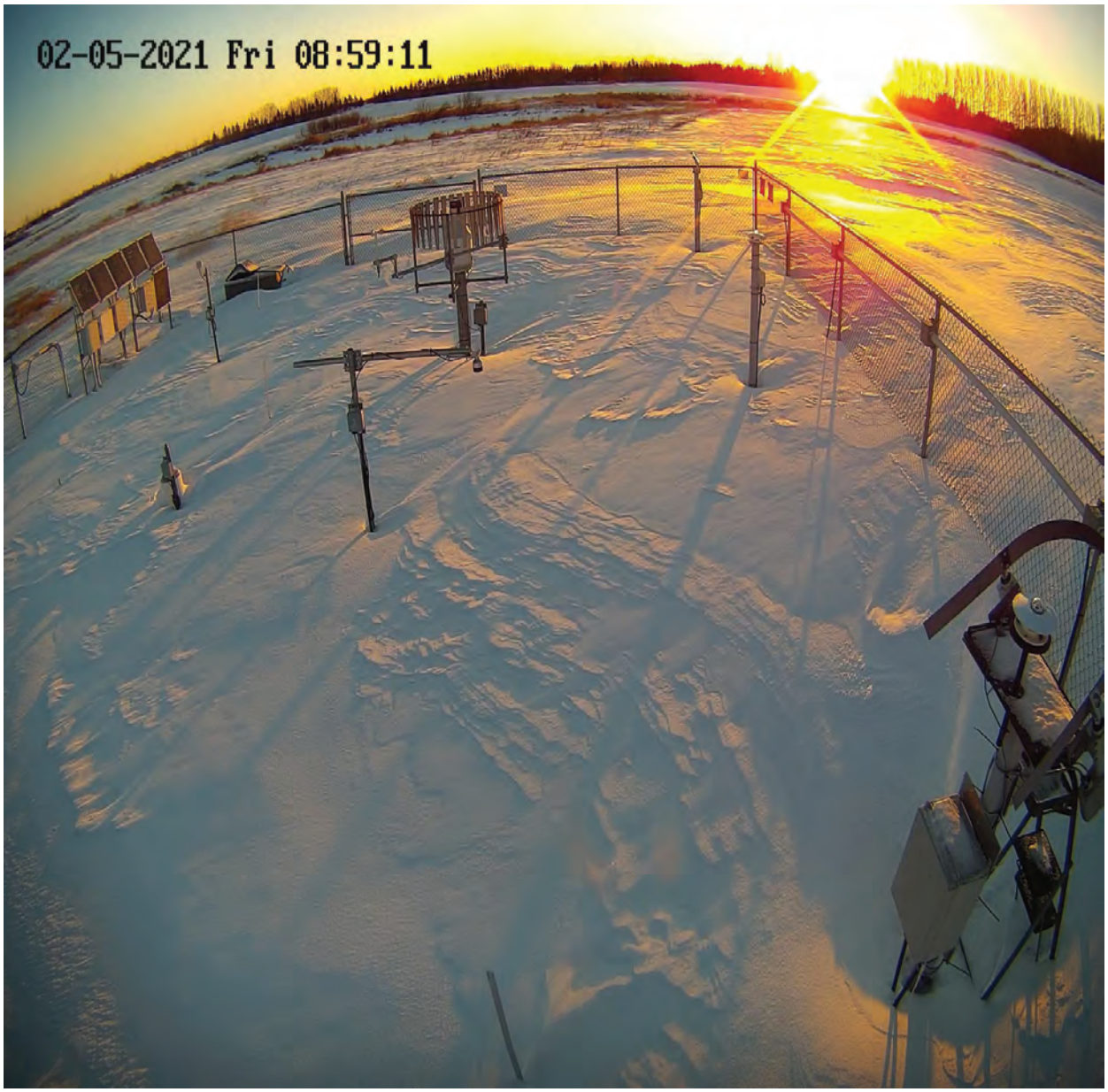
SASKATCHEWAN RESEARCH COUNCIL

CLIMATE REFERENCE STATION
Conservation Learning Center
RM of Prince Albert #461
ANNUAL SUMMARY 2021

V. Wittrock
Saskatchewan Research Council



SRC Publication No. 13000 - 1E23
August 2023

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

COVER PHOTOGRAPHS
Report cover: Climate Station (February 2021)
photo credit: Camera at site
Inside cover: Climate Station (May 2021)
photo credit: Camera at site

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ACKNOWLEDGEMENTS

The 2021 data were compiled and recorded by Virginia Wittrock. Wittrock was responsible for the data monitoring while most of the instrument maintenance is the responsibility of Saskatchewan Research Council (SRC) Process Development (Ryan Jansen and Graham Epp) and Development Engineering and Manufacturing Business Units (Ken Babich and others). Grounds maintenance (lawn mowing) is managed by the Conservation Learning Centre personnel. Consultations with Terri Lang and others from Environment Canada, Saskatoon, SK were most helpful in verifying and comparing data. Editorial assistance for this report was provided by Kenelm Grismer and Celeste Bodnaryk (SRC Environmental Performance and Climate Business Unit).

Enquiries concerning the SRC Conservation Learning Centre (CLC) Climate 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 web site: http://www.src.sk.ca
Monthly data sheets and annual summaries: http://src.nu/crsdata

SASKATCHEWAN RESEARCH COUNCIL

CLIMATE REFERENCE STATION SUPPORTERS, 2020-2021

WE GRATEFULLY ACKNOWLEDGE THE SUPPORT OF THE FOLLOWING:

CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

KIPP & ZONEN
SINCE 1830

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

Conservation LEARNING CENTRE

SRC'S CONSERVATION LEARNING CENTRE CLIMATE REFERENCE STATION HISTORY

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

V. Wittrock has been project manager since the site was established. Wittrock and C. Beaulieu were the first observers. S. Dunn became primary observer between 2014-2016 with assistance from V. Wittrock. V. Wittrock took over this role in 2017 as well as remaining project manager. Instrument maintenance is carried out by R. Jansen, K. Babich and G. Epp plus others. Summer of 2018 data monitoring assistance was provided by A. Carlson. V. Wittrock continues to be the primary observer and is also 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.

Aerial view of CRS at CLC
Photo: Lettvenuk, J.
Date: Sept 2013

WHAT IS THE CLIMATE REFERENCE STATION?

The Saskatchewan Research Council's Climate Reference Station (SRC CRS) at Conservation Learning Centre is classified as a principal climatological station with supplementary climatological observations[1]. A climate reference station's data are intended for the purpose of determining climatic trends. This requires long periods (not less than thirty years) of homogeneous records, where man-made environmental changes have been or are expected to remain at a minimum. Ideally the records should be of sufficient length to enable the identification of secular changes of climate[2]. At CRS Conservation Learning Centre, half-hourly readings are taken of elements (temperature, precipitation amount, humidity, wind and atmospheric pressure). Supplemental observations include rainfall intensity, soil temperature (7 levels), bright sunshine, solar radiation (diffuse and global), snow depth, relative humidity, barometric pressure, soil moisture (3 levels) and grass level temperature. High quality and consistent climatological observations are maintained providing data sets to meet the current concerns of the effects of climatic change and increased variability.

Purpose and Benefits

The purpose of the SRC CRS is to provide a record of observed meteorogical 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, as well as health and comfort.

The CRS allows us to:

- Evaluate long-term climatic trends – early warning system for increased frequencies of extreme events such as floods, droughts, 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 health implications;
- Do value-added research;
- Be part of regional, national and global networks in important agricultural and ecological areas;
- Facilitate development of additional programs – e.g., air quality, biodiversity and climate change monitoring;
- Have roles in various programs within SRC including spray drift work, Boreal Ecosystem At mospheric Study (BOREAS), and collaborative research with the Western College of Veterinary Medicine and the College of Agriculture, University of Saskatchewan; and
- Provide climate data to various industries, government organizations, non-government organizations, media outlets, institutions of learning, and interested individuals.

Goals

The goals of the CRS are first to maintain the high quality of data gathered over a long time period at a set location and to continue to monitor a large variety of elements. These various elements combined with the long-term collection period as well as the stable location allow the SRC CRS at Conservation Learning Centre to be an extremely valuable climate information collection station.

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

ACTIVITIES ASSOCIATED WITH THE SRC CLIMATE REFERENCE STATION AT THE CONSERVATION LEARNING CENTRE, 2021

The CLC is a research and demonstration farm. Its outreach program for grades 3-11 students resulted in approximately 300 students being exposed to hands-on activities related to air, soil, and water interactions at the farm. The SRC Climate Reference Station is included in the program allowing the students to become familiar with the CRS's suite of instruments. The station emphasizes the importance of climate and its application to the practical world of farming and ecology.[1] Unfortunately, with COVID-19 in 2020, that program needed to be put on hiatus.

Spring maintenance occurred on May 3, 2021 reinstalled temperature/relative humidity back up sensor, re-calibrated global and diffuse pyranometers and additional soil temperature sensors were installed installed at the 5, 10, 20 and 50cm depths. Geonor all-season precipitation gauge had one transducer replaced. Fall maintenance occurred on September 28 2021.

SRC had a major IT issue in the fall of 2021. This resulted in us not being able to access the data from the datalogger for about three months. Becuase this site is off the grid, we did not lose any information. The diffuse ring is programmed to move automatically and the datalogger is able to store large amounts of information resulting in no data loss.

Replacement of pyranometer for diffuse radiation
May 2021
Photo: Camera at site

Geonor all-season precipitation gauge spring maintenace
May 2021
Photo:Camera at site

Duplicate soil temperature sensors (5, 10, 20 and 50cm depths)
May 2021
Photo:R. Jansen

SUMMARY FOR 2021

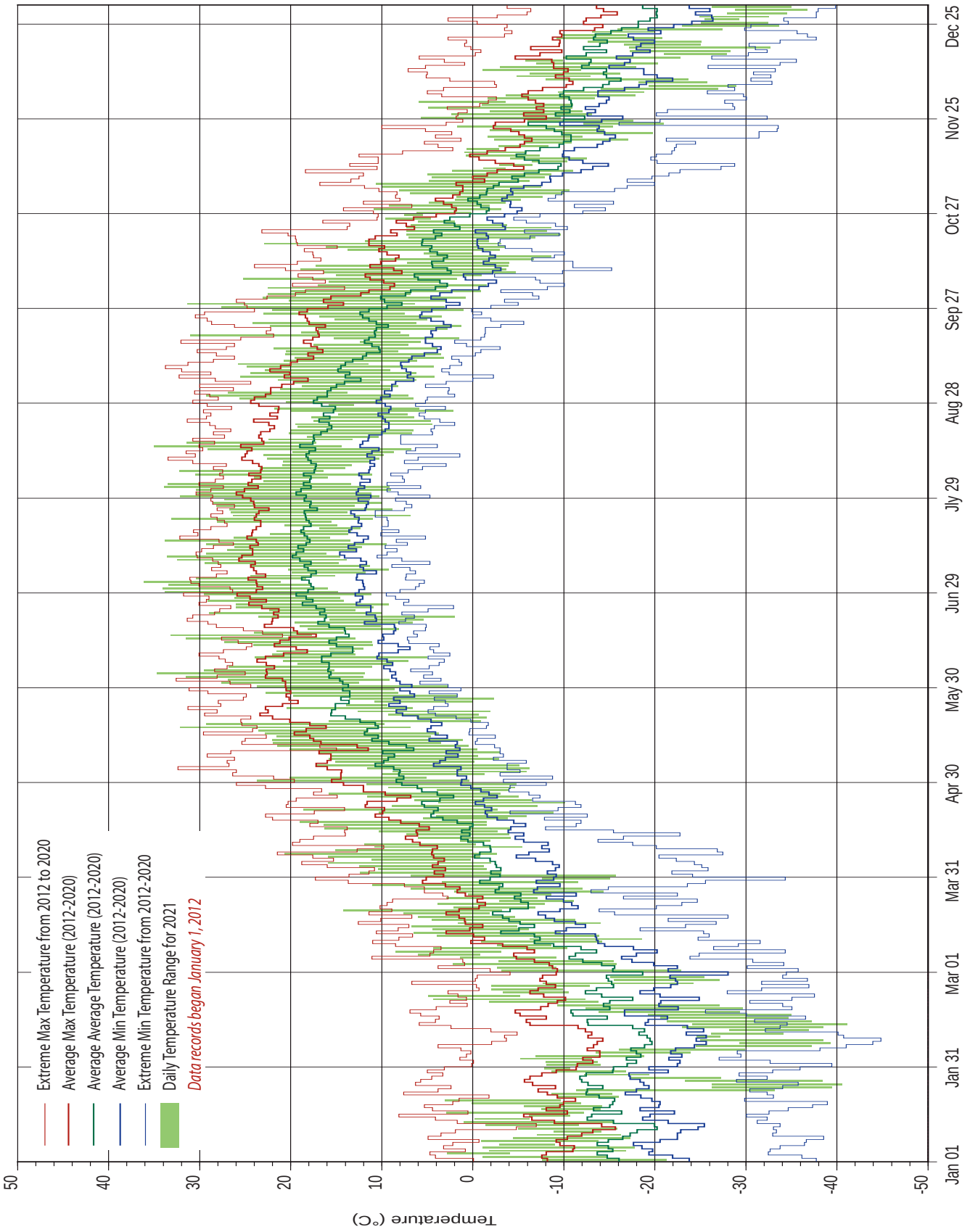
Data, including temperature, precipitation, wind speed and direction, bright sunshine, solar radiation, soil temperature and moisture, was recorded during 2021 by the Saskatchewan Research Council's (SRC) Climate Reference Station (CRS) at the Conservation Learning Centre (CLC) (53.03 N, 105.77 W), located in the Rural Municipality of Prince Albert #461, Saskatchewan.

SRC's Climate Reference Station at the CLC has been in operation for ten years (2012-2021), tracking similarities and differences of various parameters between the years and seasons. Once the station has data that extends to a full 10 years, there will be sufficient data for certain statistical analyses, such as determining averages. This report examines the types of weather and climate that occurred in 2021 and compares it to the previous nine years.

Synopsis for 2021 CLC:

- 25 days with temperatures at or greater than +30C at CLC
    - Hottest day was 36.1C (July 2)
- 21 days with temperatures at or below -30C at CLC
- 2 days with temperatures at or below -40C at CLC
    - Coldest day was -41.1C (February 13)
- 2021 has the highest maximum temperatures, average minimum temperature and average mean temperature.
    - Winter had average high and low temperatures.
    - Spring, Summer and Autumn all had the highest maximum average temperature for the 10 years at this site, while the minimum temperatures were average.
    - Summer 2021 had the highest summer average temperature for this site's ten years of existence.
- Frost-free season was 128 days long (May 26 to Oct 2). This was both the latest last spring frost and the latest first fall frost recorded at this site's ten years of existence. It did get REALLY chilly on August 25 with a measured temperature of 2.1C.
- The hot summer of 2021 resulted in the largest number of growing degree-days (1756), largest number of cooling degree days (182) and largest number of extreme cooling degree days (11) this site's ten years of existence.
- 2021 was a dry year for CLC with the second lowest precipitation amount measured (298.2mm). The lowest was in 2017 with 264.4mm.
- The continuous snowpack for the 2020-2021 winter started on November 8 and lasted until April 1. The deepest the snow got at site was 41 cm at the end of January / early February.
- The lack of precipitation resulted in the greatest amount of bright sunshine recorded at site (2694.7 hours).
    - 2021 had the second highest number of days with bright sunshine (333 days). Only 2017 had more (334) which was also the driest year at this CRS.
- Peak wind for the year was measured on March 29 (66.5 km/h)
    - CLC had four days with peak winds categorized as gale force winds.
- 2021 had two measured temperatures at or below -40C. When windspeed is included to calculate windchill, CLC had 24 days rated at 'high risk' to 'very high risk' (see windchill calculation chart).

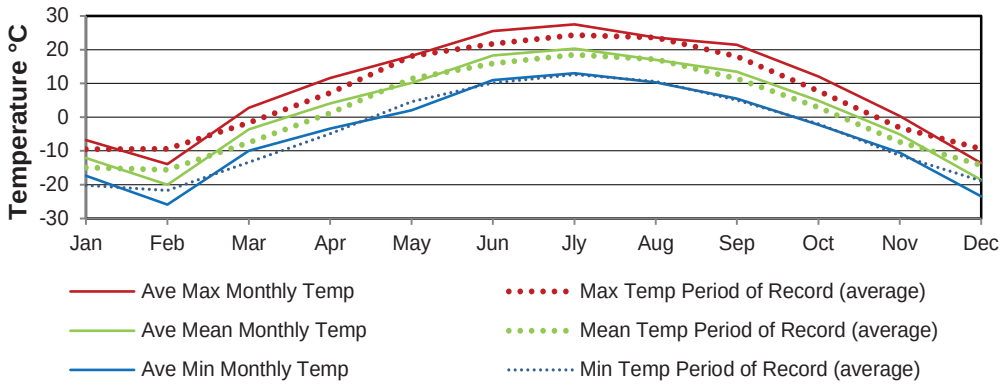
DAILY TEMPERATURE



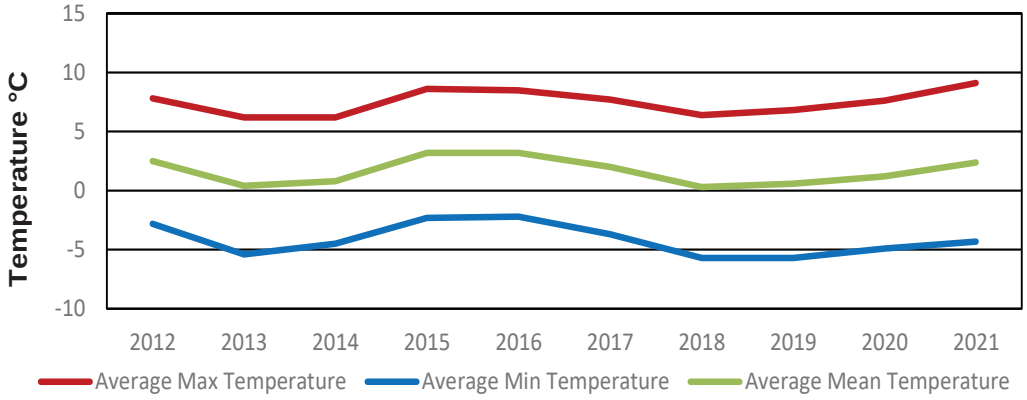
TEMPERATURE

MONTH	AVERAGE MAXIMUM TEMPERATURE (°C)	AVERAGE MINIMUM TEMPERATURE (°C)	AVERAGE TEMPERATURE (°C)	EXTREME VALUES TEMPERATURE (°C) 2021				EXTREME VALUES TEMPERATURE (°C) FOR 2012 TO 2021					
	2021	2021	2021	Max	Day	Min	Day	Max	Day	Year	Min	Day	Year
January	-6.8	-17.4	-12.1	3.1	20	-40.6	25	8.1	15	2014	-41.1	16	2020
February	-13.9	-25.9	-20.0	4.9	22	-41.1	13	6.9	17	2017	-44.9	8	2019
March	2.8	-10.0	-3.6	14.2	20	-22.9	1	17.3	30	2012	-35.8	1	2014
April	11.6	-3.4	4.1	23.7	30	-10.1	23	26.0	29	2015	-30.0	3	2020
May	18.2	2.0	10.1	32.1	17	-6.2	4	32.4	4	2016	-8.8	1	2019
June	25.5	11.0	18.3	34.7	3	2.0	21	34.7	3	2021	2.0	21	2021
July	27.5	13.0	20.3	36.1	2	6.8	23	36.1	2	2021	4.7	8	2015
August	23.6	10.3	17.0	35.0	14	2.1	25	35.0	14	2021	1.4	11	2019
September	21.5	5.5	13.5	31.4	28	0.8	30	33.8	8	2011	-7.3	30	2018
October	12.1	-2.3	4.9	25.2	6	-9.6	20	25.2	6	2021	-15.5	30	2019
November	0.4	-10.5	-5.1	10.6	5	-21.0	24	18.4	9	2016	-33.6	23	2013
December	-13.6	-23.5	-18.6	5.9	1	-36.7	30	7.1	11	2014	-39.9	31	2013
Average	9.1	-4.3	2.4										

