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: MARSHALL, MN **COOP ID: 215204**

Climate Division: MN 7 **NWS Call Sign:** **Elevation: 1,152 Feet** **Lat: 44˚28N** **Lon: 95˚47W**

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	23.5	5.1	14.3	67	1981	24	29.1	1990	-30	1970	18	.3	1982	1571	0	.0	.0	.6	22.1	30.9	13.9
Feb	30.6	12.3	21.5	65	1981	17	33.0	1987	-30	1996	2	6.8	1979	1219	0	.0	.0	1.9	16.1	27.2	7.9
Mar	41.4	23.7	32.6	83	1968	31	40.6	2000	-24	1962	1	25.0	1975	1007	0	.0	.0	6.7	8.1	25.9	2.0
Apr	58.0	35.8	46.9	94+	1985	18	54.2	1987	3	1975	1	39.1	1975	548	5	.0	.2	20.7	.8	12.8	.0
May	72.9	48.4	60.7	99	1998	18	67.3	1988	21+	1967	4	55.6	1983	199	64	.0	.7	30.1	.0	1.3	.0
Jun	81.0	57.8	69.4	106	1988	24	75.8	1988	32	1995	8	64.0	1982	32	164	.2	3.9	30.0	.0	@	.0
Jul	84.7	62.2	73.5	109	1988	31	77.5	1974	42+	1971	30	65.6	1992	11	272	.4	7.1	31.0	.0	.0	.0
Aug	83.1	59.9	71.5	105	1988	15	77.4	1983	38	1965	28	65.4	1977	23	225	.2	4.6	31.0	.0	.0	.0
Sep	74.7	50.5	62.6	100	1976	7	69.6	1998	24	1974	22	57.8	1993	141	70	@	1.5	29.6	.0	.7	.0
Oct	61.3	38.8	50.1	92+	1997	2	56.7	1973	9	1981	26	44.2	1976	466	2	.0	.1	25.0	.1	10.3	.0
Nov	41.6	24.3	33.0	78	1999	8	44.8	1999	-15	1977	26	22.3	1985	962	0	.0	.0	7.2	8.7	25.3	1.4
Dec	27.7	11.2	19.5	64+	1998	2	28.8	1997	-27+	1983	23	2.6	1983	1413	0	.0	.0	.8	19.4	30.6	9.4
Ann	56.7	35.8	46.3	109	Jul 1988	31	77.5	Jul 1974	-30+	Feb 1996	2	.3	Jan 1982	7592	802	.8	18.1	214.6	75.3	165.0	34.6

\+ 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: 1948-2001

(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	.83	.71	1.19	1984	30	2.39	1997	.02+	1990
Feb	.58	.51	1.17+	1965	10	1.39	1977	.00	1995
Mar	1.83	1.71	1.55	1985	4	5.36	1977	.31	1994
Apr	2.34	2.14	4.22	2001	23	6.10	1986	.04	1980
May	3.13	3.29	3.68	1993	8	6.09	1990	.54	1981
Jun	3.73	3.12	8.07	1957	17	12.40	1993	.91	1973
Jul	3.55	3.62	3.42	1968	26	7.53	1993	.13	1975
Aug	3.09	2.81	6.50	1994	10	8.52	1994	.86	1984
Sep	2.28	2.22	3.44	1955	19	6.12	1986	.18	1974
Oct	1.96	1.72	3.27	1979	31	4.94	1971	.01	1989
Nov	1.63	1.59	2.16	1982	12	4.10	1983	.00	1980
Dec	.79	.64	1.92	1959	28	2.37	1996	.00+	1994
Ann	25.74	25.70	8.07	Jun 1957	17	12.40	Jun 1993	.00+	Feb 1995

Mean Number of Days (3)

