LIMITED REPORT

Saskatoon SRC Climatological Reference Station Annual Summary, 1993

by

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Environment Technology Division

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SASKATOON SRC

CLIMATOLOGICAL REFERENCE STATION

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ABSTRACT

Data concerning temperature, precipitation, soil temperature, wind speed, bright sunshine and solar radiation at the Saskatoon Climatological Reference Station (52°09'N, 106°36'W, 497 m MSL) are presented for the year 1993 and compared with the long term historic and standard period (1961-1990) records (Table 1).

The year 1993, like 1992, had a very cool growing season. The number of growing degree-days was 10% below normal. The number of growing degree-days for May to August was 1213, which is 13% above last year but 9% below the normal.

The mean annual temperature was 0.9°C above normal. Like 1992, the winter months (except November) recorded above normal mean temperatures.

The extreme maximum temperature occurred in August with a temperature of 32°C. The extreme minimum temperature occurred on the first day of 1993 with a temperature of -36.5°C. This was a continuation of the cold temperatures of the last part of December 1992.

Saskatoon received 61.4 mm less precipitation than the 1961-1990 average. The majority of that precipitation (74%) fell in the summer months (May to September). Although June usually is the wettest summer month, July was the wettest in 1993. The harvest of 1993 was late because of the 42% above normal rain and snow in September. October became the classic harvest month with only 0.4 mm of precipitation and above normal temperatures.

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HISTORY AND STATION LOCATION

The first meteorological observations appear to have been taken at or near Saskatoon by the Royal Northwest Mounted Police in 1889. At first only temperatures were recorded. A number of changes were made in the coordinates and as a result there is some disagreement in the early records as to the exact location of the weather observing point. The bulk of the evidence, however, indicates that the location was 52°15'N and 106°20'W, elevation 480 m above sea level. This would place it at Clark's Crossing, on the South Saskatchewan River, approximately 16 km north and east of the centre of the present City of Saskatoon. At that time there was a settlement at Clark's Crossing and also about 10 or 15 families on either side of the river at Saskatoon.

Little is known about the early observers. However, the records show that a Major T.H. Keenan took the observations from March, 1892 until March, 1895. Mr. George Will was the observer from January, 1897 until April, 1897. It is thought that Thomas H. Copeland was involved in the observational program from 1895 to May 1, 1901, at which time it was taken over by Mr. Eby, senior. Continuous observations were taken by the Eby's at a site on 8th Street until October 31, 1942, when the station was closed. Mr. Eby continued the program until his death in 1921. His daughter, Miss E.S. Eby, recorded the observations until April, 1931 and was replaced by her brother, J.M. Eby, who continued the program until the station was closed. The Eby station recorded temperature, precipitation and weather notes on fog, thunderstorms, winds and any unusual weather phenomena. Reports were made twice daily, morning and evening.

In 1916 a climatological station was established by the Physics Department of the University of Saskatchewan and continuous observations were kept twice daily until January 15, 1965. The long time observer at this site was Mr. Sidney Cox. The Saskatchewan Research Council took over the program in the fall of 1963 at our newly established Climatological Reference Station.

The location of the Saskatchewan Research Council's Climatological Reference Station is latitude 52°09'N and longitude 106°36'W and the elevation is 497 m above mean sea level[1].

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[1] From various sources including the *Physical Environment of Saskatoon, Canada* (E.A. Christiansen (ed.) 1970) and *1974 Annual Meteorological Summary, Saskatoon, Saskatchewan*, (Environment Canada, Atmospheric Environment Service).

The long time observer (16 years) at this present site was Mr. Joe Calvert, who retired from the program in August, 1983. Then Mr. Ray Begrand succeeded Mr. Calvert until September, 1988 when Ms. Virginia Wittrock became the primary observer. Ms Carol Beaulieu became the primary observer in 1992.

The summer of 1992 witnessed a major change in the way observations are carried out at the Saskatchewan Research Council's Climatological Reference Station. The Station was converted to an automated system of data collection. This was done by installing a Campbell Scientific Data Logger and automatic sensors at the climate station. The following data collection duties were turned over to Environment Canada: evaporation, bright sunshine (Campbell-Stokes), snow survey, snow cover, and manual temperature and precipitation programs.

FOOTNOTES TO CLIMATIC TABLES 1 TO 13

1. The annual values (Table 1) are calculated using the monthly summaries, January to December, 1993 (Tables 2 to 13).

2. 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 Saskatoon, 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 period January 1, 1961 to December 31, 1990 for data analysis. Items in this column conform to this standard, except where noted.

3. Temporal comparisons at a point are also of value in some types of climatic studies. Therefore, it is desirable to produce the maximum length of reliable climatic record to carry out studies over a period of time. Data in this column are drawn from the following data sets:

Saskatoon SRC	1963 to 1993
Saskatoon U. of S.	1916 to 1963
Saskatoon	1892 to 1915

   Station locations, exposures and measurement procedures were subject to change during this time period. Data presented in this column are unadjusted and users are cautioned accordingly.

4. The mean annual temperature is defined as the average of the daily mean temperatures for one year. In the monthly summaries (Tables 2 to 13) the daily mean temperature reported is the average of the daily mean temperatures for the one month under consideration. In turn, the daily mean temperature for a particular day is defined as the arithmetic mean of the daily maximum temperature and the daily minimum temperature for the date.

5. The mean maximum temperature tabulated is the mean of the daily maximum temperatures for one year in the case of Table 1 and for particular months in the cases of Tables 2 to 13. For details concerning measurement procedures, the reader is referred to the Atmospheric Environment Service publication *Manual of Climatological Observations*, second edition, January, 1978.

6. The mean minimum temperature as tabulated is defined as the mean of the daily minimum temperatures averaged over the appropriate time periods. Refer to note 5 above concerning measurement procedures.

7. The word "extreme" refers to the highest or lowest value of a particular element recorded during the period in question. The highest temperature recorded at Saskatoon SRC during 1993 was 32.0°C (August), while the highest value ever recorded was 41.0°C (June, 1988).

8. A day with frost is recorded on each occasion when the daily minimum temperature is equal to or less than 0°C.

9. A heating degree-day (HDD) is an index of 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 mean temperature defines the number of heating degree-days for that day. Mathematically:

$$HDD = (18°C - T), \text{ for that day,}$$

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.

10. In order for plant growth to proceed, 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 mean temperature and the 5.0°C base temperature defines the number of growing degree-days (GDD). Mathematically:

$$GDD = (T - 5.0°C), \text{ for that day,}$$

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.

11. Total precipitation is the sum of the daily rainfall and daily snowfall amounts recorded. The snowfall component of precipitation is recorded as an equivalent amount of liquid water. For particulars on precipitation measurement procedures and instruments, the reader is referred to the Atmospheric Environment Service publication Manual of Climatological Observations, second edition, January, 1978. The notation T in this column refers to a trace of precipitation (less than 0.2 mm water equivalent). As of August 7, 1993, total precipitation was measured using the Belfort weighing gauge shielded by the Alter windshield.

12. A precipitation day is recorded on occasions when the amount of precipitation in a 24-hour period equals or exceeds 0.2 mm water (0.01 inch in English units). Observations at Saskatoon SRC refer to the so-called climatological day, beginning at 9 a.m. standard time on the date of reference and ending at 9 a.m. the next morning, was employed in record-keeping. An asterisk (*) appearing in the normal column denotes the occurrence of measurable precipitation on one or more occasions, and that the calculated 30-year mean amounts to less than a trace.

13. The mean wind speed value reported is the mean of the hourly wind speeds for the period in question. Average hourly wind speeds are obtained from recording instruments. The anemometer employed is a propeller-type aerofoil at a height of 10 m.

14. Peak gust refers to the highest instantaneous value recorded by the anemometer system for the period of reference, irrespective of direction and/or duration. Comparison is again with published data for Saskatoon Airport.

15. Total bright sunshine is the sum of the daily bright sunshine values in hours and tenths of hours as recorded by a Campbell-Stokes sunshine recorder. Atmospheric Environment Service publication, "Bright Sunshine, 1951-1980", Volume 7 supplies information on measurement procedures. In August 1992, the Campbell Stokes sunshine recorder was replaced with an automatic recorder that uses voltaic cells. The output continues to be in hours and tenths of hours.

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

17. Total global solar radiation is the sum of the daily values of short wave solar radiation recorded during the period in question (Tables 1 and 15). Measurements are carried out on a horizontal surface at the ground and integrated over the whole celestial dome, summing the diffuse and direct components of the solar beam. The measuring instrument is a temperature-compensated Eppley pyranometer. 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 normal based on sixteen years of data (1975-1990). Diffuse solar radiation is also recorded (Tables 1 and 14). The instrument used is an Eppley pyranometer with a shade ring.

