SASKATCHEWAN RESEARCH COUNCIL

CLIMATE REFERENCE STATION

SASKATOON

ANNUAL SUMMARY 2013

C. Beaulieu
V. Wittrock

Saskatchewan
Research Council
Air and Climate

SRC Publication No. 10440 - 1E14
February 2014

Saskatchewan Research Council

CLIMATE REFERENCE STATION SASKATOON
ANNUAL SUMMARY 2013

50 YEARS:
AN END OF AN ERA

....Beginning of the Next

C. Beaulieu
V. Wittrock
Saskatchewan Research Council
Air and Climate

SRC Publication No. 10440 -1E14
February 2014
Saskatchewan Research Council
125 - 15 Innovation Blvd.
Saskatoon, SK S7N 2X8

COVER PHOTOGRAPHS
Stevenson screen September 2006 (Brett Smith); Bunker September 2000

INSIDE COVER PHOTOGRAPHS
Stevenson screen October 2013: Bunker May 2013
photo credit: CR Beaulieu

TABLE OF CONTENTS

Acknowledgements . . . iv
Climate Reference Station Supporters . . . iv
Climate Reference Station History . . . 1
What is the Climate Reference Station? . . . 2
Activities Associated with the Climate Reference Station . . . 3
Summary . . . 4
Temperature
Daily temperature, graph . . . 5
Temperature records, table . . . 6
Potential Evapotranspiration (PE) using the Thornthwaite Method, graph and table . . . 6
Dates and duration of the frost-free season, table . . . 6
Extreme temperatures, table . . . 6
Frost-free season duration and end points, graphs . . . 7
Temperature ranking, table . . . 8
Monthly temperatures, normals, and extremes table . . . 10
Hourly annual temperature, graph . . . 10
Monthly and annual temperatures, graphs . . . 10
Seasonal temperatures, graphs . . . 11
Days with temperatures greater than a set point, graphs . . . 12
Days with temperatures less than a set point, graphs . . . 13
Days with temperatures greater than 0°C, graphs . . . 14
Degree-days, normals and cumulative, table . . . 15
Growing degree-days, graphs . . . 15
Heating degree-days, graph . . . 16
Cooling degree-days, graph . . . 16
Extreme cooling degree-days, graph . . . 17
Daily temperature values, tables . . . 17
Precipitation
Daily precipitation, graph . . . 19
Precipitation records and extreme events, tables . . . 20
Ranking by driest month, table . . . 20
Ranking by dry spells/days, table . . . 20
Ranking, annual and seasonal, by driest year and no. of days, table . . . 21
Monthly precipitation, normals and extremes, table . . . 22
Monthly and annual precipitation, graphs . . . 22
Seasonal precipitation, graphs . . . 23
Monthly precipitation days, table . . . 24
Monthly and annual precipitation days, graphs . . . 24
Seasonal precipitation days, graphs . . . 25
Daily precipitation values, table . . . 26
Snow-on-the-ground, graphs . . . 27
Radiation
Sunrise/Sunset tables for Saskatoon, 2013 & 2014 . . . 28
Monthly bright sunshine hours, normals and days, table . . . 29
Daily global and diffuse values, table . . . 29
Bright sunshine hours, graphs . . . 30
Bright sunshine, global and diffuse radiation comparison, graph . . . 30
Bright sunshine days, graphs . . . 31
Bright sunshine ranking by % of actual to possible hours and by no. of days, tables . . . 32
Wind
Average and highest instantaneous wind speed, table . . . 33
Average speed & frequency, wind roses . . . 33
Wind Speed, ½ hourly average and maximum gust, graphs . . . 36
Extreme daily winds, table . . . 37
Windchill calculation, table . . . 37
Extreme daily windchill value, table . . . 37
Soil Temperatures
Average and normal soil temperatures at 0900h and 1600h, table . . . 38
Average and normal soil temperatures at 0900h and 1600h, graphs . . . 38
Glossary of Terms . . . 39
References and Bibliography . . . 42

ACKNOWLEDGEMENTS

The 2013 data were compiled and recorded by Carol Beaulieu with assistance from Virginia Wittrock, Shaw Dunn and others. Miss Beaulieu was responsible for the monitoring of the site while instrument maintenance was carried out by the personnel of the Development Engineering and Manufactoring of the Saskatchewan Research Council (SRC). Virginia Wittrock, Elaine Wheaton, and Dale Young assisted with the proofreading and editing of this report. Consultations with Larry Flysak of the Meteorological Service of Canada (MSC), Saskatoon, SK, were most helpful in verifying and comparing data.

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:

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

Carol Beaulieu
Research Technologist
306-933-8182
beaulieu@src.sk.ca

Shaw Dunn
Technologist
306-933-6360
Shaw.Dunn@src.sk.ca

Saskatchewan Research Council 1-800-772-7227 Web Site Home Page http://www.src.sk.ca

SASKATCHEWAN RESEARCH COUNCIL

CLIMATE REFERENCE STATION SUPPORTERS, 2013

WE GRATEFULLY ACKNOWLEDGE THE SUPPORT OF THE FOLLOWING:

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

SaskPower

Government of Saskatchewan
Ministry of the Economy

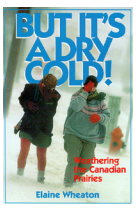
University of Saskatchewan

Saskatchewan Watershed Authority

Prince Albert Model Forest

CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

KIPP & ZONEN
SINCE 1830



CLIMATE REFERENCE STATION HISTORY

Meteorological observations at or near Saskatoon were first taken by the North-west Mounted Police in 1889 with the recording of temperature. 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. At that time, there was a settlement at Clark's Crossing 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 programme 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 closed on 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 inherited the programme in the fall of 1963 and moved it to 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. In 2013 Shaw Dunn joined the observation team.

In the summer of 1992, the CRS began to be converted to an automated system of data collection with the installation of a Campbell Scientific data logger and automatic sensors. The updating, replacing, re-installing and adding of new sensors began in 2009 and was completed in 2012. 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). Monthly summaries are submitted to Environment Canada personnel.

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

Mr. James Eby was one of the original members of the Temperance Colony Society. He filed his homestead in 1882 and returned with his family in 1883. He was the first president of the school board and served as the township supervisor for Nutana. While riding a horse in 1890, he was struck by lightning and was a partial invalid thereafter. In 1901, he and his daughter moved to Nutana where he served as a Federal Meteorologist for the next 20 years until his death in 1921 at the age of 77. He was buried, next to his wife, in the Nutana pioneer cemetery.[1]

[1]Ladd, 2008

photo credit: CR Beaulieu

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 climatological reference 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, half-hourly readings are taken of elements which include temperature, precipitation amount, humidity, wind, and atmospheric pressure. Our supplemental observations include rainfall intensity, 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 observed meteorological elements in order 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 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, 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 areas;
- 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, 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 accident studies, agricultural sectors, authors, building science, chemical companies, construction firms, governments, insurance agencies, lawyers, media, recreation facilities, schools, tourism groups, transportation studies, universities, wildlife studies, and interested individuals.

Goals

The goals of the Climate Reference Station are first, to maintain the high quality of data gathered over its fifty 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 an extremely valuable climate information collection station.

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

ACTIVITIES ASSOCIATED WITH THE SASKATOON CLIMATE REFERENCE STATION, 2013

2013 was the golden anniversary year for the Saskatoon climate reference station. Fifty years ago, the site began construction and in November of that year data collection began. This milestone was celebrated by an open house on May 30th with presentations by Joe Muldoon, Vice President of SRC and Virginia Wittrock, Research Scientist responsible for the SRC climate stations. Former observers Orville Olm, Ray Begrand, Rolf Jaren and Brett Smith along with the media joined conference attendees of the Canadian Meteorological and Oceanographic Society, Canadian Geophysical Union and the Canadian Water Resources Association in touring the site.

Fairhaven Public Elementary school hosted the eighth year of the SPLIT programme (Schools Plant Legacy in Trees). As one of their six areas of interest, presentations on climate for their kindergarten to grade 8 participants was requested. Approximately 250 students received hands-on experience with the weather instruments or a computer presentation highlighting Saskatoon's climate; past, present and future and why consideration of the climate is necessary for the planning of the urban landscape.

The media, on numerous occasions during 2013, requested information on how the winer of 2012/2013 compared to previous years. Information and explanations regarding the volume of snow, its duration into May along with cold winter and cool spring temperatures and how all these compared to previous years were very much in demand.

With the replacement of the old data logger, the bunker was no longer needed. So after 50 years of stellar service it was demolished. Then, at the end of September, the last of the original Stevenson screens fell victim to Gale force winds. Thanks to Environment Canada, Saskatoon, a new screen was donated and installed. These two events signaled the end of an era and the beginning of the next.

50th Anniversary Open House
photo credit: SRC 2013

A Cold, Snowy December

SPRING RUNOFF

City crews hope for slow snow melt

WEATHER

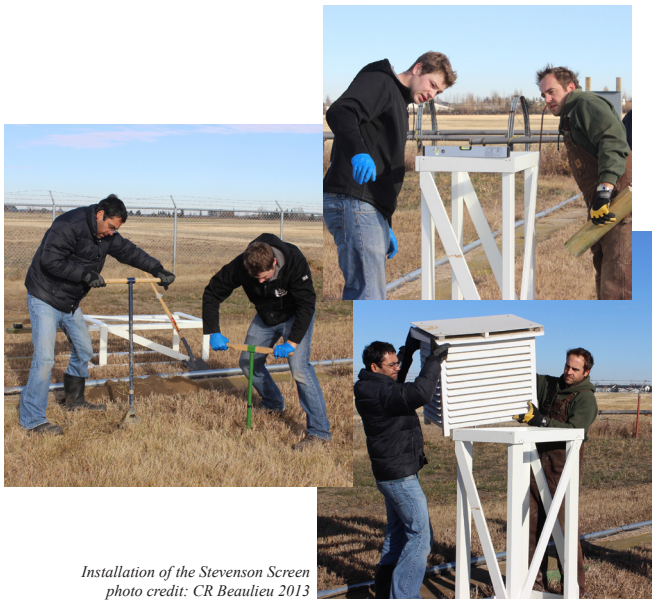
Saskatoon shines? Not this winter

HANNAH SPRAY
THE STARPHOENIX

GORD WALDNER/The StarPhoenix

Riley Paterson enjoys the sunshine Feb. 22 at Meewasin rink

Demolition of the Bunker
photo credit: CR Beaulieu 2013



Installation of the Stevenson Screen
photo credit: CR Beaulieu 2013

SUMMARIES FOR 2013

Data concerning temperature, precipitation, wind speed and direction, bright sunshine, solar radiation, and soil temperatures, recorded at the Saskatchewan Research Council (SRC) Climate Reference Station (CRS) (52°09'N, 106°36'W, 497 m asl), are presented for the year 2013 and compared with the long-term (*circa* 1900-2012) and standard-period/normal (1981-2010) records.

The 50th year of the SRC CRS Saskatoon had its memorable moments. The winter of 2012/2013 officially arrived with permanent snow pack starting on October 12th, 2012 and remained intact until April 26th, 2013. Snow-on-the-ground hPas not been recorded this late since 1990 when snow-on-the-ground was recorded at the end of April. The winter was unique due to the absence of any major warm periods. December 2012 lacked any days above zero; January had two (4.6 and 0.2); February three (1.8, 0.1 and 2.1) and March had five. Compared to this, 2012 had 12 days above zero in both January and February and 23 in March. A result of the persistent cold weather was that the CRS Saskatoon site 'officially' recording snow-on-the-ground for seven months with snow banks and drifts remaining into the first weeks of May, much to the consternation of returning geese from their winter vacation sites and winter weary Saskatoonians.

The very cool spring allowed the large snow pack to melt slowly, much to the relief of those concerned about the potential of major flooding. The below normal spring temperature was followed by a slightly cool summer. September began autumn with above normal temperatures. The year's extreme high temperature occurred on September 5th (34.3°C). The warm September allowed the agricultural community to complete harvest with very little weather related stoppages. The warmest period for the entire year, was between August 15th and September 13th with ten out of eleven daily temperatures above 30°C. October's temperatures were normal, followed by below normal temperatures for November leading to the deep freeze conditions of December with mean temperatures 5.5°C below normal. No daily maximum temperatures records were set this year but two daily extreme minimum records were set; one on April 8th with a temperature of -17.5°C (-11.9°C in 1997) and the other on July 14th with a temperature of 6.2°C (6.5°C in 1993). The frost-free season began May 11th and ended October 4th for a length of 144 days, 20 days longer than normal.

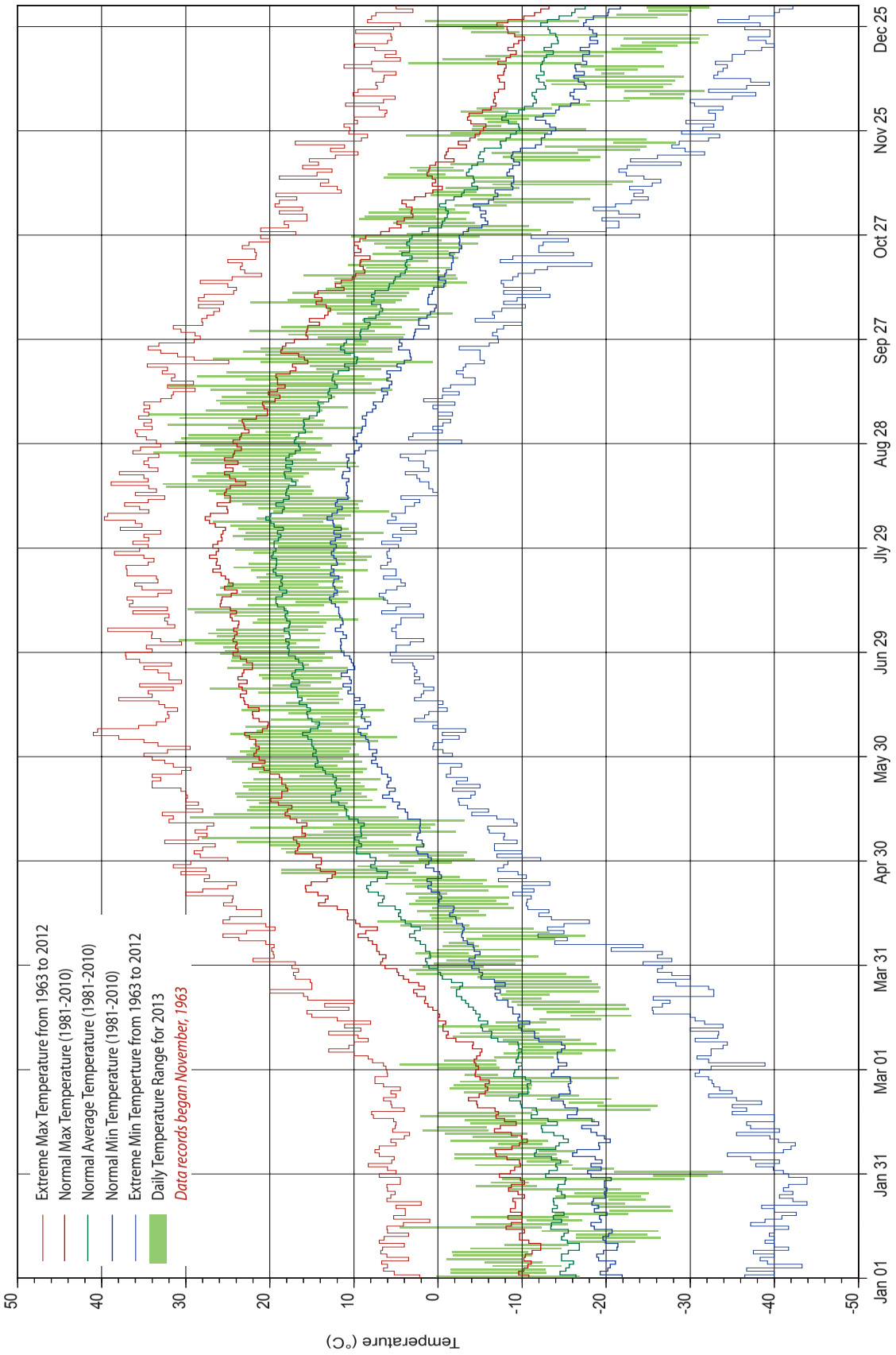
Below normal yearly precipitation was the result of a dry spring combined with a dry late summer and fall period from August to November. Eight out of twelve months posted below normal precipitation. The longest dry spell, from August 31st to September 24th, was 25 days while the longest wet spell, from June 13th to 23rd, was 11 days producing 101.6mm of moisture. Great rain or snow storms were conspicuously absent in 2013.

With the exception of June, the Bright Sunshine values soared above their normals from March to November. 2013 tied with 2011 for most hours as compared to the possible hours of bright sunshine. Spring finished second behind 1980 and autumn took home third place behind 2011 and 1976. June, July and August recorded bright sunshine for every day.

2013 did not experience any notable wind storms. The highest wind gust was recorded on June 17th at 78.2 km/h. The most frequent direction for wind gusts was from the southeast. The combination of low temperatures and wind speed produced wind chill factors of -40°C five times in January, once in February and nine times in December.

A few problems were encountered at the site during 2013; all to do with the soil temperatures. The first glitch occurred from April 29th to 30th when the readings at all levels were recording incorrectly. This occurred again from June 22nd to 23rd for the 150cm and 300cm levels. From July 1st to 3rd the problem raised its head again for the three lower levels and again on the 8th and 9th for the lower two levels. We believe the problem to be caused by sudden water infiltration in the area where the probes are buried and where the fill is still settling.

DAILY TEMPERATURE



TEMPERATURE

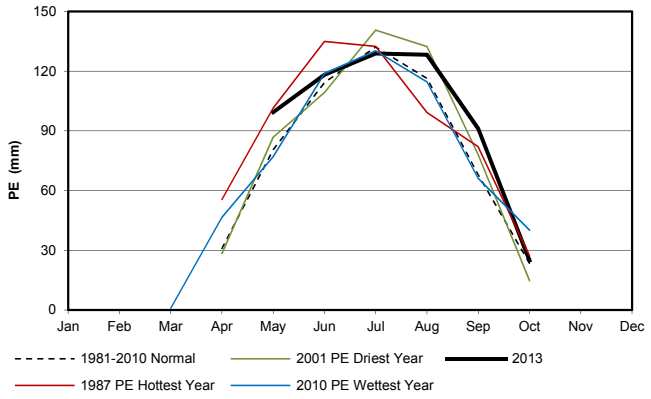
2013 TEMPERATURE RECORDS °C

TYPE				DATE	NEW RECORD	OLD RECORD/year
DAILY	Max	*Extreme High*		none		
		Low		April 16	0.7	1.9/2011
				July 13	16.9	17.2/1979
	Minimum	*High*		June 13	15.7	15.0/1965
				July 03	18.3	15.4/1996
				August 30	17.6	16.5/2002
				September 05	16.4	13.5/2001
		Extreme Low		April 08	-17.5	-11.9/1997
				July 14	6.2	6.5/1993
	Mean	*High*		August 24	24.1	23.1/2002
				September 05	25.4	21.7/1967
		Low		July 26	14.0	14.0/1997
Monthly	Max	*Ext*	Lowest	June	18/27.1	27.2/4/1969
	Min	*None*				
Most No. of Days during a month when...	Max Temp >= 20°C			May	23	21/1988,1998
	Min Temp <= -2°C			April	24	24/1967, 2002
Least No. of Days during a month when...	Max Temp >= 10°C			April	3	3/1967,1979

Ave = Average Ext = Extreme

POTENTIAL EVAPOTRANSPIRATION (PE) using the Thornthwaite Method[1]

MONTH	PE (mm) 2013	PE (mm) 2010 WettestYear	PE (mm) 2001 Driest Year	PE(mm) 1987 Hottest Year	PE (mm) 1981-2010 Normal
Jan	0	0	0	0	0
Feb	0	0	0	0	0
Mar	0	0.9	0	0	0
Apr	0	46.5	28.5	55.5	30.9
May	99.4	77.0	86.8	101.4	80.5
June	118.2	118.8	109.3	135.0	114.2
July	128.9	130.2	140.6	132.5	132.1
Aug	128.3	114.6	132.4	99.2	116.3
Sept	91.1	66.1	78.1	82.1	67.9
Oct	25.0	40.1	14.8	27.3	23.4
Nov	0	0	0	0	0
Dec	0	0	0	0	0
Total	563.7	594.3	590.4	632.9	565.4



[1]*Thornthwaite and Mather 1955*

DATES & DURATION OF THE FROST-FREE SEASON

YEAR	LAST SPRING FROST	FIRST FALL FROST	Frost-free Season Length
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	130
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	122
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
2003	May 18	Sept 29	133
2004	May 20	Sept 30	132
2005	May 14	Sept 28	136
2006	May 04	Sept 19	137
2007	May 10	Sept 14	126
2008	May 26	Sept 26	122
2009	June 05	Oct 07	123
2010	May 07	Sept 17	132
2011	May 10	Sept 14	126
2012	April 26	Oct 04	160
2013	May 11	Oct 04	144
1981-2010 Normal	May 18	Sept 20	124

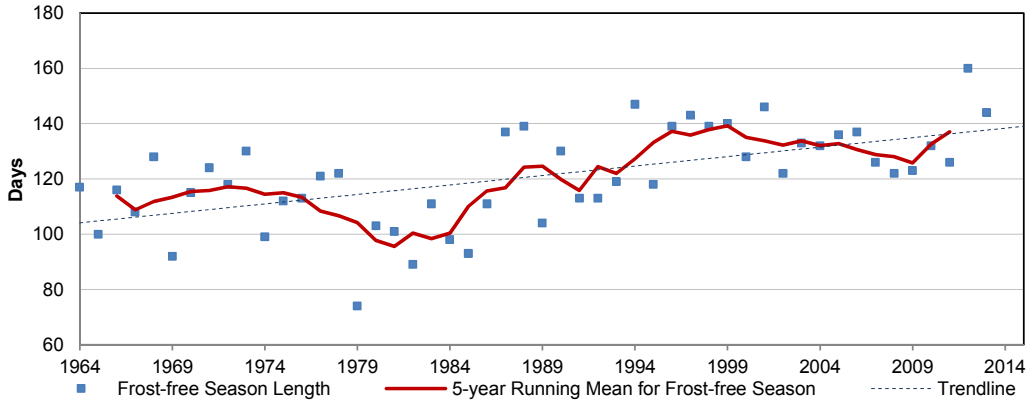
2013 EXTREME TEMPERATURES

COLD SPELL (less than or equal to -30°C)		HOT SPELL (greater than or equal to 30°C)	
DATE	TEMPERATURE °C	DATE	TEMPERATURE °C
January 30	-32.1	July 02	30.9
January 31	-33.8	August 15	32.4
December 07	-31.7	August 16	32.8
December 21	-30.9	August 24	30.9
December 22	-31.1	August 25	33.9
December 23	-32.1	August 28	31.3
December 30	-30.2	August 29	30.6
December 31	-32.2	September 02	32.1
		September 04	30.8
		September 05	34.3
		September 13	32.1

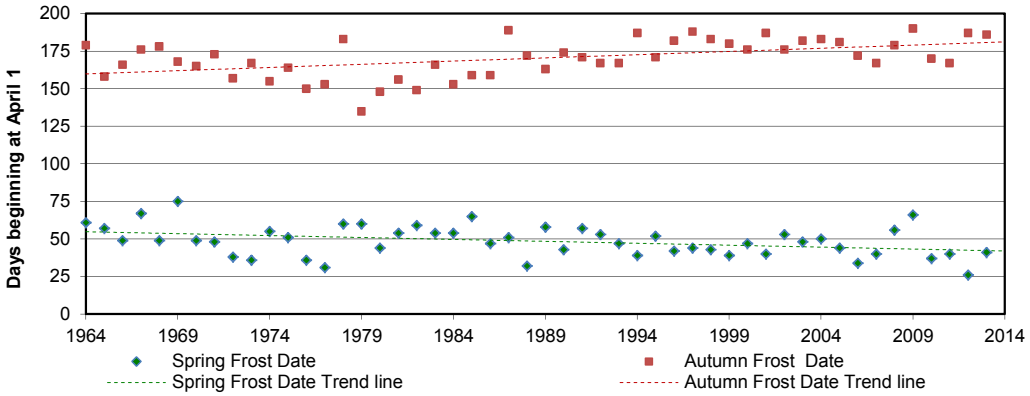
Coloured cells indicate extremes for the year

TEMPERATURE

Frost-free Growing Season Duration



Frost-free Growing Season End Points



Day 1 = April1 Day 50 = May 20 Day 100 = July 9 Day 150 = August 28 Day 200 = October 17

Stevenson Screen with minimum thermometer
Shaw Dunn SRC technologist November 2013
photo credit: CR Beaulieu

TEMPERATURE RANKINGS

AVERAGE ANNUAL TEMPERATUES °C

MAXIMUM TEMP		MINIMUM TEMP		MEAN TEMP	
1987	11.6	1987	-0.8	1987	5.4
2001	10.8	2006	-1.3	2001	4.6
1981	10.5	2012	-1.3	1981	4.5
1988	10.1	1999	-1.4	1998	4.3
1998	10.1	2010	-1.5	1999	4.2
1999	9.8	1981	-1.5	2006	4.2
2006	9.6	1998	-1.5	2012	4.0
2011	9.6	2005	-1.6	1988	3.9
1976	9.5	2001	-1.6	2011	3.8
1997	9.5	2011	-2.1	2005	3.8
2003	9.3	2007	-2.2	2010	3.7
2012	9.3	1988	-2.3	1997	3.5
2005	9.1	1997	-2.4	2003	3.4
1986	9.0	2003	-2.5	1991	3.2
1991	8.9	1993	-2.5	1986	3.2
2010	8.9	1991	-2.5	2007	3.2
2000	8.8	1992	-2.5	1976	3.0
1984	8.7	1986	-2.6	1992	3.0
1990	8.7	2004	-2.8	2000	3.0
1977	8.6	2002	-2.9	1984	2.9
1980	8.6	1984	-2.9	1993	2.8
2007	8.6	2000	-2.9	2004	2.8
1992	8.5	1964	-2.9	2002	2.8
2008	8.5	1994	-3.2	1964	2.7
2002	8.5	1983	-3.2	1994	2.7
1994	8.5	2008	-3.3	2008	2.6
2004	8.4	2013	-3.3	1990	2.6
1989	8.3	1995	-3.4	1977	2.5
1964	8.2	1968	-3.4	1980	2.4
1993	8.1	1976	-3.5	1989	2.3
1995	7.9	1990	-3.6	1995	2.3
1973	7.8	1977	-3.6	1983	2.2
1968	7.7	1989	-3.8	2013	2.2
2009	7.7	1980	-3.8	1968	2.2
2013	7.7	2009	-3.8	2009	2.0
1983	7.7	1973	-4.0	1973	1.9
1978	7.4	1970	-4.0	1970	1.7
1970	7.3	1978	-4.6	1978	1.4
1974	7.1	1969	-4.6	1971	1.2
1971	7.1	1971	-4.6	1974	1.2
1967	7.0	1974	-4.7	1967	1.1
1985	6.9	1967	-4.7	1969	1.1
1975	6.9	1985	-4.8	1985	1.1
1969	6.8	1972	-4.8	1975	0.9
1979	6.5	1975	-5.1	1972	0.6
1966	6.4	1996	-5.2	1979	0.6
1965	6.3	1965	-5.3	1965	0.5
1982	6.2	1982	-5.3	1966	0.4
1996	6.1	1979	-5.3	1996	0.4
1972	6.1	1966	-5.5	1982	0.4