Monthly

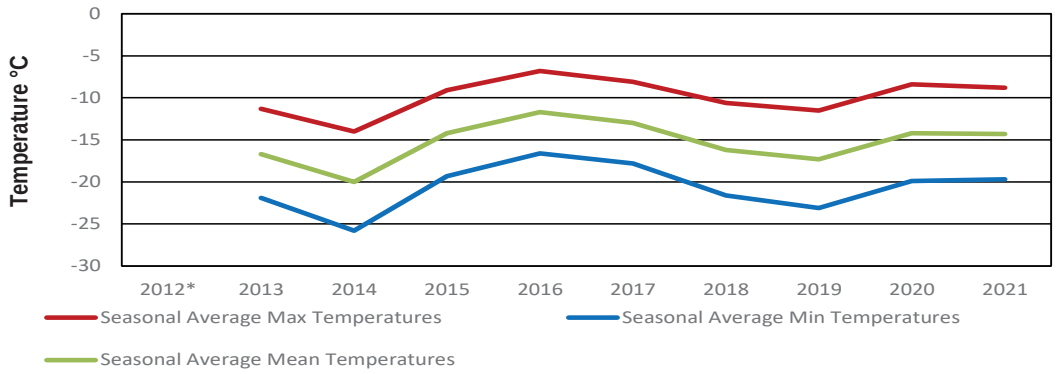


Annual

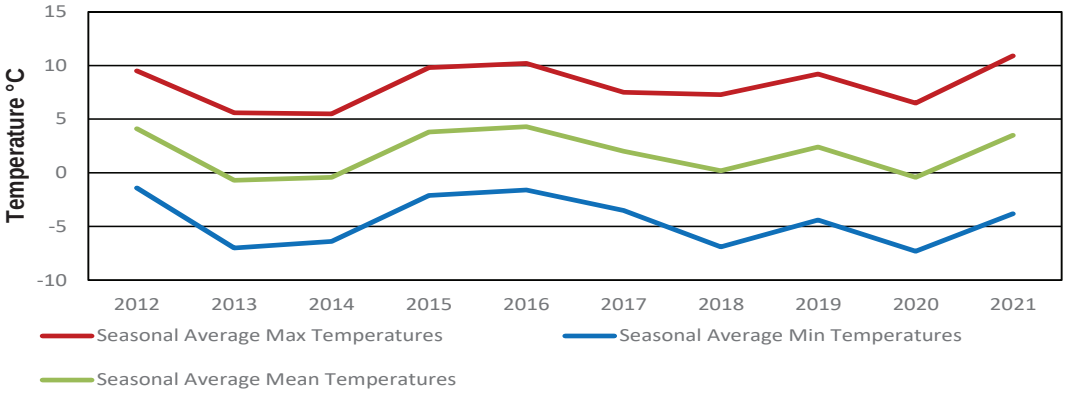


SEASONAL TEMPERATURES

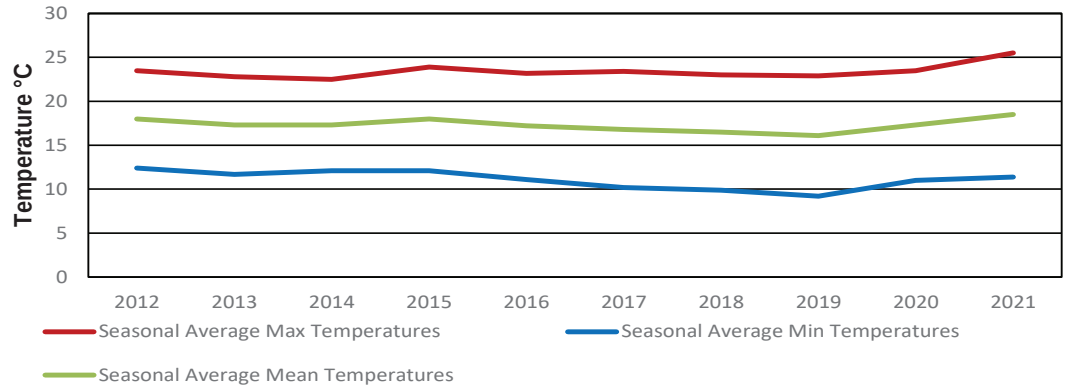
Winter (DJF)



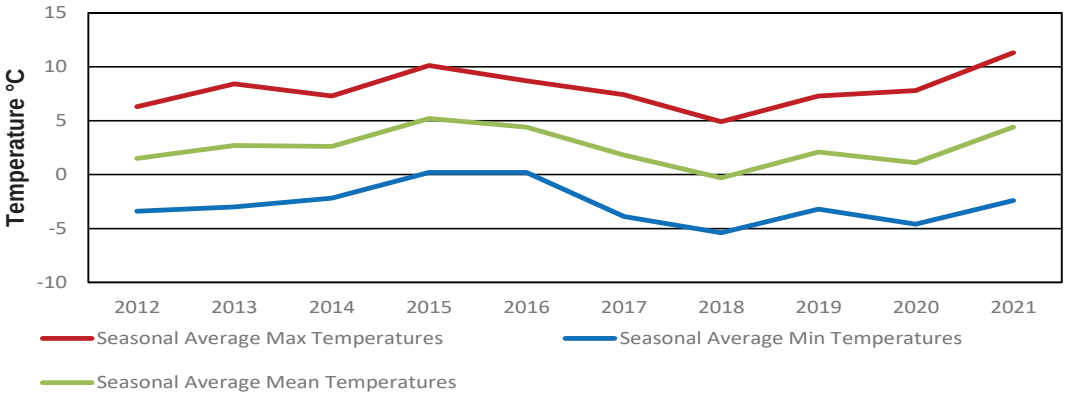
Spring (MAM)



Summer (JJA)



Autumn (SON)



TEMPERATURE

2021 EXTREME TEMPERATURES

COLD (less than or equal to -30°C)			HOT (greater than or equal to 30°C)		
DATE (month/day)		TEMPERATURE °C	DATE (month/day)		TEMPERATURE °C
January	23	-33.2	May	17	32.1
	24	-39.5	June	2	31.5
	25	-40.6		3	34.7
	26	-38.4		14	31.5
February	6	-37.2		15	33.2
	7	-39.3		29	33.8
	8	-38.5		30	34.0
	10	-34.1	July	1	33.4
	11	-36.9		2	36.1
	12	-38.5		3	30.4
	13	-41.1		9	32.5
	14	-37.2		10	33.6
	15	-34.7		15	33.8
	16	-35.0		22	33.1
December	18	-32.7		29	32.2
	25	-33.6		30	30.3
	26	-32.5		31	30.4
	28	-32.5	August	1	33.9
	29	-34.5		2	33.5
	30	-36.7		5	30.5
	31	-35.0		6	32.2
				14	35.0
Coloured cells indicate extremes				15	31.4
			September	18	31.0
				28	31.4

TEMPERATURE RANKINGS

AVERAGE ANNUAL TEMPERATUES °C

MAXIMUM TEMP		MINIMUM TEMP		MEAN TEMP	
2021	9.1	2016	-2.2	2015	3.2
2015	8.6	2015	-2.3	2016	3.2
2016	8.5	2012	-2.8	2012	2.5
2012	7.8	2017	-3.7	2021	2.4
2017	7.7	2021	-4.3	2017	2.0
2020	7.6	2014	-4.5	2020	1.2
2019	6.8	2020	-4.9	2014	0.8
2018	6.3	2013	-5.4	2019	0.5
2013	6.2	2019	-5.7	2013	0.4
2014	6.2	2018	-5.8	2018	0.3

SEASONAL MAXIMUM AVERAGE TEMPERATURES °C

WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2012	M	2021	10.9	2021	25.5	2021	11.3
2016	-6.8	2016	10.2	2015	23.9	2015	10.1
2017	-8.1	2015	9.8	2020	23.5	2016	8.7
2020	-8.4	2012	9.5	2012	23.5	2013	8.4
2021	-8.8	2019	9.2	2017	23.4	2020	7.8
2015	-9.1	2017	7.5	2016	23.2	2017	7.4
2018	-10.7	2018	7.3	2018	23.0	2019	7.3
2013	-11.3	2020	6.5	2019	22.9	2014	7.3
2019	-11.5	2013	5.6	2013	22.8	2012	6.3
2014	-14.0	2014	5.5	2014	22.5	2018	4.9

SEASONAL MINIMUM AVERAGE TEMPERATURES °C

WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2012	M	2012	-1.4	2012	12.4	2015	0.2
2016	-16.6	2016	-1.6	2014	12.1	2016	0.2
2017	-17.7	2015	-2.1	2015	12.1	2014	-2.2
2015	-19.2	2017	-3.5	2013	11.7	2021	-2.4
2021	-19.7	2021	-3.8	2021	11.4	2013	-3.0
2020	-19.9	2019	-4.4	2016	11.1	2019	-3.2
2018	-21.7	2014	-6.4	2020	11.0	2012	-3.4
2013	-22.0	2018	-6.9	2017	10.2	2017	-3.9
2019	-23.2	2013	-7.0	2018	9.9	2020	-4.6
2014	-25.8	2020	-7.3	2019	9.2	2018	-5.4

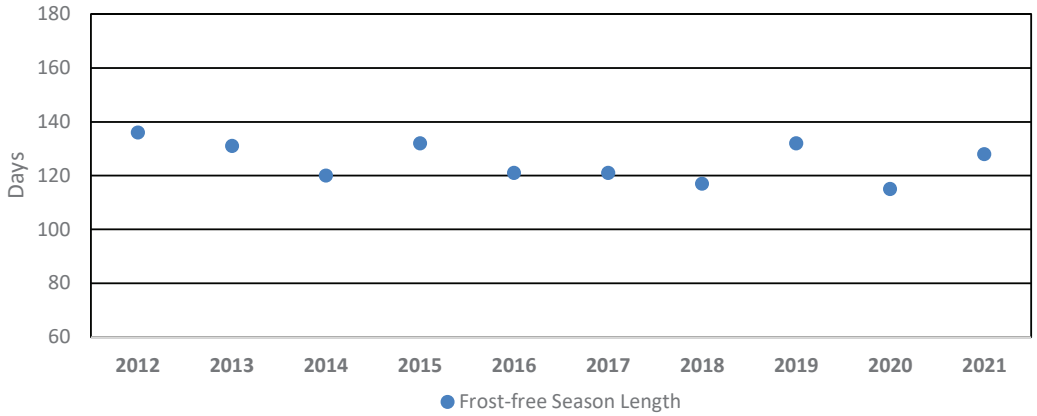
SEASONAL MEAN AVERAGE TEMPERATURES °C

WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2012	M	2016	4.3	2021	18.5	2015	5.2
2016	-11.7	2012	4.1	2015	18.0	2016	4.4
2017	-13.0	2015	3.8	2012	18.0	2021	4.4
2020	-14.2	2021	3.5	2014	17.3	2013	2.7
2015	-14.2	2019	2.4	2020	17.3	2014	2.6
2021	-14.3	2017	2.0	2013	17.3	2019	2.1
2018	-16.3	2018	0.2	2016	17.2	2017	1.8
2013	-16.7	2020	-0.4	2017	16.8	2012	1.5
2019	-17.4	2014	-0.4	2018	16.5	2020	1.1
2014	-19.9	2013	-0.7	2019	16.1	2018	-0.3

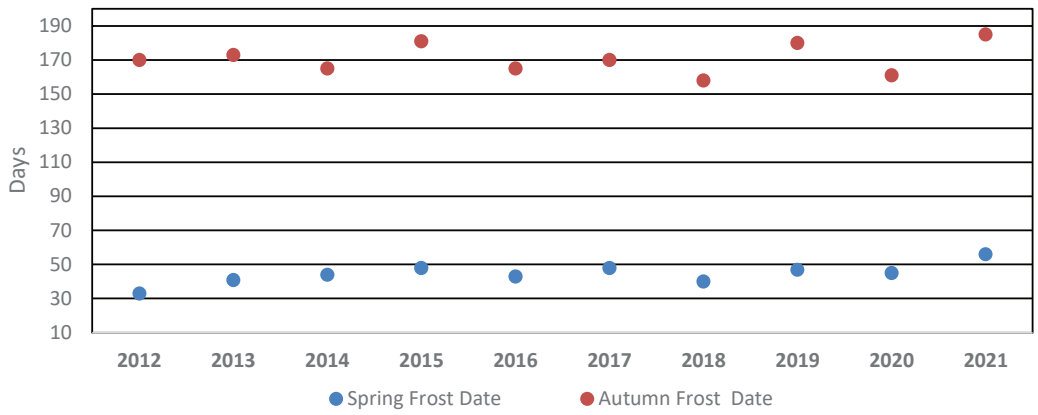
DATES & DURATION OF THE FROST-FREE SEASON			
YEAR	LAST SPRING FROST	FIRST FALL FROST	Frost-free Season Length
2011		September 14	
2012	May 3	September 17	136
2013	May 10	September 19	131
2014	May 14	September 12	120
2015	May 18	September 28	132
2016	May 13	September 13	121
2017	May 18	September 18	121
2018	May 10	September 5	117
2019	May 17	September 27	123
2020	May 15	September 8	115
2021	May 26	October 2	128

Coloured cells indicate extremes

Frost-free Growing Season Duration



Frost-free Growing Season End Points



TEMPERATURE GRID °C

Average Temperature °C Daily

2021	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-14.5	-10.9	-13.1	4.7	12.6	18.1	25.6	21.6	15.2	14.7	-2.9	1.2
2	-7.9	-9.2	-6.0	4.5	4.3	21.8	28.6	23.5	13.5	9.5	-1.6	-7.5
3	-0.7	-12.9	-6.8	5.7	1.5	23.3	24.4	20.5	15.0	12.7	-1.3	-10.7
4	-9.3	-18.7	-9.2	7.0	2.7	22.4	19.8	20.0	13.8	7.8	1.2	-14.1
5	-9.5	-23.0	-3.9	5.7	6.1	19.0	15.9	20.8	14.9	9.7	3.8	-20.6
6	-6.0	-30.9	2.6	7.6	7.5	14.0	14.8	24.3	15.3	13.5	-0.7	-24.1
7	-7.4	-34.3	2.7	9.1	6.5	14.0	17.9	18.7	16.0	7.0	-1.7	-22.0
8	-10.9	-31.8	-3.1	7.6	7.6	14.5	22.1	17.1	14.6	5.9	-1.8	-15.8
9	-11.7	-25.9	-5.7	2.7	7.0	17.5	23.2	16.1	18.7	7.6	-4.4	-8.9
10	-11.5	-30.2	-7.6	5.8	9.8	17.3	24.1	16.5	13.4	6.7	-2.4	-11.3
11	-10.5	-32.6	-12.5	-0.3	11.0	13.9	22.7	16.4	11.4	1.6	-4.7	-6.5
12	-6.5	-30.8	-5.0	0.9	12.7	17.6	19.8	14.3	12.1	1.8	-8.5	-10.5
13	-7.3	-32.6	-1.6	1.7	11.6	19.2	19.2	17.9	14.4	-2.0	-8.3	-13.7
14	-3.2	-29.3	-0.9	3.8	13.1	22.2	19.4	24.7	12.9	2.7	-3.4	-7.9
15	-8.5	-27.7	0.9	6.1	13.3	25.5	23.7	24.3	12.3	5.4	-2.5	-16.4
16	-4.7	-27.2	-6.2	7.5	17.6	19.1	21.0	17.8	9.1	6.3	-1.2	-24.5
17	-10.8	-21.6	-3.4	8.8	19.5	13.1	18.0	14.3	8.4	9.9	-5.6	-22.8
18	-9.9	-21.0	0.7	0.9	19.5	14.6	16.7	13.5	19.0	5.0	-8.4	-25.0
19	-5.9	-18.2	2.9	-1.0	7.5	13.1	14.6	13.3	13.4	0.0	-9.8	-20.8
20	-3.3	-7.8	5.5	0.7	2.4	10.6	17.8	14.6	9.9	-1.2	-6.8	-18.9
21	-12.6	-4.1	-2.4	8.0	4.4	12.8	21.9	12.0	11.8	-0.4	-14.8	-15.0
22	-12.0	-0.2	-2.1	0.9	5.4	19.5	22.1	11.1	15.2	-0.7	-8.2	-13.4
23	-22.3	-6.9	-7.0	-3.2	13.6	17.7	16.6	12.1	10.1	1.6	-6.9	-16.5
24	-32.9	-6.0	-2.1	0.0	11.7	18.5	20.2	11.0	10.1	4.0	-16.6	-21.7
25	-33.5	-7.4	-4.1	3.3	5.4	17.6	17.8	11.1	15.3	7.1	-11.8	-28.3
26	-30.9	-16.0	-6.2	6.4	5.7	21.7	20.6	13.9	11.5	6.5	-2.0	-28.8
27	-22.3	-21.3	-2.6	0.0	10.7	20.4	19.3	14.5	15.4	3.2	-5.4	-27.4
28	-15.9	-20.3	4.0	2.4	15.5	20.3	19.3	15.3	18.9	3.9	-7.0	-28.7
29	-12.7		-4.1	3.4	14.6	24.3	21.3	16.1	11.6	3.7	-3.0	-31.2
30	-9.3		-11.4	12.1	13.3	25.0	20.7	18.2	12.0	0.6	-6.0	-32.8
31	-11.1		-4.5		20.1		19.7	20.4		-1.7		-30.7

Air temperature / relative humidity sensors
April 2021
Photo: Camera at site

Maximum Temperature °C Daily

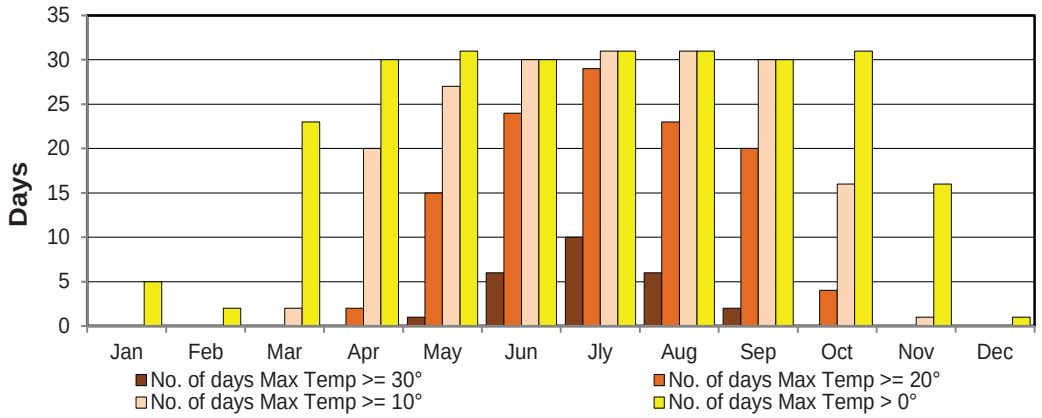
2021	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-7.6	-8.0	-3.2	12.4	20.1	26.9	33.4	33.9	21.2	22.5	1.8	5.9
2	-1.1	-5.3	-2.7	10.4	9.9	31.5	36.1	33.5	18.7	19.9	6.9	-1.6
3	2.8	-6.9	2.2	12.5	8.8	34.7	30.4	23.0	19.7	22.5	8.1	-3.6
4	-1.8	-13.5	-2.8	15.9	11.6	29.5	24.4	24.0	21.4	17.0	9.9	-9.4
5	-1.1	-16.1	1.4	11.1	17.3	26.8	19.9	30.5	25.5	15.8	10.6	-14.1
6	-2.9	-24.5	6.0	15.9	15.1	19.2	20.3	32.2	24.4	25.2	4.8	-19.3
7	-0.9	-29.3	8.5	20.7	15.8	20.8	24.4	23.4	22.8	15.0	4.5	-18.2
8	-4.4	-25.0	4.3	15.1	15.6	23.9	29.4	20.9	24.8	16.4	5.0	-8.0
9	-7.1	-24.6	-2.7	10.8	16.9	22.0	32.5	20.8	25.8	18.9	2.3	-4.8
10	-8.9	-26.2	-0.9	11.9	20.1	21.6	33.6	22.6	20.7	17.3	-1.2	-6.3
11	-5.0	-28.2	-6.3	1.4	21.5	15.7	29.3	23.0	19.6	7.2	-2.9	-1.1
12	-1.4	-23.0	3.9	6.0	21.9	24.1	26.9	19.8	20.6	10.2	-6.5	-3.0
13	1.0	-24.1	6.5	7.3	22.0	27.3	26.2	29.1	20.5	4.7	-4.1	-7.0
14	-0.2	-21.3	4.4	10.3	21.6	31.5	29.3	35.0	21.9	5.4	0.7	-5.8
15	-6.2	-20.6	6.7	16.3	22.8	33.2	33.8	31.4	17.5	13.7	0.9	-9.9
16	2.9	-19.3	1.6	16.4	23.6	24.0	26.3	22.4	12.4	16.1	0.6	-21.0
17	-7.5	-13.8	4.5	19.0	32.1	18.1	22.3	18.2	15.2	22.9	-2.8	-17.3
18	-5.6	-12.4	6.0	5.5	29.3	19.0	20.0	20.2	31.0	11.8	-5.8	-17.2
19	0.1	-9.3	7.6	4.0	15.8	19.6	16.8	20.0	18.8	7.0	-2.4	-16.6
20	3.1	-1.8	14.2	10.3	6.2	15.7	20.7	19.2	17.0	7.3	-1.6	-12.6
21	-9.2	4.3	2.1	18.6	9.3	23.6	28.1	19.5	22.3	7.3	-9.8	-9.2
22	-8.6	4.9	3.8	8.9	12.6	28.9	33.1	17.5	24.2	7.3	-1.9	-9.8
23	-11.4	-3.3	-2.9	3.8	20.5	22.4	26.3	17.7	15.2	6.8	1.7	-13.1
24	-26.3	-2.1	2.9	6.4	13.9	26.0	26.6	14.8	16.8	6.0	-12.2	-15.9
25	-26.3	-2.0	0.5	11.6	10.8	26.0	26.7	20.0	23.0	9.6	-6.0	-23.0
26	-23.3	-7.7	2.0	15.8	13.6	29.1	28.2	21.8	22.0	7.5	5.7	-25.1
27	-17.3	-15.5	6.8	3.9	19.7	26.2	28.6	15.8	27.6	6.2	2.3	-25.5
28	-12.3	-15.1	11.0	9.3	22.7	29.5	27.3	20.5	31.4	10.9	-1.9	-24.9
29	-8.6		3.4	11.6	20.6	33.8	32.2	25.6	20.2	9.2	4.9	-27.9
30	-7.9		-7.6	23.7	23.7	34.0	30.3	29.3	23.1	4.8	-1.0	-28.8
31	-8.1		6.8		27.6		30.4	26.9		1.9		-26.3