18. The year/day entry appearing in Tables 2 to 13 refers to the year and day on which an extreme event occurred. Reference to the month appears in the table heading. For example, referring to Table 2, the warmest day in January, 1993 was the 28th with a high temperature of 3.0°C, while the warmest January day on record was January 30, 1931 with a high temperature of 10.0°C.

19. Due to missing observations, faulty instrument calibration, lost records, etc., only partial data are available especially during the period 1892 to 1915. The number of years of useful record is therefore cited.

20. Soil temperature, under a short grass surface with normal snow accumulation, is measured according to procedures outlined in the Atmospheric Environment Service publication "Soil Temperature", January 1, 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.

Table 1 Annual Climatic Summary, Saskatoon SRC, 1993.

	1993 Values	1992 Values	Normals[2] (1961-90) and Extremes[3] (1892-1993)
Mean Annual Temperature[4] (°C)	2.9	2.9	2.0
Mean Maximum Temperature[5] (°C)	8.2	8.5	7.8
Mean Minimum Temperature[6] (°C)	-2.5	-2.6	-3.8
Extreme Maximum Temperature[7] (°C)	32.0 (Aug.)	33.5 (Aug.)	41.0 (June, 1988)
Extreme Minimum Temperature[7] (°C)	-36.5 (Jan.)	-40.0 (Dec.)	-50.0 (Feb., 1893)
Days with Frost[8]	188[b]	200	198
Heating Degree-Days[9] (18°C base)	5372	5549	5684
Growing Degree-Days[10] (5°C base)	1493	1367	1660
Total Precipitation[11] (mm)	300[e]	288.1	361.4
Greatest 24-h Precipitation (mm)	35.6 (Sept.)	27.6 (Aug.)	99.4 (June, 1983)
Precipitation Days[12]	84[e]	115	114
Mean Wind Speed[13] (km/h)	14.4	15.0 [c]	16.3
Peak Wind Gust[14] (km/h)	97.4 (July)	89 (Dec.)	151 (Aug.)[a]
Total Bright Sunshine[15] (h)	2004.1	1965.7	2399.3
Total Global Radiation[17] (MJ m^{-2})	4396.6[c]	4046.2	4322.0
Total Diffuse Radiation[17] (MJ m^{-2})	1831.7[d]	1951.3	1729.5

[a] information from Saskatoon Airport
[b] February and December frost days confirmed with Saskatoon Airport
[c] one month missing data
[d] 4 days missing data
[e] February data taken from Saskatoon Airport

Table 2 Monthly Weather Summary for January, 1993

Element	1993 Value	1992 Value	Mean or Extreme Value 1961 - 1990	Extreme All Years
Monthly Mean Temperature[4] (°C)	-16.3	-10.1	-17.6	
Monthly Mean Maximum Temperature[5] (°C)	-11.4	-4.5	-12.4	
Monthly Mean Minimum Temperature[6] (°C)	-21.1	-15.7	-22.7	
Extreme Maximum Temperature[7] (°C)	7.0	3.0	7.0	10.0
Year/Day(s)[18]	1993/30	1992/28	1986/11	1931/30
Years of Record[19]	1	1	28	95
Extreme Minimum Temperature[7] (°C)	-36.5	-30.5	-43.9	-48.9
Year/Day(s)[18]	1993/1	1992/14&15	1966/22&1969/29	1893/31
Years of Record[19]	1	1	28	95
Days with Frost[8]	31	31	31	
Heating Degree-Days[9] (18°C base)	1062.5	889.5	1043.0	
Growing Degree-Days[10] (5°C base)	0.0	0.0	0.0	
Total Precipitation[11] (mm)	3.0	19.3	20.8	
Greatest 24-hour Precipitation (mm)	0.6	4.9	15.4	30.5
Year/Day(s)[18]	1993/7	1992/25	1989/30	1893/23
Years of Record[19]	1	1	28	95
Precipitation Days[12]	4	11	11	
Mean Wind Speed (km/h)[13]	12.6	14.4	15.7	
Peak Gust Speed (km/h)[14]	84.5	69.6	111.0	
Total Bright Sunshine (h)[15]	131.4	72.6	104.9	
Percent Possible Bright Sunshine[16]	51	28	41	
Total Global Radiation (MJ m^{-2})[17]	128.3[a]	115.4	129.9	
Total Diffuse Radiation (MJ m^{-2})[17]	75.2[b]	89.5	71.4	
Mean Soil Temperature (°C) (10,50 cm)[20]	-5.6, -1.1	-3.1, 0.2	-8.3, -3.9	
Mean Soil Temperature (°C) (150,300 cm)[20]	2.7, 5.2	3.7, 5.5	1.8, 4.4	

[a] 2 days missing data
[b] 1 day missing data

Table 3 Monthly Weather Summary for February, 1993

Element	1993 Value	1992 Value	Mean or Extreme Value 1961 - 1990	Extreme All Years
Monthly Mean Temperature[4] (°C)	-13.6[a]	-9.9	-13.8	
Monthly Mean Maximum Temperature[5] (°C)	-9.2[a]	-5.9	-9.0	
Monthly Mean Minimum Temperature[6] (°C)	-18.0[a]	-13.9	-18.3	
Extreme Maximum Temperature[7] (°C)	4.5	7.5	7.5	12.8
Year/Day(s)[16]	1993/28	1992/27	1988/26	1931/19
Years of Record[19]	1	1	28	97
Extreme Minimum Temperature[7] (°C)	-28.5[a]	-29.5	-41.1	-50.0
Year/Day(s)[16]	1993/16&17	1992/11	1972/6	1893/1
Years of Record[19]	1	1	28	97
Days with Frost[8]	28[c]	27	28	
Heating Degree-Days[9] (18°C base)	778.8[a]	806.5	878.0	
Growing Degree-Days[10] (5°C base)	0.0[a]	0.0	0.0	
Total Precipitation[11] (mm)	3.0[d]	15.8	14.5	
Greatest 24-hour Precipitation (mm)	1.6[d]	10.6	14.2	20.3
Year/Day(s)[16]	1993/11[d]	1992/19	1979/13	1918/7
Years of Record[19]	1[d]	1	28	97
Precipitation Days[12]	6[d]	8	10	
Mean Wind Speed (km/h)[13]	12.9	15.0[b]	15.8	
Peak Gust Speed (km/h)[14]	52.7	65[b]	106	
Total Bright Sunshine (h)[15]	136.4	116.9	133.2	
Percent Possible Bright Sunshine[16]	49.8	42.7	48.6	
Total Global Radiation (MJ m^{-2})[17]	223.9	215.9	210.1	
Total Diffuse Radiation (MJ m^{-2})[17]	115.5	137.8	105.3	
Mean Soil Temperature (°C) (10,50 cm)[20]	-4.7, -0.7	-3.3, -0.5	-7.3, -4.1	
Mean Soil Temperature (°C) (150,300 cm)[20]	1.8, 3.6	2.7, 4.6	0.8, 3.2	

[a] 3 days missing data.
[b] 12 days missing data.
[c] used Saskatoon Airport to confirm minimum temperature values.
[d] Saskatoon airport data used because our equipment failed.

Table 4 Monthly Weather Summary for March, 1993

Element	1993 Value	1992 Value	Mean or Extreme Value 1961 - 1990	Extreme All Years
Monthly Mean Temperature[4] (°C)	-0.4	-0.6	-7.1	
Monthly Mean Maximum Temperature[5] (°C)	3.8	3.8	-2.2	
Monthly Mean Minimum Temperature[6] (°C)	-4.5	-5.0	-12.1	
Extreme Maximum Temperature[7] (°C)	20.0	14.5	15.0	22.8
Year/Day(s)[16]	1993/23	1992/27	1973/24&1981/16	1910/23
Years of Record[19]	1	1	28	97
Extreme Minimum Temperature[7] (°C)	-19.0	-19.0	-38.9	-43.3
Year/Day(s)[16]	1993/17	1992/9	1972/2	1897/14
Years of Record[19]	1	1	28	97
Days with Frost[8]	26	31	30	
Heating Degree-Days[9] (18°C base)	569.7	574.5	727.8	
Growing Degree-Days[10] (5°C base)	18.3	2.0	1.5	
Total Precipitation[11] (mm)	16.8	3.0	19.9	
Greatest 24-hour Precipitation (mm)	11.3	1.4	32.0	32.0
Year/Day(s)[16]	1993/25	1992/7	1967/30	1967/30
Years of Record[19]	1	1	28	92
Precipitation Days[12]	6	3	9	
Mean Wind Speed (km/h)[13]	15.3	14.7	16.6	
Peak Gust Speed (km/h)[14]	55.0	79.0	87	
Total Bright Sunshine (h)[15]	176.4	194.2	176.9	
Percent Possible Bright Sunshine[16]	48.2	53.1	48.3	
Total Global Radiation (MJ m^{-2})[17]	359.4	383.7	362.4	
Total Diffuse Radiation (MJ m^{-2})[17]	164.0	170.8	173.9	
Mean Soil Temperature (°C) (10,50 cm)[20]	-0.7, 1.0	0.5, 1.4	-3.1, -1.8	
Mean Soil Temperature (°C) (150,300 cm)[20]	1.6, 3.3	2.5, 3.8	0.4, 2.4	

