Climate Reference Station

Conservation Learning Center

RM of Prince Albert #461

ANNUAL SUMMARY 2016

S. Dunn
V. Wittrock
Saskatchewan Research Council
Air and Climate

SRC Publication No. 13000-1E17
January 2017

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125-15 Innovation Blvd.
Saskatoon, SK S7N 2X8

COVER PHOTOGRAPHS
SRC Climate Reference Station at Conservation Learning Centre
and Diffuse Radiation Sensor with Automated Shade Ring.
28 June 2016
Photo credit: R. Jansen

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Acknowledgements

The 2016 data was compiled and recorded by Shaw Dunn and Virginia Wittrock. Instrument maintenance was carried out by the personnel from the Development Engineering, and Manufacturing (DE&M) Business Unit of the Saskatchewan Research Council (SRC). Editorial assistance was provided by Suzanne Johnston, Communications Business Unit, SRC.

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Saskatchewan Research Council web site: http://www.src.sk.ca
Monthly data sheets and annual summaries: http://src.nu/crsdata

SASKATCHEWAN RESEARCH COUNCIL
Climate Reference Station Supporters, 2016

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KIPP & ZONEN SINCE 1830

Prince Albert Model Forest

CAMPBELL SCIENTIFIC WHEN MEASUREMENTS MATTER

Conservation LEARNING CENTRE

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

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Climate Reference Station History

The Saskatchewan Research Council's Climate Reference Station (CRS) at the Conservation Learning Centre (CLC) was established in 2011 with the first full year of data in 2012. This Station is situated approximately 16km east of MacDowall, approximately 11km north of St. Louis and 18km south of Prince Albert, Saskatchewan. The oldest recordings of meteorological data in the area are south of the North Saskatchewan River at Prince Albert beginning in 1884 and lasting until 1942. In 1953, the present day Prince Albert station was established at the airport north of the river and east of the city. Other nearby stations recording intermittent data were at MacDowall (1914-2003) and Hoey (south of St. Louis) (1986-2012) with MacDowall recording both precipitation and temperature and Hoey only recording precipitation.

The first observers of the site were Virginia Wittrock and Carol Beaulieu. In 2013, Shaw Dunn joined the group and in 2014 became the primary observer for the site with assistance from V. Wittrock. Site maintenance is carried out by Ryan Jansen and Ken Babich (DE&M). V. Wittrock continues to be the project manager of SRC's Climate Reference Stations.

The instrument array consists of temperature, precipitation, humidity, barometric pressure, wind (speed and direction), snow depth, barometric pressure, solar radiation (global, diffuse and bright sunshine), and soil moisture, grass height air temperature and soil temperature (seven levels). The site is a self-contained unit with power generated from solar panels while the data is retrieved from the data logger by an internet connection via the cellular network.

Activities Associated with the CRS at CLC in 2016

The CLC is a research and demonstration farm. Its outreach program for grades 3-11 students resulted in approximately 300 students being exposed to hands-on activities related to air, soil, and water interactions at the farm. The SRC Climate Reference Station is included in the program allowing the students to become familiar with the CRS's suite of instruments. The station emphasizes the importance of climate and its application to the practical world of farming and ecology.[1]

Important events in 2016 included general maintenance of the site occuring in May, June and October, recalibration of the tipping bucket instrument and installing the recalibrated bright sunshine instrument. We now have five years of data at this location allowing us to track monthly, seasonal and yearly variations and have included this information to allow for year to year comparison. Only 25 more years of data are needed to obtain high quality averages.

[1]Conservation Learning Centre 2011

Tipping bucket Replacement
28 June 2016
Photo: R. Jansen

Data loggers and communication
28 June 2016
Photo: R. Jansen

What is a Climate Reference Station?

The Saskatchewan Research Council's Climate Reference Station (SRC CRS) at the Conservation Learning Centre is classified as a principal climatological station with supplementary climatological observations.[1] A reference climatological station's data are intended for the purpose of determining climatic trends which require 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. As the Climate Reference Station is in its infancy, data for trend analyses are not available. At the 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, soil moisture, snow depth, bright sunshine and solar radiation. High quality and consistent climatological observations are maintained which will provide 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 will allows us to:

- Evaluate long term climate trends after operating for a standard period - 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;
- Conduct value-added research;
- Be part of regional, national and global networks in an important agricultural and ecological area;
- Facilitate development of additional programs - e.g. air quality, biodiversity, and climate change monitoring;
- Have roles in various programs within SRC and collaborative research with other agencies
- 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 gather high quality of data at its current location and, second, to monitor a large variety of elements. These various elements combined with a long-term collection period as well as the stable location will allow CRS to be an extremely valuable climate information collection station.

[1]*Environment Canada 1992*

SRC Publication No. 13000-1E17

Summary for 2016

Data, including temperature, precipitation, wind speed and direction, bright sunshine, solar radiation, soil temperature and moisture, was recorded during 2016 by the Saskatchewan Research Council's (SRC) Climate Reference Station (CRS) at the Conservation Learning Centre (CLC) (53.03 N, 105.77 W), located in the Rural Municipality of Prince Albert #461, Saskatchewan.

SRC's Climate Reference Station at the CLC has been in operation for five years (2012-2016), allowing for tracking of similarities and differences between the years and seasons of various parameters. Once the station has data that extends to 10 years, sufficient data will be available for certain statistical analysis, such as determining averages. This report examines the types of weather and climate that occurred in 2016 and compares it to the previous four years.

The average annual temperature in 2016 was the same as 2015 at 3.2°C. The average annual minimum temperature was slightly warmer in 2016 than 2015, and the average annual maximum temperature was slightly cooler. Over the last five years, 2015 had the warmest average summer and autumn (18.0°C and 5.2°C), whereas 2016 had the warmest average winter and spring temperatures (-11.7°C and 4.3°C). The seasonal maximum temperatures worked in the same pattern with 2015 having the warmest summer and autumn (23.9°C and 10.1°C) and 2016 having the warmest winter and spring temperatures (-6.8°C and 10.2°C). The seasonal minimum temperature has a more dispersed result; 2014 had the coldest winter minimum average with -25.8°C and 2013 recorded the coldest spring at -7.0°C. The coolest summer happened last summer with a minimum average of 11.1°C, and 2012 had the coolest fall with an average minimum temperature of -3.4°C.

In 2016, there were 10 cold spell events (temperatures less than -30°C), with the coldest day of the year happening on February 29 (-34.5°C). Two three-day cold spells were measured in 2016. One occurring January 16-18 and the second, December 16-18. Only two hot spells were measured in 2016 and they occurred in late spring (May 4 at 32.4°C) and early summer (June 9 at 30.1°C). The maximum daily temperatures did not go above 30°C for the rest of 2016.

The 2016 frost-free season was the second shortest over the 2012-2016 period with 122 days and was 10 days shorter than 2015. The number of growing degree-days, during the frost-free period, was the lowest over the five-year recording period. This is due to the cool summer. The total number of growing degree-days (GDD) for all of 2016 was 57 fewer than 2015. November's high temperatures translated into an usually high number of GDDs at 20.6 days.

The temperatures affected heating and cooling days as well, causing a slight increase from 5,428.1 heating degree-days in 2015 to 5,472.5 in 2016. Also, a very substantial decrease occurred in cooling degree-days from 122.9 in 2015 to 59.8 degree days in 2016, the lowest in the five years on record.

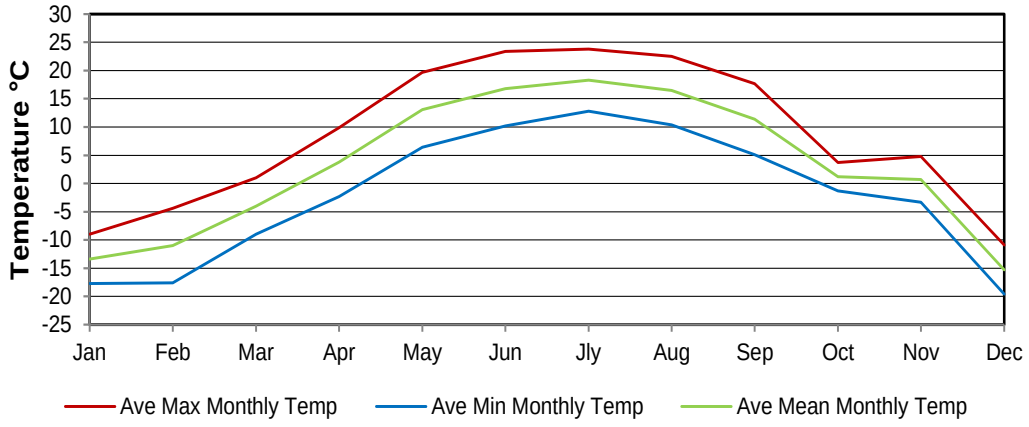
The second driest year over the 2012-2016 period was 2016 with 377.6 mm. April and December had very little precipitation (4.6 mm and 7.3 mm). August's precipitation amount was the greatest at 79.5 mm, followed closely by July with 72.5 mm. October was also very wet with 58.2 mm of precipitation. 2016 had the second highest number of days with measureable precipitation (156 days). The 2015-2016 permanent snow cover season lasted from November 24 and until April 2. The snowpack was at its greatest depth (32 cm) in February and March. The longest wet spell was shared by four events, each lasting six days (January 31-February 5, July 3-8, August 7-12, and October 4-9) and the longest dry period lasted 21 days (April 14-May 4).

Soil temperatures were relatively mild in the winter of 2015-2016 compared to the previous five years. The 9 a.m. reading at the 50 cm and deeper soil depths did not go below 0°C. The shallower depths temperatures ranged from -0.5 to -1.0°C for the entire winter period. All seven soil depths were at or above 0°C by April 15. The upper levels of the soil did not go below 0°C again until December 9 when the 5 cm had a 9 a.m. reading of -1.0°C. On December 18, the 5 cm soil temperature was at -4.0°C, the coldest the ground had been January 2015.

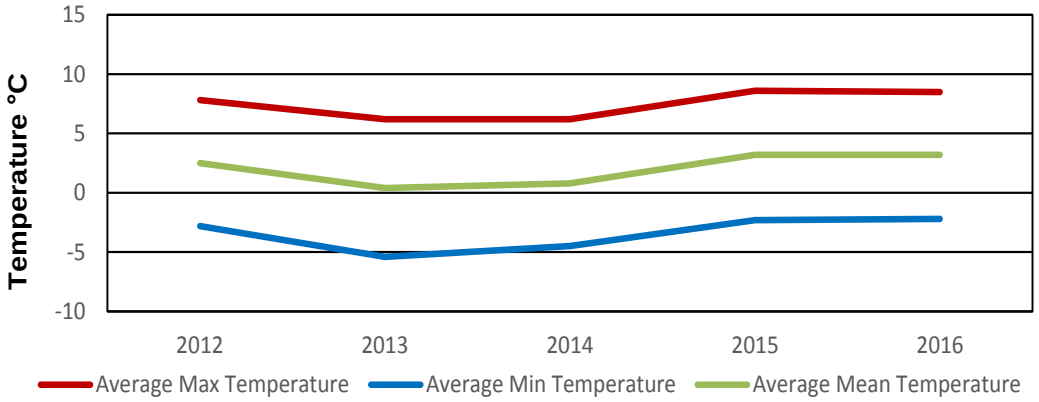
Temperature 2016

	Average Maximum (°C)	Average Minimum (°C)	Average Mean (°C)	2016 Extreme Values (°C)	
	2016	2016	2016	Max/Date	Min/Date
January	-9.0	-17.7	-13.4	4.5/27	-33.4/10
February	-4.4	-17.6	-11.0	6.7/26	-34.5/29
March	1.0	-9.0	-4.0	11.1/5	-29.2/1
April	9.9	-2.3	3.8	22.8/19	-10.9/11
May	19.7	6.4	13.1	32.4/4	-0.5/13
June	23.4	10.2	16.8	30.1/9	4.7/11
July	23.8	12.8	18.3	28.1/19	9.3/15
August	22.5	10.4	16.5	28.8/16	5.0/29
September	17.7	5.1	11.4	26.3/1	-1.2/21
October	3.7	-1.3	1.2	16.5/2	-7.0/13
November	4.8	-3.3	0.7	18.4/9	-11.8/18
December	-10.9	-19.6	-15.3	0.9/19	-32.4/17
Average	8.5	-2.2	3.2		

Monthly Comparison



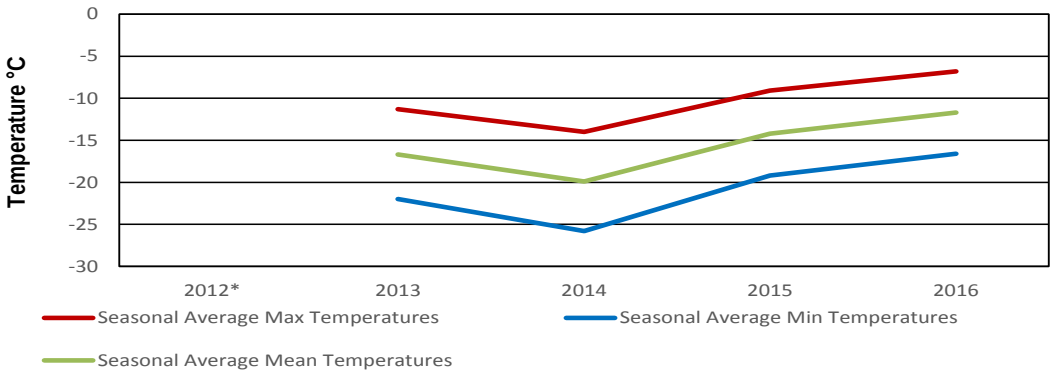
Annual Comparison



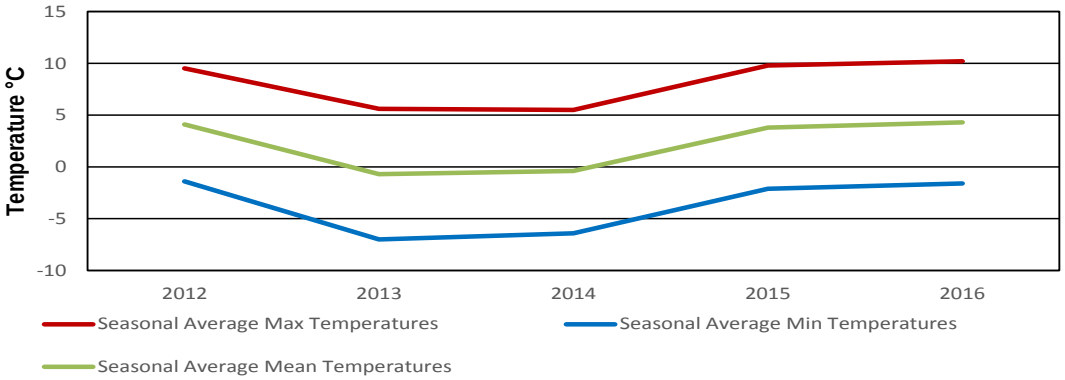
SEASONAL TEMPERATURES

Winter (DJF)

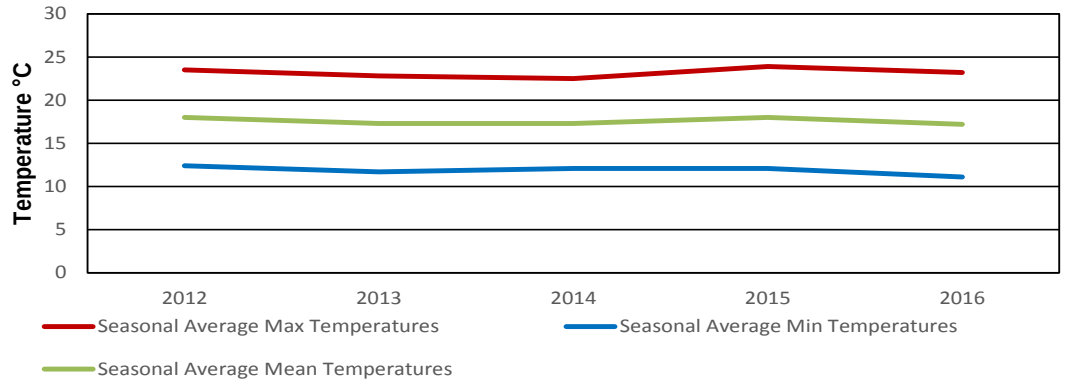
* Missing Data



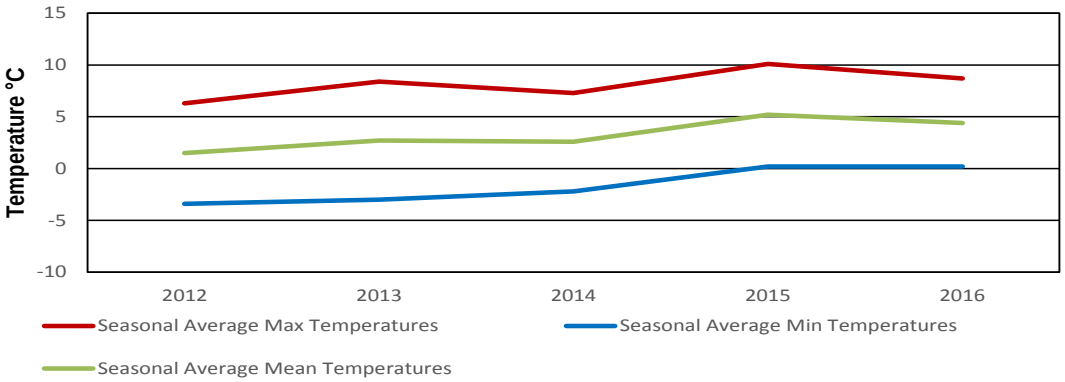
Spring (MAM)