Daily Precipitation

Month	>= 0.01	>= 0.10	>= 0.50	>= 1.00
Jan	5.5	2.3	.4	.1
Feb	5.0	1.9	.3	.0
Mar	7.3	4.3	1.3	.4
Apr	8.3	5.2	1.6	.5
May	10.0	6.3	2.0	.7
Jun	9.5	6.3	2.4	.9
Jul	8.7	5.9	2.1	1.1
Aug	8.6	5.5	2.0	.7
Sep	7.3	4.5	1.6	.5
Oct	6.4	3.9	1.4	.5
Nov	5.6	3.5	1.2	.3
Dec	4.6	2.2	.5	.2
Ann	86.8	51.8	16.8	5.9

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	.03	.06	.15	.25	.38	.53	.73	.98	1.35	1.98	2.63
Feb	.05	.12	.21	.30	.39	.48	.59	.72	.90	1.18	1.46
Mar	.23	.38	.64	.90	1.16	1.46	1.81	2.23	2.81	3.76	4.67
Apr	.36	.56	.90	1.22	1.56	1.92	2.35	2.86	3.55	4.68	5.76
May	.66	.95	1.41	1.83	2.25	2.70	3.20	3.81	4.61	5.88	7.09
Jun	.98	1.33	1.87	2.35	2.82	3.31	3.86	4.50	5.35	6.68	7.92
Jul	.74	1.06	1.58	2.06	2.53	3.04	3.62	4.31	5.22	6.68	8.06
Aug	.75	1.04	1.50	1.90	2.30	2.72	3.19	3.74	4.48	5.64	6.72
Sep	.42	.62	.95	1.26	1.58	1.92	2.31	2.77	3.40	4.40	5.35
Oct	.09	.19	.42	.68	.98	1.34	1.78	2.35	3.16	4.55	5.94
Nov	.04	.14	.35	.58	.84	1.14	1.51	1.98	2.64	3.75	4.86
Dec	.00	.08	.22	.35	.48	.62	.79	.98	1.25	1.69	2.12
Ann	15.50	17.36	19.80	21.70	23.43	25.11	26.88	28.87	31.31	34.91	38.08

\+ 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: 1948-2001
(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	7.1	5.6	7	6
Feb	6.0	6.6	6	3
Mar	8.5	7.2	3	1
Apr	1.7	.5	#	0
May	.0	.0	#	0
Jun	.0	.0	0	0
Jul	.0	.0	0	0
Aug	.0	.0	0	0
Sep	.0	.0	0	0
Oct	.6	.0	#	0
Nov	7.4	5.5	1	#
Dec	8.4	8.4	5	2
Ann	39.7	33.8	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	8.3	1999	2	22.6	1979	35	1997	30	31	1997
Feb	8.0	1984	19	10.8	1971	30	1997	17	28	1997
Mar	8.5	1984	4	16.5	1983	26	1997	8	15	1997
Apr	8.0	1994	29	8.0	1994	10	1975	3	2	1975
May	.5	1976	2	.5	1976	#+	1997	13	#+	1997
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	4.5	1999	2	5.5	1976	2+	1999	2	#+	1999
Nov	12.0	1983	28	25.0	1983	21	1983	30	9	1979
Dec	12.0	1982	28	17.2	1973	31	1996	31	24	1996
Ann	12.0+	Nov 1983	28	25.0	Nov 1983	35	Jan 1997	30	31	Jan 1997

Mean Number of Days (1)

Snow Fall >= Thresholds

Month	0.1	1.0	3.0	5.0	10.0
Jan	4.9	2.9	1.0	.5	.0
Feb	3.8	1.9	.6	.1	.0
Mar	3.6	2.2	1.0	.5	.0
Apr	.9	.6	.1	.1	.0
May	@	.0	.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	.2	.2	.1	.0	.0
Nov	3.1	2.0	.8	.3	.1
Dec	3.8	2.3	.8	.4	.1
Ann	20.3	12.1	4.4	1.9	.2

