Climate Reference Station
Conservation Learning Center
RM of Prince Albert #461
ANNUAL SUMMARY 2015

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

SRC Publication No. 13000-1E16
February 2016

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COVER PHOTOGRAPHS
SRC Climate Reference Station at Conservation Learning Centre
9 Sept 2015
Photo credit: R. Jansen

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Acknowledgements

The 2015 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, 2015

We gratefully acknowledge the support of the following:

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 2015

The CLC is a research and demonstration farm. Its outreach program for grades 3 to 11 students,science clubs or other interested groups offers hands-on activities related to soil, water, air, and wildlife habitat.[1] The SRC Climate Reference Station is included in the program exposing participants to the CRS's suite of instruments. The station emphasizes the importance of climate in the practical world of farming and ecology.

Important events in 2015 include the installation of a new RM Young Wind Speed and Direction instrument, and installation of re-calibrated global and diffuse radiation sensors. We now have four years of data at this location allowing us to start tracking monthly, seasonal and yearly variations and have included these graphs for the first time to allow for year to year comparison. Another 26 years of data are needed to obtain high quality averages.

[1]Conservation Learning Centre 2011

Conservation Learning Centre
24 July 2014
Photo: V. Wittrock

Conservation Learning Centre
9 Sept 2015
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*

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Summary for 2015

Data, including temperature, precipitation, wind speed and direction, bright sunshine, solar radiation, soil temperature and moisture, was recorded during 2015 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 four full years of data, allowing us to start tracking similarities and differences between the years and seasons of the various parameters measured. No statistical analysis has been undertaken, such as trends analysis, because it is still a short timeframe, but examining the multiple years and seasons does assist with answering questions like, "It was a really cold spring a few years ago. What year and spring was that?"

There were very interesting weather highlights in 2015. The average annual temperature of 2015 was the warmest year on record: 0.7°C warmer than 2012 and 2.8°C higher than 2013. The average annual minimum was -2.3°C, while the average annual maximum was 8.6°C. These were the warmest annual temperatures recorded at this location. Maximum temperatures for all four seasons were the highest (i.e., warmest) in 2015. Winter and autumn had the highest minimum temperatures, and spring and summer had the second warmest of the four years on record.

The 2014-15 winter (December, January and February) had 13 cold spells (temperatures less than -30°C). From June to August, there were three times more hot spells (temperatures greater than 30°C) than in 2014, but less than in 2013. The warm temperatures of 2015 were further apparent in the length of the frost-free season. It increased to 132 days in 2015 from 120 days in 2014. The warm temperatures also showed up in the number of heating and cooling degree-days. Heating degree-days decreased to 5428 days from a four-year high in 2014 of 6317 days. Cooling degree-days increased to a four-year high of 123 days in 2015.

2015 was the second wettest year of the last four years due to July receiving more than 175 mm of rainfall. 2015 also had some very dry months: March and December received less than 10 mm of precipitation. Snow-on-ground reduced from 2014 records, continuing a two-year downward trend. The snowpack's greatest depth was 36 cm in early February and had melted by March 19. This is very different from the spring of 2013, where the snowpack was over 70 cm deep at the end of March and didn't fully melt until early May.

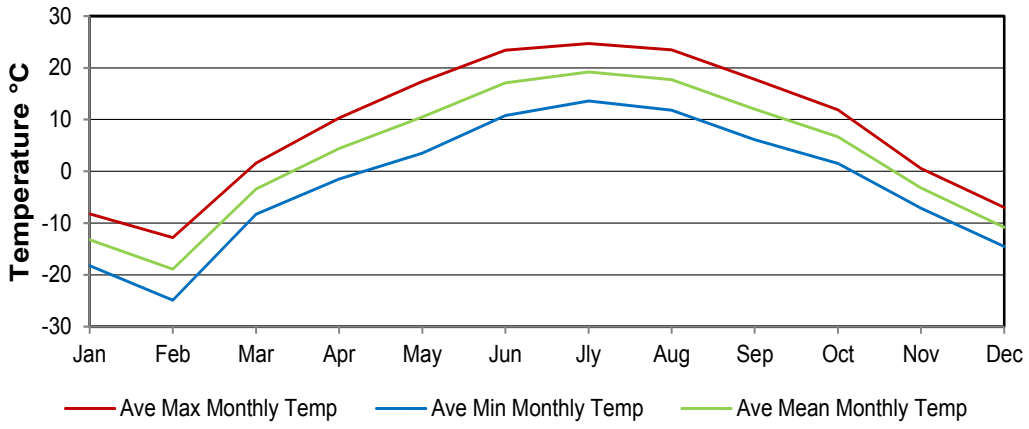
With an overall milder winter, soil temperatures were warm. The ground froze down to a depth of 50 cm by February and remained at or below 0°C until April 29. The soils did not return to below zero temperatures again until December 14 at a depth of 10 cm. Twenty centimeters and deeper, soil temperatures hadn't dip below 0°C by the end of December 2015, and the 5-10 cm depths had only reached -0.5°C.

SRC's Climate Reference Station at Conservation Learning Center
24 July 2014
Photo: V. Wittrock

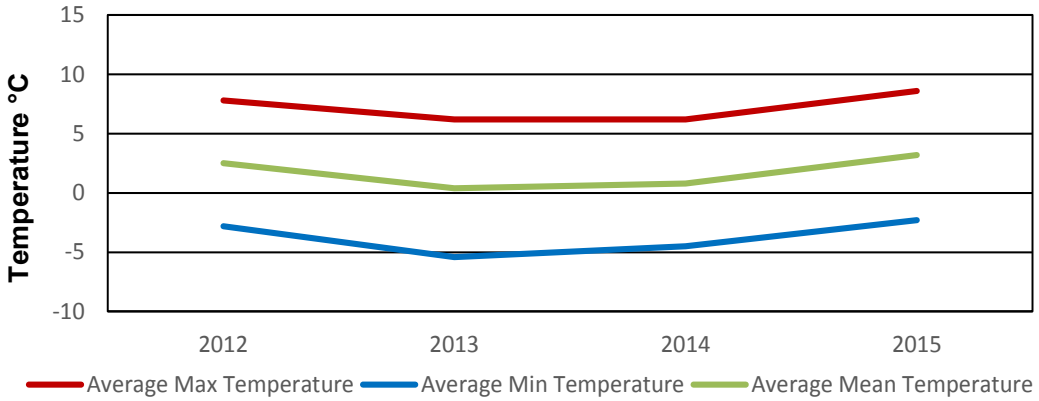
Temperature 2015

	Average Maximum (°C)	Average Minimum (°C)	Average Mean (°C)	2015 Extreme Values (°C)	
	2015	2015	2015	Max/Date	Min/Date
January	-8.2	-18.2	-13.2	7.6/22	-32.7/4
February	-12.8	-24.9	-18.9	1.3/23	-37.6/22
March	1.6	-8.3	-3.4	12.1/29	-30.8/4
April	10.3	-1.5	4.4	20.6/29	-9.6/4
May	17.4	3.5	10.5	28.3/23	-2.1/8
June	23.4	10.8	17.1	31.8/28	5.1/18
July	24.7	13.6	19.2	31.1/3	4.7/8
August	23.5	11.8	17.7	31.5/12	5.3/23
September	17.8	6.1	12.0	28.2/12	-0.9/28
October	11.9	1.5	6.7	24.0/10	-4.1/25
November	0.6	-7.1	-3.2	8.3/7	-20.9/26
December	-7.0	-14.5	-10.8	5.0/4	-26.3/25
Average	8.6	-2.3	3.2		

Monthly Comparison



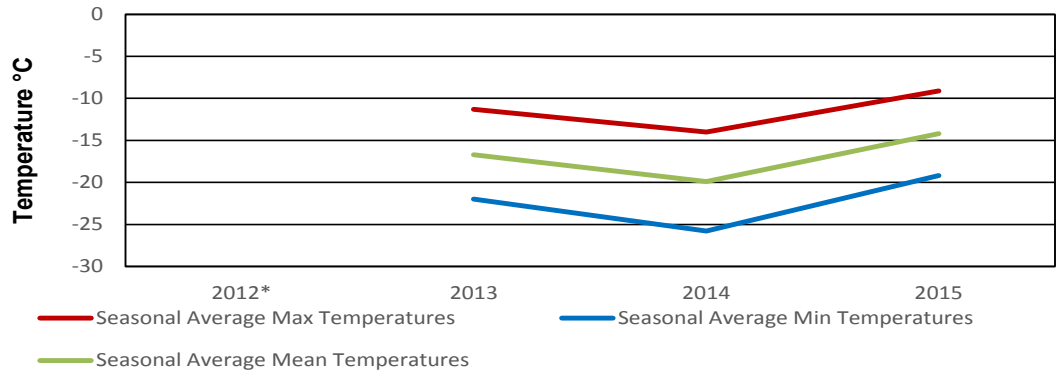
Annual Comparison



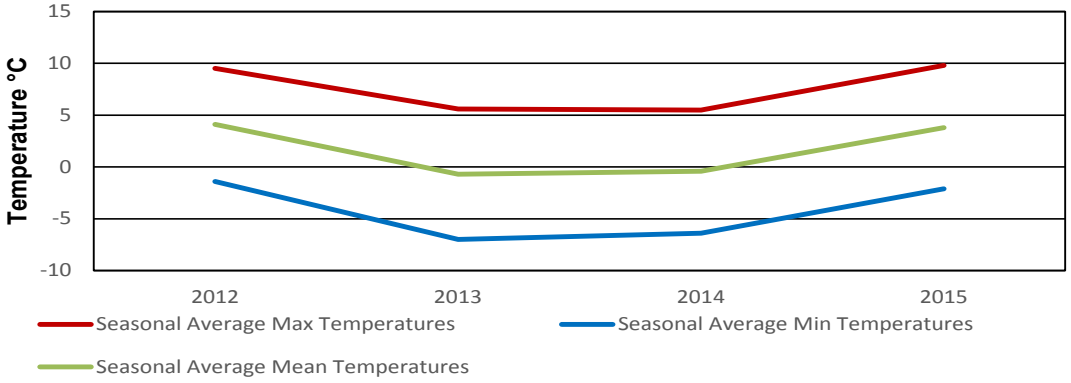
SEASONAL TEMPERATURES

Winter (DJF)

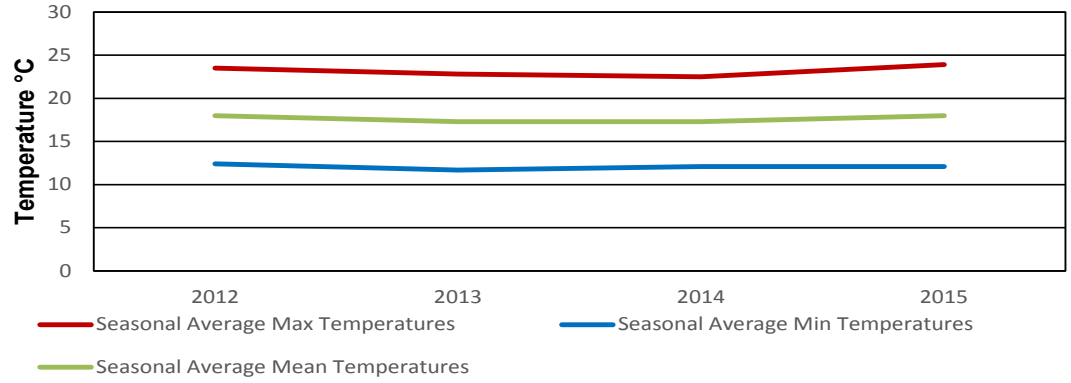
* Missing Data



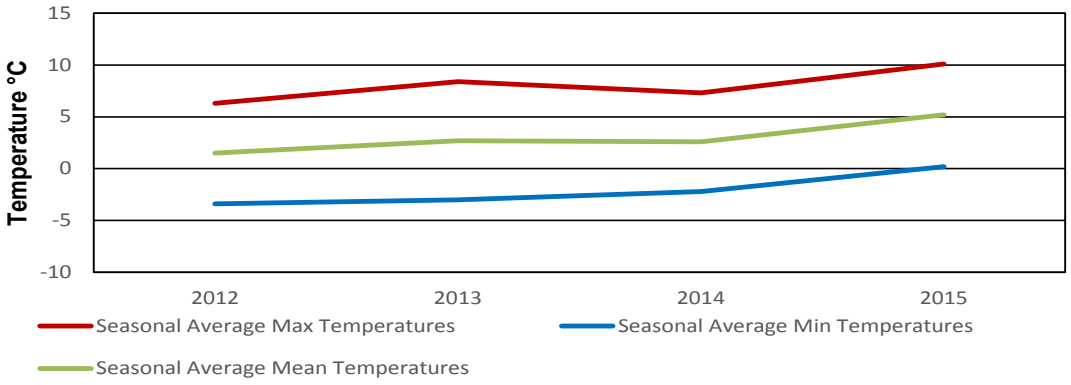
Spring (MAM)



Summer (JJA)

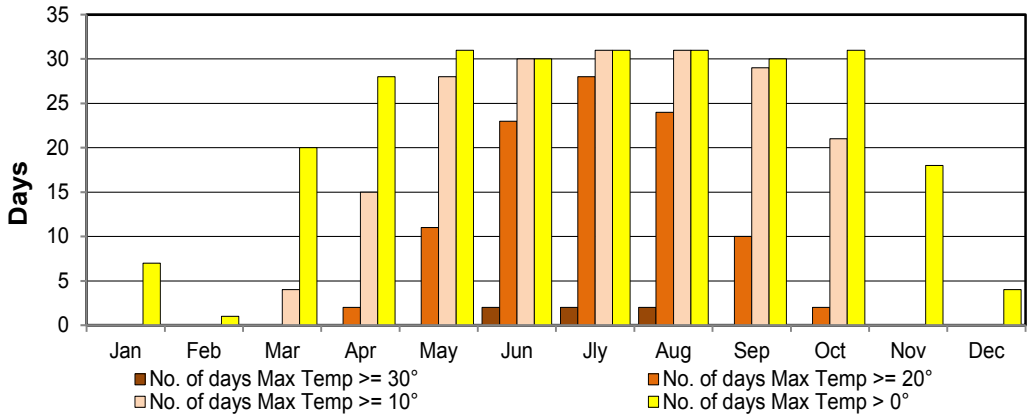


Autumn(SON)

