0/14	39.3/05	39.3/ 2001/05	40.0/1919/17&1941/19&1946/30
	Average monthly minimum (°C)	14.0	13.0	11.5 (11.5)	
	Extreme monthly minimum (°C/date)	6.8/03	6.7/04	1.7/1967/02&1978/09	-0.6/1918/25
	Monthly average (°C)	20.9	20.3	18.2 (18.3)	
	No.of Frost days (Temperature ≤ 0°C)	0	0	1(0)	
DEGREE-DAYS	Monthly growing (5°C base)	493.9	475.7	408.4 (414.8)	
	Yearly total-to-date growing	1078.5	1077.9	1014.8(1007.5)	
	Monthly heating (18°C base)	19.0	10.8	35.3 (32.0)	
	Yearly total-to-date heating	3502.9	3503.4	3402.4(3552.6)	
	Monthly cooling (18°C base)	109.9	83.5	40.7 (43.9)	
	Yearly total-to-date cooling	175.9	175.8	70.7(72.3)	
PRECIPITATION	Monthly total (mm)	70.8	48.2	58.0 (55.7)	
	Yearly total-to-date (mm)	151.5	124.4	233.1 (238.3)	
	Greatest 24-hr (mm/date)	26.6/09	19.4/25	45.5/1968/29	79.2/1946/03
	Measurable precipitation days (≥ 0.2mm)	9	11	12(11)	
WIND	Average monthly speed (km/h)	16.0	14.6		16.0
	Peak gust (direction/speed/date)	WNW75.6/05	WNW84.8/28		E113.0/1955/05
RADIATION	Monthly bright sunshine (hours)	314.1	282.5	305.7(329.1)	
	% possible bright sunshine	62.6	56.3	60.9(65.8)	
	Bright Sunshine days	30	31	30(30)	
	Monthly global radiation(MJ/m²)	700.8	631.7	(633.5)	
	Monthly diffuse radiation (MJ/m²)	193.9	212.5	(216.5)	
SOIL	Average temperature (°C) @ 9:00am — grass level*/5 cm	21.5/15.7	23.2/15.3	na/(17.6)	
	10 cm/20 cm	19.6/20.7	18.9/19.7	(18.0)/(18.8)	
	50 cm/100cm	16.7/13.0	15.7/12.5	(16.8)/(13.2)	
	150 cm/300cm	10.5/6.9	10.5/7.4	(11.1)/(7.5)	

For Your Information

After 22 months of below normal precipitation, July 2002 broke out of the rut with 12.8mm of above normal precipitation. The majority of the rain did not come as drips and drabs but as three gully-washers on the 9th (26.6mm), 17th (22.0mm) and 26th (13.8mm). Even with the above normal rainfall for the month, the yearly total is only 65% of normal which is, however, better than last year's cumulative total to July of 53.4%. Along with being wet, July was hot. Twelve days registered over 30°C, with five days breaking or tying maximum daily records. The extreme maximum temperature for July of 39.3°C set last year on the 5th was not broken. The extreme cooling degree-days (base 24°), 15.7 above normal, reflected the high temperatures.

It is not only farmers that have felt the drought. The duck population in Canada and the northern United States has dropped 14% this year due mainly to the dried up sloughs where the ducks live, feed, and breed. The south part of Saskatchewan has seen the duck population drop by 45% from last year. Some species, like the northern pintail which favour temporary and seasonal ponds, are down 63%. Some duck species flew over the prairies to the boreal forest to find nesting sites and raised that area's duck population by 70%.[1] [1]Strelieff, 2002.