Table 5 Monthly Weather Summary for April, 1993

Element	1993 Value	1992 Value	Mean or Extreme Value 1961 - 1990	Extreme All Years
Monthly Mean Temperature[4] (°C)	5.4	4.8	3.5	
Monthly Mean Maximum Temperature[5] (°C)	11.2	11.3	9.9	
Monthly Mean Minimum Temperature[6] (°C)	-0.5	-1.8	-2.0	
Extreme Maximum Temperature[7] (°C)	20.0	26.5	30.6	33.0
Year/Day(s)[16]	1993/23	1992/27	1977/26	1952/28
Years of Record[19]	1	1	28	96
Extreme Minimum Temperature[7] (°C)	-4.0	-15.0	-27.8	-28.3
Year/Day(s)[16]	1993/16	1992/11	1979/1	1893/5&1954/2
Years of Record[19]	1	1	28	96
Days with Frost[8]	18	21	20	
Heating Degree-Days[9] (18°C base)	379.8	400.0	388.0	
Growing Degree-Days[10] (5°C base)	37.5	78.0	60.2	
Total Precipitation[11] (mm)	21.0	12.0	20.2	
Greatest 24-hour Precipitation (mm)	6.5	7.8	24.6	30.2
Year/Day(s)[16]	1993/6	1992/9	1985/19	1955/19
Years of Record[19]	1	1	28	96
Precipitation Days[12]	9	6	7	
Mean Wind Speed (km/h)[13]	16.2	18.6	17.6	
Peak Gust Speed (km/h)[14]	62.3	74.3	93	
Total Bright Sunshine (h)[15]	176.5	220.0	231.3	
Percent Possible Bright Sunshine[16]	42.5	53	56	
Total Global Radiation (MJ m^{-2})[17]	484.1	478.0[a]	492.2	
Total Diffuse Radiation (MJ m^{-2})[17]	209.7	214.7[a]	178.5	
Mean Soil Temperature (°C) (10,50 cm)[20]	3.9, 4.2	5.1, 4.9	3.1, 2.5	
Mean Soil Temperature (°C) (150,300 cm)[20]	2.8, 3.2	3.3, 3.6	1.2, 2.2	

[a] 2 days missing data

Table 6 Monthly Weather Summary for May, 1993

Element	1993 Value	1992 Value	Mean or Extreme Value 1961 - 1990	Extreme All Years
Monthly Mean Temperature[4] (°C)	12.4	10.6	11.5	
Monthly Mean Maximum Temperature[5] (°C)	19.1	17.4	18.5	
Monthly Mean Minimum Temperature[6] (°C)	5.7	3.8	4.5	
Extreme Maximum Temperature[7] (°C)	32.0	32.5	35.0	37.2
Year/Day(s)[16]	1993/11	1992/5	1988/30	1936/27
Years of Record[19]	1	1	28	96
Extreme Minimum Temperature[7] (°C)	-0.5	-1.0	-10.0	-19.8
Year/Day(s)[16]	1993/16	1992/10	1967/2	1907/6
Years of Record[19]	1	1	28	96
Days with Frost[8]	2	5	6	
Heating Degree-Days[9] (18°C base)	188.2	237.0	193.1	
Growing Degree-Days[10] (5°C base)	235.9	175.5	209.9	
Total Precipitation[11] (mm)	24.4	40.5	43.9	
Greatest 24-hour Precipitation (mm)	11.0	14.6	39.9	51.3
Year/Day(s)[16]	1993/27	1992/11	1985/4	1909/30
Years of Record[19]	1	1	28	96
Precipitation Days[12]	7	11[a]	9	
Mean Wind Speed (km/h)[13]	15.6	[a]	17.6	
Peak Gust Speed (km/h)[14]	89.3	244.0	98	
Total Bright Sunshine (h)[15]	262.5	50	284.6	
Percent Possible Bright Sunshine[16]	54.1	551.5	59	
Total Global Radiation (MJ m^{-2})[17]	659.7	263.6	586.3	
Total Diffuse Radiation (MJ m^{-2})[17]	233.0	10.2, 9.8	222.2	
Mean Soil Temperature (°C) (10,50 cm)[20]	10.9, 10.6	6.0, 4.6	10.5, 8.9	
Mean Soil Temperature (°C) (150,300 cm)[20]	6.1, 4.5		4.4, 3.1	

[a] missing data due to equipment malfunction

Table 7 Monthly Weather Summary for June, 1993

Element	1993 Value	1992 Value	Mean or Extreme Value 1961 - 1990	Extreme All Years
Monthly Mean Temperature[4] (°C)	14.1	15.1	15.9	
Monthly Mean Maximum Temperature[5] (°C)	19.8	21.8	22.6	
Monthly Mean Minimum Temperature[6] (°C)	8.3	8.3	9.2	
Extreme Maximum Temperature[7] (°C)	30.0	30.5	41.0	41.0
Year/Day(s)[16]	1993/21	1992/9	1988/5	1988/5
Years of Record[19]	1	1	28	97
Extreme Minimum Temperature[7] (°C)	1.5	1.5	-3.3	-3.9
Year/Day(s)[16]	1993/3	1992/5	1967/6	1903/9&1917/2
Years of Record[19]	1	1	28	97
Days with Frost[8]	0	0	0	
Heating Degree-Days[9] (18°C base)	134.0	107.0	77.9	
Growing Degree-Days[10] (5°C base)	270.6	299.5	338.8	
Total Precipitation[11] (mm)	53.6	21.5	63.6	
Greatest 24-hour Precipitation (mm)	14.6	6.2	99.4	99.4
Year/Day(s)[16]	1993/13	1992/4	1983/24	1983/24
Years of Record[19]	1	1	28	97
Precipitation Days[12]	12	9	12	
Mean Wind Speed (km/h)[13]	16.8	16.7	17.0	
Peak Gust Speed (km/h)[14]	78.4	72.4	117	
Total Bright Sunshine (h)[15]	207.1	253.6	299.3	
Percent Possible Bright Sunshine[16]	41.7	51	60	
Total Global Radiation (MJ m^{-2})[17]	586.5	586.6	638.7	
Total Diffuse Radiation (MJ m^{-2})[17]	225.3	279.0	228.1	
Mean Soil Temperature (°C) (10,50 cm)[20]	14.0, 13.9	14.7, 13.3	15.7, 14.0	
Mean Soil Temperature (°C) (150,300 cm)[20]	8.7, 6.3	8.3, 6.0	8.3, 5.3	

Table 8 Monthly Weather Summary for July, 1993

Element	1993 Value	1992 Value	Mean or Extreme Value 1961 - 1990	Extreme All Years
Monthly Mean Temperature[4] (°C)	15.9	16.2[a]	18.4	
Monthly Mean Maximum Temperature[5] (°C)	21.2	22.2[a]	25.1	
Monthly Mean Minimum Temperature[6] (°C)	10.5	10.2[a]	11.6	
Extreme Maximum Temperature[7] (°C)	32.0	28.5[a]	38.5	40.0
Year/Day(s)[16]	1993/29	1992/13&26	1984/27	1919/17&1941/19
Years of Record[19]	1	1	28	97
Extreme Minimum Temperature[7] (°C)	5.0	5.5[a]	1.7	-0.6
Year/Day(s)[16]	1993/12	1992/11	1967/2	1918/25
Years of Record[19]	1	1	28	97
Days with Frost[8]	0	0	0	
Heating Degree-Days[9] (18°C base)	77.2	65.0[a]	28.7	
Growing Degree-Days[10] (5°C base)	339.9	308.5[a]	409.8	
Total Precipitation[11] (mm)	66.0	56.9[a]	55.8	
Greatest 24-hour Precipitation (mm)	29.6	17.6[a]	45.5	
Year/Day(s)[16]	1993/4	1992/15	1968/29	
Years of Record[19]	1	1[a]	27	79.2
Precipitation Days[12]	13	15[a]	12	1946/3
Mean Wind Speed (km/h)[13]	13.9	11.6	15.5	97
Peak Gust Speed (km/h)[14]	97.4	71.4	103.0	
Total Bright Sunshine (h)[15]	233.8	224.7	333.1	
Percent Possible Bright Sunshine[16]	46.7	44.8	66.5	
Total Global Radiation (MJ m^{-2})[17]	641.3	529.3[a]	633.5	
Total Diffuse Radiation (MJ m^{-2})[17]	242.0	252.2[a]	216.5	
Mean Soil Temperature (°C) (10,50 cm)[20]	15.9, 15.8	16.9, 16.4	18.1, 16.8	
Mean Soil Temperature (°C) (150,300 cm)[20]	9.8, 7.9	10.8, 8.2	11.0, 7.5	

[a] 2 days missing data due to power outage.