Minimum Temperature °C Daily

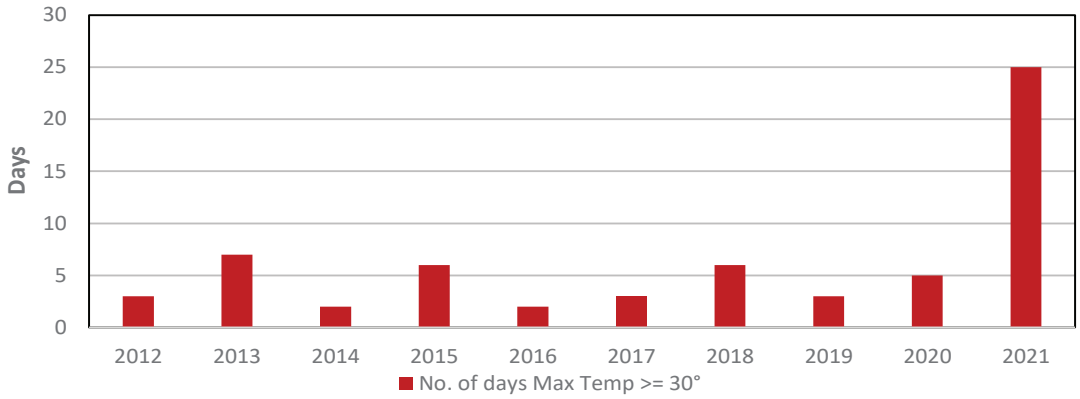
2021	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-21.3	-13.7	-22.9	-3.1	5.1	9.2	17.7	9.2	9.1	6.8	-7.6	-3.6
2	-14.7	-13.1	-9.2	-1.5	-1.3	12.0	21.1	13.4	8.2	-0.9	-10.0	-13.4
3	-4.1	-18.8	-15.8	-1.2	-5.9	11.9	18.3	17.9	10.2	2.8	-10.6	-17.8
4	-16.8	-23.9	-15.5	-2.0	-6.2	15.2	15.1	15.9	6.2	-1.5	-7.5	-18.8
5	-17.8	-29.9	-9.2	0.2	-5.1	11.1	11.8	11.1	4.2	3.6	-3.0	-27.0
6	-9.0	-37.2	-0.8	-0.8	-0.2	8.7	9.3	16.4	6.2	1.7	-6.2	-28.9
7	-13.8	-39.3	-3.1	-2.6	-2.9	7.1	11.3	14.0	9.1	-1.0	-7.9	-25.7
8	-17.3	-38.5	-10.4	0.0	-0.5	5.0	14.7	13.3	4.3	-4.7	-8.6	-23.6
9	-16.3	-27.2	-8.6	-5.4	-3.0	12.9	13.9	11.4	11.5	-3.7	-11.0	-12.9
10	-14.1	-34.1	-14.2	-0.3	-0.5	13.0	14.6	10.3	6.1	-3.9	-3.6	-16.2
11	-15.9	-36.9	-18.6	-1.9	0.5	12.0	16.1	9.8	3.2	-4.0	-6.5	-11.9
12	-11.6	-38.5	-13.9	-4.2	3.5	11.0	12.7	8.7	3.5	-6.7	-10.4	-17.9
13	-15.5	-41.1	-9.6	-4.0	1.1	11.1	12.2	6.7	8.2	-8.6	-12.5	-20.4
14	-6.2	-37.2	-6.2	-2.7	4.6	12.9	9.5	14.4	3.9	0.0	-7.4	-9.9
15	-10.7	-34.7	-4.9	-4.1	3.7	17.7	13.5	17.2	7.1	-3.0	-5.9	-22.8
16	-12.2	-35.0	-14.0	-1.5	11.5	14.2	15.7	13.2	5.7	-3.6	-2.9	-27.9
17	-14.0	-29.3	-11.3	-1.5	6.8	8.1	13.7	10.4	1.5	-3.1	-8.3	-28.3
18	-14.2	-29.6	-4.6	-3.8	9.7	10.1	13.4	6.7	7.0	-1.8	-10.9	-32.7
19	-11.9	-27.1	-1.8	-5.9	-0.9	6.6	12.3	6.5	7.9	-6.9	-17.1	-25.0
20	-9.6	-13.8	-3.2	-8.9	-1.5	5.4	14.9	10.0	2.8	-9.6	-12.0	-25.1
21	-16.0	-12.4	-6.9	-2.7	-0.6	2.0	15.6	4.5	1.3	-8.1	-19.8	-20.8
22	-15.3	-5.2	-7.9	-7.1	-1.9	10.0	11.0	4.6	6.2	-8.6	-14.5	-16.9
23	-33.2	-10.5	-11.1	-10.1	6.6	12.9	6.8	6.5	5.0	-3.7	-15.4	-19.9
24	-39.5	-9.9	-7.1	-6.5	9.4	10.9	13.8	7.2	3.4	2.0	-21.0	-27.4
25	-40.6	-12.8	-8.6	-5.0	0.0	9.2	8.8	2.1	7.5	4.6	-17.6	-33.6
26	-38.4	-24.3	-14.4	-3.0	-2.3	14.2	13.0	5.9	1.0	5.5	-9.6	-32.5
27	-27.3	-27.1	-12.0	-3.9	1.7	14.6	10.0	13.1	3.1	0.2	-13.1	-29.3
28	-19.4	-25.4	-3.1	-4.6	8.2	11.1	11.3	10.1	6.4	-3.1	-12.1	-32.5
29	-16.8		-11.5	-4.8	8.6	14.8	10.3	6.5	3.0	-1.8	-10.9	-34.5
30	-10.7		-15.1	0.4	2.8	15.9	11.1	7.1	0.8	-3.6	-11.0	-36.7
31	-14.0		-15.7		12.5		9.0	13.8		-5.3		-35.0

DAYS WITH MAXIMUM TEMPERATURES GREATER THAN A SET POINT

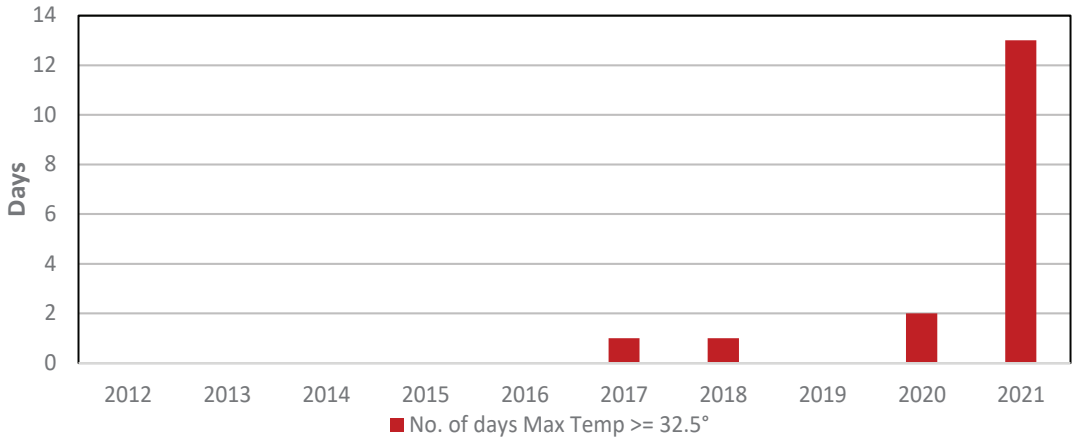
Maximum temperature relative to set points Monthly



30°C or Greater

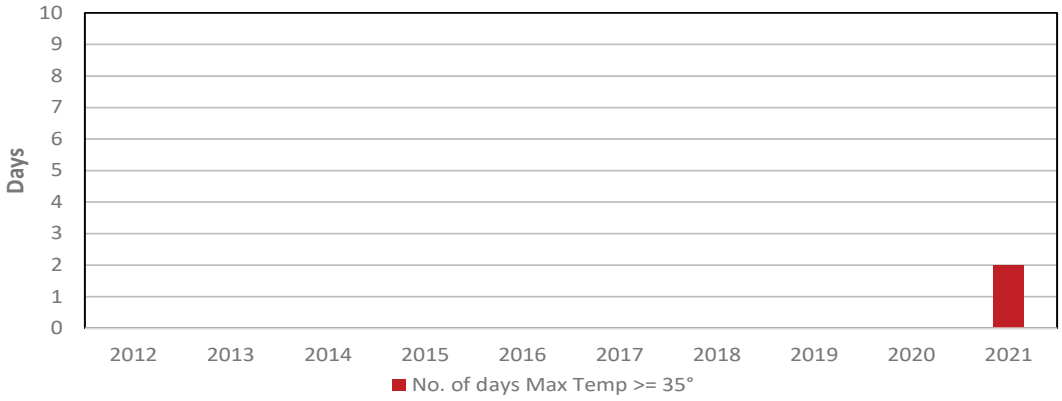


32.5°C or Greater

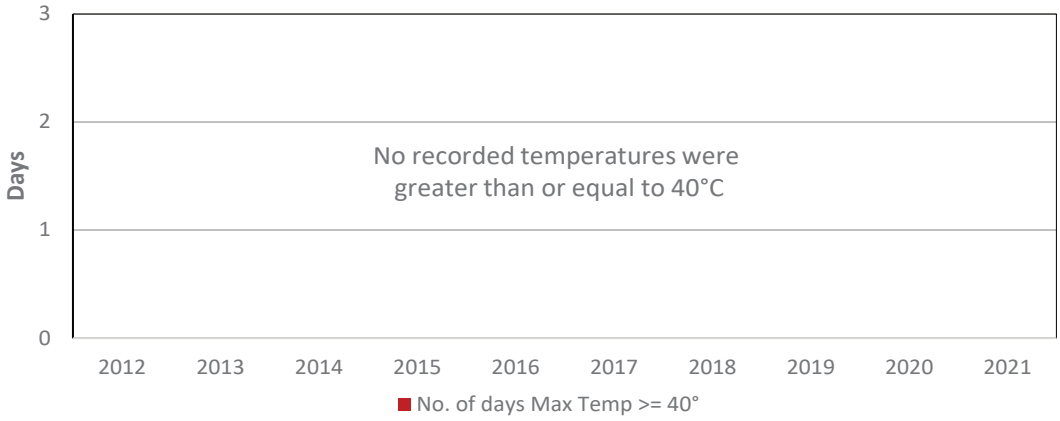


DAYS WITH MAXIMUM TEMPERATURES GREATER THAN A SET POINT

35°C or Greater



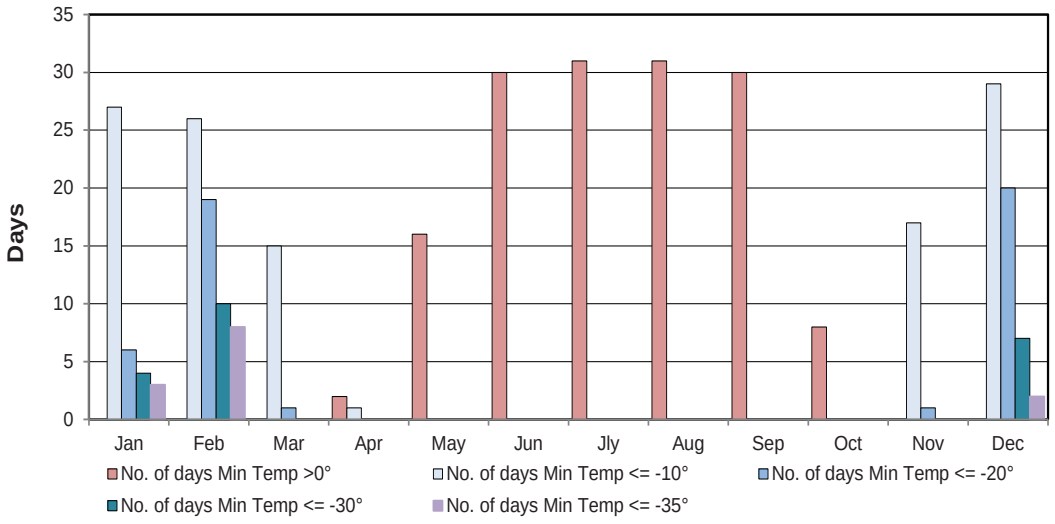
40°C or Greater



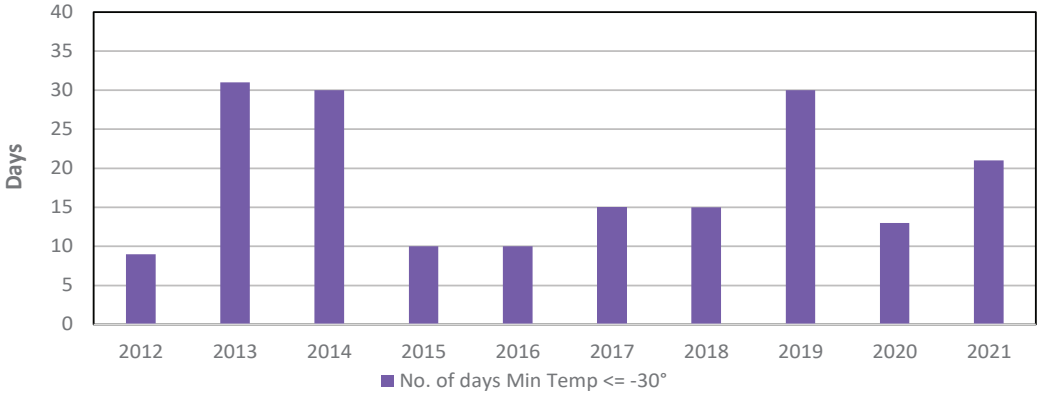
Early spring at the CLC CRS
March 2021
Photo: Camera on site

DAYS WITH MINIMUM TEMPERATURES LESS THAN A SET POINT

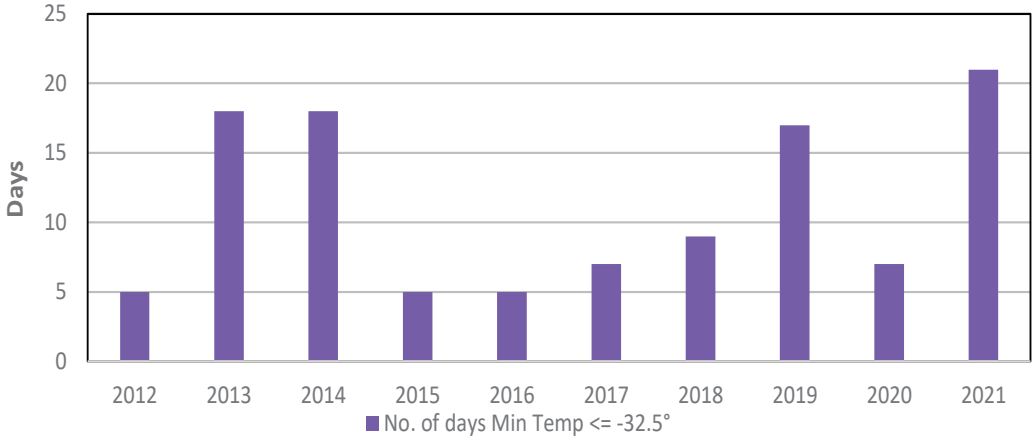
Minimum temperature relative to set points Monthly



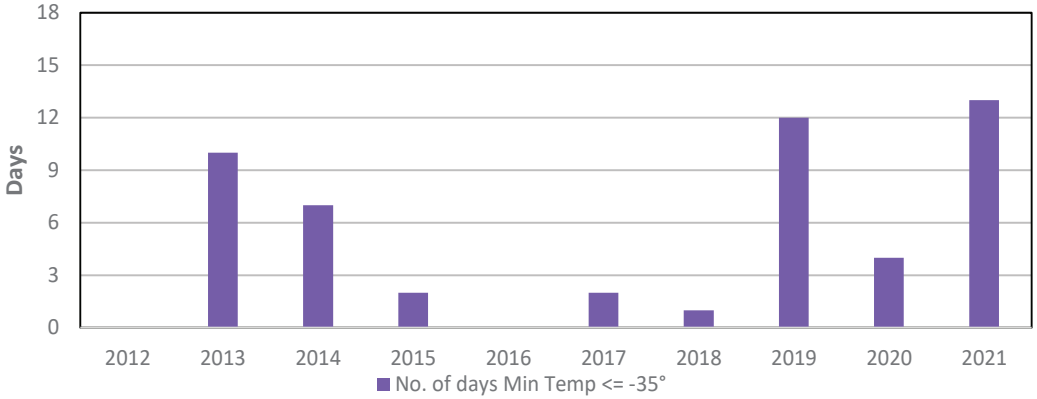
Minus 30°C or Less



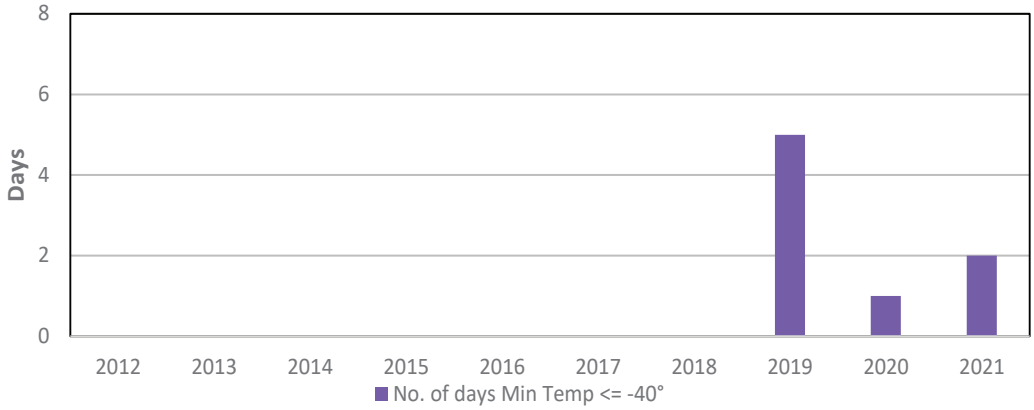
Minus 32.5°C or Less



DAYS WITH TEMPERATURES LESS THAN A SET POINT



Minus 35°C or Less

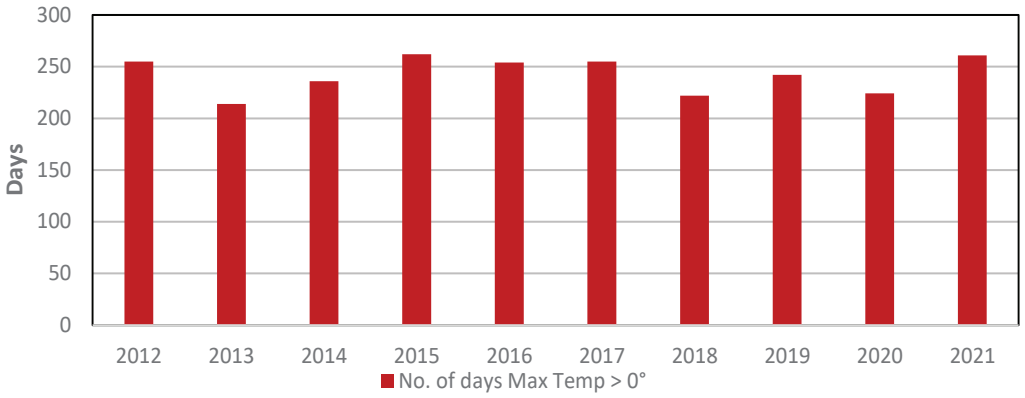


Minus 40°C or Less

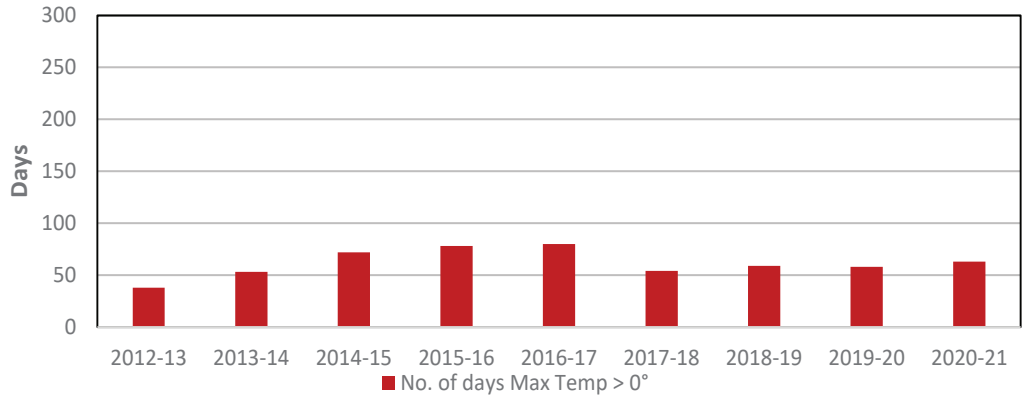
CLC CRS
April 2021
Photo: Camera at site

DAYS WITH TEMPERATURES GREATER THAN SET POINT

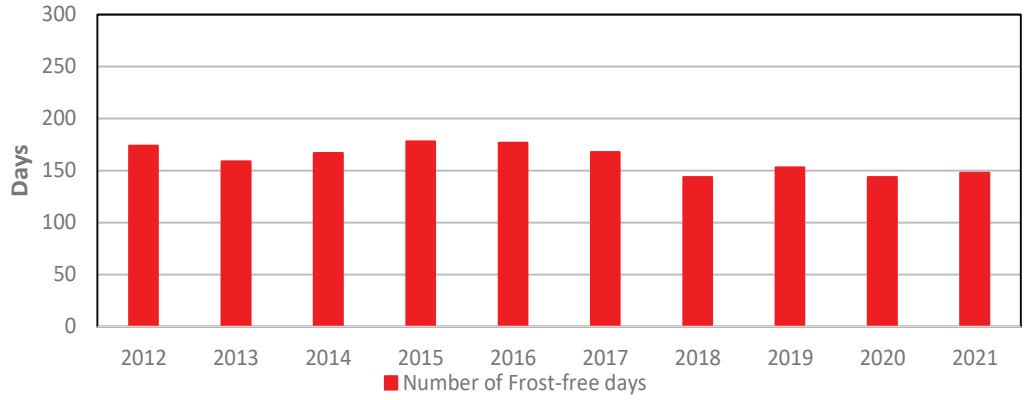
Maximum Temperature greater than 0°C (Thaw Days) Jan 1st to Dec 31st



