Climate Reference Station
Conservation Learning Center
RM of Prince Albert #461
ANNUAL SUMMARY 2017

V. Wittrock
Saskatchewan Research Council
Air and Climate

SRC Publication No. 13000-1E18
Februrary 2018

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COVER PHOTOGRAPHS
SRC Climate Reference Station at Conservation Learning Centre.
28 July 2017
Photo credit: V. Wittrock
SRC Climate Reference Station at Conservation Learning Centre.
11 October 2017
Photo credit: R. Jansen

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Monthly data sheets and annual summaries: http://src.nu/crsdata

SASKATCHEWAN RESEARCH COUNCIL

Climate Reference Station Supporters, 2017

We gratefully acknowledge the support of the following:

KIPP & ZONEN SINCE 1830

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.

V. Wittrock has been project manager since the site was established. Wittrock and C. Beaulieu were the first observers. S. Dunn became primary observer between 2014-2016 with assistance from V. Wittrock. V. Wittrock took over this role in 2017 as well as remaining project manager. Instrument 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.

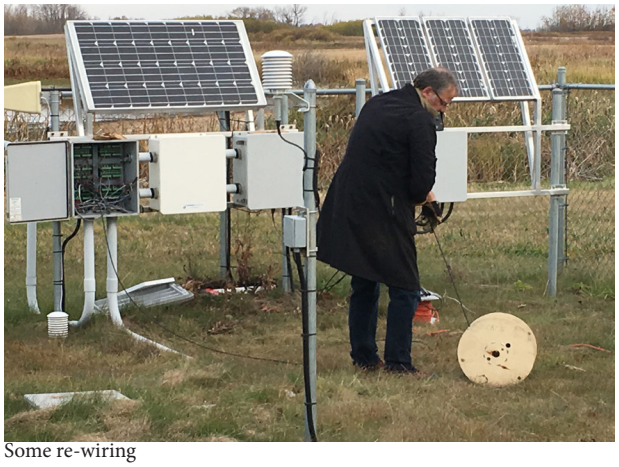
The instrument array consists of temperature, precipitation, humidity, barometric pressure, wind (speed and direction), snow depth, barometric pressure, solar radiation (global, diffuse and bright sunshine), and soil moisture, grass height air temperature and soil temperature (seven levels). The site 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 2017

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 2017 included V. Wittrock participating in the CLC Field Day by providing a tour of the Climate Reference Station (28 July 2017). Two scheduled general maintenance visits to the site occurred in April and October. These included general maintenance on the precipitation gauges and radiation sensors but also involved some larger maintenance items. The bright sunshine instrument was realigned, a new actuator was installed on one of the arms of the diffuse autoshield, and the station's batteries were replaced. We have more than 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 24 more years of data are needed to obtain high quality averages.

[1]Conservation Learning Centre 2011



Some re-wiring
11 Oct 2017
Photo: R. Jansen

CLC Field Day
28 July 2017
Photo: V. Wittrock

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*

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Summary for 2017

Data, including temperature, precipitation, wind speed and direction, bright sunshine, solar radiation, soil temperature and moisture, was recorded during 2017 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 six years (2012-2017), tracking similarities and differences of various parameters 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 analyses, such as determining averages. This report examines the types of weather and climate that occurred in 2017 and compares it to the previous five years.

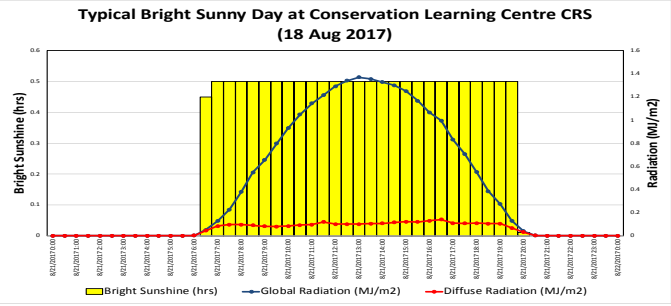
The average annual temperature in 2017 was 2.0°C, more than a degree cooler than last year. Winter was the second warmest since 2013, but summer was the coolest due in part to the low nighttime temperatures. The CRS at CLC had 121 frost-free days. The last spring frost was on May 18 (-1.2°C) and the first fall frost was on September 18 (-1.3°C). The SRC's CRS at CLC did record its first temperature that was greater than or equal to 32.5°C on June 1 (32.6°C), which was also the hottest day of the year. The coldest temperature of 2017 was -38.0°C recorded on December 30. This was a temperature spread of more than 70 degrees.

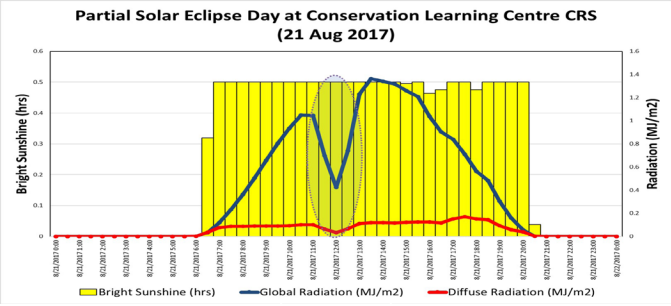
The recorded temperature was below -30°C 14 times. When wind speed is also taken into account to determine the 'feels like' temperature or wind chill, this value increases 37 times. The wind chill value went down twice in 2017: to -49°C on Dec 29 and 30.

With only six years of climate data to compare, it is interesting to see how different 2017 was to the preceding wet years. The wettest year over the last six years was 2012. the driest year by far was 2017 with nearly 330 mm less precipitation than in 2012. This lack of moisture was reflected in the minimal snow pack of 2016-2017. The permanent snow cover season began on December 8 and lasted until March 19. The deepest snow pack was on March 16 with only 16 cm of snow. Compare this to March 16, 2014 when the snow pack was measured at 45 cm.

The lack of precipitation is reflected in the number of bright sunshine hours. The summer bright sunshine hours of 2017 were more than 66 hours greater than what was recorded during the wet summer of 2012.

Saskatchewan and Conservation Learning Center were on the pathway of a partial solar eclipse in August 2017. At the bottom of this page, the graph on the left shows the bright sunshine, global and diffuse radiation measurements on a 'normal' bright sunny day in August. The graph on the right illustrates the change in global radiation that occurred due to the partial solar eclipse. The bright sunshine instrument still measured sunshine because it was only a partial solar eclipse, while the global and diffuse radiation decreased during the event.

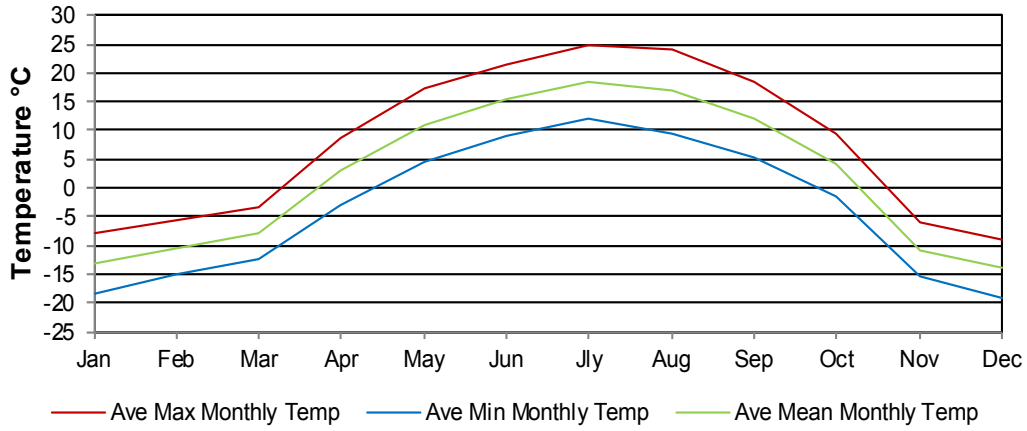




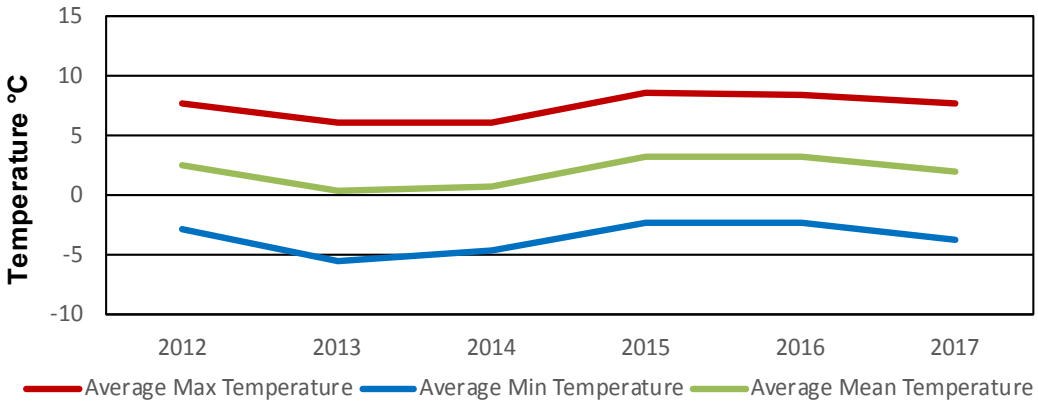
Temperature 2017

	Average Maximum (°C)	Average Minimum (°C)	Average Mean (°C)	2017 Extreme Values (°C)	
	2017	2017	2017	Max/Date	Min/Date
January	-7.9	-18.5	-13.2	5.3/18	-33.8/12
February	-5.6	-15.1	-10.4	6.9/17	-28.9/6
March	-3.5	-12.3	-7.9	8.6/31	-31.6/10
April	8.7	-2.8	3.0	21.5/7	-11.4/16
May	17.4	4.5	11.0	26.8/5	-1.2/18
June	21.3	9.2	15.3	32.6/1	2.1/24
July	24.8	11.9	18.4	32.2/16	8.1/18
August	24.1	9.4	16.8	30.6/31	3.6/22
September	18.5	5.4	12.0	29.8/8	-1.3/18
October	9.6	-1.6	4.0	19.5/1	-6.7/14
November	-5.9	-15.4	-10.7	2.8/29	-23.9/18
December	-8.9	-19.0	-14.0	5.1/9	-38.0/30
Average	7.7	-3.7	2.0		

Monthly Comparison



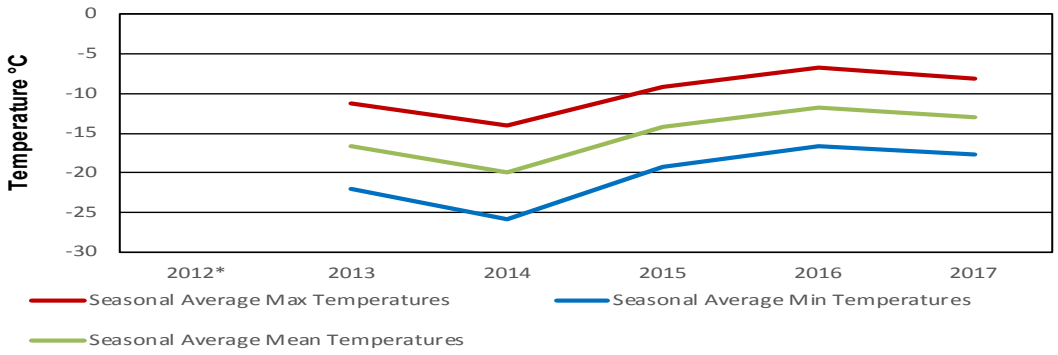
Annual Comparison



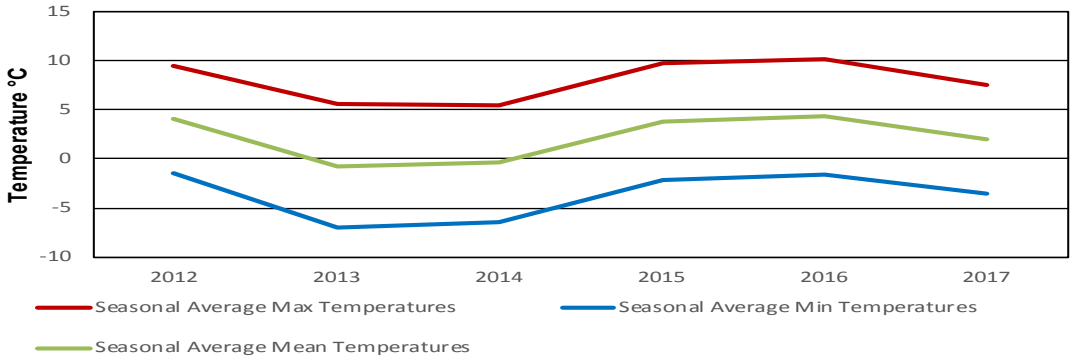
SEASONAL TEMPERATURES

Winter (DJF)

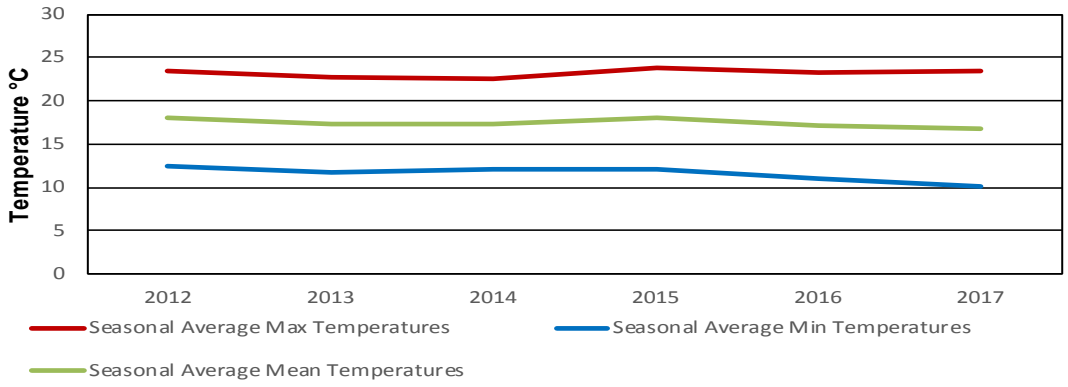
* Missing Data



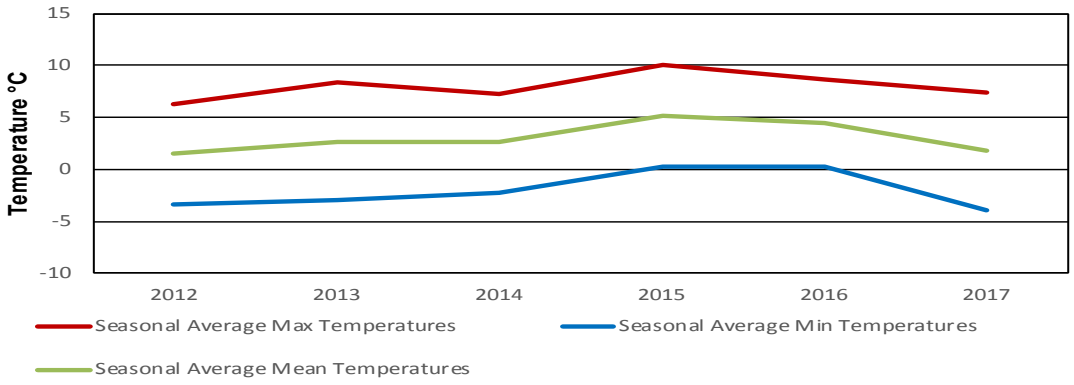
Spring (MAM)



Summer (JJA)

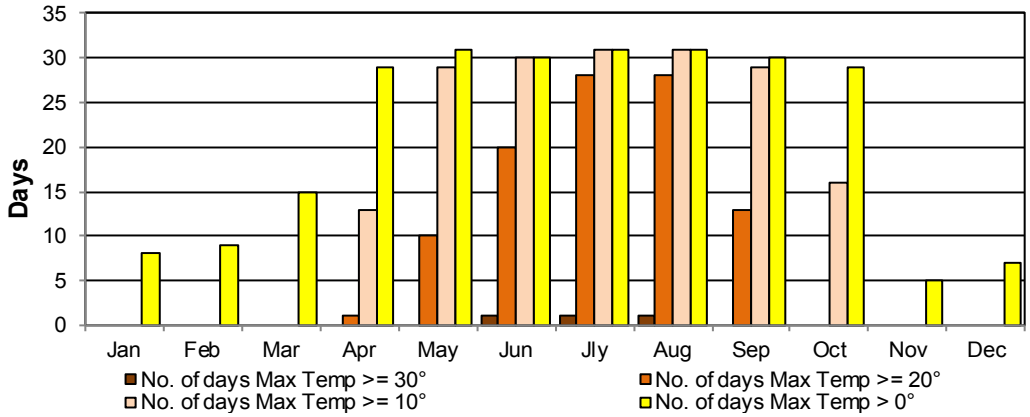


Autumn (SON)

