SASKATCHEWAN RESEARCH COUNCIL

CLIMATE REFERENCE STATION
Conservation Learning Centre

ANNUAL SUMMARY 2012

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

SRC Publication No. 13000 - 1E13
March 2013

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COVER PHOTOGRAPH
Site of the Climate Station at the Conservation Learning Centre
photo credit: V. Wittrock

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ACKNOWLEDGEMENTS

The 2012 data was compiled and recorded by Carol Beaulieu with assistance from Virginia Wittrock. Ms Shannon Poppy (Ecosystems & Forestry Business Unit, Saskatchewan Research Council) and Mr. Curtis Braaten (Conservation Learning Centre) monitored the site while instrument maintenance was carried out by the personnel of the Alternative Energy & Manufacturing/Development Engineering of the Saskatchewan Research Council (SRC).

Enquiries concerning the SRC Climatological Reference Station (CRS), its data, measurement programs and publications, or becoming a supporter are most welcome. For further information contact:

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SASKATCHEWAN RESEARCH COUNCIL
CLIMATE REFERENCE STATION SUPPORTERS, 2012

WE GRATEFULLY ACKNOWLEDGE THE SUPPORT OF THE FOLLOWING:

Kipp & Zonen

CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

Prince Albert Model Forest

Conservation LEARNING CENTRE

CLIMATE REFERENCE STATION HISTORY

The Saskatchewan Research Council's climate reference station at the Conservation Learning Centre (CLC) is situated approximately 16km east of Macdowall, approximately 11km north of St. Louis and 18 km 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 SRC climate reference station at CLC was established in 2011 and began producing a full array of climate data January 2012. The array consists of temperature, precipitation, humidity, barometric pressure, wind, solar radiation, and soil moisture and temperature. The principal observers are Ms S. Poppy (SRC) and Mr. C Braaten (CLC). As the station is almost completely automated, weekly site checks involve moving the shade ring on the diffuse radiation sensor and inspecting the instruments. This unique station being totally off the power grid, is powered by solar panels while the data is retrieved from the data logger by an internet connection with the site via the cellular network.

ACTIVITIES ASSOCIATED WITH THE SRC CRS AT CLC, 2012

The CLC is a research and demonstration farm. Its outreach programme 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 programme exposing participants to a working climate station's suite of instruments beyond just temperature and precipitation. The station emphasizes the importance of climate in the practical world of farming and ecology.

The 2012 field day at CLC on July 17th was a wet and soggy time for both participants and presenters. Ms Virginia Wittrock's presentation on the climate reference station was forced to change venues from the station to the field day tent situated in the farm yard.

A month later Prince Albert media interviewed Virginia Wittrock regarding the new climate station and its association with CLC as well as the climatic conditions recorded at the site.

[1] Conservation Learning Centre 2011

Day of the officail opening
photo credit: S. Poppy

WHAT IS THE 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;
- do value-added research;
- be part of regional, national and global networks in an important agricultural and ecological area;
- facilitate development of additional programs - *e.g.* air quality, biodiversity, and climate change monitoring;
- have roles in various programs within SRC 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 [2]World Meteorological Organization 1988

SUMMARIES FOR 2012

Overview

Data concerning temperature, precipitation, wind speed and direction, bright sunshine, solar radiation, soil temperature and moisture as recorded by the Saskatchewan Research Council (SRC) at the Climate Reference Station (CRS), Conservation Learning Centre (CLC) (53.03ºN, 105.77°W) are presented for the year 2012.

With the first year of operation at the Conservation Learning Centre now complete, we can celebrate a year of accomplishment. With the exception of a few "hiccups" at the end of the year, the site ran well and the suite of instruments produced a good annual data set.

The monthly average temperature values produced a typical graph for the year. Maximum temperatures reached above 30°C on three occasions; July 10th and 11th and August 28th. Minimum temperatures below -30°C occurred on nine occasions, five of which were in December. The first frost-free day for the year was on March 18th. The frost-free season of 136 continuous frost-free days, started on May 4th and ended on September 16th. The site recorded its last frost-free day on October 20th.

The total precipitation for the year was almost 600 mm with 45 % occurring in June and July. The Prince Albert Airport, the closest site for comparison, normally would receive 424 mm annual. The biggest storm event happen on June 9th when the greatest 1 hour, 2 hour, 6 hour, 12 hour, daily and 24 hour totals were set for the year. March followed by April then June were the months with the most precipitation days. The driest month was February with September having the fewest precipitation days. By the end of March, measurable snow-on-the-ground was absent and then resumed by the October measurement. The end of December snow depth measurement was over 25cm.

Bright sunshine for the first year of operation was 48% of possible hours. It appears, from the graph, that April, June and perhaps October through to December may have been bright sunshine deprived. A comparison to future years will determine this.

Average wind speeds were between 10 and 15 km/h with the winds from northwest slightly stronger. While the predominating direction was from the east, the directions northwest through to the south combined would greatly outweigh the percentage of wind from the east. The strongest wind at 113 km/h occurred on June 25th during a storm. February, March and December had the highest percentage of calm occurrences. Winds and temperatures combined on January 18th to produce the most extreme annual wind chill of -48.

Soil temperatures produced the classic graphic curves with 0900h temperatures ranging from -9°C to 20°C for the 5cm level. All levels, except the 300cm level, experienced frost.



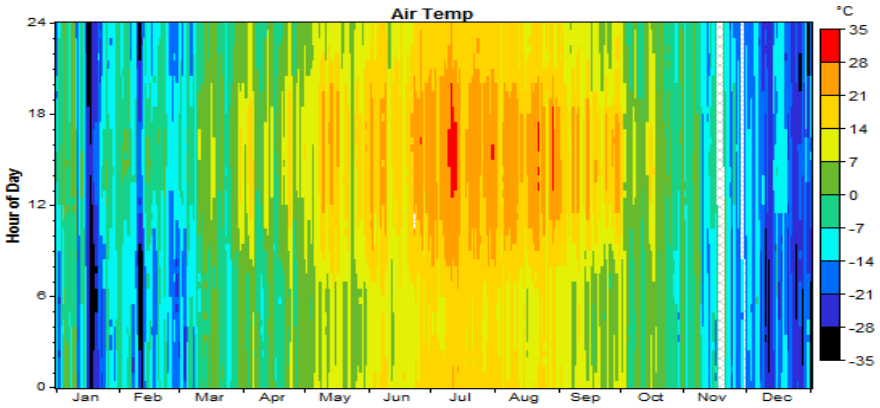

TEMPERATURE 2012

NOTED 2012 TEMPERATURE EVENTS	
COLD SPELL (less than or equal to -30°C)	
DATE	TEMPERATURE °C
January 17	-34.7
January 18	-33.7
February 10	-34.1
February 11	-32.2
December 9	-32.8
December 11	-33.3
December 27	-31.3
December 30	-30.2
December 31	-32.4
HOT SPELL (greater than or equal to 30°C)	
July 10	30.3
July 11	30.4
August 28	30.8
LAST SPRING FROST	
May	3
FIRST FALL FROST	
September	17
Frost-free Season Length	
136	days

	Average Maximum (°C)	Average Minimum (°C)	Average Mean (°C)	2012 Extreme Values (°C)		Growing Degree-days	Heating Degree-days	Cooling Degree-days	Extreme Cooling Degree-days
	2012	2012	2012	Max/Date	Min/Date	base 5°	base 18°	base 18°	base 24°
January	-6.4	-16.9	-11.7	4.9/08	-34.7/17	0.0	920.1	0.0	0.0
February	-3.9	-16.7	-10.4	1.6/22	-34.1/10	0.0	822.7	0.0	0.0
March	3.5	-7.5	-2.0	17.3/30	-23.2/03	8.9	620.3	0.0	0.0
April	9.0	-1.5	3.8	18.8/04	-8.4/09	34.8	427.1	0.0	0.0
May	15.9	4.8	10.4	26.6/09	-0.3/03	166.8	237.0	0.8	0.0
June	21.2	11.0	16.1	28.4/25	5.2/11	334.0	70.4	14.4	0.0
July	25.5	14.7	20.1	30.4/11	11.8/06	469.1	3.9	70.0	0.4
August	23.8	11.5	17.7	30.8/28	7.7/04	392.2	38.0	27.2	0.0
September	19.9	5.7	12.9	27.1/14	-1.0/25	235.7	155.2	0.9	0.0
October	5.0	-2.5	1.3	18.5/15	-14.6/28	20.1	519.1	0.0	0.0
November*	-5.9	-13.3	-9.6	6.1/05	-25.6/23	0.0	717.8	0.0	0.0
December	-14.2	-23.4	-18.8	-5.3/15	-33.3/11	0.0	1141.2	0.0	0.0
Average	7.8	-2.8	2.5			1661.6	5672.8	113.3	0.4

* missing data from November 16-19

Hourly



Daily Maximum

2012	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-6.4	-0.1	-3.5	8.8	12.1	24.1	24.5	25.3	23.5	16.2	-5.3	-12.4
2	-5.0	1.4	-4.8	10.5	11.5	26.4	25.3	21.6	19.9	9.5	-2.8	-12.9
3	1.6	0.7	-7.0	16.0	13.2	19.7	24.5	15.9	20.4	6.7	-1.0	-14.4
4	0.8	0.2	1.1	18.8	7.6	21.2	19.2	22.0	18.2	3.6	0.9	-10.6
5	3.2	1.3	0.7	15.3	11.1	19.7	24.1	25.9	19.4	6.4	6.1	-6.9
6	2.2	-3.0	-4.0	5.5	9.4	26.4	26.0	24.8	14.8	10.9	5.2	-10.4
7	-2.4	-6.6	-2.7	4.5	16.9	23.1	27.6	26.5	24.8	8.5	0.6	-14.6
8	4.9	-5.2	-1.9	-0.8	20.3	25.7	28.0	25.5	20.4	6.8	-2.3	-13.6
9	3.5	-8.8	0.1	3.7	26.6	16.8	28.6	27.9	24.6	5.1	-8.6	-19.3
10	1.9	-13.3	8.0	4.4	13.1	13.8	30.3	26.4	26.6	4.4	-11.1	-17.3
11	-14.4	-11.7	3.3	10.5	16.8	16.6	30.4	23.7	13.2	1.6	-10.5	-22.3
12	-7.3	-7.8	6.0	13.4	21.8	19.6	29.8	21.2	15.6	5.9	-6.5	-21.6
13	1.7	0.3	7.1	6.9	24.6	17.5	26.7	22.7	18.4	9.0	-4.2	-11.6
14	-2.4	1.2	4.4	9.2	19.4	19.4	26.3	16.5	27.1	16.7	0.4	-9.3
15	-12.5	0.3	7.0	1.7	18.5	18.8	19.8	16.8	18.0	18.5	-4.0	-5.3
16	-21.9	-3.6	12.6	1.0	23.0	19.2	20.5	22.0	12.9	14.9	M	-8.1
17	-27.5	-2.5	8.7	1.6	11.9	14.2	22.8	25.8	17.6	7.9	M	-10.4
18	-24.9	-2.6	6.4	5.9	9.2	15.9	23.2	25.2	21.9	5.6	M	-10.3
19	-18.9	0.6	1.5	9.1	14.4	19.8	25.1	26.6	16.1	2.5	M	-11.7
20	-15.5	-2.6	3.7	7.8	18.8	20.7	25.7	28.3	18.4	3.1	4.1	-16.2
21	-13.9	-4.5	6.8	12.6	17.7	22.0	27.3	28.9	14.0	2.3	-8.6	-14.0
22	-11.6	1.6	-1.4	18.6	9.8	24.3	26.6	20.6	16.7	0.5	-10.6	-15.6
23	-5.8	-2.7	-4.1	17.2	7.0	23.1	26.9	26.0	24.8	0.2	-9.2	-21.9
24	-5.5	-7.6	-1.7	14.6	15.5	23.5	24.0	25.8	19.5	0.8	-6.6	-20.1
25	1.4	-10.6	1.0	3.9	15.2	28.4	19.3	14.3	17.5	-0.6	-12.1	-20.2
26	-0.4	-8.8	3.9	9.3	17.9	24.0	23.9	20.5	22.0	-4.1	-12.1	-19.3
27	-4.1	-8.5	5.3	9.7	16.0	17.3	25.2	25.0	22.0	-5.1	-14.1	-19.3
28	-6.2	-7.3	6.9	6.6	13.1	22.9	28.1	30.8	25.1	-5.5	-16.4	-16.5
29	-7.5	-4.1	13.7	7.7	19.0	26.4	25.9	26.2	26.0	0.4	-12.8	-10.3
30	-4.8		17.3	15.3	21.7	25.2	28.4	24.1	18.2	2.6	-12.4	-10.0
31	0.1		13.6		21.3		26.0	24.7	0.0	-0.4		-12.5