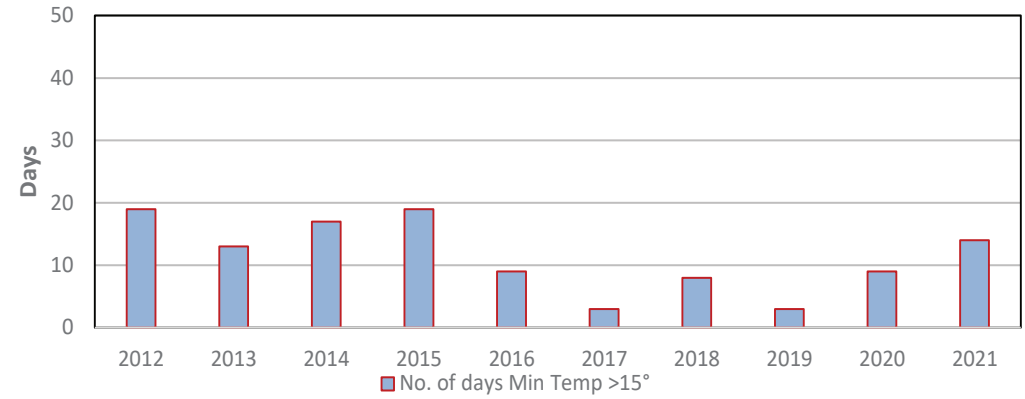
Maximum Temperature greater than 0°C (Thaw Days) Oct 1st to Mar 31st (Cold Season)



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



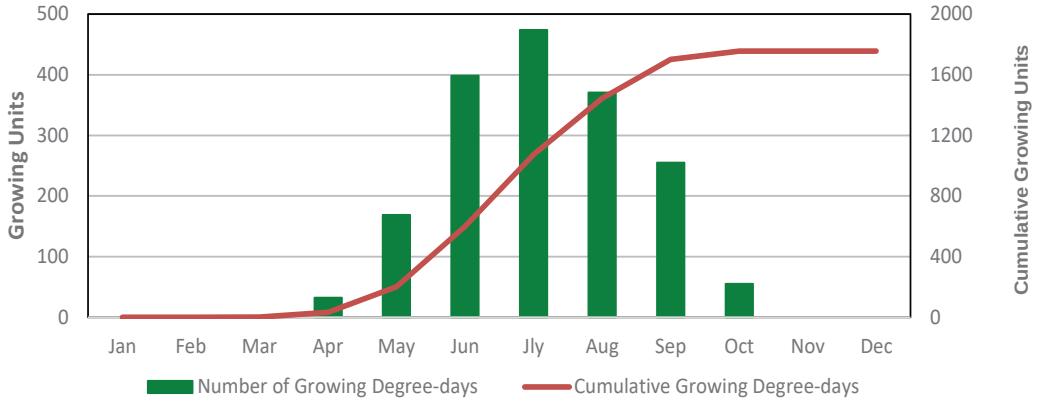
Minimum Temperature greater than 15°C



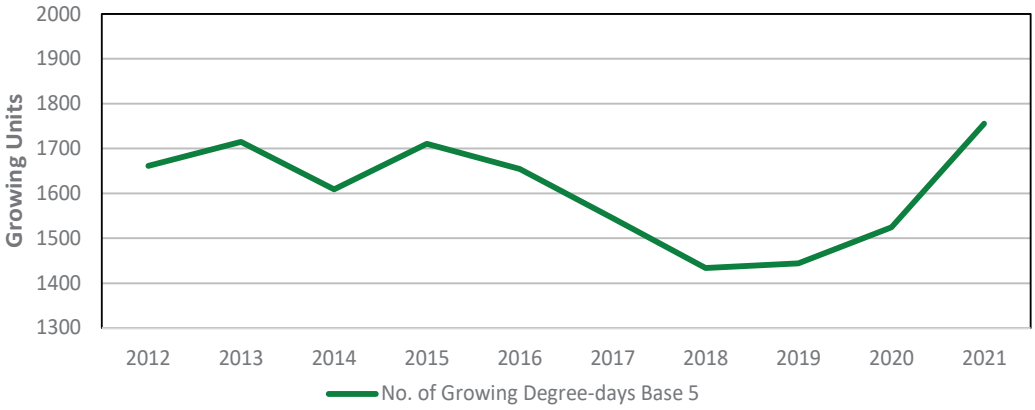
DEGREE-DAYS

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	
	2021	Cumulative	2021	Cumulative	2021	Cumulative	2021	Cumulative
January	0.0	0.0	933.5	933.5	0.0	0.0	0.0	0.0
February	0.0	0.0	1062.8	1996.3	0.0	0.0	0.0	0.0
March	0.5	0.5	670.2	2666.5	0.0	0.0	0.0	0.0
April	32.4	32.9	417.2	3083.7	0.0	0.0	0.0	0.0
May	168.9	201.8	248.9	3332.6	5.1	5.1	0.0	0.0
June	398.6	600.4	43.7	3376.3	52.3	57.4	2.8	2.8
July	473.8	1074.2	11.9	3388.2	82.7	140.1	6.7	9.5
August	370.9	1445.1	71.1	3459.3	39.0	179.1	1.3	10.8
September	255.2	1700.3	137.4	3596.7	2.6	181.7	0.0	10.8
October	55.3	1755.6	405.6	4002.3	0.0	181.7	0.0	10.8
November	0.0	1755.6	692.7	4695.0	0.0	181.7	0.0	10.8
December	0.0	1755.6	1133.3	5828.3	0.0	181.7	0.0	10.8

Growing Degree-days Monthly

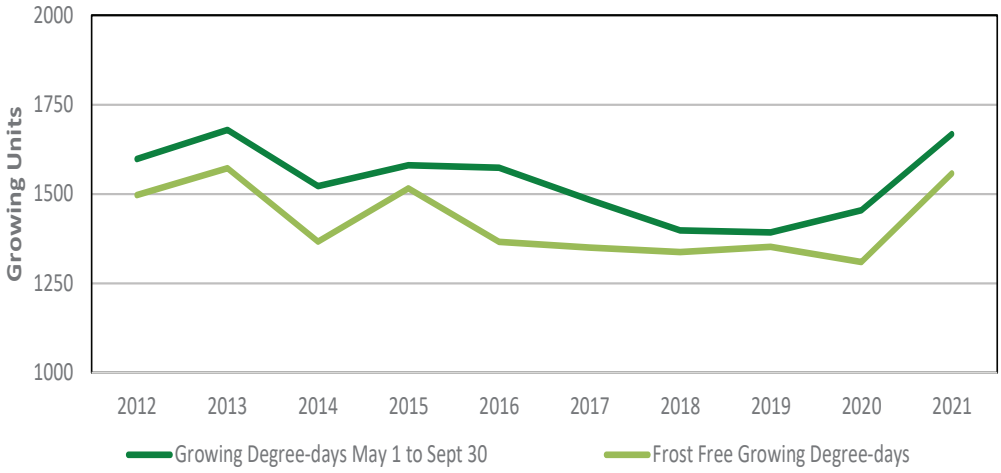


Growing Degree-days Annual



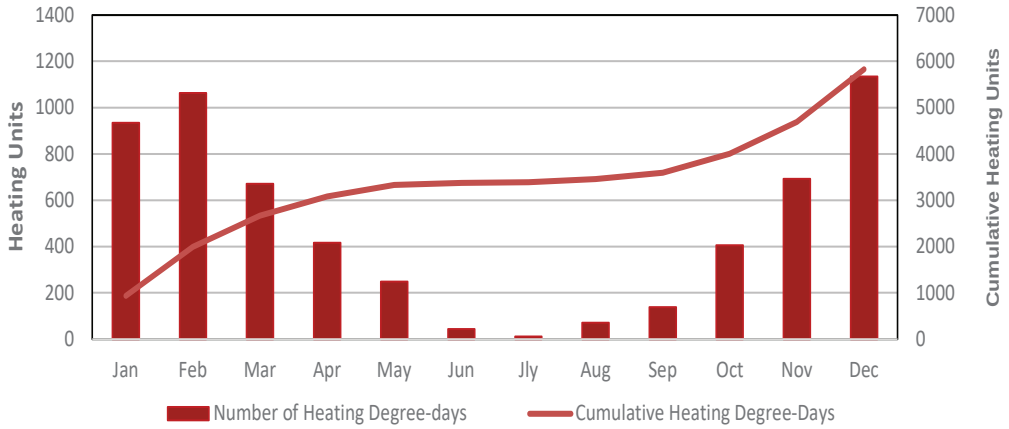
Growing Degree-days May 1 to September 30 base 5C

Growing Degree-days in Frost Free Period bace 5C

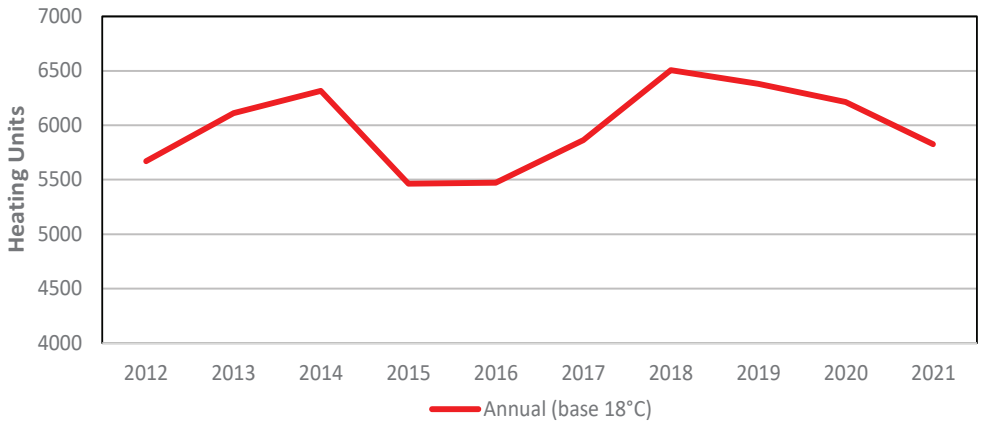


DEGREE-DAYS

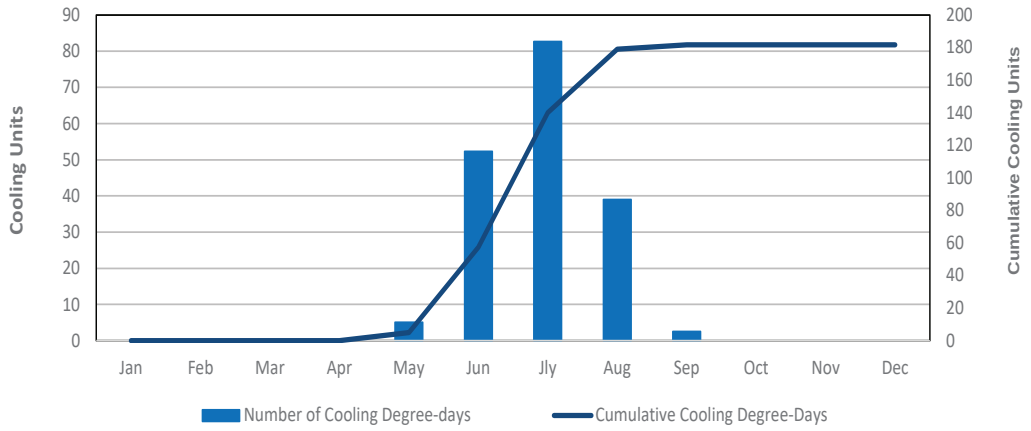
Heating Degree-days Monthly



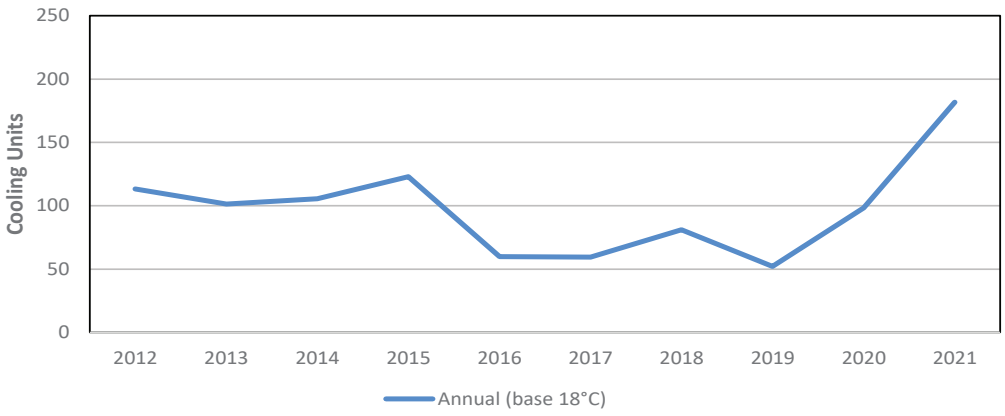
Heating Degree-days Annual



Cooling Degree-days Monthly

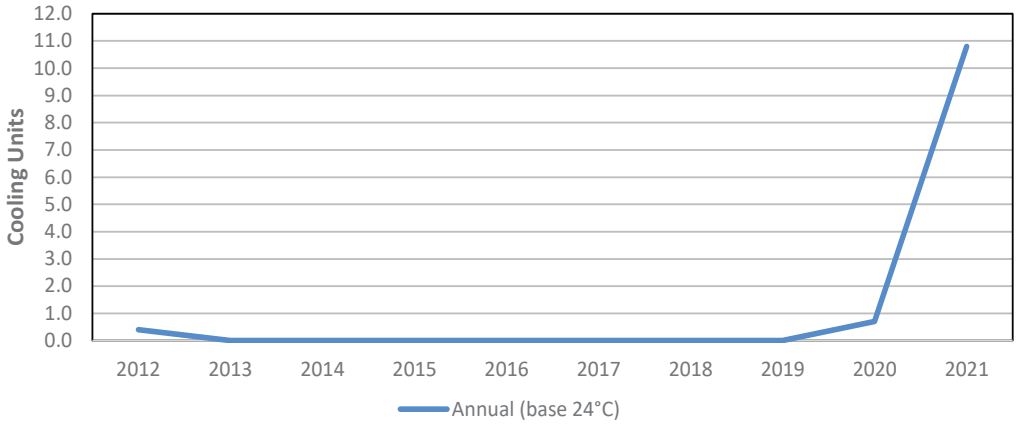


Cooling Degree-days Annual



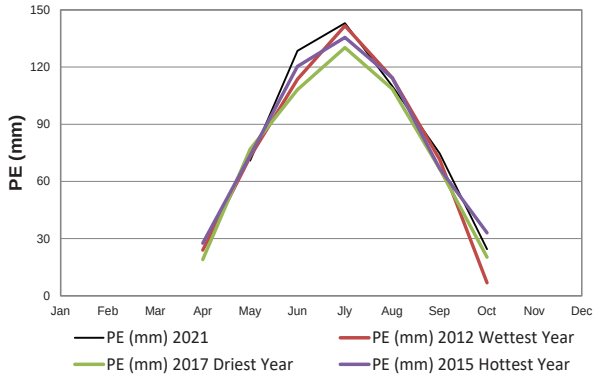
DEGREE-DAYS

Extreme Cooling Degree-days Annual

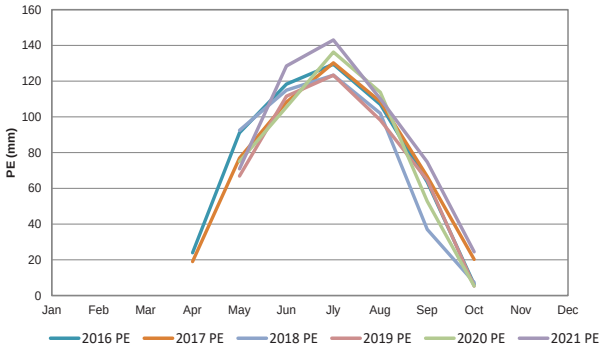


POTENTIAL EVAPOTRANSPIRATION (PE) using the Thornthwaite Method[1]

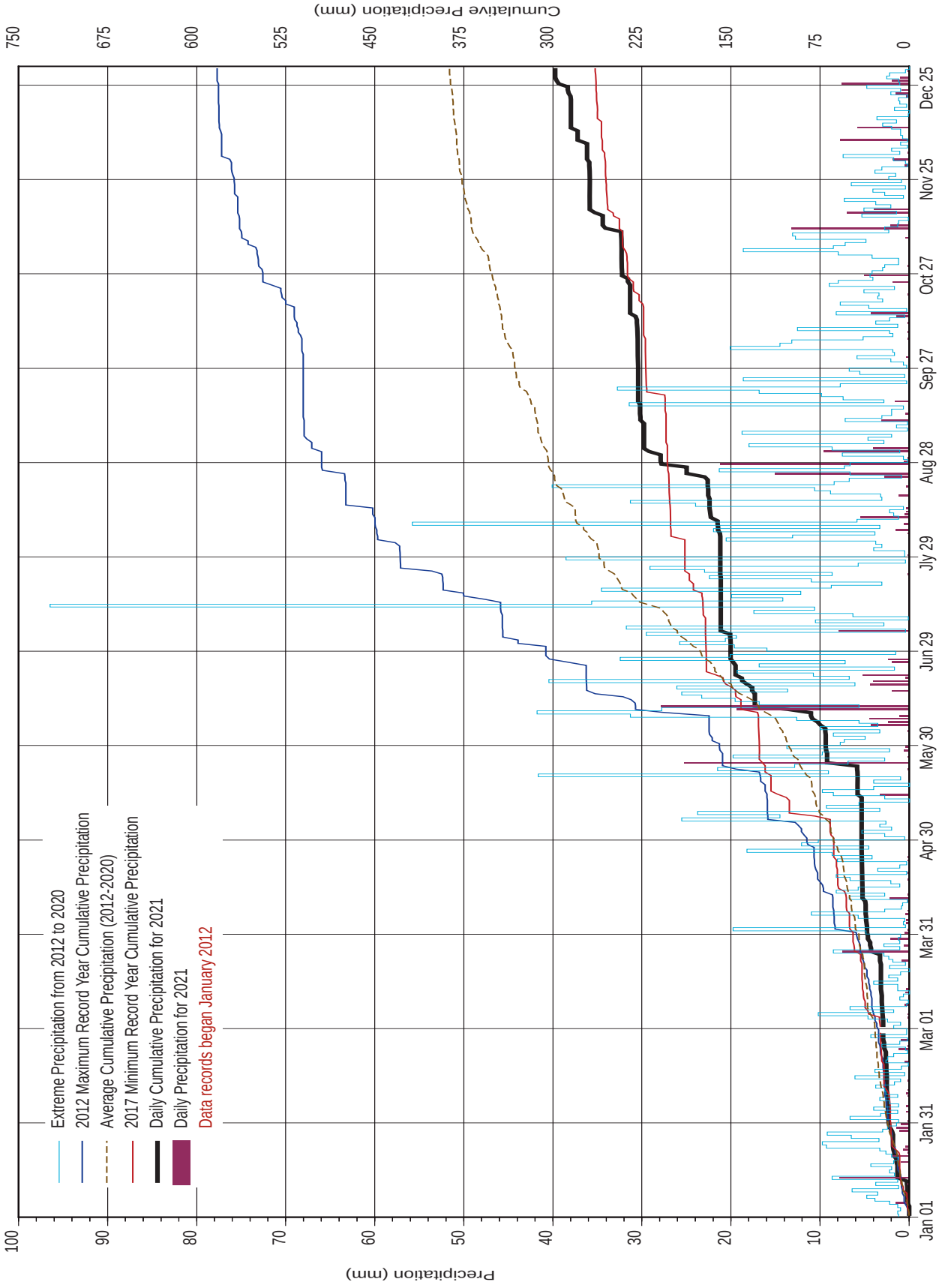
MONTH	PE (mm) 2021	PE (mm) 2012 Wettest Year	PE (mm) 2017 Driest Year	PE (mm) 2015 Hottest Year
Jan				
Feb				
Mar				
Apr		24.0	19.0	27.6
May	70.9	73.0	76.9	73.6
June	128.5	113.6	108.2	120.4
July	143.0	141.7	130.2	135.6
Aug	110.0	114.4	108.5	114.4
Sept	74.7	71.5	66.7	66.7
Oct	24.5	6.8	20.2	33.1
Nov				
Dec				
Total	551.7	545.0	529.7	571.4



[1]*Thornthwaite and Mather 1955*
Thornthwaite 1948



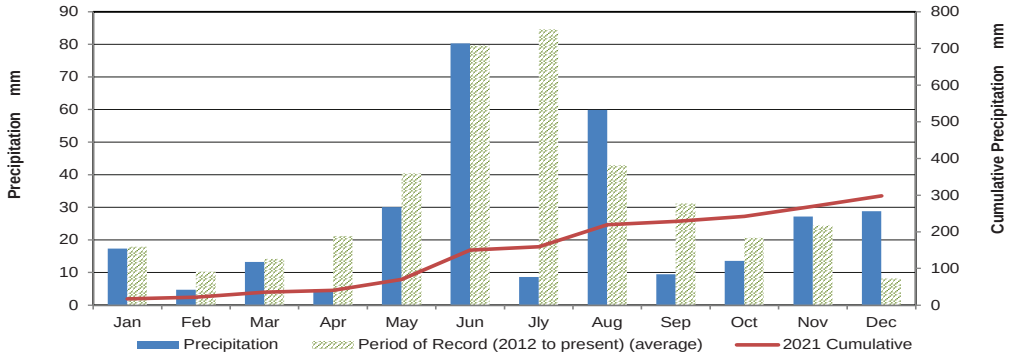
DAILY PRECIPITATION



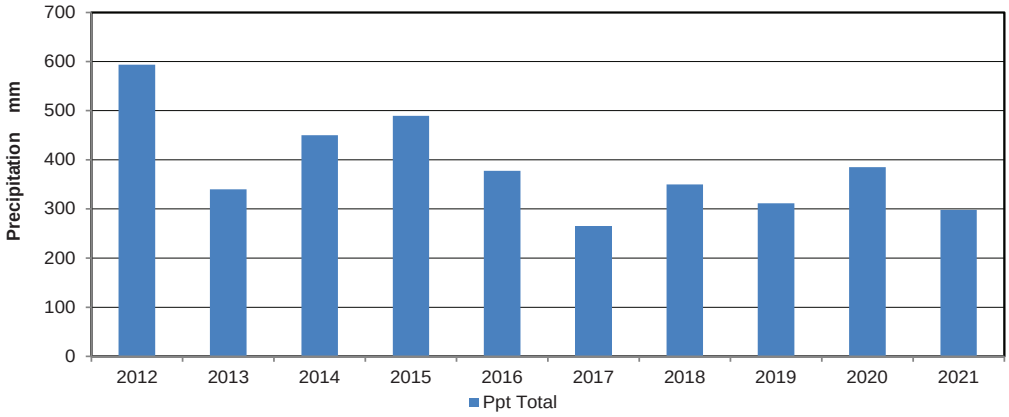
PRECIPITATION

MONTH	MONTHLY PRECIPITATION (mm)		EXTREME VALUES (mm) (2012-2021)			
	2021	Cumulative 2021	Monthly Maximum		Monthly Minimum	
			Year	Amount	Year	Amount
January	17.4	17.4	2013	26	2014	8.9
February	4.7	22.1	2015	18.3	2018	4.7
March	13.3	35.4	2018	25.7	2019	2.5
April	4.8	40.2	2014	52.5	2016	4.6
May	30.1	70.3	2012	85.4	2013	6.8
June	80.3	150.6	2012	140.4	2017	44.9
July	8.6	159.2	2015	176.6	2017	17.6
August	59.9	219.1	2016	79.5	2013	5.8
September	9.5	228.6	2019	66.3	2014	11.0
October	13.6	242.2	2016	58.2	2013	5.6
November	27.2	269.4	2013	34.6	2016	11.7
December	28.8	298.2	2013	15.1	2015	2.4
Total	298.2		2012	593.5	2017	264.4

