U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data,
and Information Service

Climatography of the United States No. 20 1971-2000

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801
www.ncdc.noaa.gov

Station: CASS LAKE, MN **COOP ID: 211374**

Climate Division: MN 2 **NWS Call Sign:** **Elevation: 1,296 Feet** **Lat: 47˚23N** **Lon: 94˚37W**

Temperature (˚F)

	Mean (1)			Extremes										Degree Days (1) Base Temp 65		Mean Number of Days (3)					
Month	Daily Max	Daily Min	Mean	Highest Daily(2)	Year	Day	Highest Month(1) Mean	Year	Lowest Daily(2)	Year	Day	Lowest Month(1) Mean	Year	Heating	Cooling	Max >= 100	Max >= 90	Max >= 50	Max <= 32	Min <= 32	Min <= 0
Jan	15.6	-8.8	3.4	53	1973	26	16.4	1990	-48	1996	20	-10.7	1982	1912	0	.0	.0	.1	27.6	31.0	21.7
Feb	23.8	-1.8	11.0	60+	1976	25	28.0	1998	-48	1996	1	-.7	1979	1513	0	.0	.0	.6	20.2	28.0	15.7
Mar	35.6	13.4	24.5	73+	1986	30	33.6	1973	-37	1962	1	15.9	1996	1256	0	.0	.0	3.8	11.2	29.1	7.2
Apr	51.4	27.5	39.5	96	1980	22	47.4	1987	-15	1954	3	32.2	1975	767	0	.0	@	16.6	1.3	21.5	.4
May	66.6	40.7	53.7	95	1964	22	63.8	1977	10	1966	1	46.4	1979	376	25	.0	.2	28.8	@	7.4	.0
Jun	74.7	50.5	62.6	98+	1995	18	69.4	1988	25+	1964	4	56.1	1982	139	67	.0	1.1	30.0	.0	.6	.0
Jul	79.0	55.5	67.3	104	1988	7	71.3	1974	33	1984	7	60.0	1992	52	122	.2	2.3	31.0	.0	.0	.0
Aug	76.9	53.6	65.3	101+	1983	8	69.8	1983	20	1952	1	59.0	1977	86	93	.1	1.5	31.0	.0	.2	.0
Sep	65.9	44.4	55.2	98	1983	3	61.1	1998	17+	1974	22	49.8	1993	303	9	.0	.4	28.7	.0	4.0	.0
Oct	52.8	33.2	43.0	92	1963	6	49.5	1973	2+	1976	27	37.6	1976	682	0	.0	.0	19.3	.6	16.4	.0
Nov	33.9	17.2	25.6	74	1975	5	35.2	1999	-31	1964	30	16.3	1996	1182	0	.0	.0	3.7	14.1	28.4	3.5
Dec	20.3	-.4	10.0	58	1962	3	23.7	1997	-46+	1983	20	-5.0	1983	1708	0	.0	.0	.3	25.2	31.0	16.6
Ann	49.7	27.1	38.4	104	Jul 1988	7	71.3	Jul 1974	-48+	Feb 1996	1	-10.7	Jan 1982	9976	316	.3	5.5	193.9	100.2	197.6	65.1

\+ Also occurred on an earlier date(s)

@ Denotes mean number of days greater than 0 but less than .05

Complete documentation available from: www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

(1) From the 1971-2000 Monthly Normals

(2) Derived from station's available digital record: 1911-2001

(3) Derived from 1971-2000 serially complete daily data

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Precipitation (inches)

Precipitation Totals

Month	Means/ Medians(1) Mean	Means/ Medians(1) Median	Extremes Highest Daily(2)	Year	Day	Highest Monthly(1)	Year	Lowest Monthly(1)	Year
Jan	.82	.72	1.00	1969	6	2.51	1975	.07	1973
Feb	.65	.64	1.30	1986	18	1.90	1986	.04	1988
Mar	1.28	1.18	1.55	1995	31	3.10	1995	.31	1986
Apr	1.83	1.75	1.70	1957	19	4.59	1986	.12	1980
May	2.78	2.62	3.13	1962	23	6.66	1999	.12	1976
Jun	3.95	4.07	4.05	1974	6	8.85	1994	.50	1987
Jul	4.30	3.71	6.06	1975	2	8.74	1987	.78	1984
Aug	3.35	3.46	3.63	1978	23	8.31	1978	.74	1979
Sep	2.82	2.63	4.07	1950	18	5.82	1973	.46	1976
Oct	2.55	2.11	2.76	1990	3	6.56	1971	.30	1992
Nov	1.39	1.30	1.47	1974	1	3.37	1977	.03	1999
Dec	.68	.71	2.10	1968	23	1.41	1972	.10	1982
Ann	26.40	26.38	6.06	Jul 1975	2	8.85	Jun 1994	.03	Nov 1999