TEMPERATURE 2012

Daily Minimum

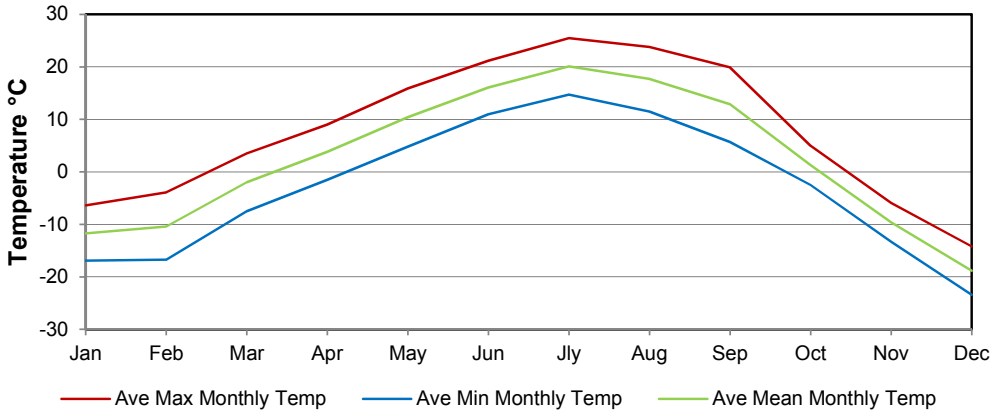
2012	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-20.1	-14.7	-13.2	1.3	4.3	8.6	13.7	13.3	11.9	2.8	-9.1	-14.7
2	-21.4	-13.2	-19.9	-1.4	3.0	9.5	16.0	11.5	8.8	5.5	-5.4	-15.0
3	-10.2	-12.6	-23.2	-3.4	-0.3	11.5	13.6	9.8	10.2	-1.1	-3.7	-16.4
4	-11.1	-9.3	-14.7	5.3	3.2	10.5	12.2	7.7	7.9	-1.6	-3.7	-17.6
5	-3.4	-10.8	-9.1	0.9	6.1	11.1	12.8	14.5	9.3	-6.4	-2.6	-12.5
6	-5.4	-19.9	-18.8	-0.5	7.1	12.8	11.8	10.7	6.9	-2.4	-4.2	-21.3
7	-12.3	-22.4	-19.6	-2.3	5.0	13.5	12.2	10.7	4.8	-0.8	-3.3	-24.1
8	-12.0	-15.2	-13.0	-6.2	1.9	11.6	14.6	14.1	5.3	1.0	-9.5	-24.9
9	-4.2	-24.6	-9.1	-8.4	10.9	12.3	14.9	15.1	9.7	-3.1	-15.9	-32.8
10	-14.5	-34.1	-7.8	-8.4	3.8	6.2	17.8	11.9	11.2	-2.7	-13.1	-26.6
11	-20.1	-32.2	-7.1	-6.8	7.8	5.2	18.2	14.7	7.4	-3.5	-20.0	-33.3
12	-18.8	-18.8	-2.1	-1.1	2.8	6.1	17.2	9.9	7.8	-1.3	-20.3	-24.7
13	-11.4	-15.9	-1.9	3.1	8.0	8.6	16.8	8.3	2.3	0.4	-12.8	-22.7
14	-12.8	-10.1	-1.9	1.6	7.4	11.9	13.7	13.5	5.6	0.4	-13.2	-21.8
15	-22.8	-12.4	-6.6	-7.1	2.1	9.8	15.8	7.9	7.4	2.1	-16.7	-16.5
16	-22.8	-12.4	-6.6	-7.1	2.1	9.8	15.8	7.9	7.4	2.1	M	-22.4
17	-34.7	-20.6	-0.8	-3.4	7.1	10.9	13.4	7.9	-0.9	3.5	M	-22.1
18	-33.7	-18.5	1.4	-7.6	6.0	8.9	16.2	9.5	4.0	-2.0	M	-12.6
19	-29.7	-12.9	-3.9	-4.4	4.2	8.1	14.6	11.5	6.8	-3.1	M	-22.0
20	-29.4	-8.8	-6.0	-3.1	1.8	9.5	12.4	11.7	4.5	0.3	-8.7	-25.8
21	-23.2	-10.4	-4.0	0.9	9.3	11.3	13.7	11.9	1.6	-3.6	-11.1	-18.2
22	-23.7	-8.1	-5.7	-0.7	6.5	15.8	16.3	14.9	-0.3	-6.9	-22.3	-26.8
23	-23.5	-11.7	-9.2	5.6	4.3	11.8	15.3	13.4	1.5	-1.9	-25.6	-26.1
24	-20.6	-19.1	-9.9	3.8	2.7	11.6	17.0	12.7	5.1	-1.5	-14.3	-29.4
25	-8.2	-15.9	-12.2	-2.0	3.0	15.9	13.8	11.8	-1.0	-4.5	-20.6	-26.7
26	-15.1	-19.2	-2.5	-3.6	4.2	15.7	12.0	11.8	0.1	-7.4	-18.9	-29.2
27	-15.5	-16.8	-2.3	1.9	4.7	11.4	13.2	9.4	5.2	-12.1	-20.2	-31.3
28	-13.4	-23.3	-5.7	2.9	4.8	13.9	16.1	15.3	4.4	-14.6	-18.3	-24.6
29	-15.5	-21.6	1.0	3.0	1.3	12.4	15.1	13.3	9.7	-5.6	-16.4	-20.8
30	-10.1		1.9	2.7	4.5	14.3	13.9	10.4	7.3	-0.4	-14.7	-30.2
31	-5.3		0.2		8.3		16.7	8.0		-8.3		-32.4

Daily Mean

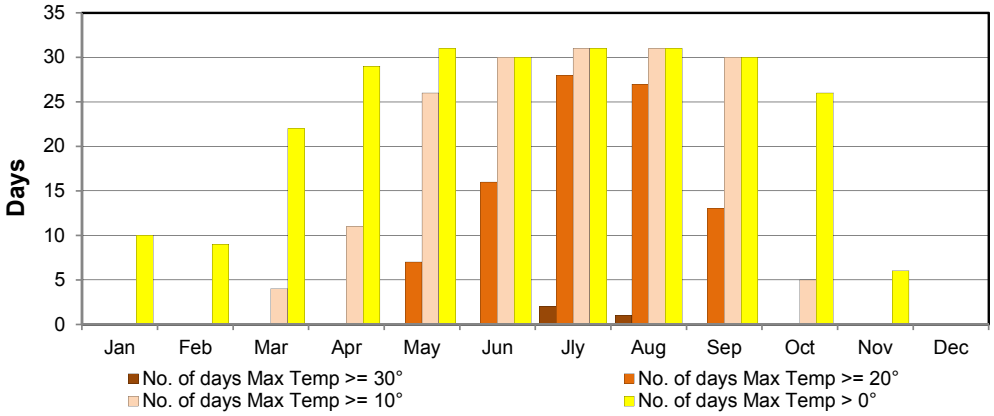
2012	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-13.3	-7.4	-8.4	5.1	8.2	16.4	19.1	19.3	17.7	9.5	-7.2	-13.6
2	-13.2	-5.9	-12.4	4.6	7.3	18.0	20.7	16.6	14.4	7.5	-4.1	-14.0
3	-4.3	-6.0	-15.1	6.3	6.5	15.6	19.1	12.9	15.3	2.8	-2.4	-15.4
4	-5.2	-4.6	-6.8	12.1	5.4	15.9	15.7	14.9	13.1	1.0	-1.4	-14.1
5	-0.1	-4.8	-4.2	8.1	8.6	15.4	18.5	20.2	14.4	0.0	1.8	-9.7
6	-1.6	-11.5	-11.4	2.5	8.3	19.6	18.9	17.8	10.9	4.3	0.5	-15.9
7	-7.4	-14.5	-11.2	1.1	11.0	18.3	19.9	18.6	14.8	3.9	-1.4	-19.4
8	-3.6	-10.2	-7.5	-3.5	11.1	18.7	21.3	19.8	12.9	3.9	-5.9	-19.3
9	-0.4	-16.7	-4.5	-2.4	18.8	14.6	21.8	21.5	17.2	1.0	-12.3	-26.1
10	-6.3	-23.7	0.1	-2.0	8.5	10.0	24.1	19.2	18.9	0.9	-12.1	-22.0
11	-17.3	-22.0	-1.9	1.9	12.3	10.9	24.3	19.2	10.3	-1.0	-15.3	-27.8
12	-13.1	-13.3	2.0	6.2	12.3	12.9	23.5	15.6	11.7	2.3	-13.4	-23.2
13	-4.9	-7.8	2.6	5.0	16.3	13.1	21.8	15.5	10.4	4.7	-8.5	-17.2
14	-7.6	-4.5	1.3	5.4	13.4	15.7	20.0	15.0	16.4	8.6	-6.4	-15.6
15	-17.7	-6.1	0.2	-2.7	10.3	14.3	17.8	12.4	12.7	10.3	-10.4	-10.9
16	-22.4	-8.0	3.0	-3.1	12.6	14.5	18.2	15.0	10.2	8.5	M	-15.3
17	-31.1	-11.6	4.0	-0.9	9.5	12.6	18.1	16.9	8.4	5.7	M	-16.3
18	-29.3	-10.6	3.9	-0.9	7.6	12.4	19.7	17.4	13.0	1.8	M	-11.5
19	-24.3	-6.2	-1.2	2.4	9.3	14.0	19.9	19.1	11.5	-0.3	M	-16.9
20	-22.5	-5.7	-1.2	2.4	10.3	15.1	19.1	20.0	11.5	1.7	-2.3	-21.0
21	-18.6	-7.5	1.4	6.8	13.5	16.7	20.5	20.4	7.8	-0.7	-9.9	-16.1
22	-17.7	-3.3	-3.6	9.0	8.2	20.1	21.5	17.8	8.2	-3.2	-16.5	-21.2
23	-14.7	-7.2	-6.7	11.4	5.7	17.5	21.1	19.7	13.2	-0.9	-17.4	-24.0
24	-13.1	-13.4	-5.8	9.2	9.1	17.6	20.5	19.3	12.3	-0.4	-10.5	-24.8
25	-3.4	-13.3	-5.6	1.0	9.1	22.2	16.6	13.1	8.3	-2.6	-16.4	-23.5
26	-7.8	-14.0	0.7	2.9	11.1	19.9	18.0	16.2	11.1	-5.8	-15.5	-24.3
27	-9.8	-12.7	1.5	5.8	10.4	14.4	19.2	17.2	13.6	-8.6	-17.2	-25.3
28	-9.8	-15.3	0.6	4.8	9.0	18.4	22.1	23.1	14.8	-10.1	-17.4	-20.6
29	-11.5	-12.9	7.4	5.4	10.2	19.4	20.5	19.8	17.9	-2.6	-14.6	-15.6
30	-7.5		9.6	9.0	13.1	19.8	21.2	17.3	12.8	1.1	-13.6	-20.1
31	-2.6		6.9		14.8		21.4	16.4		-4.4		-22.5