Monthly



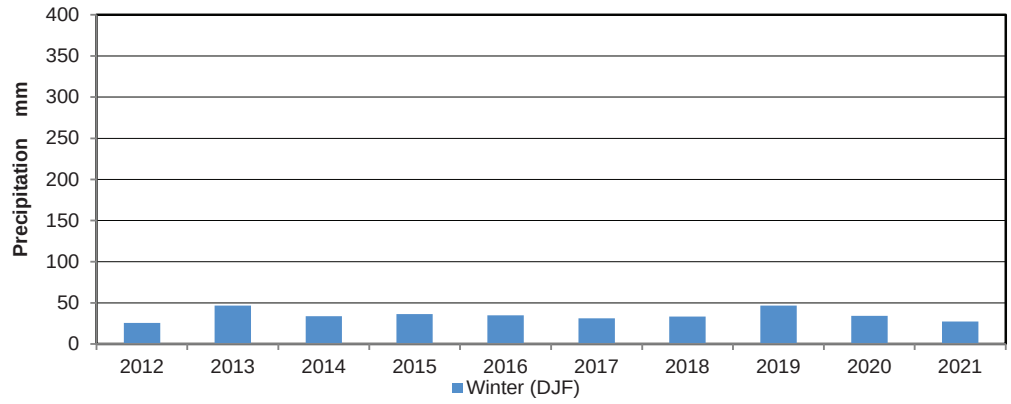
Annual



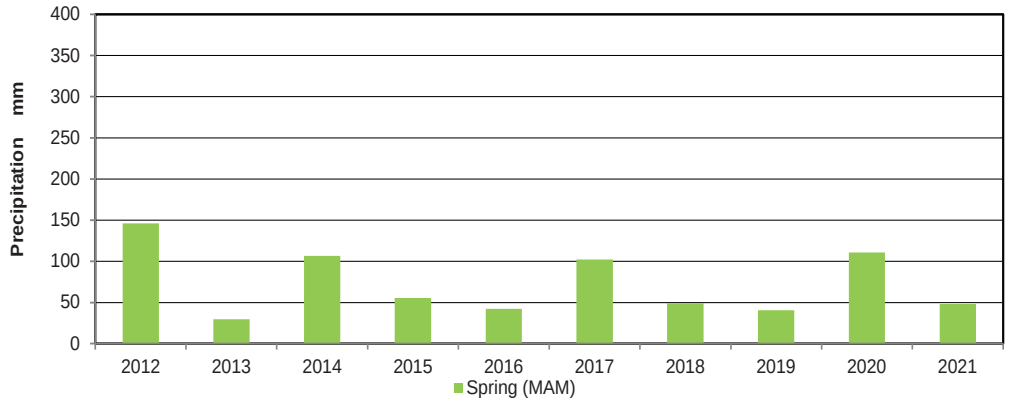
PRECIPITATION

SEASONAL PRECIPITATION (mm)

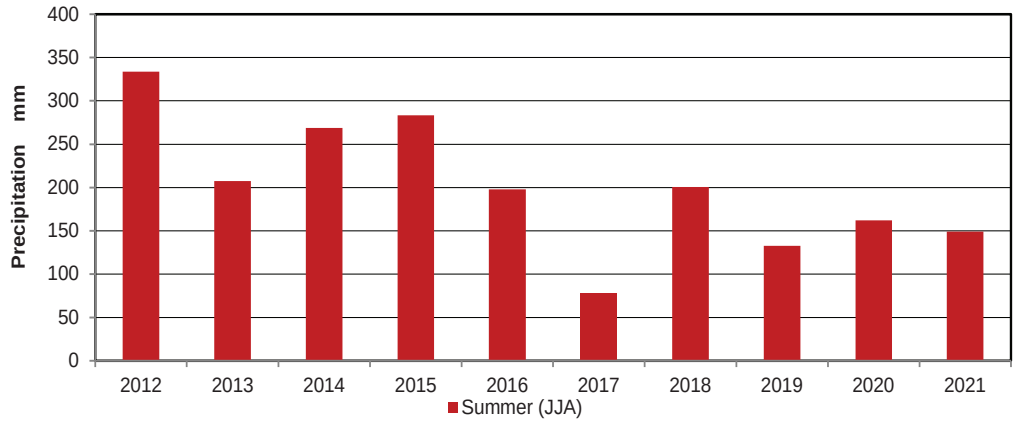
Winter



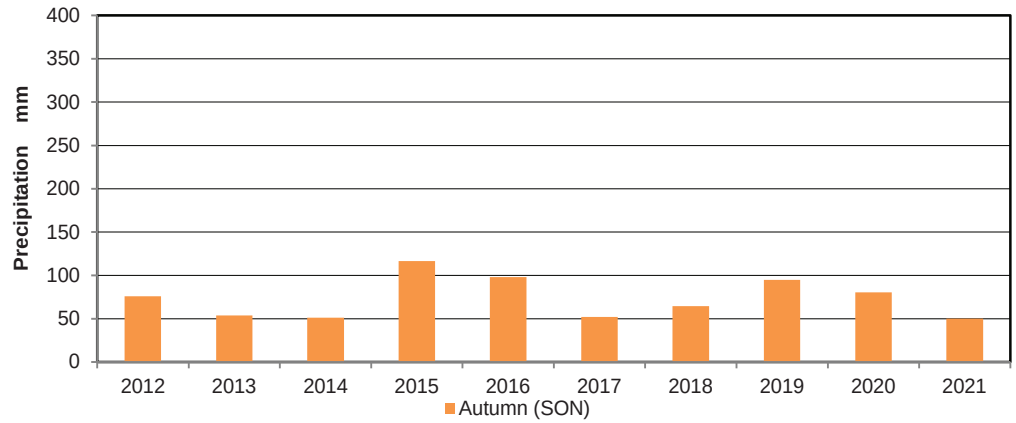
Spring



Summer



Autumn

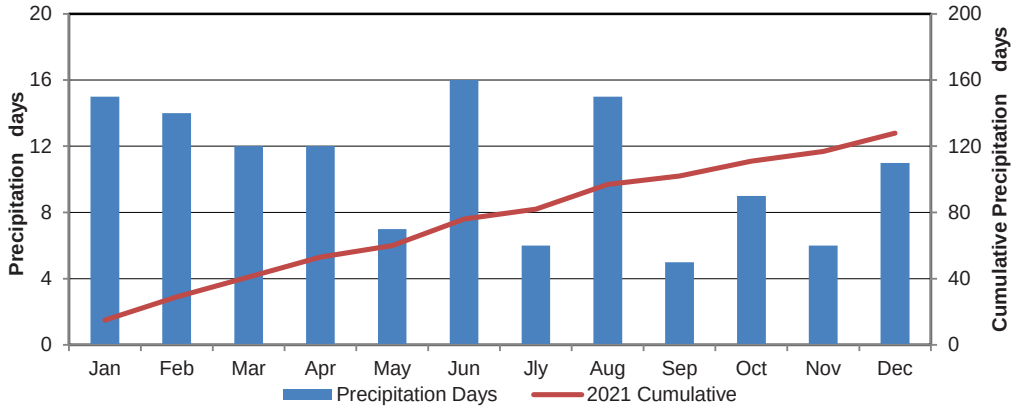


PRECIPITATION

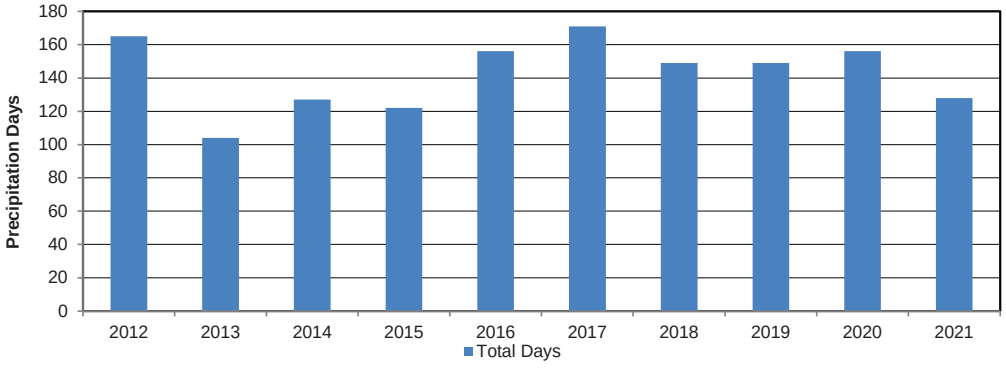
PRECIPITATION DAYS

MONTH	NUMBER OF DAYS WITH MEASURABLE PRECIPITATION		EXTREME VALUES (2012-2020)			
	2021	CUMULATIVE 2021	Monthly Maximum		Monthly Minimum	
			Year	Days	Year	Days
January	15	15	2020	21	2014	8
February	14	29	2016	18	2014	6
March	12	41	2012	19	2019	2
April	12	53	2012	17	2013	4
May	7	60	2012	13	2013	4
June	16	76	2020	19	2018	12
July	6	82	2016	19	2014	10
August	15	97	2016	15	2013	5
September	5	102	2018	18	2012	5
October	9	111	2016	18	2013	4
November	6	117	2014	21	2015	10
December	11	128	2016	17	2015	6
Total	128		2017	171	2013	104

Monthly Days



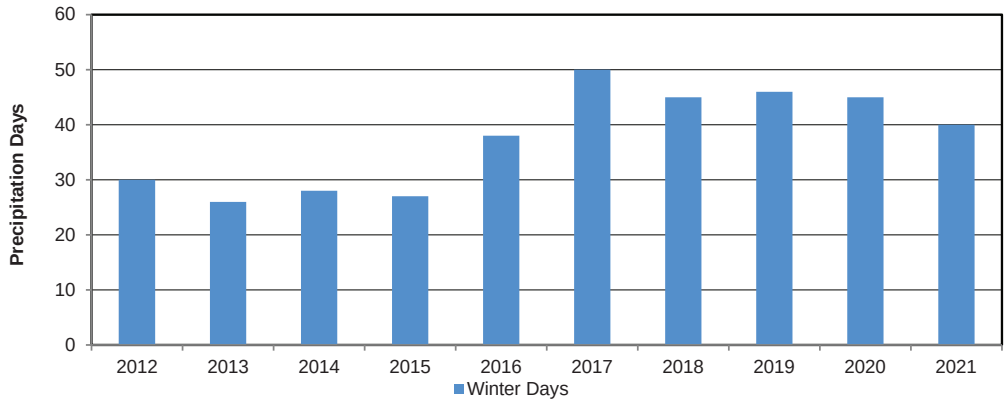
Annual Days



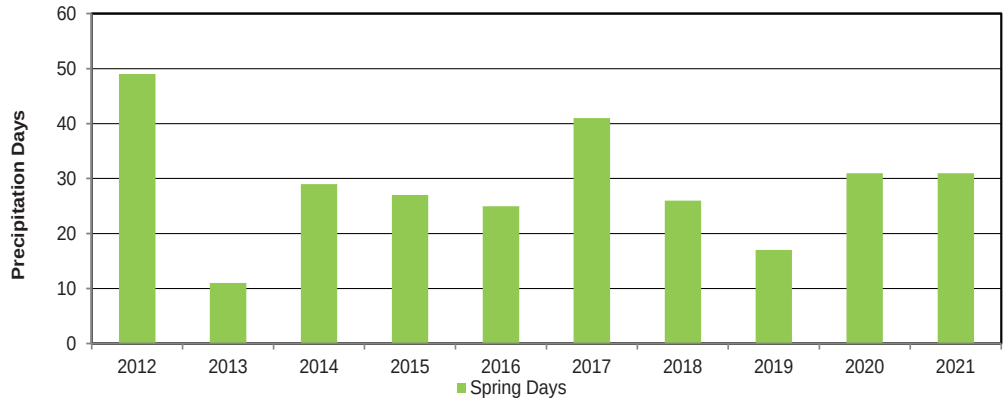
PRECIPITATION

SEASONAL PRECIPITATION DAYS

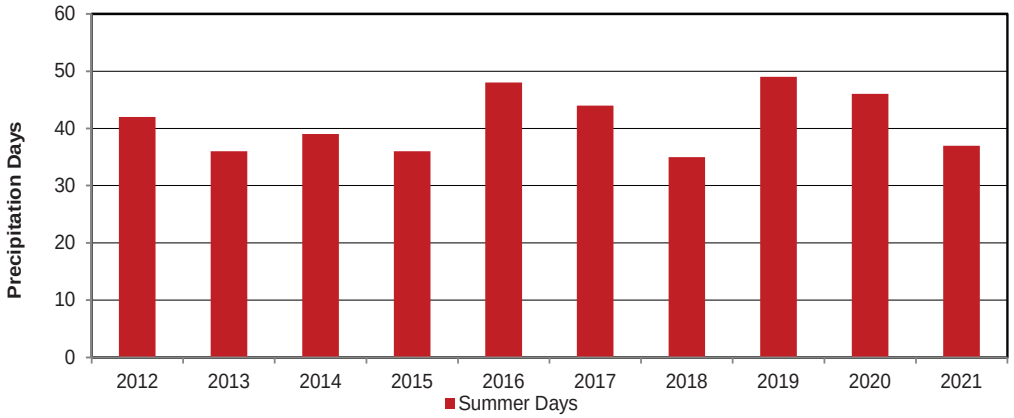
Winter Days



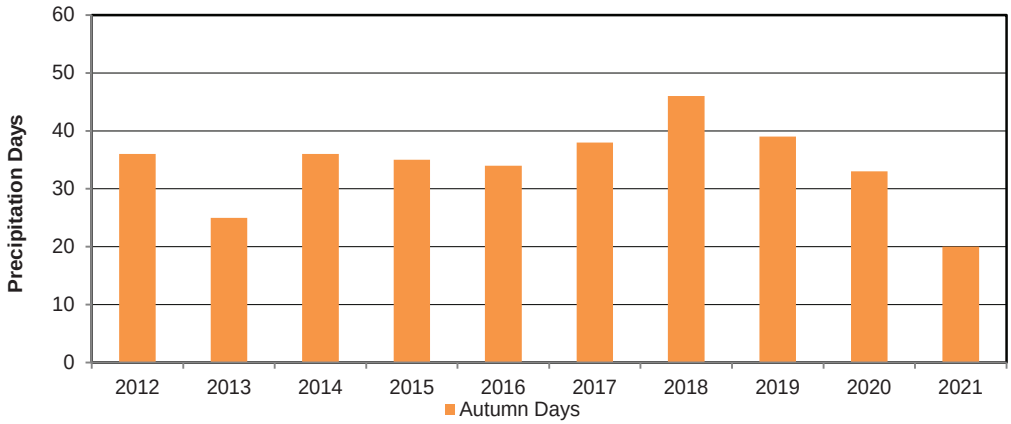
Spring Days



Summer Days



Autumn Days



PRECIPITATION

PRECIPITATION RANKINGS

RANKING BY WETTEST YEAR (mm)

ANNUAL (JAN-DEC)		WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2017	264.4	2012*	25.6	2013	29.4	2017	78.6	2021	50.3
2021	298.2	2021	27.3	2019	40.5	2019	132.6	2014	51.3
2019	311.4	2017	31.4	2016	42.2	2021	148.8	2017	52.0
2013	340.0	2018	33.5	2021	48.2	2020	162.0	2013	53.6
2018	349.5	2014	33.9	2018	49.0	2016	197.8	2018	64.4
2016	377.6	2020	34.2	2015	55.4	2018	200.6	2012	75.9
2020	385.1	2016	34.8	2017	102.1	2013	207.6	2020	80.6
2014	450.2	2015	36.4	2014	106.6	2014	268.8	2019	94.6
2015	489.5	2013	46.5	2020	110.7	2015	283.4	2016	97.9
2012	593.5	2019	46.8	2012	146.0	2012	333.8	2015	116.6

Winter 2012* missing December 2011 data

ANNUAL RANKING BY DAYS WITH PRECIPITATION

ANNUAL (JAN-DEC)		WINTER (DJF)		SPRING (MAM)		SUMMER (JJA)		AUTUMN (SON)	
2013	104	2013	26	2013	11	2015	26	2021	20
2015	122	2015	27	2019	17	2018	35	2013	25
2014	127	2014	28	2016	25	2013	36	2020	33
2021	128	2012*	30	2018	26	2021	37	2016	34
2018	149	2016	38	2015	27	2014	39	2015	35
2019	149	2021	40	2014	29	2012	42	2012	36
2016	156	2018	45	2020	31	2017	44	2014	36
2020	156	2020	45	2021	31	2020	46	2017	38
2012	165	2019	46	2017	41	2016	48	2019	41
2017	171	2017	50	2012	49	2019	49	2018	46

Winter 2012* missing December 2011 data

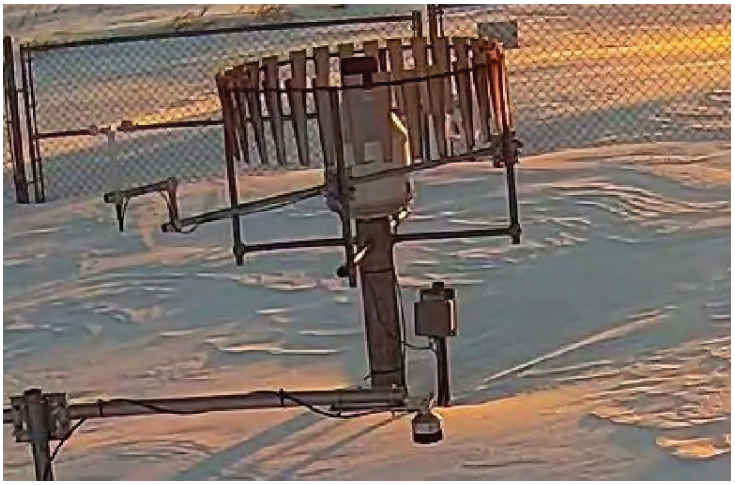
RANKING BY DRIEST MONTH

PRECIPITATION AMOUNT (mm)		PRECIPITATION DAYS	
FEBRUARY	4.7	SEPTEMBER	5
APRIL	4.8	JULY	6
JULY	8.6	NOVEMBER	6
SEPTEMBER	9.5	MAY	7
MARCH	13.3	OCTOBER	9
OCTOBER	13.6	DECEMBER	11
JANUARY	17.4	MARCH	12
NOVEMBER	27.2	APRIL	12
DECEMBER	28.8	FEBRUARY	14
MAY	30.1	JANUARY	15
AUGUST	59.9	AUGUST	15
JUNE	80.3	JUNE	16

RANKING BY

Total Number of Dry Days*		Maximum Length of Dry Spell*		Maximum Length of Wet Spell*	
2013	261	2019	25	2015	9
2015	250	2012	21	2013	8
2014	239	2016	21	2014	7
2021	236	2021	19	2020	7
2018	216	2014	17	2016	6
2019	214	2018	16	2017	6
2016	210	2013	15	2018	6
2020	208	2015	14	2019	6
2012	200	2020	13	2012	5
2017	194	2017	9	2021	4

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



All-season precipitation weighing gauge with anemometer at 2 meter height
February 2021
Photo: Camera at site

PRECIPITATION GRID (mm)