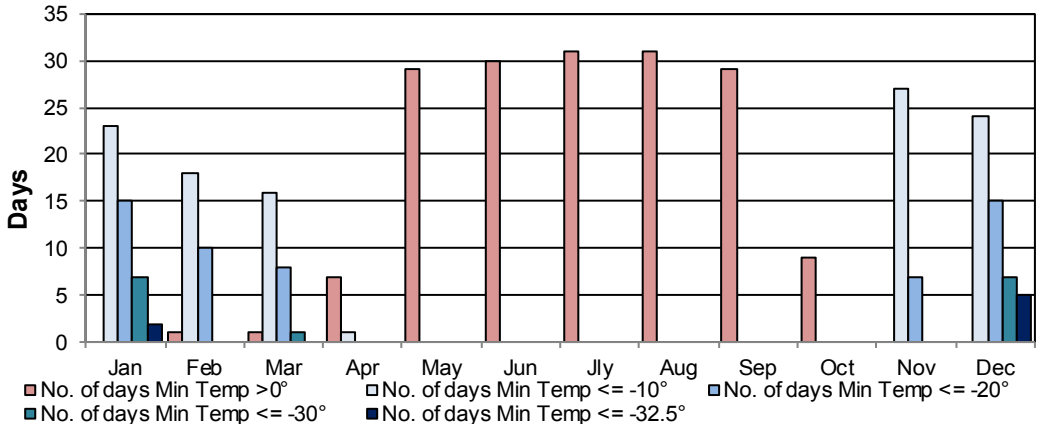


DAYS WITH TEMPERATURES GREATER THAN A SET POINT

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
2017	-8.1	2015	9.8	2012	23.5	2016	8.7
2015	-9.1	2012	9.5	2017	23.4	2013	8.4
2013	-11.3	2017	7.5	2016	23.2	2017	7.4
2014	-14.0	2013	5.6	2013	22.8	2014	7.3
2012	M	2014	5.5	2014	22.5	2012	6.3

SEASONAL MINIMUM AVERAGE TEMPERATURES °C							
WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2016	-16.6	2012	-1.4	2012	12.4	2015	0.2
2017	-17.7	2016	-1.6	2014	12.1	2016	0.2
2015	-19.2	2015	-2.1	2015	12.1	2014	-2.2
2013	-22.0	2017	-3.5	2013	11.7	2013	-3.0
2014	-25.8	2014	-6.4	2016	11.1	2012	-3.4
2012	M	2013	-7.0	2017	10.2	2017	-3.9

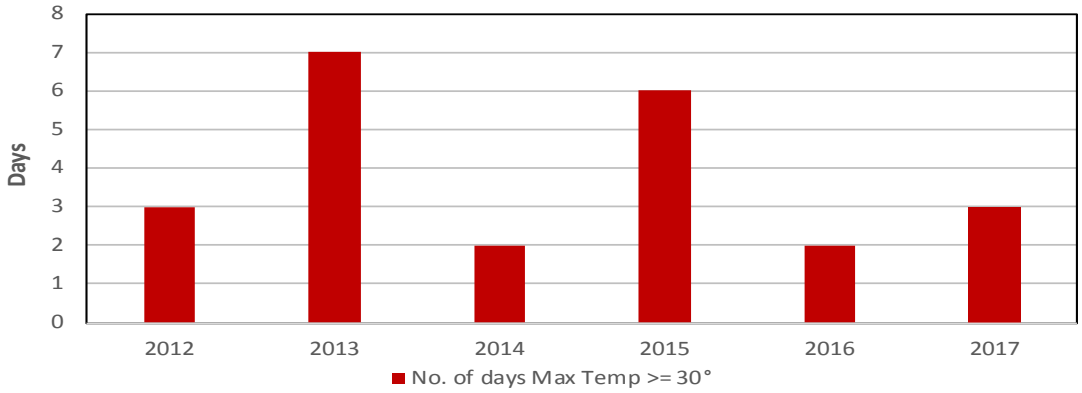
SEASONAL MEAN AVERAGE TEMPERATURES °C							
WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2016	-11.7	2016	4.3	2015	18.0	2015	5.2
2017	-13.0	2012	4.1	2012	18.0	2016	4.4
2015	-14.2	2015	3.8	2014	17.3	2013	2.7
2013	-16.7	2017	2.0	2013	17.3	2014	2.6
2014	-19.9	2014	-0.4	2016	17.2	2017	1.8
2012	M	2013	-0.7	2017	16.8	2012	1.5

AVERAGE ANNUAL TEMPERATUES °C					
MAXIMUM TEMP		MINIMUM TEMP		MEAN TEMP	
2015	8.6	2016	-2.2	2015	3.2
2016	8.5	2015	-2.3	2016	3.2
2012	7.8	2012	-2.8	2012	2.5
2017	7.7	2017	-3.7	2017	2.0
2013	6.2	2014	-4.5	2014	0.8
2014	6.2	2013	-5.4	2013	0.4

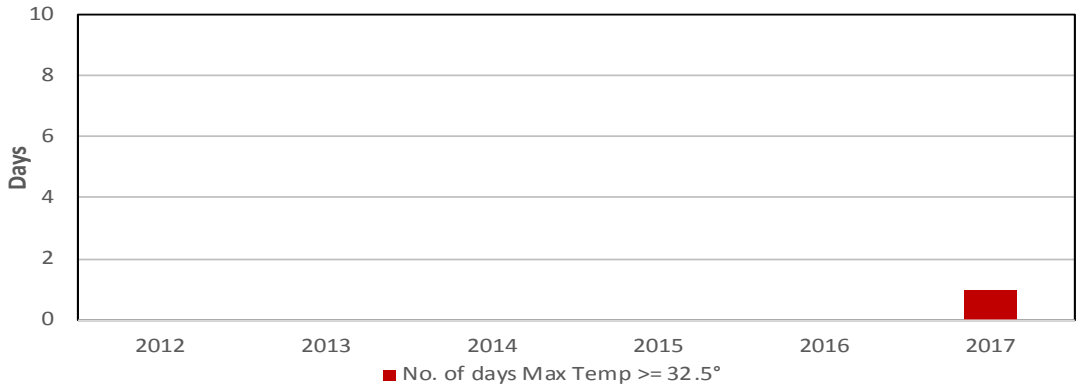
M = Missing Data

DAYS WITH TEMPERATURES GREATER THAN A SET POINT

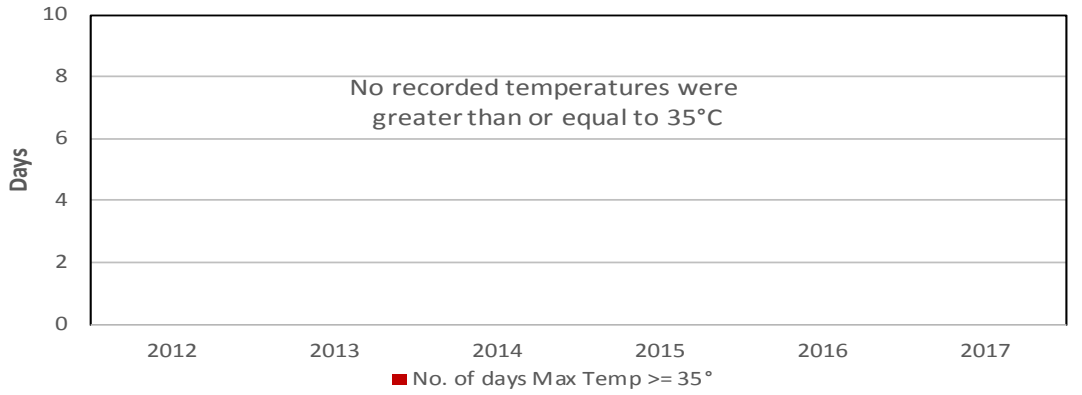
30°C or Greater



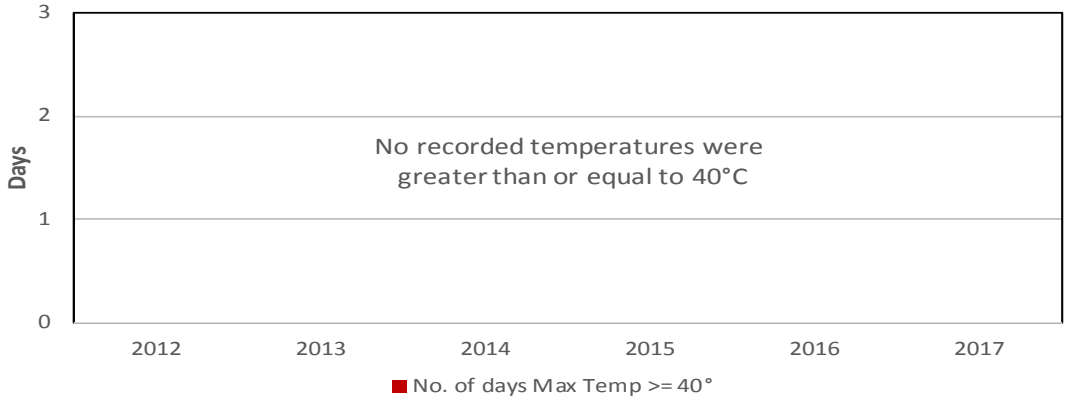
32.5°C or Greater



35°C or Greater

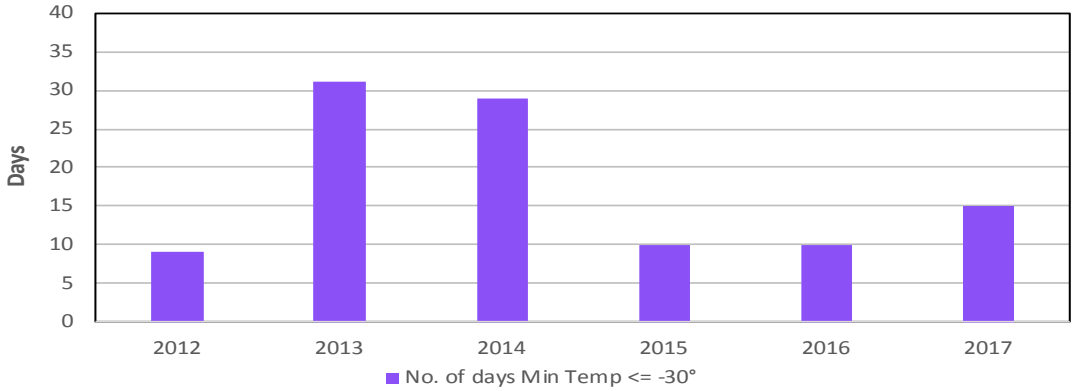


40°C or Greater

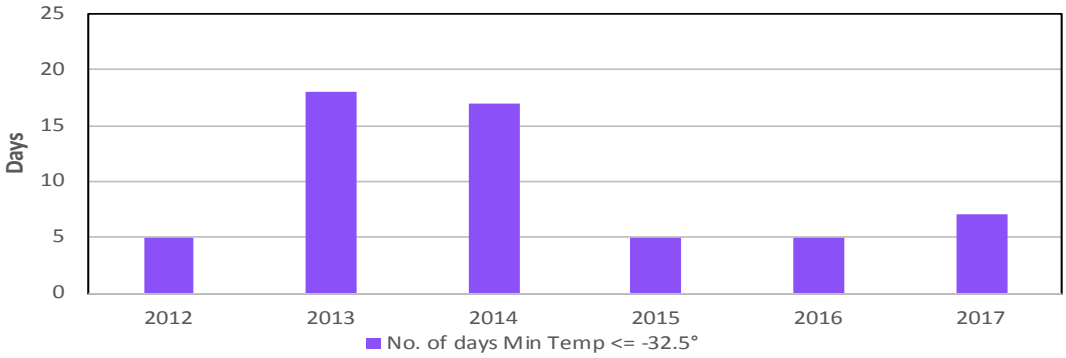


DAYS WITH TEMPERATURES LESS THAN A SET POINT

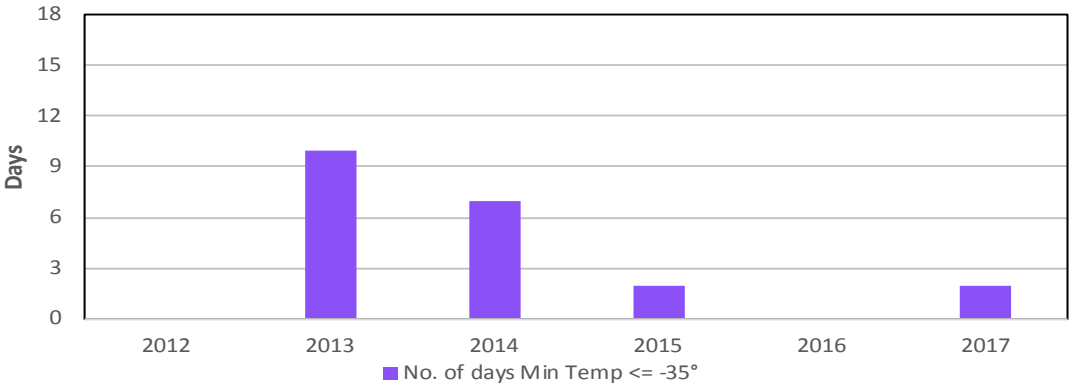
Minus 30°C or Less



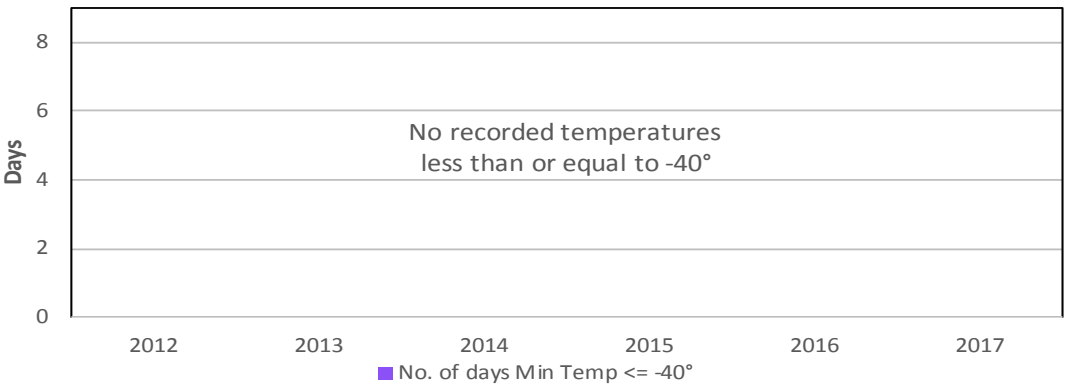
Minus 32.5°C or Less



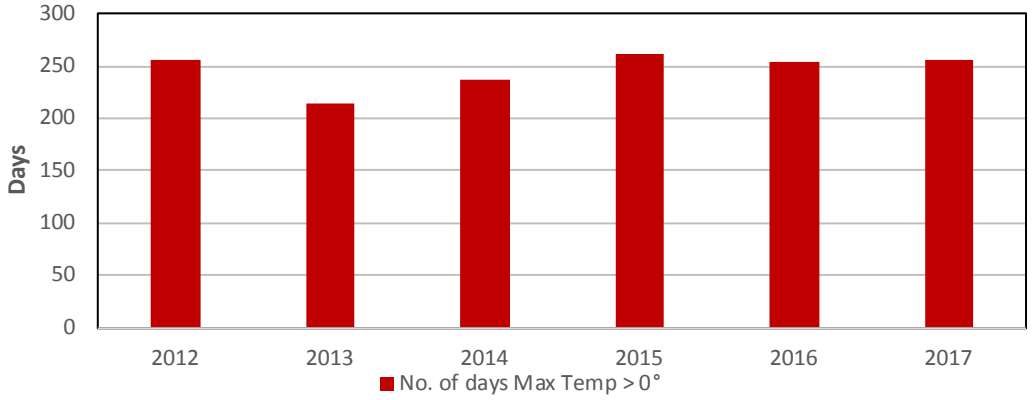
Minus 35° or Less



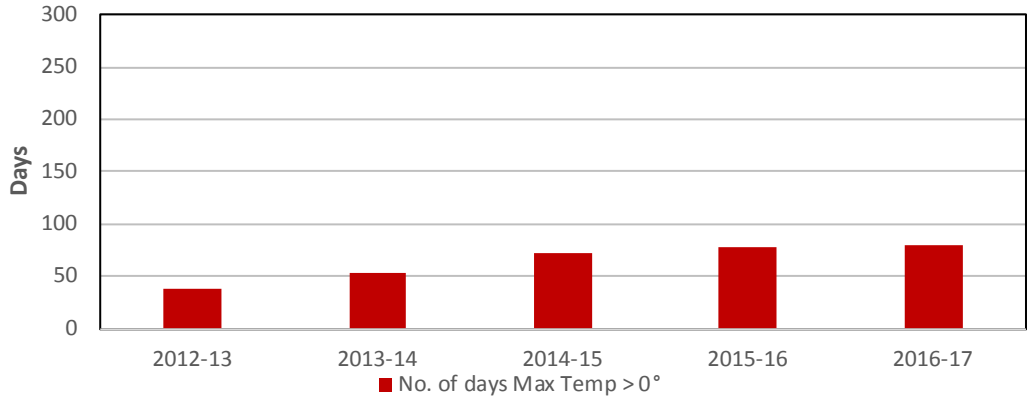
Minus 40°C or Less



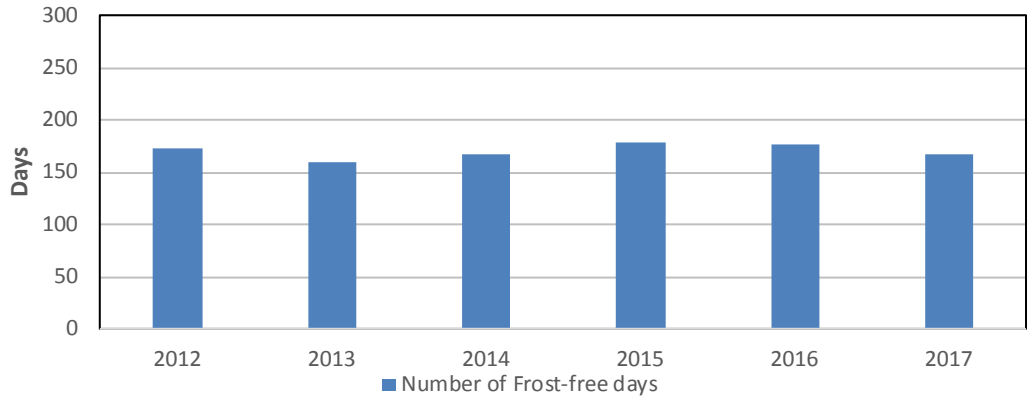
Days with Temperature Greater than 0°C



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)