Summer (JJA)

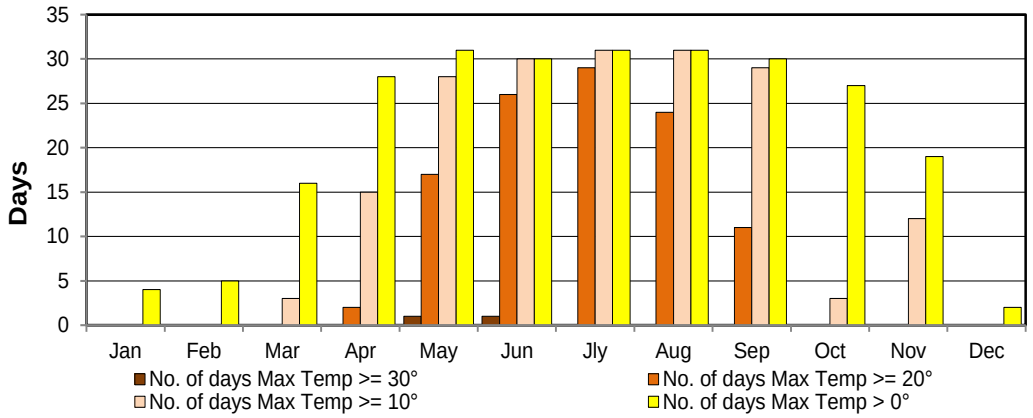


Autumn (SON)

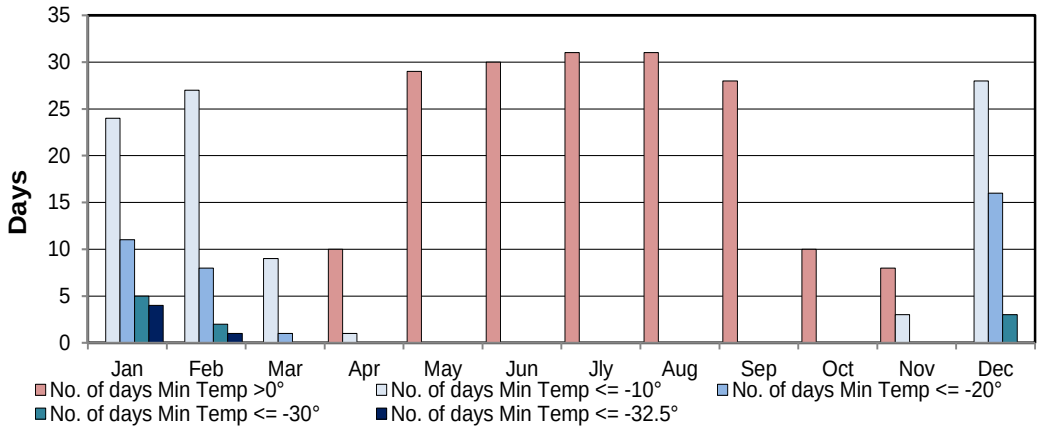


DAYS WITH TEMPERATURES GREATER THAN A SET POINT

Maximum temperature relative to a set points Monthly



Minimum temperature relative to set points Monthly



TEMPERATURE RANKINGS

SEASONAL MAXIMUM AVERAGE TEMPERATURES °C							
WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2016	-6.8	2016	10.2	2015	23.9	2015	10.1
2015	-9.1	2015	9.8	2012	23.5	2016	8.7
2013	-11.3	2012	9.5	2016	23.2	2013	8.4
2014	-14.0	2013	5.6	2013	22.8	2014	7.3
2012	M	2014	5.5	2014	22.5	2012	6.3

M = Missing Data

SEASONAL MINIMUM AVERAGE TEMPERATURES °C							
WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2016	-16.6	2012	-1.4	2012	12.4	2016	0.2
2015	-19.2	2016	-1.6	2015	12.1	2015	0.2
2013	-22.0	2015	-2.1	2014	12.1	2014	-2.2
2014	-25.8	2013	-6.4	2013	11.7	2013	-3.0
2012	M	2014	-7.0	2016	11.1	2012	-3.4

M = Missing Data

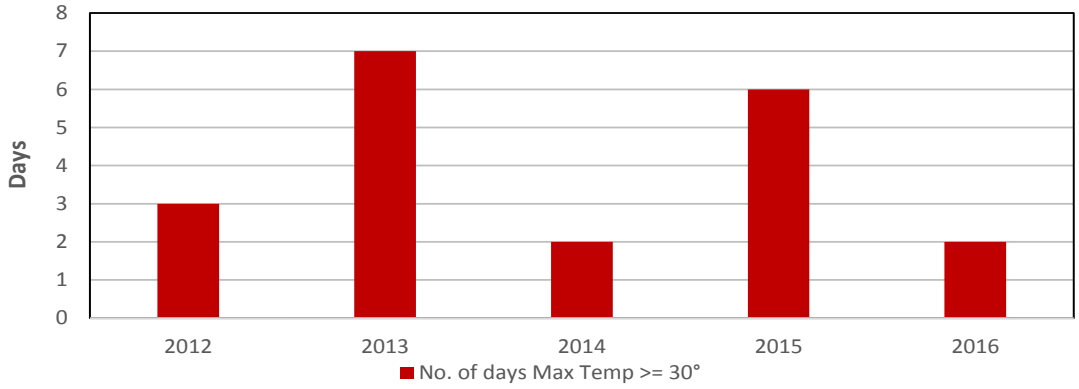
AVERAGE ANNUAL TEMPERATUES °C					
MAXIMUM TEMP		MINIMUM TEMP		MEAN TEMP	
2015	8.6	2016	-2.2	2016	3.2
2016	8.5	2015	-2.3	2015	3.2
2012	7.8	2012	-2.8	2012	2.5
2014	6.2	2014	-4.5	2014	0.8
2013	6.2	2013	-5.4	2013	0.4

SEASONAL MEAN AVERAGE TEMPERATURES °C							
WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2016	-11.7	2016	4.3	2015	18.0	2015	5.2
2015	-14.2	2012	4.1	2012	18.0	2016	4.4
2013	-16.7	2015	3.8	2013	17.3	2013	2.7
2014	-19.9	2014	-0.4	2014	17.3	2014	2.6
2012	M	2013	-0.7	2016	17.2	2012	1.5

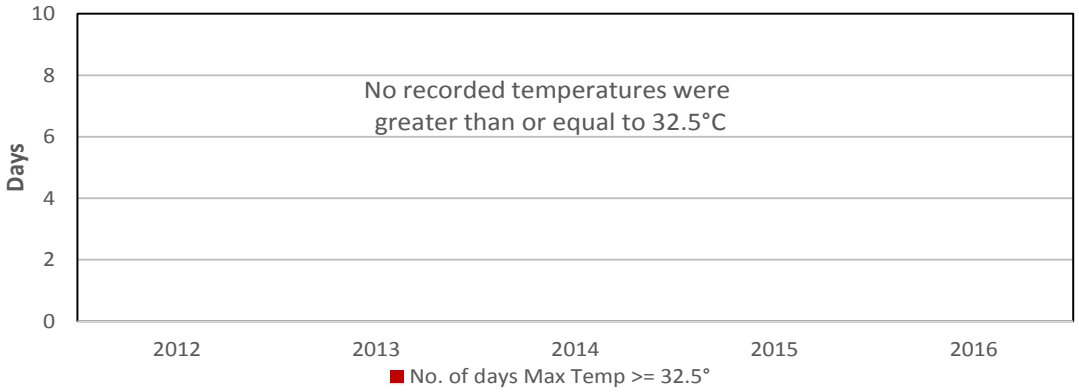
M = Missing Data

DAYS WITH TEMPERATURES GREATER THAN A SET POINT

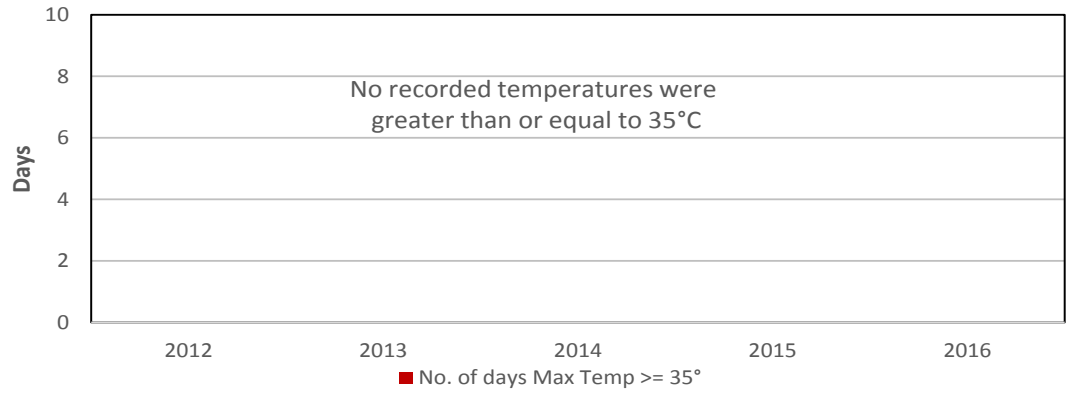
30°C or Greater



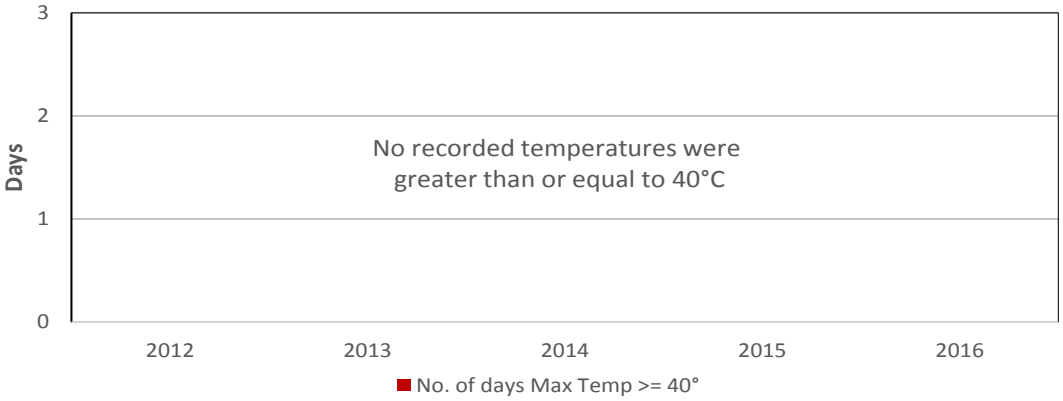
32.5°C or Greater



35°C or Greater

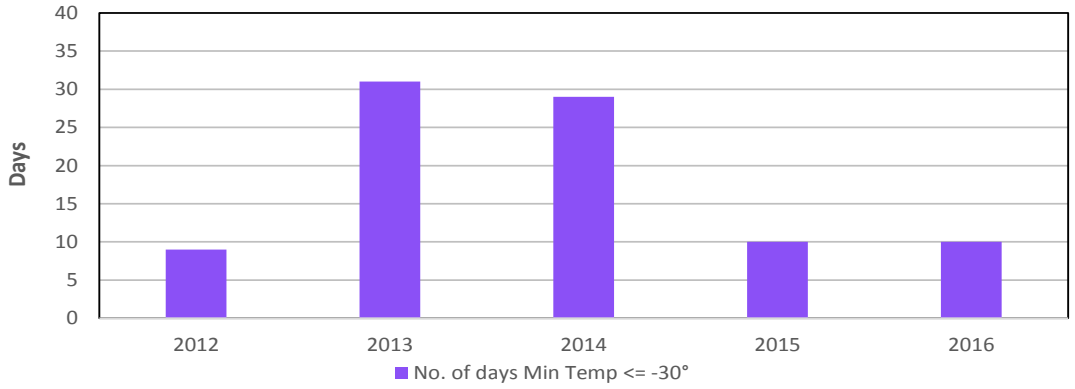


40°C or Greater

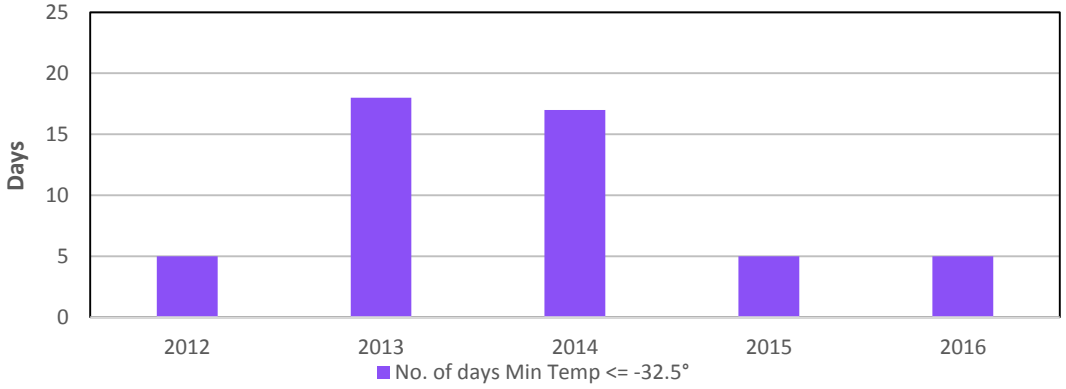


DAYS WITH TEMPERATURES LESS THAN A SET POINT

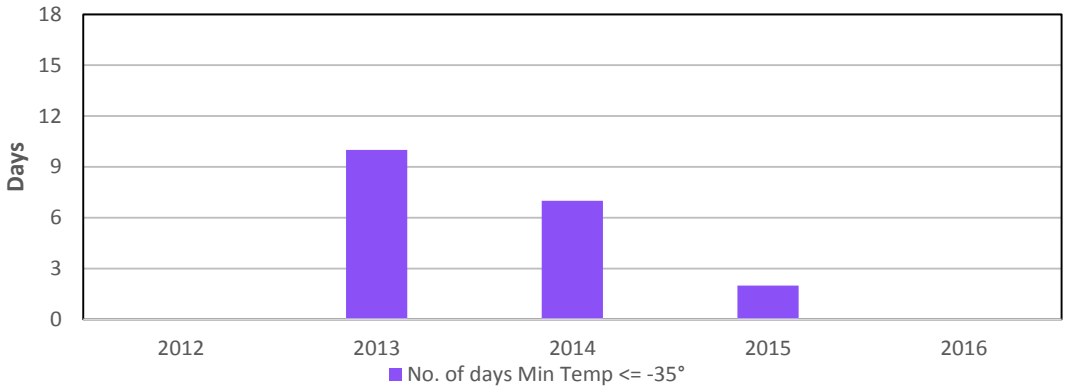
Minus 30°C or Less



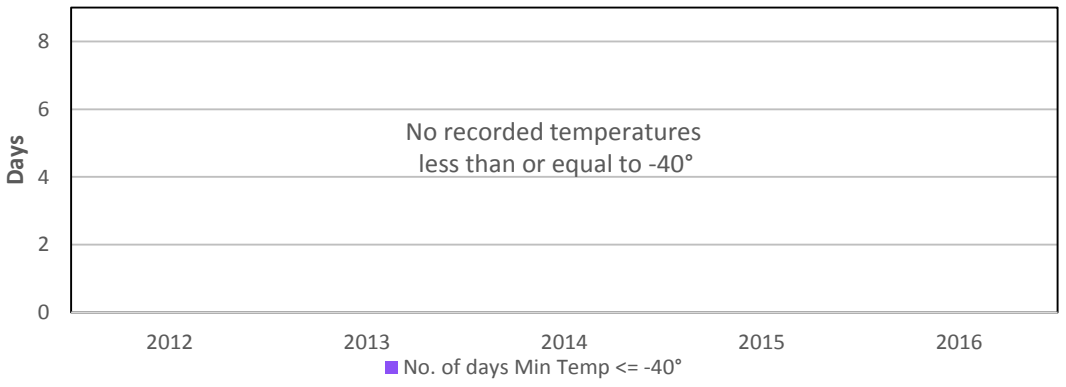
Minus 32.5°C or Less



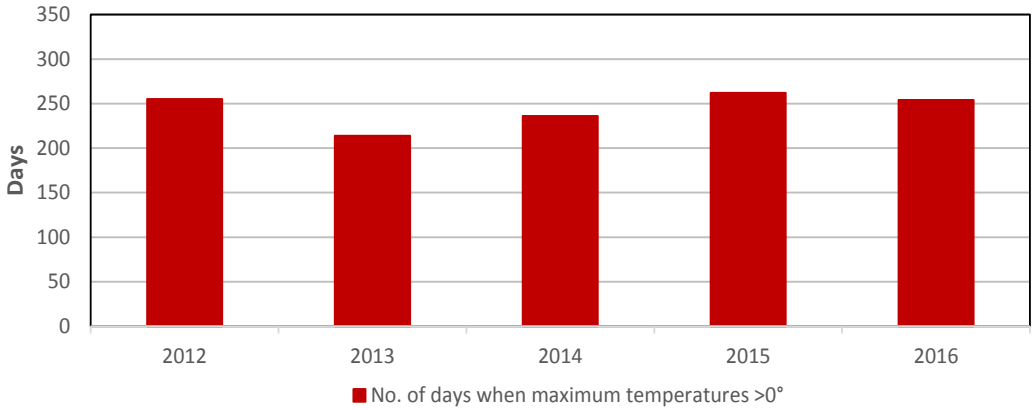
Minus 35° or Less



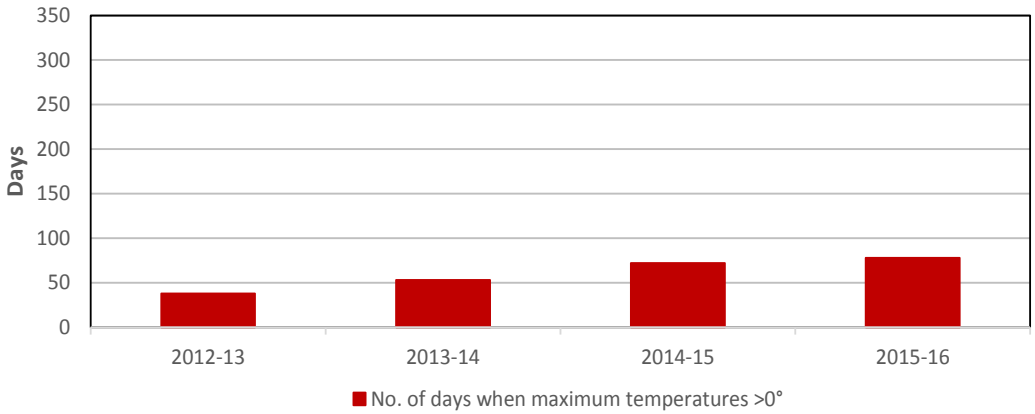
Minus 40°C or Less



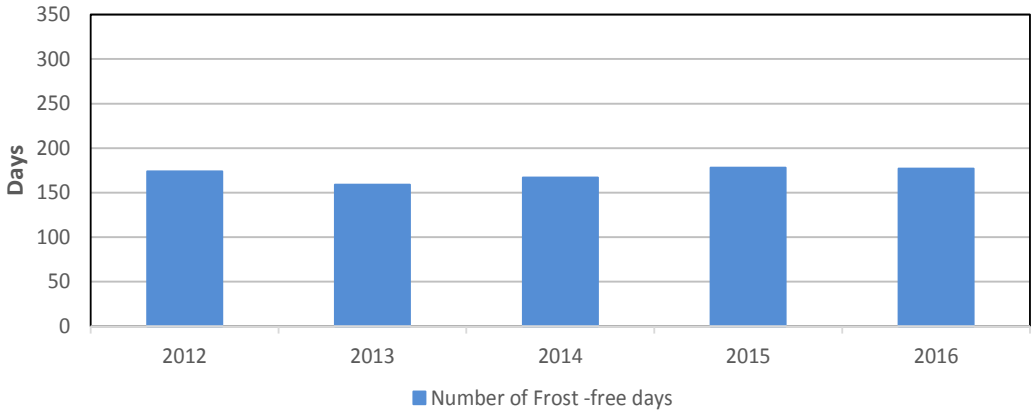
Days with Temperature Greater than 0°C



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)