Precipitation Daily

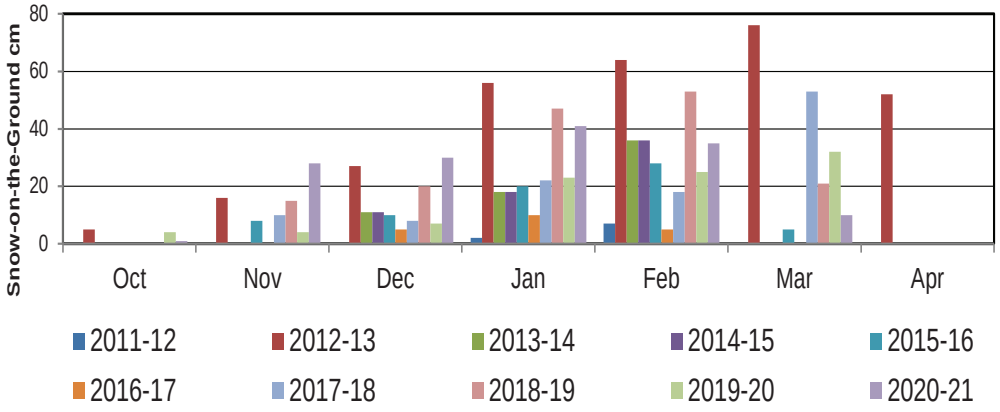
2021	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	0.1	0.0	0.0	0.2	0.0	0.1	0.0	0.0	4.1	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8
3	0.0	0.3	0.0	0.3	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
4	0.0	0.1	0.2	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2
5	1.5	0.3	0.2	0.0	0.0	4.3	7.9	0.2	0.0	0.0	0.0	0.0
6	0.0	0.0	0.1	0.4	0.0	2.4	0.0	1.5	0.0	0.2	0.0	0.0
7	0.0	0.0	0.0	0.2	0.0	4.5	0.0	0.0	0.0	0.0	0.4	0.0
8	0.0	0.2	0.5	0.0	0.0	1.1	0.0	0.6	0.0	0.2	0.0	7.7
9	0.1	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.2	0.0	0.2	0.0	19.4	0.0	5.5	3.1	0.0	13.2	0.0
11	0.2	0.1	0.0	2.2	0.0	27.9	0.0	0.5	0.0	0.2	2.1	0.0
12	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.3	0.4	0.0	0.0	5.8
13	7.8	0.2	0.3	0.0	0.0	0.0	0.0	0.3	0.0	1.4	0.0	0.0
14	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	4.3	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0
16	0.0	0.1	0.0	0.0	0.0	1.9	0.0	0.0	1.6	0.0	4.0	0.0
17	0.1	0.0	0.0	0.2	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0
18	0.9	0.1	0.0	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.5	0.0	0.2	0.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0
20	1.8	0.0	0.0	0.0	0.0	0.4	0.0	0.3	0.0	0.2	0.0	0.0
21	0.2	0.0	0.0	0.0	0.0	5.2	0.1	0.0	0.0	0.0	0.0	0.0
22	0.7	0.0	0.8	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3
23	0.4	1.2	0.0	0.2	0.1	0.0	0.2	2.8	0.0	0.0	0.0	1.5
24	0.0	0.2	0.0	0.2	25.3	0.0	0.0	15.1	0.0	1.8	0.0	0.8
25	0.0	0.0	7.5	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.9	0.0	0.0	0.2	2.4	0.0	0.0	0.0	5.1	0.0	7.6
27	0.0	0.0	0.6	0.0	0.0	0.0	0.0	21.2	0.0	0.0	0.0	1.9
28	1.1	0.0	0.0	0.0	0.6	0.1	0.0	0.6	0.0	0.0	0.0	1.0
29	1.4		2.1	0.0	0.4	0.0	0.2	0.2	0.0	0.2	0.0	0.0
30	0.9		0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.5	0.2
31	0.2		0.5	0.0	0.0	0.0	0.0	9.6		0.0		0.0
TOTAL	17.4	4.7	14.9	4.8	30.1	80.3	8.6	59.9	9.5	13.6	27.2	28.8

2021 EXTREME PRECIPITATION EVENTS

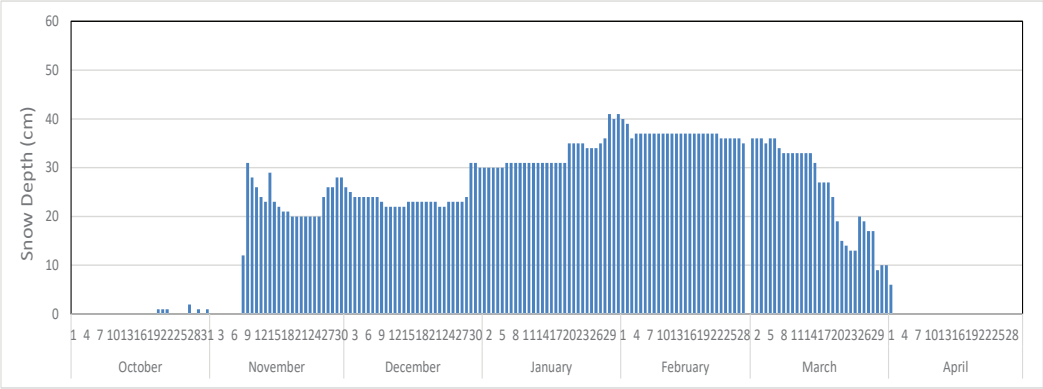
PERIOD	DATE (time)	AMOUNT (mm)
0.5 hour*	6/10/2021 21:00-21:30	10.6
	5/24/2021 07:00-07:30	6.4
1 hour*	6/10/2021 21:00-22:00	12.8
	5/24/2021 06:30-07:30	8.8
2 hours*	6/10/2021 21:00-23:00	14.8
	6/11/2021 06:30-08:30	12.8
6 hours*	6/11/2021 06:00-12:00	26.2
	5/24/2021 03:00 - 15/24/2021 09:00	20.8
12 hours*	6/10/2021 21:00 - 6/11/2021 09:00	29.0
	5/24/2021 03:00 - 15/24/2021 15:00	21.8
24 hours*	6/10/2021 15:00 - 6/11/2021 15:00	45.8
	5/23/2021 23:00 - 15/24/2021 23:00	26.0
Calendar Day	June 11 2021	28.6
	May 24 2021	26.0
Greatest amount over more than one day	June 10 to 11 2021	47.3
Longest wet spells	Jan 20 to 23 2021 (3.1mm)	4 days
	Jan 28 to 31 2021 (3.6 mm)	
	Feb 8 to Feb 11 2021 (0.8 mm)	
	June 5 to 8 2021 (12.3 mm)	
	June 18 to 21 2021 (14.1mm)	
	Aug 10 to 13 2021 (6.6 mm)	
Longest dry spells	Apr 25 to May 13 2021	19 days
	July 6 to 20 2021	15 days

*recorded by the tipping bucket gauge

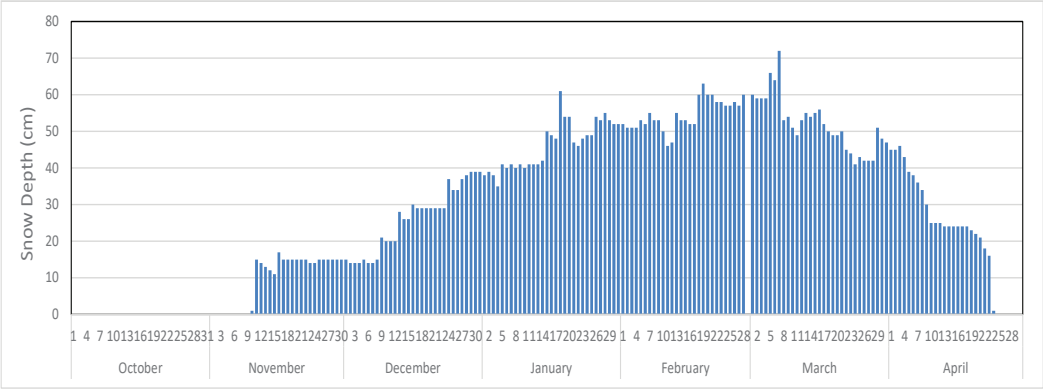
SNOW-ON-THE-GROUND (SOG)



Snow-on-the-Ground (cm)
on Last Day of Month
(2011 to present)



Snow-on-the-Ground (cm)
October 2020 to April 2021
Daily, 9am



Snow-on-the-Ground (cm)
October 2021 to April 2022
Daily, 9am

Snow Depth Sensor
24 March 2021
Photo: Camera at site

RADIATION

Sunrise/Sunset Tables for Conservation Learning Centre, 2021 & 2022[1]

2021	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	9:16	16:58	8:46	17:48	7:49	18:42	6:36	19:39	5:29	20:32	4:43	21:20	4:42	21:32	5:21	20:56	6:14	19:51	7:05	18:39	8:02	17:31	8:54	16:50
2	9:16	16:59	8:44	17:50	7:47	18:44	6:33	19:41	5:27	20:34	4:42	21:21	4:43	21:31	5:23	20:55	6:15	19:49	7:07	18:37	8:03	17:29	8:56	16:49
3	9:16	17:00	8:42	17:52	7:45	18:46	6:31	19:42	5:25	20:36	4:42	21:22	4:43	21:31	5:25	20:53	6:17	19:46	7:09	18:34	8:05	17:27	8:57	16:49
4	9:16	17:01	8:40	17:54	7:42	18:48	6:29	19:44	5:23	20:38	4:41	21:23	4:44	21:30	5:26	20:51	6:19	19:44	7:10	18:32	8:07	17:25	8:59	16:48
5	9:15	17:02	8:39	17:56	7:40	18:50	6:26	19:46	5:21	20:39	4:40	21:24	4:45	21:30	5:28	20:49	6:20	19:42	7:12	18:30	8:09	17:24	9:00	16:48
6	9:15	17:04	8:37	17:58	7:38	18:52	6:24	19:48	5:20	20:41	4:40	21:25	4:46	21:29	5:30	20:47	6:22	19:39	7:14	18:27	8:11	17:22	9:01	16:47
7	9:14	17:05	8:35	18:00	7:35	18:54	6:22	19:50	5:18	20:43	4:39	21:26	4:47	21:29	5:31	20:45	6:24	19:37	7:16	18:25	8:13	17:20	9:02	16:47
8	9:14	17:07	8:33	18:02	7:33	18:55	6:19	19:51	5:16	20:44	4:39	21:26	4:48	21:28	5:33	20:43	6:26	19:34	7:17	18:23	8:15	17:18	9:04	16:47
9	9:13	17:08	8:31	18:04	7:31	18:57	6:17	19:53	5:14	20:46	4:38	21:27	4:49	21:27	5:35	20:41	6:27	19:32	7:19	18:20	8:17	17:17	9:05	16:46
10	9:12	17:09	8:29	18:06	7:28	18:59	6:15	19:55	5:12	20:48	4:38	21:28	4:50	21:26	5:36	20:39	6:29	19:30	7:21	18:18	8:18	17:15	9:06	16:46
11	9:12	17:11	8:27	18:08	7:26	19:01	6:12	19:57	5:11	20:49	4:37	21:29	4:51	21:25	5:38	20:37	6:31	19:27	7:23	18:16	8:20	17:13	9:07	16:46
12	9:11	17:13	8:25	18:10	7:24	19:03	6:10	19:59	5:09	20:51	4:37	21:29	4:53	21:24	5:40	20:35	6:32	19:25	7:25	18:13	8:22	17:12	9:08	16:46
13	9:10	17:14	8:24	18:12	7:21	19:05	6:08	20:00	5:07	20:53	4:37	21:30	4:54	21:23	5:41	20:33	6:34	19:22	7:26	18:11	8:24	17:10	9:09	16:46
14	9:09	17:16	8:21	18:14	7:19	19:06	6:06	20:02	5:06	20:54	4:37	21:31	4:55	21:22	5:43	20:31	6:36	19:20	7:28	18:09	8:26	17:09	9:10	16:46
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18	9:05	17:23	8:13	18:21	7:09	19:14	5:57	20:09	5:00	21:01	4:36	21:32	5:00	21:18	5:50	20:23	6:43	19:10	7:36	18:00	8:33	17:03	9:13	16:47
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31	8:47	17:46			6:38	19:37			4:44	21:18			5:20	20:58	6:12	19:53			8:00	17:33			9:17	16:56

2022	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	9:16	16:57	8:46	17:48	7:50	18:42	6:36	19:38	5:30	20:32	4:43	21:19	4:42	21:32	5:21	20:57	6:13	19:52	7:05	18:40	8:01	17:31	8:54	16:50
2	9:16	16:58	8:44	17:50	7:47	18:44	6:34	19:40	5:28	20:34	4:43	21:20	4:42	21:32	5:23	20:55	6:15	19:49	7:06	18:37	8:03	17:30	8:55	16:50
3	9:16	17:00	8:43	17:52	7:45	18:46	6:32	19:42	5:26	20:35	4:42	21:22	4:43	21:31	5:24	20:53	6:17	19:47	7:08	18:35	8:05	17:28	8:57	16:49
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31	8:48	17:46			6:39	19:37			4:44	21:18			5:19	20:59	6:12	19:54			7:59	17:33			9:17	16:56

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

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

Bright Sunshine (left) Global (middle) and Diffuse Radiation (right)
April 2021
Photo:Camera at site

RADIATION

MONTH	BRIGHT SUNSHINE (HOURS)				BRIGHT SUNSHINE DAYS				
	2021	POSSIBLE SUNSHINE*	% OF POSSIBLE	2021 CUMULATIVE HOURS	2021 NUMBER OF DAYS	2021 CUMULATIVE DAYS	2021 WITH 1 OR MORE HOURS	2021 WITH 5 OR MORE HOURS	2021 WITH 10 OR MORE HOURS
JAN	102.2	255.62	40.0	102.2	26	26	22	11	0
FEB	199.9	277.58	72.0	302.1	28	54	28	21	0
MAR	248.3	369.9	67.1	550.4	30	84	27	26	12
APR	300.7	421.08	71.4	851.1	29	113	29	28	19
MAY	333.0	492.26	67.6	1184.1	30	143	30	28	20
JUNE	319.3	505.47	63.2	1503.4	30	173	29	27	19
JULY	342.3	506.06	67.6	1845.7	30	203	29	27	21
AUG	204.2	454.51	44.9	2049.9	28	231	26	17	11
SEP	258.5	378.96	68.2	2308.4	30	261	30	27	9
OCT	196.4	326.99	60.1	2504.8	27	288	23	21	4
NOV	99.2	260	38.2	2604.0	24	312	20	10	0
DEC	90.7	237.41	38.2	2694.7	21	333	18	10	0
TOTAL	2694.7	4485.8	60.1		333.0		311	253	115

** National Research Council, Canada, Hertzberg Institue of Astrophysics*

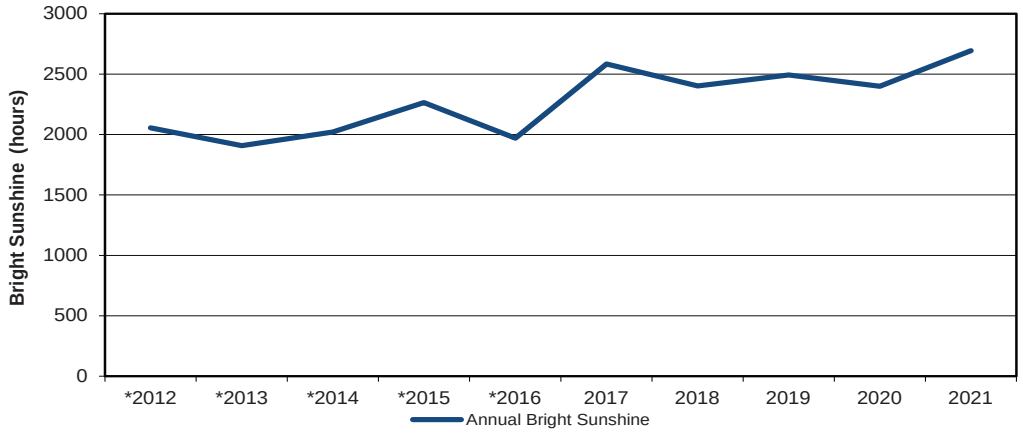
Global and Diffuse Radiation (MJ/m^2)

DATE	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse	Global	Diffuse
1	4.3	1.3	6.0	3.2	9.2	6.6	17.7	5.4	15.6	8.6	35.3	11.6	29.0	4.5	21.2	7.8	10.4	5.4	12.7	2.0	6.5	2.3	2.1	2.0
2	3.5	1.5	4.9	3.2	10.2	5.7	18.7	3.4	12.3	6.2	36.9	13.5	27.7	4.4	18.6	10.4	8.8	6.7	12.4	2.9	8.1	1.9	2.3	1.8
3	3.0	1.5	5.0	3.6	13.3	3.6	19.1	3.2	25.1	3.0	41.1	9.3	22.0	9.8	4.5	4.1	10.8	7.4	12.1	3.1	8.1	1.2	4.0	0.9
4	3.7	0.8	6.2	3.3	13.5	3.7	10.1	8.1	27.9	3.5	41.0	10.5	25.8	7.9	8.1	7.0	16.2	6.4	11.2	3.5	6.7	1.3	4.5	1.1
5	1.6	1.5	7.9	1.5	7.5	6.6	18.4	3.5	25.5	5.3	28.8	14.4	14.8	10.7	20.6	8.4	12.3	8.0	8.0	4.8	5.8	2.0	4.5	1.2
6	3.2	2.4	9.0	1.6	11.4	4.4	18.3	4.1	27.3	3.5	23.7	15.5	18.7	13.6	18.5	9.9	12.8	4.8	6.2	5.1	2.0	1.7	4.6	1.6
7	5.0	1.4	9.6	1.8	13.7	2.0	19.4	4.2	26.2	5.8	30.3	8.6	22.2	10.7	9.5	7.9	18.8	2.7	11.4	2.3	5.5	1.5	3.1	1.7
8	4.9	1.2	7.9	3.9	15.8	2.5	16.6	5.5	26.8	8.6	33.9	10.7	25.6	6.6	16.6	9.9	17.8	2.1	11.5	2.6	4.0	2.7	1.5	1.5
9	4.5	1.3	6.9	3.6	12.4	4.1	21.4	2.7	27.9	3.8	24.0	17.9	27.0	6.2	9.9	7.7	15.8	5.2	11.4	2.6	6.4	2.0	3.4	0.9
10	3.0	1.8	8.5	2.3	4.6	4.2	20.1	3.6	25.7	6.5	17.4	10.1	25.1	8.3	15.7	5.9	16.5	3.7	8.1	5.7	1.9	1.8	2.4	1.9
11	2.8	1.9	9.5	2.2	15.1	2.6	5.6	5.0	23.9	7.8	9.2	8.1	16.9	8.3	18.8	5.9	14.0	4.9	3.0	2.9	3.7	3.6	3.7	1.1
12	4.8	1.0	9.7	2.8	12.9	6.3	19.2	8.6	21.4	8.2	40.4	10.7	26.1	8.2	22.9	4.7	15.2	6.1	11.0	1.4	3.3	3.2	0.9	0.8
13	1.9	1.8	10.6	1.9	15.3	2.6	18.5	7.8	24.4	7.1	45.9	5.1	23.2	9.5	23.8	3.1	15.7	3.1	3.9	3.5	3.5	3.3	0.9	0.9
14	1.9	1.8	10.3	1.9	15.1	2.7	20.2	4.2	16.1	8.7	44.9	5.4	25.1	9.0	19.1	7.7	16.6	3.8	4.9	4.6	3.2	3.1	1.0	1.0
15	2.1	2.0	10.5	1.9	14.4	3.0	22.1	2.9	20.1	8.2	43.2	6.2	24.8	8.5	19.7	6.1	12.0	6.5	10.5	1.5	3.0	2.7	2.4	2.0
16	3.7	1.7	10.5	2.5	16.3	2.9	21.2	3.8	18.5	10.1	36.2	11.7	22.6	10.0	7.1	5.7	9.6	6.0	9.9	1.7	1.1	1.0	3.0	2.0
17	3.7	2.8	10.8	2.2	16.7	2.7	18.8	6.3	25.3	7.7	22.4	13.8	20.7	10.7	5.5	4.9	13.9	4.7	9.3	2.6	3.1	3.0	3.8	1.3
18	2.2	2.1	10.7	2.1	15.3	3.9	23.2	3.3	22.7	8.4	25.2	15.3	13.9	11.1	16.1	10.0	13.0	5.9	9.6	1.6	3.8	3.3	3.3	2.0
19	3.0	2.6	10.4	3.2	15.3	4.0	14.0	9.6	22.8	12.5	26.4	15.3	6.6	5.9	11.2	9.5	12.7	4.3	10.7	1.5	6.0	1.5	3.3	1.4
20	3.7	2.5	10.6	3.4	13.6	3.6	23.0	5.1	16.3	12.8	32.6	16.1	10.9	9.6	8.0	6.7	12.6	3.5	10.4	1.5	3.6	2.5	1.6	1.6
21	3.3	3.0	6.9	6.1	17.3	2.4	23.8	3.5	15.9	9.3	33.2	9.0	19.6	10.2	22.5	4.1	14.6	4.4	10.3	2.1	3.1	2.5	2.0	2.0
22	3.8	3.1	10.2	2.8	12.7	7.4	17.7	8.1	21.4	10.2	37.5	11.9	24.1	7.3	6.0	5.5	12.6	4.2	10.4	1.6	2.6	2.4	2.0	1.9
23	4.7	2.1	12.0	5.0	11.4	8.7	17.5	6.4	23.7	11.0	37.7	11.6	26.7	5.5	7.1	6.1	13.8	2.8	7.9	2.3	4.3	1.7	1.8	1.7
24	7.1	1.1	10.4	3.0	14.8	6.3	22.7	7.0	7.1	6.3	37.8	14.6	26.8	4.9	5.7	5.0	13.7	5.0	2.1	2.0	3.3	2.8	3.5	1.0
25	7.9	1.2	7.0	6.1	10.2	9.2	18.3	9.3	15.4	9.8	26.3	17.4	19.8	10.0	17.7	7.9	8.7	5.8	3.5	3.2	3.3	2.7	2.9	2.2
26	6.7	3.0	8.7	5.8	16.9	8.9	19.8	6.9	30.8	5.3	40.2	7.2	22.2	9.0	17.7	8.1	9.8	5.1	1.8	1.8	3.3	2.8	1.6	1.5
27	7.4	1.7	9.5	5.0	17.1	4.4	22.6	7.0	29.7	4.9	42.9	8.7	19.6	10.3	2.6	2.4	13.3	2.1	2.4	2.3	4.4	0.9	2.6	2.3
28	4.1	3.8	10.6	4.8	16.5	6.0	15.0	9.7	20.8	7.6	42.3	8.1	26.3	4.0	10.2	8.0	9.4	3.3	7.8	1.2	2.2	2.2	2.1	2.1
29	4.7	4.2	0.0	0.0	3.9	3.5	26.2	3.5	29.5	4.5	41.7	8.4	20.6	9.5	19.1	5.8	12.5	2.4	4.7	3.2	5.0	1.0	4.4	1.3
30	3.8	3.5			19.0	7.1	20.3	5.4	30.5	3.5	42.5	5.2	25.8	4.9	19.1	4.0	13.3	2.6	6.2	2.0	2.9	1.7	3.4	1.8
31	3.5	3.3			18.5	4.6			22.5	13.3			24.5	4.8	8.1	4.7			9.1	4.7			5.5	3.0
TOTAL	123.5	64.9	250.8	90.7	419.9	146.2	569.5	167.1	699.1	232.0	1020.3	331.3	684.7	253.9	431.2	204.9	397.2	138.9	254.4	83.8	123.7	66.3	88.1	49.5