TEMPERATURE 2012

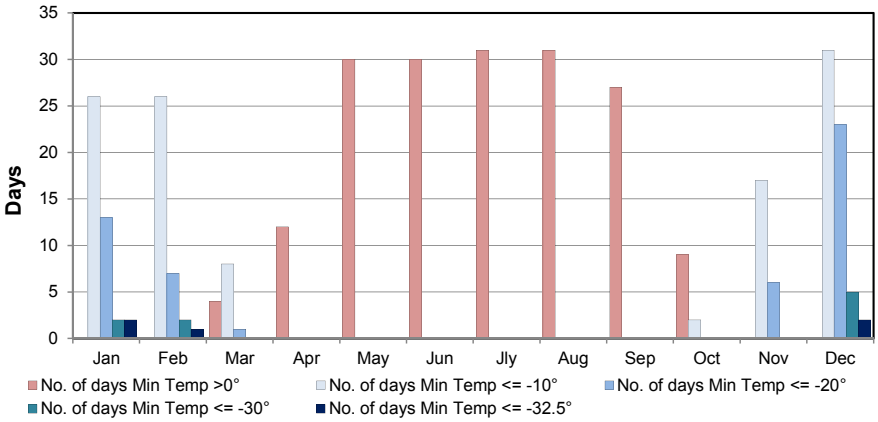
Monthly



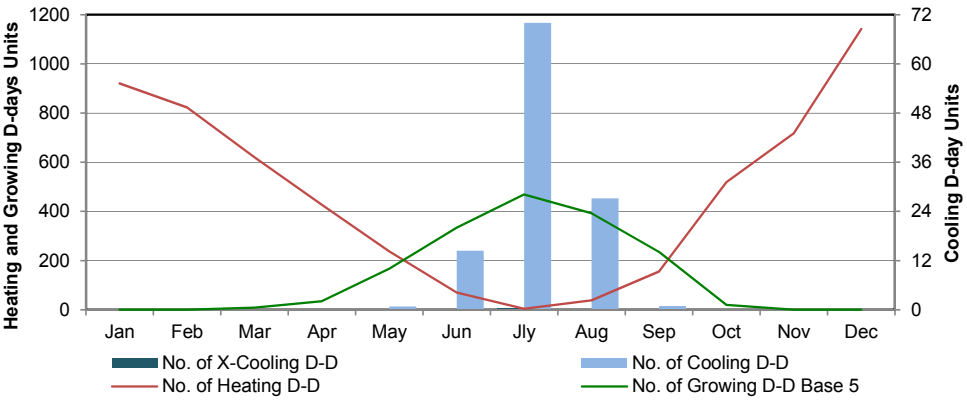
Days when maximum temperature is at a set point



Days when minimum temperature is at a set point



Degree-days Monthly



PRECIPITATION 2012

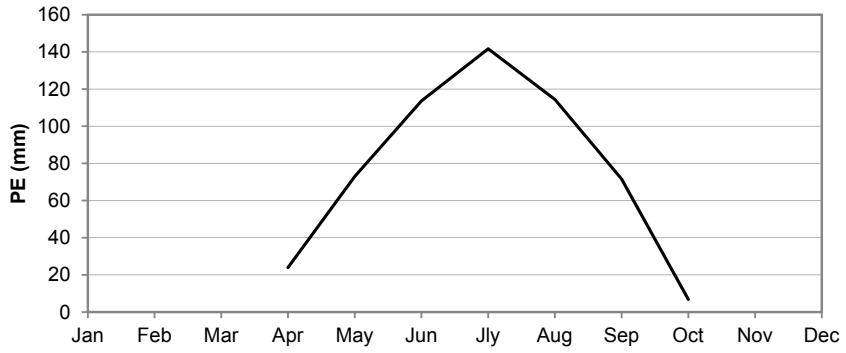
EXTREME PRECIPITATION EVENTS *		
PERIOD	DATE	AMOUNT
0.5 hour	June 25	16.0 mm
0.5 hour	July 25	9.8 mm
1 hour	June 9	19.2 mm
1 hour	June 25	16.0 mm
2 hours	June 9	24.6 mm
2 hours	July 25	20.2 mm
6 hours	June 9	34.6 mm
6 hours	July 25	23.8 mm
12 hours	June 9	38.8 mm
12 hours	July 25	23.8 mm
24 hours	June 9 - 10	58.2 mm
Daily	June 9	38.8 mm
Daily	July 25	26.2 mm
More than one day	June 9-10	62.0 mm
Longest wet spell	June 12-17	6 days
Longest dry spell	September 12- October 1	20 days

**recorded by the tipping bucket from May to September inclusive*

RANKING BY DRIEST MONTH			
AMOUNT mm		% OF POSSIBLE DAYS	
February	8.0	*September	16.7
December	12.2	December	25.8
*September	15.6	*July	38.7
January	17.6	*May	41.9
March	19.0	*August	45.2
November	22.7	February	48.3
October	37.6	November	50.0
April	41.6	January	51.6
*August	65.6	October	51.6
*May	85.4	*June	53.3
*July	127.8	April	56.7
*June	140.4	March	61.3

* Tipping bucket

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



MONTH	PE (mm) 2012
Jan	0
Feb	0
Mar	0
Apr	24.0
May	73.0
June	113.6
July	141.7
Aug	114.4
Sept	71.5
Oct	6.8
Nov	0
Dec	0
Total	545.0

[1]Thornthwaite and Mather 1955

Snow depth sensor and Geonor precipitation gauge photo credit: S. Poppy

PRECIPITATION 2012

MONTH	AMOUNT mm		Month end Snow-on-the-Ground cm	DAYS WITH MEASURABLE PRECIPITATION	
	2012	CUMULATIVE 2012		2012	CUMULATIVE 2012
January*	17.6	17.6	2	16	16
February*	8.0	25.6	7	14	30
March*	19.0	44.6	0	19	49
April*	41.6	86.2	0	17	66
May	85.4	171.6	0	13	79
June	140.4	312.0	0	16	95
July	127.8	439.8	0	12	107
August	65.6	505.4	0	14	121
September	15.6	521.0	0	5	126
October*	37.6	558.6	5	16	142
November*	22.7	581.3	16	15	157
December*	12.2	593.5	27	8	165
Total	593.5			165	

*weighing gauge values

Daily

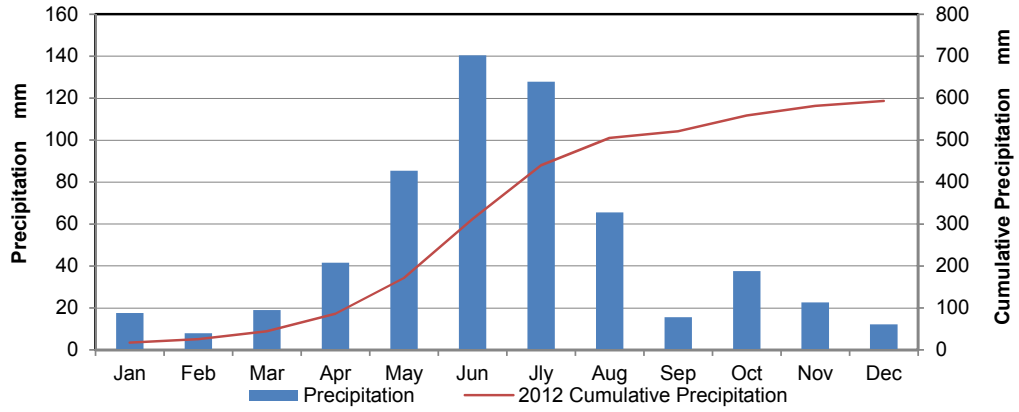
2012	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	0.0	0.0	1.6	17.8	2.4	0.0	24.0	0.0	8.2	0.0	0.3	0.0
2	1.2	0.4	0.0	0.0	3.0	2.6	0.2	3.8	0.2	0.9	0.9	1.6
3	0.0	0.2	1.6	0.6	0.0	0.2	13.4	14.6	0.0	0.0	0.0	6.7
4	1.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	4.2	0.0	1.2	0.0
5	2.0	0.6	0.8	0.0	3.2	0.0	0.2	0.6	2.2	0.0	6.5	0.0
6	0.0	0.0	1.0	0.2	23.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.2	0.8	0.0	0.0	0.0	0.0	1.4	0.0	1.1	5.2	0.0
8	1.4	1.2	0.0	0.8	0.0	0.0	0.0	0.2	0.0	2.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	38.8	0.0	0.2	0.0	0.0	0.3	0.0
10	0.6	0.0	0.0	0.2	0.8	23.2	0.0	0.0	0.0	1.2	1.7	0.0
11	0.0	0.2	0.6	0.0	0.0	0.0	2.0	1.6	0.8	0.0	0.0	0.9
12	0.6	0.0	0.0	0.4	0.0	0.2	0.0	0.0	0.0	2.0	0.0	1.1
13	0.0	0.8	1.2	7.4	0.0	3.6	0.0	0.0	0.0	0.2	0.0	0.0
14	0.2	0.0	0.0	0.0	0.0	6.6	0.0	22.8	0.0	0.0	0.2	0.2
15	2.0	0.0	0.8	1.0	0.0	23.6	14.2	0.2	0.0	0.0	1.3	0.0
16	0.4	0.2	0.0	1.9	0.0	7.0	18.6	0.0	0.0	0.2	0.0	0.0
17	0.0	0.4	1.4	2.2	0.0	0.2	0.0	0.0	0.0	7.0	0.0	0.0
18	0.0	0.0	0.0	0.0	4.4	0.0	18.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.8	0.2	0.2	0.0	0.0	3.2	0.0	0.0
20	0.0	0.4	2.0	1.3	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.4
21	2.4	1.6	0.4	1.0	0.0	0.0	0.0	0.0	0.0	0.6	2.5	0.0
22	0.0	0.2	0.8	0.3	21.4	0.0	0.0	0.4	0.0	0.0	0.0	0.0
23	0.2	0.0	1.2	0.0	11.6	0.0	0.0	0.2	0.0	8.1	0.0	0.0
24	1.0	0.6	0.0	0.3	0.0	0.0	10.0	0.4	0.0	7.2	0.0	0.2
25	1.4	1.0	1.2	0.0	0.0	16.0	26.2	18.6	0.0	0.0	0.3	0.0
26	0.0	0.0	0.2	0.0	0.0	15.0	0.0	0.6	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.6	2.8	0.0	0.0	0.0	0.0	1.4	1.1
28	0.8	0.0	1.0	5.4	4.0	0.2	0.0	0.0	0.0	0.8	0.5	0.0
29	2.2	0.0	1.1	0.6	0.0	0.0	0.0	0.0	0.0	2.5	0.3	0.0
30	0.2		0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0
31	0.0		0.4		7.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
TOTAL	17.6	8.0	19.0	41.6	85.4	140.4	127.8	65.6	15.6	37.6	22.7	12.2

"Whether it is raining or snowing,
the weather is never so bad outside as it looks
through a living room window."