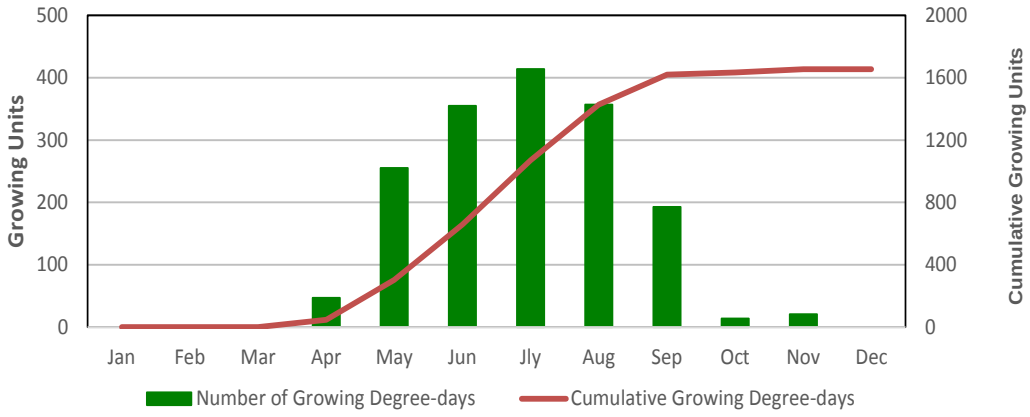
Minimum Temperature greater than 0°C (Frost-free Days)

Extreme Frost Event
Conservation Learning Centre
23 Dec 2014
Photo credit: R. Jansen

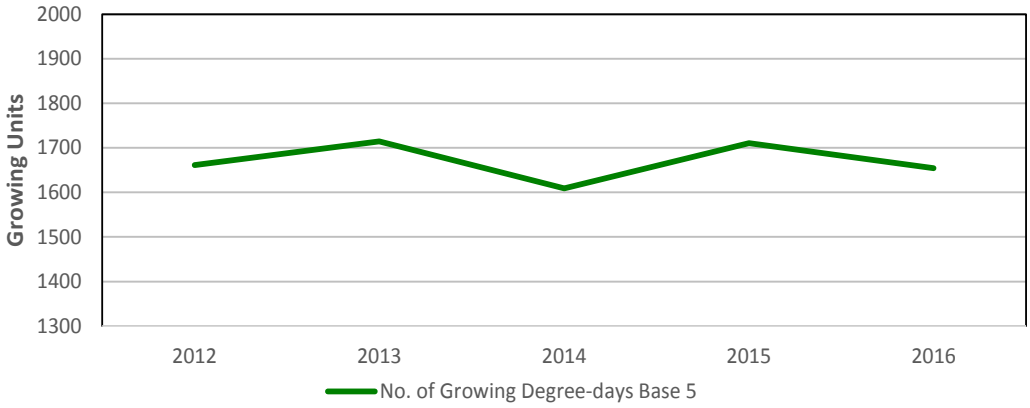
Degree-Days

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	
	2016	Cumulative	2016	Cumulative	2016	Cumulative	2016	Cumulative
January	0.0	0.0	972.6	972.6	0.0	0.0	0.0	0.0
February	0.0	0.0	841.5	1814.1	0.0	0.0	0.0	0.0
March	0.0	0.0	681.4	2495.5	0.0	0.0	0.0	0.0
April	46.7	46.7	425.9	2921.4	0.0	0.0	0.0	0.0
May	255.3	302.0	157.6	3079.0	5.0	5.0	0.0	0.0
June	354.8	656.8	53.5	3132.5	18.3	23.3	0.0	0.0
July	413.7	1070.5	14.6	3147.1	25.3	48.6	0.0	0.0
August	356.6	1427.1	56.3	3203.4	9.9	58.5	0.0	0.0
September	192.9	1620.0	198.4	3401.8	1.3	59.8	0.0	0.0
October	13.8	1633.8	519.9	3921.7	0.0	59.8	0.0	0.0
November	20.6	1654.4	518.5	4440.2	0.0	59.8	0.0	0.0
December	0.0	1654.4	1032.3	5472.5	0.0	59.8	0.0	0.0

Growing Degree-days Monthly

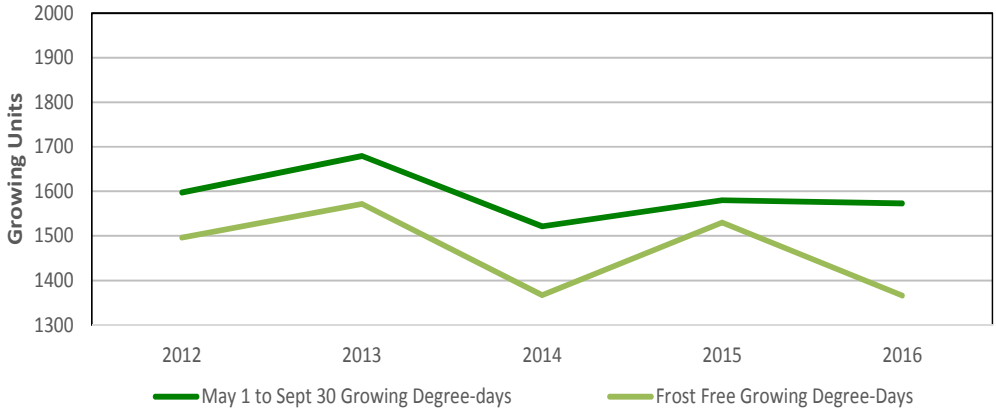


Growing Degree-days Annual



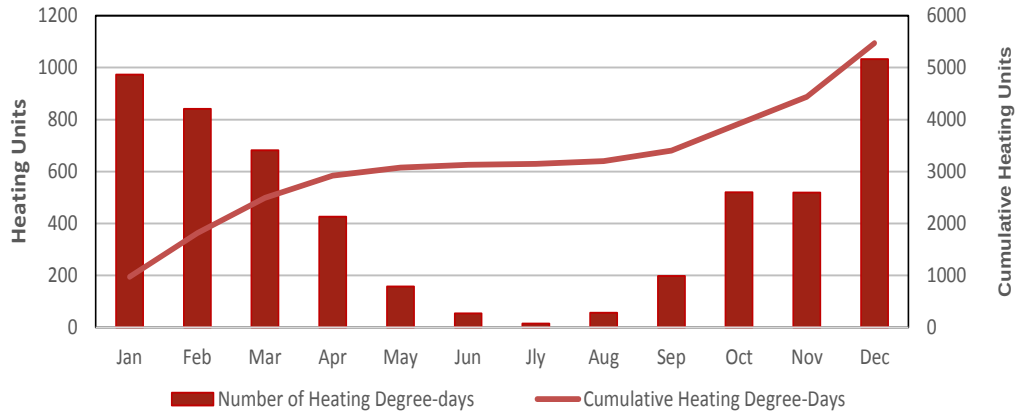
Growing Degree-days May 1 to September 30 base 5C

Growing Degree-days in frost free period base 5C

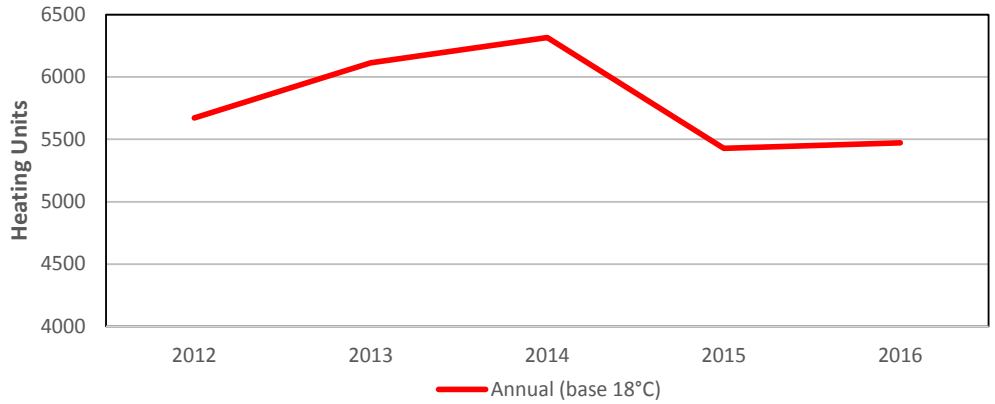


Degree-Days

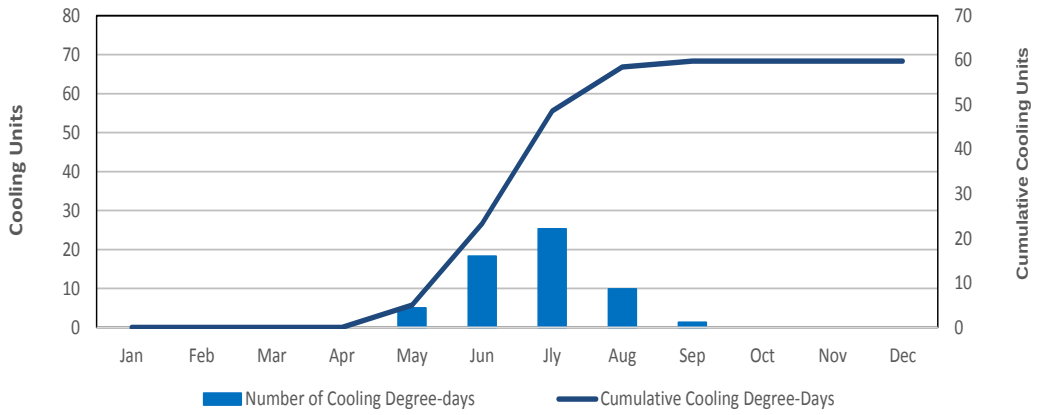
Heating Degree-days Monthly



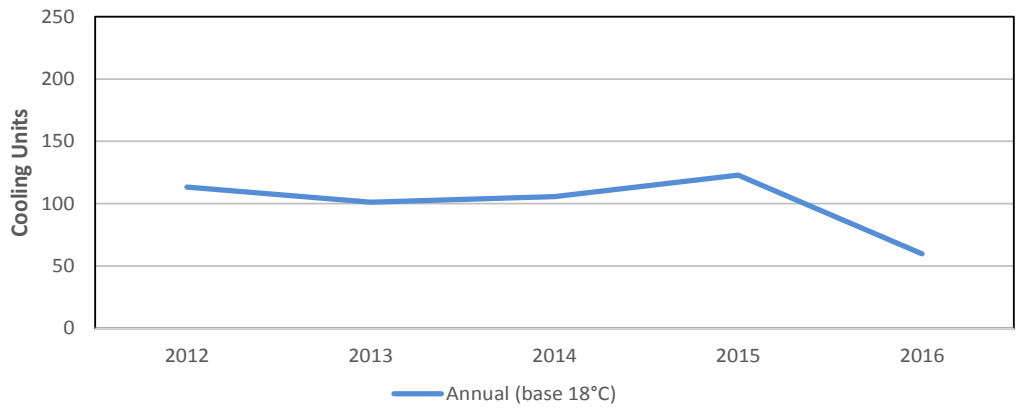
Heating Degree-days Annual



Cooling Degree-days Monthly

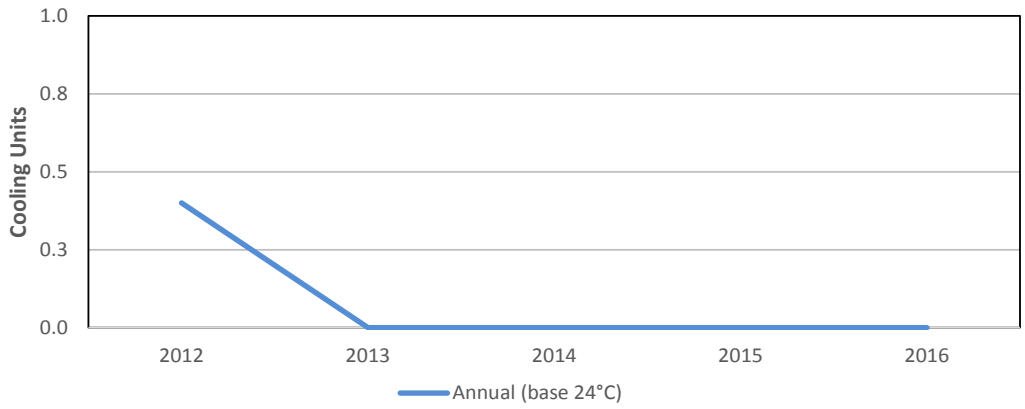


Cooling Degree-days Annual



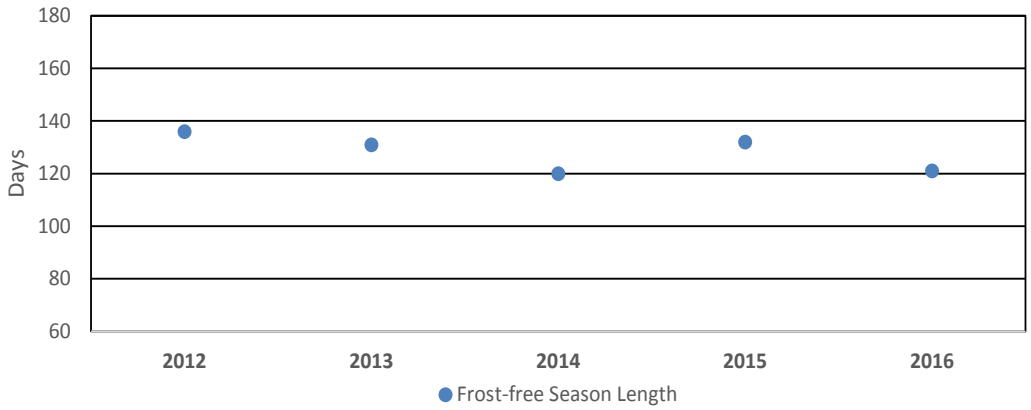
Degree-Days

Extreme Cooling Degree-days Annual

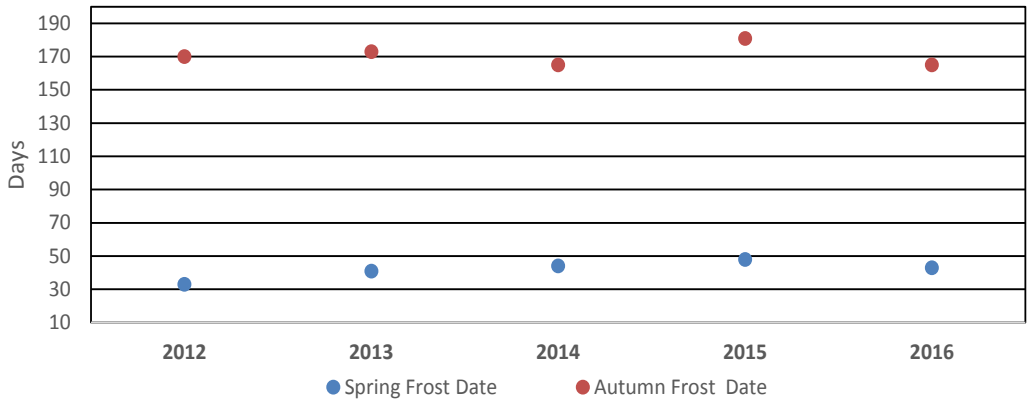


DATES & DURATION OF THE FROST-FREE SEASON			
YEAR	LAST SPRING FROST	FIRST FALL FROST	Frost-free Season Length
2012	May 3	Sept 17	136
2013	May 10	Sept 19	131
2014	May 14	Sept 12	120
2015	May 18	Sept 28	132
2016	May 13	Sept 13	122