RADIATION

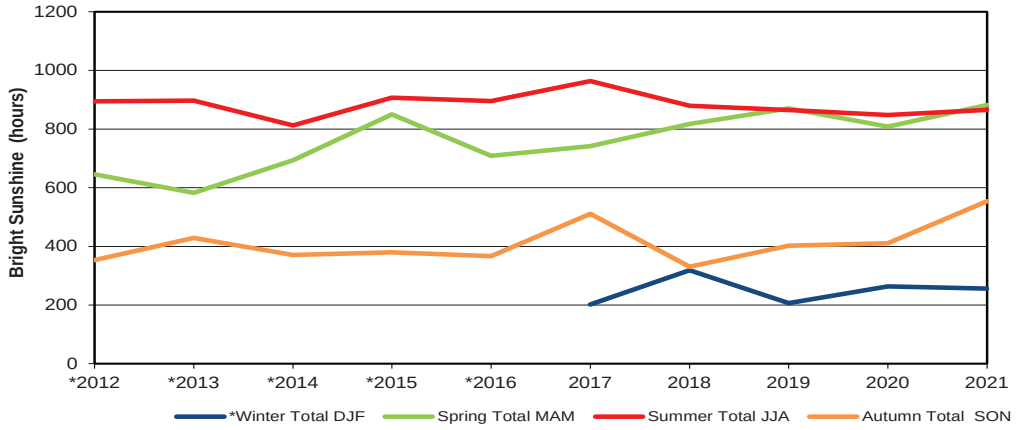
Annual Bright Sunshine Hours

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

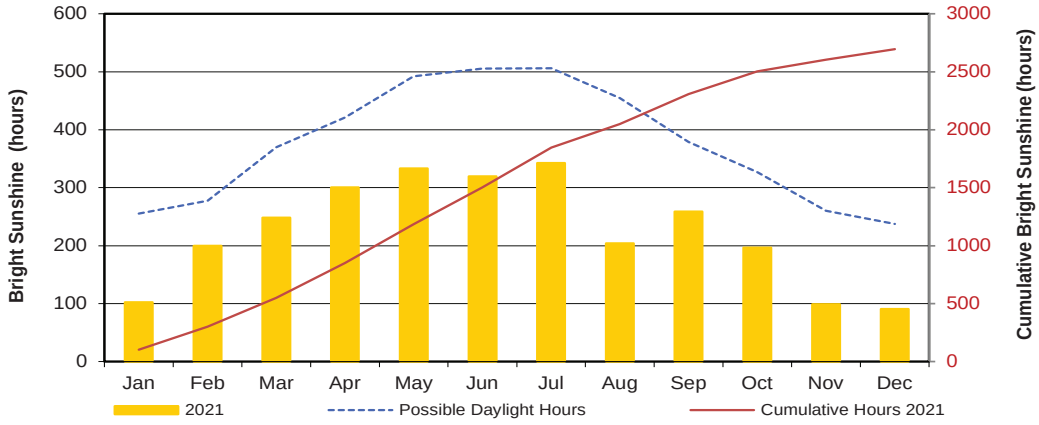


Seasonal Bright Sunshine Hours

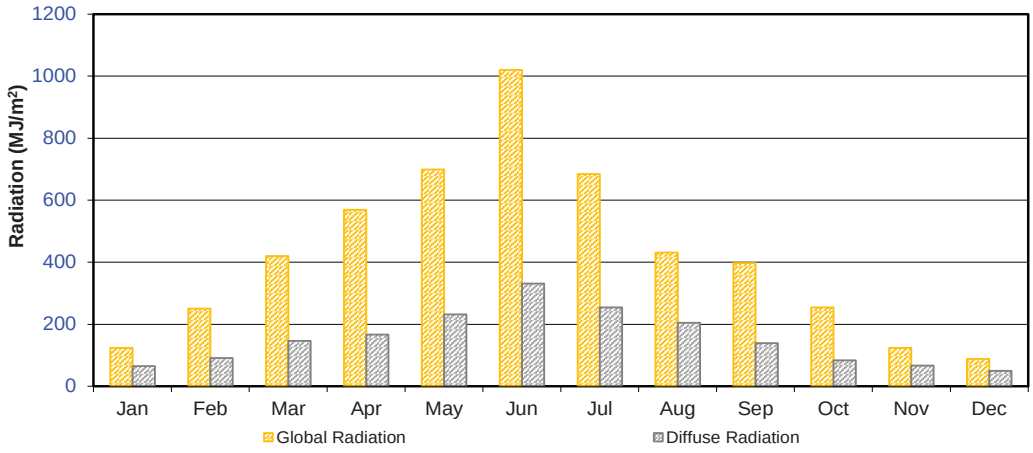
Note: Winter bright sunshine is low for the 2012 to 2016 period due to instrument misalignment



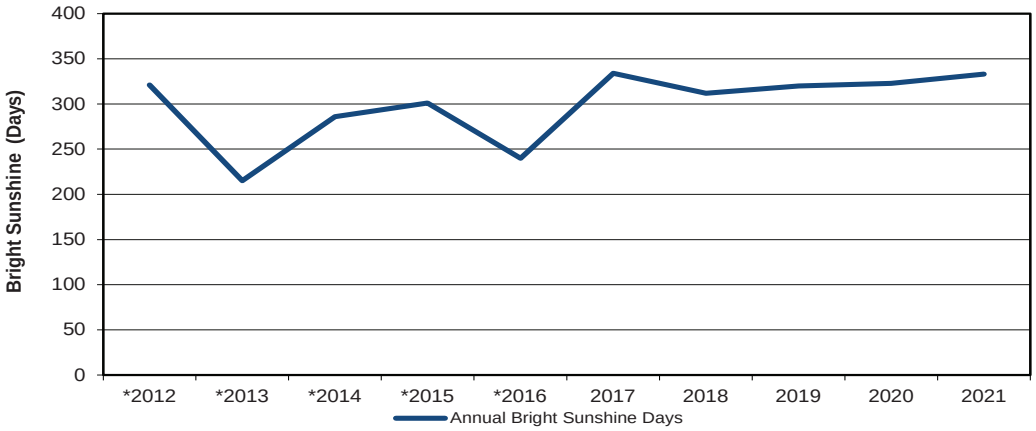
Monthly Bright Sunshine Hours



Global & Diffuse Radiation

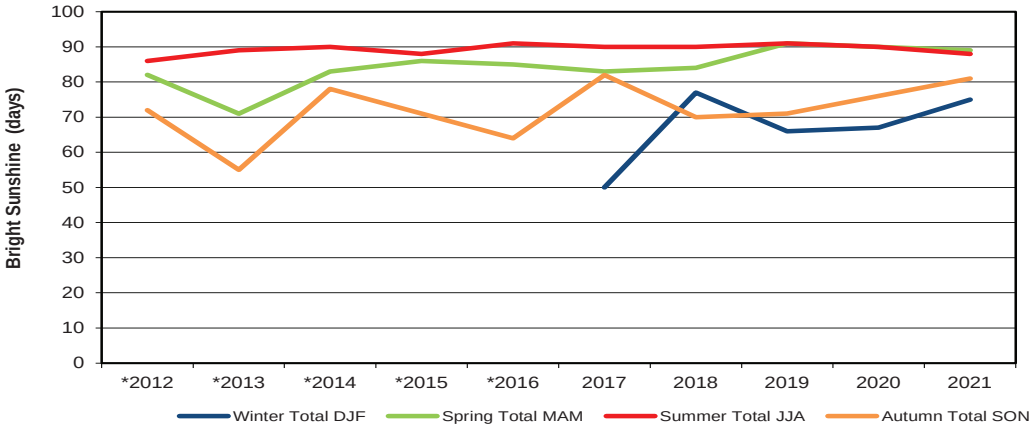


RADIATION



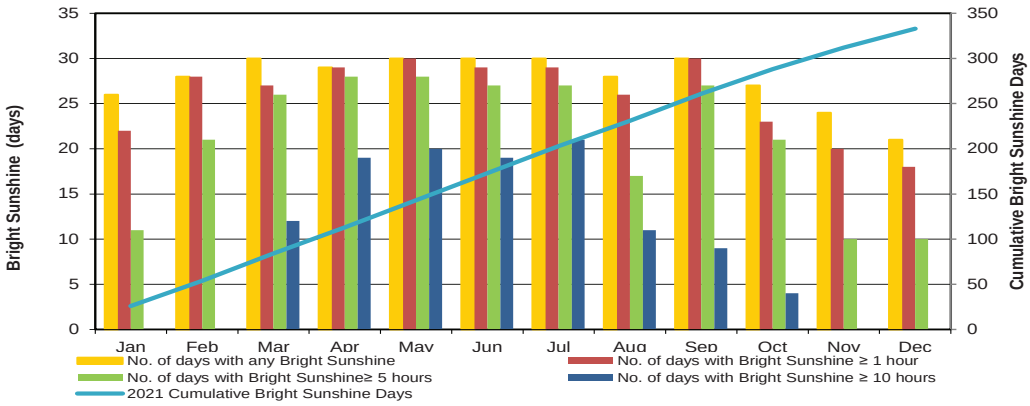
Annual Bright Sunshine Days

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



Seasonal Bright Sunshine Days

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



Monthly Bright Sunshine Days

Bright Sunshine Ranking

% OF ACTUAL TO POSSIBLE HOURS BRIGHT SUNSHINE

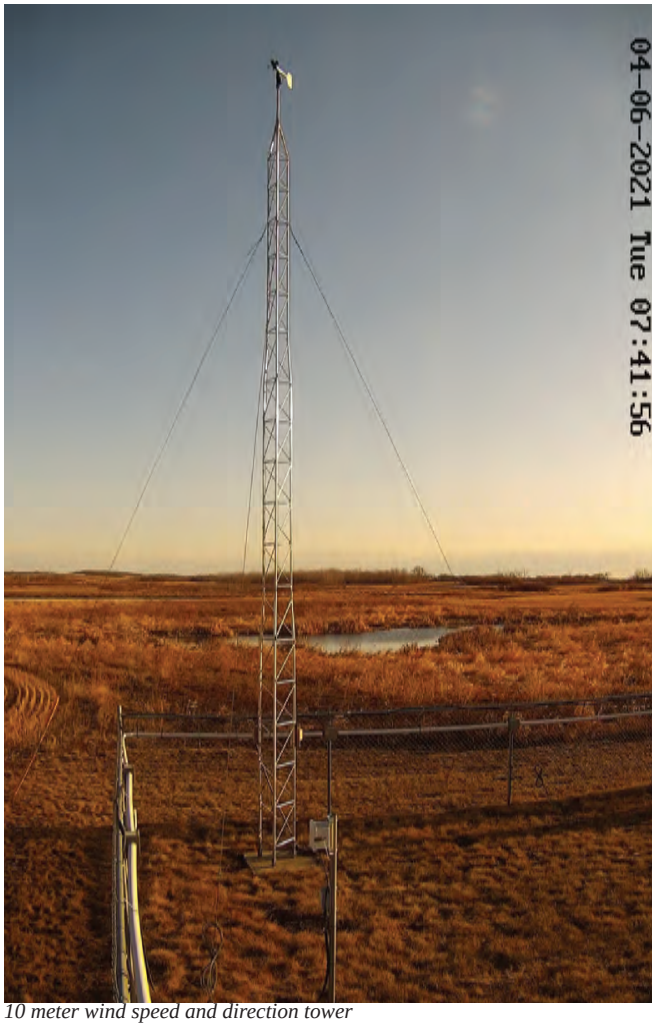
ANNUAL		WINTER DJF		SPRING MAM		SUMMER JJA		AUTUMN SON	
2021	60.1	2018	41.4	2021	68.7	2017	65.7	2021	57.4
2017	57.6	2020	34.4	2019	68.0	2015	62.3	2017	52.9
2015	55.4	2021	33.2	2015	66.7	2013	61.2	2015	47.6
2019	55.3	2019	26.9	2018	63.7	2016	61.1	2013	44.4
2020	53.5	2017	26.2	2020	62.9	2012	61.0	2014	43.0
2018	53.5	2012	IF	2017	57.8	2018	60.0	2020	42.6
2012	47.9	2013	IF	2016	55.2	2021	59.1	2019	41.5
2014	46.6	2014	IF	2014	54.0	2019	58.9	2012	39.7
2016	43.9	2015	IF	2012	50.2	2020	57.9	2016	38.0
2013	42.5	2016	IF	2013	45.4	2014	55.3	2018	34.2

DAYS WITH BRIGHT SUNSHINE

ANNUAL		WINTER DJF		SPRING MAM		SUMMER JJA		AUTUMN SON	
2017	334	2018	77	2019	91	2016	91	2017	82
2021	333	2021	75	2020	90	2019	91	2021	81
2020	323	2020	67	2021	89	2014	90	2014	78
2012	321	2019	66	2015	86	2017	90	2020	76
2019	319	2017	50	2016	85	2018	90	2012	72
2018	312	2012	IF	2018	84	2020	90	2015	71
2015	301	2013	IF	2014	83	2013	89	2019	71
2014	286	2014	IF	2017	83	2015	88	2018	70
2016	240	2015	IF	2012	82	2021	88	2016	64
2013	215	2016	IF	2013	71	2012	86	2013	55

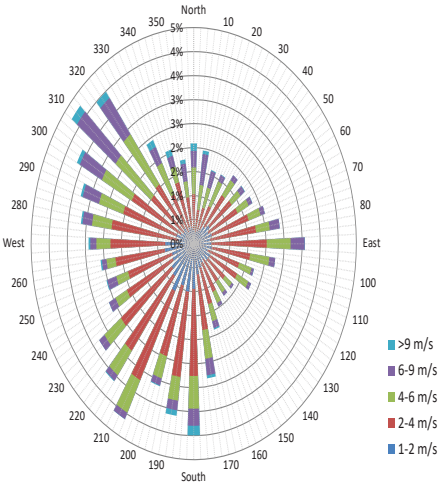
WIND

MONTH	AVERAGE WIND SPEED (km/h)		HIGHEST INSTANTANEOUS WIND SPEED (km/h)		
	2021 Average	2021 1/2 Hr. Maximum Average	2021 for CRS @ CLC (Speed / direction / date)		
January	11.0	15.4	62.5	NNW	13
February	11.9	16.2	54.9	NW	22
March	13.6	18.8	66.5	N	29
April	14.9	21.8	54.5	N	22
May	14.6	22.1	62.3	NW	29
June	12.7	19.2	58.5	W	16
July	11.7	17.7	61.4	W	23
August	9.9	15.3	65.7	NW	11
September	12.2	18.2	53.3	NW	15
October	11.6	16.8	48.4	SSE	6
November	10.8	15.3	51.4	NW	20
December	11.7	16.2	47.2	WNW	3

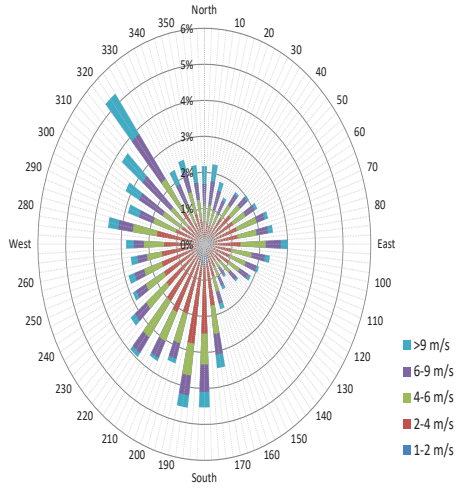


10 meter wind speed and direction tower
April 2021
Photo:Camera at site

10 minute Average Wind Speed and Direction CLC 2021



1/2 hr Maximum Wind Speed and Direction CLC 2021



Wind Speed
Daily Average (km/h)

2021	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	9.2	11.6	12.1	13.0	10.6	8.1	10.3	3.4	8.8	15.0	7.6	15.6
2	9.5	10.2	12.1	16.1	19.2	14.2	18.3	4.6	18.8	9.0	8.7	7.8
3	14.5	23.4	4.3	6.5	11.2	10.3	15.7	9.0	13.5	9.5	6.4	17.9
4	8.5	11.7	6.8	11.6	7.7	12.1	15.4	9.0	7.2	10.0	4.6	7.6
5	9.6	17.6	12.0	17.4	9.7	14.8	10.2	5.5	9.0	16.5	8.7	16.5
6	10.0	8.6	14.7	12.3	13.1	13.6	9.5	10.6	11.0	13.1	6.3	9.7
7	6.1	9.2	12.9	15.4	16.6	7.8	11.6	8.4	16.1	12.1	9.5	6.2
8	8.2	21.7	11.0	24.0	17.3	6.0	7.9	14.1	6.1	8.0	10.7	11.4
9	10.4	22.6	11.3	11.6	8.7	13.9	5.5	6.4	11.8	7.6	12.7	13.1
10	7.8	11.5	15.8	15.3	7.6	20.3	9.6	16.3	15.1	5.5	24.8	12.9
11	10.0	12.9	9.6	25.1	10.4	16.6	9.5	21.0	5.1	18.3	14.8	15.2
12	9.6	6.5	12.8	22.9	8.5	13.4	14.8	17.8	9.6	8.7	13.2	7.3
13	14.1	3.8	7.5	20.0	7.7	9.4	7.0	9.4	12.1	9.1	6.6	0.4
14	31.4	7.7	26.8	6.8	8.1	15.7	6.3	11.7	8.4	14.6	4.6	14.0
15	10.4	6.1	21.9	9.7	8.5	21.5	12.1	7.6	17.8	12.2	10.3	22.5
16	14.8	5.9	9.1	8.7	9.5	22.6	13.7	10.0	25.0	7.3	15.9	12.2
17	9.4	5.7	8.5	15.1	17.3	17.9	21.4	9.8	13.9	8.0	17.1	6.3
18	12.0	7.0	12.7	20.3	17.0	10.3	15.5	5.4	13.0	17.4	11.7	8.9
19	17.2	14.9	13.6	15.6	26.4	9.7	11.5	4.0	15.6	7.5	8.2	17.7
20	29.3	14.4	7.2	10.3	17.8	13.8	11.9	7.0	10.4	7.7	19.3	12.4
21	14.0	18.3	19.1	16.9	12.0	12.3	10.0	12.1	10.8	12.4	11.4	9.9
22	5.4	21.6	13.0	25.6	9.8	9.8	15.4	9.3	11.3	13.6	8.1	10.6
23	14.7	7.8	16.5	12.1	13.1	19.2	22.1	10.7	18.7	18.2	16.4	22.6
24	2.7	11.9	16.2	9.0	20.4	10.5	17.6	15.5	14.1	15.3	8.4	18.2
25	2.6	13.2	14.7	13.3	26.0	11.5	9.5	6.1	10.2	21.2	7.1	6.5
26	5.4	12.8	6.5	17.1	7.2	9.5	6.1	12.5	8.1	9.8	11.0	10.1
27	11.5	8.7	8.7	17.5	26.2	13.6	7.1	8.7	6.3	6.4	12.4	12.6
28	10.8	6.6	13.7	11.7	30.1	8.5	9.8	10.5	8.3	11.5	7.6	10.2
29	8.8		31.0	11.5	27.3	7.2	9.8	5.3	14.9	7.9	10.6	8.4
30	6.1		23.1	14.1	9.1	5.5	10.5	9.3	15.4	14.1	8.8	7.9
31	6.8		15.8		17.2		5.9	15.9		11.7		9.8

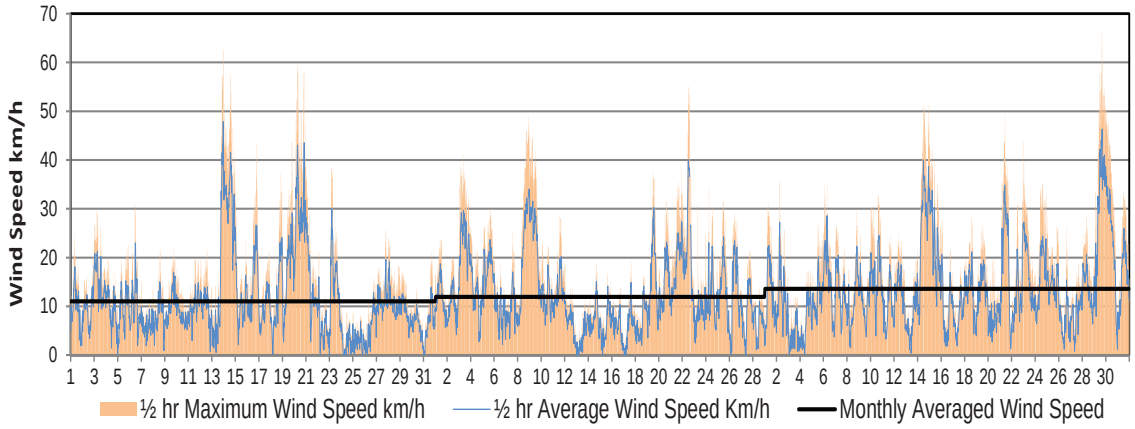
Wind Speed
Daily Gust (km/h)