SEASONAL MAXIMUM AVERAGE TEMPERATURES °C

WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2012	-1.9	1977	12.9	2001	26.5	1987	13.1
1987	-3.6	1987	12.7	2003	26.3	2011	12.6
2006	-4.7	1988	12.6	1984	26.1	2009	12.1
1998	-4.8	1981	12.1	1988	26.0	1994	11.8
2000	-5.4	1998	12.0	1970	25.9	2001	11.8
1992	-5.7	2001	11.9	2006	25.6	2008	11.8
2002	-6.0	1994	11.5	1998	25.6	1999	11.4
1964	-6.6	2010	11.4	1997	25.6	1981	11.1
1983	-7.1	1993	11.4	1981	25.3	1997	11.0
1988	-7.2	1980	11.3	1989	25.3	2005	11.0
2004	-7.2	1986	11.1	2002	25.3	1976	10.8
1986	-7.3	2000	11.0	1983	25.0	1980	10.8
1976	-7.3	2012	10.9	1996	24.9	1974	10.6
1981	-7.4	1992	10.8	1991	24.8	1979	10.6
1977	-7.4	1991	10.5	1964	24.6	2004	10.5
2007	-7.7	1976	10.4	2008	24.5	1998	10.4
2003	-8.0	1984	10.2	2007	24.5	1967	10.4
2005	-8.0	1999	10.1	1979	24.5	2000	10.3
1975	-8.0	2007	10.1	1995	24.4	1988	10.3
1999	-8.0	2006	10.1	2011	24.4	2013	10.1
1984	-8.1	1968	10.0	2012	24.4	1975	9.9
1995	-8.1	2004	10.0	1967	24.3	1989	9.8
1990	-8.2	1985	10.0	1978	24.2	2007	9.8
1991	-8.6	1990	10.0	1965	24.2	1990	9.7
1989	-8.7	2005	9.9	1969	24.1	1968	9.7
2013	-9.2	1973	9.9	1990	24.1	2010	9.6
2001	-9.3	1978	9.7	1987	24.0	2003	9.4
1970	-9.3	2003	9.4	1972	24.0	1970	9.3
2011	-9.5	2008	9.1	1976	23.8	1983	9.2
1980	-9.5	1972	9.1	1973	23.8	1992	8.8
2010	-9.8	1971	8.6	2000	23.8	1971	8.8
1968	-9.8	1969	8.3	2013	23.7	1964	8.8
2008	-10.1	1995	8.3	1971	23.6	1978	8.7
1973	-10.3	1989	8.2	1986	23.6	1977	8.7
1997	-11.0	1964	8.2	1994	23.5	1966	8.6
1967	-11.1	1966	8.1	1980	23.5	1995	8.6
1993	-11.5	1997	7.6	1975	23.2	1993	8.4
1985	-11.6	2011	7.5	1999	23.1	1982	8.3
2009	-11.7	2009	7.4	2010	23.0	2012	8.2
1994	-12.1	1983	7.0	1977	23.0	1969	8.0
1996	-12.2	1982	6.7	2009	22.9	2002	7.8
1974	-12.6	2013	6.4	1966	22.8	2006	7.5
1966	-13.1	1996	6.3	1982	22.6	1986	7.3
1982	-13.3	1970	6.1	2005	22.6	1965	7.3
1971	-13.4	2002	5.8	1985	22.4	1973	7.3
1978	-14.5	1965	5.7	1974	22.4	1991	7.0
1965	-14.8	1979	4.8	1992	22.4	1972	6.6
1972	-14.9	1974	4.7	1968	22.0	1996	6.2
1969	-15.2	1975	4.4	2004	21.6	1984	5.6
1979	-15.5	1967	4.4	1993	21.1	1985	4.5

TEMPERATURE RANKINGS

SEASONAL MINIMUM AVERAGE TEMPERATURES °C

WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2012	-12.6	1993	0.3	2012	12.9	2009	1.3
2006	-13.2	2010	0.2	2006	12.5	2005	0.4
1998	-13.4	2012	0.0	2003	12.5	2011	0.3
1987	-13.6	1987	-0.2	1988	12.3	2008	0.1
1992	-14.9	1977	-0.5	1970	12.3	1998	0.1
1964	-15.0	1999	-0.5	2002	12.2	1981	0.0
2002	-15.5	1985	-0.7	1991	12.2	2001	-0.1
1983	-15.6	1994	-0.8	2013	12.0	1967	-0.2
2000	-15.8	1981	-1.0	2011	11.8	1968	-0.2
2004	-16.7	1992	-1.0	2001	11.7	1997	-0.3
1999	-16.8	2006	-1.0	2007	11.7	1987	-0.3
2007	-17.0	1988	-1.0	1989	11.6	2004	-0.4
1981	-17.1	1986	-1.1	1998	11.6	1994	-0.5
1995	-17.2	2000	-1.1	2010	11.5	1999	-0.6
1986	-17.3	2001	-1.2	1997	11.5	1992	-0.7
2003	-17.5	2007	-1.3	2008	11.3	2010	-0.7
1988	-17.8	2005	-1.4	1984	11.2	1980	-0.9
1976	-17.8	1990	-1.5	1996	11.2	1983	-1.0
1984	-17.8	1973	-1.7	1983	11.2	1970	-1.1
2005	-17.8	1978	-1.7	1964	11.0	2007	-1.1
2011	-18.3	1991	-2.0	2005	11.0	1964	-1.4
2013	-18.4	1968	-2.0	1972	11.0	1988	-1.4
1975	-18.5	1998	-2.0	2000	11.0	1979	-1.4
1970	-18.7	1984	-2.2	1981	10.9	2013	-1.5
1977	-18.8	2003	-2.3	1995	10.8	2000	-1.7
1989	-18.9	1972	-2.4	1990	10.7	1989	-1.8
2001	-19.0	2004	-2.5	1999	10.7	1969	-1.9
2010	-19.1	1980	-2.6	1987	10.6	2012	-1.9
1990	-19.1	2008	-3.2	1994	10.6	1971	-2.1
1991	-19.3	1976	-3.3	1965	10.5	2002	-2.2
2008	-19.5	1983	-3.7	1976	10.5	2003	-2.2
1980	-19.6	1969	-3.8	1971	10.3	1977	-2.4
1968	-20.0	1995	-3.8	2009	10.3	1974	-2.4
1973	-20.3	1966	-3.9	1973	10.0	1975	-2.5
1993	-20.5	1964	-3.9	1979	10.0	1993	-2.5
1994	-20.8	2011	-3.9	1966	9.9	1995	-2.6
1967	-21.1	1971	-4.0	1993	9.9	1972	-2.7
1997	-21.3	1997	-4.3	1975	9.8	2006	-2.8
2009	-21.4	1982	-4.3	2004	9.7	1978	-2.9
1996	-21.9	1989	-4.3	1978	9.7	1986	-3.1
1974	-22.6	1996	-4.9	1980	9.6	1990	-3.4
1985	-22.9	2013	-4.9	1982	9.6	1976	-3.6
1971	-23.1	1970	-5.0	1986	9.6	1982	-3.7
1982	-23.6	2009	-5.6	1974	9.6	1991	-3.7
1966	-23.6	1965	-5.8	1967	9.5	1984	-3.8
1969	-24.0	1979	-6.1	1969	9.4	1966	-4.3
1965	-24.0	1974	-6.5	1968	9.2	1996	-4.3
1978	-24.5	1975	-6.5	1992	8.8	1965	-4.4
1972	-25.0	1967	-6.9	1977	8.8	1973	-4.6
1979	-25.2	2002	-7.6	1985	8.2	1985	-6.0

SEASONAL MEAN AVERAGE TEMPERATURES °C

WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2012	-7.3	1987	6.2	2003	19.4	2009	6.7
1987	-8.6	1977	6.2	1988	19.2	2011	6.5
2006	-8.9	1993	5.8	2001	19.1	1987	6.4
1998	-9.1	2010	5.8	1970	19.1	2008	5.9
1992	-10.3	1988	5.8	2006	19.1	2001	5.8
2000	-10.6	1981	5.6	2002	18.8	2005	5.7
2002	-10.8	2012	5.4	1984	18.7	1994	5.7
1964	-10.8	1994	5.4	2012	18.7	1981	5.5
1983	-11.4	2001	5.4	1998	18.6	1999	5.4
2004	-12.0	1986	5.0	1997	18.5	1997	5.4
1981	-12.3	1998	5.0	1991	18.5	1998	5.3
1986	-12.3	1992	4.9	1989	18.5	1967	5.1
2007	-12.4	2000	4.9	1983	18.1	2004	5.0
1999	-12.4	1999	4.8	1981	18.1	1980	5.0
1988	-12.5	1985	4.7	2011	18.1	1968	4.8
1976	-12.6	2006	4.5	2007	18.1	1979	4.6
1995	-12.7	2007	4.4	1996	18.1	1988	4.4
2003	-12.7	1980	4.4	2008	17.9	2010	4.4
2005	-12.9	1991	4.3	2013	17.9	2007	4.4
1984	-13.0	2005	4.3	1964	17.8	2000	4.3
1977	-13.1	1990	4.3	1995	17.7	2013	4.3
1975	-13.3	1973	4.1	1972	17.5	1970	4.2
1990	-13.7	1978	4.0	2000	17.4	1974	4.1
2013	-13.8	1968	4.0	1990	17.4	1983	4.1
1989	-13.8	1984	4.0	1965	17.4	1992	4.1
2011	-14.0	2004	3.8	1987	17.3	1989	4.0
1991	-14.0	2003	3.6	1979	17.3	1975	3.8
1970	-14.0	1976	3.5	1976	17.2	1964	3.7
2001	-14.2	1972	3.4	2010	17.2	1976	3.6
2010	-14.5	2008	2.9	1994	17.1	2003	3.6
1980	-14.6	1971	2.3	1978	17.0	1971	3.4
2008	-14.8	1969	2.2	1971	17.0	1977	3.2
1968	-15.0	1995	2.2	1973	17.0	1990	3.2
1973	-15.4	1964	2.2	1999	16.9	2012	3.1
1993	-16.0	1966	2.1	1967	16.9	1969	3.1
1967	-16.1	1989	2.0	2005	16.8	1995	3.0
1997	-16.2	2011	1.9	1969	16.7	1978	2.9
1994	-16.5	1997	1.7	1986	16.6	1993	2.9
2009	-16.6	1983	1.6	2009	16.6	2002	2.8
1996	-17.1	1982	1.2	1980	16.6	2006	2.4
1985	-17.3	2009	0.9	1975	16.5	1982	2.3
1974	-17.6	1996	0.7	1966	16.4	1966	2.2
1971	-18.3	2013	0.7	1982	16.2	1986	2.1
1966	-18.4	1970	0.5	1974	16.0	1972	1.9
1982	-18.5	1965	-0.1	1977	15.9	1991	1.6
1965	-19.4	1979	-0.7	2004	15.7	1965	1.5
1978	-19.5	1974	-0.9	1992	15.6	1973	1.3
1969	-19.6	2002	-0.9	1968	15.6	1984	0.9
1972	-20.0	1975	-1.0	1993	15.5	1996	0.9
1979	-20.4	1967	-1.3	1985	15.3	1985	-0.8

TEMPERATURE

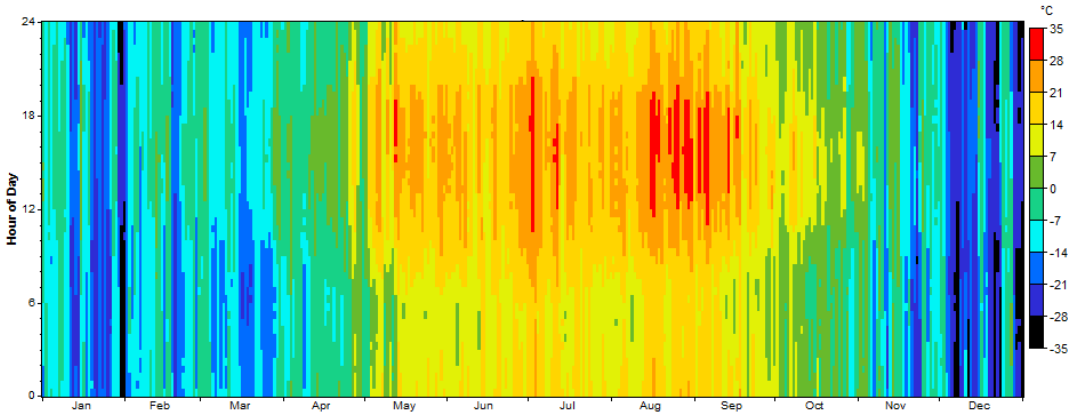
MONTH	AVERAGE MAXIMUM TEMPERATURE (°C)		AVERAGE MINIMUM TEMPERATURE (°C)		AVERAGE TEMPERATURE (°C)		EXTREME VALUES TEMPERATURE (°C)		EXTREME VALUES FOR SASKATOON STATIONS	
	2013	Normal	2013	Normal	2013	Normal	Max/Date	Min/Date	Max/Date	Min/Date
January	-9.6	-9.8	-19.6	-19.7	-14.6	-14.7	4.6/15	-33.8/31	11.0/1980/23$_{SWT}$	-48.9/1893/31$_{SM}$
February	-5.3	-7.1	-14.2	-17.0	-9.8	-12.1	2.1/16	-26.1/19	12.8/1931/19$_{SE}$	-50.0/1893/01$_{SM}$
March	-5.4	0.0	-15.1	-9.7	-10.3	-4.9	4.6/02	-23.0/16	22.8/1910/23$_{SE}$	-43.3/1897/14$_{SM}$
April	3.4	11.2	-5.9	-1.4	-1.3	4.9	18.7/26	-17.5/08	33.3/1952/28$_{SA\,US}$	-30.5/1979/01$_{SWT}$
May	21.2	18.3	6.3	4.6	13.8	11.5	29.5/12	-3.4/02	37.2/1936/27$_{SE}$	-12.8/1907/06$_{SE}$
June	21.4	22.5	11.2	9.8	16.3	16.2	27.1/18	4.9/04	41.5/1988/06$_{S2}$	-3.9/1917/02$_{US}$
July	23.4	25.2	12.1	12.1	17.8	18.7	30.9/02	6.2/14	40.0/1919,1941,1946$_{SE\,SA\,US}$	-0.6/1918/25$_{SE}$
August	26.3	24.9	12.8	11.0	19.6	18.0	33.9/25	5.8/08	39.7/1998/06$_{SRC}$	-2.8/1901/23SM&1976/28$_{SRC}$
September	23.1	18.7	9.0	5.6	16.1	12.2	34.3/05	0.7/20	35.6/1978/04$_{SRC}$	-11.1/1908/28$_{SE}$
October	10.0	10.4	-1.0	-1.1	4.5	4.6	22.4/07	-12.2/28	32.2/1943/05$_{SA\,US}$	-25.6/1919/26$_{SE\,US}$
November	-2.8	-0.6	-12.4	-9.3	-7.6	-5.0	8.8/01	-28.3/22	21.7/1903/03$_{SE}$	-39.4/1893/30$_{SM}$
December	-13.8	-8.3	-23.1	-17.4	-18.5	-12.9	3.6/15	-32.2/31	14.4/1939/05$_{SE}$	-43.9/1892/22$_{SM}$
Average	7.7	8.8	-3.3	-2.7	2.2	3.0				

Normal = 1981-2010

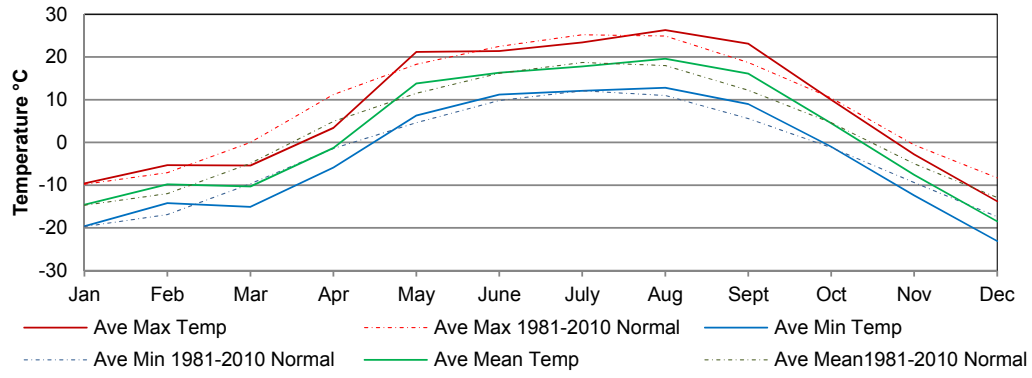
SE = Saskatoon Eby 1901-1942
US = University of Saskatchewan 1915-1964
SWT = Saskatoon Water Treatment Plant 1974 -
SRC = Saskatchewan Research Council 1963-

SA = Saskatoon Diefenbaker Int'l Airport 1942-
S2= Saskatoon 2 1977-1990
SM = Saskatoon stations circa 1889 -1901 (RNWMP *etal)*

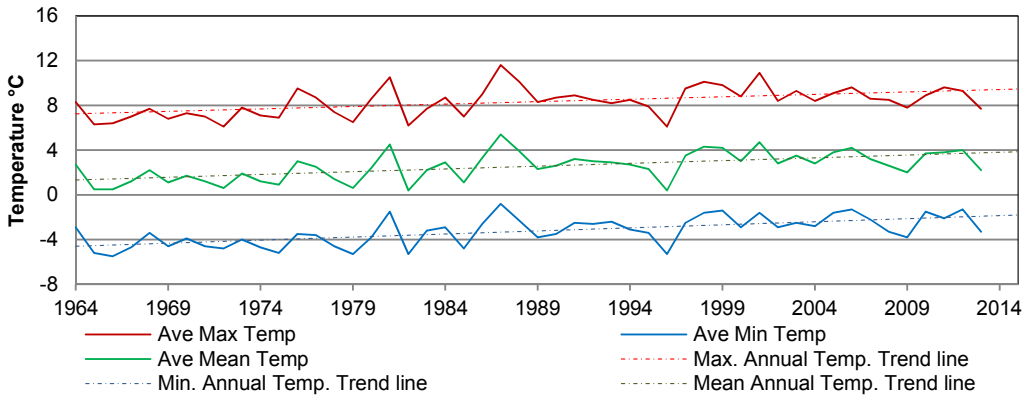
Hourly



Monthly

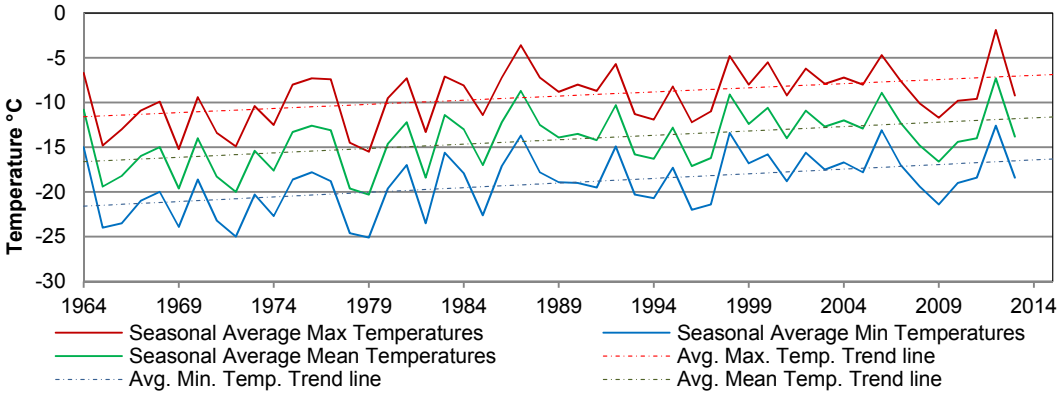


Annual

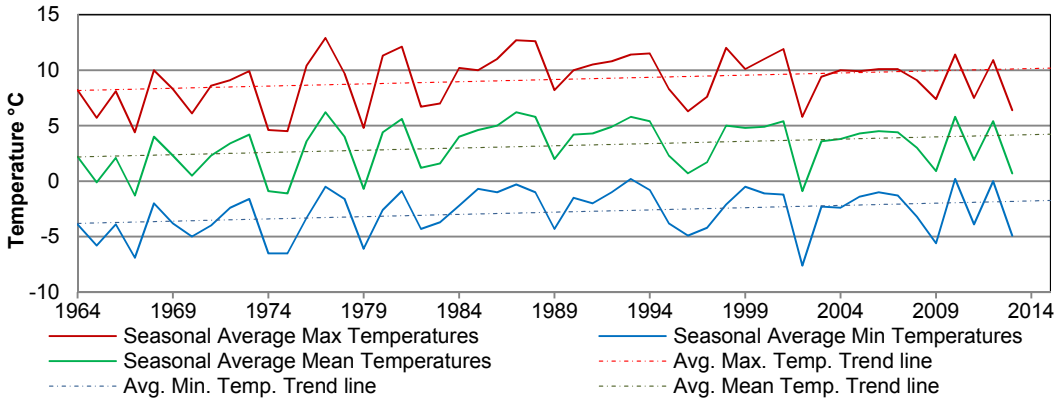


SEASONAL TEMPERATURES for 1964 to 2013

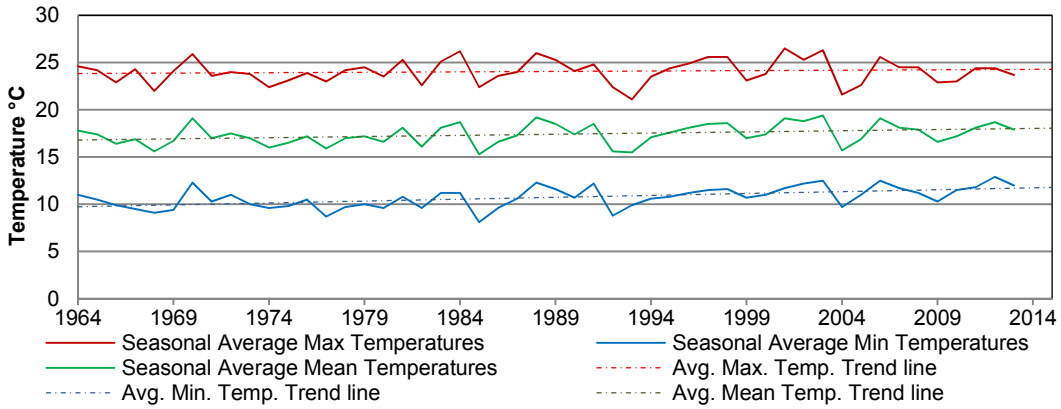
Winter (DJF)



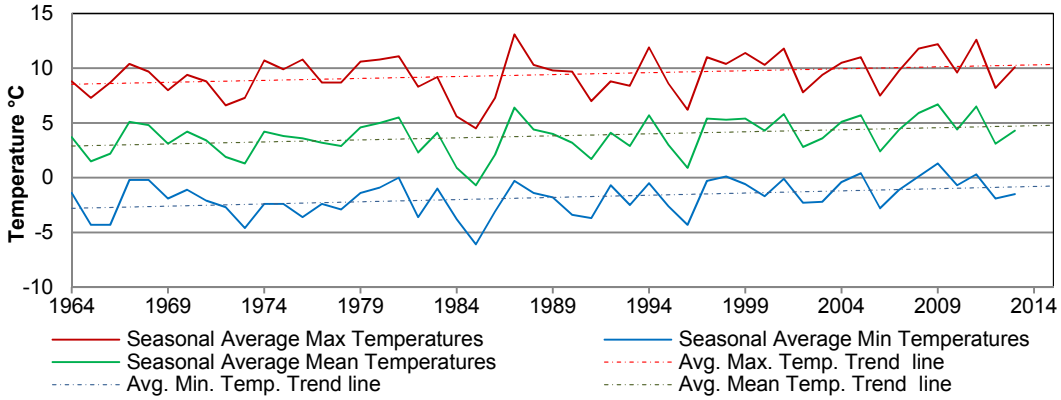
Spring (MAM)



Summer (JJA)

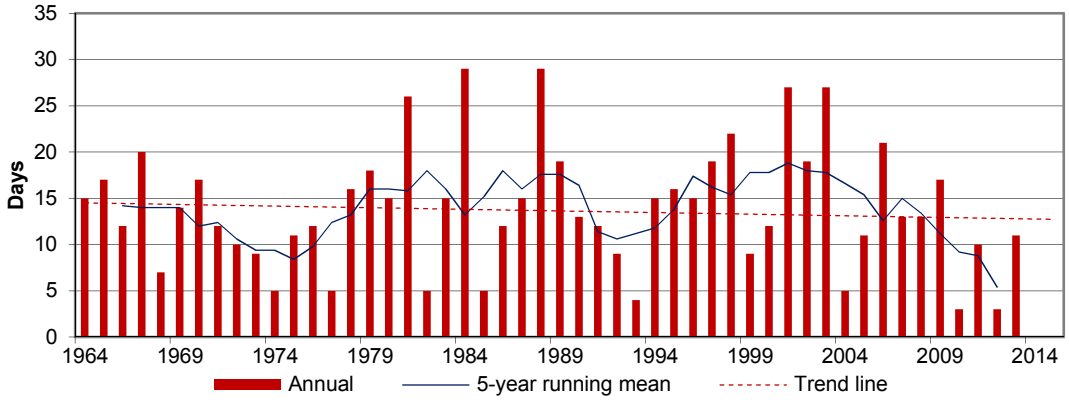


Autumn(SON)