Frost-free Growing Season Duration



Frost-free Growing Season End Points



Temperature 2016

Daily Maximum

2016	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-1.9	-10.1	-6.0	7.7	21.9	21.6	21.9	21.0	26.3	11.4	2.3	-3.7
2	-1.7	-6.4	-7.7	10.2	26.4	24.8	23.1	24.6	22.4	16.5	3.7	-3.1
3	-7.1	-7.6	-6.4	-3.6	26.0	22.1	24.1	20.4	20.5	14.1	10.3	-2.2
4	-2.4	-9.6	-0.2	0.8	32.4	25.3	20.9	22.2	12.9	6.9	11.9	-0.7
5	-7.9	-7.3	11.1	3.0	24.2	22.4	22.6	24.8	13.6	0.4	16.8	-4.9
6	-10.4	3.8	2.1	8.6	17.3	22.0	19.9	27.3	17.9	0.4	13.4	-14.9
7	-10.7	-2.1	-2.1	2.4	26.2	24.7	23.7	26.0	15.2	2.1	12.5	-15.5
8	-17.6	-3.7	-0.1	1.0	29.2	27.9	23.2	22.7	20.4	-0.6	12.0	-19.7
9	-20.1	-7.0	1.0	2.5	13.4	30.1	24.8	19.8	16.3	0.4	18.4	-22.0
10	-19.0	-7.5	11.0	-3.2	7.5	17.7	21.8	20.8	22.5	1.2	10.5	-19.7
11	-16.1	-12.7	8.1	4.2	4.7	20.4	18.1	20.7	14.6	0.0	13.5	-17.3
12	-12.6	-20.0	5.2	17.5	4.6	22.6	20.2	24.0	8.0	2.2	10.4	-19.5
13	-12.8	-7.9	5.8	9.8	12.9	25.8	21.2	25.8	16.4	0.2	10.4	-15.5
14	-11.5	4.1	4.1	13.0	17.0	27.6	21.3	26.9	23.4	0.4	12.5	-19.9
15	-19.4	-4.9	0.6	6.5	21.3	20.8	24.7	25.6	21.4	-2.0	6.8	-18.2
16	-22.4	-4.8	-6.0	11.6	24.2	20.5	24.6	28.8	24.1	-0.3	1.7	-25.3
17	-17.2	5.2	-5.1	17.0	23.7	18.6	22.6	24.1	20.2	1.6	-1.8	-22.0
18	-17.4	-1.6	-3.2	22.0	25.4	24.7	25.8	19.8	14.7	2.2	-6.0	-2.6
19	-12.5	-1.2	-2.0	22.8	25.5	18.6	28.1	18.8	15.8	0.5	-7.3	0.9
20	-12.9	-7.5	-1.6	14.9	23.8	22.4	27.0	22.0	14.2	4.5	-0.7	0.7
21	-11.2	-5.8	-2.3	8.0	25.0	24.5	24.0	22.1	15.8	9.3	-0.7	-0.8
22	-4.7	-0.9	-5.4	10.6	20.2	25.8	24.8	25.8	19.1	1.0	-0.9	-3.5
23	-6.1	2.7	-0.5	9.1	16.5	27.8	24.5	18.5	10.0	5.0	-1.6	-4.7
24	-5.0	-1.3	0.3	6.1	11.1	25.4	24.7	20.8	11.3	4.2	0.3	-21.4
25	-4.3	-0.4	0.0	10.5	20.1	22.6	23.9	23.3	17.0	8.1	1.1	-17.1
26	-0.7	6.7	5.3	13.1	24.9	15.2	25.1	16.8	20.4	5.7	1.8	-10.7
27	4.5	-0.3	2.5	16.6	17.7	25.0	25.8	23.1	23.3	3.3	-0.7	-9.9
28	0.6	-5.5	5.6	16.5	17.7	28.7	27.6	19.8	17.5	2.9	-2.4	-2.7
29	3.8	-14.2	10.1	17.2	15.0	23.7	25.4	18.4	15.6	5.6	-2.4	-6.0
30	1.6		7.2	19.6	18.0	22.0	27.5	20.5	19.9	4.5	-3.1	-8.4
31	-3.5		1.0		16.2		25.0	22.8		4.3		-8.7

Daily Minimum

2016	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-11.4	-21.6	-29.2	-5.2	4.0	4.8	11.3	11.6	12.2	9.0	-4.2	-6.5
2	-12.8	-18.7	-17.3	-5.0	5.1	12.3	12.0	13.4	12.1	4.3	-2.4	-5.2
3	-15.1	-19.7	-17.5	-7.2	8.4	11.3	14.0	10.5	8.1	1.9	0.8	-4.0
4	-16.4	-17.8	-8.2	-9.9	10.5	10.9	12.4	11.5	7.8	-0.2	-0.4	-10.2
5	-17.8	-12.8	-7.7	-2.6	10.5	11.7	10.0	9.1	6.4	-2.5	0.3	-15.0
6	-14.2	-11.8	-8.6	-1.7	5.1	6.4	13.2	9.9	2.6	-2.5	3.4	-17.2
7	-17.7	-10.3	-8.0	-3.7	3.0	11.0	11.9	9.2	7.4	-2.4	1.2	-19.9
8	-20.5	-14.7	-7.8	-7.7	9.6	13.0	10.6	13.8	2.5	-4.4	0.6	-25.9
9	-33.0	-11.4	-4.6	-4.0	6.6	14.5	15.5	11.8	4.2	-1.8	4.2	-27.6
10	-33.4	-13.7	-4.7	-8.9	3.6	8.6	15.0	11.1	3.3	-2.2	-1.8	-28.4
11	-19.9	-21.9	-4.0	-10.9	1.0	4.7	15.3	12.8	4.6	-2.4	-2.3	-26.1
12	-20.5	-31.4	-8.2	-2.8	-0.3	11.8	13.6	11.7	2.8	-4.4	0.6	-24.5
13	-15.9	-24.6	-0.6	1.6	-0.5	8.9	13.1	10.4	-0.9	-7.0	0.4	-23.4
14	-20.6	-12.5	-3.4	0.3	2.4	10.5	11.3	13.0	5.5	-2.1	-0.1	-25.1
15	-28.5	-15.5	-7.6	-2.5	0.4	11.0	9.3	14.1	5.5	-6.5	-1.5	-26.3
16	-32.6	-13.3	-10.0	-4.6	3.9	8.0	9.5	11.9	3.4	-3.6	-5.1	-30.3
17	-30.9	-9.9	-7.7	-2.6	8.6	6.0	13.1	13.2	7.0	-1.5	-8.8	-32.4
18	-32.7	-7.7	-8.7	0.2	7.1	7.5	11.6	11.2	8.8	-2.7	-11.8	-31.1
19	-19.2	-17.7	-15.6	3.4	7.2	10.8	15.0	9.7	6.3	-3.4	-10.1	-10.4
20	-21.9	-26.4	-13.9	0.0	12.1	7.4	15.0	7.4	2.8	-4.4	-9.7	-16.6
21	-20.4	-27.6	-9.5	-4.2	11.2	6.4	15.1	13.0	-1.2	-1.5	-10.1	-17.5
22	-13.5	-15.3	-10.4	1.2	12.0	8.1	12.3	11.9	0.9	-4.5	-3.9	-12.2
23	-9.7	-16.0	-11.0	1.4	6.3	11.4	16.3	10.1	6.8	-2.8	-4.2	-21.4
24	-9.3	-15.8	-9.3	-0.9	7.1	16.8	13.6	9.3	7.9	1.5	-2.0	-26.7
25	-8.3	-17.7	-11.6	-2.1	5.9	13.5	14.1	6.5	5.5	2.2	-3.8	-23.5
26	-13.3	-10.1	-4.5	0.0	8.3	11.4	10.5	9.7	0.2	1.9	-7.8	-20.7
27	-5.3	-15.2	-8.8	2.6	9.5	11.8	10.6	7.6	4.1	0.6	-6.1	-22.4
28	-9.1	-24.1	-8.6	1.2	7.1	15.5	12.8	8.8	2.4	0.8	-5.4	-17.2
29	-4.9	-34.5	-4.4	3.1	8.1	13.1	14.6	5.0	7.2	0.7	-3.7	-12.4
30	-9.9		-1.6	3.4	7.5	7.9	12.3	5.6	7.4	-0.5	-6.2	-13.9
31	-10.2		-5.8		7.9		13.3	8.5		0.8		-13.8

Daily Mean

2016	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-6.7	-15.9	-17.6	1.3	13.0	13.2	16.6	16.3	19.3	10.2	-1.0	-5.1
2	-7.3	-12.6	-12.5	2.6	15.8	18.6	17.6	19.0	17.3	10.4	0.7	-4.2
3	-11.1	-13.7	-12.0	-5.4	17.2	16.7	19.1	15.5	14.3	8.0	5.6	-3.1
4	-9.4	-13.7	-4.2	-4.6	21.5	18.1	16.7	16.9	10.4	3.4	5.8	-5.5
5	-12.9	-10.1	1.7	0.2	17.4	17.1	16.3	17.0	10.0	-1.1	8.6	-10.0
6	-12.3	-4.0	-3.3	3.5	11.2	14.2	16.6	18.6	10.3	-1.1	8.4	-16.1
7	-14.2	-6.2	-5.1	-0.7	14.6	17.9	17.8	17.6	11.3	-0.2	6.9	-17.7
8	-19.1	-9.2	-4.0	-3.4	19.4	20.5	16.9	18.3	11.5	-2.5	6.3	-22.8
9	-26.6	-9.2	-1.8	-0.8	10.0	22.3	20.2	15.8	10.3	-0.7	11.3	-24.8
10	-26.2	-10.6	3.2	-6.1	5.6	13.2	18.4	16.0	12.9	-0.5	4.4	-24.1
11	-18.0	-17.3	2.1	-3.4	2.9	12.6	16.7	16.8	9.6	-1.2	5.6	-21.7
12	-16.6	-25.7	-1.5	7.4	2.2	17.2	16.9	17.9	5.4	-1.1	5.5	-22.0
13	-14.4	-16.3	2.6	5.7	6.2	17.4	17.2	18.1	7.8	-3.4	5.4	-19.5
14	-16.1	-4.2	0.4	6.7	9.7	19.1	16.3	20.0	14.5	-0.9	6.2	-22.5
15	-24.0	-10.2	-3.5	2.0	10.9	15.9	17.0	19.9	13.5	-4.3	2.7	-22.3
16	-27.5	-9.1	-8.0	3.5	14.1	14.3	17.1	20.4	13.8	-2.0	-1.7	-27.8
17	-24.1	-2.4	-6.4	7.2	16.2	12.3	17.9	18.7	13.6	0.1	-5.3	-27.2
18	-25.1	-4.7	-6.0	11.1	16.3	16.1	18.7	15.5	11.8	-0.3	-8.9	-16.9
19	-15.9	-9.5	-8.8	13.1	16.4	14.7	21.6	14.3	11.1	-1.5	-8.7	-4.8
20	-17.4	-17.0	-7.8	7.5	18.0	14.9	21.0	14.7	8.5	0.0	-5.2	-8.0
21	-15.8	-16.7	-5.9	1.9	18.1	15.5	19.6	17.6	7.3	3.9	-5.4	-9.2
22	-9.1	-8.1	-7.9	5.9	16.1	17.0	18.6	18.9	10.0	-1.8	-2.4	-7.9
23	-7.9	-6.7	-5.8	5.3	11.4	19.6	20.4	14.3	8.4	1.1	-2.9	-13.1
24	-7.2	-8.6	-4.5	2.6	9.1	21.1	19.2	15.1	9.6	2.9	-0.9	-24.1
25	-6.3	-9.1	-5.8	4.2	13.0	18.1	19.0	14.9	11.3	5.2	-1.4	-20.3
26	-7.0	-1.7	0.4	6.6	16.6	13.3	17.8	13.3	10.3	3.8	-3.0	-15.7
27	-0.4	-7.8	-3.2	9.6	13.6	18.4	18.2	15.4	13.7	2.0	-3.4	-16.2
28	-4.3	-14.8	-1.5	8.9	12.4	22.1	20.2	14.3	10.0	1.9	-3.9	-10.0
29	-0.6	-24.4	2.9	10.2	11.6	18.4	20.0	11.7	11.4	3.2	-3.1	-9.2
30	-4.2		2.8	11.5	12.8	15.0	19.9	13.1	13.7	2.0	-4.7	-11.2
31	-6.9		-2.4		12.1		19.2	15.7		2.6		-11.3

Temperature Events 2016

Cold Spell (less than or equal to -30°C)	
Date	Temperature (°C)
January 9	-33.0
January 10	-33.4
January 16	-32.6
January 17	-30.9
January 18	-32.7
February 12	-31.4
February 29	-34.5
December 16	-30.3
December 17	-32.4
December18	-31.1

Hot Spell (greater than or equal to 30°C)	
Date	Temperature (°C)
May 4	32.4
June 9	30.1

Temperature and
Relative Humidity sensor
28 June 2016
Photo: R. Jansen

Precipitation 2016

Extreme Precipitation Events		
Period	Date	Amount (mm)
0.5 Hour	Aug 8	20.8
0.5 Hour	July 4	12.0
1 Hour	Aug 8	35.2
1 Hour	July 4	19.0
2 Hours	Aug 8	44.6
2 Hours	July 4	22.8
6 Hours	Aug 8	44.6
6 Hours	July 4	22.8
12 Hours	Aug 8	47.2
12 Hours	July 4	23.0
24 Hours	Aug 8	47.2
24 Hours	Aug 9	40.2
Calendar Day	Aug 8	47.2
Calendar Day	July 4	25.8
More than one day	Aug 8-9	50.6
Longest wet spells	Jan 31-Feb 5 Jul 3-8 Aug 7-12 Oct 4-9	6 Days
Longest dry spell*	Apr 14-May 4	21 Days

* Weighing Gauge Value

Ranking By Driest Month	
	Amount (mm)
April	4.6
December	7.3
November	11.7
February	14.2
March	18.1
January	18.2
May	19.5
September	28.0
June	45.8
October	58.2
July	72.5
August	79.5

Daily Precipitation Values

2016	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.2
2	0.0	0.2	0.0	0.0	0.0	7.7	0.0	0.0	0.0	0.0	0.0	0.4
3	0.0	0.6	1.6	0.4	0.0	1.0	2.7	0.4	0.0	0.0	0.0	0.0
4	0.0	0.3	0.1	0.0	0.0	0.0	26.6	0.0	0.0	13.1	0.0	0.0
5	0.0	0.4	0.0	0.0	0.1	1.2	0.1	0.0	0.0	11.9	0.0	0.2
6	3.5	0.0	0.0	2.5	0.0	0.0	12.5	0.0	0.0	4.7	0.0	0.1
7	3.8	0.1	3.7	0.0	0.1	0.0	0.9	0.2	0.0	1.7	0.0	0.1
8	0.2	0.0	0.0	0.0	0.0	0.0	1.4	50.2	0.0	0.1	0.0	0.0
9	0.2	2.4	0.1	0.7	3.0	0.0	0.0	0.4	0.0	11.3	0.0	0.0
10	0.1	0.3	0.0	0.0	8.4	0.1	5.2	1.1	0.1	0.0	0.0	0.2
11	0.0	0.1	0.0	0.0	5.1	5.1	8.0	1.3	1.8	0.8	0.0	0.4
12	0.1	0.1	0.0	0.0	0.0	1.7	3.3	0.1	0.0	0.0	0.1	0.3
13	0.0	0.1	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1	0.0
14	0.7	0.0	1.2	0.0	0.0	0.0	0.4	12.1	0.0	7.4	0.0	0.0
15	0.2	0.5	3.6	0.0	0.0	0.8	0.0	0.0	0.0	0.3	0.0	0.0
16	0.0	0.0	1.2	0.0	0.0	12.3	0.0	0.0	0.0	4.1	3.8	0.1
17	0.1	0.0	2.1	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0
18	0.5	0.0	0.9	0.0	0.0	0.0	0.0	0.9	8.9	0.0	0.1	1.5
19	0.1	2.4	0.0	0.0	0.0	8.4	0.1	0.1	0.0	0.3	0.0	0.3
20	0.0	2.2	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.6	0.0
21	0.1	0.0	0.0	0.0	0.0	0.0	0.5	0.6	0.0	0.0	0.5	1.1
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0
23	8.4	0.0	2.1	0.0	1.1	0.0	4.2	0.4	16.8	0.1	0.0	0.4
24	0.0	0.1	0.4	0.0	0.0	0.1	0.0	6.0	0.4	0.0	1.6	0.2
25	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0	1.0
26	0.0	0.0	1.0	0.0	0.0	5.6	0.0	3.9	0.0	0.0	0.0	0.0
27	0.0	3.9	0.0	0.0	0.0	0.6	0.2	0.0	0.0	0.4	0.0	0.4
28	0.0	0.3	0.0	0.0	0.2	1.0	1.7	0.0	0.0	0.6	0.0	0.0
29	0.0	0.1	0.0	0.0	1.5	0.0	0.2	0.0	0.0	0.0	0.8	0.0
30	0.0		0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.1	0.4
31	0.2		0.0	0.0	0.0	0.0	3.6	0.0		0.0		0.0
Total	**18.2**	**14.2**	**18.1**	**4.6**	**19.5**	**45.8**	**72.5**	**79.5**	**28.0**	**58.2**	**11.7**	**7.3**