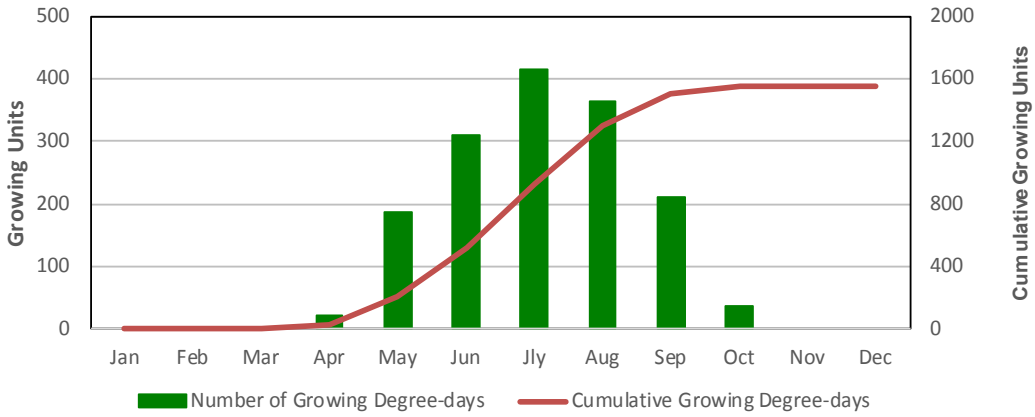
Minimum Temperature greater than 0°C (Frost-free Days)

SRC Climate Reference Station
Conservation Learning Centre
13 March 2017
Photo credit: R. Jansen

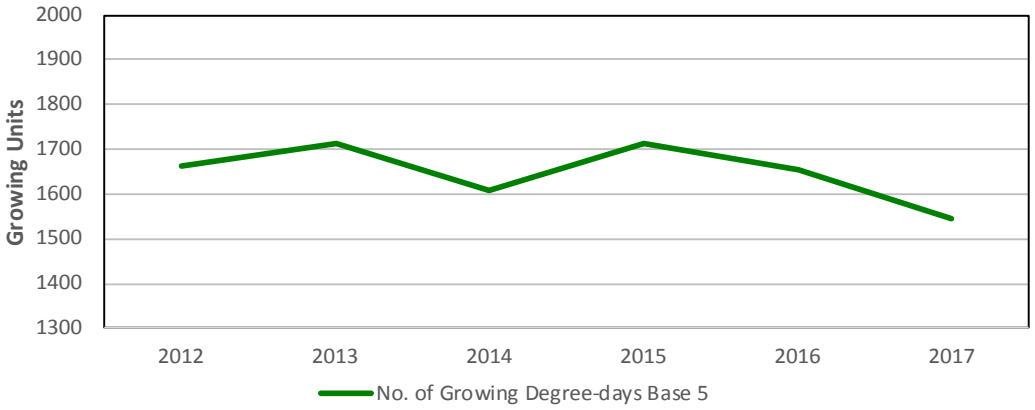
Degree-Days

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	
	2017	Cumulative	2017	Cumulative	2017	Cumulative	2017	Cumulative
January	0.0	0.0	968.2	968.2	0.0	0.0	0.0	0.0
February	0.0	0.0	794.4	1762.6	0.0	0.0	0.0	0.0
March	0.0	0.0	803.2	2565.8	0.0	0.0	0.0	0.0
April	23.2	23.2	450.3	3016.1	0.0	0.0	0.0	0.0
May	185.5	208.7	217.5	3233.6	0.0	0.0	0.0	0.0
June	309.0	517.7	95.0	3328.6	14.0	14.0	0.0	0.0
July	415.8	933.5	18.8	3347.4	31.6	45.6	0.0	0.0
August	364.3	1297.8	46.9	3394.3	8.2	53.8	0.0	0.0
September	209.6	1507.4	186.0	3580.3	5.6	59.4	0.0	0.0
October	38.1	1545.5	433.3	4013.6	0.0	59.4	0.0	0.0
November	0.0	1545.5	860.7	4874.3	0.0	59.4	0.0	0.0
December	0.0	1545.5	991.0	5865.3	0.0	59.4	0.0	0.0

Growing Degree-days Monthly

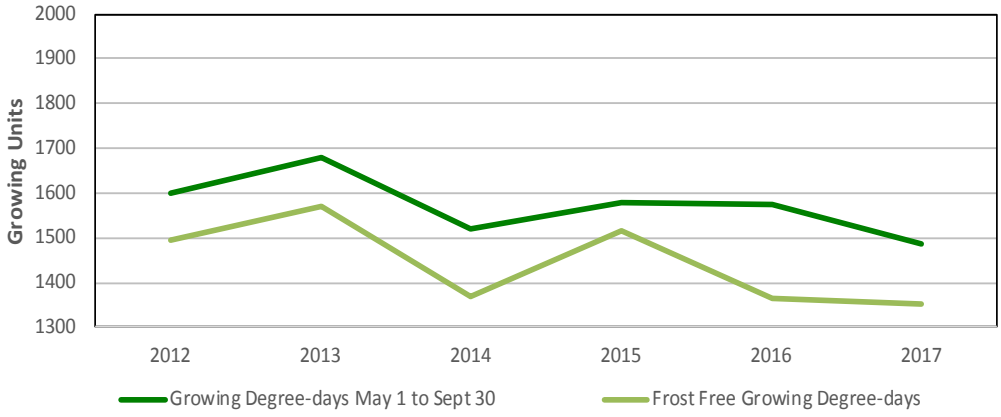


Growing Degree-days Annual



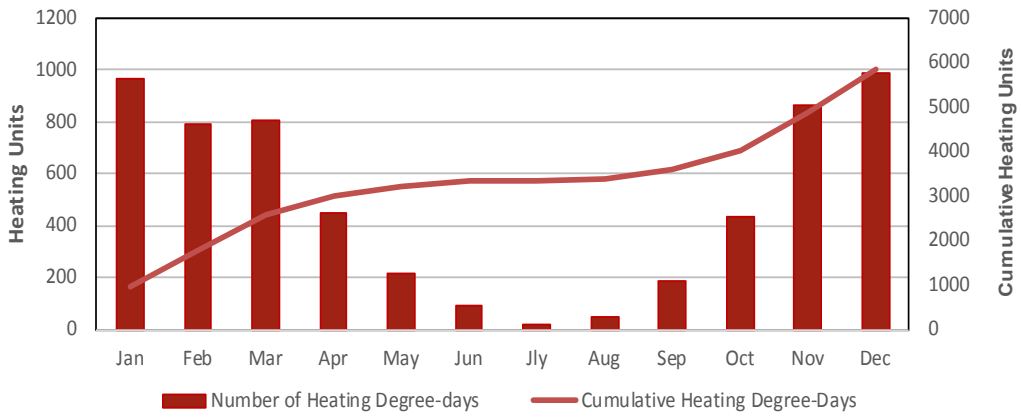
Growing Degree-days May 1 to September 30 base 5C

Growing Degree-days in frost free period base 5C

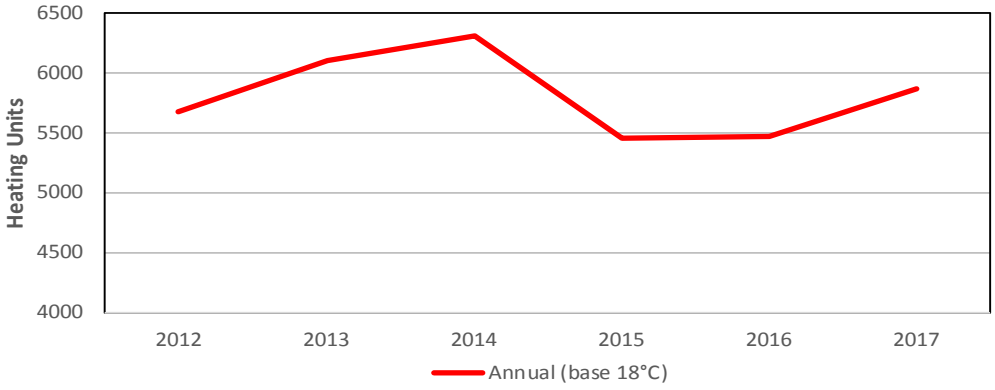


Degree-Days

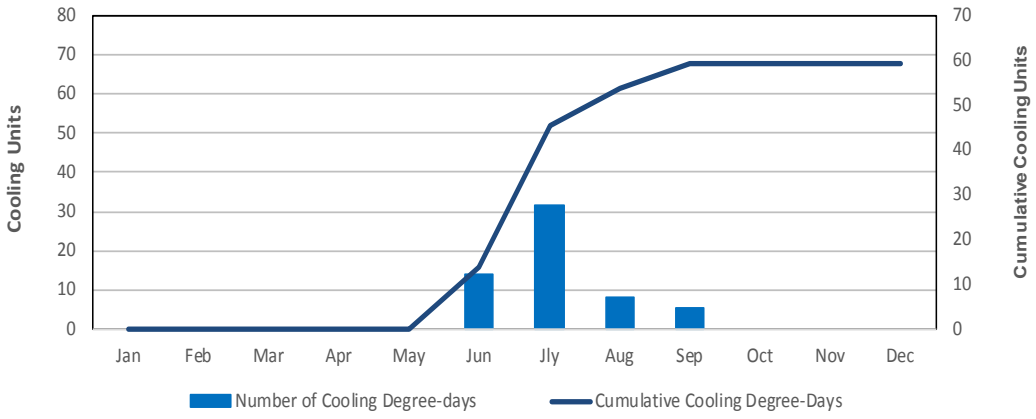
Heating Degree-days Monthly



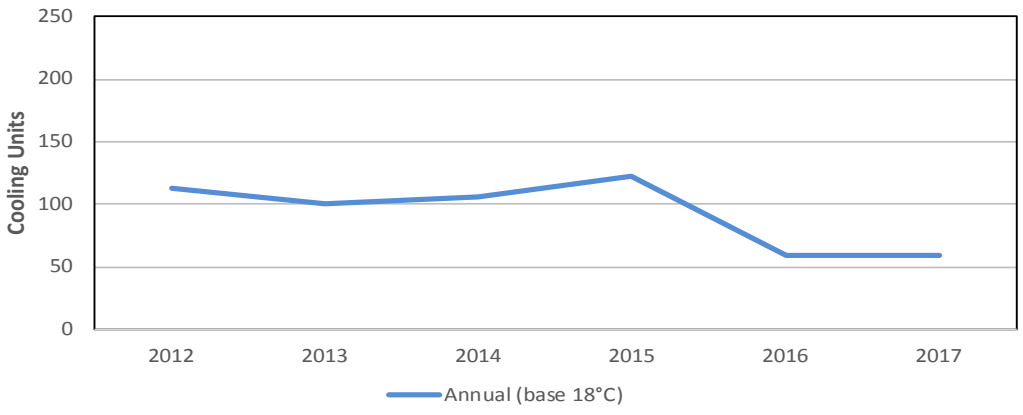
Heating Degree-days Annual



Cooling Degree-days Monthly

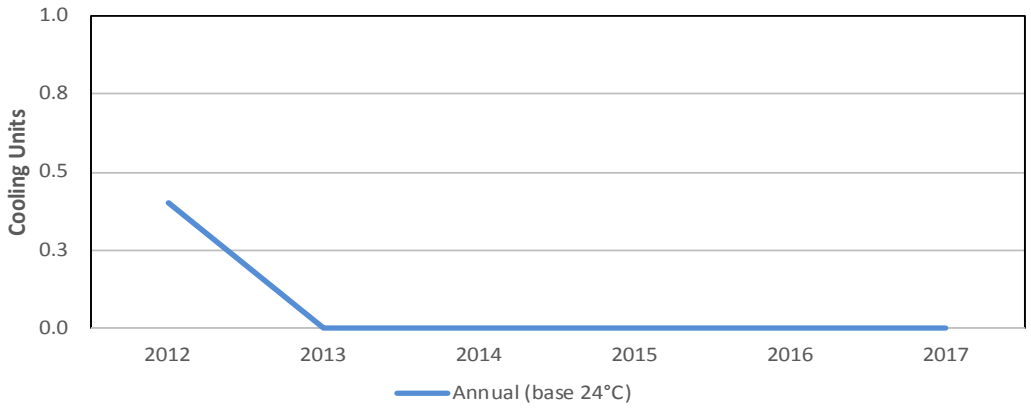


Cooling Degree-days Annual



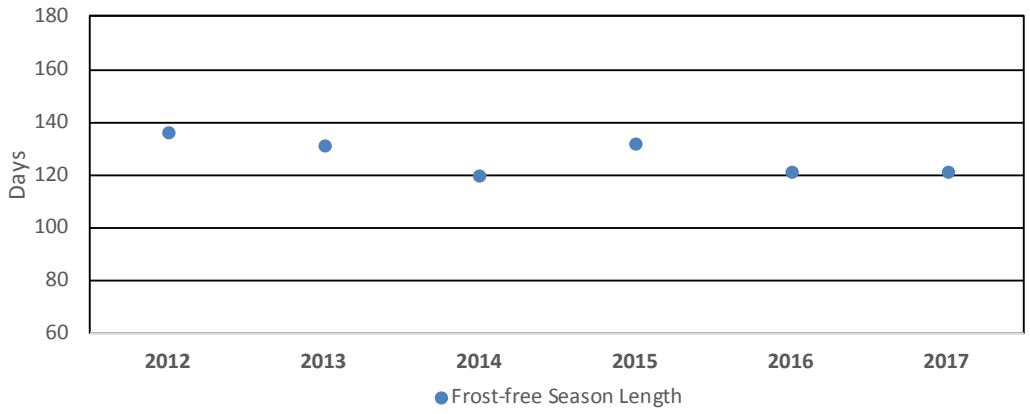
Degree-Days

Extreme Cooling Degree-days Annual

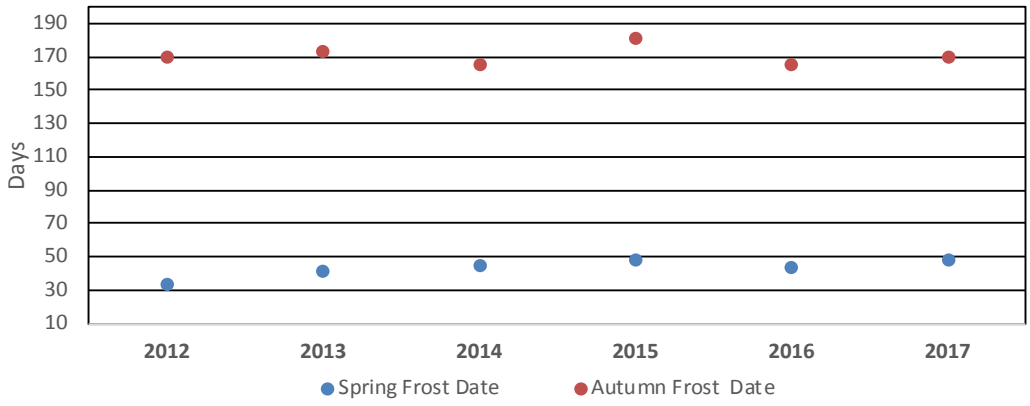


DATES & DURATION OF THE FROST-FREE SEASON			
YEAR	LAST SPRING FROST	FIRST FALL FROST	Frost-free Season Length
2012	May 3	Sept 17	136
2013	May 10	Sept 19	131
2014	May 14	Sept 12	120
2015	May 18	Sept 28	132
2016	May 13	Sept 13	122
2017	May 18	Sept 18	121