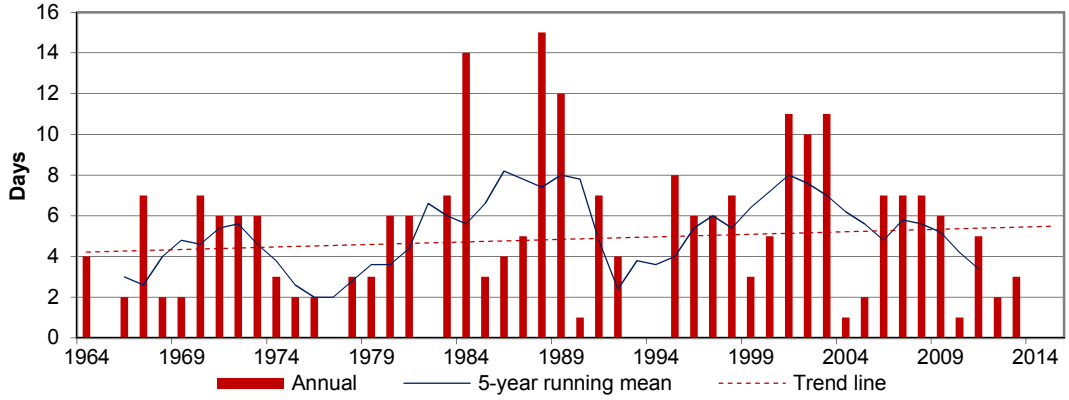


DAYS WITH TEMPERATURES GREATER THAN A SET POINT

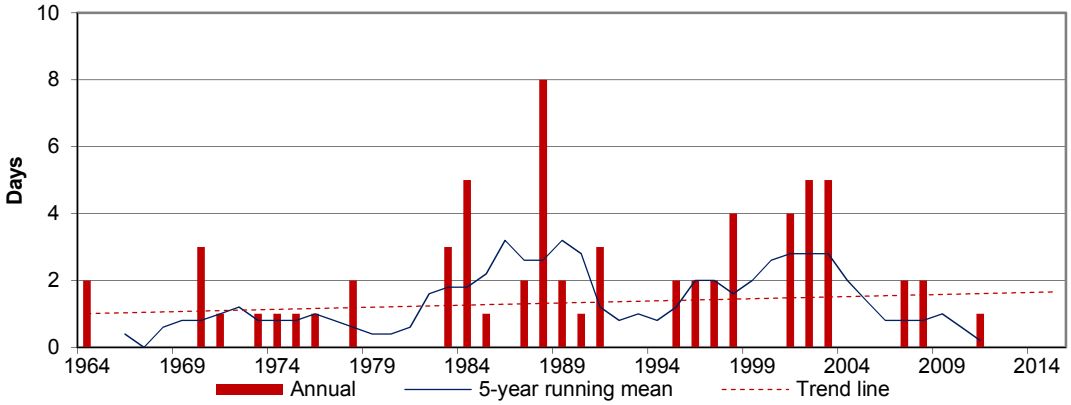
30°C or Greater



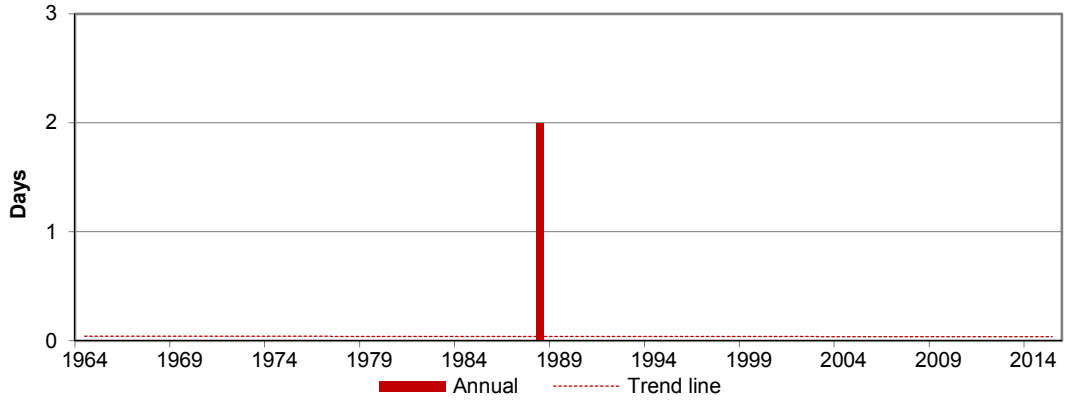
32°C or Greater



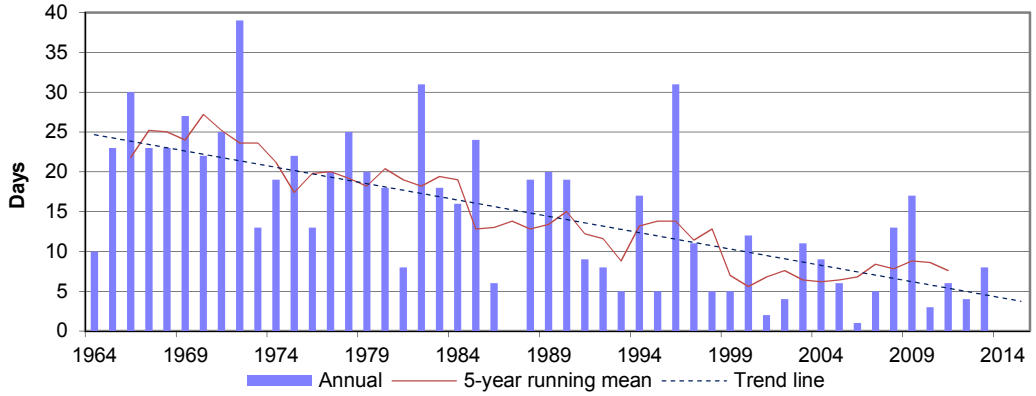
35°C or Greater



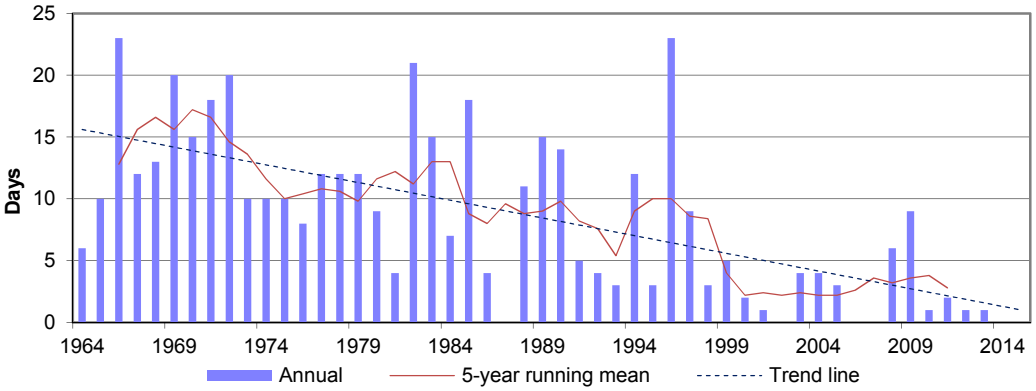
40°C or Greater



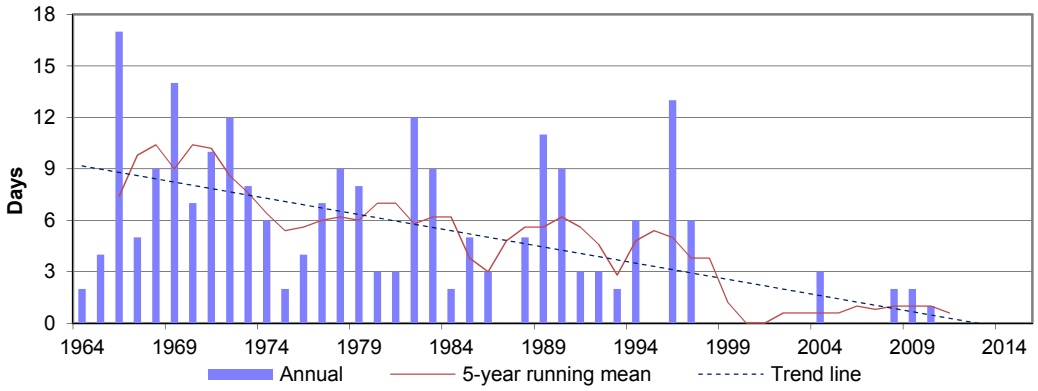
DAYS WITH TEMPERATURES LESS THAN A SET POINT



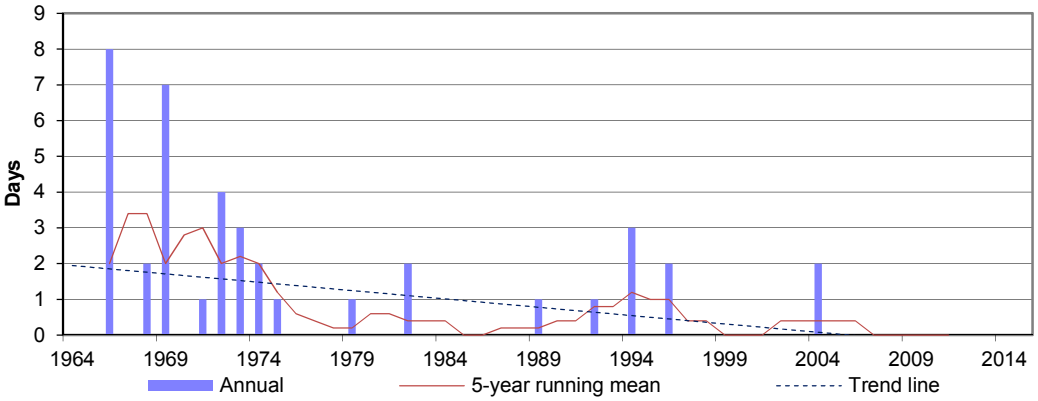
Minus 30°C or Less



Minus 32°C or Less



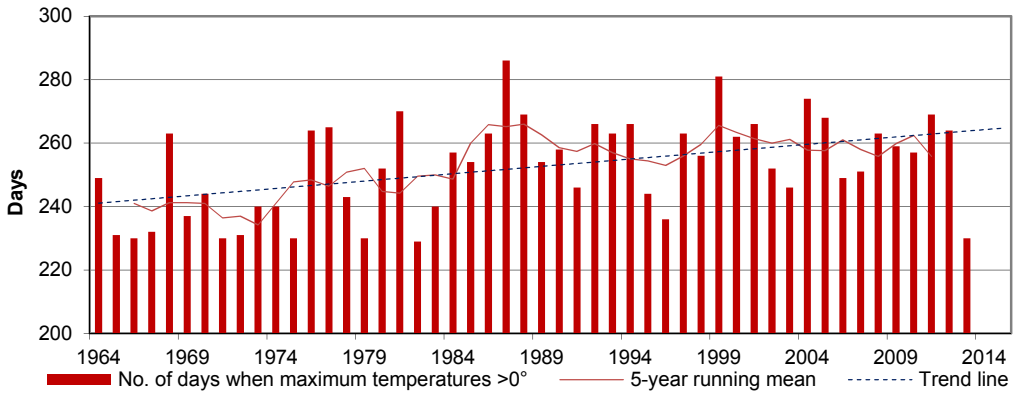
Minus 35° or Less



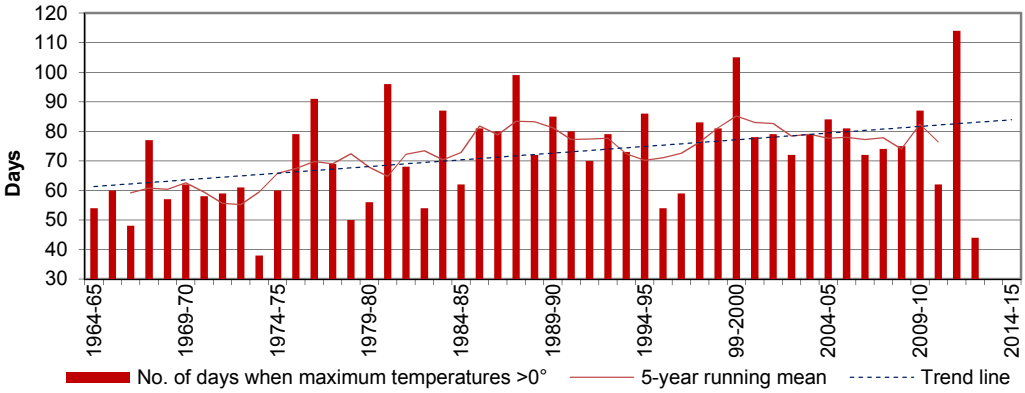
Minus 40°C or Less

DAYS WITH TEMPERATURES GREATER THAN 0°C

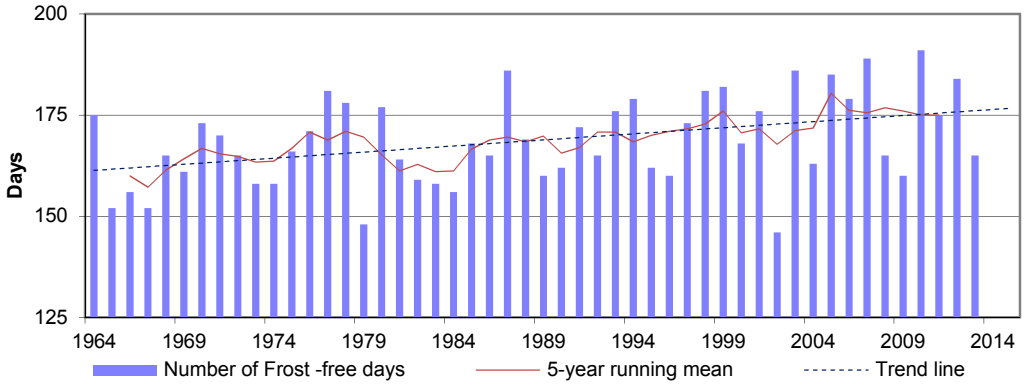
Maximum Temperature greater than 0°C (Thaw Days) Jan 1st to Dec 31st



Maximum Temperature greater than 0°C (Thaw Days) Oct 1st to Mar 31st (Cold Season)



Minimum Temperature greater than 0°C (Frost-free Days)



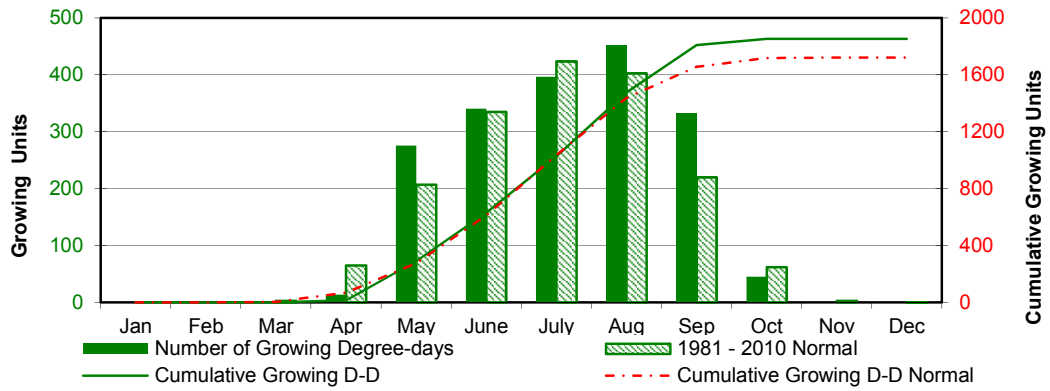
Site Resident
photo credit: CR Beaulieu 2013

Old Stevenson Screen September 2013
(CR Beaulieu and guests)
photo credit: SRC

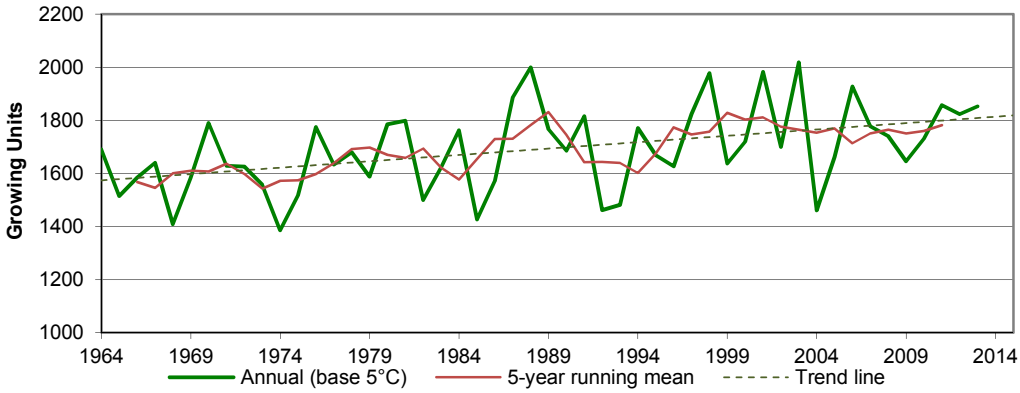
DEGREE-DAYS

MONTH	GROWING DEGREE-DAYS Base 5°C			HEATING DEGREE-DAYS Base 18°C			COOLING DEGREE-DAYS Base 18°C			EXTREME COOLING DEGREE-DAYS Base 24°C		
	2013	Cumulative	Normal	2013	Cumulative	Normal	2013	Cumulative	Normal	2013	Cumulative	Normal
January	0.0	0.0	0.0	1011.0	1011.0	1015.1	0.0	0.0	0.0	0.0	0.0	0.0
February	0.0	0.0	0.0	782.5	1793.5	848.2	0.0	0.0	0.0	0.0	0.0	0.0
March	0.0	0.0	3.0	876.4	2669.9	708.8	0.0	0.0	0.0	0.0	0.0	0.0
April	13.2	13.2	65.2	578.0	3247.9	402.4	0.0	0.0	0.2	0.0	0.0	0.0
May	275.4	288.6	206.9	132.9	3380.8	209.3	1.8	1.8	6.3	0.0	0.0	0.1
June	339.9	628.5	334.8	59.5	3440.3	81.4	9.4	11.2	24.8	0.0	0.0	1.5
July	396.2	1024.7	424.0	40.4	3480.7	30.7	33.6	44.8	51.7	0.0	0.0	2.9
August	451.7	1476.4	402.8	23.6	3504.3	50.0	72.3	117.1	49.8	1.4	1.4	3.5
September	332.1	1808.5	219.9	89.3	3593.6	182.5	31.4	148.5	7.6	1.4	2.8	0.1
October	44.5	1853.0	62.2	417.1	4010.7	415.1	0.0	148.5	0.1	0.0	2.8	0.0
November	0.0	1853.0	2.9	767.4	4778.1	690.1	0.0	148.5	0.0	0.0	2.8	0.0
December	0.0	1853.0	0.1	1131.1	5909.2	957.5	0.0	148.5	0.0	0.0	2.8	0.0