Precipitation 2016

Month	AMOUNT (mm)		RECORD VALUES (mm)		Days with Measurable Precipitation		Month end Snow-on-Ground (cm)		
	2016	Cumulative	CRS Maximum	CRS Minimum	2016	Cumulative	2016	CRS Maximum	CRS Minimum
January	18.2	18.2	26.0/2013	8.9/2014	14	14	20	56/2013	2/2012
February	14.2	32.4	18.3/2015	8.0/2012	18	32	28	64/2013	7/2012
March	18.1	50.5	19.0/2012	6.5/2015	13	45	5	76/2013	0/2015
April	4.6	55.1	52.5/2014	4.6/2016	4	49	0	52/2013	0/2015
May	19.5	74.6	85.4/2012	6.8/2013	8	57	0	0	0
June	45.8	120.4	140.4/2012	45.0/2015	14	71	0	0	0
July	72.5	192.9	176.6/2015	72.5/2016	19	90	0	0	0
August	79.5	272.4	79.5/2016	5.8/2013	15	105	0	0	0
September	28.0	300.4	64.8/2015	11.0/2014	5	110	0	0	0
October	58.2	358.6	58.2/2016	5.6/2013	18	128	0	5/2012	0/2015
November	11.7	370.3	34.6/2013	11.7/2016	11	139	0	242013	0/2016
December	7.3	377.6	15.1/2013	2.4/2015	17	156	5	40/2013	5/2016
Total	377.6				156		58.0		

RANKING BY DRIEST YEAR (mm)

ANNUAL (JAN-DEC)		WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2013	340.0	2012*	25.6*	2013	29.4	2016	197.8	2014	51.3
2016	377.6	2014	33.9	2016	42.2	2013	207.6	2013	53.6
2014	450.2	2016	34.8	2015	55.4	2014	268.8	2012	75.9
2015	489.5	2015	36.4	2014	106.6	2015	283.4	2016	97.9
2012	593.5	2013	46.5	2012	146.0	2012	333.8	2015	116.6

*Missing December 2011

ANNUAL RANKING BY DAYS WITH PRECIPITATION

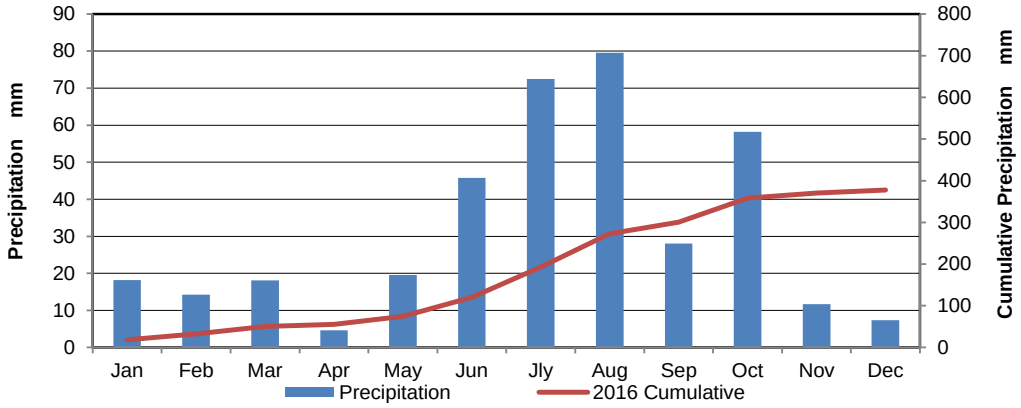
ANNUAL (JAN-DEC)		WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2012	165	2016	38	2012	49	2016	48	2012	36
2016	156	2012*	30	2014	29	2012	42	2014	36
2014	127	2014	28	2015	28	2014	39	2016	34
2015	119	2015	27	2016	25	2013	36	2015	31
2013	104	2013	26	2013	11	2015	36	2013	25

*Missing December 2011

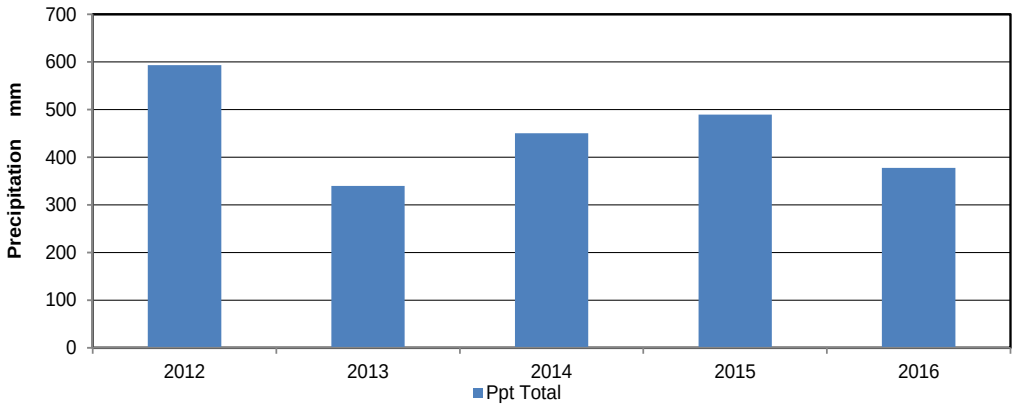
RANKING BY

Total Number of Dry Days		Maximum Length of Dry Spell		Maximum Length of Wet Spell	
2013	261	2012	21	2015	9
2015	250	2016	21	2013	8
2014	239	2014	17	2014	7
2016	210	2013	15	2016	6
2012	200	2015	14	2012	5