*Grass temperature is taken from a surface probe whose calibration is unknown at present

technology is our business

Saskatchewan Research Council

Monthly Weather Summary

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

CRS estab. 1963

August 2002

		2002 VALUE	2001 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	23.4	29.2	24.6(24.3)	
	Extreme monthly maximum (°C/date)	32.8/24	37.8/03	39.7/1998/06	39.7/1998/06
	Average monthly minimum (°C)	11.2	12.7	10.4(10.1)	
	Extreme monthly minimum (°C/date)	2.6/02&04	5.9/12	-2.8/1976/28	-2.8/1976/28&1901/23
	Monthly average (°C)	17.3	21.0	17.5(17.2)	
	No.of Frost days (Temperature ≤ 0°C)	0	0	1(0)	
DEGREE-DAYS	Monthly growing (5°C base)	382.8	495.1	387.8(379.6)	
	Yearly total-to-date growing	1461.3	1638.3	1402.6 (1387.1)	
	Monthly heating (18°C base)	65.8	8.9	57.7(62.4)	
	Yearly total-to-date heating	3568.7	3023.2	3460.1(3615.0)	
	Monthly cooling (18°C base)	45.6	101.0	42.5(39.0)	
	Yearly total-to-date cooling	221.4	209.4	113.2 (111.3)	
PRECIPITATION	Monthly total (mm)	81.8	7.0	36.2(35.3)	84.3/1945/03
	Yearly total-to-date (mm)	233.3	131.4	269.3(273.6)	
	Greatest 24-hr (mm/date)	18.0/11	6.0/14	33.8/1998/17	
	Measurable precipitation days (≥ 0.2mm)	18	2	10 (9)	
WIND	Average monthly speed (km/h)	12.5	14.0		16.0
	Peak gust (direction/speed/date)	E62.2/25	NW61.6/14		W151.0/1967/14
RADIATION	Monthly bright sunshine (hours)	221.9	332/4	280.8(295.2)	
	% possible bright sunshine	49.0	73/5	62.0 (65.2)	
	Bright Sunshine days	30	31	30(30)	
	Monthly global radiation(MJ/m²)	514.8	601.8	(529.0)	
	Monthly diffuse radiation (MJ/m²)	187.4	155.7	(185.6)	
SOIL	Average temperature (°C) @ 9:00am — grass level*/5 cm	16.2/10.6	23.5/16.1	(na)/(16.4)	
	10 cm/20 cm	15.0/16.3	19.7/20.6	(16.8)/(17.9)	
	50 cm/100cm	14.5/12.9	17.1/14.3	(16.8)/(14.1)	
	150 cm/300cm	11.6/8.8	12.3/9.1	(12.4)/(9.1)	

For Your Information

August, a month of contrasts, began with record daily minimum temperature of 2.6°C on the 2nd and 4th, and closed with maximum temperatures over 30°C on the 24th, 25th and 28th. Monthly average maximum (1.2°C below normal) and minimum temperatures (0.8°C above normal) evened out to a monthly average near normal. Rainfall continued to be above average to the relief of many. By the 10th, the Climate Reference Station (CRS) had received in excess of the monthly normal and by month's end the total was 81.8mm; 2.3 times the normal value for August. Two daily records were set; 18.0mm on the 11th easily toppled the old record of 5.8mm set in 1982 and 7.2 mm on the 30th eased out the 1982 record of 6.2mm. With the abundance of rain falling on twice as many days as usual, the yearly total increase to 86.6% of normal. All days except one received some bright sunshine but with the increased rain activity, the total monthly bright sunshine was 21% less than normal. Soil temperatures at all levels continued to be well below seasonal values, especially in the upper levels.

Since 1993, CRS has recorded from 1 to 29 above normal days for the frost-free season. During the early days of the Red River, now Winnipeg area, Alexander Ross wrote of the growing season "On the 7th of June we had a heavy fall of snow ... but still nothing serious happened to dampen our hopes till the 19th of August when ...frost blasted our prospects by the destroying the crops." This made a 54-day growing season; 69 days less than modern-day normals.[1] As there were no 'supermarkets', a complete crop failure would have been disastrous for the new community. This year, for an above average growing season, frost can occur no earlier than September 20th.