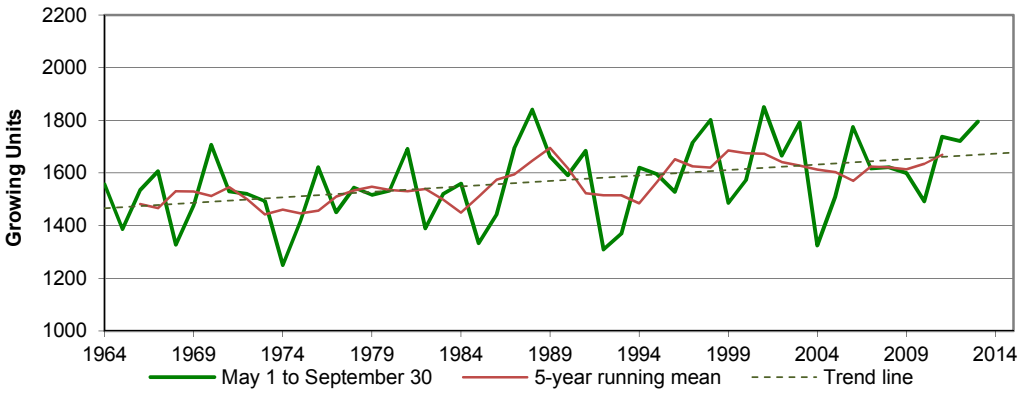
Growing Degree-days Monthly



Growing Degree-days Annual

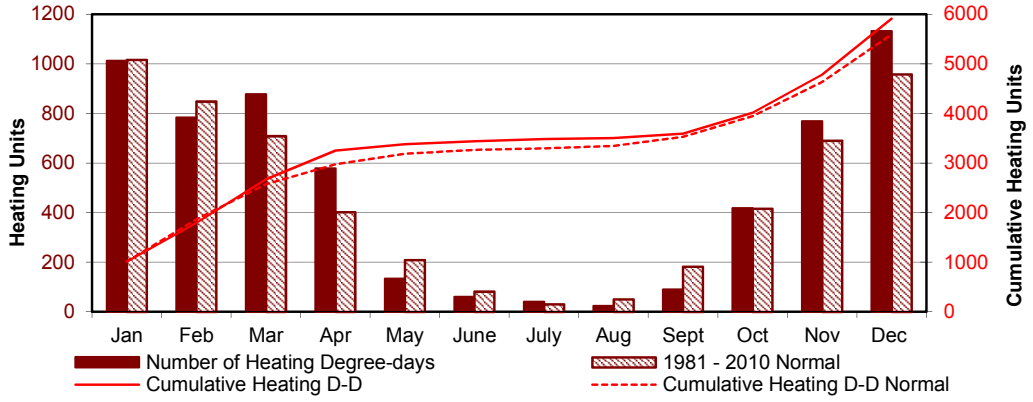


Growing Degree-days May 1 to September 30

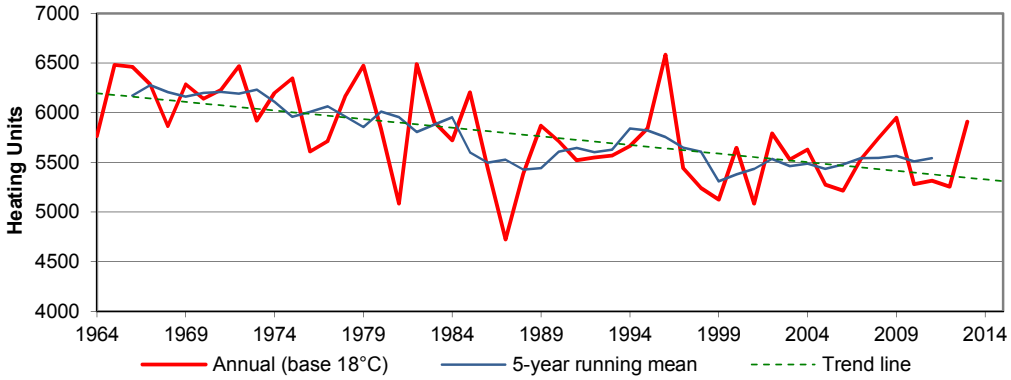


DEGREE-DAYS

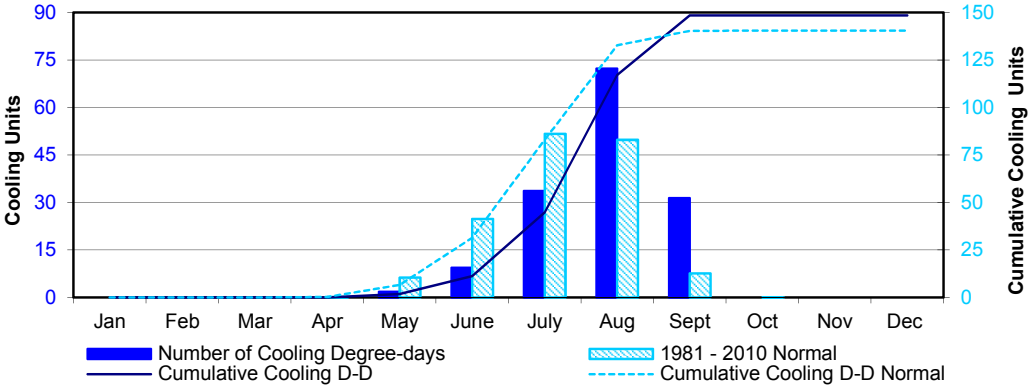
Heating Degree-days Monthly



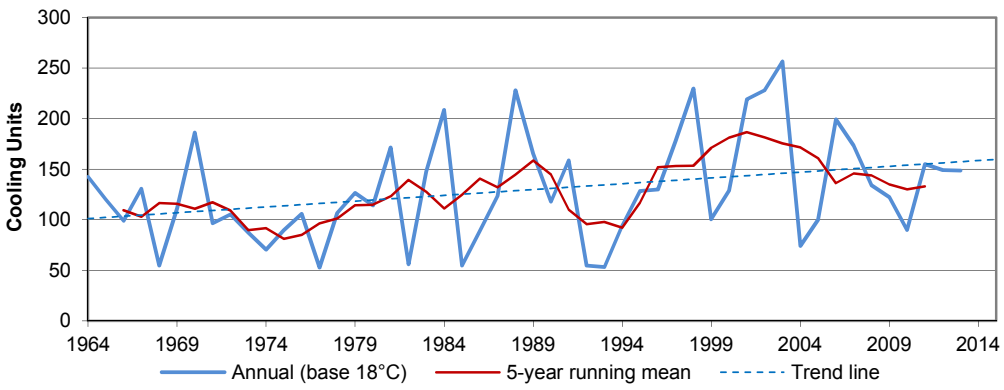
Heating Degree-days Annual



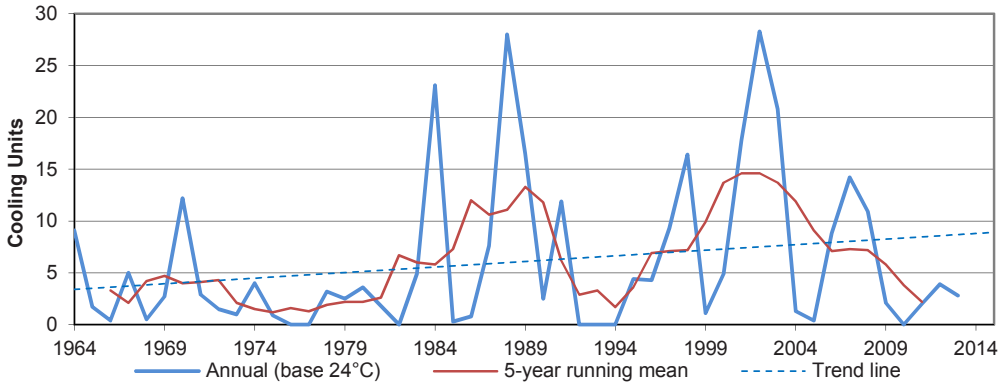
Cooling Degree-days Monthly



Cooling Degree-days Annual



DEGREE-DAYS



Extreme Cooling Degree-days Annual

TEMPERATURE GRID °C

Maximum Temperature °C Daily

2013	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	0.2	-15.9	-0.1	-1.0	5.9	22.3	28.9	24.4	25.0	11.4	8.8	-2.7
2	-1.5	-4.4	4.6	1.2	18.1	21.9	30.9	22.9	32.1	9.0	8.2	-4.6
3	-1.5	-10.5	-0.7	2.7	18.6	21.8	26.3	23.8	23.8	8.4	4.7	-13.5
4	-6.5	-2.0	-6.7	0.1	20.0	22.9	27.3	24.7	30.8	12.0	-2.0	-17.6
5	-5.5	-2.0	-7.8	-0.5	23.9	24.7	26.4	26.8	34.3	13.2	-6.6	-22.1
6	-1.0	-12.0	-9.3	-1.3	28.1	21.6	17.9	21.6	27.6	16.4	-3.9	-25.2
7	-1.8	-6.1	-10.1	-3.3	16.3	22.9	22.0	16.1	22.7	22.4	0.9	-22.2
8	-1.7	-7.2	-8.3	-5.3	13.7	14.7	21.5	19.6	25.9	17.9	0.7	-19.9
9	-3.8	-1.5	-7.7	-0.6	22.3	19.9	24.2	21.4	26.4	10.9	-0.9	-13.5
10	-7.9	-4.1	-1.8	1.9	12.5	13.9	28.9	23.3	25.8	17.3	-6.5	-12.8
11	-15.4	-0.8	-2.6	4.5	16.3	17.8	29.8	24.9	22.8	13.4	-4.3	-16.0
12	-16.4	1.8	-6.0	7.2	29.5	23.4	22.6	25.5	27.1	11.6	6.5	-19.4
13	-16.4	0.1	-0.1	0.8	26.7	22.5	16.9	26.4	32.1	12.3	6.0	-18.6
14	-12.3	-3.9	-6.9	0.9	22.7	18.0	21.6	27.2	20.0	12.3	2.5	-17.0
15	4.6	-3.2	-12.1	2.5	22.4	15.6	26.4	32.4	22.9	16.0	3.4	3.6
16	-4.5	2.1	-15.8	0.7	21.3	16.6	23.4	32.8	28.7	10.1	-1.5	-0.5
17	-10.5	0.0	-12.9	3.4	22.8	21.4	25.9	28.6	25.2	8.6	-8.9	-5.6
18	-4.0	-11.1	-11.3	2.7	23.9	27.1	25.1	29.2	14.5	10.7	-7.7	-10.2
19	-13.9	-19.0	-9.4	2.3	24.1	19.7	21.2	27.5	15.3	9.4	-6.4	-20.6
20	-20.4	-15.5	-8.7	3.8	22.5	17.4	21.6	22.5	21.1	3.4	-16.6	-21.7
21	-18.9	-11.8	-7.6	0.7	23.2	20.9	20.5	23.3	26.8	7.8	-12.7	-24.3
22	-15.3	-5.5	-7.4	2.8	23.3	21.3	22.2	29.4	20.6	4.7	-20.9	-22.1
23	-20.3	-3.1	-8.1	6.3	21.9	20.0	24.3	29.3	23.2	6.3	-4.7	-9.1
24	-13.9	-1.4	-1.5	3.0	16.5	25.1	22.5	30.9	21.1	7.6	3.8	-3.9
25	-16.2	-1.9	-6.8	12.6	21.3	23.3	20.0	33.9	13.3	9.0	-1.5	-2.9
26	-8.3	-2.6	-6.7	18.7	22.6	24.6	20.0	26.6	10.0	10.4	-4.1	0.2
27	-4.5	-5.0	-4.7	18.7	21.0	24.5	21.9	28.3	14.3	3.7	-4.2	1.6
28	-6.3	-3.2	2.6	9.6	24.5	25.9	24.1	31.3	17.8	-3.3	-5.9	-16.6
29	-7.6		3.5	4.6	25.1	25.3	19.0	30.6	22.4	3.5	-5.5	-21.3
30	-25.6		1.8	2.3	22.8	25.6	19.9	29.7	18.6	5.3	-3.7	-25.0
31	-20.9		0.5		23.6		23.1	20.6		9.4		-24.8

TEMPERATURE GRID °C

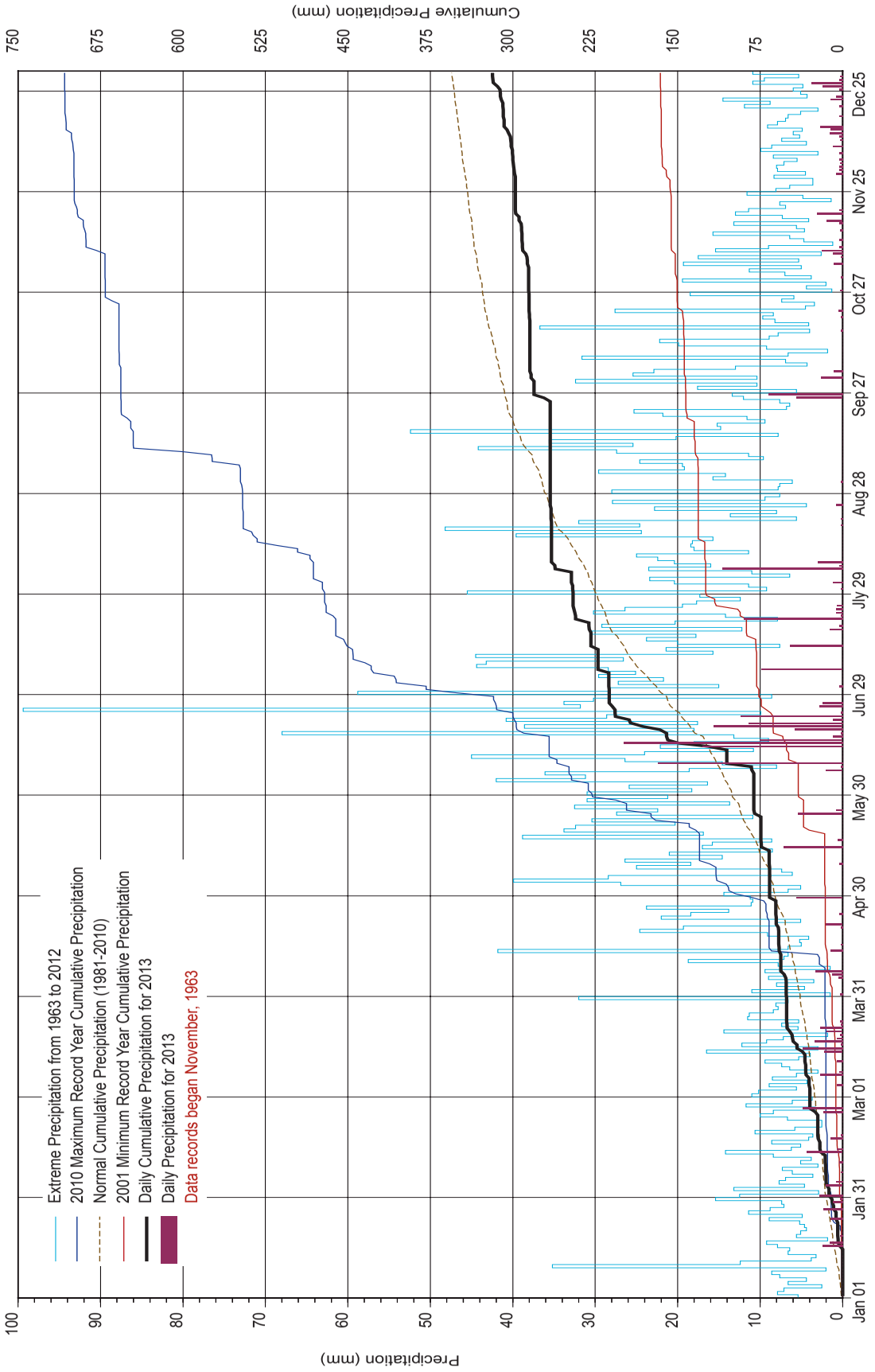
Minimum Temperature °C Daily

2013	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-16.9	-20.9	-7.3	-10.1	-3.0	10.4	16.9	10.4	9.1	5.7	0.3	-8.3
2	-12.9	-16.0	-6.9	-11.9	-3.4	9.8	14.1	6.5	13.7	2.1	-3.7	-13.5
3	-12.8	-15.5	-6.9	-3.6	4.7	7.2	18.3	10.7	13.5	0.2	-2.0	-18.1
4	-14.7	-14.2	-13.7	-9.8	1.6	4.9	13.4	11.5	14.8	-1.7	-8.2	-22.8
5	-12.3	-14.1	-17.1	-4.8	5.4	8.4	15.5	13.7	16.4	2.3	-16.1	-29.1
6	-9.9	-16.3	-21.1	-4.3	8.5	12.7	13.7	11.1	13.8	7.3	-18.1	-29.3
7	-11.2	-13.9	-12.5	-13.9	3.2	9.4	13.3	10.4	10.8	5.1	-8.7	-31.7
8	-10.7	-12.4	-18.8	-17.5	-2.1	10.7	9.6	5.8	13.6	4.4	-4.6	-26.7
9	-14.6	-13.1	-16.9	-13.2	0.9	10.1	11.5	9.5	14.2	3.8	-9.6	-27.8
10	-15.5	-9.4	-15.2	-11.3	0.4	8.1	14.1	9.6	12.3	3.5	-20.7	-28.2
11	-23.4	-10.6	-12.0	-3.7	-3.1	9.6	18.0	9.0	7.4	2.3	-23.2	-29.2
12	-26.5	-6.0	-14.4	-1.7	4.7	6.4	13.6	10.5	5.5	-0.9	-8.9	-22.1
13	-24.9	-5.8	-10.3	-2.6	11.9	15.7	10.8	15.0	12.0	-3.4	-0.8	-23.7
14	-26.2	-12.9	-12.9	-5.7	10.7	11.8	6.2	14.8	7.9	-2.3	-3.1	-26.9
15	-12.3	-18.6	-19.4	-4.8	6.2	11.3	11.9	15.2	5.8	-2.1	-1.8	-17.0
16	-15.4	-9.2	-23.0	-9.0	10.8	11.9	10.7	17.7	8.8	-0.2	-8.9	-7.3
17	-17.1	-11.2	-18.6	-8.3	7.8	11.8	11.4	16.7	12.4	-1.4	-18.1	-19.6
18	-15.5	-25.2	-22.7	-6.9	8.5	11.4	14.3	16.0	6.8	3.3	-19.3	-26.7
19	-22.6	-26.1	-22.3	-8.4	9.1	15.2	11.3	15.4	4.9	1.2	-16.7	-25.9
20	-27.9	-19.6	-16.8	-1.1	7.2	12.7	11.3	12.2	0.7	-2.4	-24.0	-28.4
21	-27.6	-20.6	-12.3	-6.0	8.8	11.5	12.3	9.5	7.7	-2.0	-24.7	-30.9
22	-22.2	-16.7	-13.2	-8.3	9.3	12.7	8.4	9.8	10.4	-1.2	-28.3	-31.1
23	-24.7	-10.9	-19.1	-5.3	6.8	10.8	14.0	14.4	5.5	-2.8	-24.8	-32.1
24	-24.1	-11.1	-19.3	-5.8	10.5	10.8	11.0	17.3	5.5	-4.7	-4.9	-9.6
25	-25.0	-11.2	-19.0	-2.6	9.0	15.4	8.5	14.0	8.6	-0.4	-13.1	-7.9
26	-21.7	-16.0	-18.3	2.7	8.5	13.8	7.9	14.7	8.3	-4.9	-17.6	-7.8
27	-11.7	-21.5	-18.0	3.6	12.0	12.6	9.7	12.7	4.1	-11.1	-7.5	-16.7
28	-10.8	-7.1	-15.2	2.9	9.0	13.5	12.2	15.8	3.9	-12.2	-9.3	-26.1
29	-29.3		-9.8	-1.6	11.3	11.1	10.8	13.8	7.5	-10.8	-10.8	-29.7
30	-32.1		-5.4	-4.3	9.4	14.2	10.9	17.6	4.3	-4.4	-13.9	-30.2
31	-33.8		-9.2		10.6		8.9	14.9		-3.3		-32.2

Average Temperature °C Daily

2013	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-8.4	-18.4	-3.7	-5.6	1.5	16.4	22.9	17.4	17.1	8.6	4.6	-5.5
2	-7.2	-10.2	-1.2	-5.4	7.4	15.9	22.5	14.7	22.9	5.6	2.3	-9.1
3	-7.2	-13.0	-3.8	-0.5	11.7	14.5	22.3	17.3	18.7	4.3	1.4	-15.8
4	-10.6	-8.1	-10.2	-4.9	10.8	13.9	20.4	18.1	22.8	5.2	-5.1	-20.2
5	-8.9	-8.1	-12.5	-2.7	14.7	16.6	21.0	20.3	25.4	7.8	-11.4	-25.6
6	-5.5	-14.2	-15.2	-2.8	18.3	17.2	15.8	16.4	20.7	11.9	-11.0	-27.3
7	-6.5	-10.0	-11.3	-8.6	9.8	16.2	17.7	13.3	16.8	13.8	-3.9	-27.0
8	-6.2	-9.8	-13.6	-11.4	5.8	12.7	15.6	12.7	19.8	11.2	-2.0	-23.3
9	-9.2	-7.3	-12.3	-6.9	11.6	15.0	17.9	15.5	20.3	7.4	-5.3	-20.7
10	-11.7	-6.8	-8.5	-4.7	6.5	11.0	21.5	16.5	19.1	10.4	-13.6	-20.5
11	-19.4	-5.7	-7.3	0.4	6.6	13.7	23.9	17.0	15.1	7.9	-13.8	-22.6
12	-21.5	-2.1	-10.2	2.8	17.1	14.9	18.1	18.0	16.3	5.4	-1.2	-20.8
13	-20.7	-2.9	-5.2	-0.9	19.3	19.1	13.9	20.7	22.1	4.5	2.6	-21.2
14	-19.3	-8.4	-9.9	-2.4	16.7	14.9	13.9	21.0	14.0	5.0	-0.3	-22.0
15	-3.9	-10.9	-15.8	-1.2	14.3	13.5	19.2	23.8	14.4	7.0	0.8	-6.7
16	-10.0	-3.6	-19.4	-4.2	16.1	14.3	17.1	25.3	18.8	5.0	-5.2	-3.9
17	-13.8	-5.6	-15.8	-2.5	15.3	16.6	18.7	22.7	18.8	3.6	-13.5	-12.6
18	-9.8	-18.2	-17.0	-2.1	16.2	19.3	19.7	22.6	10.7	7.0	-13.5	-18.5
19	-18.3	-22.6	-15.9	-3.1	16.6	17.5	16.3	21.5	10.1	5.3	-11.6	-23.3
20	-24.2	-17.6	-12.8	1.4	14.9	15.1	16.5	17.4	10.9	0.5	-20.3	-25.1
21	-23.3	-16.2	-10.0	-2.7	16.0	16.2	16.4	16.4	17.3	2.9	-18.7	-27.6
22	-18.8	-11.1	-10.3	-2.8	16.3	17.0	15.3	19.6	15.5	1.8	-24.6	-26.6
23	-22.5	-7.0	-13.6	0.5	14.4	15.4	19.2	21.9	14.4	1.8	-14.8	-20.6
24	-19.0	-6.3	-10.4	-1.4	13.5	18.0	16.8	24.1	13.3	1.5	-0.6	-6.8
25	-20.6	-6.6	-12.9	5.0	15.2	19.4	14.3	24.0	11.0	4.3	-7.3	-5.4
26	-15.0	-9.3	-12.5	10.7	15.6	19.2	14.0	20.7	9.2	2.8	-10.9	-3.8
27	-8.1	-13.3	-11.4	11.2	16.5	18.6	15.8	20.5	9.2	-3.7	-5.9	-7.6
28	-8.6	-5.2	-6.3	6.3	16.8	19.7	18.2	23.6	10.9	-7.8	-7.6	-21.4
29	-18.5		-3.2	1.5	18.2	18.2	14.9	22.2	15.0	-3.7	-8.2	-25.5
30	-28.9		-1.8	-1.0	16.1	19.9	15.4	23.7	11.5	0.5	-8.8	-27.6
31	-27.4		-4.4		17.1		16.0	17.8		3.1		-28.5

DAILY PRECIPITATION



PRECIPITATION

2013 PRECIPITATION RECORDS			
TYPE	**DATE**	**NEW RECORD**	**OLD RECORD/year**
Greatest Daily Precipitation (mm)	February 26	4.9	3.3/1976
	March 15	4.9	3.0/1996
	June 8	22.4	14.6/1997
	June 14	26.6	18.0/1970
	June 15	10.0	9.0/1995
	July 21	12.0	7.9/1967
Most number of days with any precipitation	December	21	19/1977
Least number of days with any precipitation	September	2	2/1995
Most number of Days with Monthly Precipitation >10 mm	June	7	6/2010
Most number of Days with Monthly Precipitation >15 mm	June	4	4/1970

EXTREME PRECIPITATION EVENTS		
PERIOD	DATE	AMOUNT (mm)
½ hour*	June 19	8.6
Next ½ hour*	August 5	8.2
1 hour*	June 18-19	14.2
Next 1 hour*	August 5	9.6
2 hours*	June 18-19	19.8
Next 2 hours*	August 5	12.4
6 hours*	June 14	21.6
Next 6 hours*	June 18-19	20.8
12 hours*	June 14	24.2
Next 12 hours*	June 8	22.0
24 hours*	June 14	35.2
Next 24 hours*	June 15	26.8
Daily	June 8	22.4
Next Daily	June 13	17.0
Greatest amount over more than one day	June 13-23	101.6
2nd greatest amount over more than one day	June 6-8	24.6
Longest wet spell	June 13-23	11 days (101.6mm)
Next longest wet spell	March 14-23	10 days (16.8mm)
Longest dry spell	August 31-September 24	25 days
Next longest dry spell	January 1-15	15 days

**recorded by the tipping bucket gauge*

RANKING BY DRIEST MONTH BY % OF NORMAL PRECIPITATION		RANKING BY DRIEST MONTH BY PRECIPITATION AMOUNT	
OCT	26.6	OCT	5.1
MAY*	35.5	NOV	11.9
SEP*	39.5	JAN	12.4
AUG*	44.3	MAY*	14.4
JUL*	56.4	SEP*	14.6
APR	65.5	APR	15.0
JAN	80.0	FEB	17.3
NOV	88.8	AUG*	20.6
MAR	156.5	DEC	20.8
DEC	163.8	MAR	21.6
FEB	186.0	JUL*	33.3
JUN*	197.3	JUN*	131.4

**recorded by the tipping bucket gauge*

RANKING BY					
Total Number of Dry Days*		**Maximum Length of Dry Spell***		**Maximum Length of Wet Spell***	
2001	282	1976	48	2003	21
1964	280	1993	40	1968	14
1984	278	2000	40	1969	14
1988	275	1965	37	1997	12
1965	271	1980	36	2013	11
1966	267	1997	36	1977	10
1986	267	2002	35	1980	10
1997	267	1964	31	1989	10
1981	266	1984	30	2004	10
1987	266	2009	30	2008	10
1967	265	2010	29	1983	9
1994	264	1966	28	1986	9
1968	260	1974	28	2010	9
1990	260	2012	28	1965	8
1998	259	1968	27	1972	8
1985	258	2004	25	1974	8
1993	258	2013	25	2005	8
1995	258	1972	23	2009	8
1999	258	1973	23	2011	8
2002	258	1996	23	1973	7
1996	256	1977	22	1976	7
2003	255	1987	22	1982	7
1976	251	1978	21	1992	7
1992	250	1982	21	1993	7
2000	248	2001	21	2000	7
2009	246	1969	20	2002	7
2008	245	1986	20	2012	7
1980	244	1999	20	1964	6
2012	244	2011	20	1966	6
1971	243	1967	19	1970	6
2013	243	1981	19	1975	6
1989	241	1988	19	1978	6
1970	240	2008	19	1979	6
1979	239	1994	18	1981	6
2011	239	1995	18	1988	6
1972	238	2003	18	1991	6
1977	238	1975	17	1994	6
2007	237	1979	17	1996	6
1975	235	1985	17	2006	6
1991	234	1998	17	2007	6
1983	233	2005	17	1971	5
2010	233	1983	16	1985	5
2005	231	1990	16	1987	5
1974	229	1991	16	1990	5
1982	229	1992	16	1995	5
2006	227	1971	15	1998	5
1978	224	2007	15	1999	5
1969	218	1989	14	1967	4
2004	208	1970	13	1984	4
1973	200	2006	13	2001	4

**For this report, a dry day is defined as a day on which precipitation is not recorded; a dry spell is 2+ consecutive days of no precipitation; a wet spell is 2+ consecutive days of precipitation.*

PRECIPITATION RANKINGS

RANKING BY DRIEST YEAR (mm)

ANNUAL (JAN-DEC)		WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2001	165.8	2002	12.1	2009	19.0	1984	70.2	1999	17.2
1987	232.4	2012	13.5	2002	20.3	1964	73.9	1994	21.0
2003	257.7	1984	19.2	2008	29.8	1977	81.9	1976	21.8
1998	263.3	2008	21.6	1998	29.8	2001	91.2	1987	27.4
1981	279.8	1993	22.0	2001	34.0	1985	91.8	2001	28.5
1964	282.7	1998	22.4	2011	41.3	1987	92.6	2012	29.1
1988	285.7	2010	22.5	1980	42.2	1969	105.5	2000	31.2
1992	288.1	2001	23.1	1965	43.2	1992	115.6	2013	31.6
1997	291.4	2003	29.2	2013	51.0	1997	116.4	1972	32.3
1984	293.1	2004	29.3	1981	54.3	1980	120.3	1990	33.9
1999	297.7	1987	30.6	2004	55.4	1981	124.9	1971	34.2
1993	300.0	1999	31.3	1992	55.5	2003	126.2	1988	38.1
1980	305.9	1995	31.3	1988	55.6	1972	133.3	1974	40.0
1990	309.8	2000	31.7	1999	56.5	1998	133.4	2007	45.3
2008	313.8	2006	32.0	1984	57.2	1979	135.9	1975	48.8
2000	315.4	2011	32.3	1996	58.8	1967	139.9	2004	50.0
1972	317.9	1988	35.9	2000	59.2	1978	142.5	1966	50.2
2013	318.4	1982	37.0	1971	61.1	1975	144.5	1965	50.9
2009	319.3	1967	37.9	1966	61.2	1990	144.5	2003	51.2
2002	320.0	2009	38.8	2003	61.8	1988	148.9	1995	52.6
2011	320.6	1991	40.3	2005	62.1	1989	149.9	1979	53.4
1995	327.7	1983	41.1	1993	62.2	1993	151.0	1985	55.2
1985	330.6	2013	41.1	2007	64.7	1996	154.4	1970	56.4
1976	331.8	1977	43.1	1995	65.4	1973	156.1	2009	56.5
1996	340.6	1994	45.1	1970	65.7	1995	164.4	1981	61.4
1994	341.4	2005	45.4	1964	65.8	1994	165.6	1997	61.6
1979	352.0	1964	47.9	1969	68.5	1976	169.4	2008	64.4
1967	354.3	1997	48.0	1976	69.1	2000	183.8	1989	64.5
1978	358.1	1996	51.0	1972	71.6	2006	183.8	1977	65.4
1965	358.8	1981	52.2	1978	72.8	2013	185.3	2011	65.7
1977	370.5	1985	52.3	1973	73.1	2011	186.6	1992	65.9
1966	376.9	1970	52.7	1987	73.6	2008	191.2	1980	66.6
1989	384.8	1968	53.8	1967	78.0	1999	194.2	1998	70.0
1970	388.8	1966	54.7	1986	82.5	1986	196.2	1968	71.3
1975	392.3	1992	55.0	1990	87.2	1974	205.5	2002	72.8
1973	393.3	1990	55.6	1979	87.3	1965	206.6	1993	73.1
2004	404.5	1986	57.2	1997	88.2	2002	206.8	1996	74.4
1986	411.3	1989	57.9	1968	97.6	1982	208.4	1967	76.8
2007	413.9	1971	60.4	1989	101.7	2009	212.8	1964	77.4
1971	414.6	1979	61.3	2006	101.8	1983	215.8	1982	81.5
1969	427.4	1978	63.0	1994	109.4	1970	216.5	1986	87.2
1982	436.2	1973	63.2	1982	110.8	1966	222.0	1973	88.2
1968	443.1	1975	67.3	1975	119.6	1968	225.9	1983	96.2
1974	462.7	1965	69.3	1983	125.2	2007	231.0	1991	105.4
1983	471.6	1976	69.5	1985	134.3	1971	248.8	2005	109.4
2005	486.8	1980	73.0	1991	147.3	1991	251.6	1978	111.4
2012	501.1	2007	74.7	1974	148.0	2004	260.0	1984	137.0
2006	517.5	1974	92.2	1977	164.1	2012	266.0	2010	151.1
1991	546.9	1972	92.2	2012	184.3	2005	269.4	1969	151.8
2010	707.4	1969	98.1	2010	216.1	2010	316.4	2006	203.4