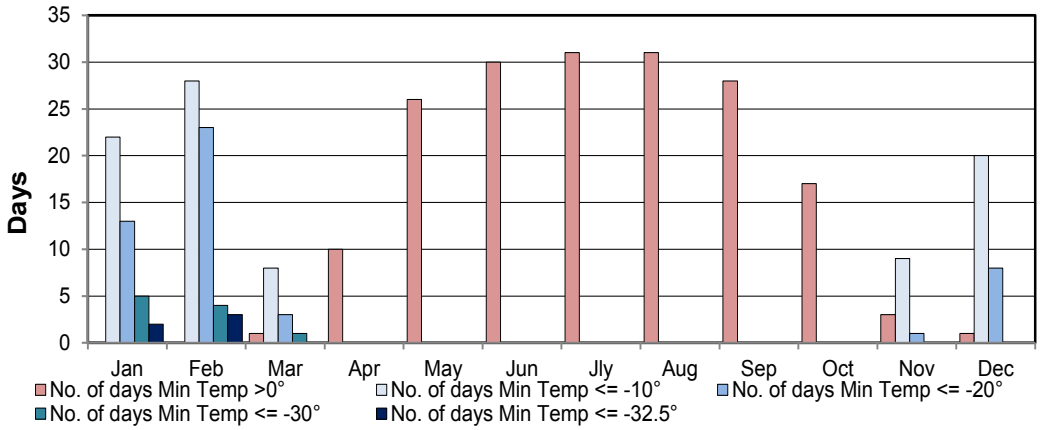


DAYS WITH TEMPERATURES GREATER THAN A SET POINT

Maximum temperature relative to a set points Monthly



Minimum temperature relative to set points Monthly



TEMPERATURE RANKINGS

AVERAGE ANNUAL TEMPERATUES °C					
MAXIMUM TEMP		MINIMUM TEMP		MEAN TEMP	
2015	8.6	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 MAXIMUM AVERAGE TEMPERATURES °C							
WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2015	-9.1	2015	9.8	2015	23.9	2015	10.1
2013	-11.3	2012	9.5	2012	23.5	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)	
2015	-19.2	2012	-1.4	2012	12.4	2015	0.2
2013	-22.0	2015	-2.1	2015	12.1	2014	-2.2
2014	-25.8	2013	-6.4	2014	12.1	2013	-3.0
2012	M	2014	-7.0	2013	11.7	2012	-3.4