Mean Number of Days (3)

Month	Daily Precipitation >= 0.01	>= 0.10	>= 0.50	>= 1.00
Jan	8.3	2.9	.3	.0
Feb	6.6	2.2	.1	@
Mar	7.8	3.5	.5	.1
Apr	8.3	4.7	1.1	.2
May	11.4	6.2	1.7	.4
Jun	12.4	7.0	2.3	1.0
Jul	11.6	7.6	2.3	1.1
Aug	10.5	6.2	2.2	.8
Sep	10.6	5.8	2.0	.4
Oct	8.4	4.6	1.7	.7
Nov	7.1	3.7	.8	.2
Dec	7.4	2.3	.2	.0
Ann	110.4	56.7	15.2	4.9

Precipitation Probabilities (1)

Probability that the monthly/annual precipitation will be equal to or less than the indicated amount

Monthly/Annual Precipitation vs Probability Levels
These values were determined from the incomplete gamma distribution

Month	.05	.10	.20	.30	.40	.50	.60	.70	.80	.90	.95
Jan	.14	.22	.34	.45	.56	.68	.82	1.00	1.22	1.59	1.94
Feb	.08	.13	.22	.31	.40	.51	.63	.79	1.00	1.34	1.67
Mar	.44	.56	.73	.88	1.03	1.17	1.33	1.52	1.76	2.13	2.48
Apr	.42	.59	.86	1.10	1.34	1.59	1.87	2.21	2.66	3.36	4.03
May	.49	.74	1.14	1.52	1.91	2.33	2.81	3.39	4.16	5.41	6.60
Jun	1.11	1.48	2.05	2.55	3.03	3.54	4.10	4.76	5.61	6.96	8.22
Jul	1.30	1.71	2.32	2.85	3.36	3.89	4.47	5.15	6.04	7.42	8.70
Aug	.80	1.12	1.61	2.04	2.48	2.94	3.45	4.06	4.87	6.14	7.33
Sep	.80	1.07	1.47	1.83	2.17	2.53	2.92	3.39	3.99	4.94	5.82
Oct	.33	.54	.90	1.26	1.63	2.04	2.52	3.11	3.91	5.22	6.48
Nov	.17	.27	.47	.66	.87	1.10	1.37	1.70	2.15	2.88	3.60
Dec	.16	.22	.32	.41	.50	.59	.69	.82	.98	1.24	1.49
Ann	18.91	20.36	22.22	23.62	24.87	26.08	27.32	28.69	30.36	32.77	34.85

\+ Also occurred on an earlier date(s)
\# Denotes amounts of a trace
@ Denotes mean number of days greater than 0 but less than .05
****** Statistics not computed because less than six years out of thirty had measurable precipitation

(1) From the 1971-2000 Monthly Normals
(2) Derived from station's available digital record: 1911-2001
(3) Derived from 1971-2000 serially complete daily data

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Snow (inches)

Snow Totals

Means/Medians (1)

Month	Snow Fall Mean	Snow Fall Median	Snow Depth Mean	Snow Depth Median
Jan	11.0	7.4	13	13
Feb	6.5	6.3	10	5
Mar	7.9	6.2	5	#
Apr	2.5	1.3	1	0
May	.1	.0	#	0
Jun	.0	.0	0	0
Jul	.0	.0	0	0
Aug	.0	.0	0	0
Sep	.0	.0	0	0
Oct	.8	.3	#	0
Nov	5.9	3.5	1	0
Dec	8.3	9.1	5	3
Ann	43.0	34.1	N/A	N/A

Extremes (2)

Month	Highest Daily Snow Fall	Year	Day	Highest Monthly Snow Fall	Year	Highest Daily Snow Depth	Year	Day	Highest Monthly Mean Snow Depth	Year
Jan	13.5	1988	13	35.4	1975	29+	1975	31	26	1975
Feb	6.2	1996	27	16.7	1979	32	1971	4	30	1975
Mar	10.1	1995	31	20.2	1995	29	1971	2	20	1971
Apr	7.0	1974	1	7.0	1974	24	1971	3	7	1971
May	1.6	1983	15	1.6	1983	2	1976	2	#+	1981
Jun	.0	0	0	.0	0	0	0	0	0	0
Jul	.0	0	0	.0	0	0	0	0	0	0
Aug	.0	0	0	.0	0	0	0	0	0	0
Sep	.0	0	0	.0	0	0	0	0	0	0
Oct	5.2	1990	18	5.2	1990	3	1995	24	#+	1996
Nov	8.0	1996	30	18.3	1977	16	1998	19	5	1991
Dec	8.5	1990	20	16.6	1988	20	1995	20	20	1995
Ann	13.5	Jan 1988	13	35.4	Jan 1975	32	Feb 1971	4	30	Feb 1975