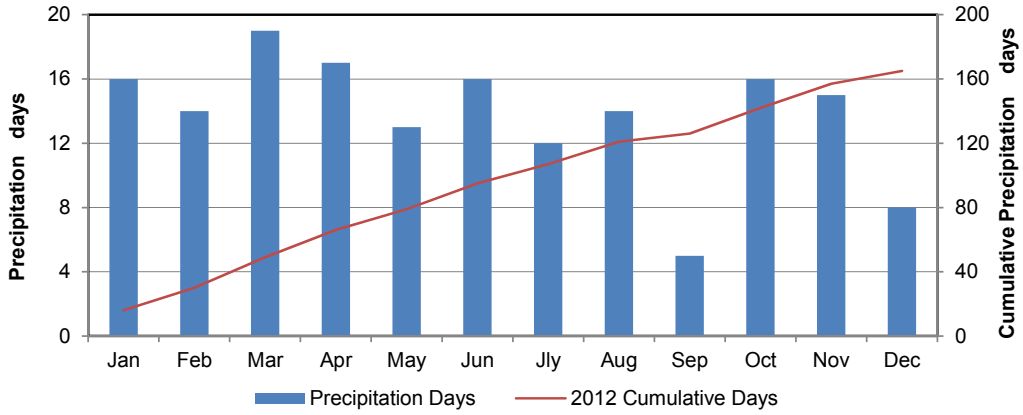
John Kieran 1892-1981 New York naturalist, trivia expert & author

PRECIPITATION 2012

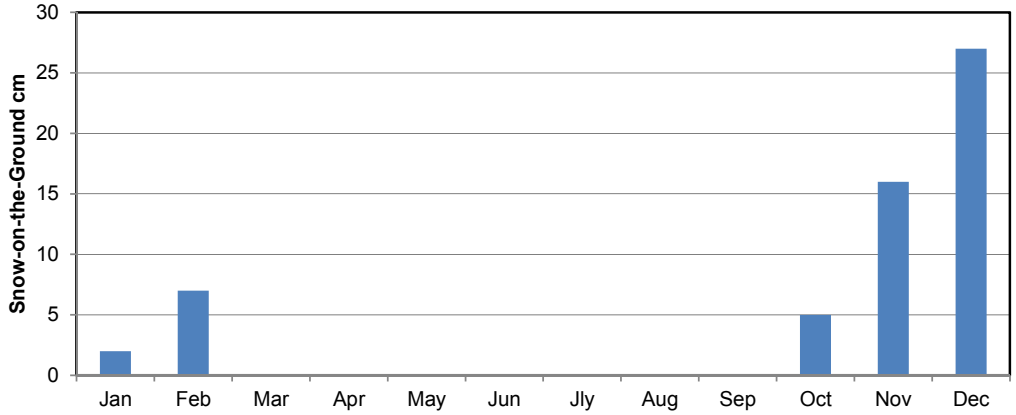
Monthly



Monthly Days



Snow-on-the-Ground



RADIATION 2012

Sunrise/Sunset Tables for Conservation Learning Centre, 2012 & 2013[1]

2012	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	9:19	16:59	8:49	17:49	7:51	18:45	6:37	19:41	5:31	20:35	4:45	21:22	4:44	21:34	5:24	20:58	6:16	19:53	7:08	18:41	8:04	17:33	8:57	16:52
2	9:19	17:00	8:48	17:51	7:49	18:47	6:35	19:43	5:29	20:37	4:44	21:23	4:45	21:34	5:25	20:56	6:18	19:50	7:09	18:38	8:06	17:31	8:58	16:51
3	9:18	17:01	8:46	17:53	7:46	18:49	6:33	19:45	5:27	20:38	4:43	21:24	4:45	21:33	5:27	20:55	6:19	19:48	7:11	18:36	8:08	17:29	9:00	16:51
4	9:18	17:02	8:44	17:55	7:44	18:50	6:30	19:47	5:25	20:40	4:43	21:25	4:46	21:33	5:28	20:53	6:21	19:46	7:13	18:34	8:10	17:27	9:01	16:50
5	9:18	17:03	8:42	17:57	7:42	18:52	6:28	19:48	5:23	20:42	4:42	21:26	4:47	21:32	5:30	20:51	6:23	19:43	7:15	18:31	8:12	17:25	9:02	16:50
6	9:17	17:05	8:41	17:58	7:39	18:54	6:26	19:50	5:21	20:43	4:41	21:27	4:48	21:31	5:32	20:49	6:25	19:41	7:16	18:29	8:14	17:23	9:04	16:49
7	9:17	17:06	8:39	18:00	7:37	18:56	6:23	19:52	5:19	20:45	4:41	21:28	4:49	21:31	5:33	20:47	6:26	19:39	7:18	18:27	8:15	17:22	9:05	16:49
8	9:16	17:07	8:37	18:02	7:35	18:58	6:21	19:54	5:18	20:47	4:40	21:29	4:50	21:30	5:35	20:45	6:28	19:36	7:20	18:24	8:17	17:20	9:06	16:49
9	9:16	17:09	8:35	18:04	7:32	19:00	6:19	19:56	5:16	20:49	4:40	21:30	4:51	21:29	5:37	20:43	6:30	19:34	7:22	18:22	8:19	17:18	9:07	16:48
10	9:15	17:10	8:33	18:06	7:30	19:02	6:16	19:57	5:14	20:50	4:39	21:30	4:52	21:28	5:38	20:41	6:31	19:31	7:23	18:20	8:21	17:17	9:08	16:48
11	9:15	17:12	8:31	18:08	7:28	19:03	6:14	19:59	5:12	20:52	4:39	21:31	4:53	21:27	5:40	20:39	6:33	19:29	7:25	18:17	8:23	17:15	9:09	16:48
12	9:14	17:13	8:29	18:10	7:25	19:05	6:12	20:01	5:11	20:54	4:39	21:32	4:55	21:26	5:42	20:37	6:35	19:27	7:27	18:15	8:25	17:14	9:10	16:48
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16	9:10	17:20	8:21	18:18	7:16	19:13	6:03	20:08	5:04	21:00	4:38	21:34	5:00	21:22	5:49	20:29	6:42	19:17	7:34	18:06	8:32	17:08	9:14	16:48
17	9:09	17:21	8:19	18:20	7:13	19:14	6:00	20:10	5:03	21:02	4:38	21:34	5:01	21:21	5:50	20:27	6:43	19:14	7:36	18:04	8:34	17:06	9:15	16:49
18	9:08	17:23	8:17	18:22	7:11	19:16	5:58	20:12	5:01	21:03	4:38	21:35	5:02	21:20	5:52	20:24	6:45	19:12	7:38	18:02	8:36	17:05	9:15	16:49
19	9:07	17:25	8:15	18:24	7:09	19:18	5:56	20:14	5:00	21:05	4:38	21:35	5:04	21:18	5:54	20:22	6:47	19:10	7:40	17:59	8:37	17:04	9:16	16:49
20	9:06	17:26	8:13	18:26	7:06	19:20	5:54	20:15	4:58	21:06	4:39	21:35	5:05	21:17	5:55	20:20	6:48	19:07	7:42	17:57	8:39	17:02	9:16	16:50
21	9:05	17:28	8:11	18:28	7:04	19:22	5:52	20:17	4:57	21:08	4:39	21:35	5:07	21:16	5:57	20:18	6:50	19:05	7:44	17:55	8:41	17:01	9:17	16:50
22	9:04	17:30	8:09	18:30	7:01	19:23	5:49	20:19	4:56	21:09	4:39	21:36	5:08	21:14	5:59	20:16	6:52	19:02	7:45	17:53	8:43	17:00	9:17	16:51
23	9:02	17:32	8:06	18:31	6:59	19:25	5:47	20:21	4:54	21:10	4:39	21:36	5:10	21:13	6:01	20:13	6:54	19:00	7:47	17:51	8:44	16:59	9:18	16:51
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25	9:00	17:36	8:02	18:35	6:54	19:29	5:43	20:24	4:52	21:13	4:40	21:36	5:13	21:10	6:04	20:09	6:57	18:55	7:51	17:47	8:48	16:57	9:18	16:53
26	8:58	17:37	8:00	18:37	6:52	19:31	5:41	20:26	4:51	21:15	4:41	21:35	5:14	21:08	6:06	20:07	6:59	18:53	7:53	17:45	8:49	16:56	9:19	16:54
27	8:57	17:39	7:58	18:39	6:49	19:32	5:39	20:28	4:50	21:16	4:41	21:35	5:16	21:07	6:07	20:04	7:01	18:50	7:55	17:42	8:51	16:55	9:19	16:54
28	8:55	17:41	7:55	18:41	6:47	19:34	5:37	20:30	4:49	21:17	4:42	21:35	5:17	21:05	6:09	20:02	7:02	18:48	7:57	17:40	8:52	16:54	9:19	16:55
29	8:54	17:43	7:53	18:43	6:45	19:36	5:35	20:31	4:48	21:18	4:42	21:35	5:19	21:03	6:11	20:00	7:04	18:45	7:58	17:38	8:54	16:53	9:19	16:56
30	8:52	17:45			6:42	19:38	5:33	20:33	4:47	21:20	4:43	21:34	5:20	21:02	6:13	19:57	7:06	18:43	8:00	17:37	8:55	16:52	9:19	16:57
31	8:51	17:47			6:40	19:40			4:46	21:21			5:22	21:00	6:14	19:55			8:02	17:35			9:19	16:58