Monthly

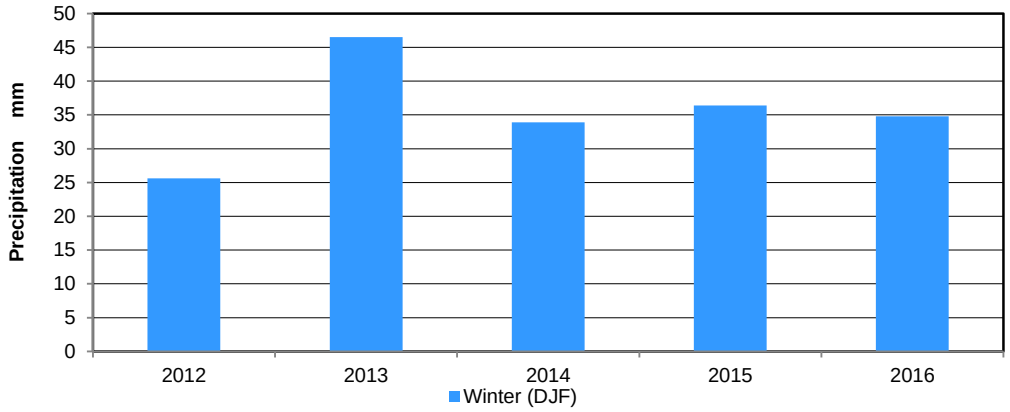


Annual

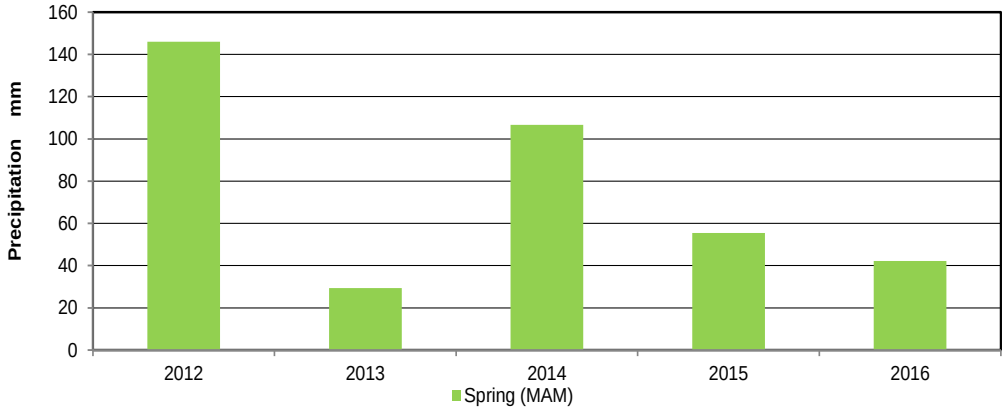


SEASONAL PRECIPITATION

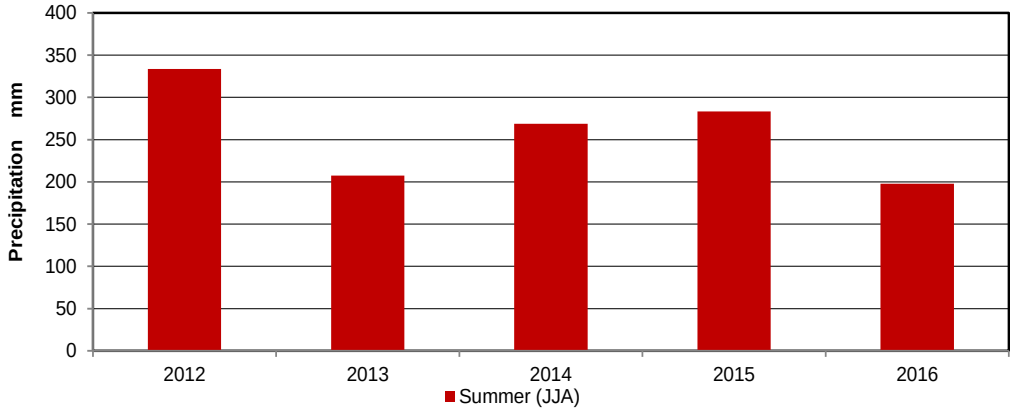
Winter



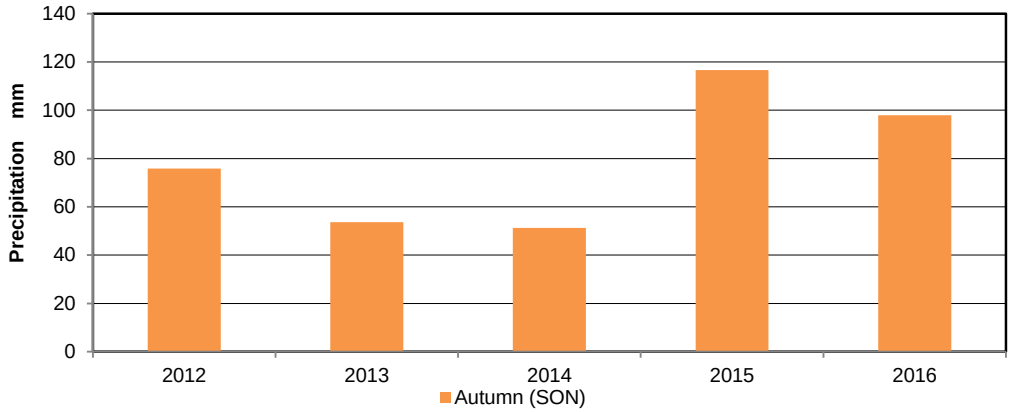
Spring



Summer

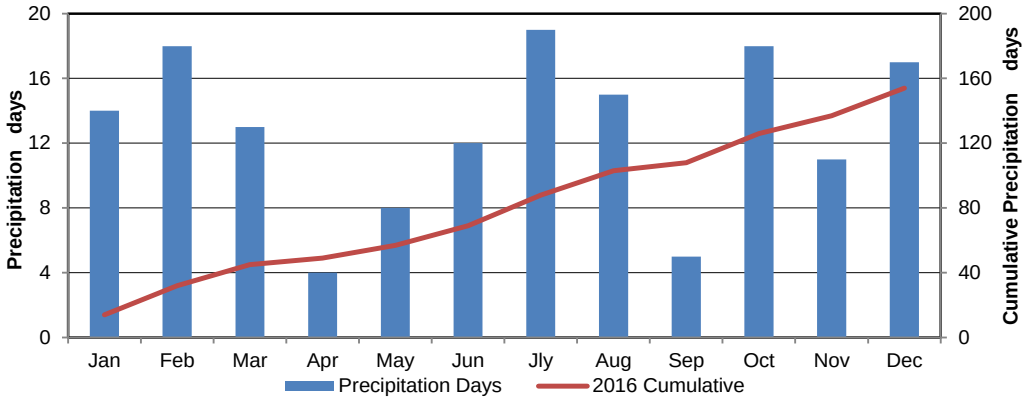


Autumn

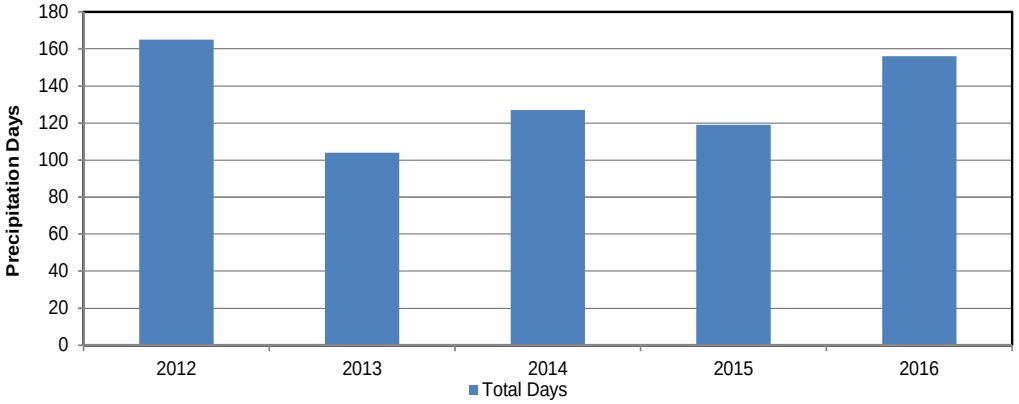


SEASONAL PRECIPITATION DAYS

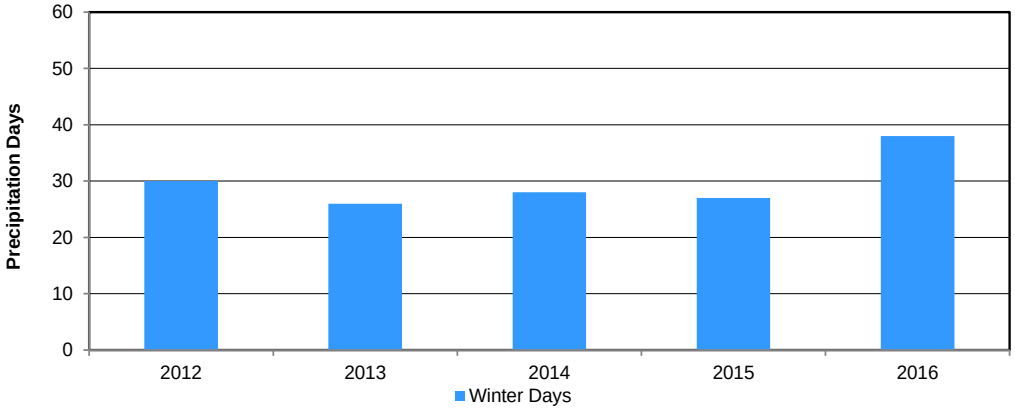
Monthly



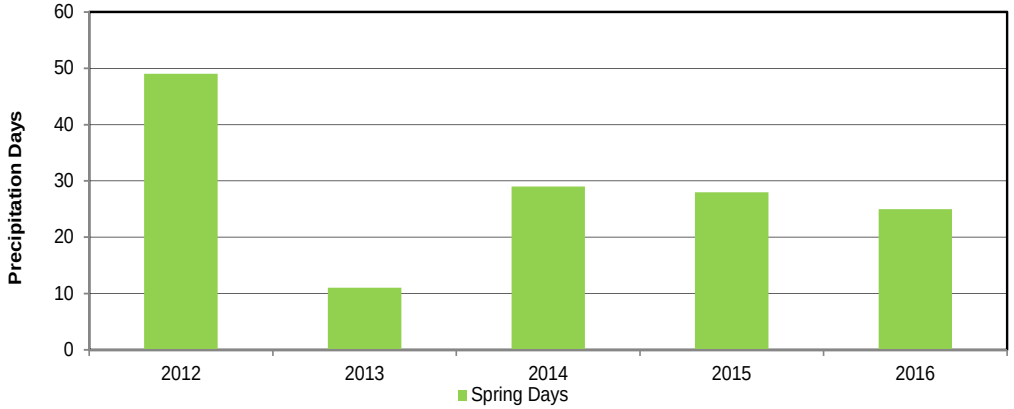
Annual



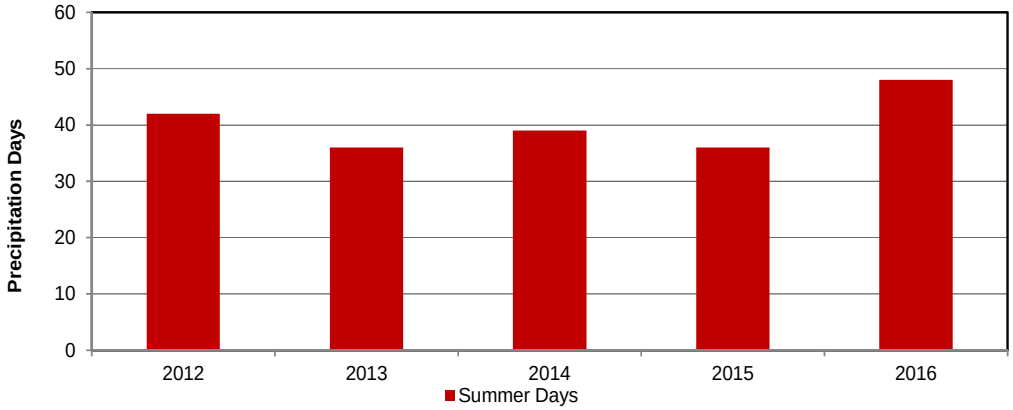
Winter



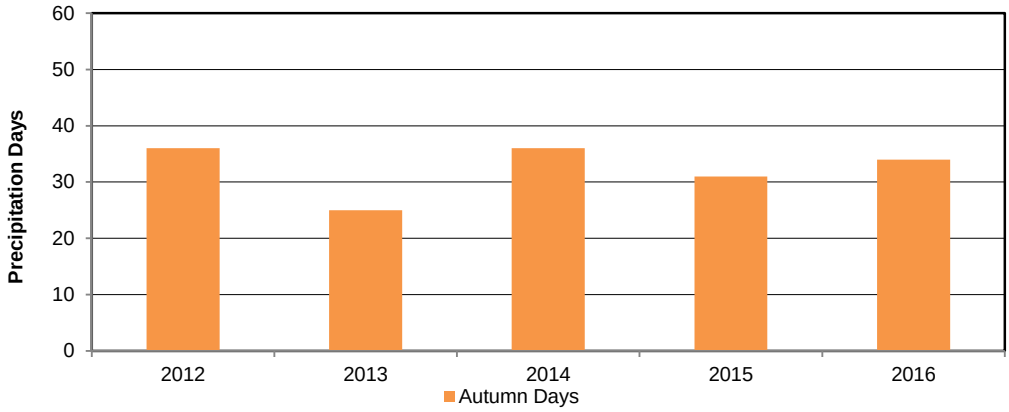
Spring



Seasonal Precipitation Days



Summer

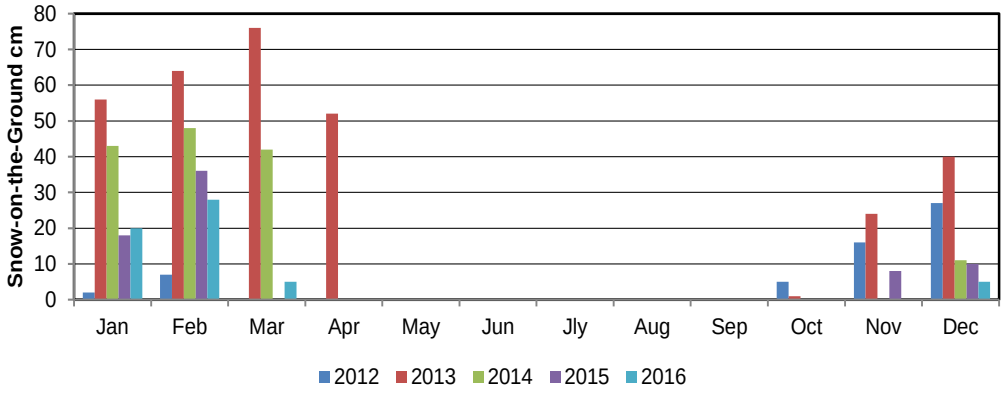


Autumn

Electroninic snow depth
28 June, 2016
photo credit: R. Jansen

Weighing gage
28 June 2016
photo credit: R. Jansen

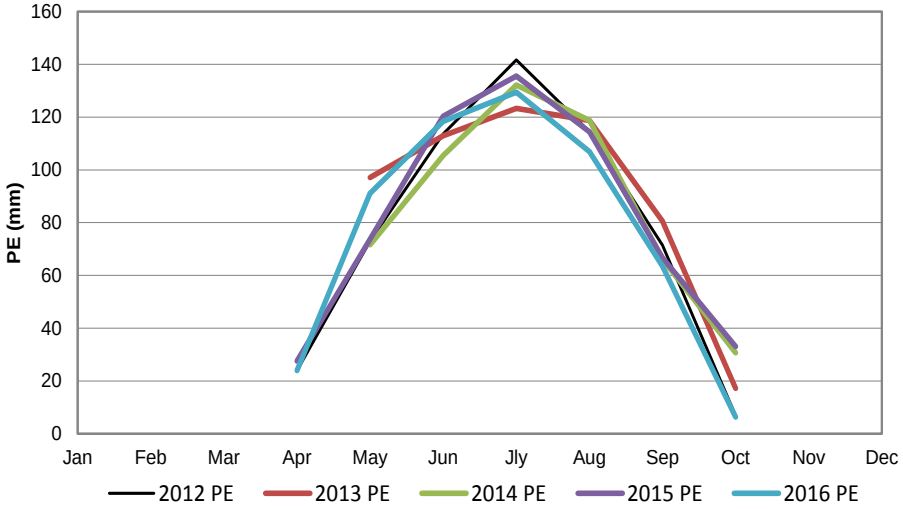
Precipitation 2016



End of the Month Snow-on-the Ground

*November 2014 Snow depth data unavailable

Potential Evapotranspiration (PE) using the Thornthwaite Method[1]



Month	2012 PE	2013 PE	2014 PE	2015 PE	2016 PE
Jan					
Feb					
Mar					
Apr	24.0			27.6	24.0
May	73.0	97.1	71.6	73.6	91.1
Jun	113.6	112.9	105.4	120.4	118.4
Jly	141.7	123.3	132.2	135.6	129.4
Aug	114.4	118.7	118.7	114.4	106.9
Sep	71.5	80.6	66.2	66.7	63.5
Oct	6.8	17.2	30.7	33.1	6.3
Nov					
Dec					
Total	545.0	549.9	543.8	571.4	539.6

1 Thornthwaite and Mather 1955
Thornthwaite 1948

Tipping bucket
28 June, 2016
photo credit: R Jansen

Radiation 2016

Sunrise & Sunset Tables for Conservation Learning Center, 2016 & 2017[1]

2016	January		February		March		April		May		June		July		August		September		October		November		December	
Date	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
1	9:15	17:05	8:47	17:53	7:51	18:47	6:40	19:42	5:35	20:33	4:51	21:18	4:51	21:30	5:29	20:56	6:19	19:53	7:08	18:43	8:03	17:37	8:54	16:58
2	9:15	17:06	8:46	17:55	7:49	18:49	6:37	19:43	5:33	20:35	4:51	21:19	4:51	21:30	5:30	20:54	6:21	19:50	7:10	18:40	8:05	17:35	8:55	16:57
3	9:15	17:07	8:44	17:57	7:46	18:51	6:35	19:45	5:31	20:36	4:50	21:20	4:52	21:29	5:32	20:52	6:22	19:48	7:12	18:38	8:07	17:33	8:56	16:57
4	9:15	17:08	8:42	17:59	7:44	18:53	6:33	19:47	5:30	20:38	4:49	21:21	4:53	21:29	5:33	20:51	6:24	19:46	7:14	18:36	8:08	17:31	8:58	16:56
5	9:14	17:09	8:41	18:01	7:42	18:55	6:31	19:49	5:28	20:40	4:49	21:22	4:54	21:28	5:35	20:49	6:26	19:43	7:15	18:33	8:10	17:30	8:59	16:56
6	9:14	17:11	8:39	18:03	7:40	18:56	6:28	19:50	5:26	20:41	4:48	21:23	4:55	21:27	5:37	20:47	6:27	19:41	7:17	18:31	8:12	17:28	9:00	16:55
7	9:14	17:12	8:37	18:05	7:37	18:58	6:26	19:52	5:24	20:43	4:48	21:24	4:56	21:27	5:38	20:45	6:29	19:39	7:19	18:29	8:14	17:26	9:01	16:55
8	9:13	17:13	8:36	18:07	7:35	19:00	6:24	19:54	5:22	20:45	4:47	21:25	4:57	21:26	5:40	20:43	6:30	19:36	7:20	18:27	8:16	17:25	9:03	16:55
9	9:13	17:15	8:34	18:08	7:33	19:02	6:21	19:55	5:21	20:46	4:47	21:26	4:58	21:25	5:41	20:41	6:32	19:34	7:22	18:24	8:17	17:23	9:04	16:55
10	9:12	17:16	8:32	18:10	7:31	19:03	6:19	19:57	5:19	20:48	4:46	21:26	4:59	21:25	5:43	20:39	6:34	19:32	7:24	18:22	8:19	17:21	9:05	16:54
11	9:11	17:18	8:30	18:12	7:28	19:05	6:17	19:59	5:17	20:49	4:46	21:27	5:00	21:24	5:45	20:37	6:35	19:29	7:26	18:20	8:21	17:20	9:06	16:54
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16	9:08	17:25	8:20	18:22	7:17	19:14	6:06	20:08	5:10	20:57	4:45	21:30	5:06	21:19	5:53	20:27	6:44	19:18	7:34	18:09	8:30	17:13	9:10	16:55
17	9:07	17:27	8:18	18:23	7:15	19:16	6:04	20:09	5:08	20:59	4:45	21:30	5:07	21:18	5:54	20:25	6:45	19:15	7:36	18:07	8:32	17:11	9:11	16:55
18	9:06	17:29	8:16	18:25	7:12	19:18	6:02	20:11	5:07	21:00	4:45	21:31	5:08	21:16	5:56	20:23	6:47	19:13	7:38	18:05	8:33	17:10	9:12	16:55
19	9:05	17:30	8:14	18:27	7:10	19:19	5:59	20:13	5:05	21:02	4:45	21:31	5:10	21:15	5:58	20:21	6:49	19:11	7:40	18:02	8:35	17:09	9:12	16:56
20	9:03	17:32	8:12	18:29	7:08	19:21	5:57	20:14	5:04	21:03	4:46	21:31	5:11	21:14	5:59	20:19	6:50	19:08	7:41	18:00	8:37	17:08	9:13	16:56
21	9:02	17:34	8:10	18:31	7:05	19:23	5:55	20:16	5:03	21:04	4:46	21:31	5:13	21:13	6:01	20:17	6:52	19:06	7:43	17:58	8:38	17:07	9:13	16:57
22	9:01	17:35	8:08	18:33	7:03	19:24	5:53	20:18	5:02	21:06	4:46	21:31	5:14	21:11	6:03	20:15	6:53	19:04	7:45	17:56	8:40	17:05	9:14	16:57
23	9:00	17:37	8:06	18:35	7:01	19:26	5:51	20:20	5:00	21:07	4:46	21:31	5:15	21:10	6:04	20:13	6:55	19:01	7:47	17:54	8:42	17:04	9:14	16:58
24	8:59	17:39	8:04	18:36	6:58	19:28	5:49	20:21	4:59	21:09	4:47	21:31	5:17	21:08	6:06	20:10	6:57	18:59	7:48	17:52	8:43	17:03	9:15	16:58
25	8:57	17:41	8:02	18:38	6:56	19:30	5:47	20:23	4:58	21:10	4:47	21:31	5:18	21:07	6:08	20:08	6:58	18:57	7:50	17:50	8:45	17:02	9:15	16:59
26	8:56	17:42	8:00	18:40	6:54	19:31	5:45	20:25	4:57	21:11	4:48	21:31	5:20	21:05	6:09	20:06	7:00	18:54	7:52	17:48	8:46	17:01	9:15	17:00
27	8:55	17:44	7:57	18:42	6:51	19:33	5:43	20:26	4:56	21:12	4:48	21:31	5:21	21:04	6:11	20:04	7:02	18:52	7:54	17:46	8:48	17:01	9:15	17:01
28	8:53	17:46	7:55	18:44	6:49	19:35	5:41	20:28	4:55	21:14	4:49	21:31	5:23	21:02	6:12	20:02	7:03	18:50	7:56	17:44	8:49	17:00	9:15	17:02
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31	8:49	17:52			6:42	19:40			4:52	21:17			5:27	20:58	6:17	19:55			8:01	17:39			9:15	17:05

2017	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	9:17	16:57	8:46	17:48	7:49	18:42	6:36	19:39	5:29	20:33	4:42	21:21	4:41	21:33	5:21	20:57	6:13	19:51	7:05	18:39	8:02	17:31	8:55	16:49
2	9:17	16:58	8:45	17:50	7:47	18:44	6:33	19:41	5:27	20:35	4:41	21:22	4:42	21:33	5:22	20:55	6:15	19:49	7:07	18:37	8:04	17:29	8:57	16:48
3	9:17	16:59	8:43	17:52	7:45	18:46	6:31	19:43	5:25	20:36	4:41	21:23	4:42	21:32	5:24	20:54	6:17	19:47	7:09	18:34	8:06	17:27	8:58	16:48
4	9:17	17:00	8:41	17:54	7:43	18:48	6:29	19:44	5:23	20:38	4:40	21:24	4:43	21:32	5:25	20:52	6:18	19:44	7:10	18:32	8:08	17:25	8:59	16:47
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11	9:13	17:10	8:28	18:07	7:26	19:01	6:12	19:57	5:10	20:50	4:36	21:30	4:50	21:26	5:37	20:38	6:30	19:28	7:23	18:16	8:21	17:13	9:08	16:45
12	9:12	17:12	8:26	18:09	7:24	19:03	6:10	19:59	5:08	20:52	4:36	21:31	4:52	21:25	5:39	20:36	6:32	19:25	7:25	18:13	8:23	17:11	9:09	16:45
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14	9:10	17:15	8:22	18:13	7:19	19:06	6:05	20:02	5:05	20:55	4:36	21:32	4:54	21:23	5:42	20:32	6:36	19:20	7:29	18:09	8:27	17:08	9:11	16:45
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16	9:08	17:18	8:18	18:17	7:14	19:10	6:01	20:06	5:02	20:58	4:35	21:33	4:57	21:21	5:46	20:28	6:39	19:15	7:32	18:04	8:30	17:05	9:12	16:45
17	9:07	17:20	8:16	18:19	7:12	19:12	5:58	20:08	5:00	21:00	4:35	21:33	4:58	21:20	5:47	20:25	6:41	19:13	7:34	18:02	8:32	17:04	9:13	16:46
18	9:06	17:22	8:14	18:21	7:09	19:14	5:56	20:10	4:59	21:01	4:35	21:33	4:59	21:19	5:49	20:23	6:43	19:11	7:36	18:00	8:34	17:02	9:14	16:46
19	9:05	17:23	8:12	18:23	7:07	19:16	5:54	20:11	4:57	21:03	4:35	21:34	5:01	21:17	5:51	20:21	6:44	19:08	7:38	17:57	8:36	17:01	9:15	16:46
20	9:04	17:25	8:09	18:25	7:05	19:17	5:52	20:13	4:56	21:04	4:36	21:34	5:02	21:16	5:53	20:19	6:46	19:06	7:40	17:55	8:37	17:00	9:15	16:47
21	9:03	17:27	8:07	18:27	7:02	19:19	5:50	20:15	4:54	21:06	4:36	21:34	5:03	21:15	5:54	20:17	6:48	19:03	7:41	17:53	8:39	16:59	9:16	16:47
22	9:01	17:29	8:05	18:29	7:00	19:21	5:47	20:17	4:53	21:07	4:36	21:34	5:05	21:13	5:56	20:14	6:49	19:01	7:43	17:51	8:41	16:58	9:16	16:48
23	9:00	17:31	8:03	18:31	6:57	19:23	5:45	20:19	4:52	21:09	4:36	21:34	5:06	21:12	5:58	20:12	6:51	18:58	7:45	17:49	8:42	16:56	9:17	16:48
24	8:59	17:32	8:01	18:33	6:55	19:25	5:43	20:20	4:51	21:10	4:37	21:34	5:08	21:10	6:00	20:10	6:53	18:56	7:47	17:47	8:44	16:55	9:17	16:49
25	8:57	17:34	7:58	18:35	6:53	19:26	5:41	20:22	4:49	21:12	4:37	21:34	5:09	21:09	6:01	20:08	6:55	18:54	7:49	17:45	8:46	16:54	9:17	16:50
26	8:56	17:36	7:56	18:36	6:50	19:28	5:39	20:24	4:48	21:13	4:38	21:34	5:11	21:07	6:03	20:05	6:56	18:51	7:51	17:43	8:47	16:53	9:17	16:50
27	8:54	17:38	7:54	18:38	6:48	19:30	5:37	20:26	4:47	21:14	4:38	21:34	5:13	21:06	6:05	20:03	6:58	18:49	7:53	17:40	8:49	16:52	9:18	16:51
28	8:53	17:40	7:52	18:40	6:45	19:32	5:35	20:28	4:46	21:16	4:39	21:34	5:14	21:04	6:06	20:01	7:00	18:46	7:55	17:38	8:51	16:51	9:18	16:52
29	8:51	17:42			6:43	19:34	5:33	20:29	4:45	21:17	4:39	21:34	5:16	21:02	6:08	19:58	7:02	18:44	7:56	17:36	8:52	16:51	9:18	16:53
30	8:50	17:44			6:41	19:35	5:31	20:31	4:44	21:18	4:40	21:33	5:17	21:01	6:10	19:56	7:03	18:41	7:58	17:34	8:54	16:50	9:18	16:54
31	8:48	17:46			6:38	19:37			4:43	21:19			5:19	20:59	6:12	19:54			8:00	17:33			9:18	16:55