Frost-free Growing Season Duration



Frost-free Growing Season End Points



Temperature 2017

Daily Maximum

2017	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-9.1	-13.6	-13.4	11.4	10.8	32.6	23.7	22.0	23.8	19.5	-2.8	-1.7
2	-19.8	-10.4	-9.4	10.8	15.9	27.6	21.6	23.3	23.4	11.1	-3.5	-5.0
3	-18.9	-12.0	0.9	12.0	17.3	24.7	27.3	25.2	20.8	10.7	-9.7	-5.9
4	-16.9	-13.8	-1.3	7.6	24.6	28.4	25.0	18.3	18.5	11.9	-8.7	-8.1
5	-14.6	-13.4	-11.8	10.0	26.8	27.0	27.0	24.9	22.1	16.2	-7.3	-10.5
6	-14.1	-20.3	-12.6	17.6	19.7	22.4	25.8	25.1	27.5	17.6	-8.3	-5.3
7	-15.1	-18.1	-13.6	21.5	19.2	26.4	26.9	22.7	25.3	13.2	-5.8	-2.4
8	-16.2	-15.5	-16.0	7.6	8.0	27.9	27.2	20.9	29.8	4.8	-10.9	1.7
9	-20.4	-13.5	-18.2	2.0	14.2	22.8	28.3	24.3	28.2	9.8	-9.9	5.1
10	-19.6	-10.2	-19.7	7.7	15.0	14.9	22.6	25.7	21.5	14.3	-4.4	4.3
11	-15.6	-2.0	-16.0	11.9	16.6	16.1	24.3	27.2	26.2	14.9	-5.8	2.3
12	-27.1	0.6	-14.1	11.7	12.5	22.6	23.5	27.1	20.8	6.1	-3.4	4.9
13	-15.1	5.9	-10.1	9.3	10.9	22.6	25.9	25.2	13.5	1.2	0.1	0.9
14	-6.6	0.5	-2.7	3.9	7.9	19.2	25.0	25.7	10.8	6.3	-5.6	-0.3
15	-2.1	3.7	3.6	1.9	16.0	13.1	26.6	19.9	14.2	10.7	-16.1	0.4
16	-2.2	5.7	1.7	-3.9	10.1	20.8	32.2	22.5	12.2	14.9	-8.4	-0.3
17	4.4	6.9	-0.2	3.6	11.7	19.0	19.2	24.0	13.8	19.3	-10.8	-0.9
18	5.3	4.0	4.9	9.3	16.0	20.4	18.5	27.3	17.1	9.1	-11.5	-1.2
19	1.6	-0.2	7.5	12.9	20.1	18.6	22.1	20.5	11.0	13.5	-10.0	-10.6
20	1.5	2.5	-0.4	14.6	22.8	21.4	24.8	19.5	14.5	10.2	-8.1	-15.3
21	-2.4	0.7	-3.8	9.2	20.3	16.1	17.4	20.3	11.2	4.8	-12.9	-9.4
22	-3.4	-0.7	3.2	4.2	22.6	14.2	23.7	21.9	9.5	4.8	-7.8	-9.0
23	-8.2	-5.0	0.9	4.8	23.6	11.6	27.4	23.2	10.1	9.2	0.4	-10.2
24	-11.0	-4.9	1.8	0.5	22.5	20.0	20.7	24.4	12.6	16.5	-0.1	-23.6
25	-6.6	-8.8	2.2	3.3	16.9	21.4	23.4	22.1	17.6	5.3	-3.2	-27.1
26	-4.1	-11.2	0.2	5.9	17.4	22.5	26.2	26.5	18.0	0.5	-6.7	-25.8
27	3.2	-9.1	3.0	8.5	19.8	24.6	28.6	29.2	19.2	2.4	1.6	-22.5
28	3.3	-4.3	3.2	13.0	15.9	21.3	26.0	27.0	17.0	14.2	0.6	-23.7
29	5.0		7.0	12.4	17.5	17.8	27.0	24.5	23.6	6.7	2.8	-29.7
30	3.1		5.7	16.2	20.2	20.9	28.5	24.6	21.3	-1.7	-0.8	-25.2
31	-2.5		8.6		26.7		23.8	30.6		-1.2		-20.6

Daily Minimum

2017	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-24.9	-20.5	-20.9	0.5	0.6	13.5	9.9	10.9	12.2	7.2	-7.3	-14.8
2	-30.5	-25.5	-22.5	-1.2	-0.3	14.1	11.0	11.4	9.0	3.5	-9.8	-11.7
3	-28.4	-23.1	-14.4	-3.0	1.9	11.9	12.4	7.5	11.3	0.5	-15.6	-16.5
4	-20.2	-19.8	-12.0	-3.7	2.7	10.0	13.7	13.3	7.7	-1.4	-13.5	-23.0
5	-19.6	-27.0	-15.2	-5.3	5.9	12.9	10.4	11.9	2.9	-3.6	-20.0	-20.5
6	-22.9	-28.9	-16.3	2.7	9.3	11.2	12.0	8.4	4.8	2.1	-16.1	-23.5
7	-29.1	-27.3	-16.3	4.1	7.0	7.8	10.1	10.6	7.1	3.6	-13.1	-11.9
8	-30.7	-27.4	-24.0	-3.0	5.2	11.0	12.3	11.0	10.8	-0.6	-17.8	-11.3
9	-30.6	-26.4	-29.2	-6.8	3.3	13.2	11.4	7.5	14.4	-3.2	-21.0	-12.7
10	-31.4	-19.4	-31.6	-7.8	1.9	6.3	15.0	8.1	11.7	-2.2	-12.6	-6.5
11	-33.1	-17.4	-24.8	-2.0	3.0	6.9	14.0	10.0	6.7	3.8	-11.7	-5.0
12	-33.8	-8.4	-23.8	-1.9	2.4	3.7	10.6	8.9	6.1	-3.1	-10.1	-3.5
13	-31.3	-3.7	-25.4	-1.2	4.4	13.3	11.9	10.5	6.8	-4.3	-15.3	-3.3
14	-19.2	-11.7	-15.6	0.6	3.9	10.7	14.6	12.6	3.0	-6.7	-17.8	-4.5
15	-11.4	-6.2	-7.1	-7.8	3.3	10.4	12.2	12.2	0.7	-0.5	-21.9	-7.8
16	-12.9	-3.7	-3.0	-11.4	2.5	7.7	13.6	8.0	2.0	1.0	-19.1	-6.1
17	-5.1	0.6	-8.7	-9.1	0.8	9.7	10.1	9.4	1.9	-1.2	-19.7	-10.1
18	-5.1	-5.9	-4.1	-4.6	-1.2	9.3	8.1	8.2	-1.3	-3.0	-23.9	-12.4
19	-6.9	-4.5	-1.9	0.8	3.6	9.3	10.0	10.6	7.4	-3.0	-21.3	-25.9
20	-4.5	-3.2	-13.3	-0.5	5.3	7.5	10.3	8.4	1.9	2.5	-15.6	-29.7
21	-6.2	-1.6	-16.0	1.0	8.2	10.1	14.1	7.2	1.3	0.3	-22.8	-20.7
22	-8.3	-7.2	-6.7	-3.0	6.7	7.8	13.0	3.6	2.8	-5.3	-22.3	-13.8
23	-11.1	-10.9	-6.1	-4.6	6.4	4.9	12.3	8.5	1.9	-3.0	-11.3	-27.3
24	-17.2	-14.9	-5.0	-2.7	9.7	2.1	12.0	9.0	1.6	-4.4	-14.1	-29.9
25	-22.2	-16.2	-1.6	-5.3	6.9	7.6	11.1	8.6	1.7	-2.6	-17.1	-30.6
26	-20.6	-21.3	-4.8	-3.7	7.8	7.0	9.4	7.1	6.7	-5.2	-11.1	-34.7
27	-13.5	-22.5	-6.5	-2.6	5.6	13.3	12.0	6.3	3.3	-3.1	-10.0	-34.2
28	-5.0	-19.0	-2.2	-1.7	8.2	9.8	15.0	9.6	3.5	-1.4	-14.6	-34.2
29	-10.5		0.2	0.3	6.4	8.0	10.7	7.8	3.2	-3.5	-4.9	-35.3
30	-6.0		-0.6	-0.2	2.7	6.3	12.7	7.2	9.6	-5.2	-11.1	-38.0
31	-22.3		-0.7		5.8		14.0	16.7		-6.2		-30.5

Daily Mean

2017	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-17.0	-17.1	-17.2	6.0	5.7	23.1	16.8	16.5	18.0	13.4	-5.1	-8.3
2	-25.2	-18.0	-16.0	4.8	7.8	20.9	16.3	17.4	16.2	7.3	-6.7	-8.4
3	-23.7	-17.6	-6.8	4.5	9.6	18.3	19.9	16.4	16.1	5.6	-12.7	-11.2
4	-18.6	-16.8	-6.7	2.0	13.7	19.2	19.4	15.8	13.1	5.3	-11.1	-15.6
5	-17.1	-20.2	-13.5	2.4	16.4	20.0	18.7	18.4	12.5	6.3	-13.7	-15.5
6	-18.5	-24.6	-14.5	10.2	14.5	16.8	18.9	16.8	16.2	9.9	-12.2	-14.4
7	-22.1	-22.7	-15.0	12.8	13.1	17.1	18.5	16.7	16.2	8.4	-9.5	-7.2
8	-23.5	-21.5	-20.0	2.3	6.6	19.5	19.8	16.0	20.3	2.1	-14.4	-4.8
9	-25.5	-20.0	-23.7	-2.4	8.8	18.0	19.9	15.9	21.3	3.3	-15.5	-3.8
10	-25.5	-14.8	-25.7	0.0	8.5	10.6	18.8	16.9	16.6	6.1	-8.5	-1.1
11	-24.4	-9.7	-20.4	5.0	9.8	11.5	19.2	18.6	16.5	9.4	-8.8	-1.4
12	-30.5	-3.9	-19.0	4.9	7.5	13.2	17.1	18.0	13.5	1.5	-6.8	0.7
13	-23.2	1.1	-17.8	4.1	7.7	18.0	18.9	17.9	10.2	-1.6	-7.6	-1.2
14	-12.9	-5.6	-9.2	2.3	5.9	15.0	19.8	19.2	6.9	-0.2	-11.7	-2.4
15	-6.8	-1.3	-1.8	-3.0	9.7	11.8	19.4	16.1	7.5	5.1	-19.0	-3.7
16	-7.6	1.0	-0.7	-7.7	6.3	14.3	22.9	15.3	7.1	8.0	-13.8	-3.2
17	-0.4	3.8	-4.5	-2.8	6.3	14.4	14.7	16.7	7.9	9.1	-15.3	-5.5
18	0.1	-1.0	0.4	2.4	7.4	14.9	13.3	17.8	7.9	3.1	-17.7	-6.8
19	-2.7	-2.4	2.8	6.9	11.9	14.0	16.1	15.6	9.2	5.3	-15.7	-18.3
20	-1.5	-0.4	-6.9	7.1	14.1	14.5	17.6	14.0	8.2	6.4	-11.9	-22.5
21	-4.3	-0.5	-9.9	5.1	14.3	13.1	15.8	13.8	6.3	2.6	-17.9	-15.1
22	-5.9	-4.0	-1.8	0.6	14.7	11.0	18.4	12.8	6.2	-0.3	-15.1	-11.4
23	-9.7	-8.0	-2.6	0.1	15.0	8.3	19.9	15.9	6.0	3.1	-5.5	-18.8
24	-14.1	-9.9	-1.6	-1.1	16.1	11.1	16.4	16.7	7.1	6.1	-7.1	-26.8
25	-14.4	-12.5	0.3	-1.0	11.9	14.5	17.3	15.4	9.7	1.4	-10.2	-28.9
26	-12.4	-16.3	-2.3	1.1	12.6	14.8	17.8	16.8	12.4	-2.4	-8.9	-30.3
27	-5.2	-15.8	-1.8	3.0	12.7	19.0	20.3	17.8	11.3	-0.4	-4.2	-28.4
28	-0.9	-11.7	0.5	5.7	12.1	15.6	20.5	18.3	10.3	6.4	-7.0	-29.0
29	-2.8		3.6	6.4	12.0	12.9	18.9	16.2	13.4	1.6	-1.1	-32.5
30	-1.5		2.6	8.0	11.5	13.6	20.6	15.9	15.5	-3.5	-6.0	-31.6
31	-12.4		4.0		16.3		18.9	23.7		-3.7		-25.6

Temperature Events 2017

Cold Spell (less than or equal to -30°C)	
Date	Temperature (°C)
January 8	-30.7
January 9	-30.6
January 10	-31.4
January 11	-33.1
January 12	-33.8
January 13	-31.3
March 10	-31.6
December 25	-30.6
December 26	-34.7
December 27	-34.2
December 28	-34.2
December 29	-35.3
December 30	-38.0
December 31	-30.5

Hot Spell (greater than or equal to 30°C)	
Date	Temperature (°C)
June 1	32.6
July 16	32.2

Temperature and
Relative Humidity sensor
and all-season precipitation gauge
28 July 2017
Photo: V. Wittrock

Precipitation 2017

Extreme Precipitation Events		
Period	Date	Amount (mm)
0.5 Hour	May 7	5.4
	May 21	4.6
1 Hour	August 4	8.2
	May 15	5.8
2 Hours	August 4	10.2
	July 18	6.6
6 Hours	May 8	10.8
	August 4	10.6
12 Hours	May 8	14.6
	September 19	12.6
24 Hours	May 8	25.8
	June 10	13.8
Calendar Day	May 8	18.4
	June 10	13.8
More than one day*	May 7-8	34.5
Longest wet spells*	June 17-22 (6 days)	24.5
Longest dry spell*	September 4-12 (9 days)	

* Includes Weighing Gauge Values

Ranking By Driest Month	
	Amount (mm)
February	8.5
December	8.7
August	15.0
January	15.6
October	15.6
April	16.0
July	17.6
November	18.2
September	18.2
March	23.2
June	44.9
May	62.9