ANNUAL RANKING BY DAYS WITH PRECIPITATION

ANNUAL (JAN-DEC)		WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2001	84	2002	16	1964	14	1984	18	1976	9
1964	86	1984	18	1965	16	2001	23	1974	13
1984	88	1987	19	1966	18	1967	25	1999	13
1988	91	2012	19	1968	19	1985	25	1987	14
1965	94	1995	21	1988	19	2011	25	1997	14
1966	98	1985	22	1992	20	2003	26	1994	15
1986	98	1988	23	1994	20	1969	27	1966	17
1997	98	1994	23	2001	20	1964	28	1964	18
1967	100	2001	23	1967	21	1970	28	1990	18
1994	101	1964	24	1981	21	1979	28	1982	19
1987	102	1993	24	1978	22	1998	28	1988	19
1990	105	1996	24	1980	22	1965	29	2000	19
1968	106	2013	24	1986	22	1971	31	1995	20
1993	106	1968	25	1998	22	1983	31	2013	20
1998	106	1999	25	2002	22	2007	31	1979	21
1985	107	1966	26	1972	23	1988	32	1968	22
1995	107	1967	26	1976	23	1990	32	1972	22
1999	107	1986	26	1984	24	1995	32	1993	22
2002	107	2008	26	1996	24	1968	33	2005	22
1996	110	1965	27	2009	24	1977	33	2012	22
2003	110	1989	27	1985	25	1992	33	1971	23
1981	113	1990	27	2008	25	1996	34	1980	23
1976	115	1998	27	1970	26	1997	34	1986	23
1992	116	2004	29	1971	26	1999	34	2009	23
2000	118	2010	29	1973	26	1966	35	1965	24
2009	119	1992	30	1987	27	1975	35	1981	24
2012	120	1997	30	1990	27	1980	35	1996	24
2008	121	2000	30	1991	27	1987	35	1998	24
1971	122	2007	30	2010	28	1993	35	2001	24
1980	123	1977	31	2013	29	2000	35	2011	24
2013	123	1975	33	1969	30	2006	35	1973	25
1989	124	1991	33	1989	30	2013	35	1975	25
1970	126	2003	33	1995	30	1972	36	2003	25
1979	126	1982	34	2003	30	1989	36	1967	27
1973	127	1973	36	2007	30	2002	36	2008	27
2011	127	1980	36	2011	30	2008	36	1985	28
1972	128	1981	36	1977	31	2009	36	1984	29
2007	128	2006	36	1993	31	1986	37	2002	29
1977	129	2005	37	1999	31	1973	38	1977	30
1975	130	1970	40	1997	32	1974	38	1991	30
1991	131	1971	40	2000	32	1981	38	2010	30
1983	132	1978	40	1982	34	1976	39	1989	31
2010	132	2011	40	1975	35	2005	40	1969	32
2005	135	1976	41	1974	36	1994	41	1970	32
1974	136	1983	41	1983	36	1982	42	1983	32
1982	136	2009	43	2005	36	1991	42	1992	33
1978	139	1972	48	2006	36	2004	42	2004	34
2006	139	1979	48	1979	37	1978	43	1978	36
1969	147	1974	57	2012	39	2012	43	2007	36
2004	158	1969	61	2004	44	2010	45	2006	38

Snow depth January 2013 photo credit: CR Beaulieu

Late April 2103 Geese tracks photo credit: CR Beaulieu

Apple blossom May 3013 photo credit: CR Beaulieu

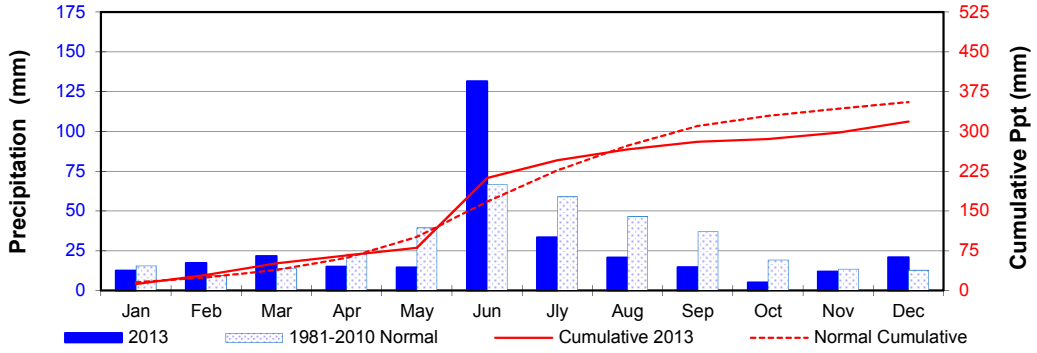
PRECIPITATION

MONTH	MONTHLY PRECIPITATION (mm)				EXTREME VALUES (mm)		
	2013	NORMAL	CUMULATIVE 2013	% OF CUMULATIVE NORMAL	CRS Maximum	CRS Minimum	SASKATOON AREA Maximum
January	12.4	15.5	12.4	80.0	48.6/1969	2.6/2001	66.1/1911[SE]
February	17.3	9.3	29.7	119.8	40.2/1979	2.5/1984	43.7/1924[SE]
March	21.6	13.8	51.3	132.9	57.1/1967	0.8/2010	59.0/1927[SE]
April	15.0	22.9	66.3	107.8	81.1/2010	2.4/1988, 89	86.1/1955[US]
May*	14.4	39.4	80.7	80.0	145.3/1977	0.2/2002	178.0/1977[SWT]
June*	131.4	66.6	212.1	126.6	171.0/2005	13.0/1985	186.8/1942[S]
July*	33.3	59.0	245.4	108.3	125.9/1971	13.0/1984	162.9/1928[SE]
August*	20.6	46.5	266.0	97.4	105.2/2007	7.0/2001	178.9/1954[NRC]
September*	14.6	37.0	280.6	90.5	128.4/2006	0.8/1995	128.4/2006[SRC]
October	5.1	19.2	285.7	86.8	69.8/1969	0.0/2000	69.8/1969[SRC]
November	11.9	13.4	297.6	86.9	48.2/1973	0.4/2009	57.3/1940[SE]
December	20.8	12.7	318.4	89.6	43.0/1977	1.2/1997	59.2/1956[SA]
Total	318.4	355.2			707.4/2010	165.8/2001	707.4/2010[SRC]

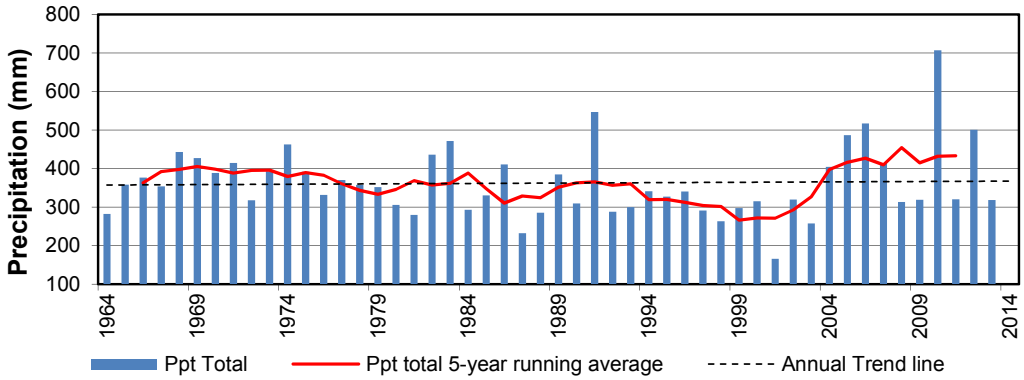
SM	Saskatoon stations circa (NWMP et al)	1889-1901
SE	Saskatoon Eby	1901-42
US	University of Saskatchewan	1915-64
S	Saskatoon	1941-42
SA	S'toon Diefenbaker In't Airport	1942-2008
NRC	National Research Council	1952-66
SRC	Sask. Research Council	1963-
SWT	S'toon Water Treatment Plant	1974-2006
SC	Saskatoon Central Ave	1974-89
S2	Saskatoon 2	1977-90
K	Saskatoon Kernen Farm	1993-2004
KCS	Saskatoon Kernen Farm CS	1996-2008
RCS	Enivonment Canada	2008-

*Tipping Bucket gauge values

Monthly



Annual

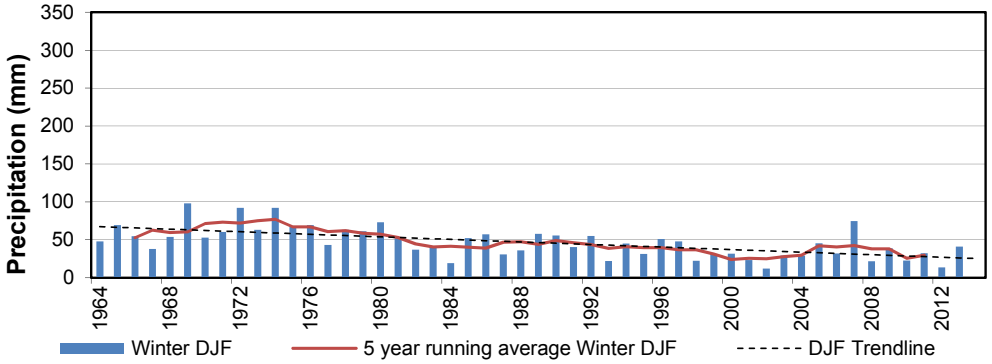


Late April 2103 lingering snow coverage
photo credit: CR Beaulieu

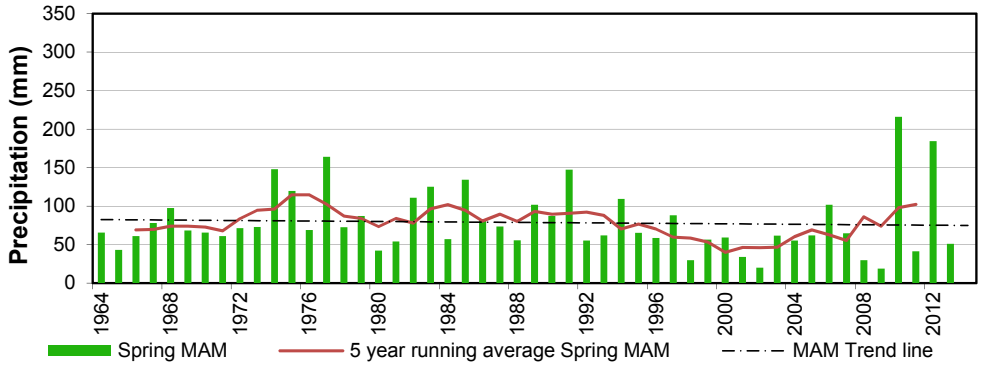
SRC Publication No. 10440-1E14

SEASONAL PRECIPITATION for 1964 to 2013

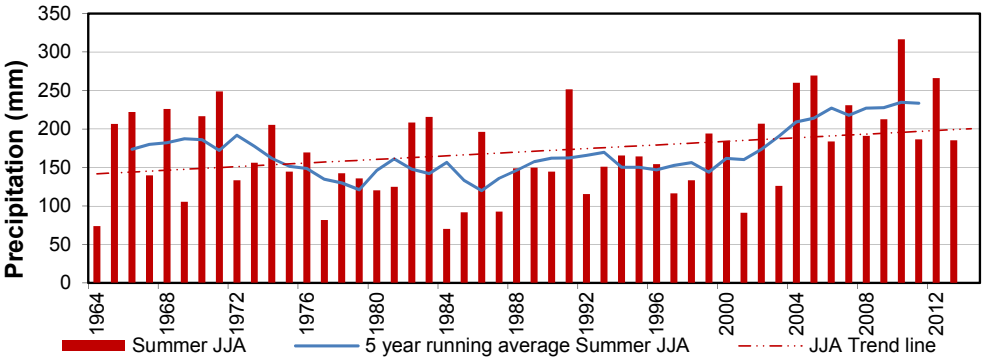
Winter



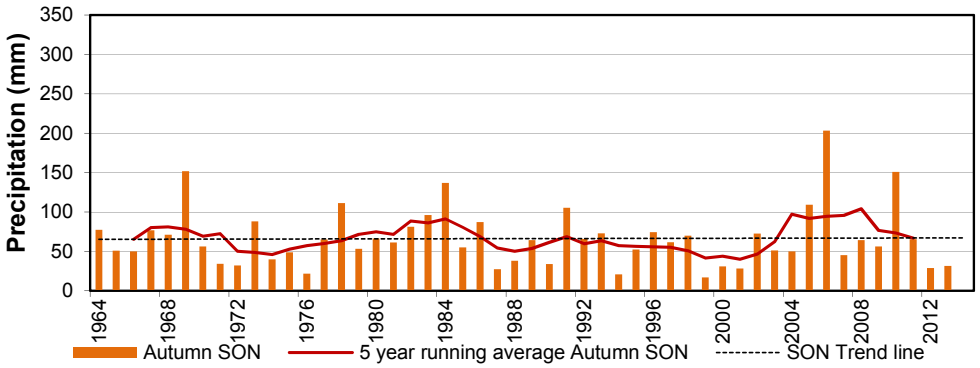
Spring



Summer



Autumn

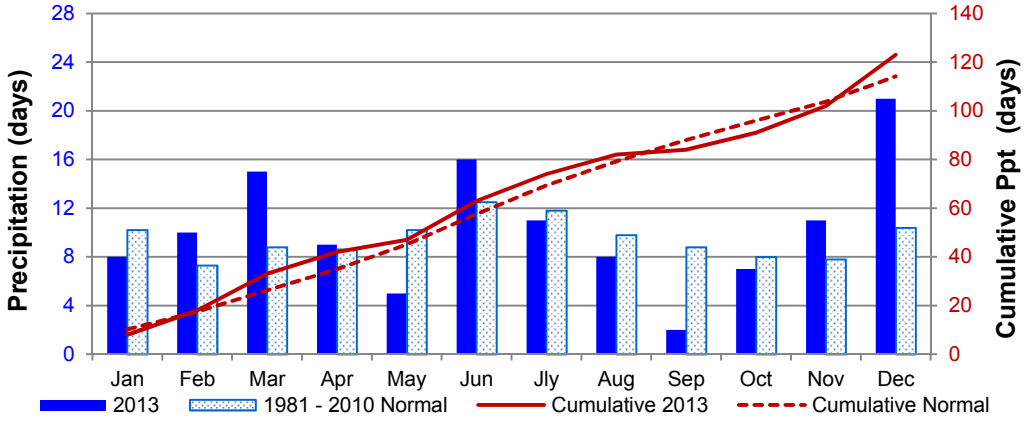


PRECIPITATION

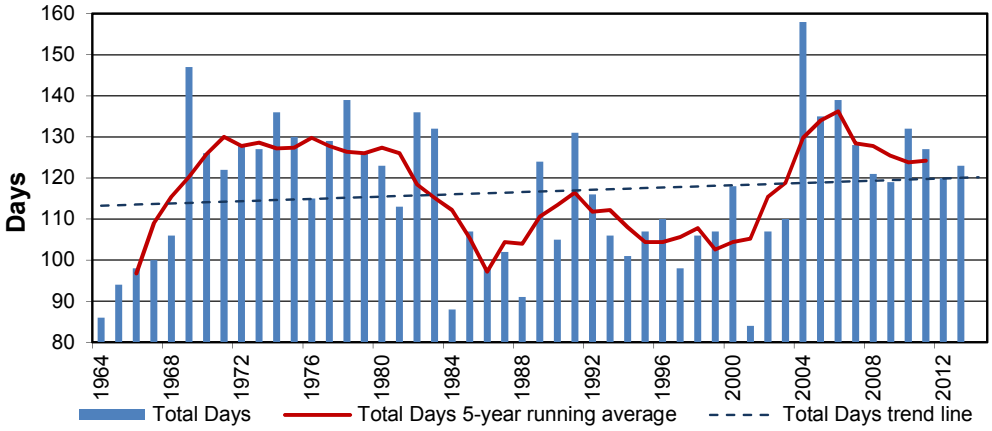
MONTH	NUMBER OF DAYS WITH MEASURABLE PRECIPITATION					EXTREME VALUES	
	2013	CUMULATIVE 2013	Normal	CUMULATIVE NORMAL	% OF CUMULATIVE NORMAL	CRS Maximum	CRS Minimum
January	8	8	10.2	10.2	78.4	25/1974	3/2001
February	10	18	7.3	17.5	102.9	20/1696	2/1984
March	15	33	8.8	26.3	125.5	19/2004	2/1990,92,94 2007
April	9	42	8.6	34.9	120.3	17/2003	2/1964
May*	5	47	10.2	45.1	104.2	19/1989	1/2002
June*	16	63	12.5	57.6	109.4	21/1991	7/1964&1968
July*	11	74	11.8	69.4	106.6	19/1986	4/1984
August*	8	82	9.8	79.2	103.5	18/2002	2/2001
September*	2	84	8.8	88.0	95.5	19/1977	2/1995
October	7	91	8.0	96.0	94.8	16/2004	0/2000
November	11	102	7.8	103.8	98.3	18/1970	1/1986,74,76, 90
December	21	123	10.4	114.3	107.6	19/1977	2/1997
Total	123		114.3			158/2004	84/2001

*Tipping Bucket Gauge Values

Monthly Days



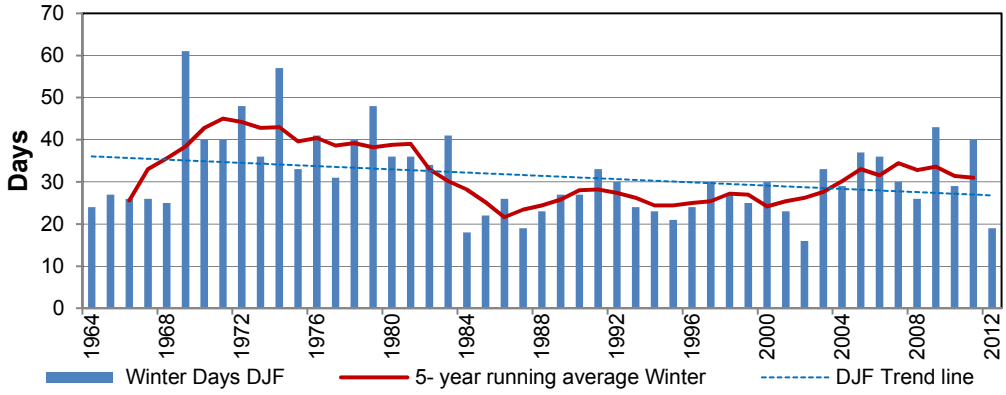
Annual Days



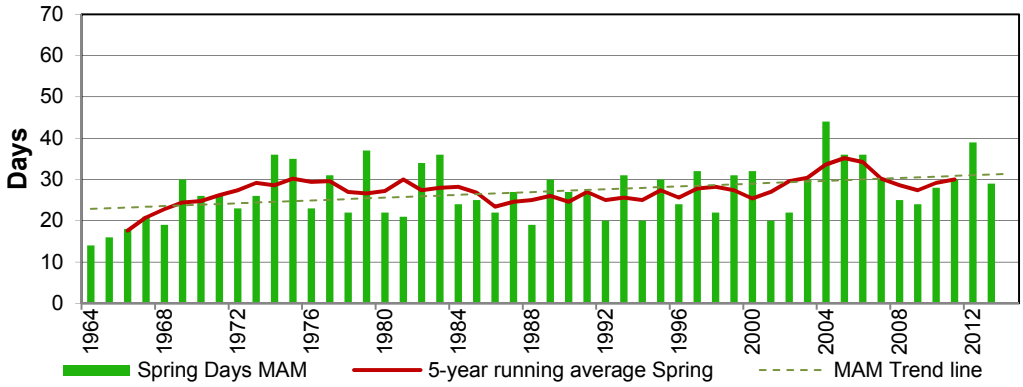
Hail May 24, 2013
photo credit: D. Desmarais 2013

SEASONAL PRECIPITATION DAYS for 1964 to 2013

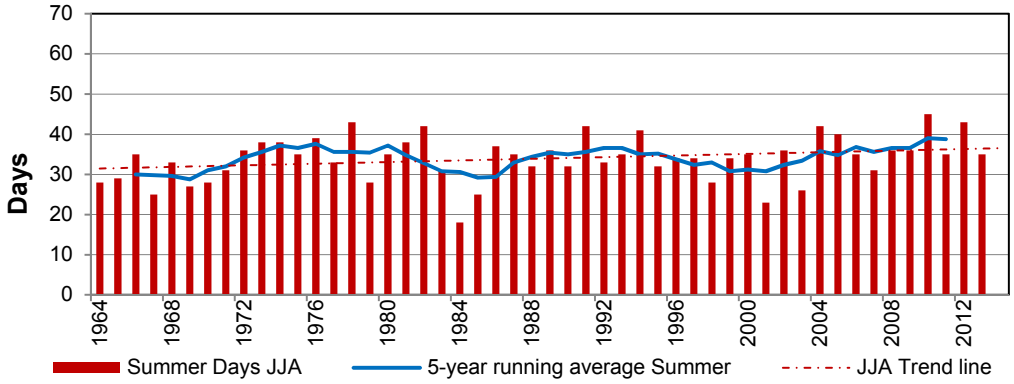
Winter Days



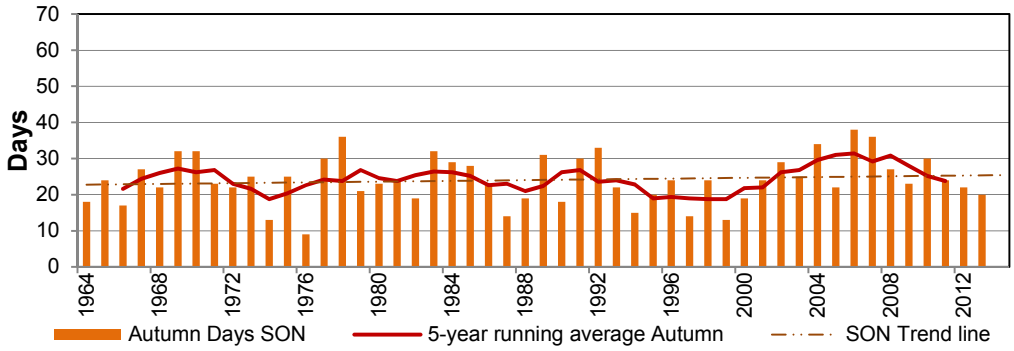
Spring Days



Summer Days



Autumn Days



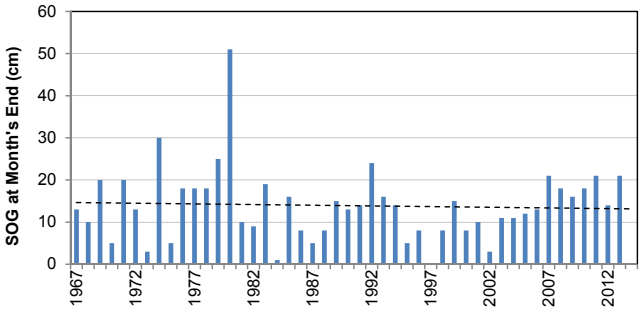
PRECIPITATION GRID mm

Precipitation Daily

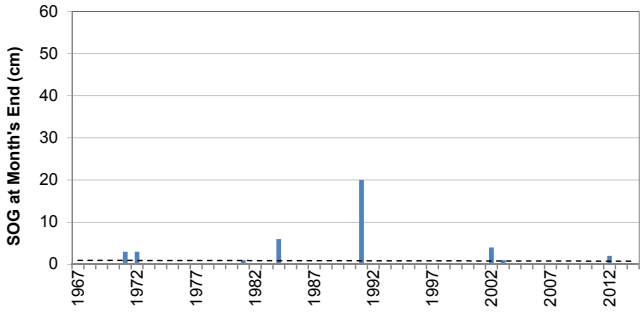
2013	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.2	0.0	2.6	0.0	0.8
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
3	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.4
4	0.0	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.3
5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	14.6	0.0	0.0	0.0	0.4
6	0.0	0.0	0.0	1.3	0.0	2.0	9.8	0.4	0.0	0.0	0.2	0.0
7	0.0	0.2	2.7	3.3	0.0	0.2	0.0	3.0	0.0	0.0	1.2	0.4
8	0.0	0.0	0.4	0.0	0.0	22.4	0.0	0.0	0.0	0.0	2.5	0.0
9	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.4	1.2
10	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
13	0.0	4.3	0.0	1.5	0.0	17.0	6.4	0.0	0.0	0.0	0.0	1.6
14	0.0	0.7	2.2	0.0	7.2	26.6	0.0	0.0	0.0	0.0	0.3	1.5
15	0.0	0.0	4.9	0.2	0.0	10.0	0.0	0.0	0.0	0.2	0.0	2.7
16	2.4	0.0	0.2	0.0	0.6	1.2	0.0	0.0	0.0	0.0	0.4	0.0
17	1.6	1.5	3.4	0.0	0.0	0.2	0.0	0.0	0.0	0.0	1.9	0.0
18	0.0	0.2	0.7	0.0	0.0	5.8	1.6	0.2	0.0	0.0	0.0	0.4
19	0.3	0.0	0.3	0.0	0.0	15.6	0.4	0.0	0.0	0.2	3.1	0.0
20	0.0	0.0	1.9	0.2	0.0	11.4	0.0	0.2	0.0	0.0	0.4	0.0
21	0.0	0.0	2.7	2.0	0.0	1.2	12.0	0.0	0.0	0.5	0.0	0.4
22	0.0	0.0	0.2	0.0	0.0	12.4	0.2	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.3	0.0	0.0	0.2	0.8	0.0	0.0	0.0	0.0	1.5
24	1.5	0.0	0.0	0.4	5.4	0.0	0.8	0.8	0.0	0.0	0.0	0.8
25	0.0	2.3	0.0	0.0	0.8	2.8	0.7	0.0	5.6	0.0	0.0	0.0
26	0.0	4.9	0.0	0.0	0.0	2.4	0.0	0.0	9.0	0.0	0.0	0.4
27	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	2.4
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8
29	1.2		0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
30	0.3		0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.3
31	2.8		0.3		0.0		0.0	0.2		0.2		0.0

Winterizing the precipitation weighing gauge
Shaw Dunn, SRC technologist, Autumn 2013
photo credit: CR Beaulieu

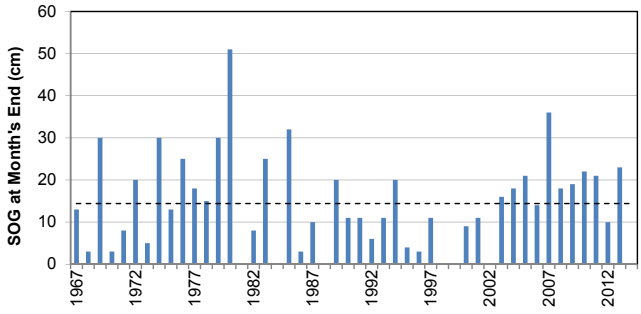
SNOW-ON-THE-GROUND (SOG)