[1] Phillips, 2001

*Grass temperature is taken from a surface probe whose calibration is unknown at present

Saskatchewan Research Council

Monthly Weather Summary

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

technology is our business

CRS estab. 1963

	September 2002	2002 VALUE	2001 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	18.4	22.4	18.1(17.7)	
	Extreme monthly maximum (°C/date)	31.3/16	33.2/25	35.6/1978/04	35.6/1978/04
	Average monthly minimum (°C)	6.2	7.1	4.9(4.8)	
	Extreme monthly minimum (°C/date)	-7.1/27	0.5/12	-7.8/1974/30	-11.1/1908/28
	Monthly average (°C)	12.4	14.8	11.6(11.3)	
	No.of Frost days (Temperature ≤ 0°C)	5	0	6(5)	
DEGREE-DAYS	Monthly growing (5°C base)	227.0	294.0	203.5(196.9)	
	Yearly total-to-date growing	1688.3	1932.3	1606.1(1584.2)	
	Monthly heating (18°C base)	175.5	105.8	198.9(206.6)	
	Yearly total-to-date heating	3744.2	3129.0	3659.0(3821.2)	
	Monthly cooling (18°C base)	6.4	9.8	5.8(6.2)	
	Yearly total-to-date cooling	227.9	219.2	119.0(117.5)	
PRECIPITATION	Monthly total (mm)	58.2	11.4	29.4(32.9)	
	Yearly total-to-date (mm)	291.5	142.8	298.7(307.3)	
	Greatest 24-hr (mm/date)	32.4/30	6.4/19	29.6/1980/03	44.2/1931/12
	Measurable precipitation days (≥ 0.2mm)	9	8	8(9)	
WIND	Average monthly speed (km/h)	15.1	14.5		17.0
	Peak gust (direction/speed/date)	NW63.2/19	W56.8/02		W148/1967/22
RADIATION	Monthly bright sunshine (hours)	206.0	265.3	186.0(188.0)	
	% possible bright sunshine	54.3	70.0	49.1(49.6)	
	Bright Sunshine days	25	30	26(26)	
	Monthly global radiation(MJ/m²)	359.9	415.1	(351.8)	
	Monthly diffuse radiation (MJ/m²)	124.2	118.8	(127.6)	
SOIL	Average temperature (°C) @ 9:00am — grass level*/5 cm	10.2/5.9	11.8/11.5	na/(10.5)	
	10 cm/20 cm	11.2/12.7	14.4/15.9	(11.2)/(12.5)	
	50 cm/100cm	12.8/12.4	14.3/13.3	(13.3)/(12.5)	
	150 cm/300cm	11.7/9.6	12.4/10.2	(11.9)/(9.9)	

For Your Information

The latter half of the old saw '*September dries up ditches or breaks down bridges*'[1] had the possibility of being true during the last days of September when a record rainfall of 32.4 mm occurred. Luckily, it was spread over 24 hours and did not pose a flood hazard. Without this last minute drenching, the precipitation would have been below the monthly normal, instead, by midnight on September 30th, it was 28.8 mm or nearly twice above normal. With the extra September rain, the yearly cumulative total is now just 7.2 mm below normal. Excluding the rain, September was generally an average month with temperature and radiation elements near their normal values. The first frost occurred on September 23rd capping the growing season at 122 days; four days above normal.

When Europe and Britain had more agrarian societies, the conclusion of the harvest each autumn was marked by great festivals of fun, feasting, and thanksgiving known as 'Harvest Home'. It was also a time to hold elections, pay workers and collect rents. These festivals usually took place in September around the time of the autumnal equinox.[1] The traditions are kept alive in the New World by the annual fall festival celebrations of Thanksgiving.

[1] Thomas, 2002

*Grass temperature is taken from a surface probe whose calibration is unknown at present