2013	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
Date	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
1	9:19	16:59	8:48	17:50	7:51	18:44	6:38	19:41	5:31	20:34	4:45	21:22	4:44	21:34	5:23	20:59	6:16	19:53	7:07	18:41	8:04	17:33	8:56	16:52
2	9:19	17:01	8:46	17:52	7:49	18:46	6:36	19:43	5:29	20:36	4:44	21:23	4:44	21:34	5:25	20:57	6:17	19:51	7:09	18:39	8:06	17:31	8:58	16:51
3	9:18	17:02	8:45	17:54	7:47	18:48	6:33	19:44	5:27	20:38	4:44	21:24	4:45	21:33	5:26	20:55	6:19	19:49	7:11	18:37	8:07	17:29	8:59	16:51
4	9:18	17:03	8:43	17:56	7:44	18:50	6:31	19:46	5:25	20:40	4:43	21:25	4:46	21:33	5:28	20:53	6:21	19:46	7:12	18:34	8:09	17:28	9:01	16:50
5	9:18	17:04	8:41	17:58	7:42	18:52	6:29	19:48	5:23	20:41	4:42	21:26	4:47	21:32	5:30	20:51	6:22	19:44	7:14	18:32	8:11	17:26	9:02	16:50
6	9:17	17:06	8:39	18:00	7:40	18:54	6:26	19:50	5:22	20:43	4:41	21:27	4:48	21:32	5:31	20:49	6:24	19:41	7:16	18:29	8:13	17:24	9:03	16:49
7	9:17	17:07	8:37	18:02	7:38	18:56	6:24	19:52	5:20	20:45	4:41	21:28	4:49	21:31	5:33	20:48	6:26	19:39	7:18	18:27	8:15	17:22	9:05	16:49
8	9:16	17:08	8:35	18:04	7:35	18:57	6:22	19:53	5:18	20:46	4:40	21:29	4:50	21:30	5:35	20:46	6:28	19:37	7:19	18:25	8:17	17:20	9:06	16:49
9	9:15	17:10	8:34	18:06	7:33	18:59	6:19	19:55	5:16	20:48	4:40	21:30	4:51	21:29	5:36	20:44	6:29	19:34	7:21	18:22	8:19	17:19	9:07	16:48
10	9:15	17:11	8:32	18:08	7:30	19:01	6:17	19:57	5:14	20:50	4:40	21:30	4:52	21:28	5:38	20:42	6:31	19:32	7:23	18:20	8:21	17:17	9:08	16:48
11	9:14	17:13	8:30	18:10	7:28	19:03	6:15	19:59	5:13	20:51	4:39	21:31	4:53	21:28	5:40	20:40	6:33	19:30	7:25	18:18	8:22	17:15	9:09	16:48
12	9:13	17:14	8:28	18:12	7:26	19:05	6:12	20:01	5:11	20:53	4:39	21:32	4:54	21:27	5:41	20:38	6:34	19:27	7:27	18:16	8:24	17:14	9:10	16:48
13	9:12	17:16	8:26	18:14	7:23	19:07	6:10	20:02	5:09	20:55	4:39	21:32	4:56	21:26	5:43	20:36	6:36	19:25	7:28	18:13	8:26	17:12	9:11	16:48
14	9:12	17:18	8:24	18:16	7:21	19:08	6:08	20:04	5:08	20:56	4:38	21:33	4:57	21:25	5:45	20:33	6:38	19:22	7:30	18:11	8:28	17:11	9:12	16:48
15	9:11	17:19	8:22	18:17	7:19	19:10	6:05	20:06	5:06	20:58	4:38	21:33	4:58	21:23	5:47	20:31	6:39	19:20	7:32	18:09	8:30	17:09	9:13	16:48
16	9:10	17:21	8:20	18:19	7:16	19:12	6:03	20:08	5:05	21:00	4:38	21:34	4:59	21:22	5:48	20:29	6:41	19:17	7:34	18:07	8:32	17:08	9:14	16:48
17	9:09	17:23	8:18	18:21	7:14	19:14	6:01	20:10	5:03	21:01	4:38	21:34	5:01	21:21	5:50	20:27	6:43	19:15	7:36	18:04	8:33	17:07	9:14	16:49
18	9:08	17:24	8:16	18:23	7:11	19:16	5:59	20:11	5:02	21:03	4:38	21:35	5:02	21:20	5:52	20:25	6:45	19:13	7:38	18:02	8:35	17:05	9:15	16:49
19	9:06	17:26	8:13	18:25	7:09	19:18	5:56	20:13	5:00	21:04	4:38	21:35	5:03	21:19	5:53	20:23	6:46	19:10	7:39	18:00	8:37	17:04	9:16	16:49
20	9:05	17:28	8:11	18:27	7:07	19:19	5:54	20:15	4:59	21:06	4:39	21:35	5:05	21:17	5:55	20:21	6:48	19:08	7:41	17:58	8:39	17:03	9:16	16:50
21	9:04	17:30	8:09	18:29	7:04	19:21	5:52	20:17	4:57	21:07	4:39	21:35	5:06	21:16	5:57	20:18	6:50	19:05	7:43	17:56	8:40	17:01	9:17	16:50
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23	9:01	17:33	8:05	18:33	7:00	19:25	5:48	20:20	4:55	21:10	4:39	21:36	5:09	21:13	6:00	20:14	6:53	19:01	7:47	17:51	8:44	16:59	9:18	16:51
24	9:00	17:35	8:03	18:35	6:57	19:27	5:46	20:22	4:53	21:12	4:40	21:36	5:11	21:12	6:02	20:12	6:55	18:58	7:49	17:49	8:46	16:58	9:18	16:52
25	8:59	17:37	8:00	18:37	6:55	19:28	5:44	20:24	4:52	21:13	4:40	21:36	5:12	21:10	6:04	20:09	6:57	18:56	7:51	17:47	8:47	16:57	9:18	16:53
26	8:57	17:39	7:58	18:39	6:52	19:30	5:41	20:26	4:51	21:14	4:41	21:35	5:14	21:09	6:05	20:07	6:58	18:53	7:52	17:45	8:49	16:56	9:19	16:53
27	8:56	17:41	7:56	18:41	6:50	19:32	5:39	20:27	4:50	21:16	4:41	21:35	5:15	21:07	6:07	20:05	7:00	18:51	7:54	17:43	8:50	16:55	9:19	16:54
28	8:54	17:43	7:54	18:42	6:48	19:34	5:37	20:29	4:49	21:17	4:42	21:35	5:17	21:05	6:09	20:03	7:02	18:48	7:56	17:41	8:52	16:54	9:19	16:55
29	8:53	17:44			6:45	19:36	5:35	20:31	4:48	21:18	4:42	21:35	5:18	21:04	6:10	20:00	7:04	18:46	7:58	17:39	8:53	16:53	9:19	16:56
30	8:51	17:46			6:43	19:37	5:33	20:33	4:47	21:19	4:43	21:35	5:20	21:02	6:12	19:58	7:05	18:44	8:00	17:37	8:55	16:53	9:19	16:57
31	8:50	17:48			6:40	19:39			4:46	21:21			5:22	21:00	6:14	19:56			8:02	17:35			9:19	16:58

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

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

RADIATION 2012

MONTH	BRIGHT SUNSHINE HOURS			BRIGHT SUNSHINE DAYS			
	2012	POSSIBLE HOURS*	% OF POSSIBLE	2012	WITH 1 OR MORE HOURS	WITH 5 OR MORE HOURS	WITH 10 OR MORE HOURS
JAN	47.5	254.4	18.7	30	17	0	0
FEB	162.8	286.8	56.8	27	24	17	1
MAR	185.2	370.5	50.0	28	26	17	5
APR	188.8	421.5	44.8	28	22	17	10
MAY	271.4	492.7	55.1	26	25	22	17
JUNE	264.7	505.7	52.3	27	27	21	14
JULY	330.1	506.0	65.2	29	30	26	21
AUG	300.2	454.3	66.1	30	27	24	21
SEP	270.5	378.6	71.4	30	29	24	16
0OCT	82.5	326.5	25.3	25	18	6	1
NOV	30.0	259.6	11.6	17	9	2	0
DEC	19.0	237.2	8.0	24	7	0	0
TOTAL	2152.7	4493.8	47.9	321	261	176	106

*National Research Council, Canada, Hertzberg Institute of Astrophysics

Global and Diffuse Radiation (MJ/m^2)