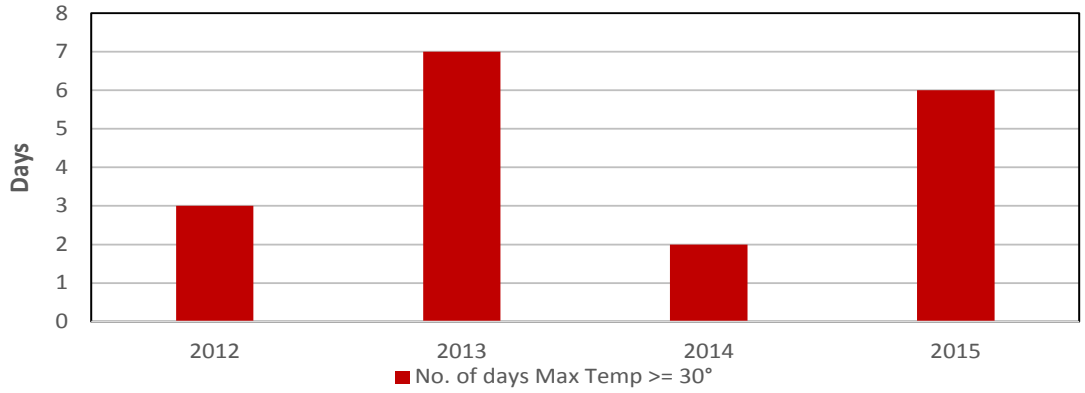
M = Missing Data

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

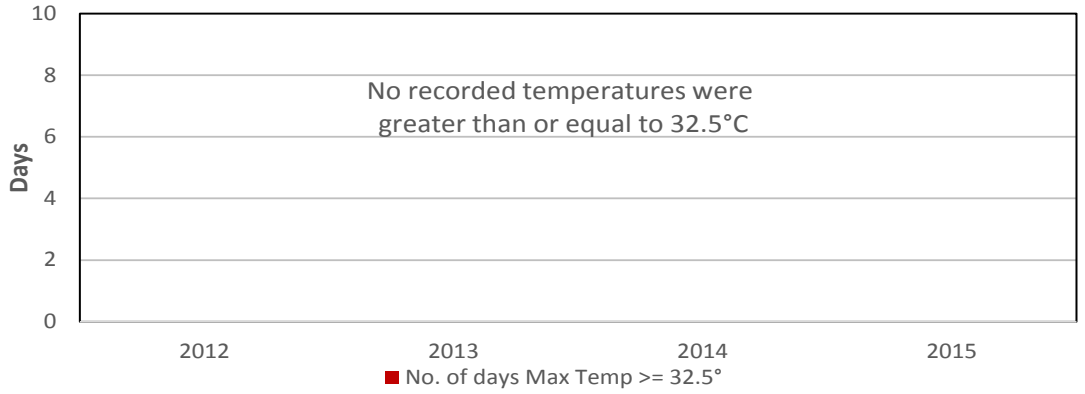
M = Missing Data

DAYS WITH TEMPERATURES GREATER THAN A SET POINT

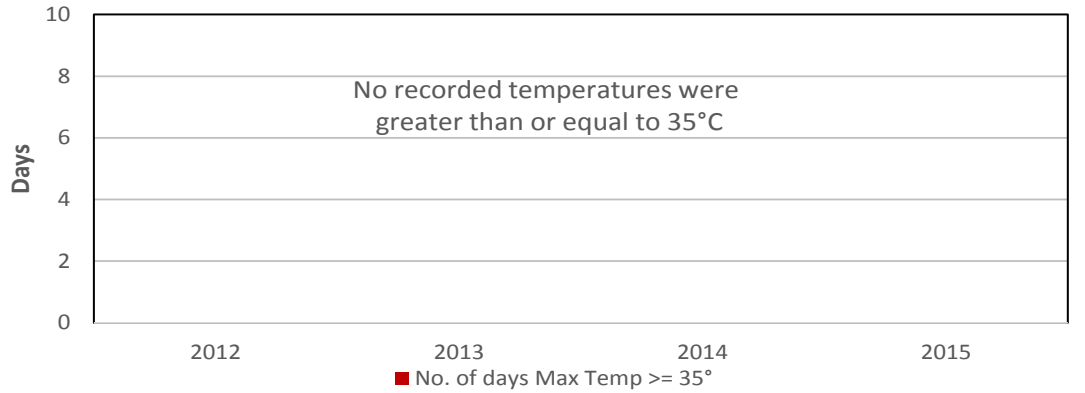
30°C or Greater



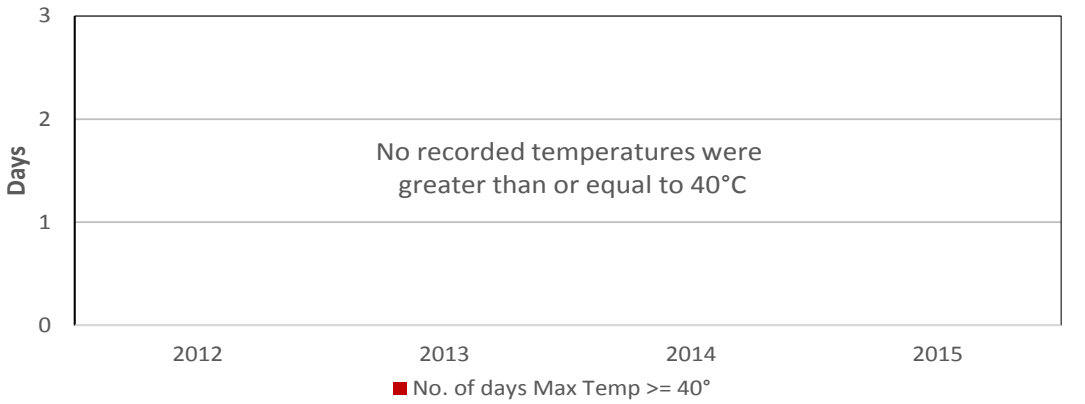
32.5°C or Greater



35°C or Greater

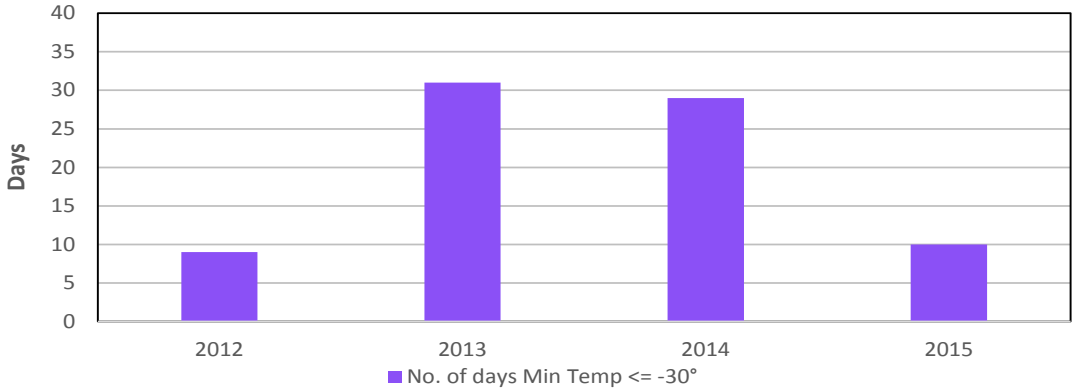


40°C or Greater

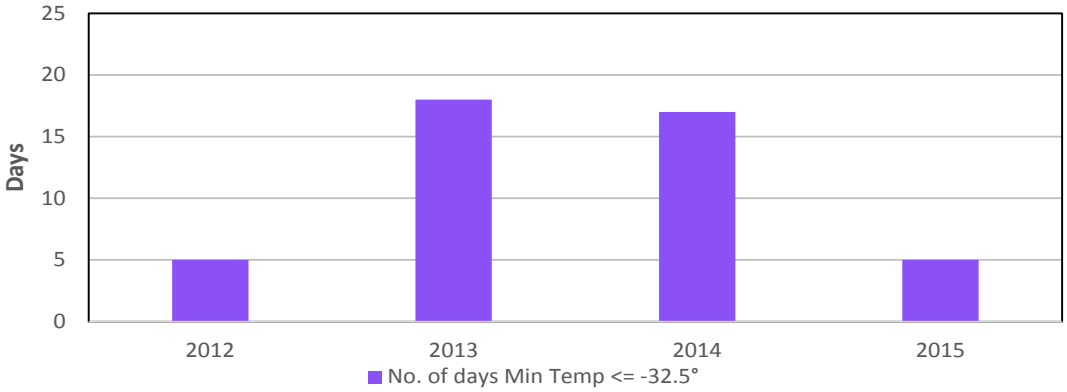


DAYS WITH TEMPERATURES LESS THAN A SET POINT

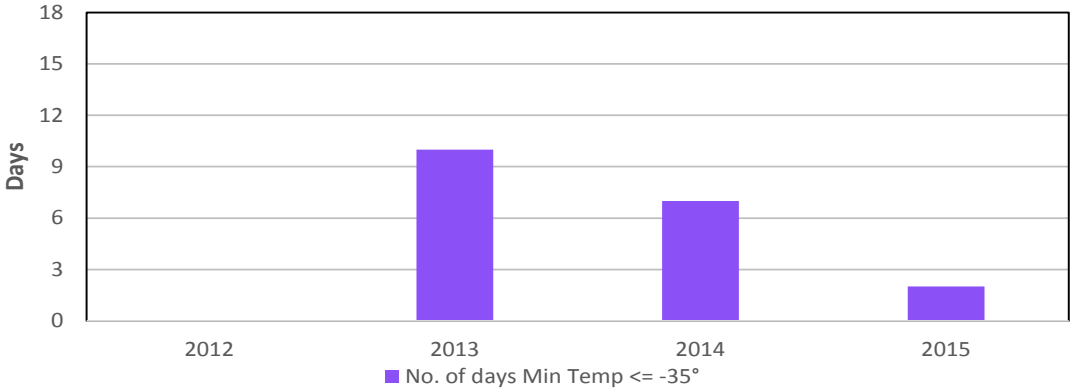
Minus 30°C or Less



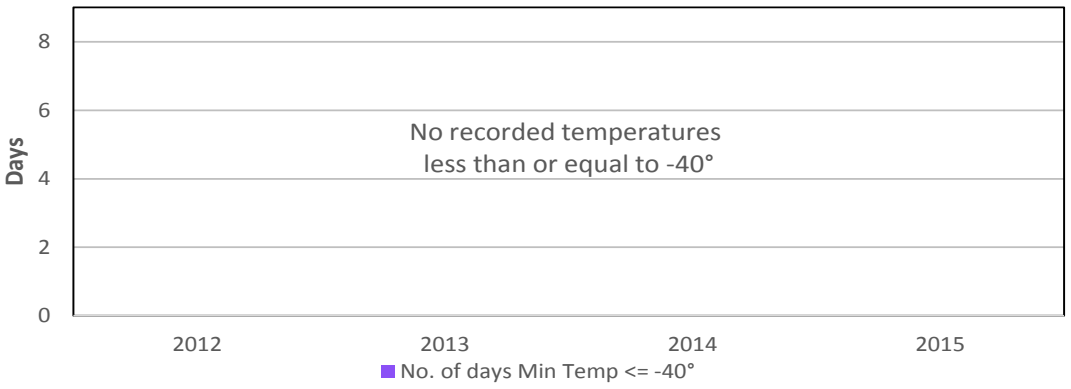
Minus 32.5°C or Less



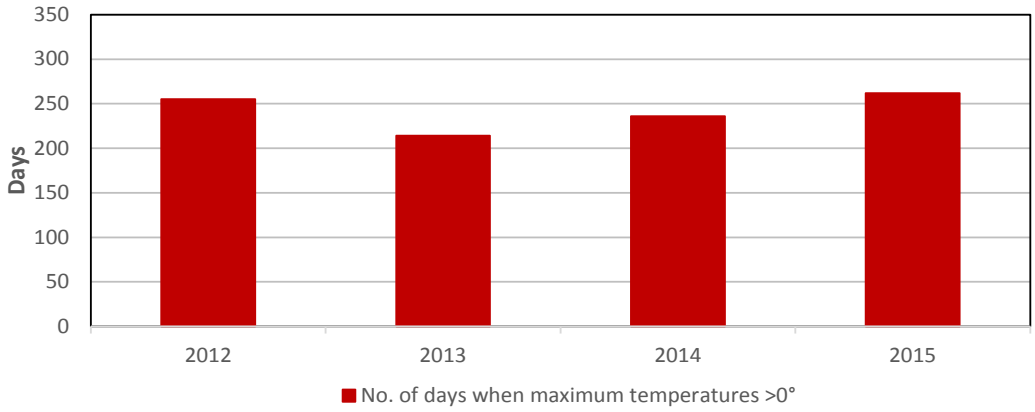
Minus 35° or Less



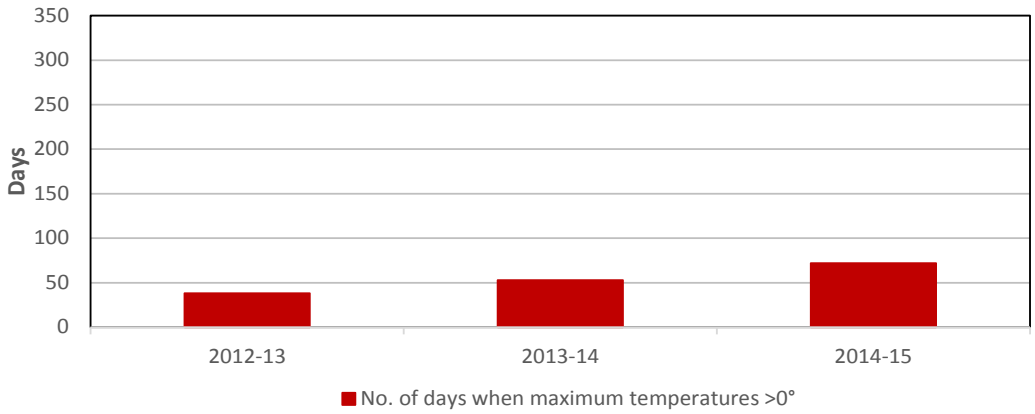
Minus 40°C or Less



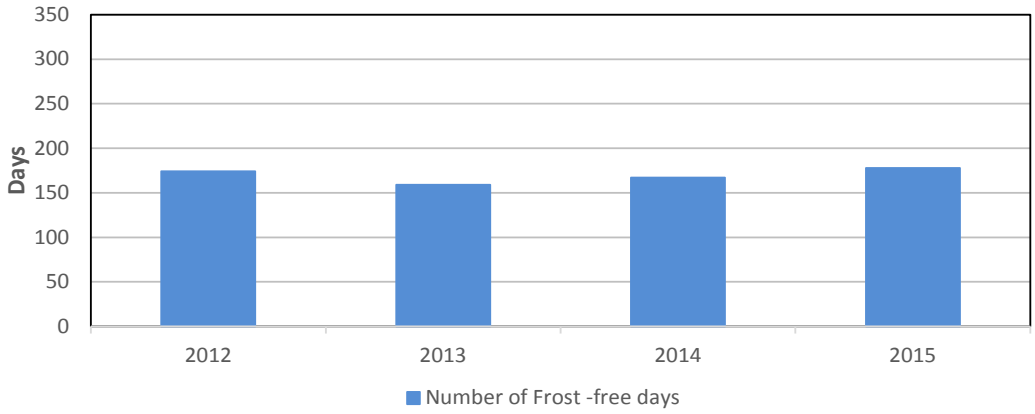
Days with Temperature Greater than 0°C



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)

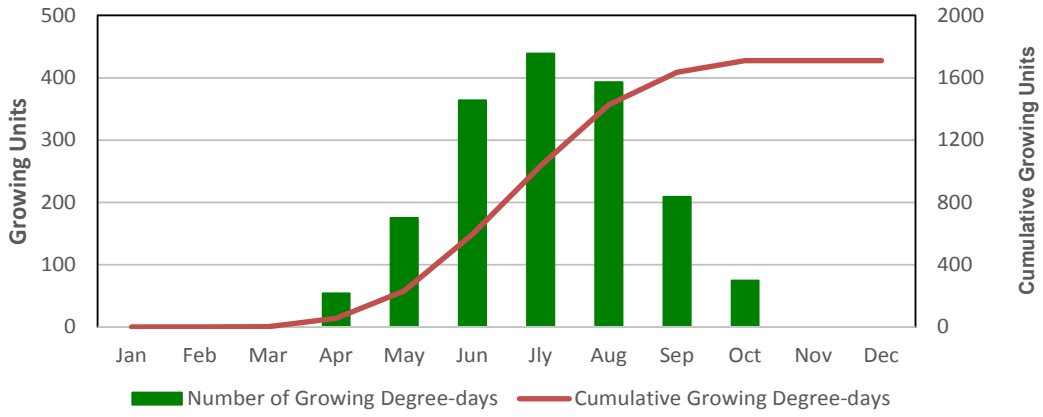


Minimum Temperature greater than 0°C (Frost-free Days)

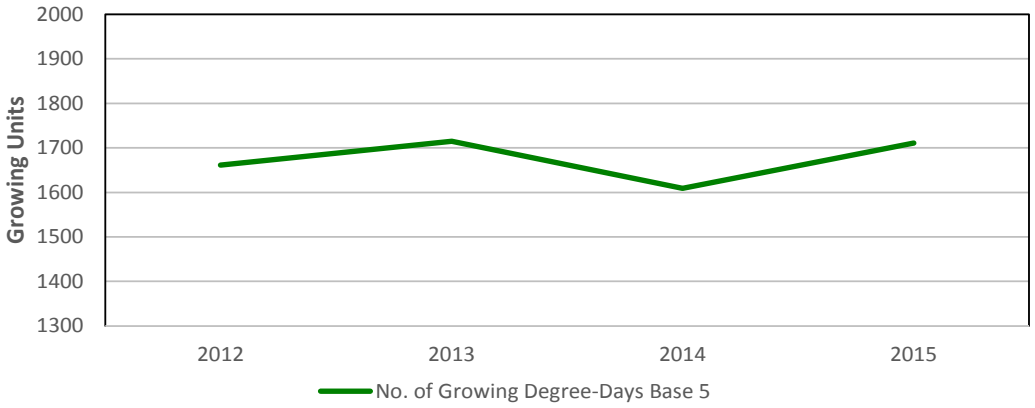
Degree-Days

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	
	2015	Cumulative	2015	Cumulative	2015	Cumulative	2015	Cumulative
January	0.0	0.0	967.6	967.6	0.0	0.0	0.0	0.0
February	0.0	0.0	1033.3	2000.9	0.0	0.0	0.0	0.0
March	2.0	2.0	662.2	2663.1	0.0	0.0	0.0	0.0
April	54.2	56.2	408.4	3071.5	0.0	0.0	0.0	0.0
May	175.3	231.5	234.9	3306.4	2.7	2.7	0.0	0.0
June	364.0	595.5	53.6	3360.0	27.6	30.3	0.0	0.0
July	438.8	1034.3	21.6	3381.6	57.4	87.7	0.0	0.0
August	393.1	1427.4	42.7	3424.3	32.8	120.5	0.0	0.0
September	208.9	1636.3	183.5	3607.8	2.4	122.9	0.0	0.0
October	74.7	1711.0	349.1	3956.9	0.0	122.9	0.0	0.0
November	0.0	1711.0	636.8	4593.7	0.0	122.9	0.0	0.0
December	0.0	1711.0	834.4	5428.1	0.0	122.9	0.0	0.0

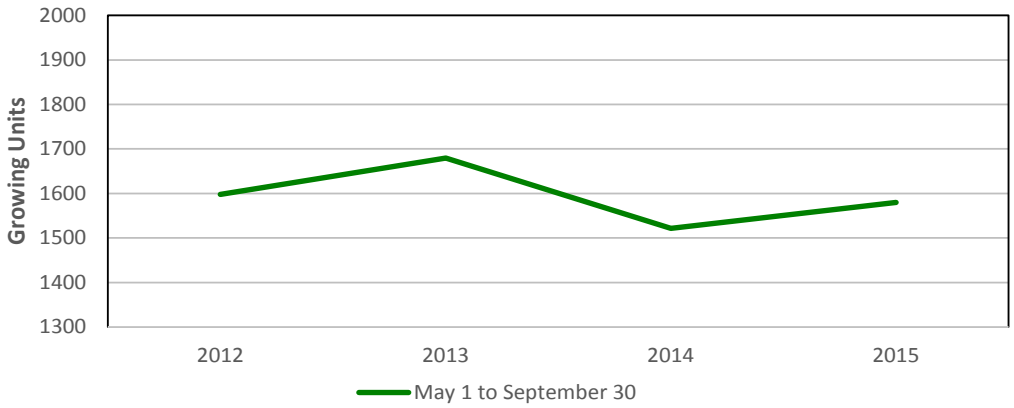
Growing Degree-days Monthly



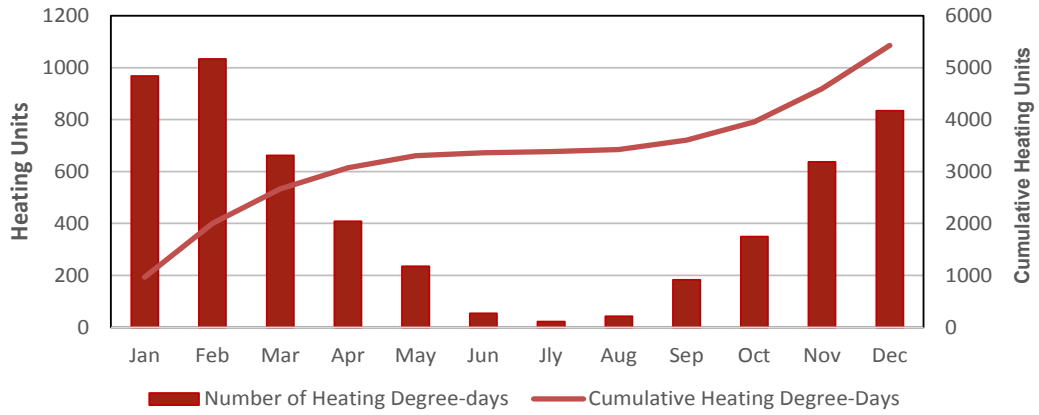
Growing Degree-days Annual



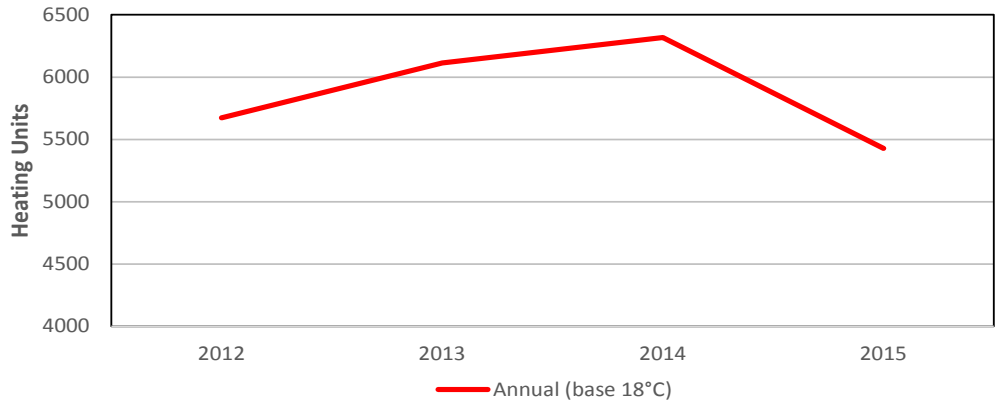
Growing Degree-days May 1 to September 30