Mean Number of Days (1)

Snow Fall >= Thresholds

Month	0.1	1.0	3.0	5.0	10.0
Jan	7.5	3.5	.9	.3	@
Feb	5.3	2.5	.6	.2	.0
Mar	5.3	2.7	.8	.2	@
Apr	1.7	.9	.1	.1	.0
May	@	@	.0	.0	.0
Jun	.0	.0	.0	.0	.0
Jul	.0	.0	.0	.0	.0
Aug	.0	.0	.0	.0	.0
Sep	.0	.0	.0	.0	.0
Oct	.9	.2	@	@	.0
Nov	4.6	2.5	.8	.3	.0
Dec	6.7	2.9	.5	.2	.0
Ann	32.0	15.2	3.7	1.3	@

Snow Depth >= Thresholds

Month	1	3	5	10
Jan	-9.9	-9.9	-9.9	-9.9
Feb	-9.9	-9.9	-9.9	-9.9
Mar	-9.9	-9.9	-9.9	-9.9
Apr	4.4	3.2	2.6	1.2
May	.0	.0	.0	.0
Jun	.0	.0	.0	.0
Jul	.0	.0	.0	.0
Aug	.0	.0	.0	.0
Sep	.0	.0	.0	.0
Oct	.4	.0	.0	.0
Nov	-9.9	-9.9	-9.9	-9.9
Dec	-9.9	-9.9	-9.9	-9.9
Ann	-9.9	-9.9	-9.9	-9.9

+ Also occurred on an earlier date(s) #Denotes trace amounts

@ Denotes mean number of days greater than 0 but less than .05

-9/-9.9 represents missing values
Annual statistics for Mean/Median snow depths are not appropriate

(1) Derived from Snow Climatology and 1971-2000 daily data

(2) Derived from 1971-2000 daily data

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Freeze Data

Spring Freeze Dates (Month/Day)

Temp (F)	Probability of later date in spring (thru Jul 31) than indicated(*)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	6/28	6/21	6/17	6/13	6/09	6/05	6/01	5/28	5/21
32	6/10	6/05	6/01	5/29	5/26	5/23	5/20	5/16	5/11
28	5/26	5/22	5/19	5/17	5/15	5/12	5/10	5/07	5/03
24	5/16	5/12	5/09	5/06	5/04	5/02	4/29	4/26	4/22
20	5/12	5/07	5/03	4/29	4/26	4/23	4/19	4/15	4/10
16	4/27	4/23	4/19	4/17	4/14	4/11	4/09	4/05	4/01

Fall Freeze Dates (Month/Day)

Temp (F)	Probability of earlier date in fall (beginning Aug 1) than indicated(*)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	8/13	8/18	8/23	8/26	8/29	9/01	9/05	9/09	9/14
32	8/29	9/03	9/07	9/10	9/13	9/16	9/19	9/23	9/28
28	9/13	9/17	9/20	9/23	9/25	9/28	9/30	10/03	10/07
24	9/20	9/25	9/29	10/02	10/05	10/08	10/12	10/15	10/21
20	9/29	10/05	10/09	10/13	10/16	10/19	10/23	10/27	11/02
16	10/12	10/18	10/22	10/25	10/29	11/01	11/04	11/09	11/14

Freeze Free Period

Temp (F)	Probability of longer than indicated freeze free period (Days)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	106	97	91	86	80	75	70	64	55
32	131	124	118	114	109	105	100	95	87
28	150	144	140	136	133	130	126	122	116
24	174	167	162	157	153	149	145	140	133
20	198	189	183	177	172	167	162	155	146
16	220	212	207	202	197	192	187	182	173

***** Probability of observing a temperature as cold, or colder, later in the spring or earlier in the fall than the indicated date.

0/00 Indicates that the probability of occurrence of threshold temperature is less than the indicated probability.

Derived from 1971-2000 serially complete daily data

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Degree Days to Selected Base Temperatures (˚F)

Heating Degree Days (1)

Base Below	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
65	1912	1513	1256	767	376	139	52	86	303	682	1182	1708	9976
60	1757	1373	1101	619	256	66	13	29	180	528	1032	1553	8507
57	1664	1289	1008	532	196	37	5	13	120	437	942	1460	7703
55	1602	1233	946	475	161	24	1	6	87	377	882	1398	7192
50	1447	1093	791	342	89	6	0	0	31	243	733	1243	6018
32	901	619	306	45	2	0	0	0	0	14	271	715	2873

Cooling Degree Days (1)