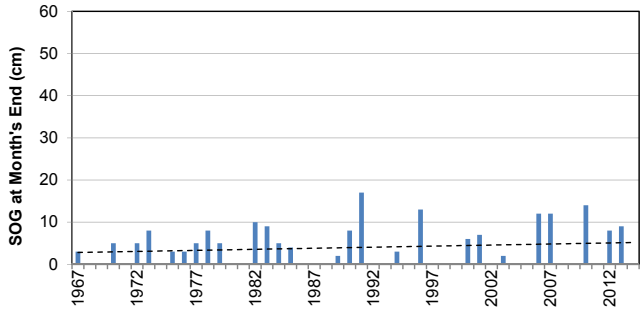
January



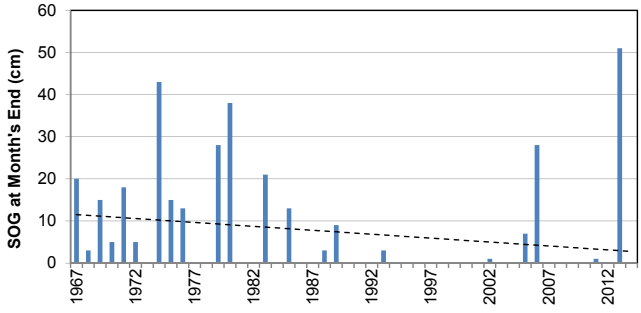
October



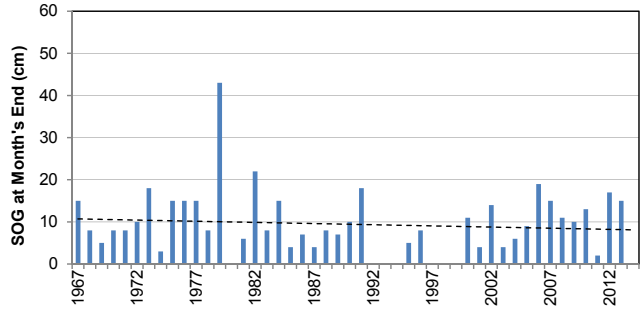
February



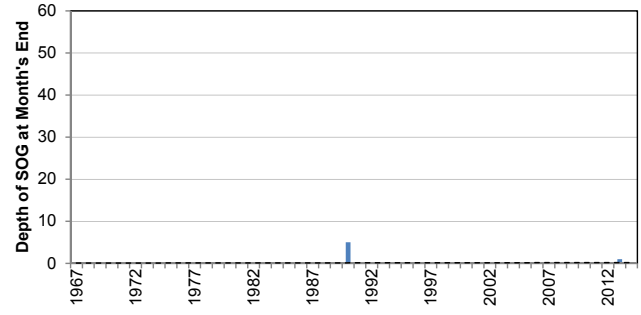
November



March



December



April

Late April snow stake
photo credit: CR Beaulieu

RADIATION

Sunrise/Sunset Tables for Saskatoon, 2013 & 2014[1]

2013	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	17:06	8:46	17:55	7:52	18:47	6:40	19:41	5:36	20:33	4:52	21:18	4:50	21:30	5:28	20:56	6:19	19:53	7:08	18:43	8:02	17:37	8:53	16:58
2	9:15	17:07	8:45	17:57	7:49	18:49	6:38	19:43	5:34	20:34	4:51	21:19	4:51	21:30	5:30	20:55	6:20	19:51	7:10	18:41	8:04	17:35	8:55	16:57
3	9:15	17:08	8:43	17:59	7:47	18:50	6:36	19:45	5:32	20:36	4:50	21:20	4:52	21:29	5:31	20:53	6:22	19:49	7:11	18:39	8:06	17:34	8:56	16:57
4	9:15	17:09	8:41	18:00	7:45	18:52	6:33	19:46	5:30	20:38	4:49	21:21	4:53	21:29	5:33	20:51	6:23	19:46	7:13	18:36	8:08	17:32	8:57	16:56
5	9:14	17:10	8:39	18:02	7:43	18:54	6:31	19:48	5:28	20:39	4:49	21:22	4:54	21:28	5:35	20:49	6:25	19:44	7:15	18:34	8:10	17:30	8:59	16:56
6	9:14	17:12	8:38	18:04	7:40	18:56	6:29	19:50	5:26	20:41	4:48	21:23	4:55	21:28	5:36	20:47	6:27	19:42	7:16	18:32	8:11	17:28	9:00	16:55
7	9:13	17:13	8:36	18:06	7:38	18:58	6:27	19:52	5:25	20:43	4:48	21:24	4:56	21:27	5:38	20:46	6:28	19:39	7:18	18:29	8:13	17:27	9:01	16:55
8	9:13	17:14	8:34	18:08	7:36	18:59	6:24	19:53	5:23	20:44	4:47	21:25	4:57	21:26	5:39	20:44	6:30	19:37	7:20	18:27	8:15	17:25	9:02	16:55
9	9:12	17:16	8:32	18:10	7:34	19:01	6:22	19:55	5:21	20:46	4:47	21:25	4:58	21:26	5:41	20:42	6:32	19:35	7:22	18:25	8:17	17:23	9:03	16:55
10	9:12	17:17	8:31	18:12	7:31	19:03	6:20	19:57	5:20	20:47	4:46	21:26	4:59	21:25	5:43	20:40	6:33	19:32	7:23	18:23	8:19	17:22	9:05	16:54
11	9:11	17:19	8:29	18:14	7:29	19:05	6:18	19:58	5:18	20:49	4:46	21:27	5:00	21:24	5:44	20:38	6:35	19:30	7:25	18:20	8:20	17:20	9:06	16:54
12	9:10	17:20	8:27	18:15	7:27	19:07	6:15	20:00	5:16	20:51	4:46	21:28	5:01	21:23	5:46	20:36	6:37	19:28	7:27	18:18	8:22	17:19	9:07	16:54
13	9:09	17:22	8:25	18:17	7:24	19:08	6:13	20:02	5:15	20:52	4:46	21:28	5:02	21:22	5:47	20:34	6:38	19:25	7:29	18:16	8:24	17:17	9:08	16:54
14	9:09	17:23	8:23	18:19	7:22	19:10	6:11	20:04	5:13	20:54	4:45	21:29	5:03	21:21	5:49	20:32	6:40	19:23	7:30	18:14	8:26	17:16	9:08	16:54
15	9:08	17:25	8:21	18:21	7:20	19:12	6:09	20:05	5:12	20:55	4:45	21:29	5:04	21:20	5:51	20:30	6:41	19:21	7:32	18:12	8:28	17:14	9:09	16:54
16	9:07	17:26	8:19	18:23	7:17	19:14	6:07	20:07	5:10	20:57	4:45	21:30	5:06	21:19	5:52	20:28	6:43	19:18	7:34	18:09	8:29	17:13	9:10	16:55
17	9:06	17:28	8:17	18:25	7:15	19:15	6:04	20:09	5:09	20:58	4:45	21:30	5:07	21:18	5:54	20:26	6:45	19:16	7:36	18:07	8:31	17:12	9:11	16:55
18	9:05	17:30	8:15	18:27	7:13	19:17	6:02	20:10	5:07	21:00	4:45	21:30	5:08	21:17	5:56	20:24	6:46	19:14	7:37	18:05	8:33	17:10	9:11	16:55
19	9:04	17:31	8:13	18:29	7:11	19:19	6:00	20:12	5:06	21:01	4:45	21:31	5:09	21:15	5:57	20:22	6:48	19:11	7:39	18:03	8:34	17:09	9:12	16:56
20	9:03	17:33	8:11	18:30	7:08	19:21	5:58	20:14	5:04	21:03	4:46	21:31	5:11	21:14	5:59	20:20	6:50	19:09	7:41	18:01	8:36	17:08	9:13	16:56
21	9:02	17:35	8:09	18:32	7:06	19:22	5:56	20:16	5:03	21:04	4:46	21:31	5:12	21:13	6:01	20:17	6:51	19:07	7:43	17:59	8:38	17:07	9:13	16:57
22	9:00	17:37	8:07	18:34	7:04	19:24	5:54	20:17	5:02	21:06	4:46	21:31	5:14	21:12	6:02	20:15	6:53	19:04	7:44	17:57	8:39	17:06	9:14	16:57
23	8:59	17:38	8:05	18:36	7:01	19:26	5:52	20:19	5:01	21:07	4:46	21:31	5:15	21:10	6:04	20:13	6:55	19:02	7:46	17:55	8:41	17:05	9:14	16:58
24	8:58	17:40	8:02	18:38	6:59	19:27	5:50	20:21	4:59	21:08	4:47	21:31	5:16	21:09	6:05	20:11	6:56	19:00	7:48	17:53	8:43	17:04	9:14	16:58
25	8:56	17:42	8:00	18:40	6:57	19:29	5:48	20:22	4:58	21:10	4:47	21:31	5:18	21:07	6:07	20:09	6:58	18:57	7:50	17:51	8:44	17:03	9:15	16:59
26	8:55	17:44	7:58	18:41	6:54	19:31	5:46	20:24	4:57	21:11	4:47	21:31	5:19	21:06	6:09	20:07	7:00	18:55	7:52	17:49	8:46	17:02	9:15	17:00
27	8:54	17:46	7:56	18:43	6:52	19:33	5:44	20:26	4:56	21:12	4:48	21:31	5:21	21:04	6:10	20:04	7:01	18:52	7:53	17:47	8:47	17:01	9:15	17:01
28	8:52	17:47	7:54	18:45	6:50	19:34	5:42	20:28	4:55	21:13	4:49	21:31	5:22	21:03	6:12	20:02	7:03	18:50	7:55	17:45	8:49	17:00	9:15	17:01
29	8:51	17:49			6:47	19:36	5:40	20:29	4:54	21:15	4:49	21:31	5:24	21:01	6:14	20:00	7:05	18:48	7:57	17:43	8:50	16:59	9:15	17:02
30	8:49	17:51			6:45	19:38	5:38	20:31	4:53	21:16	4:50	21:30	5:25	21:00	6:15	19:58	7:06	18:46	7:59	17:41	8:52	16:59	9:15	17:03
31	8:48	17:53			6:43	19:40			4:52	21:17			5:27	20:58	6:17	19:55			8:01	17:39			9:15	17:04

2014	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	7:08	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	19:43	5:34	20:34	4:51	21:19	4:51	21:30	5:30	20:55	6:20	19:51	7:09	18:41	8:04	17:36	8:54	16:57
3	9:15	17:08	8:43	17:58	7:48	18:50	6:36	19:44	5:32	20:36	4:50	21:20	4:52	21:29	5:31	20:53	6:21	19:49	7:11	18:39	8:06	17:34	8:56	16:57
4	9:15	17:09	8:42	18:00	7:45	18:52	6:34	19:46	5:31	20:37	4:50	21:21	4:53	21:29	5:33	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	17:30	8:58	16:56
6	9:14	17:11	8:38	18:04	7:41	18:55	6:29	19:49	5:27	20:41	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	16:55
7	9:13	17:13	8:36	18:06	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	19:40	7:18	18:30	8:13	17:27	9:01	16:55
8	9:13	17:14	8:35	18:07	7:36	18:59	6:25	19:53	5:23	20:44	4:47	21:24	4:56	21:26	5:39	20:44	6:30	19:38	7:19	18:28	8:15	17:25	9:02	16:55
9	9:12	17:15	8:33	18:09	7:34	19:01	6:23	19:55	5:22	20:45	4:47	21:25	4:57	21:26	5:41	20:42	6:31	19:35	7:21	18:25	8:16	17:24	9:03	16:55
10	9:12	17:17	8:31	18:11	7:32	19:03	6:20	19:56	5:20	20:47	4:46	21:26	4:58	21:25	5:42	20:40	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	20:49	4:46	21:27	4:59	21:24	5:44	20:38	6:35	19:31	7:25	18:21	8:20	17:21	9:05	16:54
12	9:10	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	8:25	18:17	7:25	19:08	6:14	20:01	5:15	20:52	4:46	21:28	5:02	21:22	5:47	20:35	6:38	19:26	7:28	18:17	8:24	17:18	9:07	16:54
14	9:09	17:23	8:23	18:19	7:23	19:10	6:11	20:03	5:13	20:53	4:45	21:29	5:03	21:21	5:49	20:33	6:39	19:24	7:30	18:14	8:25	17:16	9:08	16:54
15	9:08	17:24	8:21	18:21	7:20	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	7:32	18:12	8:27	17:15	9:09	16:54
16	9:07	17:26	8:19	18:22	7:18	19:13	6:07	20:07	5:10	20:56	4:45	21:30	5:05	21:19	5:52	20:28	6:43	19:19	7:33	18:10	8:29	17:13	9:10	16:55
17	9:06	17:28	8:17	18:24	7:16	19:15	6:05	20:08	5:09	20:58	4:45	21:30	5:07	21:18	5:54	20:26	6:44	19:17	7:35	18:08	8:31	17:12	9:11	16:55
18	9:05	17:29	8:15	18:26	7:13	19:17	6:03	20:10	5:08	20:59	4:45	21:30	5:08	21:17	5:55	20:24	6:46	19:14	7:37	18:06	8:32	17:11	9:11	16:55
19	9:04	17:31	8:13	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	6:48	19:12	7:39	18:04	8:34	17:09	9:12	16:55
20	9:03	17:33	8:11	18:30	7:09	19:20	5:58	20:13	5:05	21:02	4:45	21:31	5:10	21:15	5:58	20:20	6:49	19:09	7:40	18:01	8:36	17:08	9:13	16:56
21	9:02	17:34	8:09	18:32	7:06	19:22	5:56	20:15	5:03	21:04	4:46	21:31	5:12	21:13	6:00	20:18	6:51	19:07	7:42	17:59	8:37	17:07	9:13	16:56
22	9:01	17:36	8:07	18:34	7:04	19:24	5:54	20:17	5:02	21:05	4:46	21:31	5:13	21:12	6:02	20:16	6:53	19:05	7:44	17:57	8:39	17:06	9:14	16:57
23	8:59	17:38	8:05	18:35	7:02	19:25	5:52	20:19	5:01	21:07	4:46	21:31	5:15	21:11	6:03	20:14	6:54	19:02	7:46	17:55	8:41	17:05	9:14	16:57
24	8:58	17:40	8:03	18:37	6:59	19:27	5:50	20:20	5:00	21:08	4:47	21:31	5:16	21:09	6:05	20:12	6:56	19:00	7:48	17:53	8:42	17:04	9:14	16:58
25	8:57	17:42	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	20:09	6:58	18:58	7:49	17:51	8:44	17:03	9:15	16:59
26	8:55	17:43	7:59	18:41	6:55	19:31	5:46	20:24	4:57	21:11	4:47	21:31	5:19	21:06	6:08	20:07	6:59	18:55	7:51	17:49	8:46	17:02	9:15	17:00
27	8:54	17:45	7:56	18:43	6:52	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	6:12	20:03	7:03	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	20:00	7:04	18:48	7:57	17:43	8:50	16:59	9:15	17:02
30	8:50	17:51			6:46	19:37	5:38	20:31	4:53	21:15	4:50	21:31	5:25	21:00	6:15	19:58	7:06	18:46	7:58	17:41	8:52	16:59	9:15	17:03
31	8:48	17:52			6:43	19:39			4:53	21:17			5:26	20:58	6:17	19:56			8:00	17:39			9:15	17:04

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

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

Kipp and Zonen Bright Sunshine recorder
photo credit: V. Wittrock 2013

Diffuse Radiation Instrument
photo credit:SRC October 2013

RADIATION

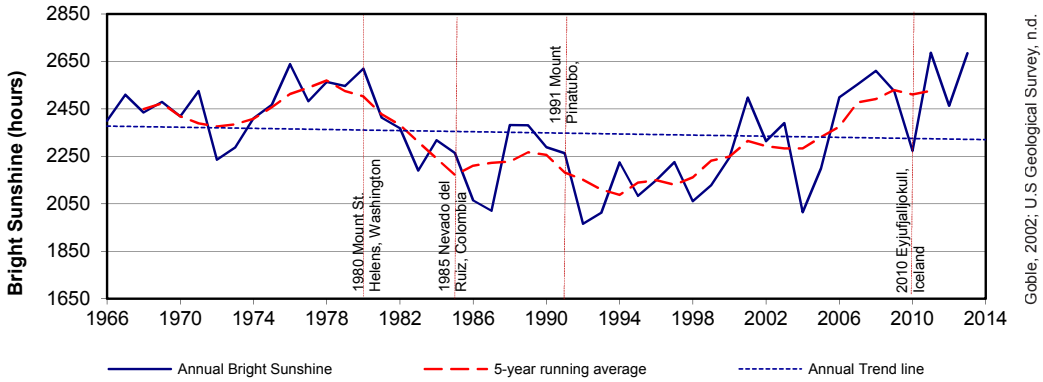
MONTH	BRIGHT SUNSHINE (HOURS)					BRIGHT SUNSHINE DAYS				
	2013	NORMAL	% OF NORMAL	POSSIBLE HOURS	% OF POSSIBLE	2013	NORMAL	WITH MORE THAN 1 HOUR	WHEN HOURS EXCEEDS 100% OF NORMAL	WHEN HOURS EXCEEDS 90% OF POSSIBLE
JAN	97.5	101.0	96.5	259.0	37.6	22	23.4	20	16	1
FEB	122.8	132.6	92.6	278.5	43.9	22	23.9	19	14	2
MAR	248.7	182.0	136.6	368.9	67.2	30	27.4	28	23	10
APR	256.0	227.2	112.7	418.0	61.1	28	27.6	27	21	4
MAY	362.8	256.9	136.8	487.3	72.0	31	29.3	30	26	8
JUNE	250.5	258.2	97.0	500.1	50.1	30	28.0	26	15	4
JULY	345.2	298.8	115.5	502.0	68.8	31	30.3	30	20	7
AUG	345.3	271.3	127.3	453.0	76.4	31	29.9	30	26	7
SEP	276.7	197.4	140.2	379.5	73.1	28	27.3	28	24	12
OCT	187.5	156.1	120.1	329.7	57.1	29	26.7	26	20	8
NOV	98.5	97.0	101.5	264.4	37.4	20	22.5	19	13	1
DEC	104.1	85.7	121.5	242.4	43.0	22	22.6	19	17	6
TOTAL	2684.2	2264.0	118.6	4482.7	59.9	323	318.7	301	219	69

Global and Diffuse Radiation (MJ/m^2)

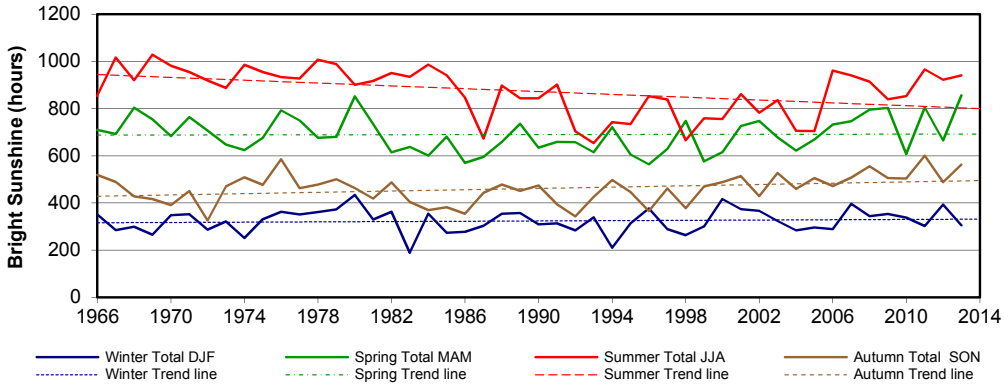
DATE	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse
1	1.8	1.6	4.3	3.7	8.5	6.3	16.1	7.2	23	5.1	22.2	10.4	25.4	3.4	21.0	4.4	19.1	1.4	4.7	4.0	6.9	1.1	1.3	1.2
2	3.3	1.7	5.5	2.8	11.4	3.2	14.3	7.4	20.2	8.2	21.9	9.3	26.2	3.7	21.5	4.5	17.9	2.5	3.9	3.3	5.4	1.9	1.9	1.7
3	3.7	1.1	3.8	3.3	6.7	5.2	18.1	4.0	13.0	8.8	27.8	5.2	23.6	6.7	23.2	3.4	17.2	3.7	8.3	4.3	0.7	0.6	3.4	2.3
4	2.4	1.9	5.7	3.1	13.6	3.3	20	4.1	24.8	2.5	28.3	3.3	26.8	4.8	19.7	5.4	16.7	3.0	11.2	3.6	4.0	3.3	3.7	2.0
5	4.6	1.5	6.5	2.0	12.1	4.7	9.3	7.7	24.3	3.4	27.3	3.6	19.1	8.4	12.3	5.5	17.1	2.2	8.8	4.7	5.4	2.6	5.7	1.3
6	3.6	1.5	4.1	3.6	14.1	3.3	9.4	7.9	24.9	2.4	22.8	5.5	3.8	3.1	16.6	6.1	15.3	6.0	11.5	1.7	5.8	2.5	3.1	2.1
7	3.5	1.0	4.3	3.7	6.4	5.5	16.9	9.1	23.0	5.8	14.2	8.9	25.2	5.1	6.4	5.0	7.4	5.8	9.2	4.6	7.3	1.4	6.0	1.5
8	2.4	1.9	8.3	2.8	13.9	4.1	21.2	3.7	25.1	4.8	4.2	3.4	22.5	7.2	18.5	5.5	16.4	2.9	11.1	1.6	2.4	2.1	4.6	1.2
9	2.3	2.0	4.7	4.0	14.4	3.0	21.3	2.7	25.1	4.0	24.8	6.2	23.9	6.9	18.9	5.1	9.5	5.9	11.3	1.3	2.9	2.2	4.4	1.2
10	2.0	1.8	3.8	3.4	11.9	7.8	18.9	9.1	22.3	5.9	13.0	9.0	26.9	3.0	20.5	4.1	15.5	3.1	9.7	1.6	6.8	1.1	3.9	1.1
11	3.2	2.1	7.7	2.5	9.7	5.6	11.3	9.2	25.4	3.3	16.2	9.4	24.6	4.7	20.5	4.2	17.2	1.6	10.5	1.7	7.4	1.7	3.4	2.0
12	6.0	1.3	7.7	1.9	14.8	3.4	10.1	8.2	20.3	8.8	27.2	4.3	26.5	4.1	19.2	6.4	16.9	1.4	10.2	1.7	6.0	1.7	2.1	1.9
13	4.3	2.3	2.7	2.2	12.5	4.5	10.3	8.3	22.2	4.5	6.6	5.0	7.3	5.1	19.2	6.4	16.6	1.5	6.8	4.7	4.4	2.7	2.0	1.8
14	3.4	2.4	6.7	3.7	8.2	6.9	20.7	6.7	22.6	5.6	6.3	3.8	26.4	3.2	20.8	4.2	16.7	1.5	9.9	1.5	2.1	1.8	1.7	1.5
15	2.2	1.9	5.8	4.5	10.3	7.9	19.5	10.2	25.6	3.5	7.1	5.6	22.6	6.1	20.6	3.7	16.3	1.5	9.8	1.5	3.0	2.6	2.4	1.8
16	3.0	2.7	8.6	3.9	15.3	5.6	20.0	10.1	11.4	8.0	8.4	6.6	26.7	3.3	19.6	4.7	15.3	2.4	6.0	4.0	2.5	2.2	3.3	2.0
17	1.8	1.6	3.5	3.0	10.1	8.5	22.5	3.4	21.0	6.3	16.5	9.0	24.9	4.0	20.5	2.9	15.7	1.8	5.7	4.0	2.7	2.4	2.1	1.7
18	2.7	2.4	9.2	3.0	14.0	7.2	13.1	9.6	22.7	6.3	21.4	6.5	18	5.6	18.5	5.3	7.1	5.5	6.5	4.2	3.0	2.3	3.1	1.3
19	4.4	2.3	8.3	5.0	16.8	4.6	22.6	5.8	22.8	7.0	9.0	7.2	16.3	8.5	21.1	2.6	11.9	3.1	2.9	2.5	2.5	2.2	4.9	1.8
20	5.3	1.1	8.6	4.9	14.0	8.4	6.5	5.4	21.2	10.8	5.9	4.4	18.1	10.2	20.0	5.0	15.1	1.5	4.7	2.5	4.2	1.4	4.8	2.2
21	3.9	3.2	8.3	5.9	14.2	10	21.9	5.6	22.6	9.9	15.1	6.8	9.8	6.6	19.5	3.8	14.3	2.3	3.1	2.7	2.5	2.2	4.1	2.0
22	3.9	2.2	9.9	2.1	8.8	7.5	23.2	3.9	22.6	8.7	16.4	5.1	17.2	6.5	20.9	2.1	7.2	4.3	2.8	2.4	5.4	2.1	6.1	1.6
23	3.2	2.8	8.8	4.1	17	5.4	22.1	6.8	24.4	5.6	15.6	8.6	22.6	5.5	16.3	6.6	13.7	2.0	8.5	1.6	3.3	2.3	1.9	1.5
24	4.6	2.3	10.9	2.0	16.1	7.2	22.9	6.3	3.7	2.9	26.5	5.1	17.2	7.4	19.0	3.3	13.5	1.8	8.8	1.7	4.1	0.9	1.6	1.4
25	5.0	2.7	7.6	5.3	17.8	9.9	20.1	6.3	14.2	9.0	9.9	6.6	22.3	5.1	18.6	4.3	2.3	1.9	7.6	1.7	3.0	1.8	2.8	1.9
26	6.4	1.7	9.6	4.5	17.8	5.4	18.8	9.5	17.7	7.3	21.3	5.9	23.8	4.3	11.3	5.1	1.3	1.1	4.6	3.0	3.7	2.4	3.5	1.9
27	2.1	1.9	6.4	5.3	15.6	4.3	21.2	4.7	21.8	9.1	27.9	2.8	24.6	4.8	20.0	1.7	11.9	2.7	5.8	3.6	1.2	1.1	1.5	1.3
28	2.6	2.3	6.4	5.6	19.3	3.2	23.6	3.6	23.1	5.3	27.5	3.2	22.6	5.3	17.1	4.7	13.0	1.4	5.4	2.5	1.9	1.7	2.0	1.8
29	5.3	2.1			18	3.7	5.8	3.8	25.9	5.4	25.7	5.7	13.8	7.7	17.8	3.7	12.0	2.8	7.2	1.6	2.1	1.8	2.1	1.8
30	4.6	3.7			18.5	3.3	20.3	8.3	24.6	7.9	18.6	8.7	19.9	7.1	18.6	2.8	9.0	4.1	6.5	2.6	6.0	1.3	4.3	1.3
31	7.1	2.0			18.3	3.0			21.4	9.2			19.9	5.7	8.0	5.5			4.2	2.5			2.2	1.9
TOTAL	106.8	71.4	204.5	100.2	383.5	169.9	570.2	196	647	220.2	640	226.4	698.6	187.8	596.9	151.8	437	106.8	227.1	83.8	118.3	69.7	73.2	44.1
1971-2000 NORMAL	129.9	71.4	210.1	105.3	362.4	173.9	492.2	178.5	586.3	222.2	638.7	228.1	633.5	216.5	529	185.6	351.8	127.6	239.1	92.6	123.7	73.6	95.2	54.3