Daily Precipitation Values

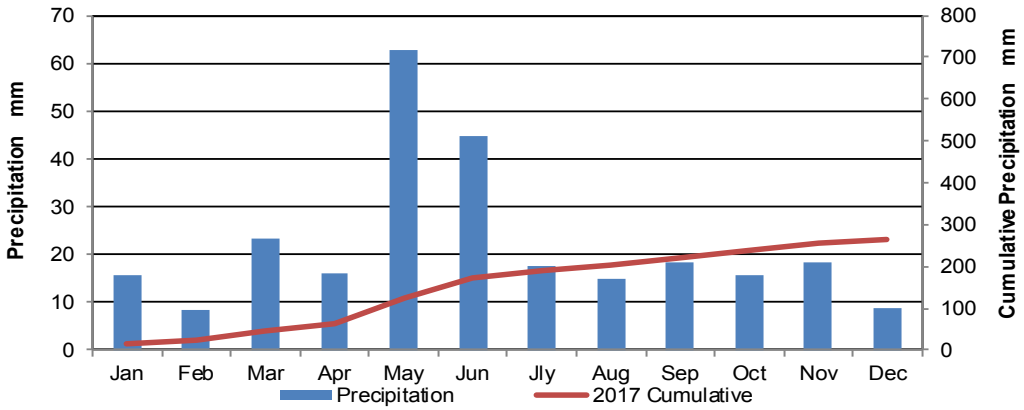
2017	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	0.0	0.0	0.0	2.3	2.5	0.0	0.0	0.1	0.0	0.0	0.0	0.1
2	0.3	0.0	0.5	0.4	0.5	0.1	0.0	0.0	0.0	0.0	0.5	0.2
3	0.9	0.3	0.2	0.0	0.0	0.2	0.2	0.1	1.1	0.0	0.9	0.5
4	0.3	0.0	0.1	0.0	0.0	0.2	0.0	11.8	0.0	0.0	2.2	0.0
5	0.1	0.0	9.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2	1.8
6	0.0	0.4	0.7	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2
7	0.2	0.1	2.3	2.5	13.1	0.1	0.1	0.3	0.0	1.6	0.0	0.0
8	0.0	0.6	0.0	0.4	21.4	0.1	0.0	0.0	0.0	0.1	0.0	0.0
9	3.1	0.2	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.2	0.4
10	0.0	2.1	1.0	0.0	0.0	14.0	2.0	0.0	0.0	0.0	2.5	0.1
11	1.9	1.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
13	0.6	0.0	1.0	1.2	2.5	0.0	0.1	0.2	0.7	0.0	0.0	0.0
14	0.0	0.0	0.0	5.2	7.7	4.2	0.0	0.0	0.0	0.0	4.8	0.0
15	0.0	0.0	0.0	0.6	5.3	0.1	0.2	0.3	0.0	0.0	0.2	3.3
16	0.5	0.0	0.2	0.0	0.0	0.0	0.7	0.0	0.0	0.0	4.6	0.1
17	0.0	0.1	0.0	0.0	0.0	3.1	0.1	0.5	0.0	0.8	0.0	0.0
18	0.0	0.0	0.0	0.5	0.1	5.5	6.9	0.0	0.3	2.7	0.3	0.0
19	0.0	2.0	0.0	0.0	0.0	1.7	0.1	0.2	15.2	0.1	0.0	0.0
20	0.1	0.1	0.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.5	0.3
21	0.7	0.1	0.0	0.6	4.6	6.6	3.4	0.0	0.3	4.6	0.0	0.4
22	3.0	0.0	1.2	0.0	0.0	7.2	0.0	0.1	0.0	0.2	0.4	0.2
23	2.4	0.0	0.0	0.1	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0
24	0.1	0.6	0.0	2.1	2.5	0.0	3.6	0.1	0.3	0.1	0.0	0.5
25	0.0	0.0	5.2	0.0	2.5	0.0	0.0	0.7	0.0	3.7	0.3	0.0
26	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.2	0.0
27	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2	0.0
28	0.0	0.1	0.8	0.0	0.1	0.4	0.0	0.0	0.1	0.0	0.0	0.2
29	0.2		0.3	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.0
30	0.1		0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.4
31	0.1		0.0	0.0	0.0	0.0	0.0	0.0		0.2		0.0
Total	**15.6**	**8.5**	**23.2**	**16.0**	**62.9**	**44.9**	**17.6**	**15.0**	**18.2**	**15.6**	**18.2**	**8.7**

Precipitation 2017

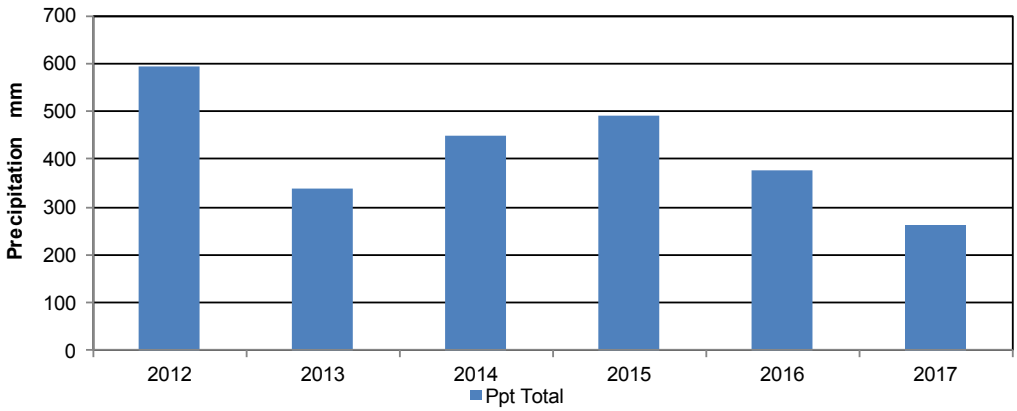
Month	AMOUNT (mm)		RECORD VALUES (mm)		Days with Measurable Precipitation		Month end Snow-on-Ground (cm)		
	2017	Cumulative	CRS Maximum	CRS Minimum	2017	Cumulative	2017	CRS Maximum	CRS Minimum
January	15.6	15.6	26.0/2013	8.9/2014	19	19	10	56/2013	2/2012
February	8.5	24.1	18.3/2015	8.0/2012	14	33	5	64/2013	7/2012
March	23.2	47.3	19.0/2012	6.5/2015	16	49	0	76/2013	0/2015
April	16.0	63.3	52.5/2014	4.6/2016	12	61	0	52/2013	0/2015
May	62.9	126.2	85.4/2012	6.8/2013	13	74	0	0	0
June	44.9	171.1	140.4/2012	45.0/2015	18	92	0	0	0
July	17.6	188.7	176.6/2015	72.5/2016	13	105	0	0	0
August	15.0	203.7	79.5/2016	5.8/2013	13	118	0	0	0
September	18.2	221.9	64.8/2015	11.0/2014	8	126	0	0	0
October	15.6	237.5	58.2/2016	5.6/2013	13	139	0	5/2012	0/2015
November	18.2	255.7	34.6/2013	11.7/2016	17	156	10	24/2013	0/2016
December	8.7	264.4	15.1/2013	2.4/2015	15	171	8	40/2013	5/2016
Total	264.4				171				

All-season precipitation gauge
Tipping Bucket
AES Standard rain guage (manual)
28 July 2017
Photo: V. Wittrock