Table 9 Monthly Weather Summary for August, 1993

Element	1993 Value	1992 Value	Mean or Extreme Value 1961 - 1990	Extreme All Years
Monthly Mean Temperature[4] (°C)	16.7	15.3[b]	17.2	
Monthly Mean Maximum Temperature[5] (°C)	22.3	22.7[b]	24.3	
Monthly Mean Minimum Temperature[6] (°C)	11.0	7.9[b]	10.1	
Extreme Maximum Temperature[7] (°C)	29.0	33.5[b]	37.0	37.8
Year/Day(s)[16]	1993/7&21	1992/14	1984/10	1893/6&1949/6
Years of Record[19]	1	1	28	96
Extreme Minimum Temperature[7] (°C)	5.0	1.5[b]	-2.8	-2.8
Year/Day(s)[16]	1993/3	1992/25	1976/28	1976/28
Years of Record[19]	1	1	28	96
Days with Frost[8]	0	0	0	
Heating Degree-Days[9] (18°C base)	52.8	102.0[b]	63.3	
Growing Degree-Days[10] (5°C base)	366.6	284.0[b]	378.3	
Total Precipitation[11] (mm)	31.4	37.2	35.2	
Greatest 24-hour Precipitation (mm)	10.0	27.6	27.9	73.7
Year/Day(s)[16]	1993/16	1992/28	1989/25	1945/3
Years of Record[19]	1	1	28	96
Precipitation Days[12]	10	9	9	
Mean Wind Speed (km/h)[13]	12.6	14.3[b]	15.5	
Peak Gust Speed (km/h)[14]	70.5	68	105	
Total Bright Sunshine (h)[15]	212.6	225.7[b]	294.8	
Percent Possible Bright Sunshine[16]	46.9	49.8	65	
Total Global Radiation (MJ m^{-2})[17]	511.9	451.6	529.0	
Total Diffuse Radiation (MJ m^{-2})[17]	202.5	191.0	185.6	
Mean Soil Temperature (°C) (10,50 cm)[20]	16.4, 17.2	15.6[a], 19.2[a]	16.7, 16.8	
Mean Soil Temperature (°C) (150,300 cm)[20]	12.2, 9.3	12.2[a], 9.6[a]	12.4, 9.3	

[a] 1 day missing data
[b] 3 days missing data

Table 10 Monthly Weather Summary for September, 1993

Element	1993 Value	1992 Value	Mean or Extreme Value 1961 - 1990	Extreme All Years
Monthly Mean Temperature[4] (°C)	10.6	10.0	11.3	
Monthly Mean Maximum Temperature[5] (°C)	17.2	16.1	17.7	
Monthly Mean Minimum Temperature[6] (°C)	3.9	3.8	4.8	
Extreme Maximum Temperature[7] (°C)	26.0	31.5	35.6	35.6
Year/Day(s)[16]	1993/8	1992/30	1978/4	1978/4
Years of Record[19]	1	1	28	94
Extreme Minimum Temperature[7] (°C)	-4.5	-3.0	-7.8	-11.1
Year/Day(s)[16]	1993/30	1992/16&18	1978/30	1908/28
Years of Record[19]	1	1	28	94
Days with Frost[8]	7	6	4	
Heating Degree-Days[9] (18°C base)	225.8	237.0	199.6	
Growing Degree-Days[10] (5°C base)	169.0	148.0	196.2	
Total Precipitation[11] (mm)	46.6	37.8	32.8	
Greatest 24-hour Precipitation (mm)	35.6	19.2	29.6	44.2
Year/Day(s)[16]	1993/12	1992/4	1980/3	1931/12
Years of Record[19]	1	1	28	94
Precipitation Days[12]	10	12	9	
Mean Wind Speed (km/h)[13]	15.0	16.3	16.7	
Peak Gust Speed (km/h)[14]	81.0	77.3	89	
Total Bright Sunshine (h)[15]	163.3	148.7	188.9	
Percent Possible Bright Sunshine[16]	43.1	39.2	50	
Total Global Radiation (MJ m^{-2})[17]	387.5	329.9	351.8	
Total Diffuse Radiation (MJ m^{-2})[17]	149.1	145.1	127.6	
Mean Soil Temperature (°C) (10,50 cm)[20]	10.2, 13.5	9.3, 12.4	11.2, 13.3	
Mean Soil Temperature (°C) (150,300 cm)[20]	11.5, 10.0	11.0, 9.9	11.9, 9.9	

Table 11 Monthly Weather Summary for October, 1993

Element	1993 Value	1992 Value	Mean or Extreme Value 1961 - 1990	Extreme All Years
Monthly Mean Temperature[4] (°C)	5.2[b]	4.5	4.8	
Monthly Mean Maximum Temperature[5] (°C)	11.3[b]	9.8	10.9	
Monthly Mean Minimum Temperature[6] (°C)	-0.9[b]	-0.9	-1.3	
Extreme Maximum Temperature[7] (°C)	18.0[b]	28.0	28.5	32.2
Year/Day(s)[16]	1993/23&24	1992/1	1984/8	1943/5
Years of Record[19]	1	1	28	94
Extreme Minimum Temperature[7] (°C)	-8.0[b]	-12.5	-19.5	-25.6
Year/Day(s)[16]	1993/29	1992/18	1984/30&31	1919/26
Years of Record[19]	1	1	28	94
Days with Frost[8]	17[b]	20	19	
Heating Degree-Days[9] (18°C base)	388.2[b]	414.0	405.2	
Growing Degree-Days[10] (5°C base)	55.4[b]	71.5	62.2	
Total Precipitation[11] (mm)	0.4	13.6[a]	18.0	
Greatest 24-hour Precipitation (mm)	0.2	5.8[a]	36.7	36.7
Year/Day(s)[16]	1993/26&28	1992/4	1984/16	1984/16
Years of Record[19]	1	1	28	94
Precipitation Days[12]	2	9[a]	6	
Mean Wind Speed (km/h)[13]	14.1[b]	14.8	17.1	
Peak Gust Speed (km/h)[14]	68.3[b]	73	96	
Total Bright Sunshine (h)[15]	162.8	149.1	166.4	
Percent Possible Bright Sunshine[16]	49.5	45.3	51	
Total Global Radiation (MJ m^{-2})[17]	256.4	228.6	239.1	
Total Diffuse Radiation (MJ m^{-2})[17]	83.0	96.9	92.6	
Mean Soil Temperature (°C) (10,50 cm)[20]	5.3, 9.4	4.7, 8.9	4.5, 8.1	
Mean Soil Temperature (°C) (150,300 cm)[20]	9.5, 9.5	9.4, 9.4	9.7, 9.5	

[a] estimate from the tipping bucket data.
[b] 1 day missing data.