RADIATION

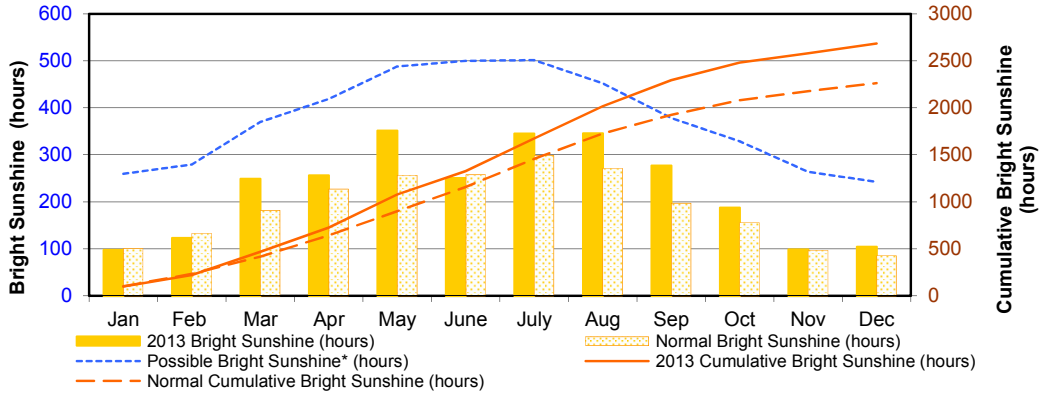
Annual Bright Sunshine Hours



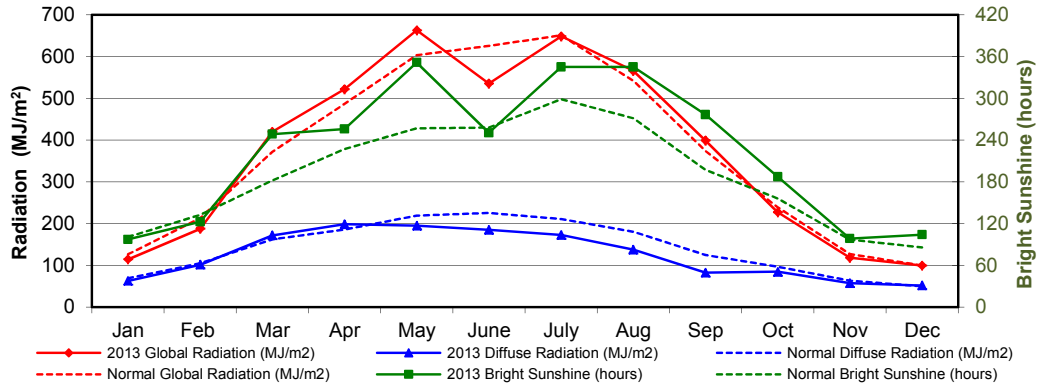
Seasonal Bright Sunshine Hours



Monthly Bright Sunshine Hours

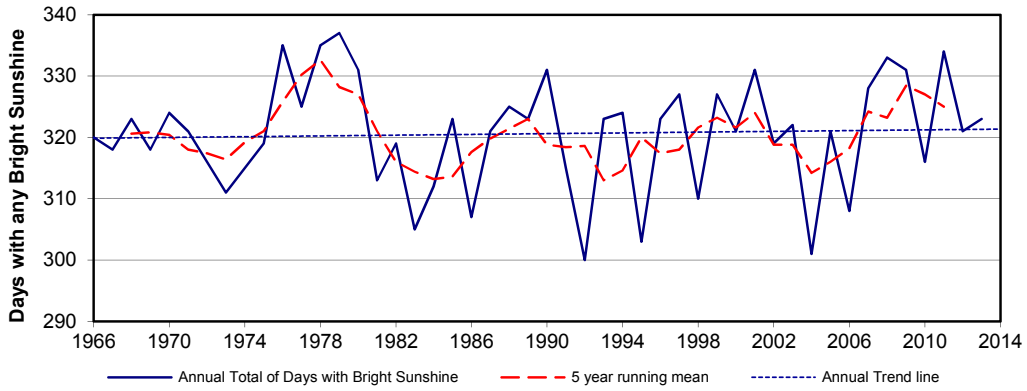


Monthly Comparison Bright Sunshine Hours, Global & Diffuse Radiation

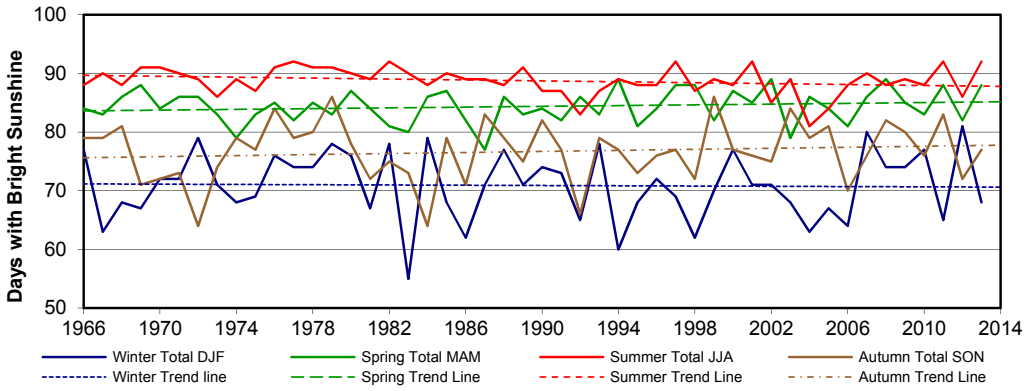


RADIATION

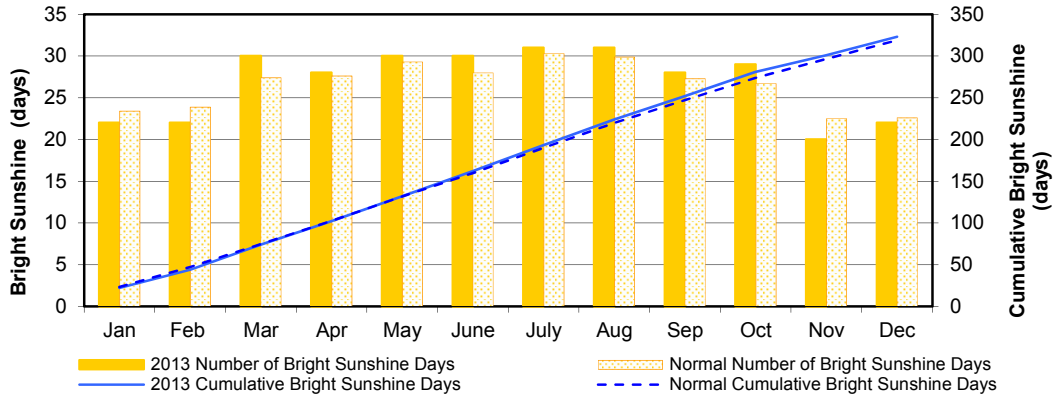
Annual Bright Sunshine Days

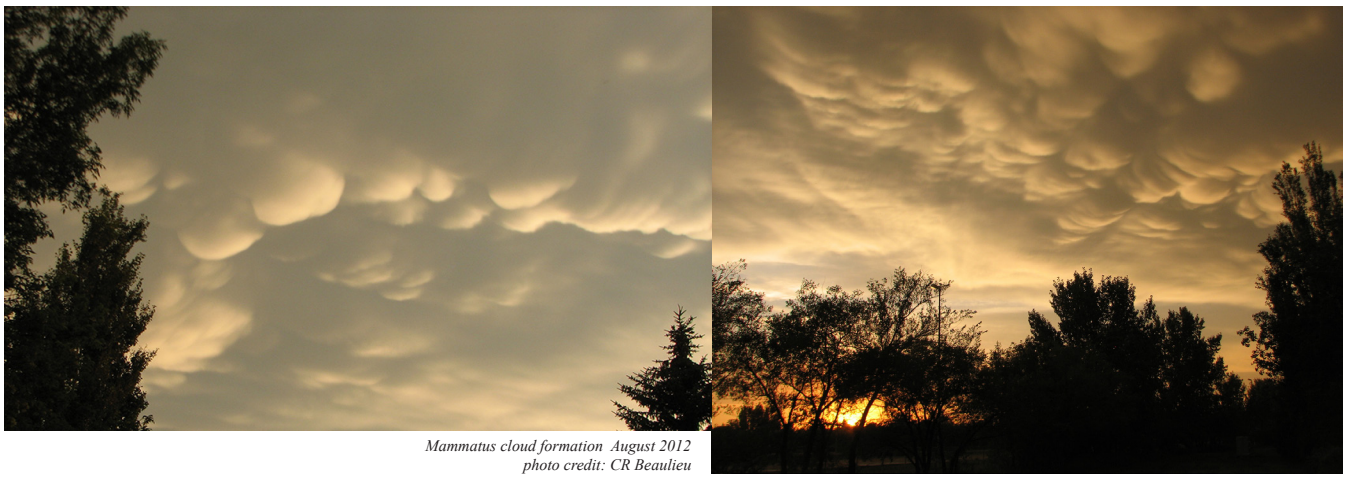


Seasonal Bright Sunshine Days



Monthly Bright Sunshine Days





Mammatus cloud formation August 2012
photo credit: CR Beaulieu

RADIATION

Bright Sunshine Ranking

% OF ACTUAL TO POSSIBLE HOURS BRIGHT SUNSHINE

% ANNUAL		WINTER % DJF		SPRING % MAM		SUMMER % JJA		AUTUMN % SON	
2011	59.9	1980	55.0	1980	66.7	1969	70.7	2011	61.7
2013	59.9	2000	52.8	2013	64.0	1967	69.8	1976	60.3
1976	58.8	2007	50.9	2011	63.1	1978	69.2	2013	58.0
1980	58.3	2012	49.7	1968	63.0	1979	67.9	2008	57.3
2008	58.1	1979	47.9	2009	62.8	1984	67.9	1966	53.3
1978	57.2	2001	47.8	2008	62.2	1974	67.7	2001	52.9
2007	57.0	1996	47.7	1976	62.1	1970	67.5	1974	52.2
1979	56.8	2002	47.1	1971	60.1	2011	66.4	2007	52.1
1971	56.3	1982	46.6	1969	59.2	2006	66.1	2009	52.1
2009	56.3	1978	46.4	1977	58.8	1975	65.6	2005	52.1
1967	56.0	1976	46.0	2002	58.6	1971	65.6	2010	51.8
2006	55.7	1989	45.8	1998	58.6	1982	65.4	1979	51.3
2001	55.7	2009	45.3	2007	58.6	1985	64.8	1994	51.1
1977	55.4	1971	45.2	1989	57.6	2013	64.7	2012	50.4
1969	55.3	1966	45.1	1981	57.6	2007	64.7	2000	50.3
1975	55.0	1977	45.0	2006	57.4	1976	64.2	1967	50.2
2012	54.8	1984	44.9	2001	56.9	1983	64.2	1982	50.0
1968	54.2	1988	44.8	1994	56.6	1977	63.8	1988	49.3
1970	53.9	1970	44.6	1966	55.7	2012	63.5	1978	49.1
1981	53.8	2008	43.5	1972	55.4	1968	63.3	2003	49.1
1974	53.8	1993	43.4	1967	54.4	1972	63.3	1975	48.9
1966	53.5	2010	43.3	1970	53.6	1981	63.1	1990	48.7
1989	53.1	1975	42.4	1979	53.4	2008	62.9	2006	48.5
1988	53.0	1981	42.2	1985	53.4	1980	62.0	1973	48.3
1982	52.8	2003	41.6	2003	53.3	1991	61.9	1980	47.7
2003	52.1	1973	41.2	1975	53.1	1988	61.8	1977	47.6
2002	51.6	1991	40.2	1978	53.0	1973	61.1	1997	47.5
1984	51.6	1995	40.2	2005	52.4	2001	59.2	2004	47.4
1990	51.0	1990	39.7	2012	52	2010	58.7	1989	46.5
1973	51.0	2013	39.1	1991	51.7	1996	58.7	1971	46.2
2010	50.7	1987	38.9	1988	51.6	1966	58.7	1995	45.8
1985	50.5	2011	38.8	1992	51.5	1986	58.2	1987	45.5
1991	50.5	1999	38.5	1973	50.8	1989	58.1	1999	44.2
2000	50.0	1968	38.0	1983	50.1	1990	58.0	2002	44.1
1972	49.8	2005	37.9	1990	49.8	2009	57.8	1968	44.0
1997	49.6	2006	37.1	1997	49.3	1997	57.7	1993	43.8
1994	49.6	1997	37.0	1974	49.0	2003	57.4	1981	43.1
2005	49.1	1967	36.5	2004	48.7	2002	53.8	1969	42.9
1983	48.9	1972	36.3	1982	48.3	1999	52.2	1983	41.5
1996	47.9	2004	35.9	1993	48.2	2000	52.1	1991	40.4
1999	46.5	1992	35.9	2000	48.1	1994	51.0	1970	40.2
1995	46.5	1986	35.6	2010	47.6	1995	50.5	1985	39.3
1986	46.0	1985	35.1	1995	47.6	2004	48.5	1998	38.9
1998	46.0	1969	34.0	1984	47.0	2005	48.5	1984	38.1
1987	45.1	1998	33.7	1987	46.8	1992	48.4	1996	37.7
1993	44.9	1974	32.2	1999	45.2	1987	46.3	1986	36.4
2004	44.8	1994	26.9	1986	44.7	1998	45.8	1992	35.3
1992	43.8	1983	24.2	1996	44.1	1993	44.9	1972	33.6

DAYS WITH BRIGHT SUNSHINE

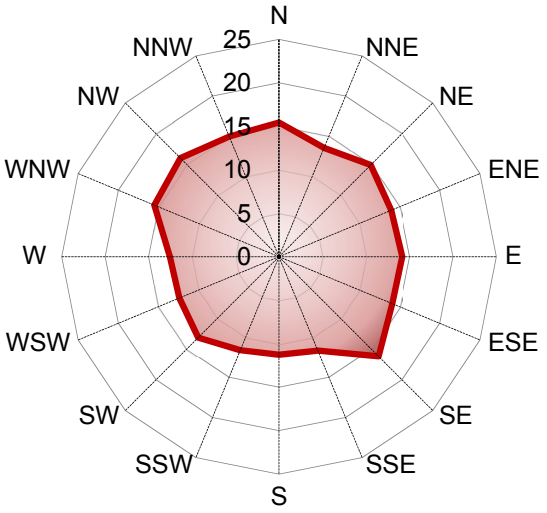
ANNUAL		WINTER DJF		SPRING MAM		SUMMER JJA		AUTUMN SON	
1979	337	2012	81	1994	89	1977	92	1979	86
1976	335	2007	80	2002	89	1982	92	1999	86
1978	335	1972	79	2008	89	1997	92	1976	84
2011	334	1984	79	1969	88	2001	92	2003	84
2008	333	1979	78	1997	88	2011	92	1987	83
1980	331	1982	78	1998	88	2013	92	2011	83
1990	331	1993	78	2011	88	1969	91	1990	82
2001	331	1966	77	2013	88	1970	91	2008	82
2009	331	1988	77	1980	87	1976	91	1968	81
2007	328	2000	77	1985	87	1978	91	2005	81
1997	327	1976	76	2000	87	1979	91	1978	80
1999	327	1980	76	1968	86	1989	91	2009	80
1977	325	1977	74	1971	86	1967	90	1966	79
1988	325	1978	74	1972	86	1971	90	1967	79
1970	324	1990	74	1984	86	1980	90	1974	79
1994	324	2008	74	1988	86	1983	90	1977	79
1968	323	2009	74	1992	86	1985	90	1985	79
1985	323	1991	73	2004	86	2007	90	1988	79
1989	323	1970	72	2007	86	1972	89	1993	79
1993	323	1971	72	1976	85	1974	89	2004	79
1996	323	1996	72	1978	85	1981	89	1980	78
2013	323	1973	71	2001	85	1986	89	1975	77
2003	322	1987	71	2009	85	1987	89	1991	77
1971	321	1989	71	1966	84	1994	89	1994	77
1987	321	2001	71	1970	84	1999	89	1997	77
2000	321	2002	71	1981	84	2003	89	2000	77
2005	321	1999	70	1990	84	2009	89	2013	77
2012	321	1975	69	1996	84	1966	88	1996	76
1966	320	1997	69	2005	84	1968	88	2001	76
1975	319	1968	68	1967	83	1984	88	2007	76
1982	319	1974	68	1973	83	1988	88	2010	76
2002	319	1985	68	1975	83	1995	88	1982	75
1967	318	1995	68	1979	83	1996	88	1989	75
1969	318	2003	68	1989	83	2000	88	2002	75
1972	316	2013	68	1993	83	2006	88	1973	74
2010	316	1969	67	2010	83	2008	88	1971	73
1974	315	1981	67	1977	82	2010	88	1983	73
1991	315	2005	67	1986	82	1975	87	1995	73
1981	313	1992	65	1991	82	1990	87	1970	72
1984	312	2011	65	1999	82	1991	87	1981	72
1973	311	2006	64	2012	82	1993	87	1998	72
1998	310	1967	63	1982	81	1998	87	2012	72
2006	308	2004	63	1995	81	1973	86	1969	71
1986	307	1986	62	2006	81	2012	86	1986	71
1983	305	1998	62	1983	80	2002	85	2006	70
1995	303	1994	60	1974	79	2005	84	1992	66
2004	301	1983	55	2003	79	1992	83	1972	64
1992	300	2010	44	1987	77	2004	81	1984	64

WIND

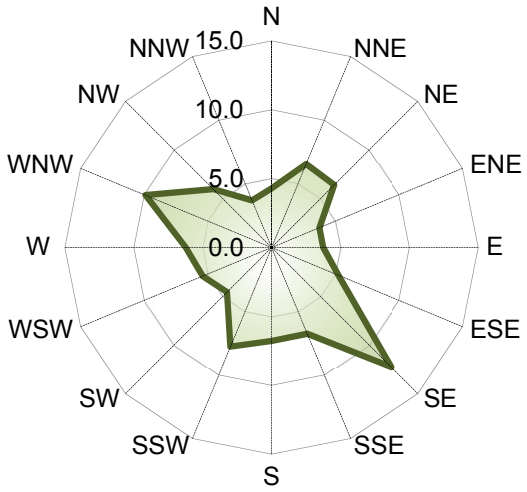
MONTH	AVERAGE WIND SPEED (km/h)			HIGHEST INSTANTANEOUS WIND SPEED (km/h)							
	2013 Average	Normal*	2013 Peak Speed Average	2013for CRS (Speed / direction / date)			Since 1953 (Saskatoon Diefenbaker Int'l. Airport) (Speed / direction / day / year)				
January	13.1	16	47.1	61.9	N	28	111	W	11		1986
February	14.7	16	40.3	58.7	WNW	15	106	N	22		1988
March	15.5	17	41.2	52.7	NE	17	93	W	18		1959
April	14.9	18	43.2	60.8	N	29	108	W	06		1959
May	15.5	18	42.2	66.0	SE	16	132	SW	17		1965
June	14.1	17	44.5	78.2	E	17	117	S	01		1986
July	15.5	16	46.6	68.0	NW	20	113	E	05		1955
August	13.0	16	41.5	59.8	WNW	16	151	W	14		1967
September	12.7	17	44.3	62.7	NW	28	148	W	22		1967
October	14.5	17	41.7	61.8	SSE	4	138	NW	16		1967
November	15.5	16	44.6	60.9	NW	25	100	W	17		1967
December	16.3	16	45.9	63.8	NW	24	121	W	12		1955

*1961-90 Normals used are from the Environment Canada, Saskatoon Diefenbaker International Airport station, 1993

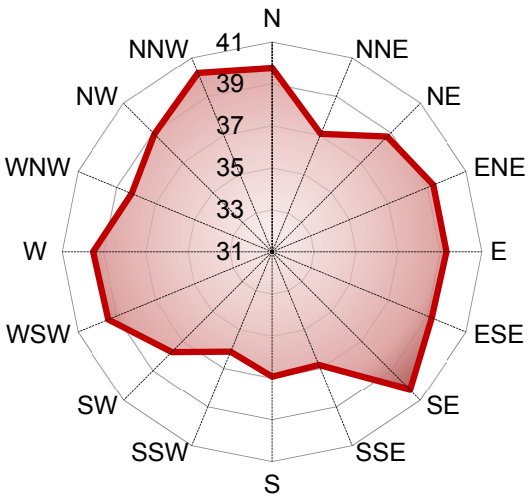
ANNUAL AVERAGE WIND SPEED (km/h)



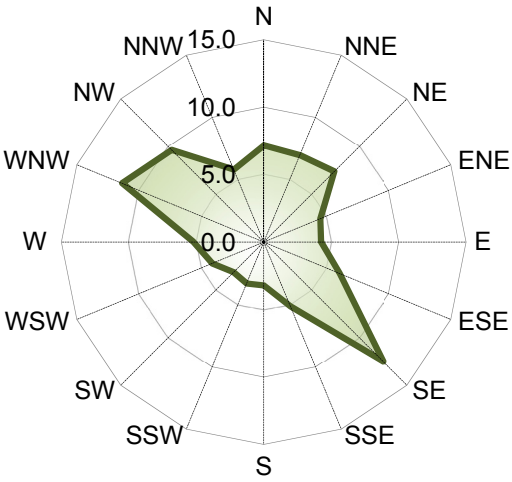
ANNUAL AVERAGE WIND FREQUENCY %



ANNUAL AVERAGE MAXIMUM WIND GUST SPEED (km/h)*



ANNUAL AVERAGE MAXIMUM WIND GUST FEQUENCY*

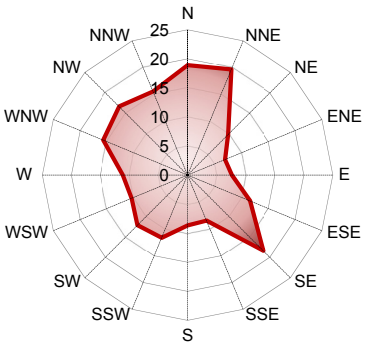


*excludes maximum ½ hour winds <31 km/h

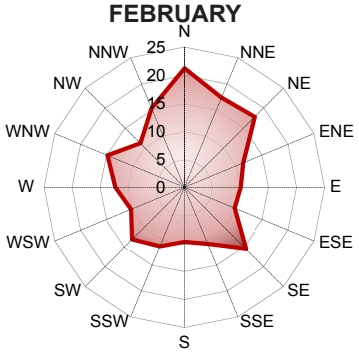
WIND

Average Wind Speed by Direction (km/h)

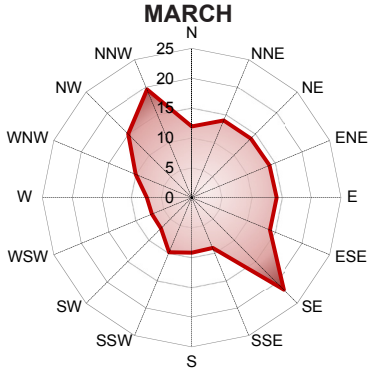
JANUARY



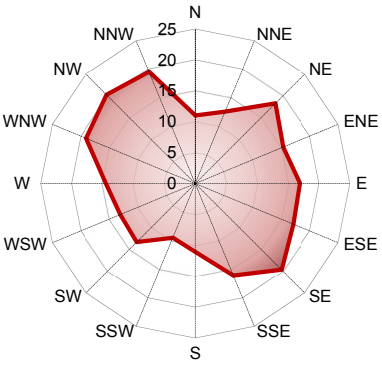
FEBRUARY



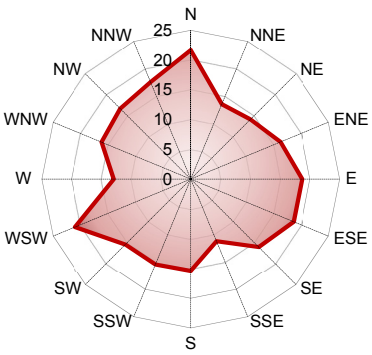
MARCH



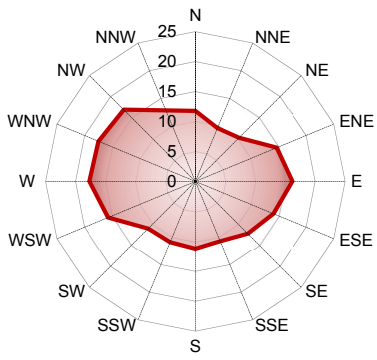
APRIL



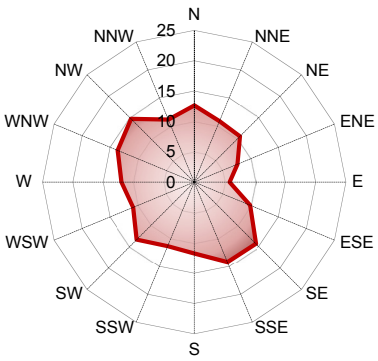
MAY



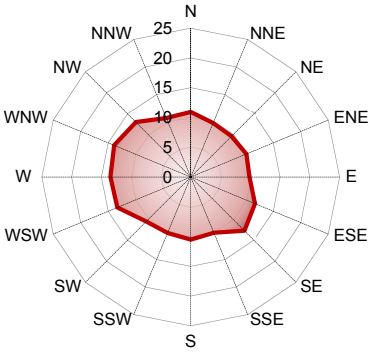
JUNE



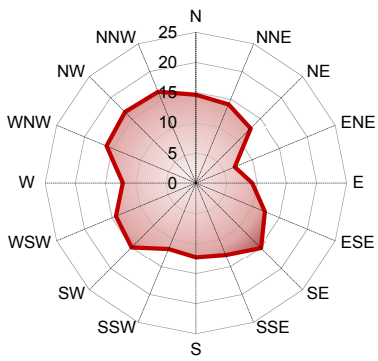
JULY



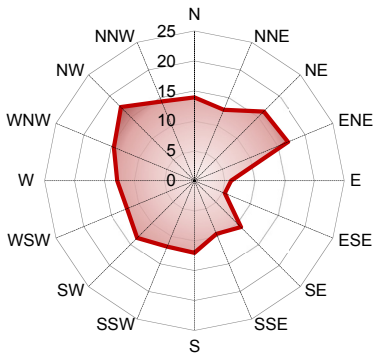
AUGUST



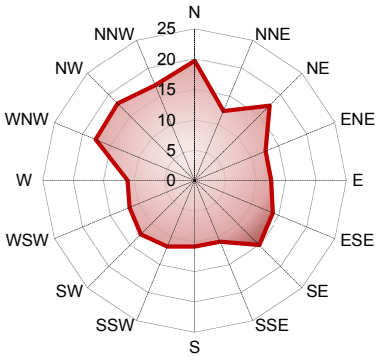
SEPTEMBER



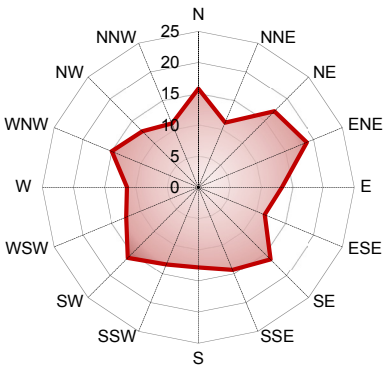
OCTOBER



NOVEMBER



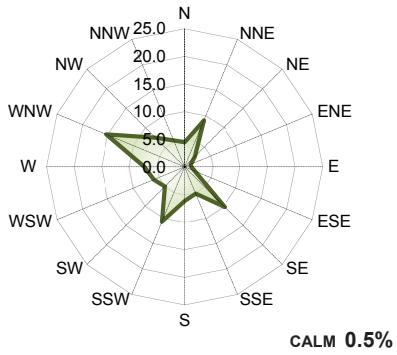
DECEMBER



WIND

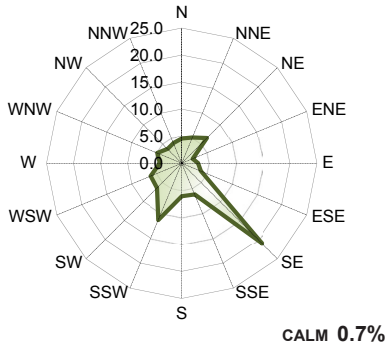
Average Wind Frequency by Direction (%)