technology is our business

Saskatchewan Research Council

Monthly Weather Summary

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

CRS estab. 1963

October 2002		2002 VALUE	2001 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	4.0	9.1	10.8(10.9)	
	Extreme monthly maximum (°C/date)	17.3/09	19.6/01	28.5/1984/08	32.2/1943/05
	Average monthly minimum (°C)	-4.7	-2.3	-1.3(-1.3)	
	Extreme monthly minimum (°C/date)	-13.5/29	-12.0/25	-21.5/1984/30&31	-25.6/1919/26
	Monthly average (°C)	-0.3	3.4	4.8(4.8)	
	No.of Frost days (Temperature ≤ 0°C)	25	20	20(19)	
DEGREE-DAYS	Monthly growing (5°C base)	11.5	39.7	63.7(61.5)	
	Yearly total-to-date growing	1699.8	1972.0	1669.8(1645.7)	
	Monthly heating (18°C base)	568.1	451.9	410.2(406.5)	
	Yearly total-to-date heating	4312.3	3580.9	4069.2(4227.7	
	Monthly cooling (18°C base)	0.0	0.0	0.1(0.0)	
	Yearly total-to-date cooling	227.9	219.2	119.1(117.5)	
PRECIPITATION	Monthly total (mm)	10.9	8.3	16.4(17.5)	
	Yearly total-to-date (mm)	302.4	151.1	315.1(324.0)	41.7/1969/03
	Greatest 24-hr (mm/date)	3.0/17	4.5/22	36.7/1984/16	
	Measurable precipitation days (≥ 0.2mm)	13	9	6(6)	
WIND	Average monthly speed (km/h)	12.7	13.9		17.0
	Peak gust (direction/speed/date)	SSW56.4/02	W70.8/17		NW138/1967/16
RADIATION	Monthly bright sunshine (hours)	127.2	[1]145.3	157.9(160.7)	
	% possible bright sunshine	38.6	44.2	47.9(48.8)	
	Bright Sunshine days	26	26	27(27)	
	Monthly global radiation(MJ/m^2)	216.8	223.5	(239.1)	
	Monthly diffuse radiation (MJ/m^2)	127.6	110.4	(92.6)	
SOIL	Average temperature (°C) @ 9:00am grass level*/5 cm	-4.3/-1.6	-1.5/3.3	na/(4.1)	
	10 cm/20 cm	1.9/3.4	5.4/7.4	(4.5/6.0)	
	50 cm/100cm	5.8/8.0	8.7/10.2	(8.0/9.2)	
	150 cm/300cm	9.0/9.2	10.6/10.1	(9.7/9.5)	

For Your Information

We can be thankful that October winds were very light and did not exacerbate the near record and record minimum daily temperatures. New daily lows were set on the 19th & 20th with temperatures of -7.4° and -8.9°C. From October 15th to the 31st, the maximum temperatures rose only once above the normal mean daily values and on four occasions failed to rise above the normal for the daily minimum. The month was the coldest October the station has experienced with record low monthly values set for mean maximum, minimum and average temperatures. Precipitation was below average with the majority falling during the latter half of the month. It was the 6th dullest October since the station began recording sunshine in 1966. Frost was evident at the 10cm soil level with the 20cm level only half a degree above freezing. All soil temperatures are below normal for this time of year.

This month may have been cold but at least football players in Saskatoon have been able to see the ball to play the game. During a 1958 November game held in Victoria, B.C., it was so foggy, players played hide-and-go-seek and had to ask each other who had the ball and where the game was. When the officials finally suspended the game at the end of the 3rd quarter, it was discovered someone had stolen the goal posts. [2]

[1] Power outage from Oct.4-10 & Oct. 26-30. Bright Sunshine missing data supplied by University of Saskatchewan, Kernen Farm [2] Phillips, 2001

*Grass temperature is taken from a surface probe whose calibration is unknown at present