Table 12 Monthly Weather Summary for November, 1993

Element	1993 Value	1992 Value	Mean or Extreme Value 1961 - 1990	Extreme All Years
Monthly Mean Temperature[4] (°C)	-6.8	-2.2	-6.1	
Monthly Mean Maximum Temperature[5] (°C)	-3.0	0.6	-1.5	
Monthly Mean Minimum Temperature[6] (°C)	-10.7	-5.0	-10.5	
Extreme Maximum Temperature[7] (°C)	4.5	5.0	19.4	21.7
Year/Day(s)[16]	1993/1	1992/6	1975/4	1903/3
Years of Record[19]	1	1	29	95
Extreme Minimum Temperature[7] (°C)	-25.5	-13.0	-33.5	-39.4
Year/Day(s)[16]	1993/23	1992/25	1985/24	1893/30
Years of Record[19]	1	1	29	95
Days with Frost[8]	28	28	29	
Heating Degree-Days[9] (18°C base)	753.8	603.0	692	
Growing Degree-Days[10] (5°C base)	0.0	0.0	2.8	
Total Precipitation[11] (mm)	26.1	14.5	14.9	
Greatest 24-hour Precipitation (mm)	7.0	7.6	19.3	27.9
Year/Day(s)[16]	1993/1	1992/22	1978/4	1938/1
Years of Record[19]	1	1	29	95
Precipitation Days[12]	6	12	8	
Mean Wind Speed (km/h)[13]	13.8	14.6	15.3	
Peak Gust Speed (km/h)[14]	75.1	69.7	100.0	
Total Bright Sunshine (h)[15]	92.3	45.1	101.8	
Percent Possible Bright Sunshine[16]	35.1	17.1	39	
Total Global Radiation (MJ m^{-2})[17]	151.6	80.4	123.7	
Total Diffuse Radiation (MJ m^{-2})[17]	71.0	53.6	73.6	
Mean Soil Temperature (°C) (10,50 cm)[20]	-0.1, 5.0	0.6, 4.8	-1.7, 2.6	
Mean Soil Temperature (°C) (150,300 cm)[20]	7.0, 8.0	6.9, 7.8	6.8, 8.1	

Table 13 Monthly Weather Summary for December, 1993

Element	1993 Value	1992 Value	Mean or Extreme Value 1961 - 1990	Extreme All Years
Monthly Mean Temperature[4] (°C)	-8.8[a]	-18.0	-14.8	
Monthly Mean Maximum Temperature[5] (°C)	-4.4[a]	-13.7	-9.8	
Monthly Mean Minimum Temperature[6] (°C)	-13.2[a]	-22.3	-19.3	
Extreme Maximum Temperature[7] (°C)	5.5[a]	1.0	9.5	13.3
Year/Day(s)[16]	1993/11	1992/1	1987/7	1939/5
Years of Record[19]	1	1	29	95
Extreme Minimum Temperature[7] (°C)	-29.0[a]	-40.0	-42.2	-43.9
Year/Day(s)[16]	1993/27	1992/31	1973/31	1892/22
Years of Record[19]	1	1	29	95
Days with Frost[8]	31[b]	31	31	
Heating Degree-Days[9] (18°C base)	761.4[a]	1113.5	987.7	
Growing Degree-Days[10] (5°C base)	0.0[a]	0.0	0.0	
Total Precipitation[11] (mm)	7.7[a]	16.0	20.6	
Greatest 24-hour Precipitation (mm)	5.0[a]	4.5	14.5	20.6
Year/Day(s)[16]	1993/5	1992/1	1973/23	1936/24
Years of Record[19]	1	1	29	95
Precipitation Days[12]	4[a]	10	13	
Mean Wind Speed (km/h)[13]	13.9	13.8	15.7	
Peak Gust Speed (km/h)[14]	53.6	89.4	97.0	
Total Bright Sunshine (h)[15]	49.0[a]	71.1	84.2	
Percent Possible Bright Sunshine[16]	20.5	29.7	35	
Total Global Radiation (MJ m^{-2})[17]	N/A	95.3	95.2	
Total Diffuse Radiation (MJ m^{-2})[17]	61.4[a]	57.1	54.3	
Mean Soil Temperature (°C) (10,50 cm)[20]	-2.5, 2.1[a]	-3.5, 2.0	-6.6, -1.7	
Mean Soil Temperature (°C) (150,300 cm)[20]	4.6, 6.6[a]	4.9, 6.7	3.9, 6.3	

[a] 2 days of missing data.
[b] used Saskatoon Airport to confirm minimum temperatures.
N/A not available due to equipment malfunction.

Table 14 **Diffuse Solar Radiation (MJm^{-2}) at Saskatoon SRC, 1993.**

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	1.8	2.3	4.4	10.4	7.7	6.7	9.8	8.6	5.9	M	3.2	1.7
2	2.0	2.8	5.8	8.0	8.0	10.9	9.2	6.5	5.8	3.2	2.8	1.4
3	2.1	2.1	3.9	7.9	11.0	10.5	9.8	7.9	5.2	3.3	1.9	2.1
4	2.3	3.1	3.5	7.5	9.8	8.3	3.1	9.6	6.2	3.2	3.1	1.7
5	2.2	3.9	3.6	6.6	9.0	8.1	8.8	8.3	6.1	2.3	3.2	1.3
6	2.3	3.1	3.5	4.4	9.8	4.8	7.1	6.2	4.2	2.2	3.5	1.3
7	3.2	3.5	4.5	6.5	6.2	11.4	8.8	4.7	5.6	3.7	2.7	1.5
8	3.2	3.1	5.5	8.2	6.0	8.1	7.5	8.8	4.5	2.0	3.1	1.6
9	2.5	3.6	6.2	7.0	6.0	9.8	9.6	4.1	5.0	2.4	2.8	1.0
10	2.2	4.3	4.7	2.9	3.2	6.9	10.1	8.2	6.4	2.0	2.0	0.9
11	2.6	5.1	5.4	4.2	3.3	9.0	8.1	7.3	6.8	3.8	3.1	0.7
12	2.9	4.2	5.8	8.6	3.5	2.9	8.9	4.0	4.8	2.0	2.6	0.6
13	3.0	4.2	3.6	7.1	7.4	4.7	9.1	6.6	6.4	2.5	1.3	0.5
14	0.1	4.2	5.8	7.2	5.2	7.0	8.2	6.4	7.8	3.1	3.1	0.6
15	2.3	5.2	6.4	5.5	5.7	9.8	7.4	8.3	6.4	3.5	2.8	0.6
16	2.4	3.7	4.0	7.9	10.0	6.1	9.6	5.5	6.3	4.0	1.9	0.4
17	2.6	3.9	3.4	7.8	10.2	10.4	9.8	5.8	4.7	3.0	2.0	0.4
18	2.1	5.2	7.9	7.1	10.8	7.6	10.4	7.3	2.3	2.1	2.2	0.6
19	2.0	4.9	5.6	7.2	8.5	6.5	5.5	5.6	4.7	2.9	2.3	0.8
20	2.1	5.6	5.3	5.2	9.9	4.2	6.2	4.8	3.3	1.8	2.8	0.7
21	2.4	5.4	5.0	3.9	9.5	8.2	5.9	5.9	3.5	2.7	2.6	0.8
22	M	5.3	7.8	8.3	5.5	5.8	10.9	6.8	2.3	5.5	2.8	M
23	3.1	5.2	8.5	7.4	7.9	6.8	6.3	3.6	2.3	2.0	1.8	M
24	3.1	5.1	7.4	6.7	7.6	6.0	5.3	4.5	4.1	2.5	1.7	M
25	2.8	3.4	8.6	8.8	5.6	3.6	8.6	5.8	4.3	2.1	1.4	1.2
26	2.5	3.8	4.2	8.1	4.4	11.4	7.9	6.7	5.9	3.4	1.3	1.9
27	3.2	5.5	2.1	3.3	9.9	9.8	8.0	6.6	2.9	2.1	2.3	1.7
28	3.3	3.8	5.1	9.7	8.4	6.6	4.9	8.6	4.4	3.2	2.0	1.9
29	3.4		3.8	8.6	8.8	2.8	3.9	7.3	6.6	3.2	1.2	2.0
30	3.6		4.6	7.7	6.6	10.6	5.6	5.7	4.7	2.5	1.7	2.0
31	2.2		8.1		7.6		7.7	6.6		2.8		1.9
TOTAL	75.5	115.5	164.0	209.7	233.0	225.3	242.0	202.6	149.4	85.0	71.2	33.8