JANUARY



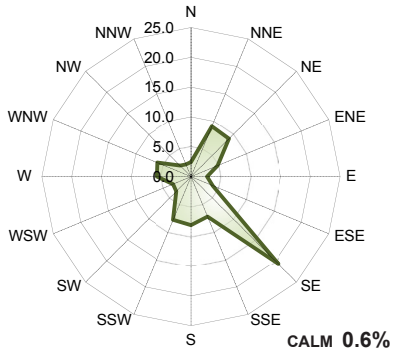
CALM 0.5%

FEBRUARY



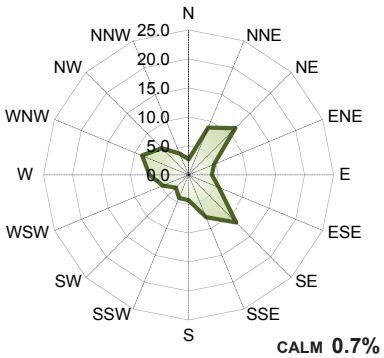
CALM 0.7%

MARCH



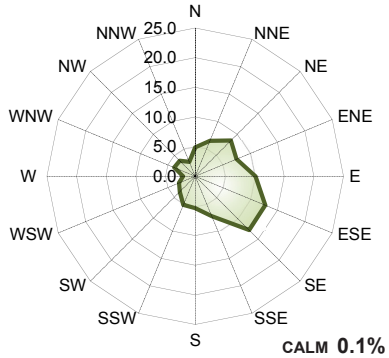
CALM 0.6%

APRIL



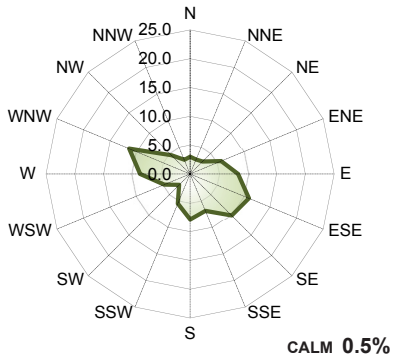
CALM 0.7%

MAY



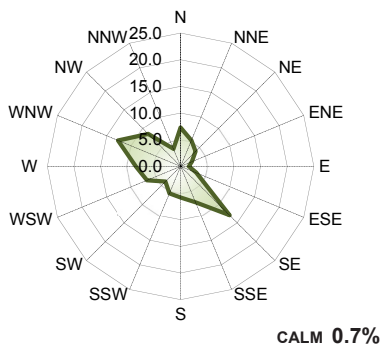
CALM 0.1%

JUNE



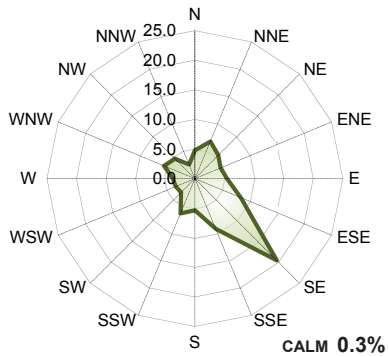
CALM 0.5%

JULY



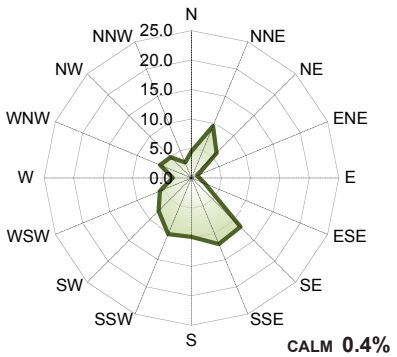
CALM 0.7%

AUGUST



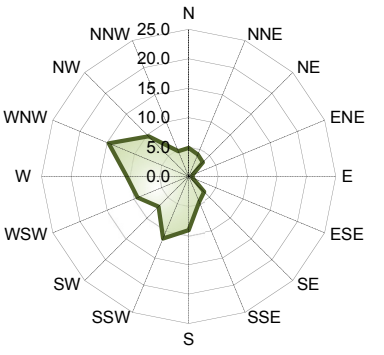
CALM 0.3%

SEPTEMBER



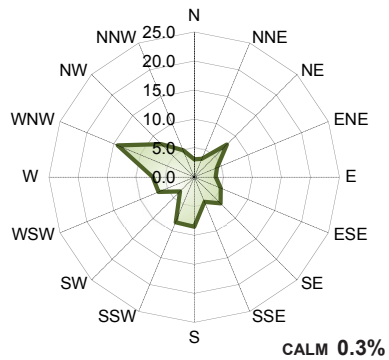
CALM 0.4%

OCTOBER



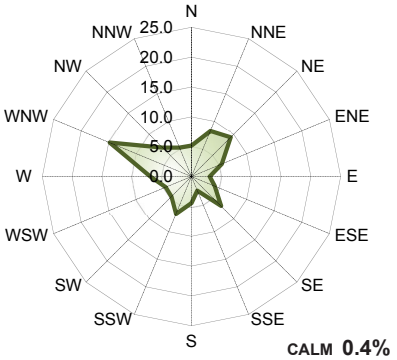
CALM 0.6%

NOVEMBER



CALM 0.3%

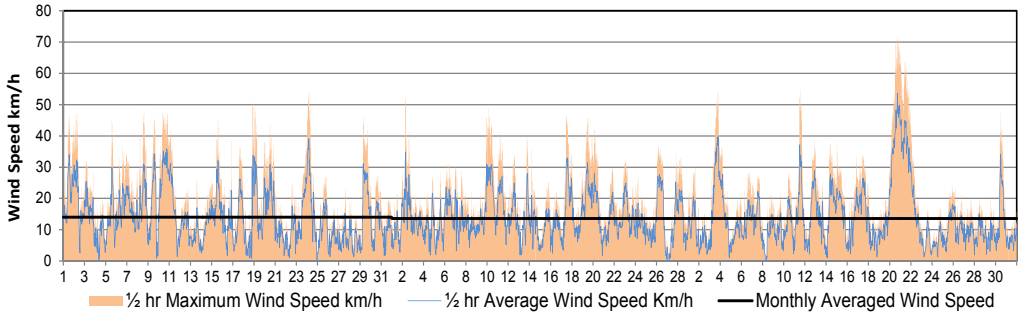
DECEMBER



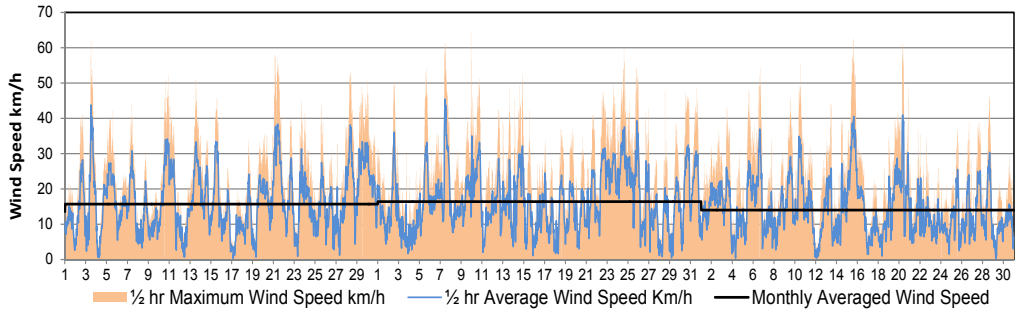
CALM 0.4%

WIND
Daily Wind Speed and Maximum Gust Wind Speed

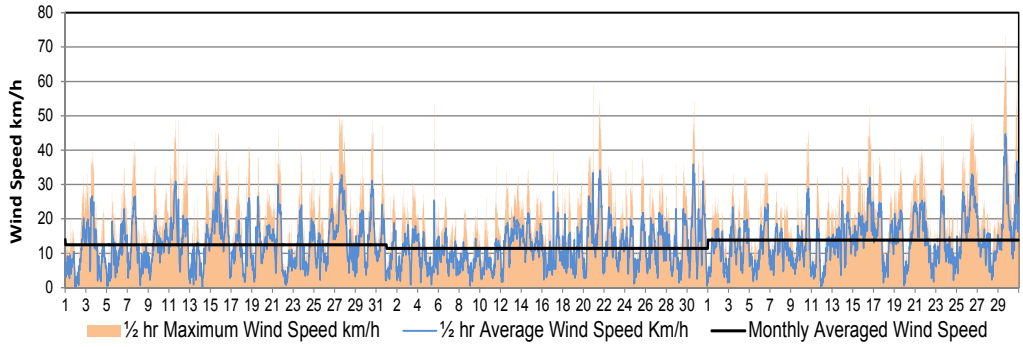
Jannuary
February
March



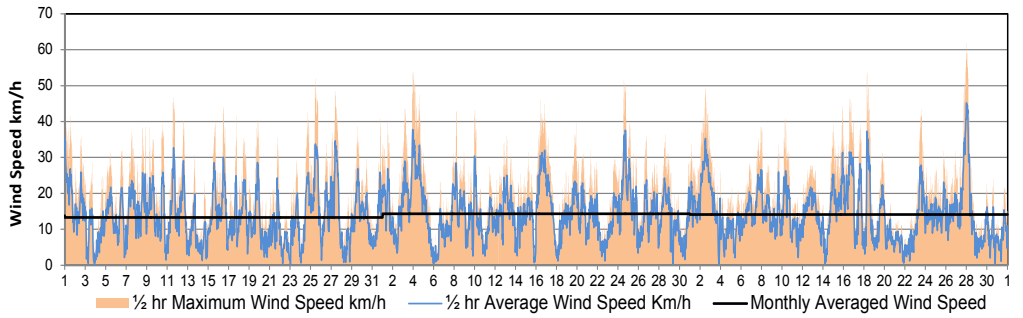
April
May
June



July
August
September



October
November
December



WIND

EXTREME DAILY WINDS (km/h)

DATE	WIND SPEED/ DIRECTION	BEAUFORT WIND SCALE DESIGNATION*
January 18	50.7 NNE	Near Gale
January 24	54.3 SE	Near Gale
February 02	52.2 N	Near Gale
March 03	54.3 NNE	Near Gale
March 11	54.8 NNW	Near Gale
March 20	71.5 SE	Gale
March 21	63.6 SE	Gale
April 03	62.0 NW	Gale
April 10	52.0 SSE	Near Gale
April 13	51.1 SE	Gale
April 21	58.0 NW	Near Gale
April 28	53.0 NW	Near Gale
April 29	50.8 NE	Near Gale
May 02	50.4 SSW	Near Gale
May 05	54.0 WSW	Near Gale
May 07	61.6 N	Near Gale
May 09	64.4 WSW	Gale
May 10	56.4 NNE	Near Gale
May 14	52.6 W	Near Gale
May 24	59.5 ESE	Near Gale
May 25	54.3 ESE	Near Gale
June 06	54.3 NW	Near Gale
June 10	55.6 WSW	Near Gale
June 15	62.7 WNW	Gale
June 20	61.2 E	Near Gale
July 27	50.8 SE	Near Gale
August 05	53.4 SSW	Near Gale
August 20	59.0 W	Near Gale
August 21	54.8 WNW	Near Gale
August 30	53.8 W	Near Gale
September 16	52.8 S	Near Gale
September 29	73.4 SW	Gale
September 30	63.1 SSW	Gale
October 01	51.2 WNW	Gale
October 25	52.0 NW	Gale
November 03	53.8 N	Gale
November 04	51.6 NNW	Gale
November 24	51.5 WNW	Gale
December 18	53.6 N	Near Gale
December 27	61.8 ENE	Near Gale
December 28	59.3 NE	Near Gale

*Near Gale >=50 but < 62 *Gale >=62 but <75
*Strong Gale >=75 but <89 *Storm >=89 but <103

WINDCHILL CALCULATION CHART [1]

T°C / km/h Speed	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**

Approximate Thresholds

-10	Low	Risk of hypothermia if outside for long periods without adequate protection.
-28	Risky	Risk of frostnip/frostbite on extremities. Exposed skin can freeze in 10 - 30 min.
-40	High Risk	High risk of frostbite. Exposed skin can freeze in 5 - 10 minutes.
-48	Very High Risk	Serious risk of frostbite. Exposed skin can freeze in 2 - 5 minutes.
-55	Extreme Risk	Outdoor conditions are hazardous. Exposed skin can freeze in 2 minutes or less.

1: Environment Canada, 2004b

EXTREME DAILY WIND CHILL WHEN TEMPERATURE <0°C

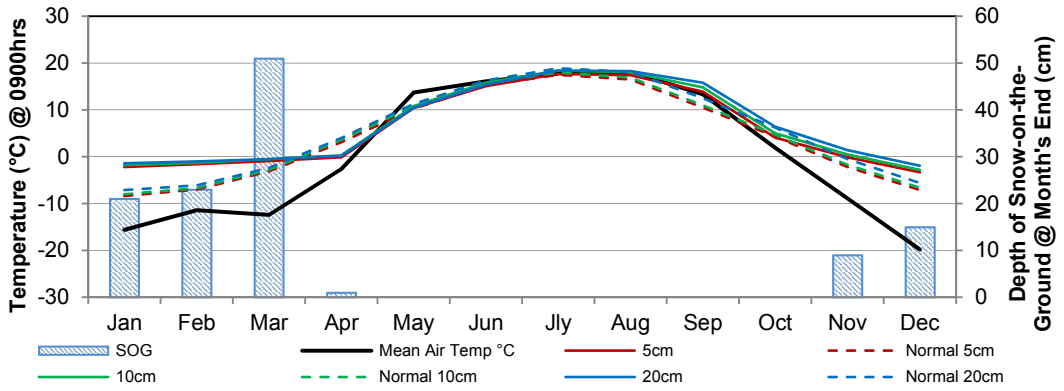
	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-24	-28	-15	-17	-10							-17
2	-23	-26	-12	-19	-8						-8	-24
3	-21	-24	-17	-9							-11	-28
4	-19	-23	-23	-11						-5	-17	-32
5	-20	-23	-24	-13							-20	-41
6	-18	-28	-32	-10							-24	-42
7	-19	-23	-20	-20							-15	-45
8	-16	-20	-21	-25	-6						-12	-37
9	-21	-20	-23	-19							-16	-40
10	-28	-20	-22	-20							-28	-38
11	-35	-21	-18	-12	-6						-30	-41
12	-38	-13	-21	-6						-6	-16	-35
13	-34	-15	-20	-10						-8	-6	-36
14	-32	-18	-23	-13						-5	-9	-35
15	-21	-27	-26	-12						-7	-8	-30
16	-22	-13	-32	-14						-4	-19	-15
17	-24	-22	-30	-10						-6	-23	-27
18	-28	-39	-29	-12							-23	-35
19	-34	-41	-30	-12							-27	-36
20	-43	-33	-30	-8						-7	-34	-36
21	-40	-29	-25	-15						-7	-36	-41
22	-30	-26	-20	-14						-4	-36	-42
23	-36	-19	-23	-9						-6	-34	-45
24	-35	-18	-24	-14						-10	-12	-17
25	-35	-18	-26	-8						-4	-20	-16
26	-30	-19	-27							-10	-26	-15
27	-18	-26	-26							-16	-15	-32
28	-18	-16	-21							-18	-18	-37
29	-43		-14	-9						-18	-16	-38
30	-44		-10	-12						-10	-19	-39
31	-45		-14							-7		-42

SOIL TEMPERATURES AND DEPTH OF SNOW-ON-THE-GROUND @ MONTH END

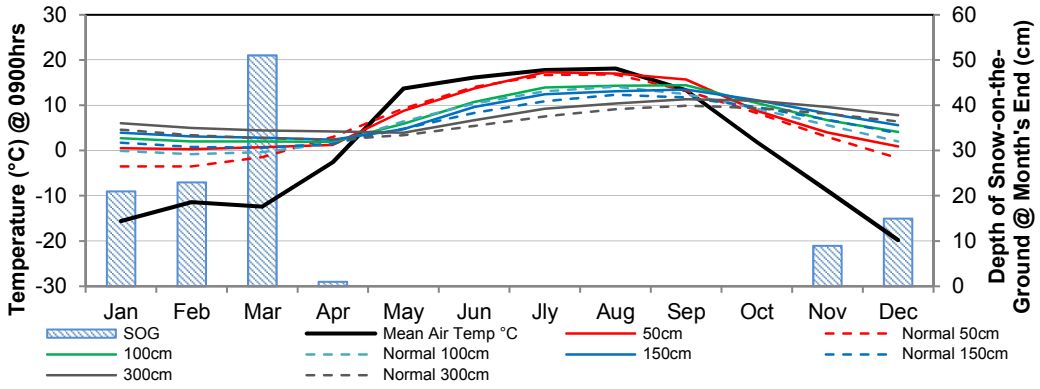
MONTH	Mean Air Temp @ 0900h (°C)	SOIL TEMPERATURES (C°) @ 0900h														Mean Air Temp @ 1600h (°C)	SOIL TEMPERATURES @ 1600h					
		5cm		10cm		20cm		50cm		100cm		150cm		300cm			5cm		10cm		20cm	
		2013	NORM	2013	NORM	2013	NORM	2013	NORM	2013	NORM	2013	NORM	2013	NORM		2013	NORM	2013	NORM	2013	NORM
January	-15.6	-2.2	-8.4	-1.8	-8.0	-1.4	-7.1	0.5	-3.5	2.7	-0.1	3.9	1.7	6.0	4.6	-12.2	-2.2	-8.4	-1.8	-7.8	-1.4	-6.2
February	-11.4	-1.6	-7.0	-1.3	-6.7	-1.0	-6.1	0.3	-3.5	2.0	-0.8	3.1	0.8	5.0	3.4	-7.2	-1.5	-6.5	-1.3	-6.6	-1.0	-5.2
March	-12.4	-0.9	-3.1	-0.5	-2.8	-0.5	-2.4	0.7	-1.5	2.0	-0.4	2.8	0.6	4.4	2.7	-6.5	-1.0	-2.9	-0.5	-2.6	-0.5	-1.8
April	-2.6	-0.1	3.1	0.3	3.6	0.2	4.0	1.2	3.0	1.9	1.6	2.4	1.5	4.2	2.4	2.2	0.1	6.0	0.2	5.5	0.2	4.6
May	13.7	10.4	10.3	10.8	10.8	10.5	11.3	8.7	9.3	5.9	6.4	4.7	4.8	3.9	3.4	20.0	15.8	14.2	14.1	13.6	10.9	12.0
June	16.1	15.1	15.3	15.8	15.7	15.4	16.3	13.7	14.0	10.7	10.4	9.6	8.3	6.7	5.4	20.2	19.0	20.0	18.1	19.0	15.7	17.1
July	17.8	17.7	17.5	18.4	18.0	18.4	18.9	17.3	16.7	13.9	13.1	12.4	10.9	9.2	7.5	21.9	22.7	22.1	21.3	21.3	18.8	19.5
August	18.1	17.4	16.5	18.0	16.9	18.3	18.1	17.0	16.8	14.3	14.1	13.1	12.3	10.4	9.1	25.1	22.7	20.6	20.9	20.0	18.6	18.6
September	13.3	13.9	10.5	14.8	11.0	15.8	12.5	15.7	13.2	14.4	12.4	13.5	11.7	11.3	9.9	22.2	18.5	13.9	17.1	13.4	15.7	13.1
October	1.9	4.1	4.3	5.0	4.7	6.4	6.2	8.8	8.3	10.5	9.2	11.1	9.6	11.0	9.4	9.2	6.4	6.1	6.2	6.4	6.3	6.9
November	-8.9	-0.1	-2.2	0.5	-1.7	1.4	-0.5	4.0	3.0	6.7	5.6	8.2	6.8	9.6	8.1	-4.7	0.0	-1.4	0.5	-1.2	1.3	0.3
December	-19.8	-3.3	-7.1	-2.8	-6.6	-1.9	-5.6	0.9	-1.7	4.1	2.0	5.6	3.8	7.8	6.4	-17.2	-3.3	-6.6	-2.8	-6.3	-2.0	-4.6

Normal temperatures (1971-2000) for our site are provided by Environment Canada 2004a

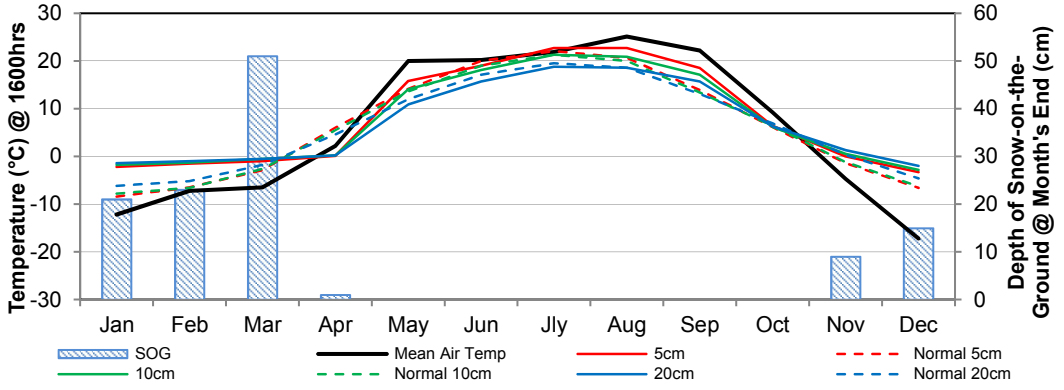
Monthly Soil Temperatures @ 0900h



Monthly Soil Temperatures @ 0900h



Monthly Soil Temperatures @ 1600h



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. A temperature base of 24° C is sometimes used as an index of extreme cooling degree-days to indicate potential heat stress. (Environment Canada 2012)

Mathematically:CDD = (T - 18°C), for that day, where T = daily mean temperature in °C if T is equal to or less than18°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 mainly from the following data sets:

SRC:1963 to present
Saskatoon Airport: 1942 to present
University of Saskatchewan:1916 to 1963
Eby station: 1901-1941
NWMP: circa1892 to circa 1900 (sporadic)

Station locations, exposures and measurement procedures were subject to change during this time period. Data are <u>not adjusted</u> 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 (1981-2010) 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 at CRS is from January 1st, 1981 to December 31st, 2010. 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. (Environment Canada, 1993, 2002, 2004a)

POTENTIAL EVAPOTRANSPIRATION (Thornthwaite Method) is the amount of water which will be lost from a surface completely covered with vegetation if there is sufficient water in the soil at all times for the use of the vegetation. It is computed by means of an empirical formula involving mean monthly temperature and average length of day.

Mathematically: $PET = mT^a$ where PET = Potential of Evaportranspiration; m = % of day length for the month as compared to the year; T = Temperature °C when T is less than or equal to 0; otherwise T = O; and a = yearly heat index. (Thornthwaite and Mather, 1955)

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. 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 a weighing gauge for the winter season and the tipping bucket during frost-free period.

SEASONS Meteorologists prefer to divide the year into four 3-month periods based primarily on temperature. Thus winter is defined as December (previous year), January, and February (DJF); spring as March, April and May (MAM); summer as June, July and August (JJA); and fall as September, October and November (SON). (Lutgens and Tarbuck, 1992)

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 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.

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.

Mathematically: $WC = 13.12 + (0.6215 \times T) - (11.37 \times V^{0.16}) + (0.3965 \times T \times V^{0.16})$; where WC = wind chill; T= air temperature °C; V= standard wind speed km/h. (Environment Canada 2004b).

WAVES - Temperature waves are defined as a sequence of three or more days when the daily maxiumum/minimum temperatures are higher/lower than, or equal to, a set temperature. For a heat wave the temperature is 32°C. (Environment Canada 2005).

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**

REFERENCES AND BIBLIOGRAPHY

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

Environment Canada, Atmospheric Environment Service (AES), 1975. 1974 Annual Meteorological Summary. AES, Saskatoon, SK.

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), 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, 2002. *Canadian Daily Climate Data on CD-ROM - Western Canada.* Climate and Water Products Division, Downsview, ON.

Environment Canada, Meteorological Service of Canada, 2004a. *Climate Data Online/Climate Normals and Averages*. http://www.climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html (accessed 2004, 2007).

Environment Canada, Meteorological Service of Canada, 2004b. Wind Chill Calculation Chart. http://www.msc.ec.gc.ca/education/windchill/windchill_chart_e.cfm (accessed April, 2009).

Environment Canada, Meteorological Service of Canada, 2005. *Fact Sheet - Summer Severe Weather Warnings*. http:/www.on.ec.gc.ca/severe-weather/summerwx_factsheet-e.html (accessed Feb 2008).

Environment Canada, Meteorological Service of Canada, 2012. *Calculation of the 1971 to 2000 Climate Normals for Canada*. http://climate.weather.gc.ca/climate_normals/normals_documentation_e.html (accessed Feb 2014).

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

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 (accessed July 30, 2001).

Ladd, M.G., 2008. *Ladds of New England: Ancestral line of Merle G. Ladd*. http://www.laddfamily.com (accessed April 29, 2009)

Lutegens, F. K. and E.J. Tarbuck, 1992. *The Atmosphere: An Introduction to Meteorology, 5th Ed.*. Prentice Hall, New Jersey.

National Research Council of Canada, Herzberg Institute of Astrophysics, n.d. *Sunrise - Sunset Tables for Saskatoon* http://www.hia-iha.nrc-cnrc.ca/sunrise_e.html (accessed January 2013, 2014).

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

Thornthwaite, C.W. and J. R. Mather, 1955. The Water Balance. Publications in Climatology Vol. 8, No.1. Drexel Institute of Technology, Laboratory of Climatology, Centerton, New Jersey.

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

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.