technology is our business

Saskatchewan Research Council

Monthly Weather Summary

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

CRS estab. 1963

	November 2002	2002 VALUE	2001 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	0.9	3.9	-1.4(-1.5)	
	Extreme monthly maximum (°C/date)	10.1/20	16.3/04	19.4/1975/04	21.7/1903/03
	Average monthly minimum (°C)	-8.3	-5.2	-10.3(-10.6)	
	Extreme monthly minimum (°C/date)	-15.7/24	-14.2/26	-33.5/1985/24	-39.4/1893/30
	Monthly average (°C)	-3.7	-0.7	-5.9(-6.0)	
	No.of Frost days (Temperature ≤ 0°C)	28	27	29(29)	
DEGREE-DAYS	Monthly growing (5°C base)	0.1	8.7	2.6(2.7)	
	Yearly total-to-date growing	1699.9	1980.7	1672.4(1648.4)	
	Monthly heating (18°C base)	650.8	560.6	715.8(721.5)	
	Yearly total-to-date heating	4963.1	4141.5	4785.0(4949.2)	
	Monthly cooling (18°C base)	0.0	0.0	0.0(0.0)	
	Yearly total-to-date cooling	227.9	219.2	119.1(117.5)	
PRECIPITATION	Monthly total (mm)	3.7	8.8	14.8(15.5)	
	Yearly total-to-date (mm)	306.1	159.9	329.9(339.5)	
	Greatest 24-hr (mm/date)	1.4/08	3.4/08	19.3/1978/04	27.9/1938/01
	Measurable precipitation days (≥ 0.2mm)	7	7	8(8)	
WIND	Average monthly speed (km/h)	13.9	13.6		16.0
	Peak gust (direction/speed/date)	NW72.8/22	NW52.6/01		W100.0/1976/17
RADIATION	Monthly bright sunshine (hours)	95.4	103.6	98.0(101.2)	
	% possible bright sunshine	36.1	39.3	37.1(38.3)	
	Bright Sunshine days	23	20	22(22)	
	Monthly global radiation(MJ/m²)	114.7	107.4	(123.7)	
	Monthly diffuse radiation (MJ/m²)	64.5	57.4	(73.6)	
SOIL	Average temperature (°C) @ 9:00am grass level*/5 cm	-9.8/-4.0	-7.1/-1.3	na/-2.2	
	10 cm/20 cm	-2.3/-0.9	0.5/2.3	-1.7/-0.5	
	50 cm/100cm	1.3/4.4	4.1/6.6	2.8/5.4	
	150 cm/300cm	6.0/7.6	7.8/8.8	6.8/8.1	

For Your Information

The unusually warm November allowed unseasonable activities to continue such as washing outside windows, raking the last of the leaves and harvesting the remainder of the crops much to the disgust of some and the pleasure of others who had thought October had put an end to such chores. Maximum temperatures climbed above freezing on 19 occasions, 13 times after the middle of the month including the extreme monthly maximum of 10.1°C and a new daily maximum of 9.6°C for the 28th. As a consequence of the warm temperatures, the heating degree-days were 9% less than normal. Precipitation was minimal with a total accumulation of only 3.6 mm. To reach the annual normal precipitation amount, December's precipitation will have to be more than double the usual amount to make up the shortfall. 'Near Gale' and 'Gale' force winds roared through the area during the last week but caused little reported damage.

Unlike the final week's wind, a fierce 1999 wind storm experienced by Winnipeg residents did cause considerable damage. Winds with gusts to 113 km/h and sustained record wind speeds of 87 km/h, roared through the city heavily damaging roofs. One pedestrian crossing Portage Avenue even had her glasses blown off her face.[1]

[1]Phillips, 2001

*Grass temperature is taken from a surface probe whose calibration is unknown at present