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

Radiation 2016

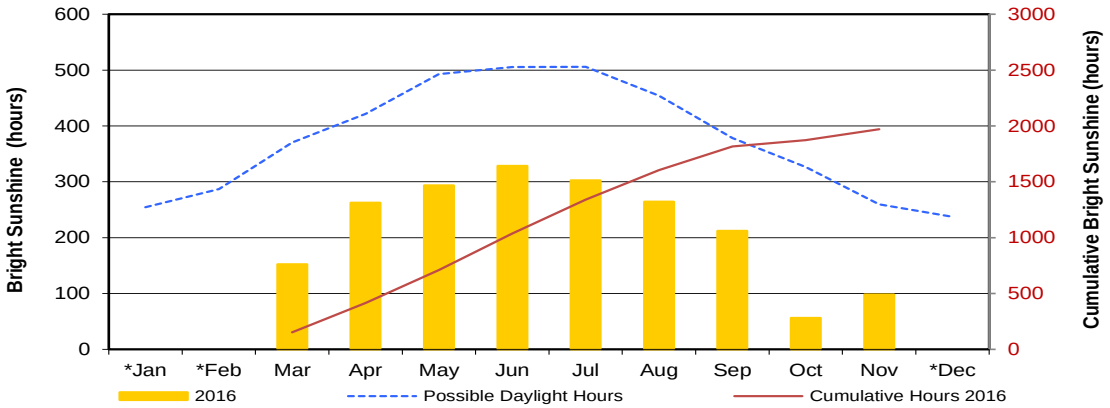
	Bright Sunshine Hours			Bright Sunshine Days			
Month	**2016 # of Hours**	**Possible hours[1]**	**% of Possible hrs**	**2016 # of Days**	**With 1 or > hours**	**With 5 or > hours**	**With 10 or > hours**
*Jan	M	253.7	M	0	0	0	0
*Feb	M	286.6	M	16	14	9	2
Mar	152.5	370.4	41.2	25	23	17	4
Apr	262.6	421.9	62.2	30	28	23	14
May	293.6	493.4	59.5	30	27	23	20
Jun	328.5	506.6	64.8	29	29	26	19
Jul	302.5	506.8	59.7	31	29	27	18
Aug	264.4	454.7	58.2	31	30	25	15
Sep	212.2	378.7	56.0	28	24	21	10
Oct	56.0	326.2	17.2	16	12	5	0
Nov	98.2	259.0	37.9	20	19	12	0
*Dec	M	236.3	M	M	M	M	M
Total	1970.5	4494.3	M	M	M	M	M

National Research Council, Canada, Hertzberg Institute of Astrophysics
* Missing or incomplete data due to Instrument Malfunction
M= Missing Data

Global and Diffuse Radiation (MJ/m²)

2016 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	3.8	0.7	3.7	3.4	8.3	7.4	15.4	4.4	23.2	7.6	22.8	9.7	19.4	11.0	14.4	10.5	9.0	In-	2.3	2.1	1.9	1.8	1.6	1.5
2	3.7	0.7	3.2	3.0	11.4	6.0	19.3	2.3	25.2	4.8	18.6	9.0	22.8	11.5	21.7	9.4	8.9	stru-	11.7	2.2	3.4	2.6	1.0	1.0
3	5.2	0.9	3.4	3.1	8.5	7.0	6.6	5.9	24.0	6.4	18.8	7.9	21.5	9.8	8.9	7.3	19.1	ment	9.8	4.2	5.3	2.2	1.0	0.9
4	3.9	1.3	3.6	3.3	7.8	7.2	17.2	5.4	26.0	4.8	27.5	7.0	21.0	10.1	23.3	12.5	9.7	Fail-	1.5	1.4	6.0	1.2	4.2	1.6
5	3.9	1.7	4.1	3.8	12.9	3.9	8.0	6.4	20.1	9.5	24.9	7.8	23.2	8.5	24.6	11.0	7.4	ure	3.2	2.9	6.9	1.3	2.3	1.9
6	2.1	2.0	6.1	3.0	13.7	4.0	13.0	7.1	23.3	7.9	27.1	7.5	12.2	9.5	22.7	9.5	15.2		6.3	5.8	4.5	2.8	2.6	1.7
7	2.4	2.2	5.2	3.2	5.1	4.7	12.4	7.8	22.8	9.9	16.5	9.4	20.2	7.7	16.6	6.2	10.7		8.9	7.2	6.3	0.9	2.8	1.9
8	2.2	2.1	4.0	3.6	7.1	6.6	16.9	5.8	22.8	7.9	26.0	7.0	16.1	8.8	10.1	8.9	15.1		8.0	6.3	3.3	2.8	3.2	1.7
9	3.6	1.7	4.0	3.7	8.1	7.4	6.2	5.0	5.3	4.6	24.2	8.0	26.5	7.1	10.6	9.0	12.8	8.2	2.0	1.8	4.8	1.3	4.9	0.9
10	2.1	1.9	4.2	3.9	10.6	8.2	14.3	8.9	4.4	3.8	11.6	10.2	13.6	10.0	11.5	9.6	11.5	5.0	5.9	5.4	5.4	0.9	4.8	1.0
11	3.4	2.2	5.6	3.9	14.6	2.4	21.7	4.6	6.3	5.5	20.7	10.2	4.4	3.8	10.8	9.1	9.7	5.8	5.8	5.3	5.6	1.3	3.3	1.7
12	2.3	2.1	9.6	2.3	8.9	6.9	21.3	2.6	12.9	9.9	26.2	5.9	6.3	5.5	17.0	11.3	6.3	5.3	10.1	5.3	2.3	2.1	3.6	1.5
13	2.2	2.1	2.8	2.6	12.9	4.2	6.4	4.9	22.6	9.2	28.5	5.5	26.1	9.1	20.5	8.6	16.5	4.2	9.7	4.1	4.3	1.6	3.3	1.6
14	2.5	2.2	9.0	2.0	12.4	4.3	19.4	5.0	24.4	9.4	28.6	4.8	22.4	12.4	21.4	8.1	17.0	2.1	2.3	2.2	4.5	2.0	3.5	1.0
15	3.3	2.7	4.5	4.0	4.3	3.9	13.8	9.1	27.3	6.2	26.3	9.3	28.3	6.3	21.5	8.0	16.7	1.8	5.4	4.3	5.3	0.8	3.8	1.4
16	6.3	1.4	5.5	5.0	8.4	7.6	23.7	3.0	27.2	6.3	9.4	6.4	26.6	6.8	20.4	9.2	15.2	3.9	1.5	1.4	3.8	2.5	5.5	1.1
17	4.9	0.9	8.6	2.0	9.8	8.7	23.5	2.9	19.7	9.9	27.5	7.4	16.6	11.0	20.0	9.8	7.6	5.7	5.7	4.7	1.4	1.3	4.5	1.4
18	2.8	2.6	3.5	3.1	14.8	8.9	23.3	2.9	24.9	9.1	27.4	6.8	21.9	8.9	19.0	11.0	4.8	4.3	6.5	4.9	4.5	2.8	1.9	1.6
19	3.1	2.9	4.6	4.3	17.2	4.1	23.1	4.0	25.4	7.4	17.8	7.0	26.8	7.1	16.7	10.9	12.2	4.6	2.3	2.2	2.2	2.0	1.8	1.6
20	4.6	2.7	9.2	3.1	16.3	7.6	23.6	3.5	24.4	10.4	30.6	4.4	24.9	5.3	15.1	8.9	12.4	4.4	8.2	3.8	4.3	1.5	3.5	0.7
21	3.6	2.6	5.7	5.3	12.2	9.5	23.6	3.1	24.1	8.5	25.6	9.9	21.5	11.0	11.5	10.1	12.7	3.3	9.2	1.3	1.8	1.6	3.3	1.5
22	3.6	2.6	9.1	2.6	12.9	9.5	18.6	8.7	24.4	8.3	29.7	5.4	25.6	9.0	19.6	9.7	15.5	3.3	2.9	2.7	0.9	0.8	2.2	1.7
23	3.6	3.4	11.4	2.0	9.3	8.4	15.1	8.7	11.1	7.0	28.7	5.8	15.1	9.2	13.9	7.7	2.0	1.8	4.0	3.6	1.0	0.9	3.5	0.7
24	2.6	2.4	9.8	3.6	14.3	9.0	7.9	7.0	7.7	6.8	26.6	6.2	22.7	10.2	13.9	11.1	2.7	2.4	1.8	1.7	1.3	1.3	2.9	1.8
25	2.0	1.9	8.8	6.7	16.1	6.7	15.7	11.1	17.9	7.5	18.2	10.8	26.9	7.6	19.1	13.4	14.8	1.6	3.9	3.2	3.3	2.4	2.3	1.8
26	4.9	2.7	11.0	2.0	12.7	7.9	18.7	10.5	28.0	6.8	6.4	5.6	25.6	8.9	10.6	9.2	14.3	1.6	2.5	2.3	5.8	0.9	2.9	1.8
27	5.1	2.2	6.1	5.6	13.8	6.7	24.1	6.9	23.9	7.5	22.2	8.3	25.2	10.2	16.6	12.4	14.0	1.5	1.6	1.5	4.0	1.5	2.0	1.6
28	5.1	2.3	7.6	4.9	18.0	5.6	25.0	4.0	16.1	9.4	21.4	5.8	23.1	6.5	14.1	11.1	12.4	2.0	2.0	1.8	0.6	0.6	2.2	1.8
29	4.7	3.0	20.5	1.8	17.3	3.3	25.5	4.1	13.0	10.6	29.4	6.7	17.7	11.9	20.8	18.1	8.1	4.4	2.6	2.4	0.9	0.9	1.7	1.6
30	6.5	1.0			9.2	7.7	25.3	4.6	25.5	9.7	30.8	4.3	21.4	7.5	19.4	12.3	12.9	1.8	1.3	1.2	2.1	1.8	2.2	1.7
31	10.6	4.6			13.3	M			38.6	19.6			40.4	15.6	37.4	26.4			3.7	3.5			4.0	3.4
Total	120.6	65.7	194.4	100.8	362.2	195.3	528.6	170.2	642.5	252.2	700.0	220.0	666.0	277.8	543.7	330.3	347.2	79.0	152.6	102.7	107.7	48.4	92.3	47.1

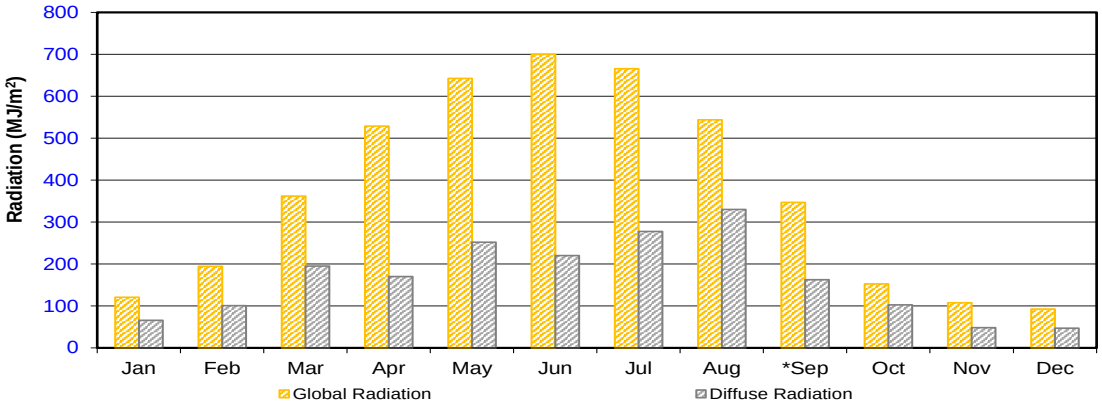
Radiation 2016



Bright Sunshine Hours

Incomplete January, February and December data due to Instrument Malfunction

Monthly Comparison Global & Diffuse Radiation



September Diffuse Information missing for September 1 to 8 due to shade ring misalignment

Bright Sunshine Instrument
16 Dec, 2015
photo credit: R. Jansen

Global Radiation Sensor
16 Dec, 2015
photo credit: R. Jansen

Wind 2016

	Average		Highest Instantaneous Wind Speed		
	Speed (km/h)	**"1/2 hr Maximum" Average**	**Speed (km/h)**	**Direction**	**Day**
January	10.8	16.1	56.7	WNW	29
February	10.0	16.0	66.1	NW	7
March	12.0	18.0	64.5	WSW	13
April	14.0	22.4	73.2	NNW	6
May	14.9	23.3	59.1	S	8
June	12.8	20.9	64.4	SW	16
July	10.3	17.1	50.9	N	12
August	10.7	17.6	50.9	W	14
September	10.4	17.5	59.4	NW	25
October	13.6	20.7	57.3	N	5
November	11.1	17.4	55.6	SSW	11
December	12.7	18.8	54.6	NW	20

Beaufort Wind Scale*	
High wind,Near Gale	50-61 km/h
Gale	62-74 km/h
Strong Gale	75-88 km/h
Storm, Whole Gale	89-102 km/h
Violent Storm	103-117 km/h
Hurricane Force	> 118 km/h

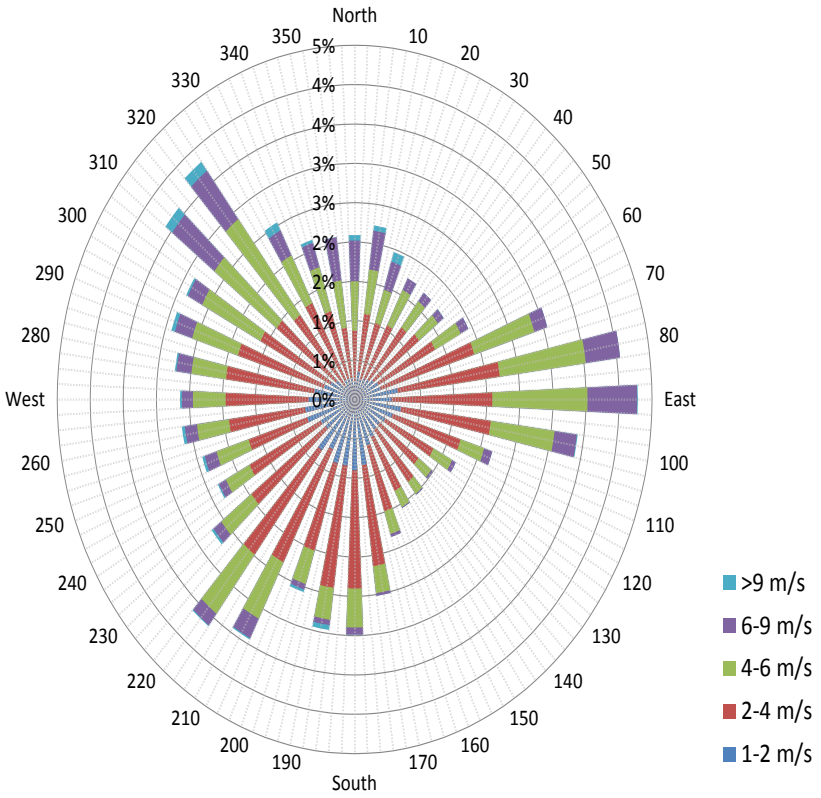
*Environment Canada, Meteorological Service of Canada, 2014. Beaufort Wind Scale Table.

Anemometer and 10 meter tower
28 June 2016
Photo: R. Jansen

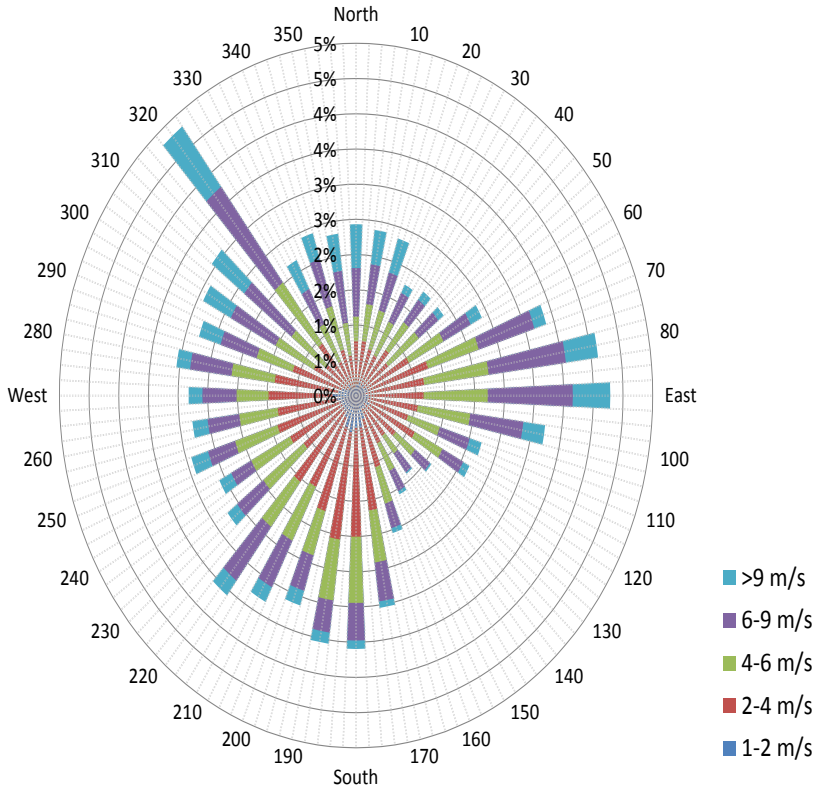
Extreme Daily Winds (km/h)		
Date	**Wind Speed/ Direction**	**Beaufort Designation***
January 27	50.8 WNW	Near Gale
January 29	56.7 WNW	Near Gale
February 6	64.3 NW	Gale
February 7	66.1 NW	Gale
March 7	51.9 E	Near Gale
March 10	55.9 WSW	Near Gale
March 13	64.5 WSW	Gale
April 1	54.0 NW	Near Gale
April 6	73.2 NNW	Strong Gale
April 20	52.3 NW	Near Gale
April 23	56.7 E	Near Gale
May 8	59.1 S	Near Gale
May 11	53.1 NNE	Near Gale
May 17	58.3 S	Near Gale
June 4	55.0 W	Near Gale
June 5	55.0 N	Near Gale
June 16	64.4 SW	Gale
June 17	59.5 WSW	Near Gale
June 19	59.6 NW	Near Gale
July 12	50.9 N	Near Gale
August 14	50.9 W	Near Gale
August 18	50.7 NNW	Near Gale
September 25	59.4 NW	Near Gale
October 4	56.2 NNE	Near Gale
October 5	57.3 N	Near Gale
November 11	55.6 SSW	Near Gale
December 13	53.5 NW	Near Gale
December 19	54.5 WNW	Near Gale
December 20	54.6 NW	Near Gale