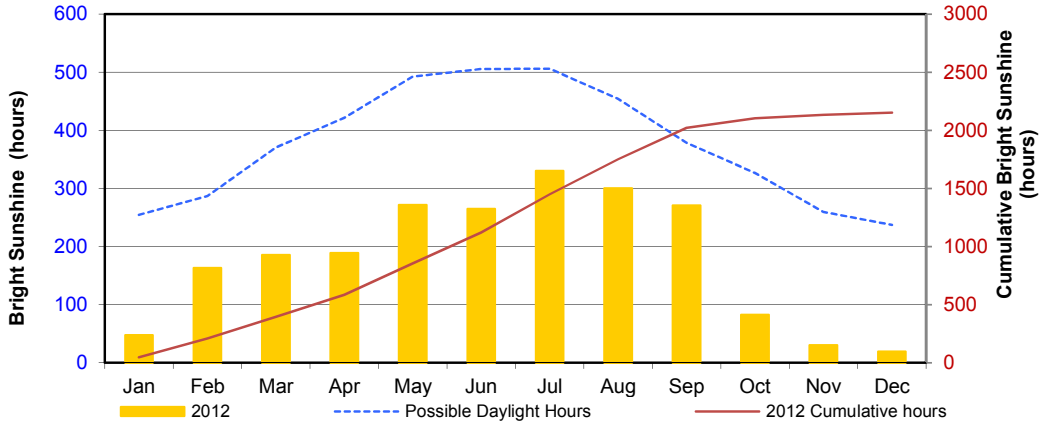
	JAN		FEB		MAR		APR		MAY		JUN		JLY		AUG		SEPT		OCT		NOV		DEC	
DATE	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse
1	3.8	0.8	8.0	3.2	7.4	6.8	2.3	2.0	12.4	9.8	27.7	14.1	16.4	9.7	21.4	6.3	10.0	7.1	5.5	3.9	2.1	1.9	2.4	2.3
2	3.0	2.1	7.9	1.6	9.8	7.2	20.3	2.3	22.0	8.2	22.1	14.7	27.7	3.6	8.7	6.3	12.7	5.8	4.8	4.0	3.3	3.0	1.9	1.8
3	3.7	0.8	7.6	3.6	8.2	7.2	20.3	8.3	27.1	8.7	13.0	9.8	14.2	6.1	5.3	4.5	17.6	5.1	7.4	4.5	2.8	2.6	2.4	2.3
4	3.2	1.9	7.1	1.3	11.9	3.9	18.6	8.2	4.1	3.5	28.7	14.4	18.3	13.0	25.7	3.9	11.4	6.9	3.8	3.6	4.9	4.4	2.8	2.6
5	2.5	1.7	8.1	1.4	10.7	6.7	16.8	10.4	6.2	5.3	17.0	11.1	29.6	11.7	24.5	5.3	11.6	7.0	13.7	1.7	2.5	2.4	1.7	1.6
6	2.7	2.0	3.6	3.4	10.9	6.5	5.4	4.9	4.4	3.8	16.6	10.9	26.7	13.0	25.3	5.1	9.0	6.5	6.9	4.8	6.0	5.6	3.6	1.2
7	2.3	1.9	5.7	4.0	12.3	5.4	12.7	8.2	26.1	10.9	27.2	18.6	29.3	11.7	22.3	5.4	18.7	2.6	3.7	3.4	1.7	1.6	2.2	2.1
8	3.3	1.2	8.9	2.5	14.3	8.5	12.6	10.5	25.9	11.6	27.3	14.6	26.0	14.6	24.4	5.0	19.3	1.8	4.4	4.0	3.3	3.1	2.7	2.4
9	3.3	2.5	8.2	2.0	10.8	9.3	22.7	12.9	26.6	7.2	7.7	6.0	28.7	11.0	21.5	6.2	17.7	4.2	6.2	5.1	2.8	2.6	4.0	2.2
10	1.7	1.6	8.7	5.4	12.6	7.1	22.2	13.4	14.5	11.3	7.0	5.5	27.9	11.5	21.2	8.1	17.6	2.8	4.7	3.2	3.4	3.2	3.1	2.4
11	4.3	1.0	9.5	5.2	13.8	5.2	21.6	14.2	23.9	10.1	24.2	15.4	25.0	11.7	17.8	7.1	6.4	5.3	9.8	4.0	6.0	5.7	2.1	1.9
12	2.9	2.1	8.9	4.7	14.7	3.2	17.0	14.9	27.2	9.2	21.4	13.6	24.9	11.0	22.4	5.1	16.4	2.8	7.1	4.0	5.1	4.8	2.5	2.3
13	3.6	1.5	8.4	4.2	12.0	7.0	2.7	2.4	28.0	6.9	13.3	10.4	26.8	11.7	19.4	5.7	16.6	3.7	6.4	4.2	3.6	3.4	2.1	1.9
14	2.1	2.0	8.4	3.9	14.9	3.8	8.8	7.9	26.5	9.5	12.5	9.7	22.9	10.9	3.6	3.1	17.3	2.0	10.6	1.3	4.1	3.7	5.3	2.1
15	3.1	2.8	6.2	4.5	14.0	4.9	12.9	11.2	21.8	11.9	13.3	10.1	4.3	3.6	12.9	9.3	17.2	2.1	10.1	1.9	5.4	5.2	3.3	2.2
16	3.8	2.2	10.5	2.7	9.7	7.2	16.2	13.3	24.6	6.9	27.8	10.5	12.2	8.5	24.0	3.9	13.5	5.0	4.4	2.9			3.4	1.8
17	4.5	2.0	10.3	2.5	13.3	3.6	7.7	5.1	12.9	10.5	7.4	6.1	13.4	10.9	21.7	6.4	12.7	4.0	2.4	2.2			2.9	2.1
18	5.3	1.3	11.4	2.2	8.5	6.3	23.3	16.5	4.1	3.5	11.8	9.7	8.7	6.8	22.9	5.1	10.9	5.2	4.0	3.6			1.4	1.2
19	5.0	1.3	6.6	5.6	2.3	2.1	23.9	5.8	23.6	11.0	26.1	14.4	25.7	8.5	23.2	5.8	9.5	7.2	1.6	1.5			2.4	1.8
20	5.6	1.5	8.7	4.2	14.5	4.6	8.1	6.9	28.4	9.2	23.3	10.4	28.1	9.3	20.9	8.3	13.7	4.8	1.8	1.7	2.9	2.4	2.0	1.6
21	2.4	2.3	5.6	5.1	17.6	6.6	12.8	7.3	19.6	12.3	29.7	10.9	22.2	10.7	20.3	5.4	15.9	1.5	8.2	2.8	2.1	2.0	2.6	1.9
22	3.0	2.7	7.6	5.6	4.6	4.2	21.1	7.5	3.9	3.2	27.9	5.9	24.6	7.2	5.3	4.6	14.4	2.3	4.3	3.5	3.9	3.4	1.9	1.7
23	4.6	2.6	7.6	6.8	3.8	3.4	15.7	8.7	5.5	4.6	28.7	8.1	22.1	8.3	18.4	7.5	14.9	1.9	2.1	2.0	4.1	2.8	1.8	1.6
24	6.0	1.5	7.0	6.2	13.6	11.4	18.5	8.7	29.0	9.9	26.9	8.7	14.4	8.8	19.7	10.7	14.6	1.8	4.7	4.1	2.4	2.2	1.5	1.3
25	5.0	2.2	6.1	5.6	18.8	11.0	10.8	8.8	29.1	10.5	27.8	7.7	11.2	8.8	3.3	3.0	15.0	1.5	6.7	5.1	4.1	3.8	3.7	2.2
26	4.0	2.2	9.7	5.7	7.6	6.6	16.9	14.0	29.8	12.9	16.3	8.7	26.9	6.5	11.9	9.1	12.8	4.2	8.9	2.8	2.4	2.2	2.1	1.7
27	4.7	2.6	9.8	6.3	10.7	9.6	4.2	3.3	16.5	13.4	10.3	6.4	24.0	6.7	21.0	7.1	12.6	3.2	4.4	4.1	3.3	2.9	1.4	1.2
28	3.7	2.2	13.0	3.8	16.5	14.1	6.3	5.1	11.3	9.5	30.5	6.7	26.1	3.8	20.3	5.9	13.2	3.0	6.9	3.7	2.4	2.3	1.7	1.5
29	2.8	2.4	11.6	4.0	15.4	7.9	6.9	5.5	28.3	14.3	30.1	5.5	24.3	6.8	15.6	6.5	12.7	2.8	3.0	2.7	1.5	1.5	2.2	1.9
30	3.7	3.4			13.1	4.4	20.6	9.6	28.7	19.8	30.2	3.4	25.5	4.8	21.0	4.6	12.3	2.4	3.2	3.0	2.4	2.3	3.4	2.5
31	5.1	2.7			20.0	6.3			50.0	32.9			24.1	5.6	20.1	4.5			2.7	2.5			5.0	3.9
TOTAL	114.7	61.0	240.7	117.2	368.3	202.0	429.9	257.8	642.0	312.3	633.8	302.0	682.2	276.8	566.0	184.8	418.2	116.5	174.4	101.8	88.5	81.0	81.5	61.2

Diffuse radiation sensor
photo credit: M. Johnston

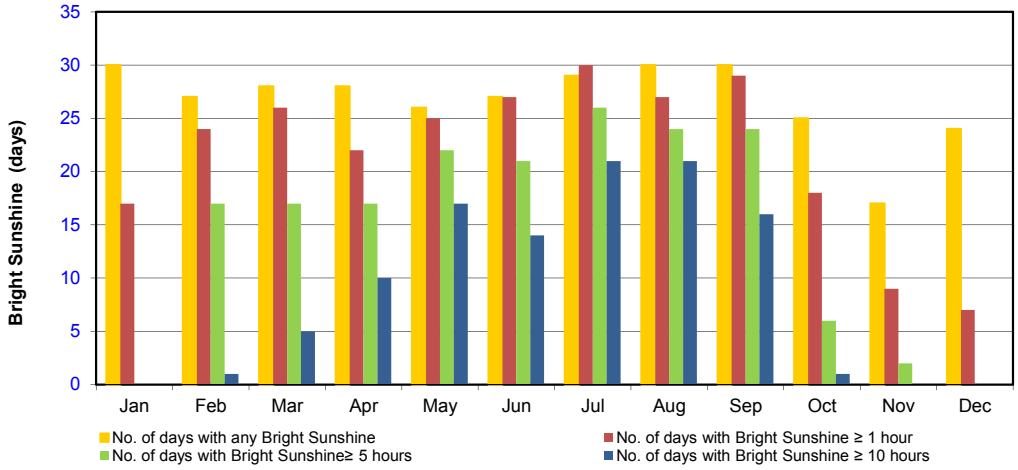
Kipp and Zonen Bright Sunshine recorder
photo credit: V. Wittrock

RADIATION 2012

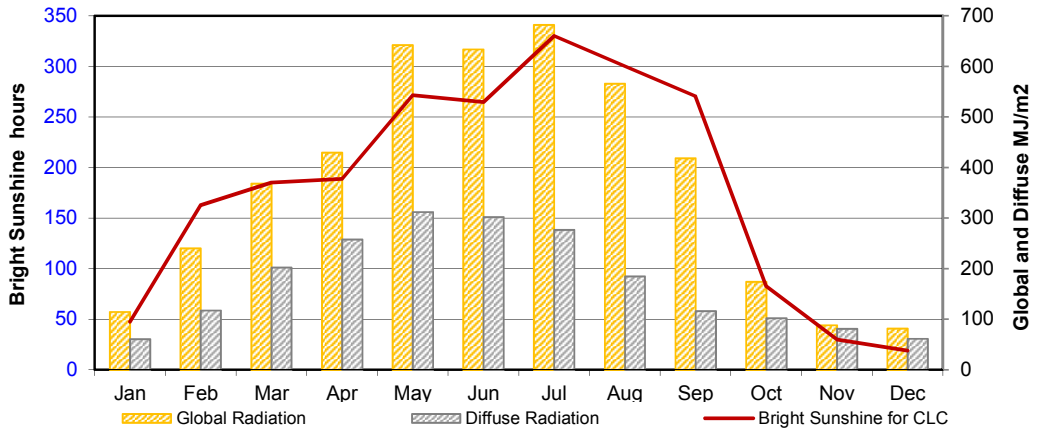
Bright Sunshine Hours



Bright Sunshine Days



Monthly Comparison Bright Sunshine Hours, Global & Diffuse Radiation



WIND 2012

	Average (km/hr)	HIGHEST INSTANTANEOUS WIND SPEED (Speed / direction / day)		
January	12.0	59.1	NW	11
February	10.1	31.8	NNW	24
March	12.2	66.0	W	15
April	13.3	36.7	ESE	27
May	14.8	60.0	NW	14
June	13.1	113.3	WNW	25
July	10.3	56.4	WSW	04
August	10.2	64.0	WNW	29
September	12.0	81.1	WNW	11
October	12.6	40.6	NW	17
November*	13.0	39.2	N	24
December	9.6	28.0	E	12

*Data incomplete for November 16-19

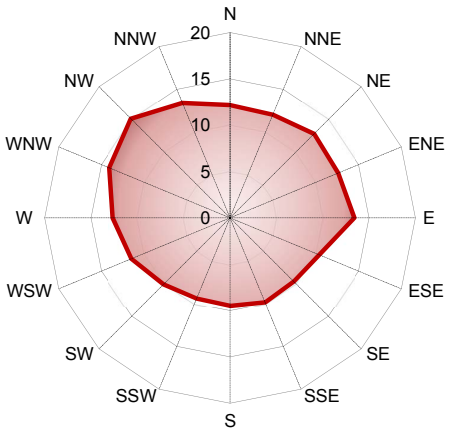
EXTREME DAILY WINDS (km/h)

DATE	WIND SPEED/ DIRECTION	BEAUFORT WIND SCALE DESIGNATION*
Jan 11	59.1 NW	Near Gale
Mar 15	66.0 W	Gale
May 14	60.0 NW	Near Gale
June 20	75.9 N	Strong Gale
June 25	113.3 WNW	Violent Storm
June 26	54.3 NE	Near Gale
July 04	56.4 WSW	Near Gale
Aug 29	64.0 WNW	Gale
Sept 10	62.0 W	Gale
Sept 11	81.1 WNW	Strong Gale
Sept 12	65.8 NW	Gale
Sept 18	61.1 NW	Near Gale

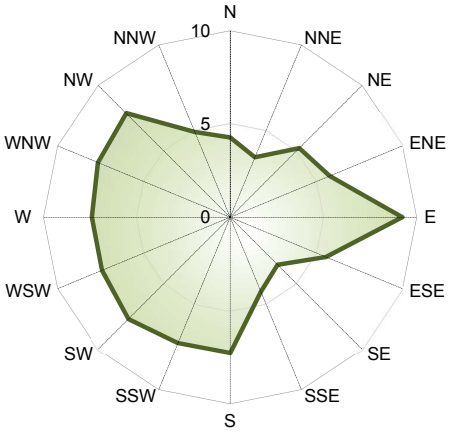
*Near Gale >=50 but < 61 *Gale >=62 but <74
*Strong Gale >=75 but <88 *Storm >=89 but <102
Violent Storm >= 103 but <117

*Environment Canada, 2011

ANNUAL AVERAGE WIND SPEED (km/h)