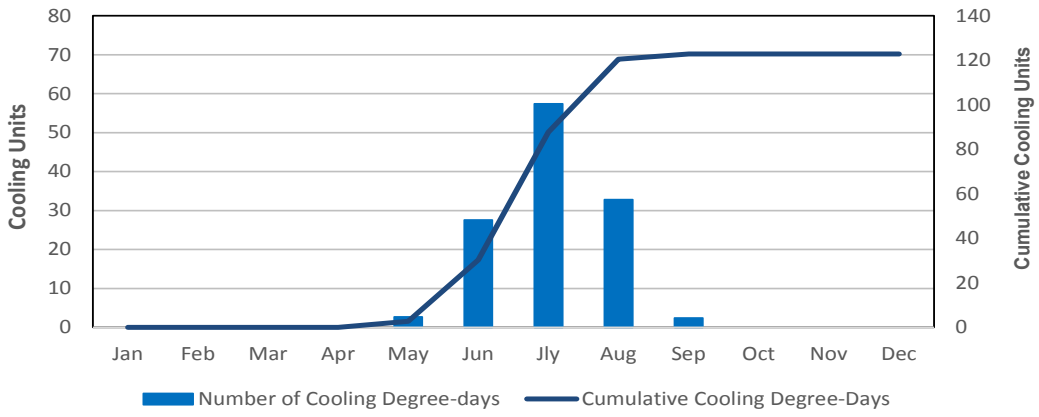
Degree-Days



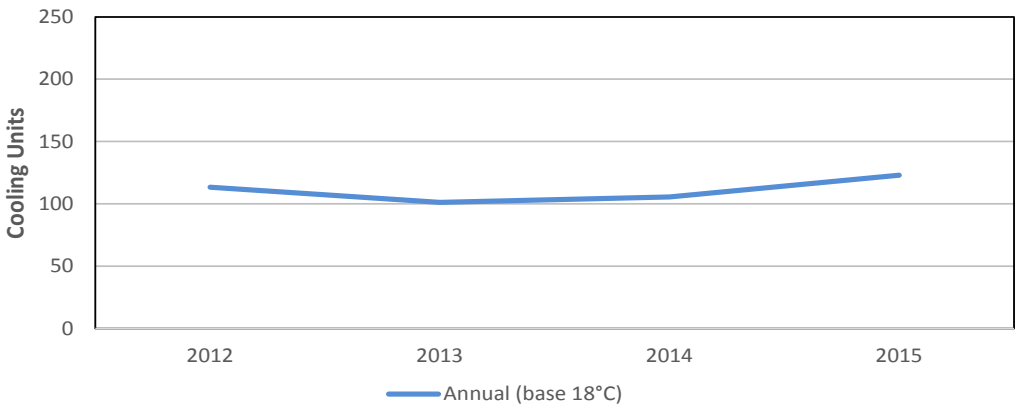
Heating Degree-days Monthly



Heating Degree-days Annual



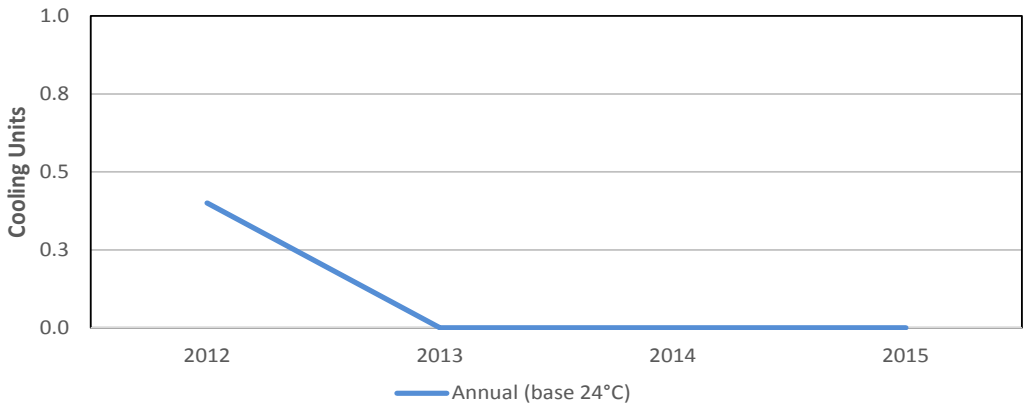
Cooling Degree-days Monthly



Cooling Degree-days Annual

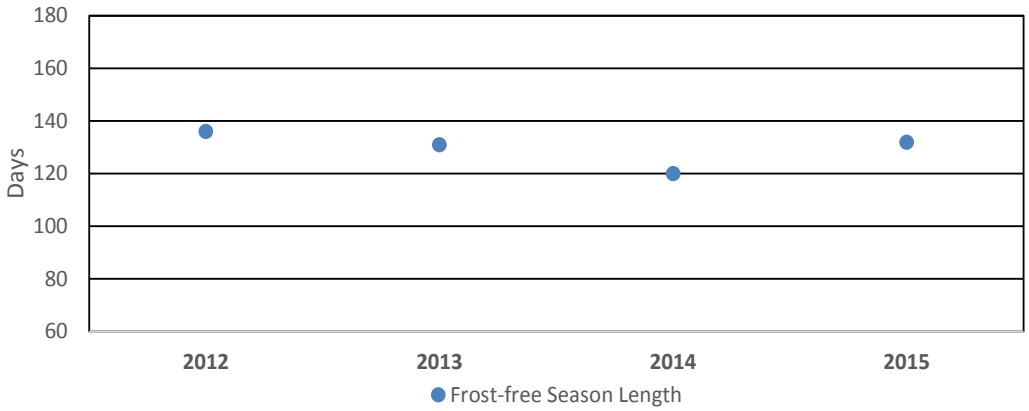
Degree-Days

Extreme Cooling Degree-days Annual

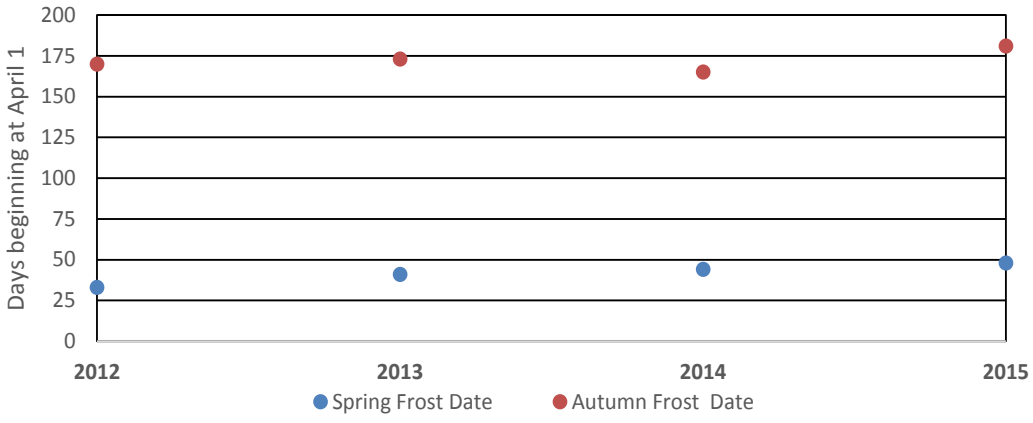


DATES & DURATION OF THE FROST-FREE SEASON			
YEAR	LAST SPRING FROST	FIRST FALL FROST	Frost-free Season Length
2012	May 3	Sept 17	136
2013	May 10	Sept 19	131
2014	May 14	Sept 12	120
2015	May 18	Sept 28	132

Frost-free Growing Season Duration



Frost-free Growing Season End Points



Temperature 2015

Daily Maximum

2015	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-5.8	-14.8	-3.5	6.6	18.8	19.8	25.2	f	26.2	13.1	3.6	-4.4
2	-18.5	-14.8	-7.7	0.3	15.5	18.7	28.8	23.4	25.3	18.4	2.0	-3.3
3	-24.6	-13.6	-18.1	1.0	12.2	22.3	31.1	26.5	16.8	11.4	3.1	2.2
4	-23.8	-13.0	-17.6	-0.3	16.0	24.1	21.6	21.0	15.9	5.8	4.0	5.0
5	-14.9	-14.1	-1.2	2.1	16.9	24.3	17.3	17.9	12.3	7.5	5.2	3.2
6	-19.9	-17.5	4.7	4.5	7.1	26.3	21.6	16.3	13.0	11.8	-0.2	-2.6
7	-16.5	-20.2	4.3	-0.1	3.6	27.2	18.0	20.8	12.5	14.6	8.3	-3.3
8	-16.7	-17.3	3.5	9.6	9.8	27.0	24.0	22.5	11.9	15.4	7.7	2.5
9	-20.1	-15.5	8.5	9.8	15.5	23.2	27.7	26.7	16.3	20.6	2.0	-1.5
10	-22.2	-14.5	3.3	19.8	10.1	23.9	30.0	29.4	20.1	24.0	-1.0	-4.0
11	-18.9	-18.4	-2.8	19.0	11.2	24.9	27.9	30.5	25.4	19.3	1.5	-6.3
12	-13.2	-10.4	-1.2	11.5	13.0	23.4	26.6	31.5	28.2	10.5	3.8	-5.5
13	-5.6	-10.5	10.6	11.5	13.0	16.1	28.1	29.7	17.9	15.8	5.5	-2.7
14	4.1	-20.3	8.2	14.1	17.4	12.4	24.6	27.7	14.1	12.7	6.0	-3.6
15	-0.2	-5.9	6.8	13.8	21.1	19.9	27.9	18.6	9.6	8.6	7.7	0.0
16	-0.4	-9.2	1.3	17.9	18.2	23.1	27.2	18.5	14.5	10.7	2.2	0.0
17	2.5	-15.8	3.4	15.7	10.9	18.0	21.2	20.1	14.1	16.0	3.8	-12.1
18	-5.4	-14.0	6.6	10.4	15.9	21.6	22.8	22.9	20.1	17.3	1.5	-14.4
19	-3.5	-3.8	2.1	9.9	22.2	24.0	21.1	22.4	22.7	13.4	-8.2	-14.9
20	-5.5	-7.9	-2.9	8.7	24.4	19.6	23.2	22.6	22.2	9.3	-8.9	-10.9
21	-1.8	-20.5	-5.4	11.3	26.0	22.0	26.9	18.4	13.9	11.8	-0.6	-6.2
22	7.6	-16.1	-4.7	13.4	27.0	22.9	28.1	15.6	13.5	13.8	4.4	-10.6
23	3.8	1.3	-1.1	9.1	28.3	24.4	24.7	19.8	18.2	12.1	0.6	-10.1
24	-1.6	-4.2	0.4	4.8	27.7	26.6	25.4	23.3	19.2	8.7	-3.8	-13.0
25	6.3	-16.1	3.3	0.3	28.0	30.1	28.1	24.1	25.0	9.4	-8.5	-18.6
26	5.7	-14.1	2.5	3.9	25.2	29.3	24.2	24.5	18.5	10.4	-11.9	-14.2
27	0.9	-10.5	3.3	13.9	20.2	29.0	21.1	25.3	15.2	3.9	-1.6	-12.7
28	-5.8	-7.1	7.5	21.2	14.3	31.8	17.1	28.3	10.9	1.0	-2.9	-12.4
29	-12.4		12.1	26.0	12.7	23.9	24.5	27.8	19.0	1.5	-3.1	-14.3
30	-8.7		11.9	18.7	16.7	23.6	23.5	24.3	22.6	12.0	-3.0	-9.3
31	-17.9		11.2		21.6		25.8	26.0		8.0		-4.4

Daily Minimum

2015	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-19.1	-27.4	-18.3	-5.1	5.3	10.1	12.9	13.6	9.6	3.1	0.4	-17.4
2	-25.7	-22.8	-18.8	-8.5	5.8	6.1	15.4	11.7	10.2	5.4	-0.4	-15.7
3	-32.5	-25.9	-28.2	-7.0	3.0	6.5	14.6	10.5	11.1	5.7	1.0	-6.6
4	-32.7	-29.1	-30.8	-9.6	1.1	7.9	13.5	13.4	8.3	3.4	0.7	0.7
5	-29.6	-19.1	-23.9	-7.5	6.3	13.0	10.8	14.8	9.7	-0.1	-0.3	-7.0
6	-24.9	-21.4	-10.7	-7.7	3.6	10.7	6.9	13.1	8.8	5.6	-5.4	-10.5
7	-31.2	-24.5	-7.7	-2.5	0.3	13.5	8.9	12.9	6.9	3.6	-5.5	-10.8
8	-20.4	-25.0	-6.7	-2.5	-2.1	13.4	4.7	12.0	3.3	1.4	-3.8	-12.5
9	-24.1	-24.9	-1.5	-1.0	0.9	11.2	15.5	10.9	2.1	5.2	-3.1	-4.3
10	-31.1	-18.5	-3.8	-0.7	0.4	9.5	15.0	15.4	1.5	7.0	-3.6	-8.9
11	-31.1	-29.0	-7.0	2.1	-1.4	12.3	17.1	15.0	7.7	3.9	-3.5	-8.9
12	-29.5	-24.6	-6.2	1.9	2.0	13.8	17.2	15.9	11.3	-0.2	-4.6	-7.3
13	-17.2	-23.3	-4.8	-2.1	2.0	9.9	18.2	14.2	6.9	5.0	-4.5	-5.6
14	-7.7	-26.0	-0.6	-3.3	-1.2	7.2	16.9	17.4	6.5	3.3	-1.9	-5.8
15	-14.6	-20.4	-2.7	2.4	2.1	6.1	16.0	11.2	8.0	-0.1	-0.7	0.0
16	-14.7	-21.0	-9.7	-1.7	4.0	8.0	15.8	10.0	8.5	-0.6	-4.6	0.0
17	-7.4	-25.6	-7.0	3.6	-1.5	8.0	13.1	9.7	3.6	0.0	-8.1	-15.5
18	-17.2	-35.1	-6.8	3.1	-1.7	5.1	14.6	7.4	3.4	2.1	-8.6	-22.2
19	-17.0	-14.9	-3.2	1.1	2.7	13.1	15.0	8.6	4.8	-0.1	-13.5	-17.1
20	-8.2	-21.9	-10.1	-4.1	4.5	11.9	12.0	13.1	6.5	3.5	-14.9	-17.8
21	-16.1	-33.7	-11.9	-4.0	5.7	9.9	13.0	10.2	5.7	0.2	-14.9	-15.9
22	-2.8	-37.6	-8.9	1.4	8.2	10.1	16.9	8.0	0.9	1.6	-3.3	-15.7
23	-1.8	-16.1	-6.2	-1.9	8.9	8.8	12.2	5.3	6.7	0.0	-5.3	-21.0
24	-9.6	-17.4	-4.4	-1.4	11.0	11.1	13.3	6.8	6.4	-0.8	-9.6	-22.5
25	-8.4	-25.2	-7.9	-3.0	9.4	12.5	14.4	10.4	12.2	-4.1	-18.2	-26.3
26	-3.2	-31.8	-6.7	-0.5	10.6	13.4	14.5	10.3	7.5	-3.2	-20.9	-25.8
27	-5.8	-28.6	-0.6	-3.5	4.1	15.9	11.8	10.8	1.6	-0.2	-12.7	-25.8
28	-13.9	-27.7	-0.2	2.7	5.2	13.0	13.2	12.3	-0.9	-0.9	-15.7	-15.6
29	-20.1		0.1	7.2	1.4	16.1	12.9	16.5	0.0	-1.6	-12.5	-22.4
30	-17.9		-0.2	6.2	2.9	15.4	13.2	13.3	3.0	-0.9	-14.6	-21.6
31	-29.0		-2.1		6.2		10.8	10.8		0.7		-15.3