technology is our business

Saskatchewan Research Council

Monthly Weather Summary

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

CRS estab. 1963

	December 2002	2002 VALUE	2001 VALUE	NORMAL OR EXTREME FOR CRS 1971-2000 (1961-90)	EXTREME FOR SASKATOON STATIONS
TEMPERATURE	Average monthly maximum (°C)	-3.5	-6.7	-9.0(-9.8)	
	Extreme monthly maximum (°C/date)	5.5/13	6.3/17	9.5/1987/07	14.4/1939/05
	Average monthly minimum (°C)	-11.9	-16.6	-18.6(-19.3)	
	Extreme monthly minimum (°C/date)	-27.2/03	-24.0/06	-42.2/1973/31	-43.9/1892/22
	Monthly average (°C)	-7.7	-11.7	-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	1699.9	1980.7	1672.5(1648.4)	
	Monthly heating (18°C base)	797.8	921.1	987.7(1004.8)	
	Yearly total-to-date heating	5760.9	5062.6	5797.7(5954.0)	
	Monthly cooling (18°C base)	0.0	0.0	0.0(0.0)	
	Yearly total-to-date cooling	227.9	219.2	119.1(117.5)	
PRECIPITATION	Monthly total (mm)	13.9	5.9	18.3(21.3)	
	Yearly total-to-date (mm)	320.0	165.8	348.2(360.8)	28.4/1936/02
	Greatest 24-hr (mm/date)	9.5/29	3.4	14.5/1973/23	
	Measurable precipitation days (≥ 0.2mm)	11	7	11(12)	
WIND	Average monthly speed (km/h)	13.9	13.3		16.0
	Peak gust (direction/speed/date)	SE54.8/16	WNW58.6/17		W121/1955/12
RADIATION	Monthly bright sunshine (hours)	89.3	102.3	85.4(83.7)	
	% possible bright sunshine	36.8	42.3	35.2(34.5)	
	Bright Sunshine days	23	24	23(23)	
	Monthly global radiation(MJ/m²)	91.2	96.3	(95.2)	
	Monthly diffuse radiation (MJ/m²)	47.9	50.1	(54.3)	
SOIL	Average temperature (°C) @ 9:00am grass level*/5 cm	-13.2/-5.6	-18.2/-7.0	na/(-7.1)	
	10 cm/20 cm	-4.5/-3.1	-5.9/-3.5	(-6.5/-5.5)	
	50 cm/100cm	-1.3/1.9	-0.8/3.1	(-1.6/1.9)	
	150 cm/300cm	3.7/6.0	5.0/7.2	(3.9/6.3)	

For Your Information

With an average temperature of -7.7° (6.2° above normal) December was the 5th warmest at CRS since 1963. Only the years 1974 (-6.9°), 1987 (-7.4°), 1997 (-4.5°), and 1999 (-6.0°) were warmer. Ten days registered maximum temperatures above 0°C. On the 15th, even the mean was above 0°C. Except for the 3rd when a minimum temperature of -27.2°C was recorded, the month was never really cold. Only five days had minimum temperatures less than -20° with 13 days ranging between 0° and -10°C. Grateful home owners saw 190 less heating degree-days due to the above normal temperatures. It was not until the latter half of the month that we began to experience snow. By Christmas, only 4cm had accumulated on the ground. By the 31st, due to 9.5mm snowfall on the 29th, 14cm had built up – enough to go cross country skiing.

Christmas on the Prairies brings to mind sparkling banks of snow and trees covered in white hoarfrost. If you live in Winnipeg or Saskatoon, your chances to experience a "Courrier and Ives" Christmas are 100%. Regina residents only have a 94% chance while Calgarians, at a 63% chance, keep their fingers crossed during December. For those who prefer a Canadian Christmas other than white, your best destination would be Vancouver at 6% or Victoria at 5%.[1]

[1] Phillips, 1993.

*Grass temperature is taken from a surface probe whose calibration is unknown at present

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**

BIBLIOGRAPHY

Anderson, F.W.. 1964. *Regina's Terrible Tornado*. Frontier Books.

Christiansen, E.A. (Ed.), 1970. *Physical Environment of Saskatoon, Canada*. Saskatchewan Research Council, Saskatoon, SK, in cooperation with National Research of Canada, Ottawa, ON.

Cole, F.W. 1980. *Introduction to Meteorology.* John Wiley & Sons, Inc., Toronto, ON.

Environment Canada, Atmospheric Environment Service (AES). 1975. *1974 Annual Meteorological Summary, Saskatoon, Saskatchewan*. AES, Downsview, ON.

Environment Canada, Atmospheric Environment Service (AES). 1976. *Soil Temperature*. AES, Downsview, ON.

Environment Canada, Atmospheric Environment Service (AES). 1978. *Manual of Climatological Observations*, 2nd Ed. AES, Downsview, ON.

Environment Canada, Atmospheric Environment Service (AES). 1982. *Canadian Climate Normals 1951-1980*. Canadian Climate Centre, Downsview ON.

Environment Canada, Atmospheric Environment Service, (AES). 1992. *AES Guidelines for Co-operative Climatological Autostation.* Environment Canada, Downsview, ON.

Environment Canada, Atmospheric Environment Service (AES). 1993. *Canadian Climate Normals 1961-1990*. Canadian Climate Centre, Downsview ON.

Environment Canada, Meteorological Service of Canada, 2001a. *Canada's New Wind Chill Index*. Minister of Public Works and Government Services Canada, Ottawa, ON.