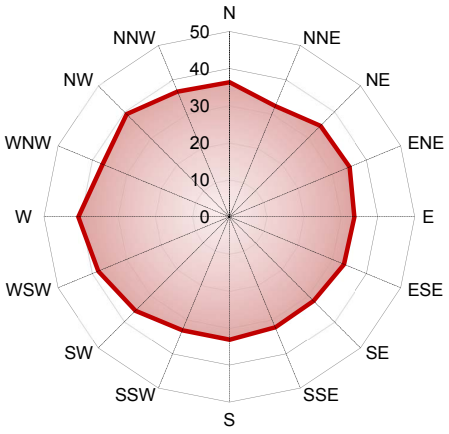


ANNUAL AVERAGE WIND FREQUENCY %

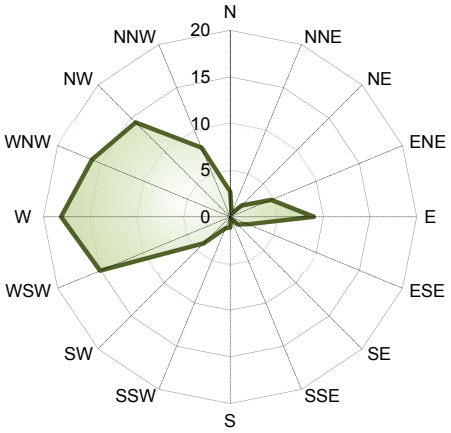


CALM 0.9%

ANNUAL AVERAGE MAXIMUM WIND GUSTS SPEED km/h*



ANNUAL AVERAGE MAXIMUM WIND GUSTS FREQUENCY %*

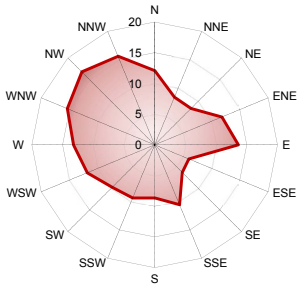


*excludes maximum ½ hour winds < 31 km/h

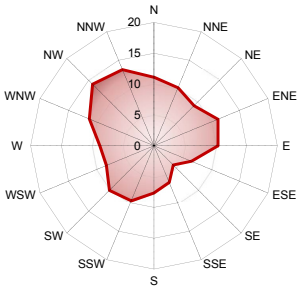
WIND 2012

Average Wind Speed by Direction (km/h)

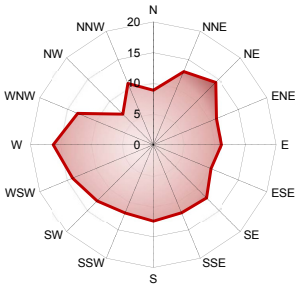
JANUARY



FEBRUARY



MARCH



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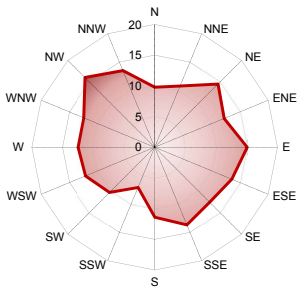

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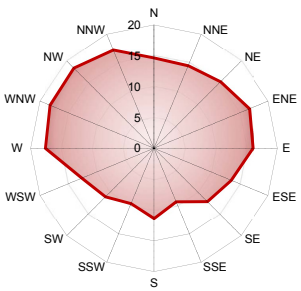

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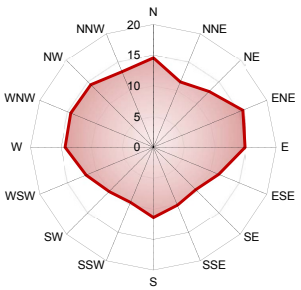

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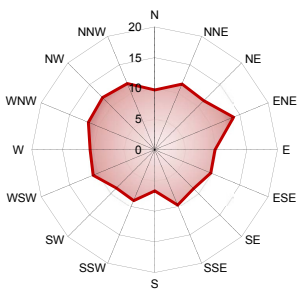

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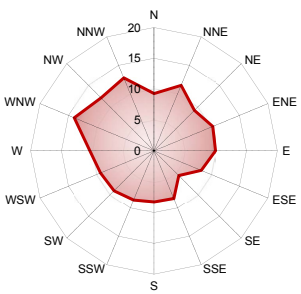

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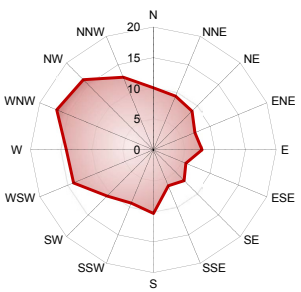

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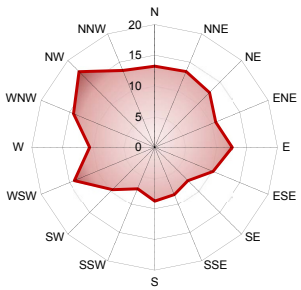

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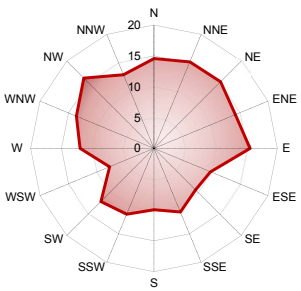

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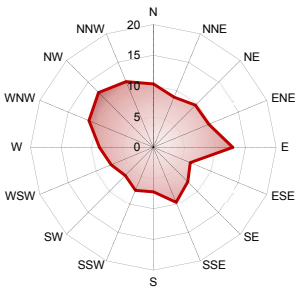
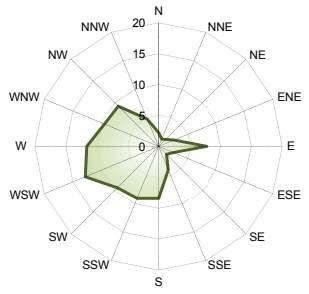


WIND 2012

Average Wind Frequency by Direction (%)

JANUARY



CALM 1.0%

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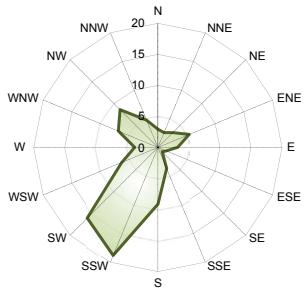
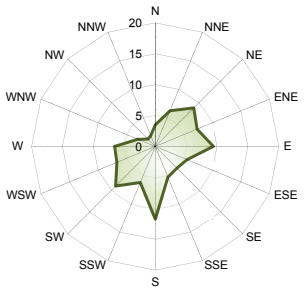


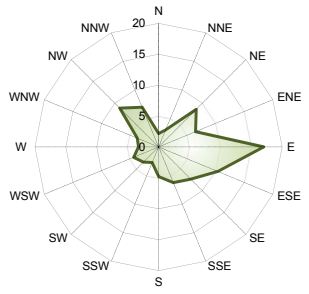
CALM 2.0%

MARCH



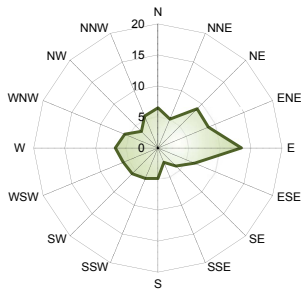
CALM 1.8%

APRIL



CALM 0.6%

MAY



CALM 0.3%

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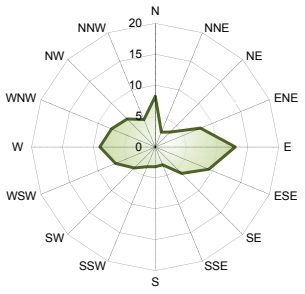

CALM 0.1%

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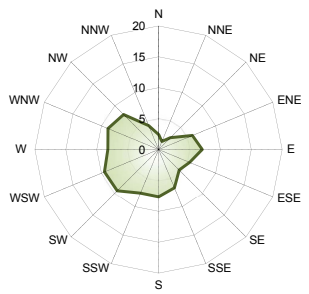

CALM 0.1%

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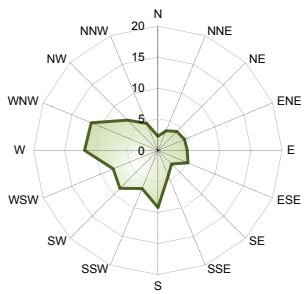

CALM 0.5%

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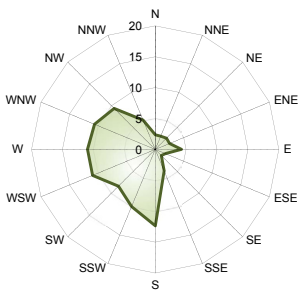
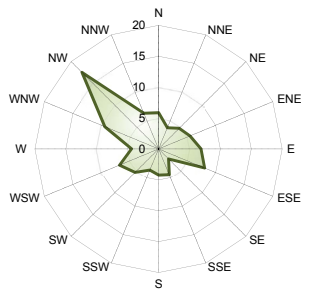


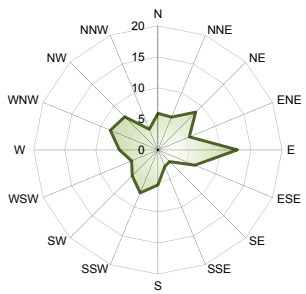
CALM 1.3%

OCTOBER



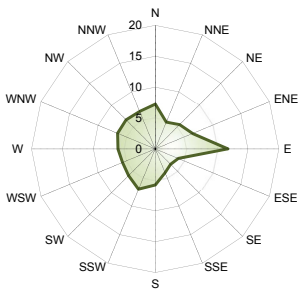
CALM 0.8%

NOVEMBER



CALM 0.3%

DECEMBER



CALM 1.9%

WIND 2012

WINDCHILL CALCULATION CHART [1]

T°C / km/h Speed	5°	0°	-5°	-10°	-15°	-20°	-25°	-30°	-35°	-40°	-45°	-50°
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	**-58**
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	**-57**	**-63**
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	**-60**	**-66**
20	1	-5	-12	-18	-24	-31	-37	-43	-49	**-56**	**-62**	**-68**
25	1	-6	-12	-19	-25	-32	-38	-45	-51	**-57**	**-64**	**-70**
30	0	-7	-13	-20	-26	-33	-39	-46	-52	**-59**	**-65**	**-72**
35	0	-7	-14	-20	-27	-33	-40	-47	-53	**-60**	**-66**	**-73**
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	**-61**	**-68**	**-74**
45	-1	-8	-15	-21	-28	-35	-42	-48	**-55**	**-62**	**-69**	**-75**
50	-1	-8	-15	-22	-29	-35	-42	-49	**-56**	**-63**	**-70**	**-76**
55	-2	-9	-15	-22	-29	-36	-43	-50	**-57**	**-63**	**-70**	**-77**
60	-2	-9	-16	-23	-30	-37	-43	-50	**-57**	**-64**	**-71**	**-78**
65	-2	-9	-16	-23	-30	-37	-44	-51	**-58**	**-65**	**-72**	**-79**
70	-2	-9	-16	-23	-30	-37	-44	-51	**-59**	**-66**	**-73**	**-80**
75	-3	-10	-17	-24	-31	-38	-45	-52	**-59**	**-66**	**-73**	**-80**
80	-3	-10	-17	-24	-31	-38	-45	-52	**-60**	**-67**	**-74**	**-81**