Daily Mean

2015	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-12.5	-21.1	-10.9	0.8	12.1	15.0	19.1	18.2	17.9	8.1	2.0	-10.9
2	-22.1	-18.8	-13.3	-4.1	10.7	12.4	22.1	17.6	17.8	11.9	0.8	-9.5
3	-28.6	-19.8	-23.2	-3.0	7.6	14.4	22.9	18.5	14.0	8.6	2.1	-2.2
4	-28.3	-21.1	-24.2	-5.0	8.6	16.0	17.6	17.2	12.1	4.6	2.4	2.9
5	-22.3	-16.6	-12.6	-2.7	11.6	18.7	14.1	16.4	11.0	3.7	2.5	-1.9
6	-22.4	-19.5	-3.0	-1.6	5.4	18.5	14.3	14.7	10.9	8.7	-2.8	-6.6
7	-23.9	-22.4	-1.7	-1.3	2.0	20.4	13.5	16.9	9.7	9.1	1.4	-7.1
8	-18.6	-21.2	-1.6	3.6	3.9	20.2	14.4	17.3	7.6	8.4	2.0	-5.0
9	-22.1	-20.2	3.5	4.4	8.2	17.2	21.6	18.8	9.2	12.9	-0.6	-2.9
10	-26.7	-16.5	-0.3	9.6	5.3	16.7	22.5	22.4	10.8	15.5	-2.3	-6.5
11	-25.0	-23.7	-4.9	10.6	4.9	18.6	22.5	22.8	16.6	11.6	-1.0	-7.6
12	-21.4	-17.5	-3.7	6.7	7.5	18.6	21.9	23.7	19.8	5.2	-0.4	-6.4
13	-11.4	-16.9	2.9	4.7	7.5	13.0	23.2	22.0	12.4	10.4	0.5	-4.2
14	-1.8	-23.2	3.8	5.4	8.1	9.8	20.8	22.6	10.3	8.0	2.1	-4.7
15	-7.4	-13.2	2.1	8.1	11.6	13.0	22.0	14.9	8.8	4.3	3.5	0.0
16	-7.6	-15.1	-4.2	8.1	11.1	15.6	21.5	14.3	11.5	5.1	-1.2	0.0
17	-2.5	-20.7	-1.8	9.7	4.7	13.0	17.2	14.9	8.9	8.0	-2.2	-13.8
18	-11.3	-24.6	-0.1	6.8	7.1	13.4	18.7	15.2	11.8	9.7	-3.6	-18.3
19	-10.3	-9.4	-0.6	5.5	12.5	18.6	18.1	15.5	13.8	6.7	-10.9	-16.0
20	-6.9	-14.9	-6.5	2.3	14.5	15.8	17.6	17.9	14.4	6.4	-11.9	-14.4
21	-9.0	-27.1	-8.7	3.7	15.9	16.0	20.0	14.3	9.8	6.0	-7.8	-11.1
22	2.4	-26.9	-6.8	7.4	17.6	16.5	22.5	11.8	7.2	7.7	0.6	-13.2
23	1.0	-7.4	-3.7	3.6	18.6	16.6	18.5	12.6	12.5	6.1	-2.4	-15.6
24	-5.6	-10.8	-2.0	1.7	19.4	18.9	19.4	15.1	12.8	4.0	-6.7	-17.8
25	-1.1	-20.7	-2.3	-1.4	18.7	21.3	21.3	17.3	18.6	2.7	-13.4	-22.5
26	1.3	-23.0	-2.1	1.7	17.9	21.4	19.4	17.4	13.0	3.6	-16.4	-20.0
27	-2.5	-19.6	1.4	5.2	12.2	22.5	16.5	18.1	8.4	1.9	-7.2	-19.3
28	-9.9	-17.4	3.7	12.0	9.8	22.4	15.2	20.3	5.0	0.1	-9.3	-14.0
29	-16.3		6.1	16.6	7.1	20.0	18.7	22.2	9.5	-0.1	-7.8	-18.4
30	-13.3		5.9	12.5	9.8	19.5	18.4	18.8	12.8	5.6	-8.8	-15.5
31	-23.5		4.6		13.9		18.3	18.4		4.4		-9.9

2015 Temperature Events

Cold Spell (less than or equal to -30°C)	
Date	Temperature (°C)
January 3	-32.5
January 4	-32.7
January 7	-31.2
January 10	-31.1
January 11	-31.1
February 18	-35.1
February 21	-33.7
February 22	-37.6
February 26	-31.8
March 4	-30.8

Hot Spell (greater than or equal to 30°C)	
Date	Temperature (°C)
June 25	30.1
June 28	31.8
July 3	31.1
July 10	30.0
August 11	30.5
August 12	31.5

Last Spring Frost	
18-May	-1.7
First Fall Frost	
28-Sep	-0.9
Frost-free Season Length	
132 Days	

Precipitation 2015

Extreme Precipitation Events		
Period	Date	Amount (mm)
0.5 Hour	July 13	40.2
0.5 Hour	August 15	12.2
1 Hour	July 13	54.8
1 Hour	August 15	15.6
2 Hours	July 13	70.0
2 Hours	August 15	17.0
6 Hours	July 13-14	86.0
6 Hours	August 15	21.6
12 Hours	July 13-14	103.0
12 Hours	July 28	28.4
24 Hours	July 13-14	106.2
24 Hours	July 28	33.8
Calendar Day	July 13	85.4
Calendar Day	July 14	33.4
More than one day	July 13-14	118.8
Longest wet spell	Sept 13-18	6 Days
Longest dry spell*	Mar 8-Mar 21	14 Days

* Weighing Gauge Value

Ranking By Driest Month	
	Amount (mm)
December	2.4
March	6.5
January	13.4
February	18.3
*May	19.4
November	18.7
April	29.5
October	33.1
*June	45.0
*August	61.8
*September	64.8
*July	176.6

**Tipping Bucket value*

Daily Precipitation Values

* Tipping Bucket

2015	JAN	FEB	MAR	APR	MAY*	JUN*	JLY*	AUG*	SEP*	OCT	NOV	DEC
1	1.1	0.0	0.1	0.5	0.0	1.4	0.0	3.4	0.0	0.0	0.5	0.0
2	0.0	0.0	0.2	0.3	1.6	0.0	0.0	0.2	0.2	0.0	5.2	0.0
3	0.0	0.0	0.1	0.1	0.8	0.0	0.2	0.0	0.2	18.1	0.8	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	3.1	0.0	0.0
5	0.0	1.1	0.0	0.0	0.2	3.4	0.0	4.4	1.6	0.0	0.6	0.0
6	0.0	2.0	0.1	0.0	7.0	3.4	0.0	16.8	16.6	0.0	0.0	0.0
7	1.8	3.0	1.1	1.9	0.6	0.0	0.0	0.0	0.6	0.0	0.0	0.0
8	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
9	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
10	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2
11	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	3.4	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	14.4	0.0	0.0	0.0	0.0	0.0	0.6
13	0.6	0.0	0.0	0.0	0.4	11.0	85.4	0.0	2.2	0.0	0.0	0.3
14	1.5	5.5	0.0	0.0	0.0	1.0	33.4	0.0	0.2	0.0	0.0	0.4
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.2	28.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.4	0.4	0.0	0.2	0.0
17	0.0	0.0	0.0	0.0	0.0	0.2	11.6	3.2	3.0	0.0	1.3	0.0
18	0.0	0.0	0.0	1.7	0.0	0.0	0.2	0.0	0.4	0.0	3.4	0.0
19	0.0	0.2	0.0	0.0	0.0	2.0	4.6	0.0	0.0	0.1	0.0	0.0
20	1.3	0.8	0.0	0.0	0.0	0.0	0.2	0.8	3.6	3.1	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.4	0.0	1.2	7.4	0.0	0.0	0.0
22	0.0	0.0	1.7	0.0	0.0	2.2	0.0	1.0	0.0	0.0	0.6	0.0
23	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2
24	2.4	2.8	2.6	0.0	0.0	0.8	0.0	0.0	0.0	0.2	5.9	0.0
25	0.0	0.0	0.0	7.8	1.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
26	0.0	0.0	0.2	16.4	0.0	0.8	0.0	0.0	0.0	0.1	0.0	0.0
27	2.0	0.0	0.4	0.0	0.0	0.0	0.6	0.0	0.0	3.8	0.0	0.0
28	2.7	0.2	0.0	0.0	1.4	0.0	33.2	0.0	0.2	0.1	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0		0.0		6.4		0.0	0.0		1.1		0.0
Total	13.4	18.3	6.5	29.5	19.4	45.0	176.6	61.8	64.8	33.1	18.7	2.4

Precipitation 2015

Month	AMOUNT (mm)		RECORD VALUES (mm)		Days with Measurable Precipitation		Month end Snow-on-Ground (cm)		
	2015	Cumulative	CRS Maximum	CRS Minimum	2015	Cumulative	2015	CRS Maximum	CRS Minimum
January	13.4	13.4	26.0/2013	8.9/2014	8	8	18	56/2013	2/2012
February	18.3	31.7	18.3/2015	8.0/2012	10	18	36	64/2013	7/2012
March	6.5	38.2	19.0/2012	6.5/2015	9	27	0	76/2013	0/2015
April	29.5	67.7	52.5/2014	14.9/2013	9	36	0	52/2013	0/2015
May*	19.4	87.1	85.4/2012	6.8/2013	10	46	0	0	0
June*	45.0	132.1	140.4/2012	45.0/2015	12	58	0	0	0
July*	176.6	308.7	176.6/2015	77.2/2013	10	68	0	0	0
August*	61.8	370.5	69.6/2014	5.8/2013	10	78	0	0	0
September*	64.8	435.3	64.8/2015	11.0/2014	11	89	0	0	0
October	33.1	468.4	37.6/2012	5.6/2013	10	99	0	5/2012	0/2015
November	18.7	487.1	34.6/2013	18.7/2015	10	109	8	242013	8/2015
December	2.4	489.5	15.1/2013	2.4/2015	6	115	10	40/2013	10/2015
Total	489.5				115				

* tipping bucket

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	2014	17	2013	8
2014	239	2013	15	2014	7
2012	200	2015	14	2012	5

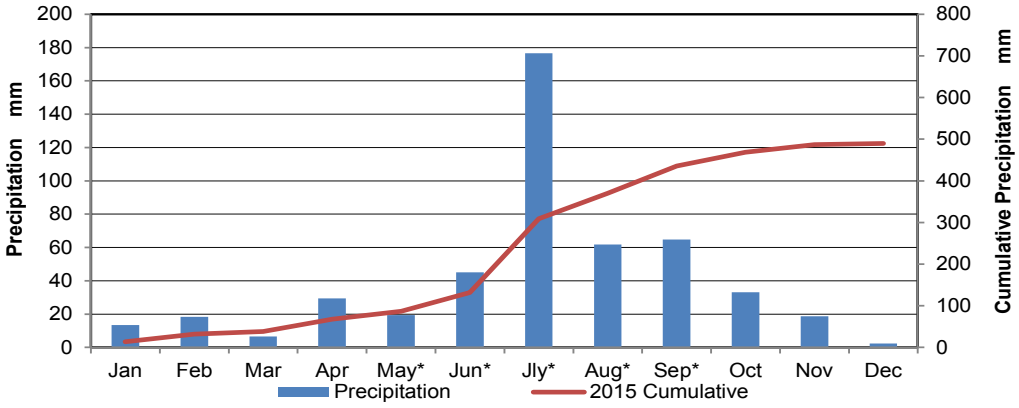
RANKING BY DRIEST YEAR (mm)									
ANNUAL (JAN-DEC)		WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2013	340	2012*	25.6*	2013	29.4	2013	207.6	2014	51.3
2014	450	2014	33.9	2015	55.4	2014	268.8	2013	53.6
2015	490	2015	36.4	2014	106.6	2015	283.4	2012	75.9
2012	594	2013	46.5	2012	146	2012	333.8	2015	116.6

*Missing December 2011

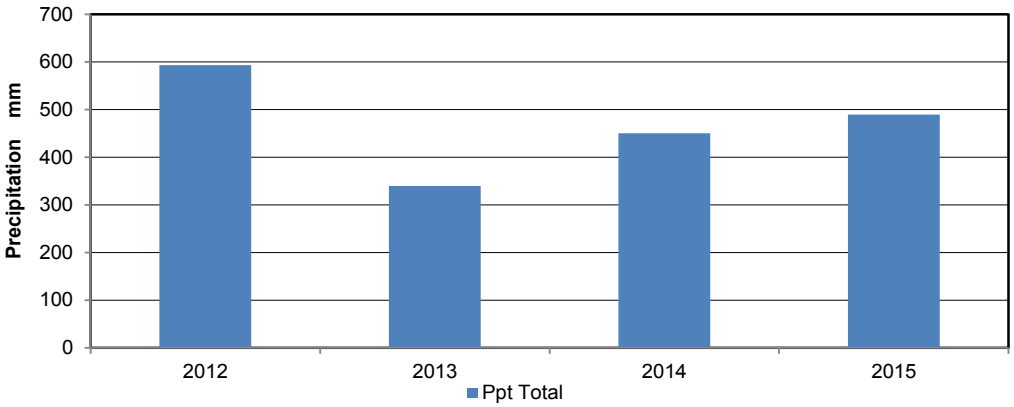
ANNUAL RANKING BY DAYS WITH PRECIPITATION									
ANNUAL (JAN-DEC)		WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2012	165	2012*	30*	2012	49	2012	42	2014	36
2014	127	2014	28	2014	29	2014	39	2012	36
2015	122	2015	27	2015	27	2015	36	2015	35
2013	104	2013	26	2013	11	2013	36	2013	25