Monthly

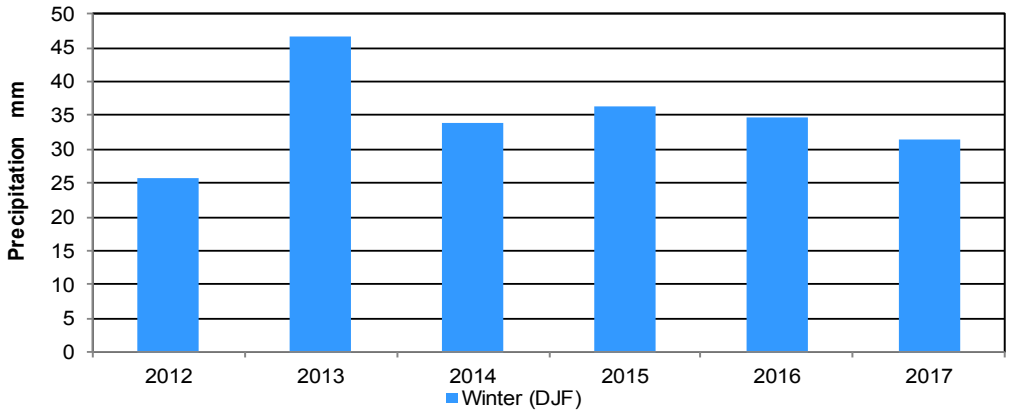


Annual

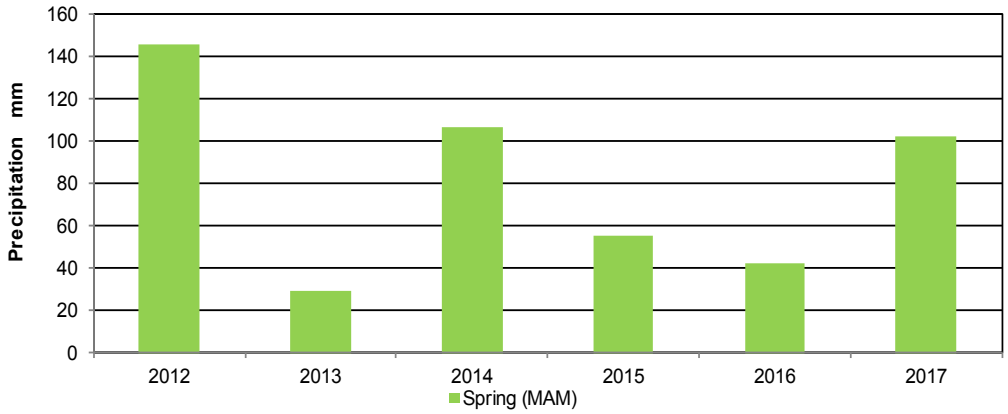


SEASONAL PRECIPITATION

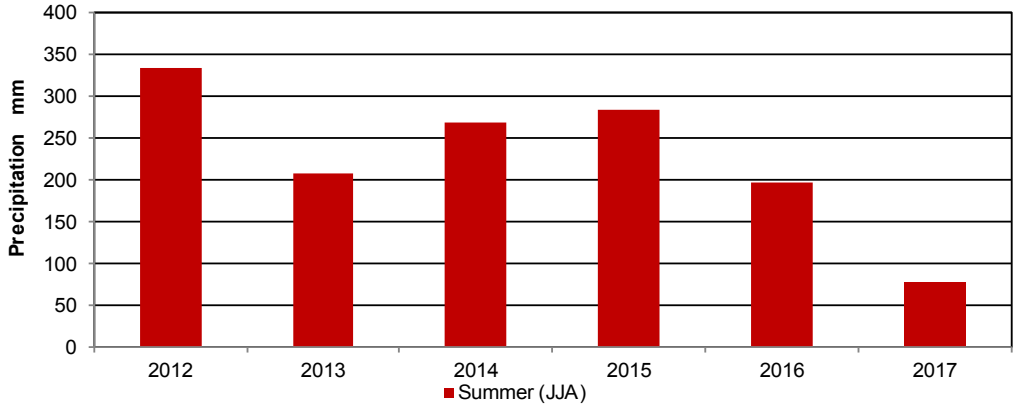
Winter



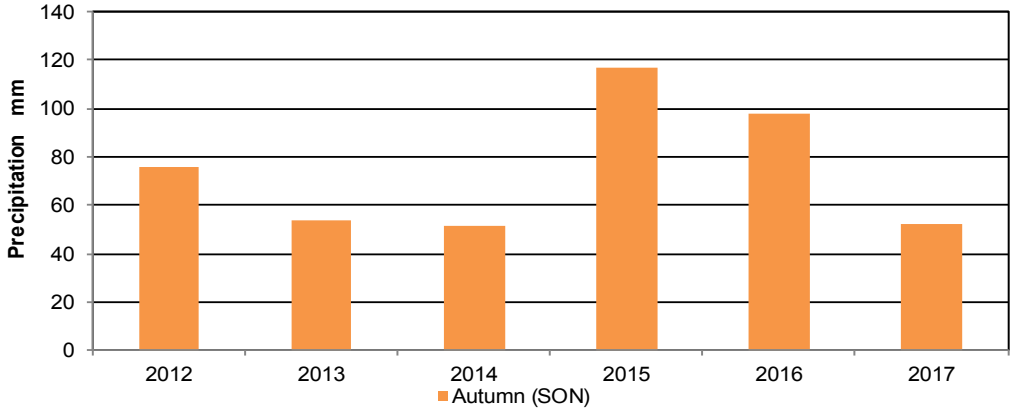
Spring



Summer

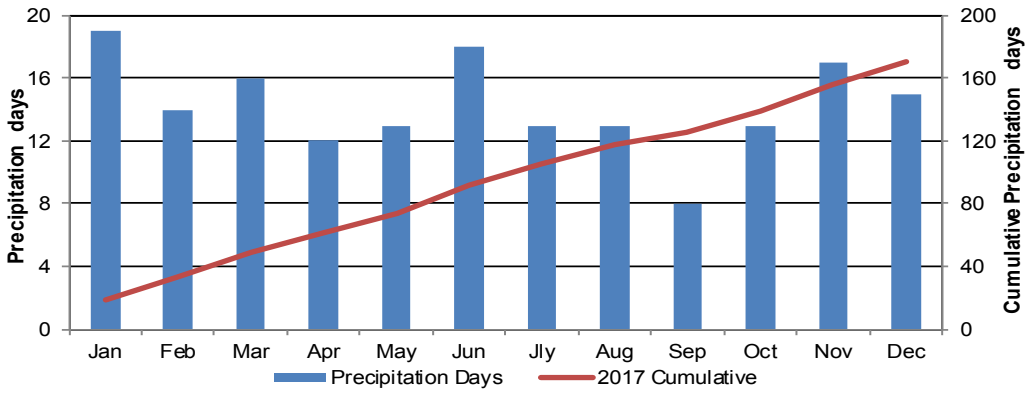


Autumn

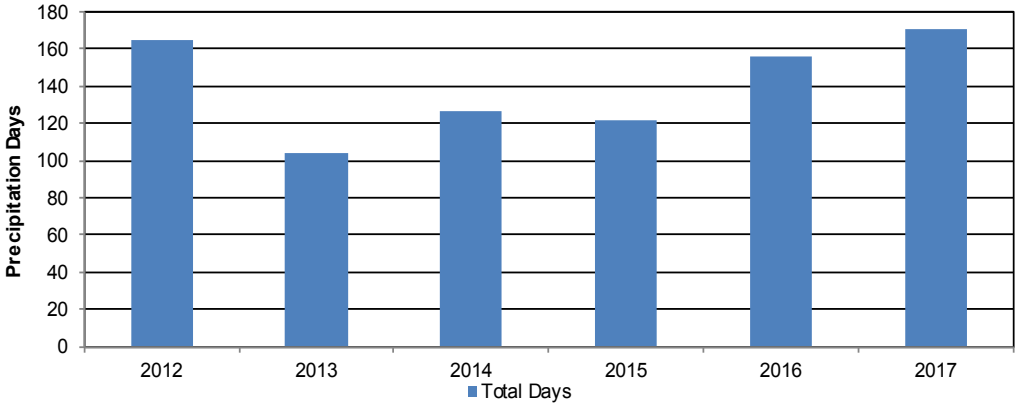


SEASONAL PRECIPITATION DAYS

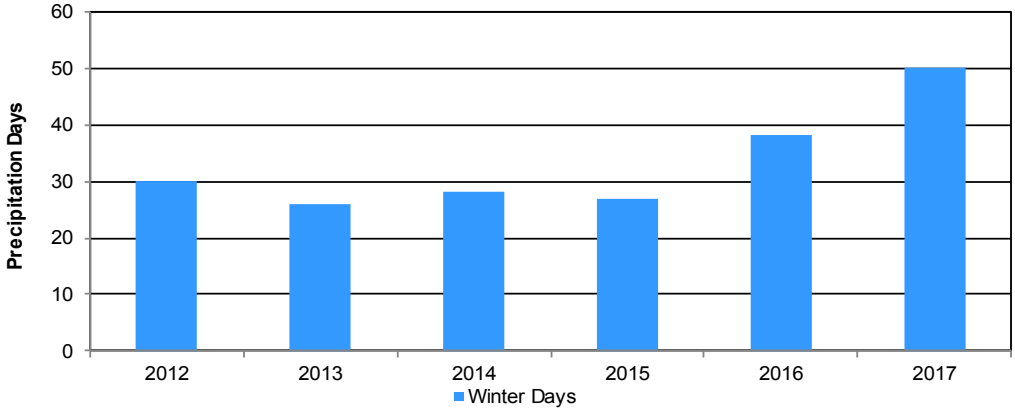
Monthly



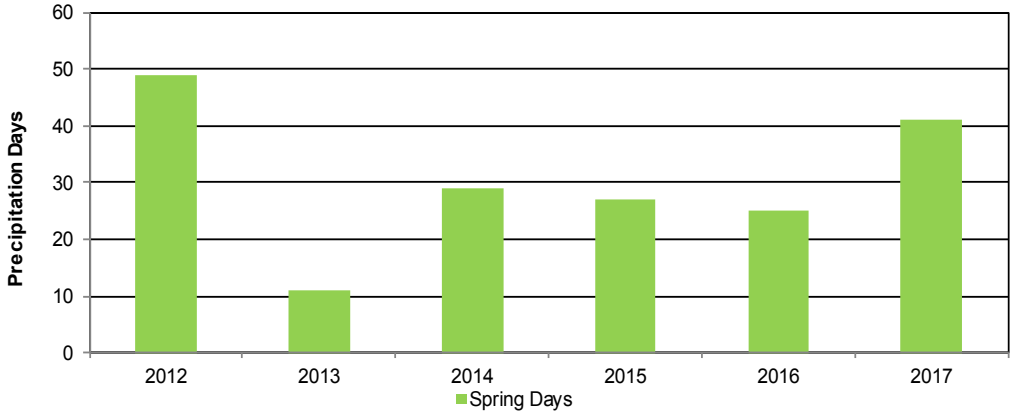
Annual



Winter

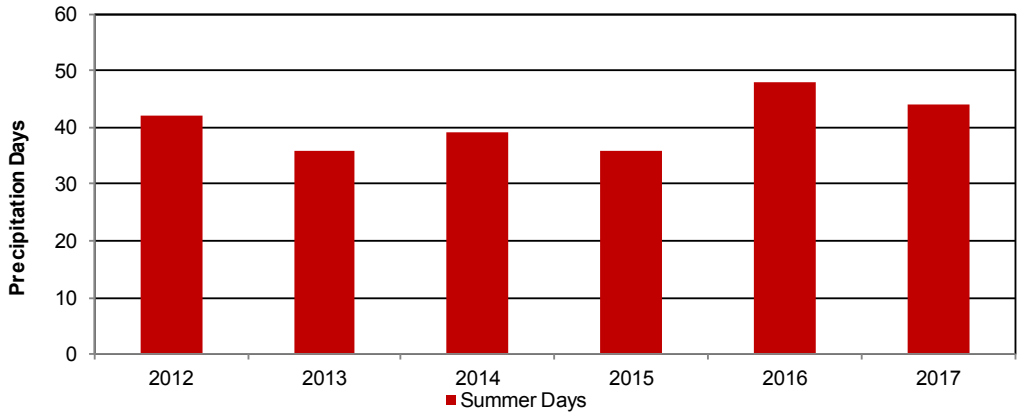


Spring

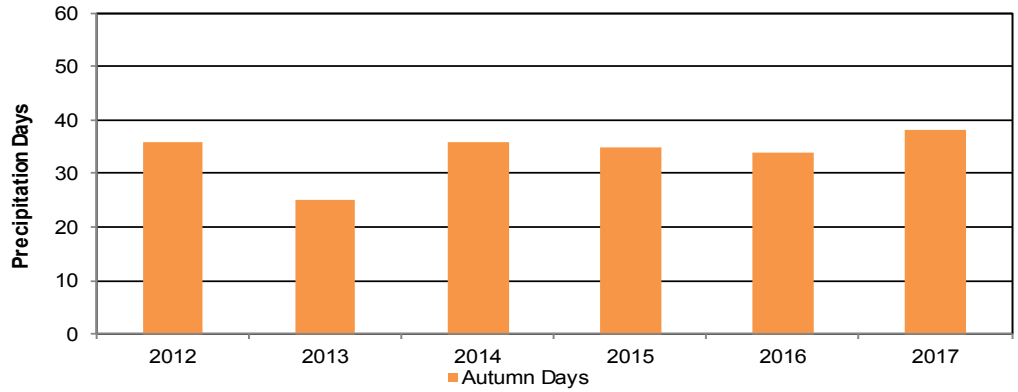


Seasonal Precipitation Days

Summer



Autumn



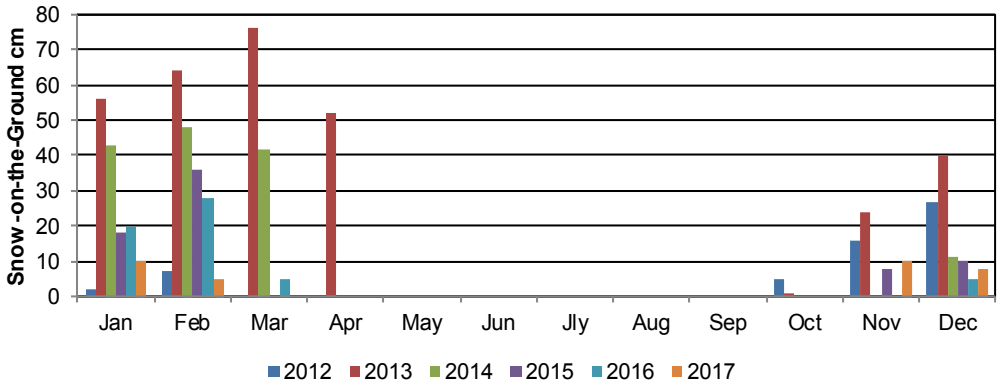
RANKING BY DRIEST YEAR (mm)									
ANNUAL (JAN-DEC)		WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2017	264.4	2012*	25.6*	2013	29.4	2017	78.6	2014	51.3
2013	340.0	2017	31.4	2016	42.2	2016	197.8	2017	52.0
2016	377.6	2014	33.9	2015	55.4	2013	207.6	2013	53.6
2014	450.2	2016	34.8	2017	102.1	2014	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

ANNUAL RANKING BY DAYS WITH PRECIPITATION									
ANNUAL (JAN-DEC)		WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2013	104	2017	50	2013	11	2015	26	2013	25
2015	122	2016	38	2016	25	2013	36	2016	34
2014	127	2012*	30	2015	27	2014	39	2015	35
2016	156	2014	28	2014	29	2012	42	2012	36
2012	165	2015	27	2017	41	2017	44	2014	36
2017	171	2013	26	2012	49	2016	48	2017	38

* = Missing December 2011

RANKING BY HIGHEST TO LOWEST					
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	2017	6
2017	194	2017	9	2012	5

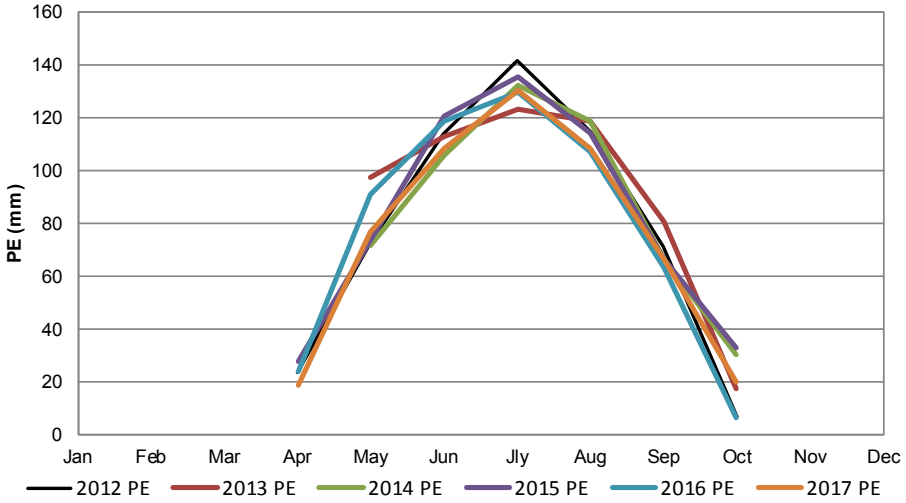
Precipitation 2017



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	2017 PE
Jan						
Feb						
Mar						
Apr	24.0			27.6	24.0	19.0
May	73.0	97.1	71.6	73.6	91.1	76.9
Jun	113.6	112.9	105.4	120.4	118.4	108.2
Jly	141.7	123.3	132.2	135.6	129.4	130.2
Aug	114.4	118.7	118.7	114.4	106.9	108.5
Sep	71.5	80.6	66.2	66.7	63.5	66.7
Oct	6.8	17.2	30.7	33.1	6.3	20.2
Nov						
Dec						
Total	545.0	549.9	524.9	571.4	539.6	529.7

[1] Thornthwaite and Mather 1955
Thornthwaite 1948

Snow Depth Sensor
28 July, 2017
photo credit: V. Wittrock

Radiation 2017

Sunrise & Sunset Tables for Conservation Learning Center, 2017 & 2018[1]

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

2018	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	7:50	18:42	6:36	19:38	5:30	20:32	4:43	21:19	4:42	21:32	5:21	20:57	6:13	19:52	7:05	18:40	8:01	17:32	8:54	16:50
2	9:16	16:58	8:44	17:50	7:47	18:44	6:34	19:40	5:28	20:34	4:43	21:20	4:42	21:32	5:23	20:55	6:15	19:49	7:06	18:37	8:03	17:30	8:55	16:50
3	9:16	17:00	8:43	17:52	7:45	18:46	6:32	19:42	5:26	20:35	4:42	21:21	4:43	21:31	5:24	20:53	6:17	19:47	7:08	18:35	8:05	17:28	8:57	16:49
4	9:16	17:01	8:41	17:54	7:43	18:47	6:29	19:44	5:24	20:37	4:41	21:23	4:44	21:31	5:26	20:51	6:18	19:45	7:10	18:33	8:07	17:26	8:58	16:48
5	9:15	17:02	8:39	17:56	7:41	18:49	6:27	19:46	5:22	20:39	4:40	21:23	4:45	21:30	5:27	20:50	6:20	19:42	7:12	18:30	8:09	17:24	8:59	16:48
6	9:15	17:03	8:37	17:58	7:38	18:51	6:25	19:47	5:20	20:40	4:40	21:24	4:46	21:29	5:29	20:48	6:22	19:40	7:13	18:28	8:11	17:22	9:01	16:47
7	9:14	17:05	8:36	18:00	7:36	18:53	6:22	19:49	5:18	20:42	4:39	21:25	4:47	21:29	5:31	20:46	6:23	19:37	7:15	18:26	8:12	17:21	9:02	16:47
8	9:14	17:06	8:34	18:01	7:34	18:55	6:20	19:51	5:16	20:44	4:39	21:26	4:48	21:28	5:32	20:44	6:25	19:35	7:17	18:23	8:14	17:19	9:03	16:47
9	9:13	17:08	8:32	18:03	7:31	18:57	6:18	19:53	5:15	20:46	4:38	21:27	4:49	21:27	5:34	20:42	6:27	19:33	7:19	18:21	8:16	17:17	9:04	16:46
10	9:13	17:09	8:30	18:05	7:29	18:59	6:15	19:54	5:13	20:47	4:38	21:28	4:50	21:26	5:36	20:40	6:29	19:30	7:21	18:19	8:18	17:16	9:06	16:46
11	9:12	17:11	8:28	18:07	7:27	19:00	6:13	19:56	5:11	20:49	4:37	21:29	4:51	21:25	5:37	20:38	6:30	19:28	7:22	18:16	8:20	17:14	9:07	16:46
12	9:11	17:12	8:26	18:09	7:24	19:02	6:11	19:58	5:09	20:51	4:37	21:29	4:52	21:25	5:39	20:36	6:32	19:26	7:24	18:14	8:22	17:12	9:08	16:46
13	9:10	17:14	8:24	18:11	7:22	19:04	6:08	20:00	5:08	20:52	4:37	21:30	4:53	21:24	5:41	20:34	6:34	19:23	7:26	18:12	8:24	17:11	9:09	16:46
14	9:10	17:15	8:22	18:13	7:19	19:06	6:06	20:02	5:06	20:54	4:37	21:30	4:55	21:23	5:43	20:32	6:35	19:21	7:28	18:09	8:25	17:09	9:10	16:46
15	9:09	17:17	8:20	18:15	7:17	19:08	6:04	20:03	5:05	20:55	4:37	21:31	4:56	21:21	5:44	20:30	6:37	19:18	7:30	18:07	8:27	17:08	9:10	16:46
16	9:08	17:19	8:18	18:17	7:15	19:10	6:02	20:05	5:03	20:57	4:36	21:31	4:57	21:20	5:46	20:28	6:39	19:16	7:31	18:05	8:29	17:06	9:11	16:46
17	9:07	17:20	8:16	18:19	7:12	19:11	5:59	20:07	5:01	20:59	4:36	21:32	4:59	21:19	5:48	20:25	6:40	19:13	7:33	18:03	8:31	17:05	9:12	16:47
18	9:06	17:22	8:14	18:21	7:10	19:13	5:57	20:09	5:00	21:00	4:36	21:32	5:00	21:18	5:49	20:23	6:42	19:11	7:35	18:01	8:33	17:04	9:13	16:47
19	9:04	17:24	8:12	18:23	7:08	19:15	5:55	20:11	4:58	21:02	4:37	21:33	5:01	21:17	5:51	20:21	6:44	19:09	7:37	17:58	8:34	17:02	9:13	16:47
20	9:03	17:26	8:10	18:25	7:05	19:17	5:53	20:12	4:57	21:03	4:37	21:33	5:03	21:15	5:53	20:19	6:46	19:06	7:39	17:56	8:36	17:01	9:14	16:48
21	9:02	17:27	8:07	18:27	7:03	19:19	5:51	20:14	4:56	21:05	4:37	21:33	5:04	21:14	5:54	20:17	6:47	19:04	7:41	17:54	8:38	17:00	9:15	16:48
22	9:01	17:29	8:05	18:29	7:00	19:20	5:48	20:16	4:54	21:06	4:37	21:33	5:05	21:13	5:56	20:15	6:49	19:01	7:42	17:52	8:40	16:59	9:15	16:49
23	9:00	17:31	8:03	18:31	6:58	19:22	5:46	20:18	4:53	21:08	4:37	21:33	5:07	21:11	5:58	20:12	6:51	18:59	7:44	17:50	8:41	16:57	9:15	16:49
24	8:58	17:33	8:01	18:32	6:56	19:24	5:44	20:19	4:52	21:09	4:38	21:33	5:08	21:10	6:00	20:10	6:52	18:57	7:46	17:48	8:43	16:56	9:16	16:50
25	8:57	17:35	7:59	18:34	6:53	19:26	5:42	20:21	4:51	21:10	4:38	21:33	5:10	21:08	6:01	20:08	6:54	18:54	7:48	17:46	8:45	16:55	9:16	16:51
26	8:55	17:36	7:56	18:36	6:51	19:28	5:40	20:23	4:49	21:12	4:39	21:33	5:11	21:07	6:03	20:06	6:56	18:52	7:50	17:43	8:46	16:54	9:16	16:51
27	8:54	17:38	7:54	18:38	6:48	19:29	5:38	20:25	4:48	21:13	4:39	21:33	5:13	21:05	6:05	20:03	6:58	18:49	7:52	17:41	8:48	16:53	9:17	16:52
28	8:52	17:40	7:52	18:40	6:46	19:31	5:36	20:27	4:47	21:14	4:40	21:33	5:15	21:04	6:06	20:01	6:59	18:47	7:54	17:39	8:49	16:53	9:17	16:53
29	8:51	17:42			6:44	19:33	5:34	20:28	4:46	21:16	4:40	21:33	5:16	21:02	6:08	19:59	7:01	18:45	7:55	17:37	8:51	16:52	9:17	16:54
30	8:49	17:44			6:41	19:35	5:32	20:30	4:45	21:17	4:41	21:32	5:18	21:00	6:10	19:56	7:03	18:42	7:57	17:35	8:52	16:51	9:17	16:55
31	8:48	17:46			6:39	19:37			4:44	21:18			5:19	20:59	6:12	19:54			7:59	17:33			9:17	16:56

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

Radiation 2017

	Bright Sunshine Hours			Bright Sunshine Days			
Month	**2017 # of Hours**	**Possible hours[1]**	**% of Possible hrs**	**2017 # of Days**	**With 1 or > hours**	**With 5 or > hours**	**With 10 or > hours**
Jan	103.6	255.5	40.5	25	25	10	0
Feb	147.6	277.5	53.2	25	22	17	1
Mar	190.2	369.9	51.4	25	25	18	11
Apr	241.1	421.0	57.3	28	28	25	8
May	310.6	492.2	63.1	30	29	26	18
Jun	262.9	505.5	52.0	29	28	22	13
Jul	365.6	506.1	72.2	31	31	29	25
Aug	335.3	454.6	73.8	30	30	29	20
Sep	240.3	379.0	63.4	29	28	22	15
Oct	169.2	327.0	51.7	28	25	19	1
Nov	101.7	260.0	39.1	25	20	10	0
Dec	117.7	237.4	49.6	29	25	13	0
Total	2585.8	4485.8	57.6	334	316	240	112

National Research Council, Canada, Hertzberg Institute of Astrophysics

Global and Diffuse Radiation (MJ/m²)