2021	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	24.8	23.7	31.1	35.5	40.9	23.3	32.3	19.7	36.5	33.2	20.8	45.9
2	23.4	20.4	35.9	38.7	45.9	38.1	40.9	13.8	47.3	25.7	20.1	24.2
3	29.7	41.1	11.9	20.7	26.6	32.0	34.4	24.0	31.4	36.4	14.7	47.2
4	19.9	25.8	17.2	35.7	25.5	33.3	37.3	25.1	21.2	27.4	11.9	20.4
5	22.6	30.0	27.3	46.0	35.7	54.4	26.2	19.6	28.3	35.6	28.1	33.7
6	30.9	19.9	35.2	32.3	33.4	44.0	21.4	24.1	45.7	48.4	18.2	18.4
7	13.8	25.1	26.6	51.7	42.1	41.3	33.5	27.2	44.1	38.4	28.4	17.6
8	21.4	49.0	30.0	51.6	42.5	31.5	23.1	35.6	20.3	27.2	28.9	22.1
9	21.8	44.9	25.0	28.3	27.2	36.1	16.5	17.5	31.5	22.3	40.1	32.0
10	16.2	22.6	33.2	36.2	24.8	44.4	25.9	51.9	43.0	15.6	44.1	26.8
11	19.7	28.6	24.4	43.7	36.9	41.8	35.7	65.7	16.9	46.8	31.4	29.3
12	21.5	18.6	24.9	45.7	40.5	31.2	37.0	41.7	26.6	28.4	32.1	27.0
13	62.5	11.7	22.0	40.9	37.7	23.7	23.3	32.2	42.2	24.5	20.2	7.5
14	57.1	19.0	51.3	18.4	36.2	41.1	25.7	28.3	26.7	29.5	12.3	31.6
15	31.1	16.8	42.6	29.3	44.9	57.3	29.4	21.8	53.3	39.4	37.9	45.8
16	43.3	13.7	27.5	33.2	22.8	58.5	28.6	38.4	52.1	15.5	47.1	22.8
17	21.0	19.2	18.9	48.5	53.0	44.2	37.5	27.6	40.7	24.2	39.7	18.5
18	37.3	16.7	28.7	41.5	42.0	30.0	29.4	16.1	34.7	43.1	26.6	22.6
19	43.6	37.5	26.7	39.3	49.3	37.3	20.8	12.7	37.9	19.1	27.0	40.1
20	59.5	31.5	19.8	28.8	34.6	37.7	26.3	33.3	31.0	23.3	51.4	25.1
21	37.0	38.6	49.0	42.1	26.4	47.0	26.4	33.3	40.7	31.3	31.9	21.9
22	21.1	54.9	44.0	54.5	25.6	28.4	60.4	30.9	27.0	30.6	24.0	28.1
23	38.3	31.0	39.2	44.6	29.3	45.0	61.4	28.5	52.0	39.2	49.3	35.5
24	10.7	34.3	35.3	25.6	48.9	33.6	47.4	33.9	38.6	33.5	31.0	45.0
25	8.2	31.5	28.3	44.4	56.5	39.1	25.8	22.3	31.0	40.9	14.9	14.5
26	15.9	28.9	26.4	44.3	22.9	44.2	19.7	37.3	23.1	33.6	35.0	25.7
27	25.8	21.7	18.8	33.1	51.6	36.2	29.6	30.6	19.4	15.5	32.3	23.6
28	23.8	13.9	28.3	28.2	52.2	24.0	33.4	26.3	28.3	36.1	19.4	19.5
29	17.1		66.5	39.7	62.3	20.4	33.9	18.2	37.0	25.5	27.3	16.8
30	13.4		50.3	41.3	22.2	14.7	32.3	30.8	44.6	34.7	21.7	24.5
31	21.2		33.8		35.5		23.6	57.7		31.7		18.8

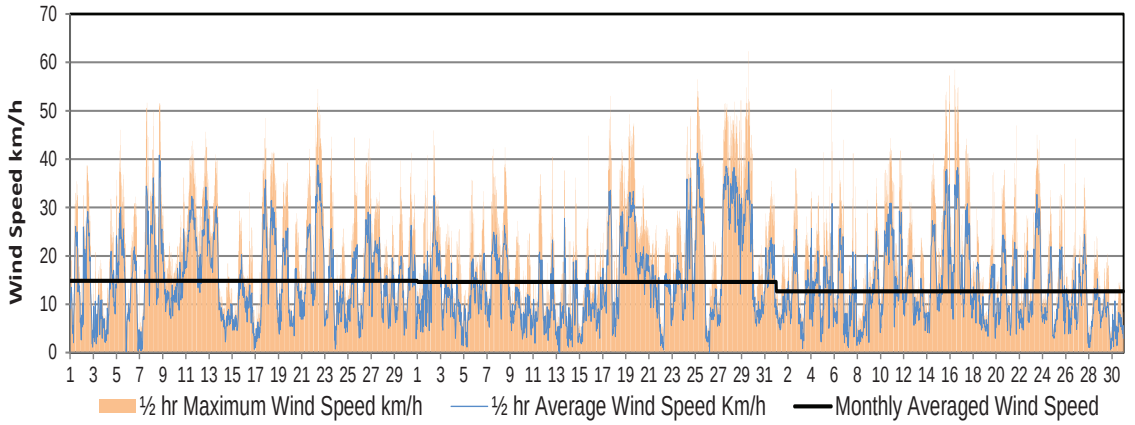
WIND

Daily Wind Speed and Maximum Gust Wind Speed

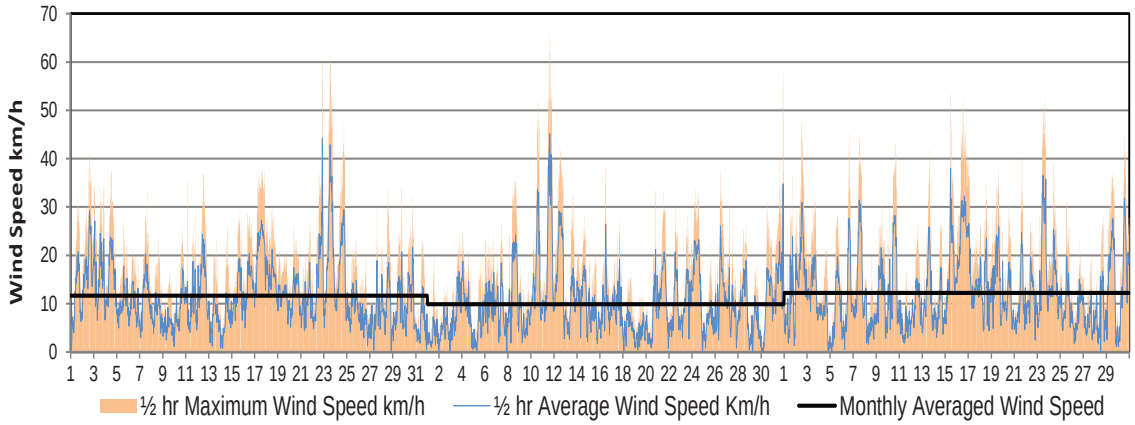
Jannuary
February
March



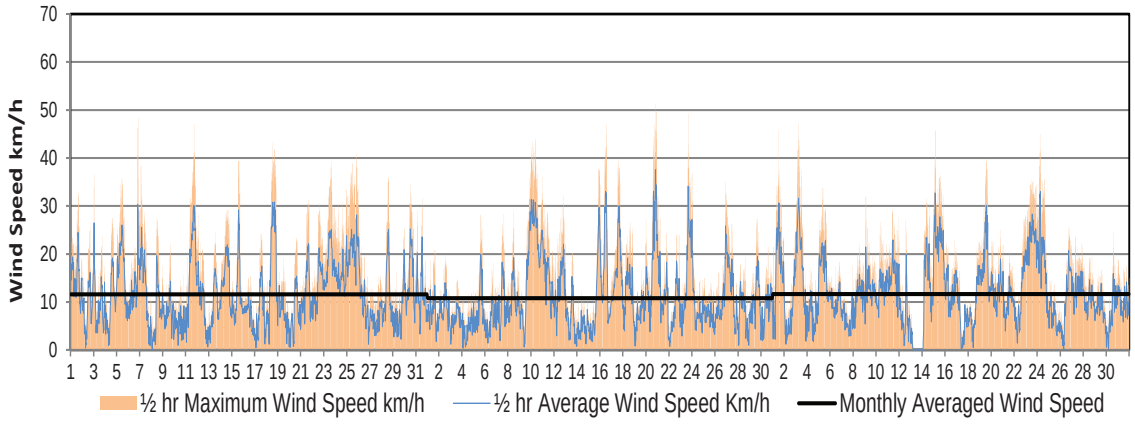
April
May
June



July
August
September



October
November
December



WIND

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	-30	-37	-43	-49	**-56**	**-62**	**-67**
25	1	-6	-12	-19	-25	-32	-38	-44	-51	**-57**	**-64**	**-70**
30	0	-6	-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**	**-69**	**-76**
55	-2	-8	-15	-22	-29	-36	-43	-50	**-57**	**-63**	**-70**	**-77**
60	-2	-9	-16	-23	-30	-36	-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	**-58**	**-65**	**-72**	**-80**
75	-3	-10	-17	-24	-31	-38	-45	-52	**-59**	**-66**	**-73**	**-80**
80	-3	-10	-17	-24	-31	-38	-45	-52	**-60**	**-67**	**-74**	**-81**

Approximate Thresholds

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

1: Environment Canada, 2004b

EXTREME DAILY WINDS (km/h)

Month	Day	WIND SPEED/ DIRECTION	BEAUFORT WIND SCALE DESIGNATION*
January	13	62.5 NNW	Gale
	14	57.1 NNW	Near Gale
	20	59.5 WNW	Near Gale
February	22	54.9 NW	Near Gale
March	14	51.3 S	Near Gale
	29	66.5 N	Gale
	30	50.3 NW	Near Gale
April	7	51.7 SSW	Near Gale
	8	51.6 NNW	Near Gale
	22	54.5 N	Near Gale
May	17	53.0 SSW	Near Gale
	25	56.5 N	Near Gale
	27	51.6 SSE	Near Gale
	28	52.2 WSW	Near Gale
	29	62.3 NW	Gale
June	5	54.4 NW	Near Gale
	15	57.3 S	Near Gale
	16	58.5 W	Near Gale
July	22	60.4 W	Near Gale
	23	61.4 W	Near Gale
August	10	51.9 NW	Near Gale
	11	65.7 NW	Gale
	31	57.7 ESE	Near Gale
September	15	53.3 NW	Near Gale
	16	52.1 WNW	Near Gale
	23	52.0 NNW	Near Gale
November	20	51.4 NW	Near Gale

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

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

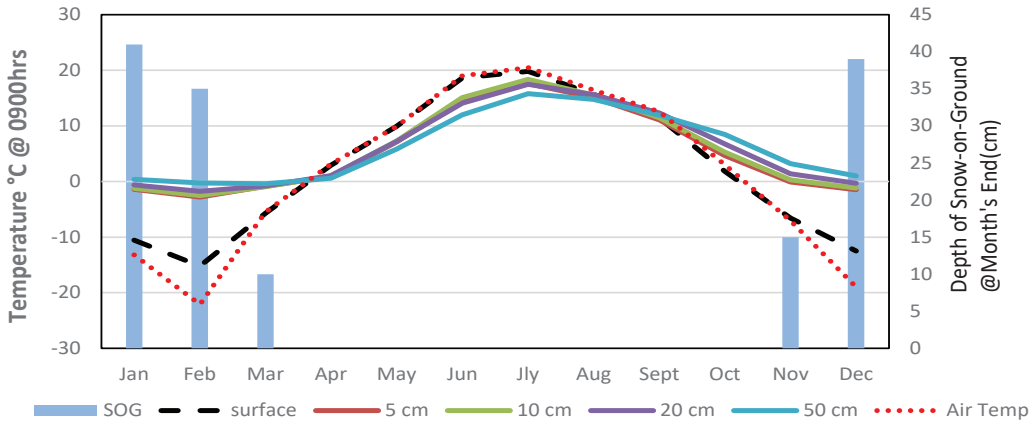
EXTREME DAILY WIND CHILL WHEN CALCULATED TO < 0

	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC
1	-29	-22	-29	-6							-11	-9
2	-21	-19	-16	-6	-7					-2	-15	-17
3	-10	-30	-22	-3	-6						-15	-23
4	-21	-33	-19	-5	-11					-4	-12	-26
5	-22	-43	-15	-5	-8						-6	-37
6	-14	-48	-5	-5	-5					-2	-11	-39
7	-21	-50	-7	-6	-7					-4	-12	-34
8	-23	-52	-15	-7	-5					-6	-14	-33
9	-22	-44	-15	-11	-7					-8	-16	-21
10	-20	-45	-22	-6	-5					-7	-12	-24
11	-23	-52	-27	-9	-4					-9	-12	-20
12	-18	-43	-20	-12						-10	-18	-23
13	-21	-48	-12	-11	-1					-13	-18	-25
14	-15	-48	-11	-6						-3	-12	-19
15	-18	-43	-11	-8						-6	-9	-35
16	-18	-45	-19	-6						-7	-9	-38
17	-22	-35	-16	-5					-3	-6	-16	-37
18	-20	-37	-10	-9						-6	-20	-40
19	-20	-35	-6	-11	-7					-10	-23	-36
20	-20	-21	-7	-13	-8					-14	-23	-36
21	-27	-20	-11	-7	-6				-2	-14	-28	-28
22	-20	-10	-13	-11	-4					-14	-19	-28
23	-42	-17	-21	-16						-9	-28	-33
24	-47	-17	-13	-12					-1	-3	-28	-37
25	-48	-20	-15	-11	-4					-1	-23	-42
26	-47	-34	-20	-7	-4				-1		-15	-40
27	-38	-35	-16	-10	-1					-4	-19	-43
28	-31	-31	-8	-12						-7	-18	-42
29	-25		-24	-9						-5	-16	-46
30	-17		-26	-2					-2	-8	-15	-45
31	-19		-22							-10		-46

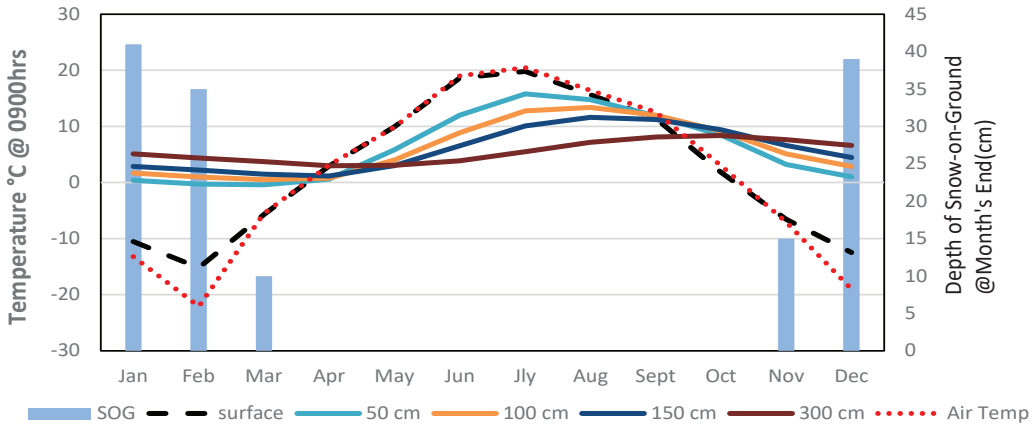
SOIL TEMPERATURES AND DEPTH OF SNOW-ON-THE-GROUND AT MONTH END (2021)

MONTH	Mean Air Temp @ 0900h (°C)	Surface Temp@ 0900h (°C)	SOIL TEMPERATURES (°C) @ 0900h							Mean Air Temp @ 1600h (°C)	Surface Temp@ 1600h (°C)	SOIL TEMPERATURES (°C) @ 1600h			SOG at month's end
			5cm	10cm	20cm	50cm	100cm	150cm	300cm			5cm	10cm	20cm	cm
January	-13.2	-10.5	-1.4	-1.2	-0.6	0.4	1.7	2.9	5.1	-8.8	-7.1	-1.4	-1.2	-0.6	41
February	-22.1	-15.2	-2.8	-2.5	-1.8	-0.3	1.0	2.2	4.4	-15.9	-11.1	-2.9	-2.6	-1.8	35
March	-5.5	-5.7	-0.9	-0.9	-0.8	-0.4	0.5	1.5	3.7	0.7	0.1	-1.3	-1.3	-1.0	10
April	3.1	3.0	0.9	1.0	1.1	0.6	0.8	1.2	3.0	10.1	11.9	3.7	2.4	1.1	-
May	9.9	10.0	7.1	7.3	7.2	5.9	4.0	3.0	3.0	16.1	18.2	11.0	9.6	7.4	
June	19.0	18.6	14.5	15.1	14.1	12.0	8.9	6.6	3.9	24.1	25.4	18.7	17.7	14.5	
July	20.5	19.8	17.6	18.4	17.5	15.8	12.8	10.1	5.5	26.4	28.1	22.0	21.1	17.7	
August	16.5	15.7	15.1	15.5	15.6	14.7	13.4	11.6	7.2	21.9	22.8	18.4	17.5	15.7	
September	12.6	11.4	11.1	11.5	12.4	11.9	12.0	11.2	8.1	20.4	21.2	14.1	13.2	12.4	-
October	3.0	1.8	4.6	5.3	6.7	8.5	9.2	9.4	8.4	11.0	11.7	6.6	6.3	6.6	0
November	-7.1	-6.6	-0.1	0.3	1.4	3.2	5.1	6.6	7.7	-1.2	-0.7	0.0	0.2	1.4	15
December	-19.0	-12.5	-1.5	-1.2	-0.3	1.0	2.9	4.4	6.6	-15.7	-10.1	-1.5	-1.3	-0.3	39

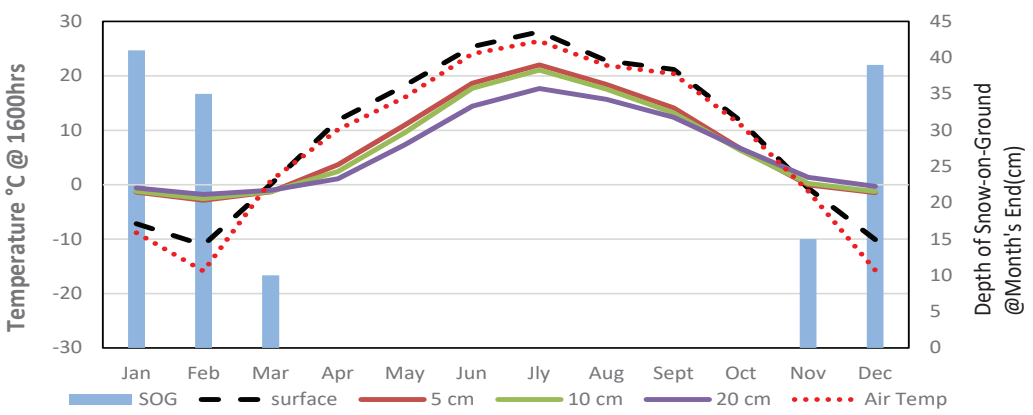
Monthly Soil Temperatures @ 0900h



Monthly Soil Temperatures @ 0900h



Monthly Soil Temperatures @ 1600h



GLOSSARY OF TERMS

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

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

BRIGHT SUNSHINE is the unobstructed direct radiation from the sun, as opposed to the shading of a location by clouds or by other atmospheric obstructions.

Number of Days is defined as the total number of days when at least 0.1 of an hour of bright sunshine was recorded.

Percentage Possible refers to the ratio of measured bright sunshine hours to the total possible daylight hours in a given period, expressed as a percentage.

Possible daylight hours (hours of illumination) are taken from the sunrise/set tables provided by the National Research Council of Canada, Herzberg Institute of Astrophysics, Victoria, BC.

Total is the sum of the daily bright sunshine values in hours and tenths of hours as measured by an automated sunshine recorder using voltaic cells.

DEGREE-DAY is an index for various temperature related calculations

Cooling (CDD) is the cooling requirement to achieve a stipulated comfort value in an indoor environment. For most purposes, a temperature of greater than 18°C is considered uncomfortable and supplementary cooling is required. On a specific day, the amount by which 18°C is less than the daily average temperature defines the number of cooling degree-days for that day. A temperature base of 24° C is sometimes used as an index of extreme cooling degree-days to indicate potential heat stress. (Environment Canada 2012)

Mathematically:CDD = (T - 18°C), for that day, where T = daily mean temperature in °C if T is equal to or less than18°C, CDD = 0.

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

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

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

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

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

Mathematically:

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

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

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

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 Conservation 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 nomals. (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 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 - 24000 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.

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) .

Official precipitation is measured using a weighing gauge, extreme precipitation events are measured using a tipping bucket rain gauge .

Snow depth is measured using a sonic ranging sensor.

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

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

SOLAR RADIATION

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

Global - Total is the sum of the direct solar and diffuse radiation during the period in question. Measurements are carried out on a horizontal surface near ground level and integrated over the whole celestial dome, summing the diffuse and direct components of the solar beam. The temperature-compensated Eppley pyranometer is used. The standard metric unit of measurement is the megajoule per square metre (MJ/m^2). (To facilitate comparison with past years' data: 1.0 MJ/m^2 = 23.895 langleys). Comparison is provided with a provisional average based on 16 years of data (l975-1990).

SPELLS - Temperature spells are defined as days when the daily maximum temperature is higher than or equal to 30°C (hot spell) or the daily minimum temperature is lower than or equal to -30°C (cold spell).

SUNRISE/SUNSET times have been included in this report. They have been acquired from the National Research Council, Canada, Herzberg Institute of Astrophysics.

TEMPERATURE

Average Annual is the average of the daily average temperatures in degrees Celsius (°C) for one year.

Average Daily is defined as the arithmetic mean of the daily maximum temperature in degrees Celsius (°C) and the daily minimum temperature in degrees Celsius (°C) for the day in question.

Average Maximum is the average of the daily maximum temperatures in degrees Celsius (°C) average over the appropriate time periods.

Average Minimum is the average of the daily minimum temperatures in degrees Celsius (°C) averaged over the appropriate time periods. Refer to TEMPERATURE-Average Maximum concerning measurement procedures.

Average Monthly is the average of the daily average temperatures in degrees Celsius (°C) for the month under consideration.

WIND CHILL describes a sensation, the way we feel as a result of the combined cooling effect of temperature and wind. This feeling can't be measured using an instrument, so a mathematical formula was developed in 1939 that related air temperature and wind speed to the cooling sensation. This formula was revised in 2001 by a team of scientists and medical experts from Canada and the U.S. with the Canadian Department of National Defence contributing human volunteers. The new index is based on the loss of heat from the face.

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

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

WIND SPEED

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

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

see also **Beaufort Wind Scale**

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