M = missing data

Table 15 **Global solar radiation (MJm^{-2}) at Saskatoon SRC, 1993.**

DAY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1	3.3	6.0	11.3	18.0	20.9	29.3	14.9	20.0	7.7	M	5.0	6.5
2	3.8	6.5	6.6	19.7	17.3	17.5	20.7	20.1	17.3	11.8	4.4	1.8
3	4.6	6.9	12.1	18.3	16.7	23.7	24.4	22.9	11.5	13.0	2.3	3.2
4	2.5	3.4	13.1	13.7	26.8	26.0	4.0	17.2	13.8	12.7	8.1	2.6
5	4.6	4.2	12.0	13.9	26.3	18.1	13.4	21.6	14.6	12.8	3.9	5.0
6	3.6	3.7	10.9	5.9	21.2	30.9	27.4	22.9	18.4	2.8	7.6	2.9
7	3.8	7.9	9.7	11.8	8.1	20.9	24.1	21.5	17.2	10.4	3.2	5.7
8	4.4	8.9	8.1	15.4	7.9	26.8	25.8	20.9	16.1	14.1	3.8	M
9	4.5	6.5	M	13.5	26.4	22.7	15.7	24.4	14.4	12.7	3.3	M
10	4.0	7.5	6.8	3.8	27.3	24.3	18.1	15.9	14.7	12.6	7.4	M
11	4.2	6.5	7.2	5.5	27.4	15.3	26.3	10.9	10.8	6.0	7.5	M
12	3.9	6.2	14.5	15.9	27.9	3.7	23.2	24.8	6.6	11.4	3.4	M
13	4.2	7.5	16.8	16.6	25.3	6.2	21.4	20.7	13.7	3.1	1.6	M
14	0.1	7.7	14.2	20.7	28.0	28.2	23.7	17.4	11.6	10.1	6.4	M
15	4.8	8.1	10.8	16.8	28.6	14.4	11.3	13.3	9.3	8.7	4.6	M
16	5.6	10.2	17.3	17.9	18.7	30.4	18.2	7.6	12.9	4.9	7.5	M
17	4.8	10.9	17.7	17.8	13.9	23.3	17.4	19.2	16.2	9.8	8.5	M
18	5.4	6.9	13.2	9.3	21.8	26.2	15.2	14.0	17.3	9.8	6.6	M
19	5.2	8.0	17.1	10.3	25.3	28.3	26.4	21.9	12.8	8.5	2.8	M
20	5.1	8.2	17.9	23.9	27.6	29.9	25.7	20.6	4.2	10.6	3.5	M
21	M	8.3	15.0	24.4	18.1	22.0	18.4	18.5	15.2	9.2	3.2	M
22	M	8.9	15.4	22.3	7.2	11.3	17.8	9.4	16.5	6.1	3.5	M
23	5.0	10.2	13.7	21.4	11.3	28.6	19.5	21.4	15.8	9.1	7.5	M
24	4.1	11.1	15.3	24.0	25.0	8.2	25.0	20.0	13.1	6.6	7.1	M
25	3.2	11.9	12.8	19.0	28.7	4.7	21.7	12.2	6.4	5.9	5.6	M
26	5.2	11.6	5.4	15.7	6.5	14.9	23.6	8.8	9.7	8.2	5.7	M
27	3.6	9.1	2.7	4.4	13.4	19.2	23.8	18.1	14.7	2.6	4.0	M
28	6.7	10.9	17.5	12.6	24.4	9.1	25.8	13.7	11.7	4.3	4.3	M
29	6.0		4.9	25.7	26.2	3.7	26.3	12.2	9.77	7.7	5.2	M
30	5.6		5.9	25.9	22.2	19.7	23.9	19.3	10.0	7.6	4.4	M
31	6.5		13.5		30.3		18.2	11.9		3.5		M
TOTAL	128.3	223.7	359.4	484.1	656.7	587.5	641.3	543.3	383.9	256.6	151.9	M

M = missing data

Table 16 **Frost free season, 1993.**

Last Spring Frost	First Fall Frost	Length of Season
1993 May 17	September 14	119
1992 May 23	September 14	114
1991 May 27	September 18	113
Normal May 19 (1961-1990)	September 15	119

Table 17 Times of sunrise at Saskatoon, 1993 (local time, in hours and minutes).

DATE	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1	9.21	8.51	7.55	6.41	5.34	4.47	4.44	5.23	6.16	7.07	8.04	8.57
2	9.21	8.49	7.52	6.39	5.32	4.46	4.45	5.25	6.17	7.09	8.06	8.59
3	9.20	8.48	7.50	6.36	5.30	4.45	4.46	5.26	6.19	7.11	8.08	9.00
4	9.20	8.46	7.48	6.34	5.28	4.44	4.46	5.28	6.21	7.13	8.10	9.01
5	9.20	8.44	7.45	6.32	5.26	4.43	4.47	5.30	6.23	7.14	8.11	9.03
6	9.19	8.42	7.43	6.29	5.24	4.43	4.48	5.31	6.24	7.16	8.13	9.04
7	9.19	8.41	7.41	6.27	5.22	4.42	4.49	5.33	6.26	7.18	8.15	9.05
8	9.18	8.39	7.38	6.24	5.20	4.42	4.50	5.35	6.28	7.20	8.17	9.07
9	9.18	8.37	7.36	6.22	5.18	4.41	4.51	5.36	6.29	7.22	8.19	9.08
10	9.17	8.35	7.34	6.20	5.17	4.41	4.52	5.38	6.31	7.23	8.21	9.09
11	9.17	8.33	7.31	6.17	5.15	4.40	4.53	5.40	6.33	7.25	8.23	9.10
12	9.16	8.31	7.29	6.15	5.13	4.40	4.55	5.41	6.35	7.27	8.25	9.11
13	9.15	8.29	7.27	6.13	5.11	4.40	4.56	5.43	6.36	7.29	8.26	9.12
14	9.14	8.27	7.24	6.11	5.10	4.39	4.57	5.45	6.38	7.31	8.28	9.13
15	9.13	8.25	7.22	6.08	5.08	4.39	4.58	5.47	6.40	7.32	8.30	9.14
16	9.12	8.23	7.20	6.06	5.07	4.39	4.59	5.48	6.41	7.34	8.32	9.15
17	9.11	8.21	7.17	6.04	5.05	4.39	5.01	5.50	6.43	7.36	8.34	9.16
18	9.10	8.19	7.15	6.01	5.03	4.39	5.02	5.52	6.45	7.38	8.36	9.16
19	9.09	8.17	7.12	5.59	5.02	4.39	5.03	5.53	6.47	7.40	8.37	9.17
20	9.08	8.15	7.10	5.57	5.01	4.39	5.05	5.55	6.48	7.41	8.39	9.18
21	9.07	8.12	7.08	5.55	4.59	4.39	5.06	5.57	6.50	7.43	8.41	9.18
22	9.06	8.10	7.05	5.53	4.58	4.40	5.08	5.59	6.52	7.45	8.43	9.19
23	9.04	8.08	7.03	5.50	4.56	4.40	5.09	6.00	6.53	7.47	8.44	9.19
24	9.03	8.06	7.00	5.48	4.55	4.40	5.11	6.02	6.55	7.49	8.46	9.20
25	9.02	8.04	6.58	5.46	4.54	4.41	5.12	6.04	6.57	7.51	8.48	9.20
26	9.00	8.01	6.55	5.44	4.53	4.41	5.14	6.05	6.59	7.53	8.49	9.20
27	8.59	7.59	6.53	5.42	4.52	4.42	5.15	6.07	7.00	7.55	8.51	9.21
28	8.57	7.57	6.51	5.40	4.50	4.42	5.17	6.09	7.02	7.56	8.52	9.21
29	8.56		6.48	5.38	4.49	4.43	5.18	6.11	7.04	7.58	8.54	9.21
30	8.54		6.46	5.36	4.48	4.43	5.20	6.12	7.06	8.00	8.56	9.21
31	8.53		6.43		4.47		5.22	6.14		8.02		9.21

Table 18 Times of sunset at Saskatoon, 1993 (local time, in hours and minutes).

DATE	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1	16.59	17.49	18.43	19.40	20.34	21.22	21.37	21.03	19.58	18.45	17.36	16.54
2	17.00	17.51	18.45	19.42	20.35	21.23	21.36	21.01	19.55	18.43	17.34	16.53
3	17.01	17.53	18.47	19.44	20.37	21.24	21.36	20.59	19.53	18.41	17.33	16.52
4	17.03	17.55	18.49	19.45	20.39	21.25	21.35	20.57	19.51	18.38	17.31	16.52
5	17.04	17.57	18.51	19.47	20.41	21.27	21.35	20.55	19.48	18.36	17.29	16.51
6	17.05	17.59	18.53	19.49	20.42	21.28	21.34	20.54	19.46	18.33	17.27	16.51
7	17.06	18.01	18.55	19.51	20.44	21.28	21.34	20.52	19.43	18.31	17.25	16.50
8	17.08	18.03	18.56	19.53	20.46	21.29	21.33	20.50	19.41	18.29	17.23	16.50
9	17.09	18.05	18.58	19.54	20.48	21.30	21.32	20.48	19.39	18.26	17.22	16.50
10	17.11	18.07	19.00	19.56	20.49	21.31	21.31	20.46	19.36	18.24	17.20	16.49
11	17.12	18.09	19.02	19.58	20.51	21.32	21.31	20.44	19.34	18.22	17.18	16.49
12	17.14	18.11	19.04	20.00	20.53	21.33	21.30	20.42	19.31	18.19	17.17	16.49
13	17.15	18.13	19.06	20.02	20.54	21.33	21.29	20.40	19.29	18.17	17.15	16.49
14	17.17	18.14	19.07	20.03	20.56	21.34	21.28	20.38	19.27	18.15	17.14	16.49
15	17.18	18.16	19.09	20.05	20.58	21.35	21.27	20.36	19.24	18.13	17.12	16.49
16	17.20	18.18	19.11	20.07	20.59	21.35	21.26	20.33	19.22	18.10	17.11	16.49
17	17.22	18.20	19.13	20.09	21.01	21.36	21.25	20.31	19.19	18.08	17.09	16.49
18	17.23	18.22	19.15	20.11	21.02	21.36	21.23	20.29	19.17	18.06	17.08	16.49
19	17.25	18.24	19.17	20.12	21.04	21.36	21.22	20.27	19.14	18.04	17.06	16.50
20	17.27	18.26	19.18	20.14	20.06	21.37	21.21	20.25	19.12	18.01	17.05	16.50
21	17.29	18.28	19.20	20.16	21.07	21.37	21.20	20.23	19.10	17.59	17.04	16.50
22	17.30	18.30	19.22	20.18	21.09	21.37	21.18	20.20	19.07	17.57	17.03	16.51
23	17.32	18.32	19.24	20.19	21.10	21.37	21.17	20.18	19.05	17.55	17.01	16.52
24	17.34	18.34	19.26	20.21	21.11	21.37	21.15	20.16	19.02	17.53	17.00	16.52
25	17.36	18.36	19.27	20.23	21.13	21.38	21.14	20.14	19.00	17.51	16.59	16.53
26	17.38	18.38	19.29	20.25	21.14	21.37	21.12	20.11	18.57	17.48	16.58	16.53
27	17.40	18.40	19.31	20.27	21.16	21.37	21.11	20.09	18.55	17.46	16.57	16.54
28	17.42	18.41	19.33	20.28	21.17	21.37	21.09	20.07	18.53	17.44	16.56	16.55
29	17.43		19.35	20.30	21.18	21.37	21.08	20.05	18.50	17.42	16.55	16.56
30	17.45		19.36	20.32	21.20	21.37	21.06	20.02	18.48	17.40	16.54	16.57
31	17.47		19.38		21.21		21.04	20.00		17.38		16.58