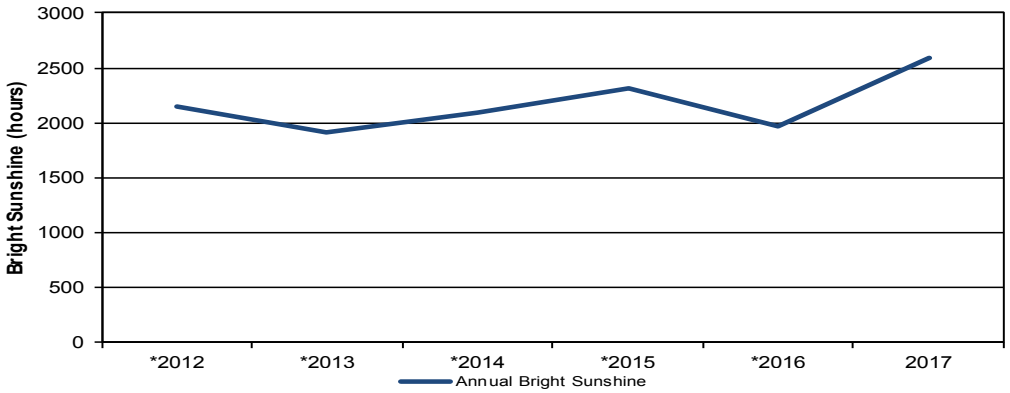
2017 Date	January		February		March		April		May		June		July		August		September		October		November		December	
	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse
1	3.2	1.5	6.5	1.8	7.7	6.3	10.1	5.8	15.6	12.6	23.6	11.6	26.2	8.5	19.2	8.0	18.9	4.5	11.1	4.0	4.1	3.7	4.6	0.9
2	5.3	0.9	4.2	3.5	10.2	4.7	19.5	10.9	17.1	9.3	22.0	12.6	14.4	12.4	24.7	4.9	17.8	4.7	2.8	2.5	4.1	2.6	2.5	1.9
3	4.3	1.8	3.6	3.3	10.2	4.8	19.7	10.8	21.9	10.7	28.0	8.0	28.1	9.5	22.2	6.2	18.1	3.7	12.9	1.7	4.8	3.2	2.3	1.7
4	2.7	2.1	4.8	3.4	8.2	4.5	20.1	10.8	23.7	11.8	28.7	7.6	30.3	10.4	3.8	3.3	16.9	5.1	12.7	1.5	5.1	4.2	4.1	0.9
5	2.6	2.1	5.9	3.7	4.9	4.4	20.9	10.3	24.4	10.2	16.9	8.8	26.9	12.7	24.3	4.8	18.2	3.6	10.3	5.2	6.3	3.4	1.5	1.3
6	5.2	0.9	5.9	3.2	6.0	5.5	12.8	10.5	17.6	12.2	30.0	7.8	25.7	10.2	22.0	4.8	17.7	3.3	11.2	2.5	6.7	2.1	2.2	1.4
7	4.4	1.9	9.1	1.8	7.1	6.4	17.5	7.9	14.7	10.4	29.1	8.8	29.1	11.2	19.0	7.8	15.4	5.9	9.1	3.3	4.9	3.7	2.6	0.8
8	4.1	0.9	8.4	1.5	14.0	3.2	5.5	4.0	3.1	2.7	29.3	9.4	23.4	14.1	12.9	7.7	18.2	2.8	6.6	5.2	4.9	3.9	2.6	2.3
9	1.8	1.7	4.6	4.2	14.7	2.2	14.5	13.4	26.6	11.7	11.3	9.2	25.9	13.8	23.8	4.2	13.1	7.0	10.6	2.3	6.9	3.4	3.5	1.0
10	2.6	0.8	6.5	4.7	12.7	6.9	17.9	12.4	24.6	13.9	7.0	6.0	11.8	9.9	21.9	5.3	15.4	4.2	9.3	4.2	2.2	2.1	1.7	1.4
11	2.5	1.9	7.0	2.5	13.3	6.2	20.4	11.2	27.2	12.9	17.7	12.2	16.3	13.4	14.4	5.8	16.7	2.8	7.8	3.8	2.6	2.4	2.0	1.4
12	4.8	1.0	8.4	2.3	14.7	3.7	17.1	10.7	15.9	11.2	30.5	9.2	27.2	14.7	24.2	3.3	16.7	2.9	4.0	3.6	2.5	2.3	2.4	1.7
13	4.5	0.9	8.0	2.4	9.4	7.5	11.7	7.2	16.0	12.6	17.2	8.7	27.0	14.5	23.7	3.1	7.6	6.1	7.0	5.1	6.3	4.3	2.6	1.2
14	4.5	2.7	8.5	2.4	14.3	3.1	1.6	1.4	4.8	4.1	8.9	7.5	21.6	15.9	19.0	6.8	7.1	6.1	10.0	2.9	3.4	3.0	3.0	1.6
15	3.4	2.5	9.1	3.5	14.5	3.5	12.1	10.1	22.0	13.8	7.5	6.5	25.3	13.2	18.6	6.8	12.3	4.7	10.1	1.9	6.6	3.1	0.8	0.6
16	4.6	2.4	6.4	4.7	4.4	4.0	16.3	12.1	15.8	11.2	23.8	10.5	22.5	15.0	21.8	4.5	7.4	6.4	8.8	3.3	2.0	1.8	1.4	1.1
17	4.3	1.5	8.7	1.4	15.8	2.3	17.7	11.4	23.4	8.0	13.7	9.8	23.8	13.3	20.3	5.4	11.7	7.2	7.3	4.1	4.9	2.3	2.0	1.7
18	3.5	2.3	7.5	3.4	11.7	5.9	19.7	11.7	29.1	4.9	22.8	10.2	18.6	8.2	22.5	2.7	14.1	4.4	9.7	2.5	6.0	2.0	3.6	1.2
19	1.8	1.6	3.7	3.4	16.1	2.3	15.2	10.2	28.2	6.3	28.4	9.7	26.7	17.6	20.9	6.1	1.9	1.7	8.4	3.0	2.7	2.4	3.3	0.8
20	3.4	2.5	3.5	3.2	16.1	3.7	18.9	9.7	27.1	5.6	19.0	9.0	20.0	12.7	13.6	7.1	14.3	6.2	5.5	4.3	2.5	2.3	4.5	0.9
21	1.7	1.6	4.2	3.7	16.5	4.3	13.1	11.1	20.5	9.2	16.0	9.7	5.7	4.4	20.4	2.8	10.1	4.7	1.1	1.0	3.6	3.3	1.8	1.5
22	2.3	2.1	3.9	3.6	3.0	2.7	17.2	11.3	28.1	4.2	10.1	8.8	26.1	18.7	10.9	9.0	7.6	5.3	6.5	5.3	3.5	3.2	2.2	1.8
23	3.0	2.8	9.0	2.9	15.6	4.4	11.2	8.4	20.4	10.2	14.2	11.0	20.8	18.2	21.7	2.6	6.8	5.8	8.4	1.9	2.8	2.4	3.1	1.0
24	3.5	3.3	8.1	5.1	14.4	6.3	9.2	8.2	9.3	6.4	24.3	10.8	22.9	19.8	19.1	4.8	8.2	6.1	6.6	1.8	4.0	1.6	4.0	1.0
25	6.3	1.3	9.9	3.2	6.8	5.8	13.9	7.9	17.0	8.8	29.9	10.1	22.3	20.1	20.0	3.7	13.6	2.7	1.3	1.2	3.0	1.8	3.8	0.9
26	5.7	1.3	10.1	3.9	6.6	5.5	16.3	11.4	23.8	15.7	25.6	9.2	25.0	17.6	21.0	2.6	6.9	4.0	5.7	3.8	2.5	2.3	4.1	0.9
27	6.8	1.9	11.8	2.7	17.8	5.6	16.8	11.4	27.1	11.5	18.0	12.1	26.4	19.2	20.8	2.5	9.9	6.0	6.0	2.2	3.7	1.6	3.1	1.9
28	5.1	2.7	10.7	3.0	4.6	4.2	18.2	9.8	21.7	10.9	22.4	10.3	23.9	19.2	18.3	5.8	13.7	1.6	6.4	2.8	4.2	1.0	3.6	1.5
29	5.9	1.9	-	-	11.3	8.7	15.9	9.3	29.9	10.7	15.6	12.1	23.4	10.3	20.5	2.2	13.5	1.6	3.1	2.9	3.8	1.4	6.0	1.1
30	4.7	4.0			7.6	6.7	17.6	8.7	29.6	10.7	14.9	10.9	23.4	5.4	16.7	5.7	13.0	1.8	3.6	3.3	3.8	1.3	6.1	1.0
31	11.4	5.1			16.3	11.4			29.3	9.3			24.5	10.7	13.1	6.6			7.4	6.7			5.7	2.1
Total	129.9	61.9	198.0	88.4	346.5	156.7	458.6	290.0	655.5	303.7	606.4	288.1	715.2	414.8	595.3	156.9	382.8	132.9	231.3	99.8	124.4	78.1	96.7	40.5

Left: Diffuse Radiation Pyranometer with auto shadow band
Middle: Global Radiation Pyranometer
Right: Bright Sunshine
28 July 2017
photo credit: V. Wittrock

Radiation 2017

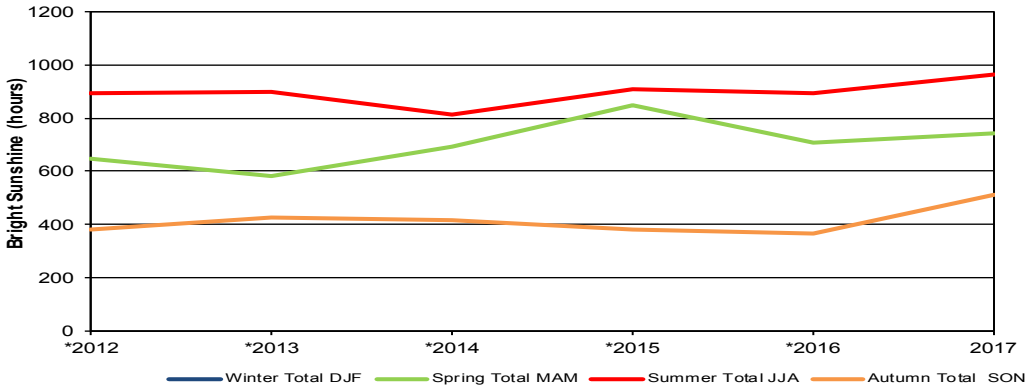
Annual Bright Sunshine Hours

Note: Winter bright sunshine is low for the 2012 to 2016 period due to instrument misalignment

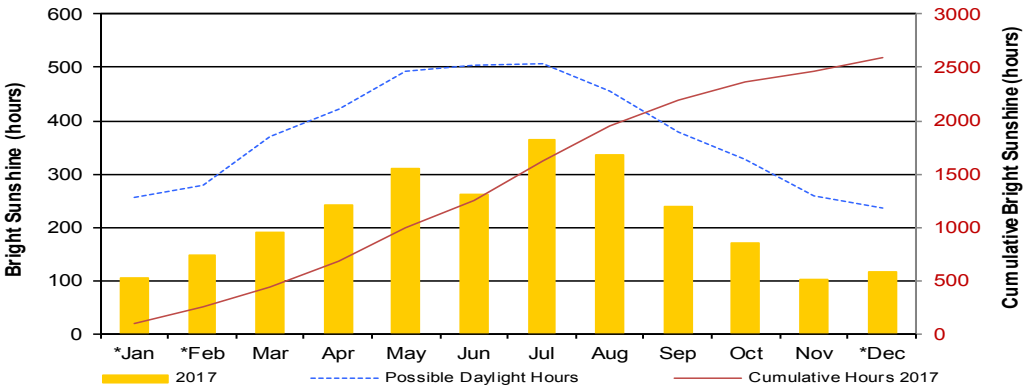


Seasonal Bright Sunshine Hours

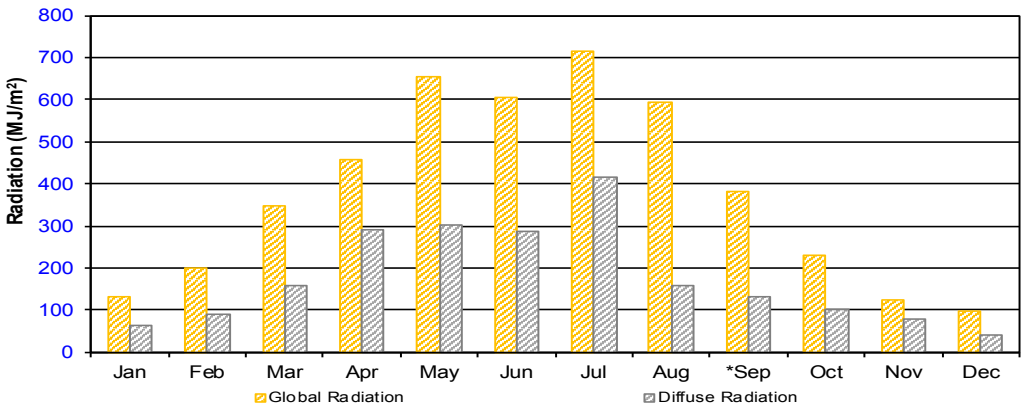
Note: Winter bright sunshine is low for the 2012 to 2016 period due to instrument misalignment



Bright Sunshine Hours



Global & Diffuse Radiation



Wind 2017

	Average		Highest Instantaneous Wind Speed		
	Speed (km/h)	"1/2 hr Maximum" Average	Speed (km/h)	Direction	Day
January	11.3	16.7	68.4	N	11
February	10.0	16.6	48.7	NW	1
March	13.7	20.8	67.5	NNW	7
April	13.8	22.1	61.5	E	14
May	15.8	24.8	64.5	SE	24
June	13.7	22.1	59.3	NNW	22
July	11.1	18.3	59.1	SSW	16
August	9.6	16.1	50.6	NW	17
September	11.1	18.4	54.8	W	10
October	15.6	24.1	83.2	WNW	18
November	12.1	18.7	69.5	WNW	27
December	11.8	17.5	54.8	NW	10

Anemometer and 10 meter tower
28 July 2017
Photo: V. Wittrock

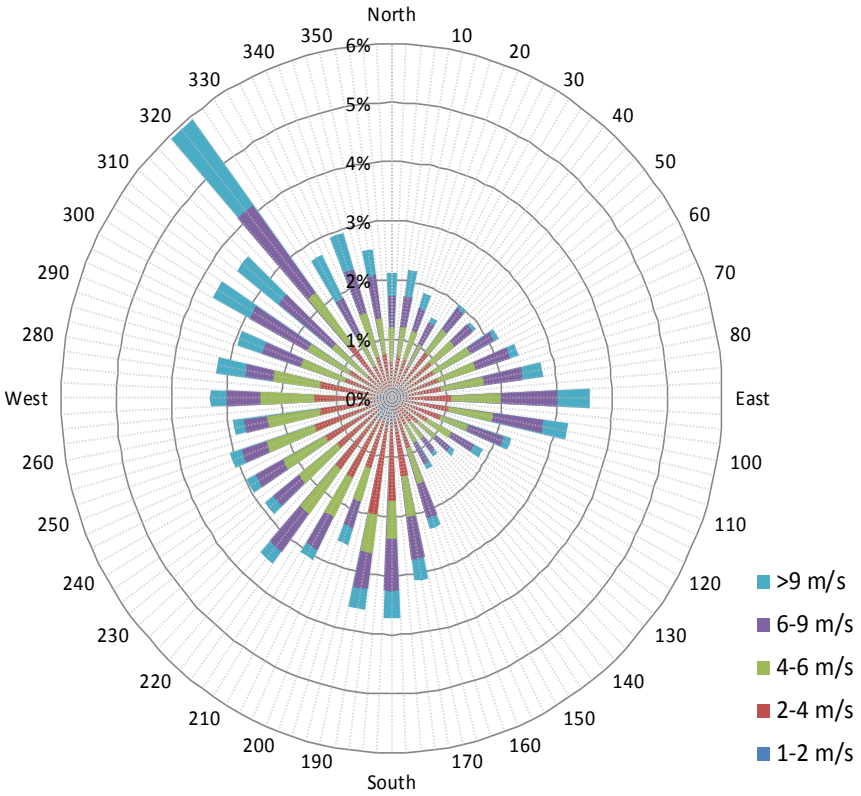
Extreme Daily Winds (km/h)				
Month	Day	Speed / Direction		Beaufort Wind Scale Definition*
January	11	68.4	N	Gale
March	7	67.5	NNW	Gale
	19	60.7	NW	Near Gale
	20	56.5	NNW	Near Gale
April	6	51.7	SSW	Near Gale
	7	57.2	SW	Near Gale
	13	58.6	ENE	Near Gale
	14	61.5	E	Gale
	21	54.3	SW	Near Gale
May	8	52.0	NNW	Near Gale
	13	62.3	E	Gale
	15	50.5	S	Near Gale
	21	51.6	N	Near Gale
	24	64.5	SE	Gale
	28	53.6	NW	Near Gale
	29	55.9	N	Near Gale
June	1	50.3	S	Near Gale
	2	59.1	WSW	Near Gale
	3	56.7	NW	Near Gale
	18	53.1	E	Near Gale
	21	58.9	NW	Near Gale
	22	59.3	NNW	Near Gale
	23	51.4	NNW	Near Gale
July	16	59.1	SSW	Near Gale
	24	51.9	WSW	Near Gale
	25	50.7	NW	Near Gale
August	17	50.6	NW	Near Gale
September	10	54.8	W	Near Gale
October	2	73.9	N	Gale
	3	52.2	N	Near Gale
	7	51.4	NW	Near Gale
	8	55.2	NNW	Near Gale
	17	80.4	WNW	Strong Gale
	18	83.2	WNW	Strong Gale
	24	58.0	NW	Near Gale
	29	60.8	NW	Near Gale
November	20	54.0	NW	Near Gale
	27	69.5	WNW	Gale
December	10	54.8	NW	Near Gale

Beaufort Wind Scale* (km/h)	
Near Gale	>= 50 but < 62
Gale	>= 62 but < 74
Strong Gale	>= 75 but < 89
Storm	>= 89 but < 103
Violent Storm	>= 103 but < 117
Hurricane Force	>= 117 km/h

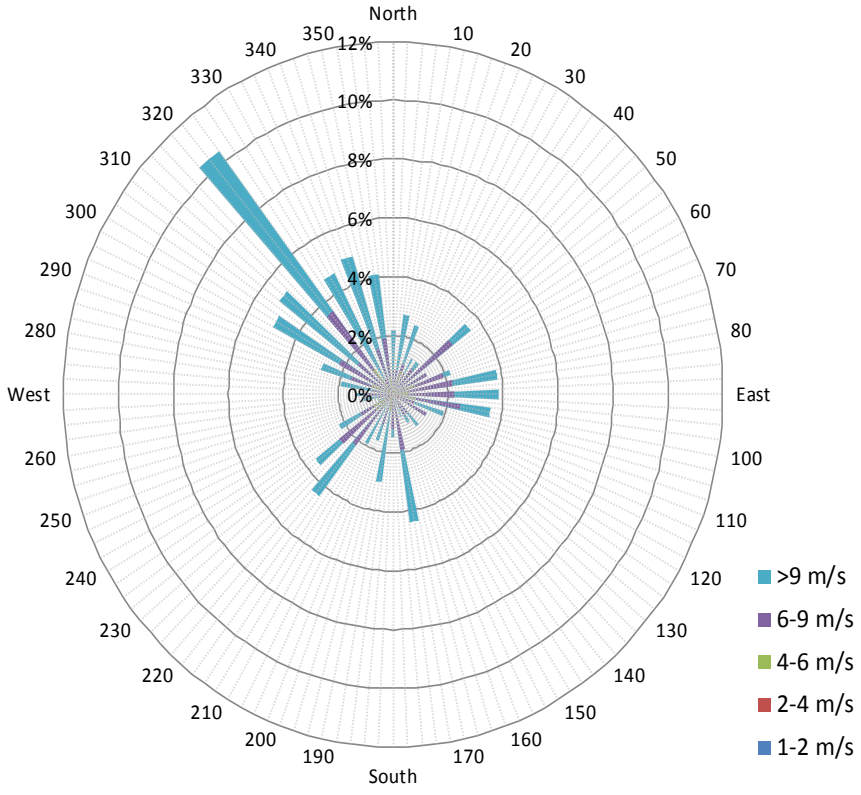
*Environment Canada, Meteorological Service of Canada, 2014. Beaufort Wind Scale Table.