*Missing December 2011

Monthly
*tipping bucket

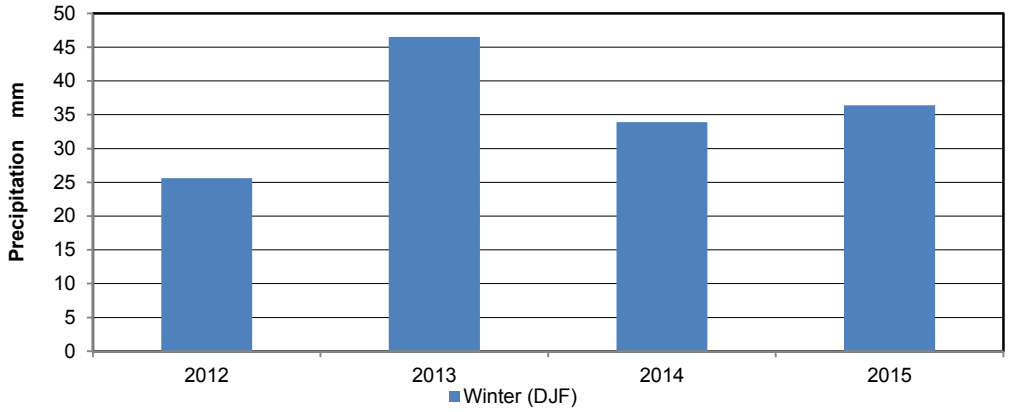


Annual

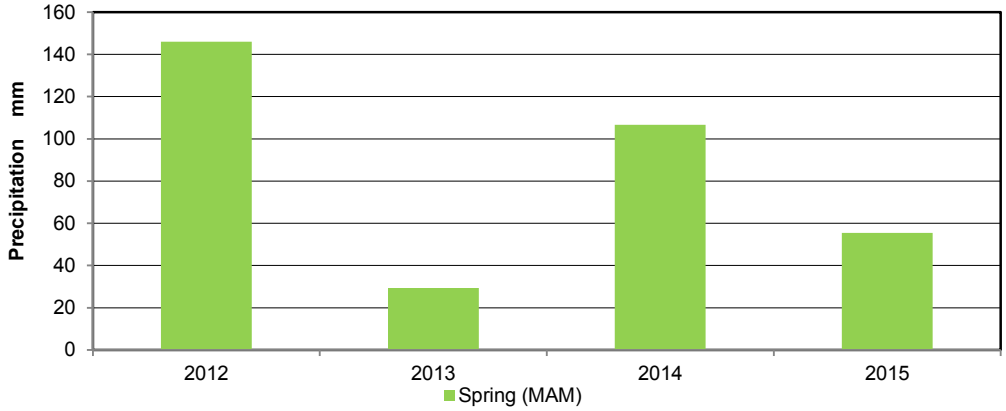


SEASONAL PRECIPITATION

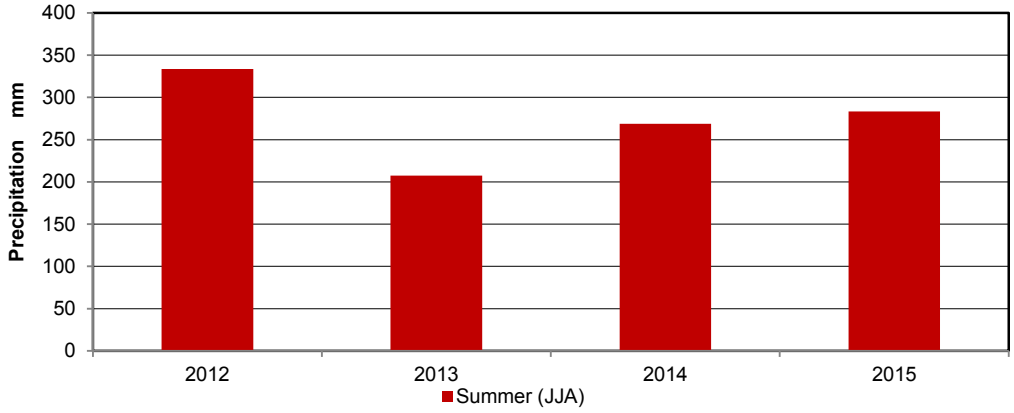
Winter



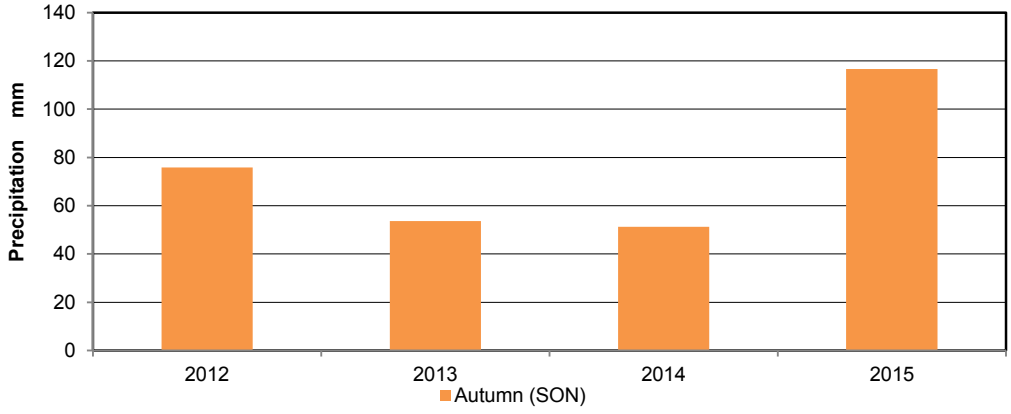
Spring



Summer

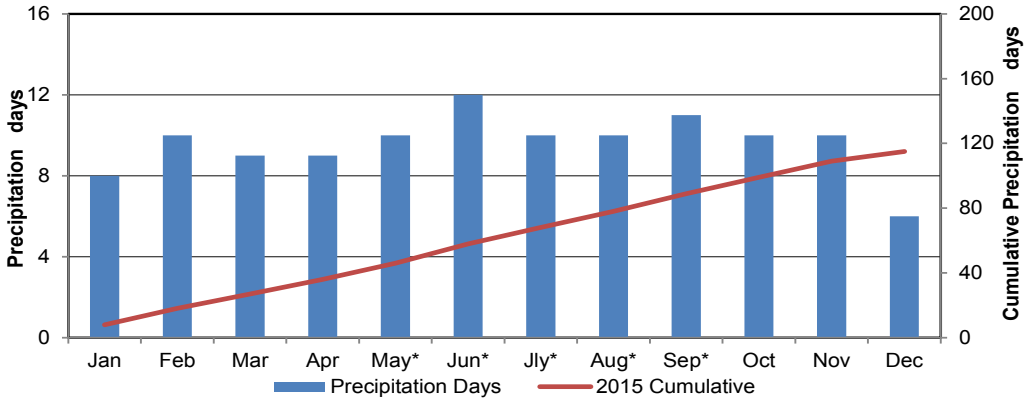


Autumn

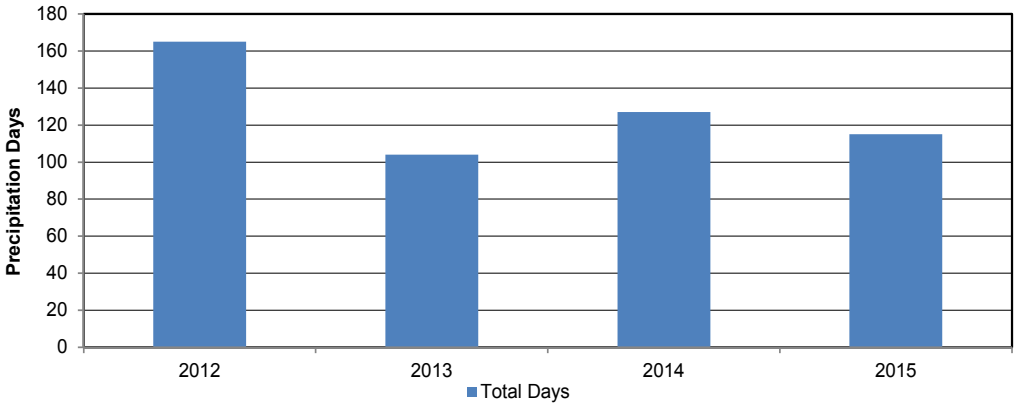


SEASONAL PRECIPITATION DAYS

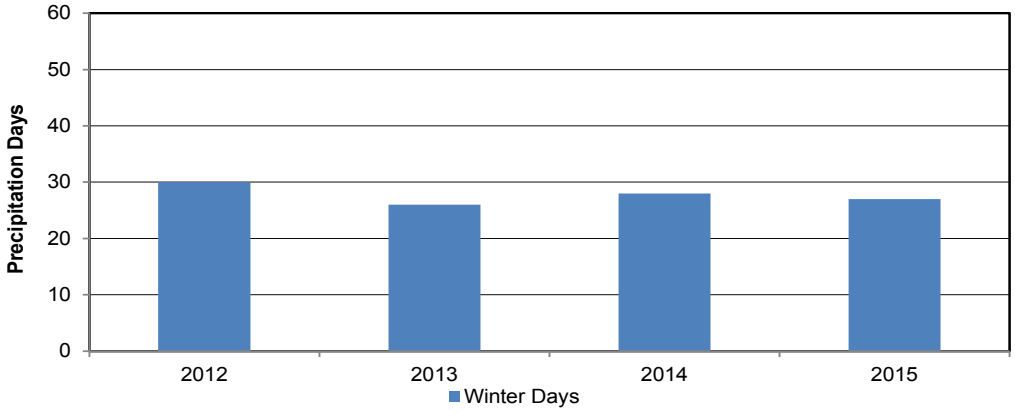
Monthly



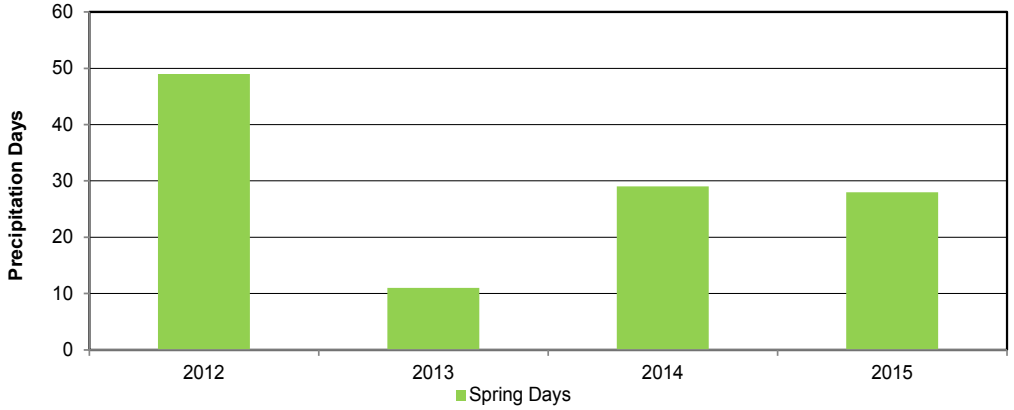
Annual



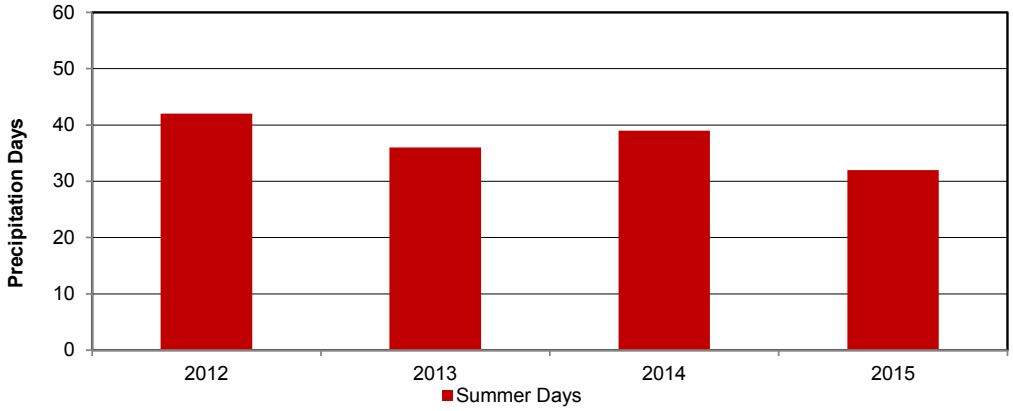
Winter



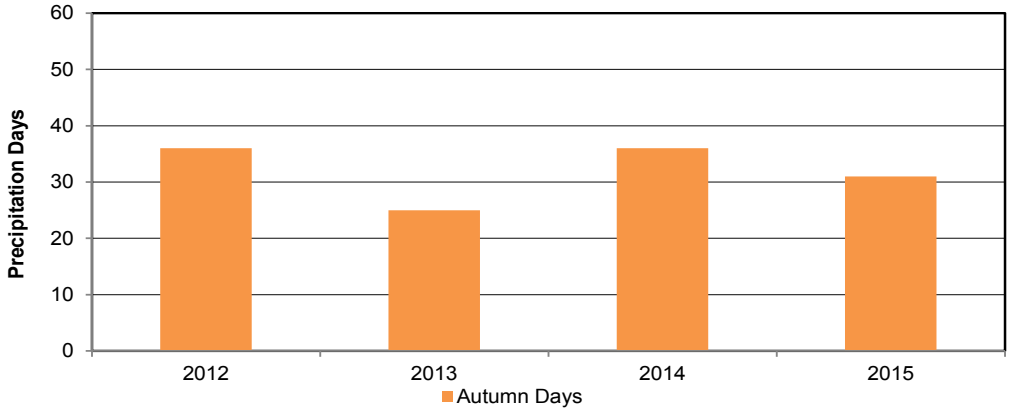
Spring



Seasonal Precipitation Days



Summer

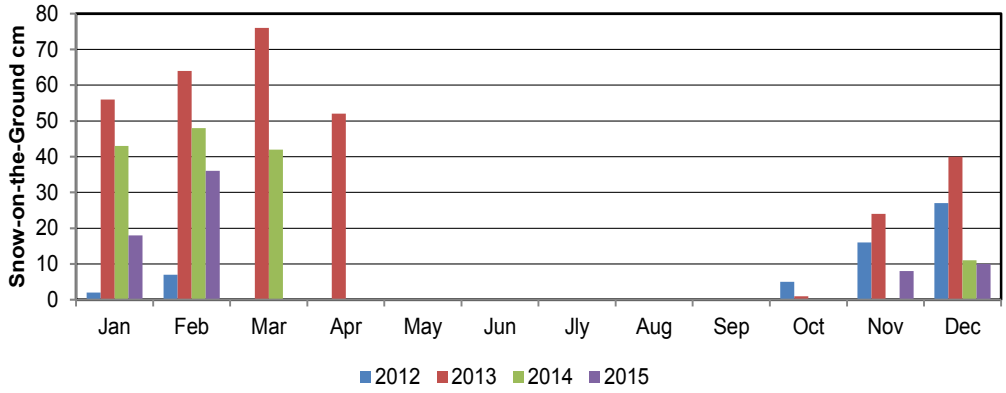


Autumn

Electroninic snow depth
13 Feb, 2015
photo credit: R. Jansen

Weighing gage
3 June 2015
photo credit: R. Jansen

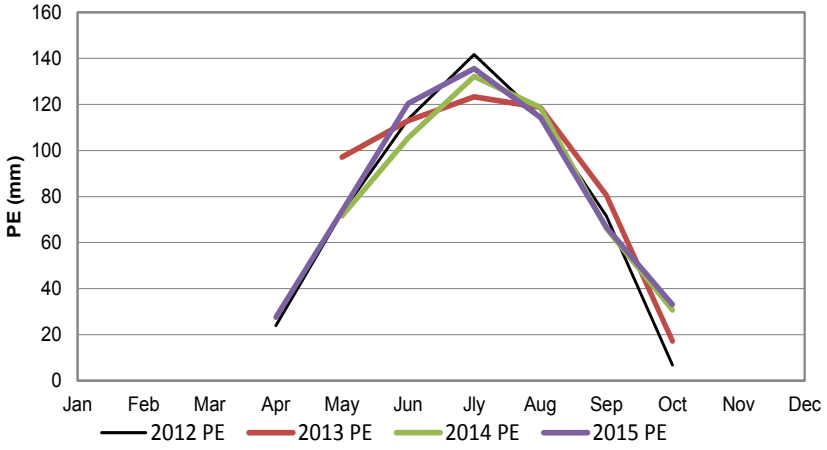
Precipitation



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
Jan				
Feb				
Mar				
Apr	24.0			27.6
May	73.0	97.1	71.6	73.6
Jun	113.6	112.9	105.4	120.4
Jly	141.7	123.3	132.2	135.6
Aug	114.4	118.7	118.7	114.4
Sep	71.5	80.6	66.2	66.7
Oct	6.8	17.2	30.7	33.1
Nov				
Dec				
Total	545.0	549.9	543.8	571.4

1 Thornthwaite and Mather 1955
Thornthwaite 1948

Tipping Bucket
12 July, 2011
photo credit: V. Wittrock

SRC CRS at CLC
03 April 2013
photo credit: M. Taylor

Radiation 2015

Sunrise & Sunset Tables for Conservation Learning Center, 2015 & 2016[1]