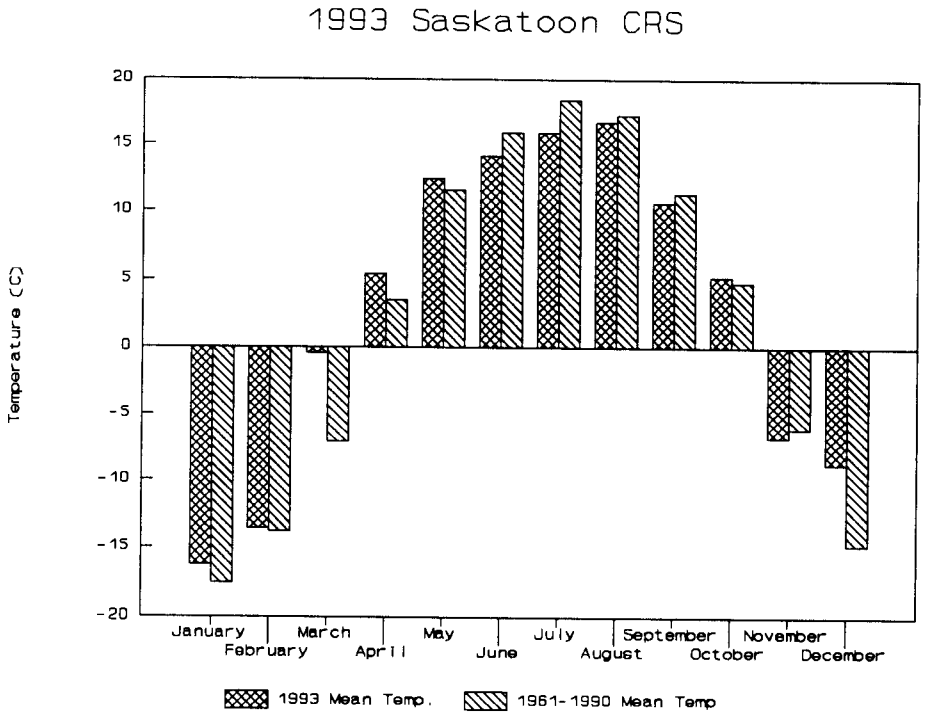

Figure 1 Monthly Mean Temperature

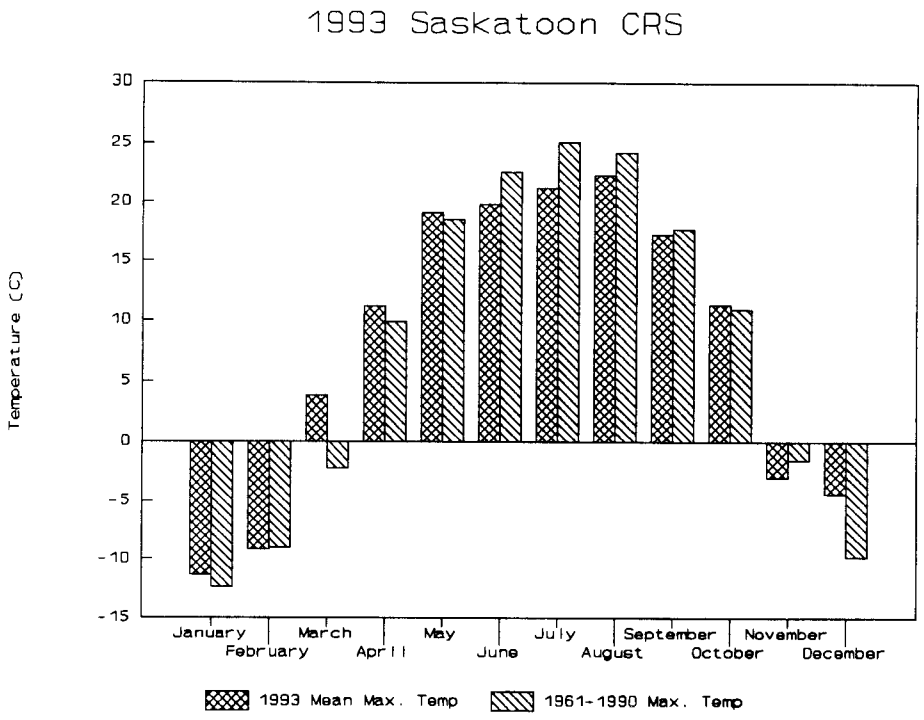

Figure 2 Mean Maximum Temperature

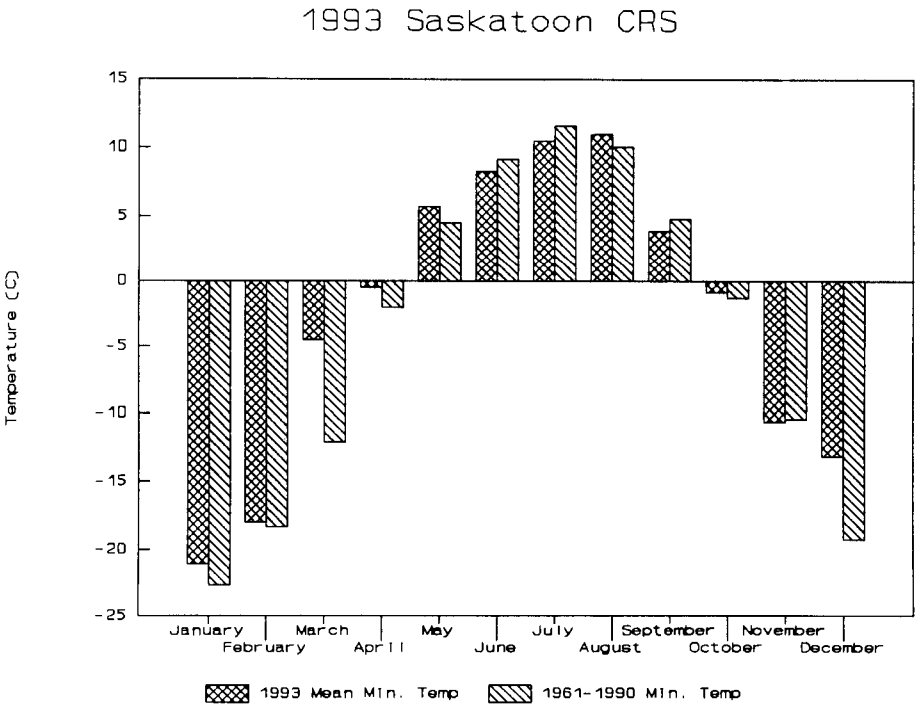

Figure 3 Mean Minimum Temperature

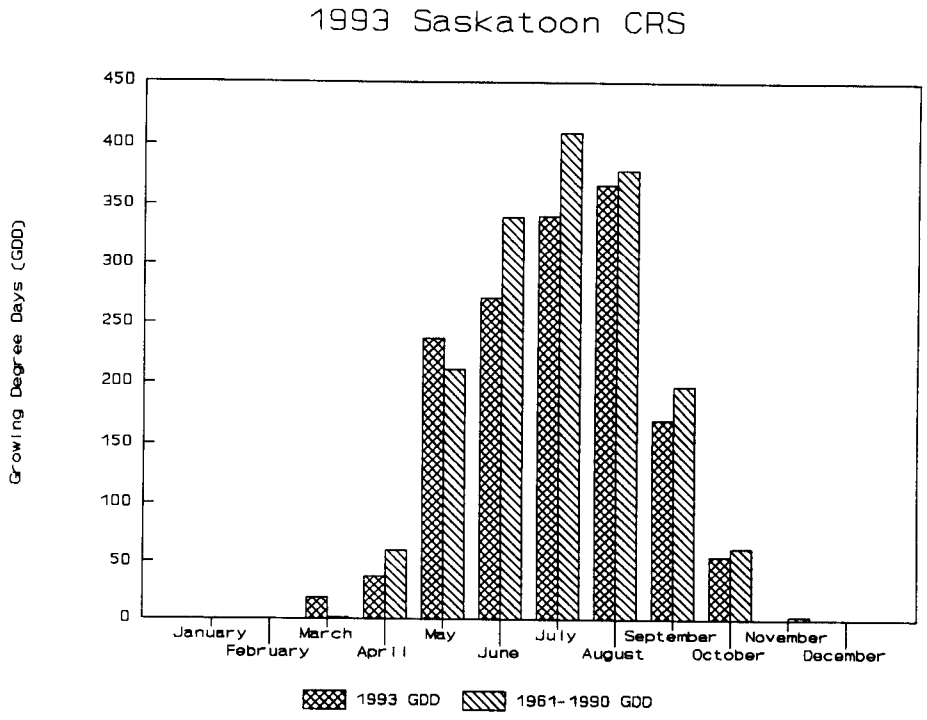