Wind 2016

Average Wind Speed and Direction CLC 2016

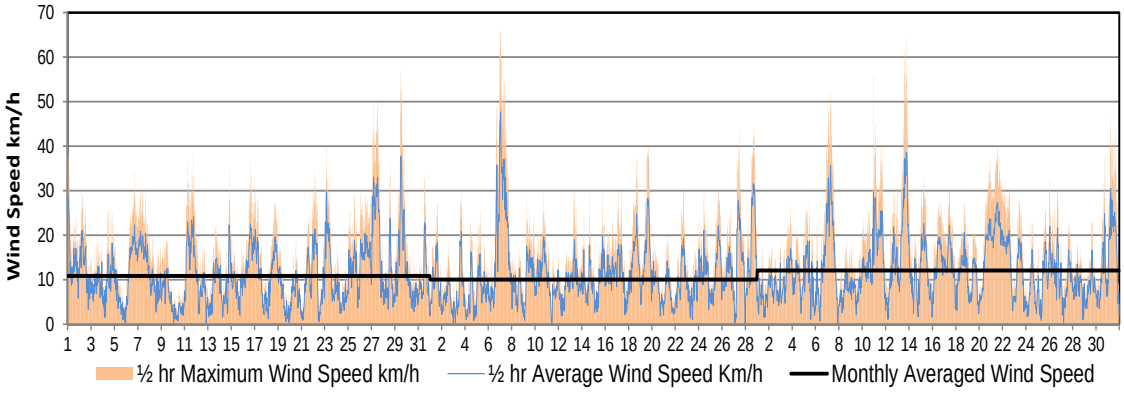


Maximum Wind Speed and Direction CLC 2016

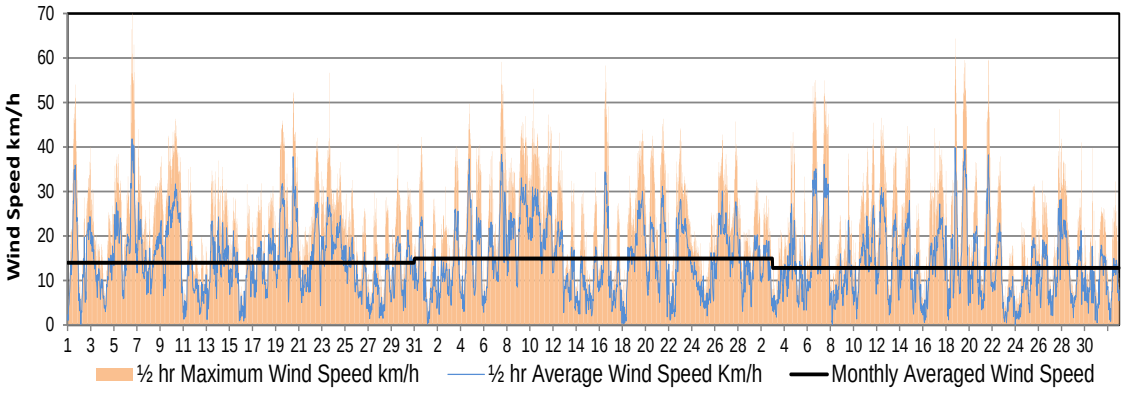


Wind 2016
Daily Wind Speed and Maximum Gust Wind Speed

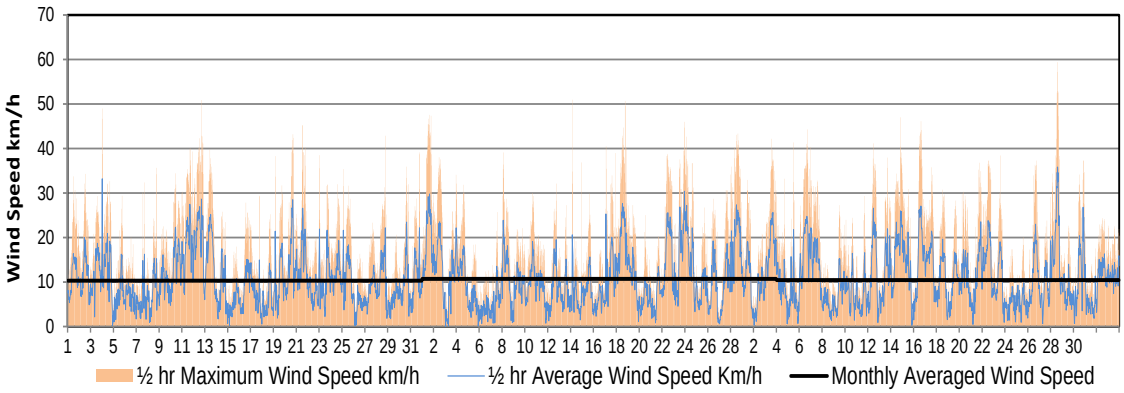
January
February
March



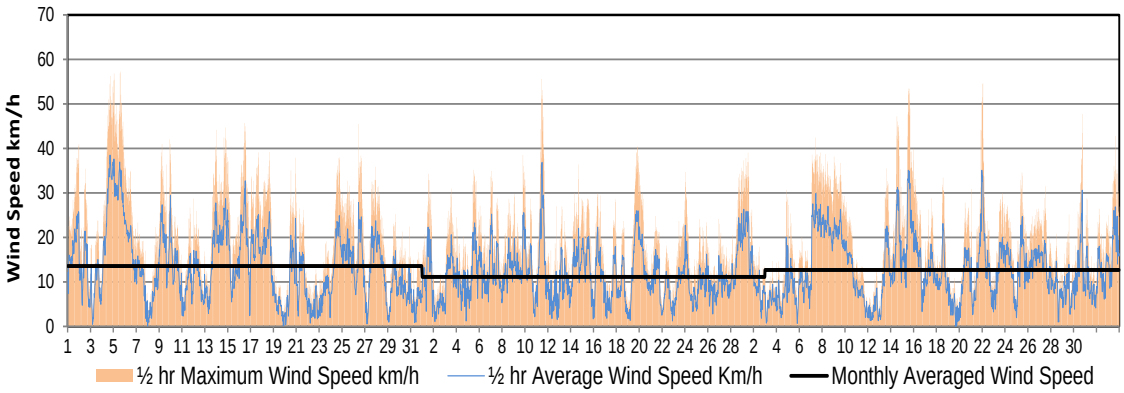
April
May
June



July
August
September



October
November
December



Wind 2016

Windchill Calculation Chart[1]												
	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 minutes.
-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 hazardous. Exposed skin can freeze in 2 minutes or less.

1: Environment Canada, 2011, 2013

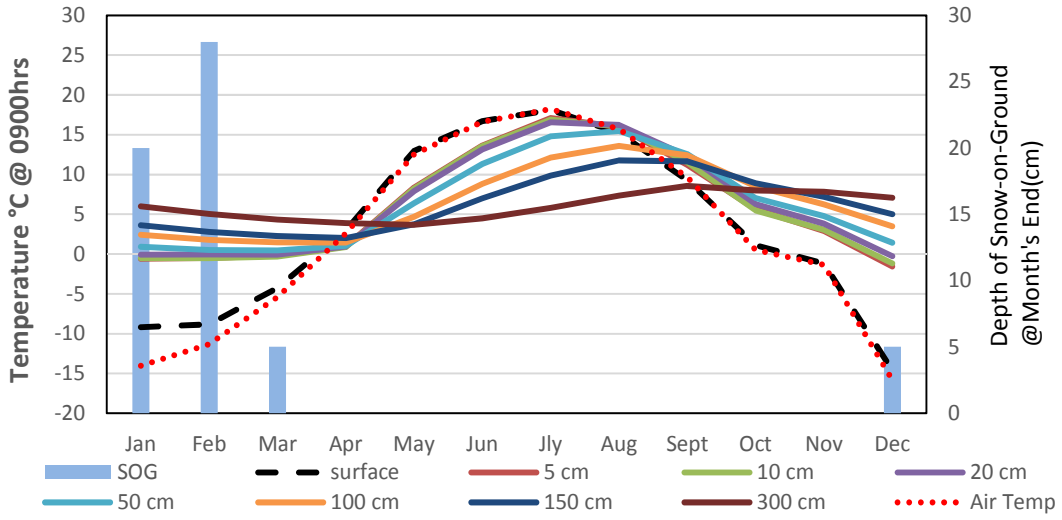
Anemometer tower
28 June 2016
photo: R. Jansen

Maximum Daily Wind Chill Value When Temperature < 0°C												
	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-17	-29	-35	-9							-9	-11
2	-19	-23	-24	-12							-6	-12
3	-22	-26	-24	-15							-5	-11
4	-22	-22	-15	-14						-8	-4	-16
5	-24	-20	-14	-10						-10	-3	-27
6	-24	-16	-11	-9						-10	-1	-30
7	-28	-20	-17	-11						-8	-3	-31
8	-30	-22	-11	-14						-8	-3	-36
9	-39	-20	-10	-12						-9		-37
10	-37	-22	-11	-18	-3					-8	-5	-34
11	-32	-31	-7	-15	-6					-8	-5	-37
12	-30	-39	-13	-6	-7					-10	-3	-36
13	-25	-35	-5		-6					-10	-2	-38
14	-31	-17	-8	-4	-1					-10	-3	-38
15	-38	-19	-13	-8	-1					-11	-7	-36
16	-44	-22	-17	-8						-11	-10	-41
17	-38	-14	-16	-6						-8	-14	-41
18	-43	-14	-15	-2						-8	-18	-40
19	-27	-25	-21							-8	-19	-15
20	-29	-33	-19	-5						-7	-16	-22
21	-25	-33	-19	-8						-6	-16	-23
22	-23	-21	-20	-4						-7	-8	-16
23	-19	-22	-15	-4						-7	-11	-32
24	-16	-20	-12	-8						-4	-9	-40
25	-15	-25	-14	-7						-3	-10	-34
26	-23	-15	-9	-3						-2	-13	-29
27	-9	-22	-13							-4	-12	-30
28	-14	-34	-14	-1						-5	-11	-24
29	-9	-43	-7	-1						-3	-11	-19
30	-14		-6							-5	-11	-22
31	-16		-9							-2		-24

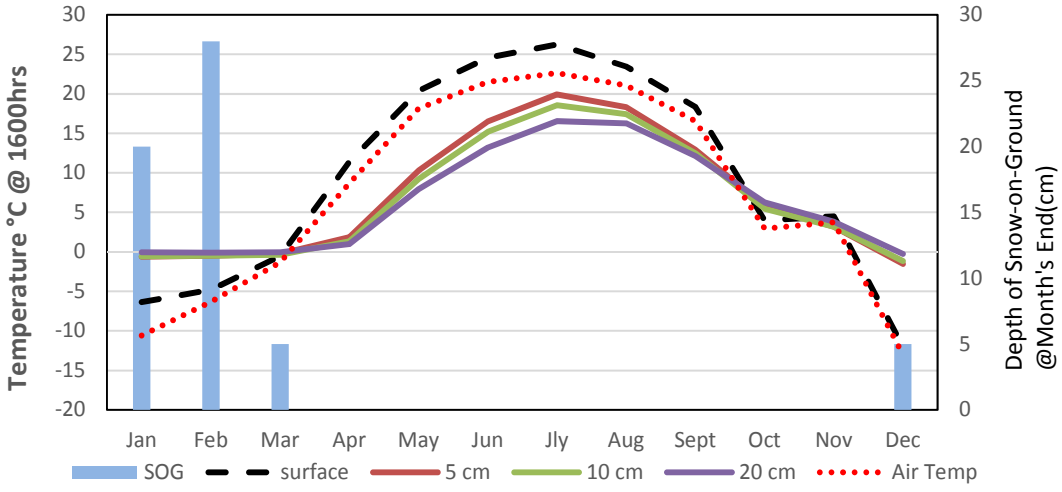
Soil Temperatures and Depth of Snow-on-the-Ground at Month's End

	Mean Air Temp @ 0900h (°C)	SOIL TEMPERATURES @ 0900 (°C)								Mean Air Temp @ 1600h (°C)	SOIL TEMPERATURES @ 1600 (°C)				SOG at Month's end (cm)
		Surface	5cm	10cm	20cm	50cm	100cm	150cm	300cm		Surface	5cm	10cm	20cm	
JAN	-14.0	-9.2	-0.6	-0.5	-0.1	0.9	2.4	3.6	6.0	-10.6	-6.4	-0.6	-0.6	0.0	20
FEB	-11.3	-8.8	-0.5	-0.5	0.0	0.5	1.8	2.8	5.1	-6.3	-4.8	-0.5	-0.5	-0.1	28
MAR	-5.4	-4.2	-0.2	-0.3	-0.1	0.5	1.5	2.3	4.3	-1.3	-0.5	-0.3	-0.4	-0.1	5
APR	2.6	3.0	1.0	0.9	1.0	1.1	1.5	2.0	3.9	8.7	11.4	1.9	1.4	1.0	0
MAY	12.5	13.0	8.3	8.2	7.9	6.4	4.7	3.8	3.7	18.1	20.4	10.3	9.2	7.9	0
JUN	16.6	16.7	13.6	13.6	13.2	11.3	8.8	7.0	4.5	21.5	24.6	16.5	15.2	13.2	0
JLY	18.2	18.1	17.1	16.9	16.6	14.8	12.1	9.9	5.8	22.6	26.3	19.9	18.6	16.6	0
AUG	15.7	15.2	16.0	16.0	16.2	15.5	13.6	11.8	7.4	21.1	23.5	18.3	17.4	16.3	0
SEP	9.6	9.3	11.2	11.6	12.3	12.6	12.4	11.7	8.6	16.5	18.4	12.9	12.5	12.1	0
OCT	0.5	1.1	5.7	5.5	6.3	7.0	8.5	8.9	8.0	3.0	4.0	5.8	5.5	6.3	0
NOV	-1.4	-1.2	2.9	3.1	3.8	4.8	6.2	7.2	7.8	3.7	4.5	3.2	3.2	3.8	0
DEC	-15.8	-14.6	-1.5	-1.2	-0.3	1.4	3.5	5.0	7.1	-13.0	-12.0	-1.5	-1.2	-0.3	5

Monthly Soil Temperatures @ 0900hrs (9:00am)



Monthly Soil Temperatures @ 1600hrs (4:00pm)



Instruments used at Climate Learning Center and Glossary of Terms

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

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

BRIGHT SUNSHINE is the unobstructed direct radiation from the sun, as opposed to the shading of a location by clouds or by other atmospheric obstructions. Number of Days is defined as the total number of days when at least 0.1 of an hour of bright sunshine was recorded. Percentage Possible refers to the ratio of measured bright sunshine hours to the total possible daylight hours in a given period, expressed as a percentage. Possible daylight hours are taken from the sunrise/set tables provided by the National Research Council of Canada, Herzberg Institute of Astrophysics, Victoria, BC. Total is the sum of the daily bright sunshine values in hours and tenths of hours as measured by an automated sunshine recorder using voltaic cells.
Bright sunshine is measured using a sunshine duration sensor.

DEGREE-DAY is an index for various temperature related calculations

Cooling (CDD) is the cooling requirement to achieve a stipulated comfort value in an indoor environment. For most purposes, a temperature of greater than 18°C is considered uncomfortable and supplementary cooling is required. On a specific day, the amount by which 18°C is less than the daily average temperature defines the number of cooling degree-days for that day.
Mathematically:CDD = (T - 18°C), for that day, where T = daily mean temperature in °C if T is equal to or less than 18°C, CDD = 0.
Monthly and annual values of CDD are obtained by summing daily values.

Growing (GDD) is the growing requirement in order for plant growth to proceed. The air temperature must ex ceed 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 > 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.

FROST is recorded on each occasion when the daily minimum temperature is equal to or less than 0°C.
Temperature is measured using a temperature and relative humidity probe housed in a solar radiation shield.

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 the Climate Learning Centre, 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 period of operation at CLC is not yet long enough to produce normals.

(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 = mTa where PET = Potential of Evapotranspiration; 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 of 0000 hours - 2400 hours 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.

Measurable precipitation is when the amount equals or exceeds 0.2 mm of water or water equivalent.

Dry day is when no measurable precipitation is recorded.

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

Official precipitation is measured using a weighing gauge, extreme precipitation events are measured using a tipping bucket rain guage. Snow depth is measured using a sonic ranging sensor.

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.

Soil temperature is measured using a temperature probe at each of the above listed depths.

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/m2).

All solar radiation is measured using a Precision Spectal Pyranometer.

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).

Precipitation spells, for this report, are defined as when more than one day is (wet spell) or is not (dry Spell) measured.

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.

Temperature is measured using a temperature and relative humidity probe housed in a solar radiation shield.

WIND CHILL describes a sensation, the way we feel as a result of the combined cooling effect of temperature and wind. This feeling can't be measured using an instrument, so a mathematical formula was developed in 1939 that related air temperature and wind speed to the cooling sensation. This formula was revised in 2001 by a team of scientists and medical experts from Canada and the U.S. with the Canadian Department of National Defence contributing human volunteers. The new index is based on the loss of heat from the face. *(Environment Canada 2004b)* Wind chill is calculated by using a temperature and relative humidity probe housed in a solar radiation shield and wind monitor otherwise known as a anemometer.

WAVES Temperature waves are defined as a sequence of three or more days when the daily maximum / 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 kilometers 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. See also **Beaufort Wind Scale**
Wind speed and direction is measured using a wind monitor otherwise known as a anemometer.

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