2015	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	9:18	16:56	8:47	17:47	7:51	18:41	6:37	19:38	5:30	20:32	4:43	21:20	4:40	21:33	5:20	20:58	6:12	19:53	7:04	18:40	8:01	17:32	8:54	16:50
2	9:17	16:57	8:46	17:49	7:48	18:43	6:35	19:40	5:28	20:34	4:42	21:21	4:41	21:33	5:21	20:56	6:14	19:50	7:06	18:38	8:03	17:30	8:56	16:49
3	9:17	16:58	8:44	17:51	7:46	18:45	6:32	19:42	5:26	20:36	4:41	21:22	4:42	21:32	5:23	20:54	6:16	19:48	7:08	18:36	8:05	17:28	8:57	16:48
4	9:17	16:59	8:42	17:53	7:44	18:47	6:30	19:44	5:24	20:37	4:40	21:23	4:43	21:32	5:25	20:53	6:18	19:46	7:10	18:33	8:07	17:26	8:59	16:48
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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
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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
29	8:52	17:48	7:53	18:46	6:47	19:37	5:39	20:30	4:54	21:15	4:49	21:31	5:24	21:01	6:14	19:59	7:05	18:47	7:57	17:42	8:51	16:59	9:15	17:03
30	8:50	17:50			6:44	19:38	5:37	20:31	4:53	21:16	4:50	21:30	5:26	20:59	6:16	19:57	7:07	18:45	7:59	17:40	8:52	16:58	9:15	17:04
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

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

Radiation 2015

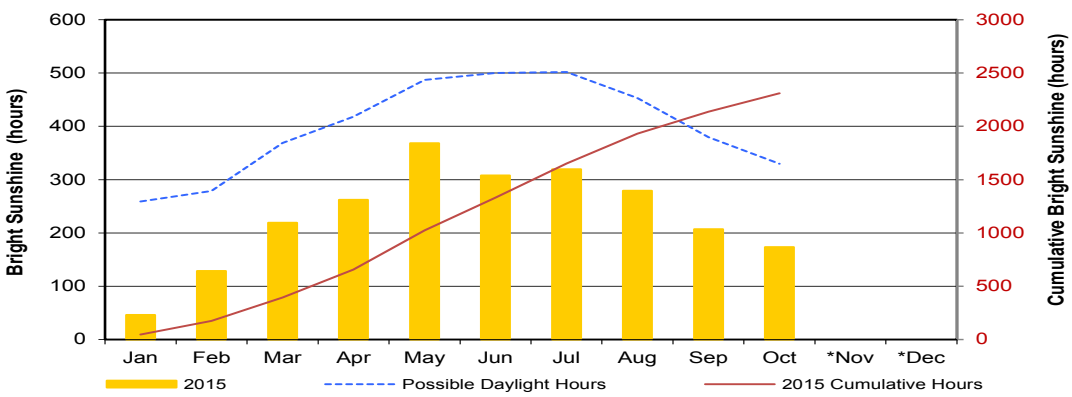
	Bright Sunshine Hours			Bright Sunshine Days			
Month	**2015 # of Hours**	**Possible hours[1]**	**% of Possible hrs**	**2015 # of Days**	**With 1 or > hours**	**With 5 or > hours**	**With 10 or > hours**
Jan	46.2	259.0	17.8	21	16	1	
Feb	128.6	278.6	46.2	22	20	14	4
Mar	219.1	369.0	59.4	28	27	20	14
Apr	262.0	418.1	62.7	28	26	22	17
May	368.3	487.3	75.6	30	30	29	24
Jun	307.7	500.1	61.5	30	29	25	18
Jly	319.7	502.0	63.7	30	30	28	19
Aug	279.3	452.9	61.7	28	28	26	16
Sep	206.9	379.5	54.5	27	27	22	8
Oct	173.2	329.6	52.5	25	24	19	3
*Nov	83.0*	264.3	31.4*	19*	17*	9*	*
*Dec	44.7*	242.4	18.4*	13*	12*	2*	*
Total	2438.7*	4482.9	54.4	301*	286*	217*	123*

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

Global and Diffuse Radiation (MJ/m²)

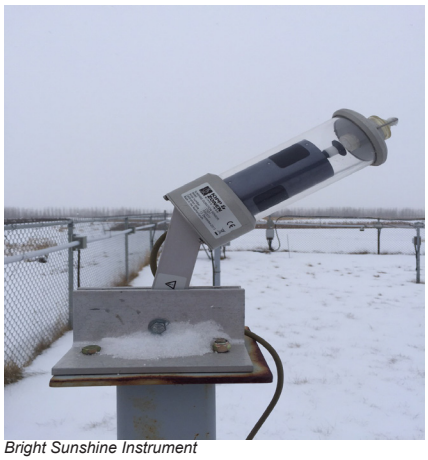
2015 Date	January		February		March		April		May		June		July		August		September		October		November		December	
	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse
1	2.5	2.4	3.9	3.8	14.4	2.8	3.9	3.5	19.7	8.7	26.3	7.7	14.0	10.1	15.6	11.9	18.8	In-	5.5	5.1	1.7	1.6	6.0	1.0
2	1.7	1.6	6.4	3.7	8.7	7.5	18.8	4.2	19.6	7.5	27.0	10.4	22.7	10.5	26.2	9.7	9.1	stru-	8.9	4.4	2.3	2.2	3.6	2.4
3	3.4	2.0	7.0	2.2	12.7	5.6	13.4	8.2	23.8	6.8	27.0	7.7	24.3	8.9	24.6	8.2	12.9	ment	1.7	1.5	1.2	1.2	3.9	0.9
4	4.7	1.3	7.3	2.8	13.2	2.5	19.9	2.4	20.3	8.8	26.1	8.6	11.2	8.7	8.2	7.1	11.7	fail-	2.1	2.0	2.1	2.0	2.3	2.0
5	4.3	1.8	5.9	3.5	12.8	2.4	18.8	3.8	21.4	7.5	19.6	10.7	15.8	11.1	2.5	2.2	3.7	ure	6.7	4.0	3.2	2.8	3.7	0.7
6	3.9	1.0	2.8	2.7	10.1	4.9	19.2	3.7	4.2	3.7	23.3	6.6	19.8	11.2	3.1	2.7	4.3		8.0	1.0	4.5	2.6	2.7	2.0
7	2.9	2.2	6.8	2.0	11.0	5.6	6.7	6.1	12.9	10.4	26.8	9.5	16.7	10.7	14.2	9.6	9.1		9.7	2.8	5.5	2.6	3.5	1.7
8	3.8	1.0	4.7	4.4	13.5	2.8	16.8	6.6	24.0	6.0	16.4	11.1	27.3	5.9	15.1	10.6	10.8		12.2	1.2	4.3	2.9	4.6	0.8
9	3.2	0.7	4.4	4.1	12.3	3.6	20.8	2.6	19.8	5.7	25.9	9.3	23.1	10.1	17.7	12.1	16.7		9.5	2.8	0.9	0.9	1.0	0.9
10	3.6	1.2	7.2	2.9	12.9	3.5	20.8	3.0	22.8	7.4	27.8	6.7	25.1	9.0	21.5	9.8	17.3	2.0	8.1	3.6	2.4	2.2	1.6	1.5
11	5.3	1.1	8.3	1.7	11.5	7.7	17.3	5.7	26.5	6.9	17.9	10.1	24.0	10.3	18.7	10.1	15.1	6.7	6.6	2.7	2.2	2.0	1.4	1.3
12	5.7	1.3	5.9	5.1	7.4	6.9	20.3	3.3	19.8	8.9	21.7	8.3	22.8	10.4	21.3	10.3	16.6	2.2	10.9	1.7	5.9	0.8	2.8	2.1
13	2.9	2.2	4.5	4.0	15.8	3.0	22.0	3.2	14.5	7.8	9.7	7.8	18.2	7.8	19.9	9.4	11.0	5.6	11.1	1.4	3.9	2.5	1.1	1.0
14	2.8	1.8	3.2	3.0	8.6	6.7	15.3	7.3	26.5	6.4	11.8	10.1	14.3	9.2	17.8	9.8	8.2	7.2	10.7	1.6	2.8	1.7	1.4	1.3
15	2.0	1.9	6.9	6.0	14.5	2.8	18.0	5.8	27.3	6.4	27.7	8.3	22.5	7.7	2.0	1.6	1.7	1.5	6.9	3.8	4.4	2.0	0.0	0.0
16	2.1	2.1	8.7	3.0	15.6	2.1	20.7	5.5	21.0	12.2	23.3	7.2	17.4	5.5	17.4	11.6	8.5	6.6	10.1	1.5	1.4	1.4	0.0	0.0
17	4.2	0.9	9.5	2.0	15.7	3.0	22.2	3.0	28.1	6.3	21.5	8.2	20.4	11.4	17.4	9.8	12.0	5.0	10.1	1.2	4.5	0.9	2.2	1.9
18	5.2	1.5	9.4	3.7	16.4	2.9	11.0	8.0	28.6	6.2	23.6	8.9	21.0	9.8	20.7	11.3	13.5	5.1	9.0	2.7	2.5	2.2	4.7	1.0
19	2.7	2.0	6.3	5.7	7.5	5.6	22.3	4.5	28.4	4.9	22.0	8.9	23.0	10.7	15.3	10.2	13.5	4.0	5.7	3.8	5.0	1.3	1.7	1.6
20	2.4	2.2	7.8	5.3	16.1	2.3	16.5	10.1	26.3	7.7	13.6	10.2	27.2	9.3	18.3	12.7	13.1	4.2	1.8	1.6	3.7	2.6	2.9	1.5
21	4.1	1.9	12.0	2.3	10.5	7.9	22.8	5.3	28.0	5.6	19.4	11.9	23.5	11.5	10.7	6.7	11.8	4.2	8.8	1.2	4.1	3.0	2.0	1.7
22	3.7	2.3	11.7	2.1	5.9	5.5	22.0	7.1	28.0	5.3	16.6	8.9	22.0	11.3	12.5	9.9	12.6	2.3	8.1	2.8	4.5	1.4	1.8	1.5
23	3.6	2.7	7.7	5.6	7.6	7.1	7.9	6.0	27.3	6.8	29.1	5.9	22.7	12.1	20.7	14.2	13.2	4.6	9.0	1.1	3.7	2.6	2.4	1.3
24	2.3	2.2	5.4	5.1	10.8	9.0	11.1	9.0	26.0	7.4	26.0	6.5	26.7	9.2	21.2	16.7	10.3	5.5	7.6	2.9	2.1	2.0	2.2	1.3
25	3.3	2.6	12.0	1.9	16.8	4.8	5.0	4.5	18.8	9.1	24.3	7.2	23.1	10.4	16.5	10.8	11.5	4.6	6.2	2.2	2.3	2.1	5.0	1.0
26	3.3	3.0	12.8	2.1	10.9	9.4	14.1	12.5	24.4	9.1	20.3	9.1	23.9	9.8	16.3	10.5	10.9	4.5	6.8	3.0	5.8	1.2	3.4	1.3
27	2.8	2.4	9.8	6.4	7.6	6.7	25.6	4.4	28.1	6.3	28.1	6.6	9.0	7.5	13.5	10.4	11.7	3.6	2.4	2.2	4.2	1.4	2.5	1.9
28	3.0	2.8	10.8	6.3	9.4	6.2	22.1	6.9	22.0	8.9	26.9	7.1	3.2	2.8	15.9	12.0	13.8	2.1	1.7	1.6	5.1	1.0	1.9	1.7
29	4.2	3.9			17.5	2.7	22.8	5.3	27.6	7.9	10.3	7.8	23.8	10.4	15.7	9.9	9.2	6.0	2.3	2.2	4.1	1.6	3.0	1.1
30	3.3	3.1			17.3	2.6	16.0	4.9	28.4	7.6	9.4	7.5	24.5	9.2	8.5	7.4	13.0	1.5	7.4	1.1	5.0	1.0	4.6	1.6
31	9.7	4.8			15.3	6.1			53.9	16.3			50.2	18.9	27.2	23.8			13.5	3.3			8.2	3.0
Total	112.6	63.9	209.1	103.4	380.3	152.2	514.1	166.4	748.0	236.5	649.4	254.8	663.4	301.4	496.2	313.0	345.6	89.0	229.1	74.0	105.3	55.7	88.1	43.0

Radiation 2015



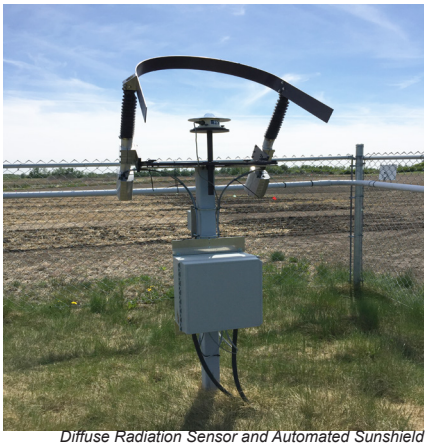
Bright Sunshine Hours

Incomplete November/ December data due to Instrument Malfunction

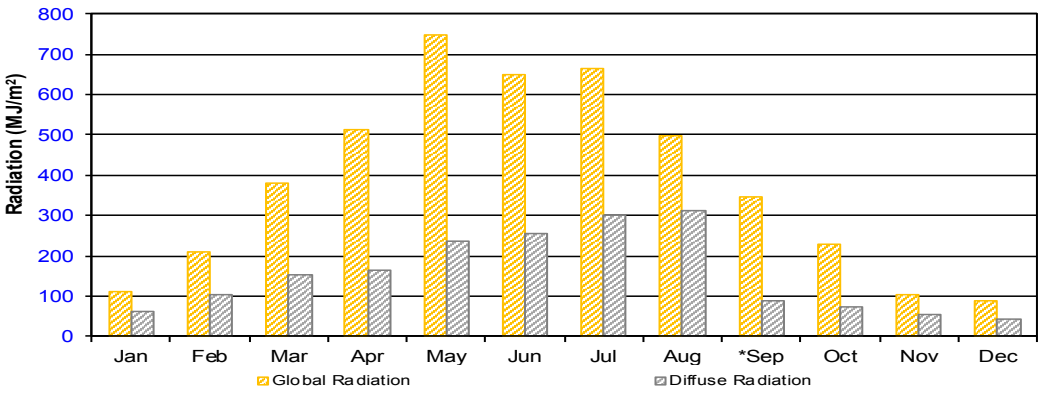


Bright Sunshine Instrument
16 Dec, 2015
photo credit: R. Jansen

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



Diffuse Radiation Sensor and Automated Sunshield
3 June 2015
photo credit: R. Jansen