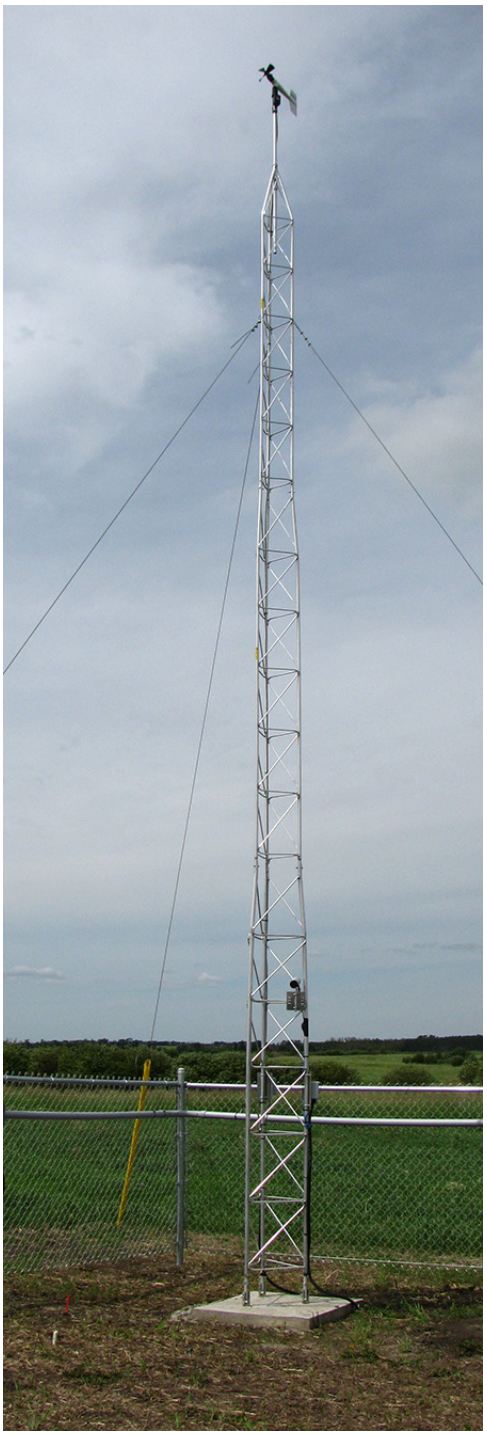
Approximate Thresholds

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

2: Environment Canada, 2012

MAXIMUM DAILY WIND CHILL VALUE WHEN TEMPERATURE <0°C

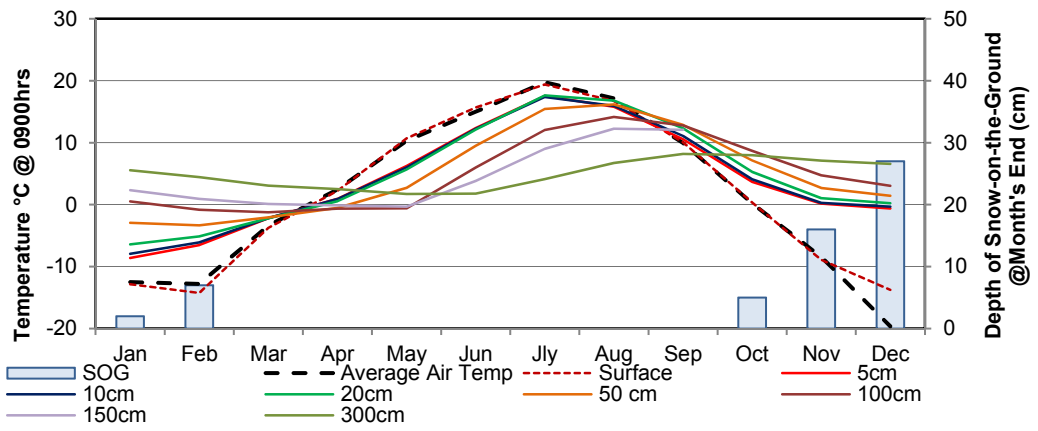
	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-26	-17	-19								-17	-25
2	-28	-16	-25	-7							-13	-27
3	-17	-18	-27	-7						-7	-10	-28
4	-16	-16	-17							-7	-9	-21
5	-9	-16	-12							-11	-8	-29
6	-10	-24	-24	-4						-6	-11	-31
7	-17	-28	-25	-8						-6	-9	-33
8	-17	-23	-21	-14							-18	-42
9	-10	-34	-17	-16						-8	-26	-34
10	-28	-41	-13	-12						-6	-22	-40
11	-31	-41	-12	-11						-10	-30	-34
12	-27	-26	-7	-6						-7	-29	-29
13	-17	-21	-6								-19	-26
14	-22	-17	-10								-20	-24
15	-34	-18	-11	-15							-26	-27
16	-42	-26		-11							-10	-26
17	-45	-25	-6	-9					-4		-5	-19
18	-48	-23		-11						-8		-29
19	-42	-14	-7	-7						-9	-7	-33
20	-39	-15	-14	-6							-17	-27
21	-31	-16	-9							-10	-19	-35
22	-29	-13	-12	-4					-2	-14	-31	-36
23	-28	-18	-17							-8	-32	-41
24	-28	-27	-18							-7	-24	-36
25	-16	-26	-15	-8					-4	-11	-29	-37
26	-20	-27	-7	-10						-15	-23	-36
27	-21	-24	-6							-21	-28	-33
28	-19	-29	-8							-24	-29	-30
29	-22	-24								-9	-26	-38
30	-14	-19								-4	-24	-40
31	-10	-25								-16	-25	



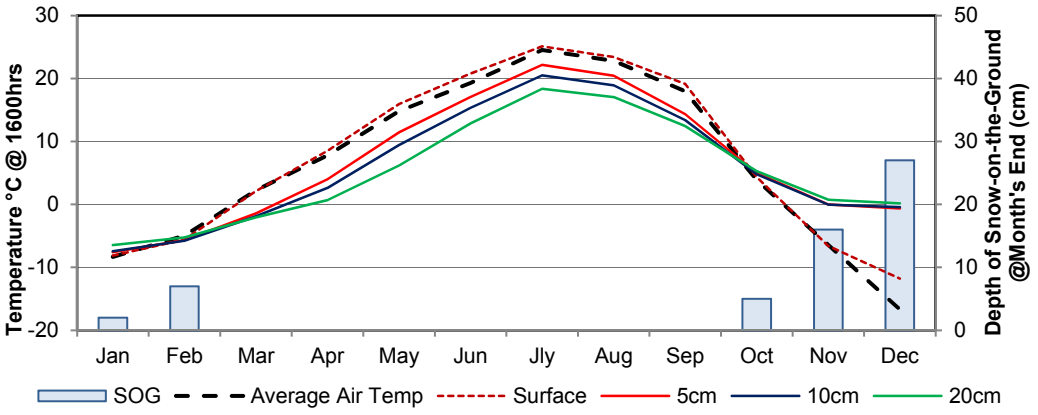
10 metre tower
photo credit: V. Wittrock

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

	Mean Air Temp @ 0900h (°C)	SOIL TEMPERATURES @ 0900h (°C)								Mean Air Temp @ 1600h (°C)	SOIL TEMPERATURES @ 1600h (°C)				SOG at Month's end (cm)
		Surface	5cm	10cm	20cm	50 cm	100cm	150cm	300cm		Surface	5cm	10cm	20cm	
JAN	-12.5	-12.9	-8.6	-7.9	-6.4	-2.9	0.5	2.3	5.5	-8.3	-8.1	-7.6	-7.4	-6.5	2
FEB	-12.8	-14.2	-6.5	-6.1	-5.1	-3.3	-0.8	0.9	4.4	-5.0	-5.6	-5.7	-5.8	-5.2	7
MAR	-3.4	-3.7	-2.2	-2.2	-2.2	-2.0	-1.2	0.1	3.1	2.2	2.1	-1.4	-1.9	-2.1	
APR	2.4	2.2	0.9	0.9	0.6	-0.5	-0.6	-0.1	2.5	7.8	8.5	4.0	2.6	0.7	
MAY	10.3	10.7	6.3	6.0	5.7	2.7	-0.6	-0.3	1.7	14.8	16.0	11.5	9.5	6.2	
JUN	15.0	15.7	12.4	12.3	12.1	9.5	6.0	3.8	1.8	19.3	20.8	17.1	15.3	12.9	
JLY	19.7	19.4	17.5	17.4	17.6	15.5	12.0	9.0	4.1	24.5	25.1	22.2	20.5	18.4	
AUG	17.2	16.7	15.8	15.9	16.8	16.2	14.2	12.3	6.7	22.8	23.4	20.5	18.9	17.0	
SEP	9.9	10.1	10.6	11.1	12.3	12.9	12.8	12.1	8.2	18.0	19.2	14.3	13.4	12.4	
OCT	0.2	0.4	3.7	4.1	5.3	7.1	8.7	NA	8.0	3.9	4.3	5.0	4.8	5.3	5
NOV	-8.4	-8.9	0.2	0.3	1.1	2.7	4.7	NA	7.1	-6.4	-6.6	0.0	0.0	0.7	16
DEC	-19.6	-13.7	-0.6	-0.3	0.2	1.4	3.0	NA	6.6	-16.7	-11.8	-0.6	-0.4	0.2	27



Monthly Soil Temperatures at@0900h



Monthly Soil Temperatures at@1600h

St Louis bridge across the S. Sask. River, south of CLC
photo credit: CR Beaulieu

INSTRUMENTS USED AT CLIMATE LEARNING CENTRE 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 than18°C, CDD = 0.

Monthly and annual values of CDD are obtained by summing daily values.

Growing (GDD) is the growing requirement in order for plant growth to proceed. The air temperature must exceed a critical value appropriate to the plant species in question. For many members of the grass family, including most commercial cereals grown on the prairies, a base temperature of 5.0°C has been established. On a specified day, the difference between the daily average temperature and the 5.0°C base temperature defines the number of growing degree-days.

Mathematically: GDD = (T - 5.0°C), for that day, where T = daily mean temperature in °C if T is equal to or less than 5.0°C, GDD = 0.

Daily GDD values are summed to provide totals for the appropriate month, growing season or year.

Heating (HDD) is the heating requirement to achieve a stipulated comfort value in an indoor environment. For most purposes, a temperature of less than 18°C is considered uncomfortable and supplementary heating is required. On a specific day, the amount by which 18°C exceeds the daily average temperature defines the number of heating degree-days for that day.

Mathematically:

HDD = (18°C - T), for that day, where T = daily mean temperature in °C if T is equal to or greater than 18°C, HDD = 0.

Monthly and annual values of HDD are obtained by summing daily values.

EXTREME is the highest or lowest value of a particular element recorded during the period in question.

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

PRECIPITATION

Day is recorded on occasions when the amount of precipitation in a 24-hour period 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 measurble 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/m^2).

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 maxiumum/minimum temperatures are higher/lower than, or equal to, a set temperature. For a heat wave the temperature is 32°C. (Environment Canada 2005).

WIND SPEED

Average is the average of the hourly wind speeds for the period in question measured in kilometres per hour (km/h). Average hourly wind speeds are obtained from a RM Young Wind Monitor anemometer at a height of 10 m.

Peak Gust refers to the highest instantaneous value recorded by the anemometer system for the period of reference, irrespective of direction and/or duration.

see also **Beaufort Wind Scale**

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