Figure 4 Monthly Growing Degree-Days

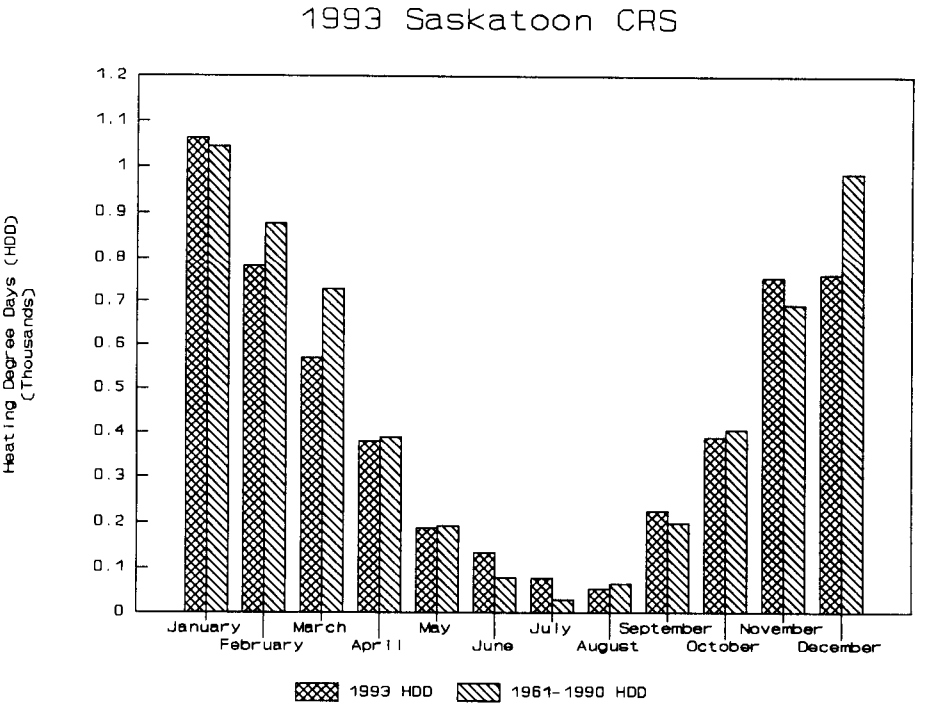

Figure 5 Monthly Heating Degree-Days

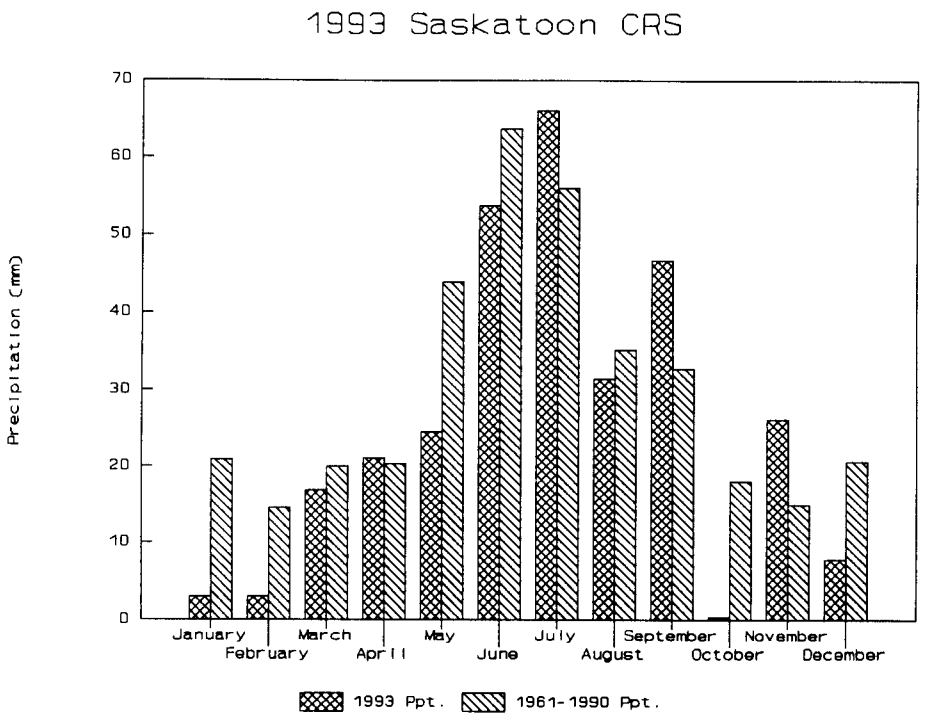

Figure 6 Monthly Precipitation

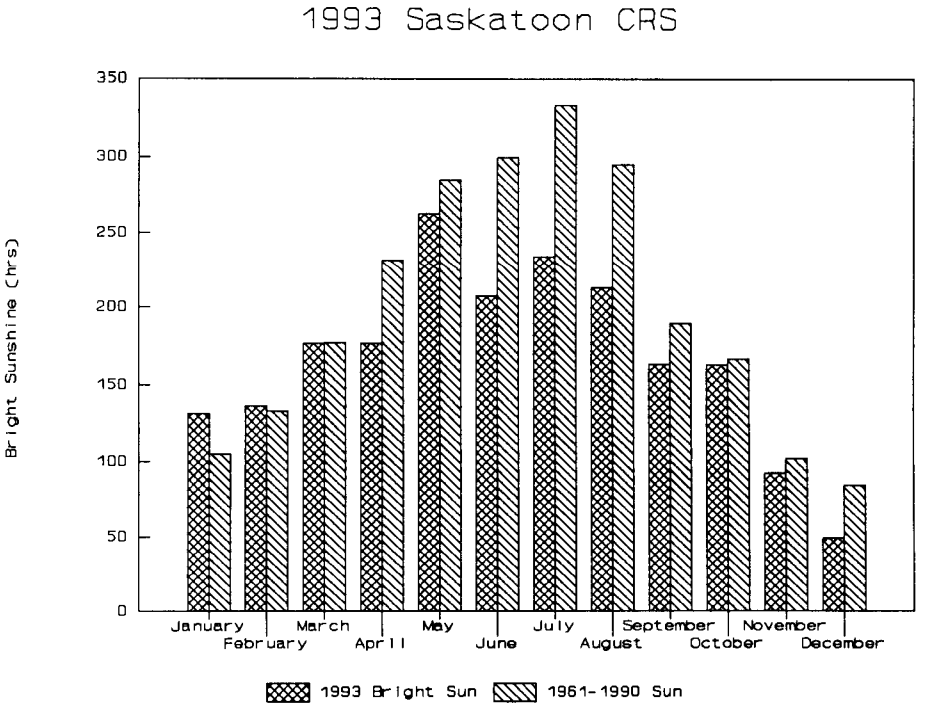

Figure 7 Monthly Bright Sunshine