Environment Canada, Meteorological Service of Canada, 2001b. *Wind Chill Calculation Chart*. http://www.msc.ec.gc.ca/windchill/Chart_chill_e.jpg (Oct 24, 2001).

Environment Canada, Meteorological Service of Canada, 2002a. *Annual Meteorological Summary, Saskatoon International Airport, 2001.* Environment Canada, Edmonton, AB.

Environment Canada, Meteorological Service of Canada, 2002b. *Canadian Daily Climate Data on CD-ROM - Western Canada.* Climate and Water Products Division, Downsview, ON.

Environment Canada, Meteorological Service of Canada, 2002c. *Monthly Weather Statistics for June 2002 for Major Sites in Prairie and Northern Region*. Environment Canada, Edmonton, AB.

Environment Canada, Meteorological Service of Canada, 2002d. *Monthly Weather Statistics for Summer 2002 for Major Sites in Prairie and Northern Region*. Environment Canada, Edmonton, AB.

Environment Canada, Meteorological Service of Canada, 2003. *Annual Meteorological Summary, Saskatoon International Airport, 2002.* Environment Canada, Edmonton, AB.

Goble, R. J., 2002. *Volcanoes*. In: Introduction to Geology/Physical Geology. http://www.class.unl.edu/geol100/Review2.html (June, 2002)

Helden, A. van, 1995. *The Thermometer* In: The Galileo Project. http://es.rice.edu/ES/humsoc/Galileo/. Rice University web site, (June 10, 2003)

Heidorn, K. 1998. *The Weather Legacy of Admiral Sir Francis Beaufort* In: Weather People and History. http://irishculture.about.com/gi/dynamic/offsite.htm?site=http://www.islandnet.com/%257Esee/weather/history/beaufort.htm (July 30, 2001).

Huschke, R.E. (Ed.) 1959. *Glossary of Meteorology.* American Meteorological Society, Boston, MA.

Luetkemeyer, K., 2001. *The Year Without a Summer*. http://geowww.gen.ou.edu/~kcluetke/exercise5.html. University of Oklahoma. (June 05, 2002)

National Research Council of Canada, Herzberg Institute of Astrophysics, n.d. *Sunrise - Sunset Tables for Saskatoon 2002*. http://www.hia.nrc.ca/services/sunmoon/sunmoon.html (Feb18, 2002).

Olm, O., 2001. *Personal Communication*. September 17, 2001. Saskatchewan Research Council, Saskatoon, SK.

Phillips, D.W. 1988. *1989 Canadian Weather Trivia Calendar*. Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, Canada.

Phillips, D.W., 1993. *The Day Niagara Falls Ran Dry!: Canadian Weather Facts and Trivia.* Key Porter Books Ltd., Toronto, ON.

Phillips, D.W. 1998. *Blame it on the Weather: Strange Canadian Weather Facts*. Key Porter Books, Ltd., Toronto, ON.

Phillips, D.W. 2001. *2002 Canadian Weather Trivia Calendar*. Fifth House Ltd., Calgary, AB.

Strelieff, J., 2002. *Drought Dries Duck's Digs*. Saskatoon StarPhoenix, Saskatoon, Sk, July 21, 2002, pA9.

Thomas, R., 2002. *The Old Farmer's Almanac 2003: Canadian Edition*. Yankee Publishing, Inc., Dublin, NH.

University of Saskatchewan, Kernen Farm 2001. *Personal Communication*. November 2001. University of Saskatchewan, Saskatoon, SK.

U.S. Geological Survey. Cascades Volcano Observatory, n.d. *Deadliest Volcanic Eruptions Since 1500 A.D.* http://vulcan.wr.usgs.gov (March 27, 2002)

Wittrock, V., 2003. *Personal Communication*, June, 2003. Saskatchewan Research Council, SK.

World Meteorological Organization (WMO). 1988. *Technical Regulations: General Meteorological Standards and Recommended Practices, 1988 ed., Suppl. No. 2 (IV. 1996), WMO - No. 49.* Geneva, Switzerland.