Monthly Comparison Global & Diffuse Radiation

September Diffuse Information missing for September 1 to 9 due to shade ring misalignment

Wind 2015

	Average		Highest Instantaneous Wind Speed		
	Speed (km/h)	"1/2 hr Maximum" Average	Speed (km/h)	Direction	Day
January	M	M	36.3*	NNW*	8*
February	M	M	36.1*	WNW*	23*
March	M	M	46.5*	WNW*	15*
April	M	M	41.7*	W*	12*
May	M	M	71.7*	W*	25*
June	10.9	17.9	55.5	N	8
July	11.0	17.8	57.6	NW	19
August	9.3	15.4	65.9	NE	15
September	11.1	18.0	60.0	W	27
October	11.5	17.9	67.8	N	11
November	12.1	18.7	66.7	NW	18
December	10.9	15.6	44.7	SSW	3

M= Missing Data
* = Instrument replaced in June therefore January - May data is suspect

Extreme Daily Winds (km/h)		
Date	Wind Speed/ Direction	Beaufort Designation*
May 25*	71.7 W*	Strong Gale
June 6	53.5 W	Near Gale
June 8	55.5 N	Near Gale
June 9	50.9 NW	Near Gale
July 19	55.9 NW	Near Gale
August 15	65.9 NE	Gale
September 21	52.4 W	Near Gale
September 27	60.0 W	Near Gale
October 11	67.8 N	Gale
October 13	60.2 WNW	Near Gale
October 14	63.0 W	Gale
October 27	52.3 NNW	Near Gale
November 18	66.7 NW	Gale
November 19	58.1 NW	Near Gale

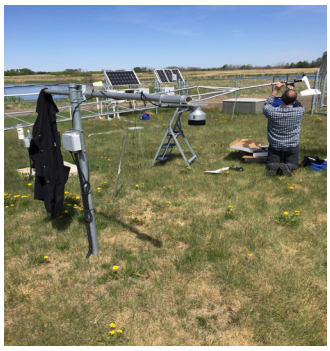
* = Instrument replaced in June therefore January - May data is suspect

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
31 July 2012
Photo: V. Wittrock

Wind 2015
Daily Wind Speed and Maximum Gust Wind Speed

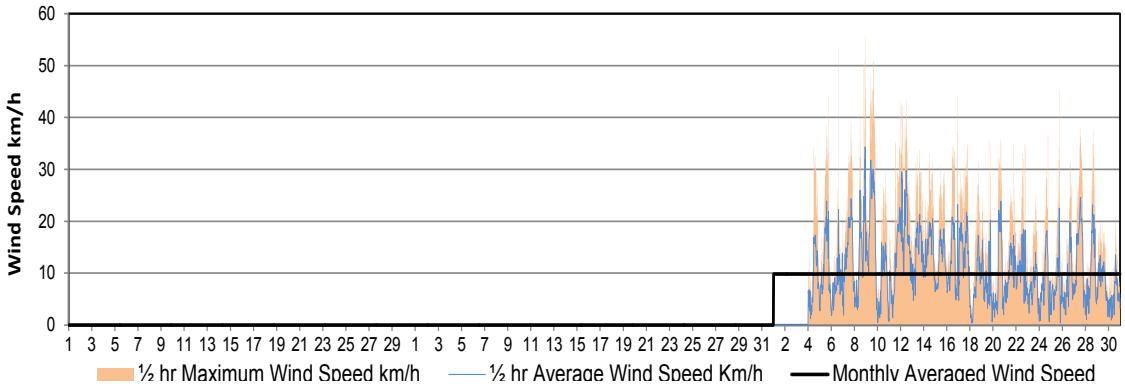


Instrument Failure, No data for January- March

Replacing the anemometer
3 June 2015
Photo: R. Jansen

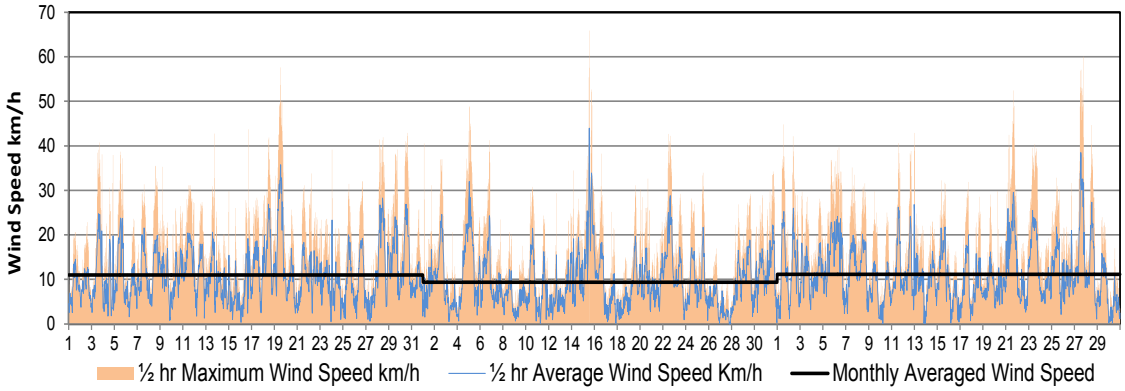
January
February
March

April*
May*
June*

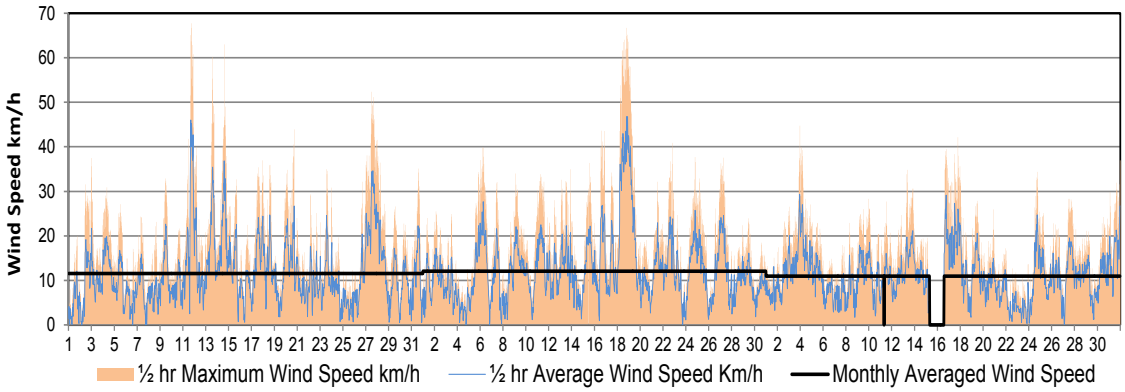


* = Instrument replaced in June therefore Jan- May data is suspect

July
August
September



October
November
December



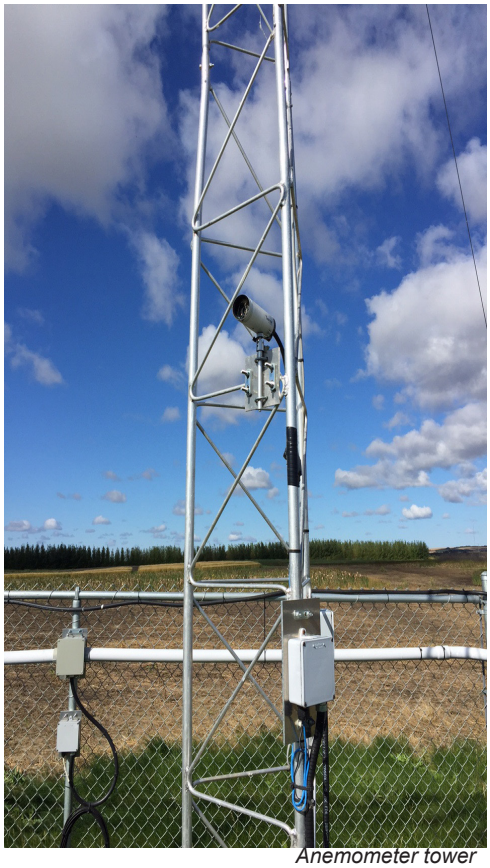
** Missing Dec 15-17 data due to datalogger malfunction*

Wind 2015

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
9 Sept 2015
photo credit: R. Jansen

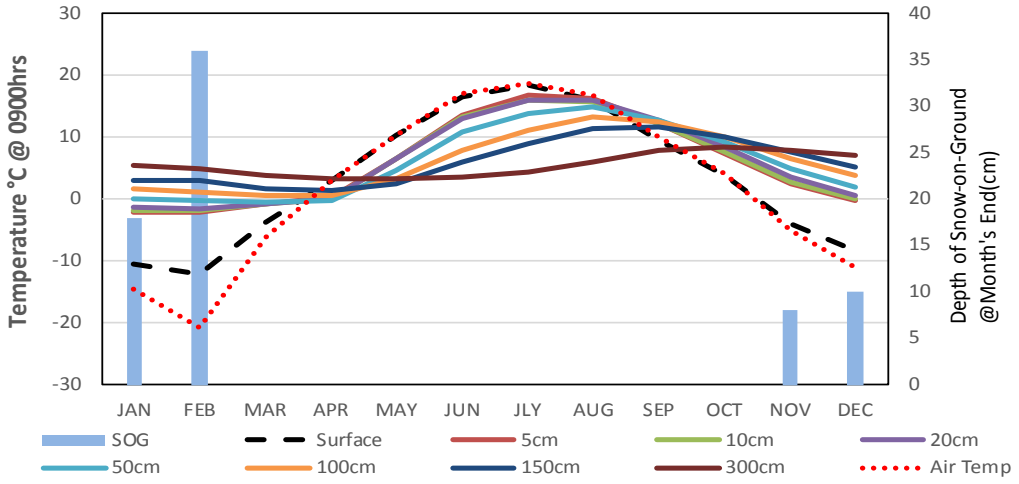
Maximum Daily Wind Chill Value When Temperature < 0°C												
	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	Missing data										-4	-23
2											-6	-21
3											-3	-13
4										-2	-2	-4
5										-3	-7	-12
6										-5	-12	-15
7											-10	-18
8										-2	-7	-17
9											-8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

Instrument Failure, No data for January- May

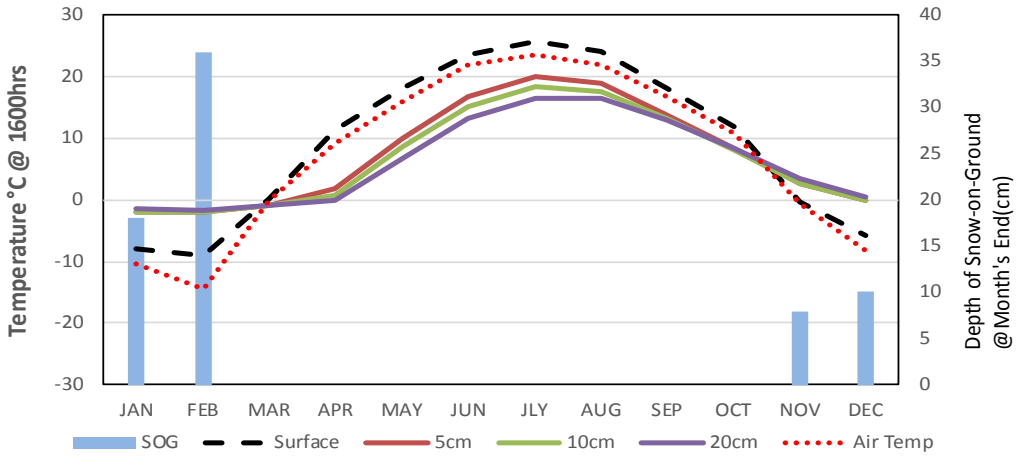
Soil Temperatures and Depth of Snow-on-the-Ground at Month's End

	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	-14.6	-10.6	-2.0	-1.9	-1.3	0.0	1.7	3.0	5.5	-10.3	-8.0	-2.0	-1.9	-1.3	18
FEB	-20.9	-12.3	-2.1	-2.0	-1.6	-0.3	1.1	3.1	4.8	-14.5	-9.1	-2.1	-2.0	-1.6	36
MAR	-6.2	-3.9	-0.8	-0.9	-0.9	-0.5	0.6	1.6	3.9	-0.1	0.2	-1.0	-1.0	-1.0	0
APR	3.0	3.1	0.3	0.1	-0.1	-0.3	0.5	1.4	3.4	9.2	11.3	1.8	0.8	0.1	0
MAY	10.4	10.3	6.6	6.5	6.4	4.8	3.1	2.5	3.2	15.9	18.2	10.0	8.5	6.6	0
JUN	17.1	16.6	13.6	13.3	12.9	10.7	8.0	5.9	3.6	22.0	23.6	16.8	15.2	13.1	0
JLY	18.7	18.4	16.8	16.1	16.0	13.9	11.2	8.9	4.3	23.5	25.8	19.9	18.5	16.5	0
AUG	16.7	15.9	16.3	15.7	16.0	14.9	13.2	11.3	6.1	22.0	24.2	18.9	17.6	16.5	0
SEP	10.1	9.6	12.1	12.2	12.8	12.9	12.5	11.7	7.9	16.7	18.0	13.8	13.1	12.8	0
OCT	4.2	3.9	7.4	7.7	8.4	9.2	10.0	10.1	8.5	10.6	11.8	8.4	8.1	8.3	0
NOV	-5.1	-3.9	2.6	2.7	3.4	4.9	6.6	7.7	7.9	-0.8	-0.3	2.7	2.6	3.4	8
DEC	-11.2	-8.4	-0.2	0.0	0.7	2.0	3.8	5.2	7.1	-8.2	-5.8	-0.1	0.0	0.6	10

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.

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.

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.

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

SOIL TEMPERATURE under a short grass surface with normal snow accumulation, is measured according to procedures outlined in the Environment Canada publication “Soil Temperature” January l, 1976. Depths below surface at which soil temperature measurements are made are: 5 cm, 10 cm, 20 cm, 50 cm, 100 cm, 150 cm and 300 cm. Since soil temperature is affected by profile structure and water content, extrapolation of the measured data is difficult.

SOLAR RADIATION

Diffuse - Total is radiation reaching the earth’s surface after having been scattered from the direct solar beam. The instrument used is an Eppley pyranometer with a shade ring (See SOLAR RADIATION-Global- Total).

Global - Total is the sum of the direct solar and diffuse radiation during the period in question. Measurements are carried out on a horizontal surface near ground level and integrated over the whole celestial dome, summing the diffuse and direct components of the solar beam. The temperature-compensated Eppley pyranometer is used. The standard metric unit of measurement is the megajoule per square metre (MJ/m2).

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.

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)*

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**

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