Snow Depth >= Thresholds

Month	1	3	5	10
Jan	18.5	15.5	12.0	4.4
Feb	-9.9	-9.9	-9.9	-9.9
Mar	7.1	4.6	3.2	.6
Apr	1.2	.5	.3	.1
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	.3	.0	.0	.0
Nov	3.7	2.2	1.6	1.1
Dec	16.5	10.3	7.2	2.3
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	5/25	5/21	5/18	5/15	5/13	5/11	5/08	5/05	5/01
32	5/19	5/13	5/10	5/06	5/03	4/30	4/27	4/23	4/18
28	5/05	4/29	4/25	4/22	4/19	4/15	4/12	4/08	4/02
24	4/21	4/16	4/13	4/10	4/08	4/05	4/02	3/30	3/25
20	4/13	4/09	4/05	4/02	3/31	3/28	3/25	3/22	3/17
16	4/09	4/04	3/31	3/28	3/25	3/22	3/19	3/15	3/10

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	9/12	9/16	9/19	9/22	9/24	9/27	9/29	10/02	10/06
32	9/21	9/25	9/28	10/01	10/03	10/05	10/08	10/10	10/14
28	9/28	10/03	10/06	10/09	10/11	10/14	10/17	10/20	10/24
24	10/04	10/10	10/14	10/18	10/21	10/25	10/29	11/02	11/08
20	10/11	10/17	10/22	10/26	10/29	11/02	11/06	11/10	11/16
16	10/27	11/01	11/04	11/07	11/10	11/13	11/16	11/19	11/24

Freeze Free Period

Temp (F)	Probability of longer than indicated freeze free period (Days)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	153	146	142	137	134	130	126	121	114
32	171	165	160	156	152	148	144	139	133
28	193	187	182	179	175	171	167	163	156
24	220	212	206	201	196	191	186	180	172
20	235	227	221	216	212	207	202	196	188
16	250	243	238	233	229	225	221	215	208

***** 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)

Base	Heating Degree Days (1)												
Below	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
65	1571	1219	1007	548	199	32	11	23	141	466	962	1413	7592
60	1416	1079	852	410	113	7	0	5	66	322	812	1258	6340
57	1323	995	759	334	75	2	0	1	37	246	723	1165	5660
55	1261	939	698	287	55	1	0	0	23	200	666	1103	5233
50	1107	809	551	185	22	0	0	0	5	108	528	952	4267
32	598	378	142	11	0	0	0	0	0	3	153	461	1746

Base	Cooling Degree Days (1)												
Above	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
32	50	83	158	458	888	1123	1285	1225	919	562	181	71	7003
55	0	0	1	44	230	433	572	512	252	46	4	0	2094
57	0	0	0	31	188	375	510	451	206	30	1	0	1792
60	0	0	0	17	133	290	417	362	145	13	0	0	1377
65	0	0	0	5	64	164	272	225	70	2	0	0	802
70	0	0	0	1	24	75	149	119	26	0	0	0	394

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	5	44	229	608	869	1023	950	641	302	47	1	0	5	49	278	886	1755	2778	3728	4369	4671	4718	4719
45	0	1	18	137	457	719	868	795	494	187	19	0	0	1	19	156	613	1332	2200	2995	3489	3676	3695	3695
50	0	0	5	70	315	569	713	640	351	102	9	0	0	0	5	75	390	959	1672	2312	2663	2765	2774	2774
55	0	0	1	38	199	421	558	485	223	46	0	0	0	0	1	39	238	659	1217	1702	1925	1971	1971	1971
60	0	0	0	14	106	280	404	331	128	16	0	0	0	0	0	14	120	400	804	1135	1263	1279	1279	1279
Base	Growing Degree Units for Corn (Monthly)												Growing Degree Units for Corn (Accumulated Monthly)											
50/86	0	1	31	147	367	560	682	624	394	185	29	0	0	1	32	179	546	1106	1788	2412	2806	2991	3020	3020

(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