Wind 2017

1/2 Hour Maximum Wind Speed and Direction CLC 2017

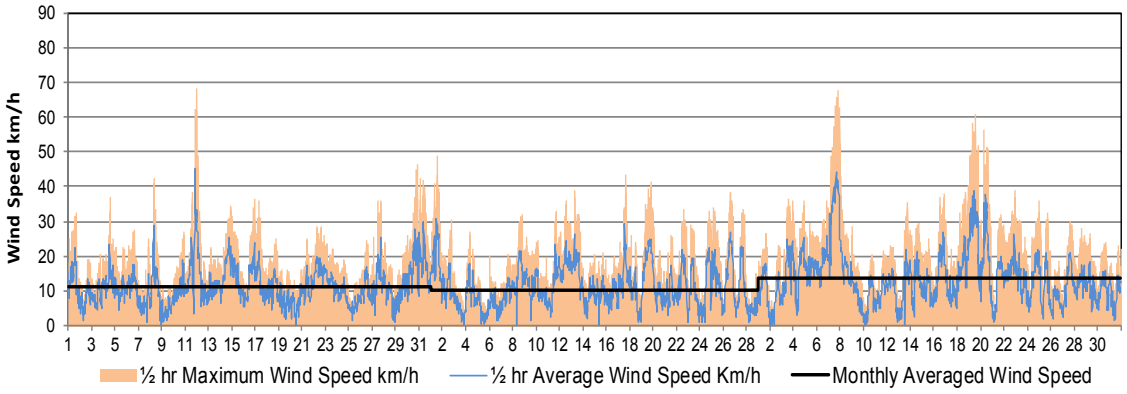


Daily Peak Wind Speed and Direction CLC 2017

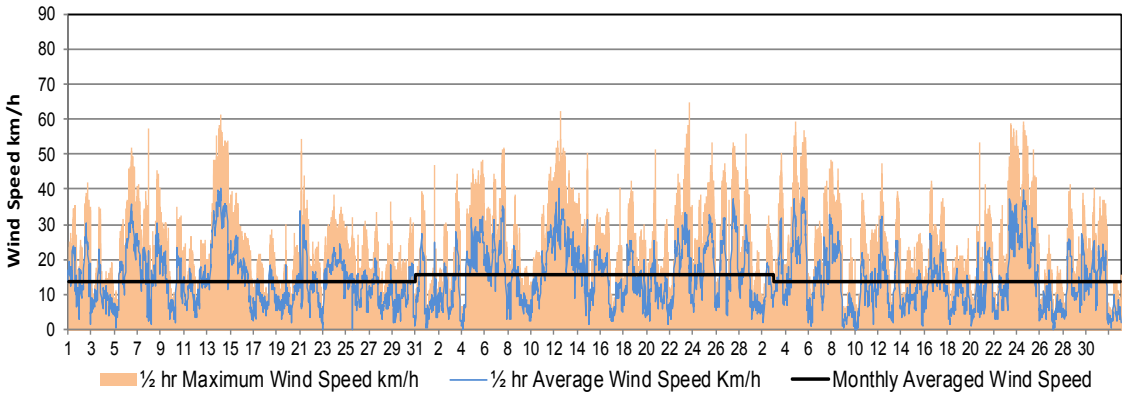


Wind 2017
Daily Wind Speed and Maximum Gust Wind Speed

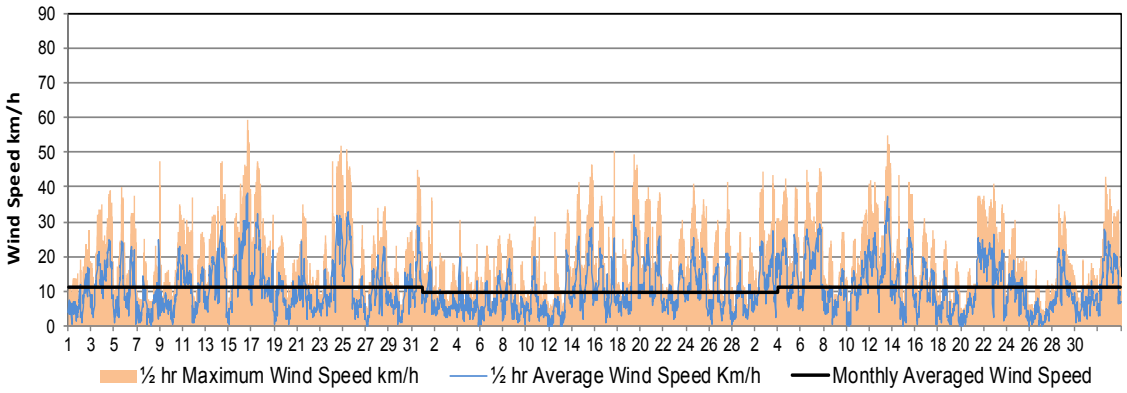
January
February
March



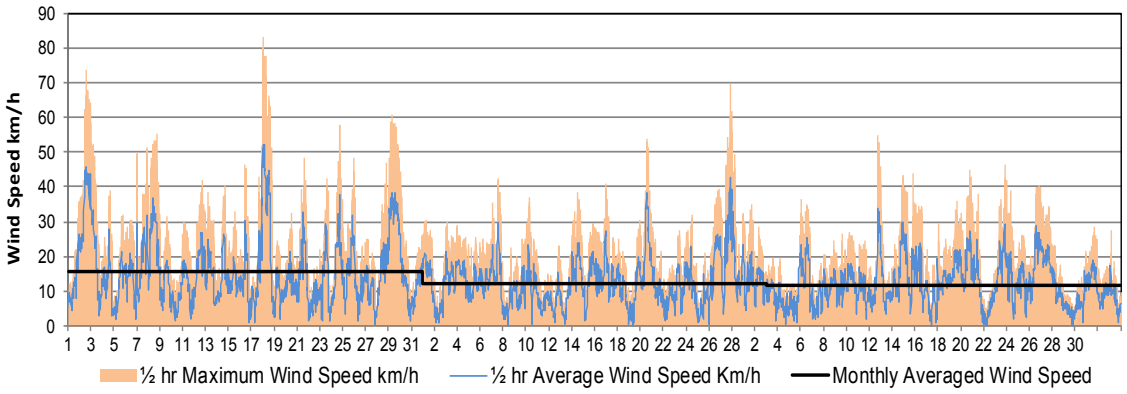
April
May
June



July
August
September



October
November
December



Wind 2017

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

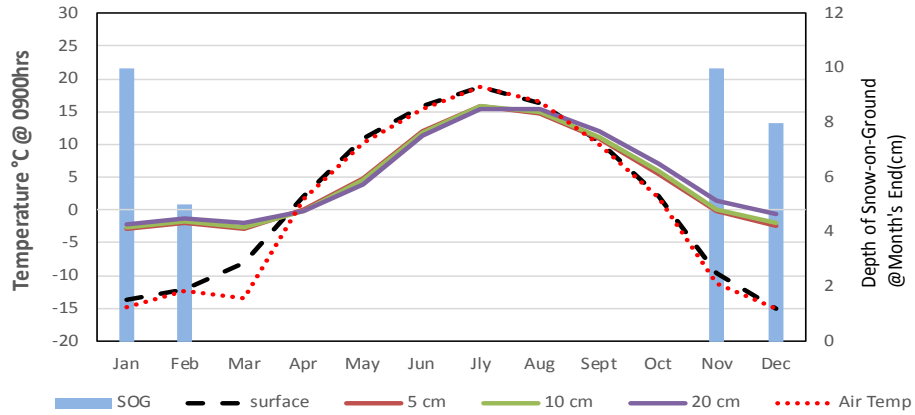
Anemometer tower
25 March 2017
photo: R. Jansen

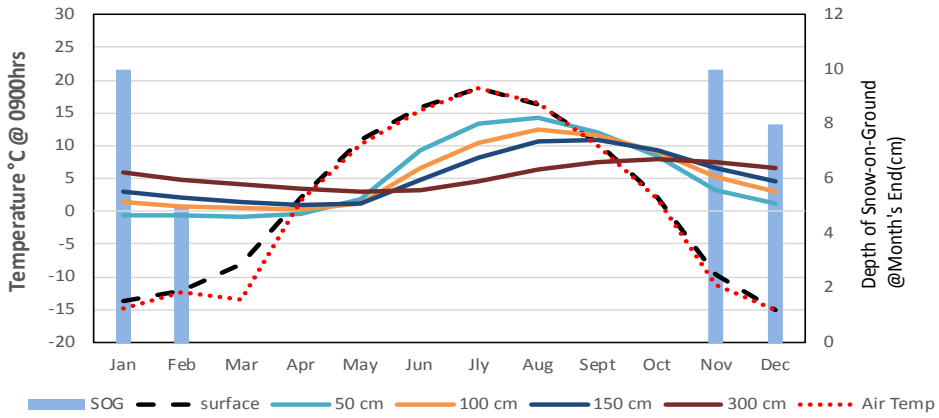
Maximum Daily Wind Chill Value When Temperature < 0°C												
	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-32	-29	-28	-5							-13	-22
2	-39	-33	-27	-5						-3	-19	-17
3	-37	-29	-19	-6						-6	-23	-23
4	-30	-28	-21	-9						-5	-22	-31
5	-30	-34	-25	-9						-7	-28	-27
6	-31	-36	-27	-4						-2	-23	-33
7	-37	-37	-31							-3	-23	-17
8	-37	-38	-36	-11						-8	-25	-17
9	-38	-38	-38	-15						-8	-28	-19
10	-41	-25	-37	-12						-5	-21	-11
11	-47	-23	-33	-6							-17	-9
12	-47	-17	-32	-6						-10	-15	-9
13	-41	-10	-31	-7	-1					-11	-20	-9
14	-27	-16	-22	-7						-12	-25	-11
15	-17	-12	-13	-16						-5	-32	-13
16	-19	-8	-9	-21	-3					-3	-29	-12
17	-12	-3	-14	-14	2					-3	-30	-17
18	-10	-8	-11	-9						-6	-32	-20
19	-11	-11	-6	-2						-6	-27	-33
20	-7	-10	-22	-3						-1	-27	-36
21	-12	-7	-21	-5						-3	-32	-30
22	-16	-14	-14	-7						-9	-30	-24
23	-19	-19	-14	-12						-7	-19	-38
24	-23	-23	-10	-10						-8	-18	-46
25	-27	-28	-8	-12						-11	-22	-46
26	-27	-28	-8	-9						-10	-22	-47
27	-20	-30	-12	-8						-7	-22	-43
28	-10	-24	-7	-5						-7	-23	-44
29	-16		-6	-3						-12	-10	-49
30	-11		-5	-4						-13	-18	-49
31	-31		-5							-12		-40

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

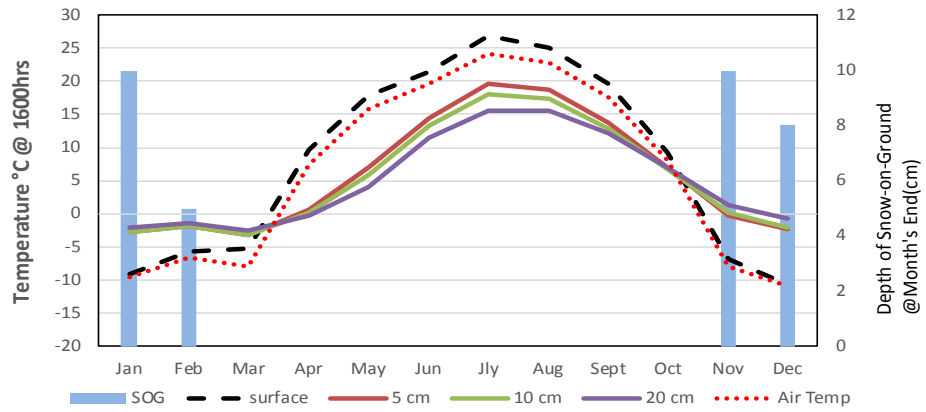
	Mean Air Temp @ 0900h (°C)	SOIL TEMPERATURES @ 0900 (°C)								Mean Air Temp @ 1600h (°C)	SOIL TEMPERATURES @ 1600 (°C)				SOG at Month's end (cm)
		Surface	5cm	10cm	20cm	50cm	100cm	150cm	300cm		Surface	5cm	10cm	20cm	
JAN	-14.8	-13.7	-2.9	-2.7	-2.1	-0.5	1.4	3.0	5.9	-9.6	-9.0	-2.8	-2.7	-2.0	10
FEB	-12.4	-12.2	-1.9	-1.8	-1.4	-0.6	0.7	2.1	4.8	-6.6	-5.7	-1.9	-1.8	-1.4	5
MAR	-13.5	-8.1	-2.8	-2.6	-1.9	-0.9	0.5	1.5	4.1	-8.0	-5.2	-3.3	-3.2	-2.6	0
APR	1.6	2.1	0.0	-0.1	-0.2	-0.3	0.4	1.1	3.5	7.4	9.7	0.6	0.1	-0.2	0
MAY	10.3	11.0	4.9	4.6	4.0	2.0	1.2	1.3	3.1	15.7	17.8	7.0	5.7	4.0	0
JUN	15.3	15.8	12.1	11.9	11.4	9.3	6.6	4.7	3.2	19.6	21.5	14.4	13.4	11.5	0
JLY	18.7	18.7	15.8	15.8	15.4	13.3	10.5	8.3	4.6	24.1	26.9	19.6	18.1	15.6	0
AUG	16.6	16.4	14.7	14.9	15.3	14.3	12.4	10.6	6.3	22.8	25.1	18.7	17.4	15.5	0
SEP	10.0	10.4	10.8	11.2	12.1	12.1	11.6	10.8	7.5	17.5	19.6	13.8	12.9	12.1	0
OCT	1.9	2.2	5.4	5.9	7.2	8.3	9.1	9.3	8.0	8.1	9.3	7.0	6.7	7.0	0
NOV	-11.3	-9.6	-0.2	0.2	1.3	3.3	5.3	6.7	7.5	-8.0	-6.9	-0.2	0.1	1.3	10
DEC	-15.1	-14.9	-2.3	-2.0	-0.7	1.3	3.0	4.5	6.5	-11.0	-10.6	-2.4	-2.1	-0.7	8

Monthly Soil Temperatures (9:00am)





Monthly Soil Temperatures (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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