Base Above	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
32	12	30	73	268	673	917	1093	1030	695	354	78	30	5253
55	0	0	0	8	119	251	381	323	92	5	0	0	1179
57	0	0	0	5	92	204	323	268	65	2	0	0	959
60	0	0	0	2	59	143	238	191	35	0	0	0	668
65	0	0	0	0	25	67	122	93	9	0	0	0	316
70	0	0	0	0	8	21	46	32	1	0	0	0	108

Growing Degree Units (2)

Base	Growing Degree Units (Monthly)												Growing Degree Units (Accumulated Monthly)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
40	0	0	10	119	442	686	855	787	465	172	14	0	0	0	10	129	571	1257	2112	2899	3364	3536	3550	3550
45	0	0	1	62	310	537	700	632	326	90	3	0	0	0	1	63	373	910	1610	2242	2568	2658	2661	2661
50	0	0	0	27	195	393	545	478	202	41	1	0	0	0	0	27	222	615	1160	1638	1840	1881	1882	1882
55	0	0	0	10	112	262	390	329	111	17	0	0	0	0	0	10	122	384	774	1103	1214	1231	1231	1231
60	0	0	0	3	52	145	249	200	51	2	0	0	0	0	0	3	55	200	449	649	700	702	702	702
Base	**Growing Degree Units for Corn (Monthly)**												**Growing Degree Units for Corn (Accumulated Monthly)**											
50/86	0	0	9	97	289	434	552	505	278	106	12	0	0	0	9	106	395	829	1381	1886	2164	2270	2282	2282

(1) Derived from the 1971-2000 Monthly Normals
(2) Derived from 1971-2000 serially complete daily data
Note: For corn, temperatures below 50 are set to 50, and temperatures above 86 are set to 86

Complete documentation available from:
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Notes

a. The monthly means are simple arithmetic averages computed by summing the monthly values for the period 1971-2000 and dividing by thirty. Prior to averaging, the data are adjusted if necessary to compensate for data quality issues, station moves or changes in station reporting practices. Missing months are replaced by estimates based on neighboring stations.

b. The median is defined as the middle value in an ordered set of values. The median is being provided for the snow and precipitation elements because the mean can be a misleading value for precipitation normals.

c. Only observed validated values were used to select the extreme daily values.

d. Extreme monthly temperature/precipitation means were selected from the monthly normals data.
Monthly snow extremes were calculated from daily values quality controlled to be consistent with the Snow Climatology.

e. Degree Days were derived using the same techniques as the 1971-2000 normals.
Compete documentation for the 1971-2000 Normals is available on the internet from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

f. Mean "number of days statistics" for temperature and precipitation were calculated from a serially complete daily data set .
Documentation of the serially complete data set is available from the link below:

g. Snowfall and snow depth statistics were derived from the Snow Climatology.
Documentation for the Snow Climatology project is available from the link under references.

Data Sources for Tables

Several different data sources were used to create the Clim20 climate summaries. In some cases the daily extremes appear inconsistent with the monthly extremes and or the mean number of days statistics. For example, a high daily extreme value may not be reflected in the highest monthly value or the mean number of days threshold that is less than and equal to the extreme value. Some of these difference are caused by different periods of record. Daily extremes are derived from the station's entire period of record while the serial data and normals data were are for the 1971-2000 period. Therefore extremes observed before 1971 would not be included in the 1971-2000 normals or the 1971-2000 serial daily data set. Inconsistencies can also occur when monthly values are adjusted to reflect the current observing conditions or were replaced during the 1971-2000 Monthly Normals processing and are not reconciled with the Summary of the Day data.

a. Temperature/ Precipitation Tables
   1. 1971-2000 Monthly Normals
   2. Cooperative Summary of the Day
   3. National Weather Service station records
   4. 1971-2000 serially complete daily data

b. Degree Day Table
   1. Monthly and Annual Heating and Cooling Degree Days Normals to Selected Bases derived from 1971-2000 Monthly Normals
   2. Daily Normal Growing Degree Units to Selected Base Temperatures derived from 1971-2000 serially complete daily data

c. Snow Tables
   1. Snow Climatology
   2. Cooperative Summary of the Day

d. Freeze Data Table
   1971-2000 serially complete daily data

References

U.S. Climate Normals 1971-2000, www.ncdc.noaa.gov/normals.html
U.S. Climate Normals 1971-2000-Products Clim20, www.ncdc.noaa.gov/oa/climate/normals/usnormalsprods.html
Snow Climatology Project Description, www.ncdc.noaa.gov/oa/climate/monitoring/snowclim/mainpage.html
Eischeid, J. K., P. Pasteris, H. F. Diaz, M. Plantico, and N. Lott, 2000: Creating a serially complete, national daily time series of temperature and precipitation for the Western United States. J. Appl. Meteorol., 39, 1580-1591,
www1.ncdc.noaa.gov/pub/data/special/ serialcomplete_jam_0900.pdf