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: MADISON SEWAGE PLANT, MN **COOP ID: 214994**

Climate Division: MN 4 **NWS Call Sign:** **Elevation: 1,080 Feet** **Lat: 45˚00N** **Lon: 96˚11W**

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	20.7	-.3	10.2	67	1981	24	26.9	1990	-35	1970	21	-3.0	1982	1702	0	.0	.0	.6	22.1	30.9	14.6
Feb	27.4	7.5	17.5	66	1991	8	30.2	1987	-36	1994	9	2.7	1979	1333	0	.0	.0	2.0	14.9	27.5	8.1
Mar	38.9	19.2	29.1	80+	1967	30	38.2	2000	-20	1984	9	21.4	1975	1114	0	.0	.0	8.1	6.7	26.4	2.3
Apr	56.0	33.0	44.5	96	1962	25	53.3	1987	0	1975	1	35.9	1975	618	3	.0	.4	22.9	.4	13.4	@
May	70.1	46.2	58.2	98+	1969	28	65.2	1977	20	1967	2	52.2	1979	251	38	.0	1.3	30.7	.0	1.8	.0
Jun	79.3	56.4	67.9	105+	1988	25	75.7	1988	32	1964	2	62.2	1982	67	152	.4	4.9	30.0	.0	.0	.0
Jul	84.0	60.6	72.3	110	1988	31	78.0	1988	40	1967	4	64.1	1992	22	248	.9	9.4	31.0	.0	.0	.0
Aug	81.2	57.5	69.4	110	1988	1	75.1	1988	34	1974	31	64.4	1985	46	181	.6	6.0	31.0	.0	.0	.0
Sep	72.3	46.8	59.6	100+	1983	2	65.8	1998	17	1974	22	54.6	1993	195	31	@	2.4	29.9	.0	1.5	.0
Oct	59.9	34.3	47.1	96	1963	5	53.1	1973	8	1967	28	41.3	1976	555	0	.0	.2	26.8	.1	11.0	.0
Nov	39.5	20.4	30.0	80	1999	9	40.6	1999	-18	1964	30	19.8	1985	1052	0	.0	.0	8.6	7.6	26.0	1.3
Dec	25.4	5.8	15.6	63+	1998	1	24.6	1997	-35	1973	31	-1.3	1983	1533	0	.0	.0	1.1	18.7	30.9	9.8
Ann	54.6	32.3	43.5	110+	Aug 1988	1	78.0	Jul 1988	-36	Feb 1994	9	-3.0	Jan 1982	8488	653	1.9	24.6	222.7	70.5	169.4	36.1

\+ 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: 1948-2001

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

Issue Date: February 2004

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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	.75	.55	1.80	1997	4	2.82	1997	.00	1974
Feb	.65	.53	2.05	1977	23	2.05	1977	.05	1976
Mar	1.49	1.33	3.30	1977	12	7.25	1977	.15	1971
Apr	2.19	2.16	2.87	1997	5	5.00	1986	.16	1980
May	2.94	2.92	2.62	1965	23	7.00	1972	.22	1976
Jun	3.77	3.51	4.47	1992	17	8.81	1992	.45	1973
Jul	3.52	3.34	3.71	1989	29	7.44	1997	.42	1975
Aug	2.90	2.85	2.96	1948	9	5.83	1977	.55	2000
Sep	2.15	2.31	3.35	1957	19	4.92	1977	.18	1979
Oct	2.29	1.76	3.17	1984	14	8.78	1984	.00	1978
Nov	1.30	.95	1.75	1970	8	3.59	1983	.00	1984
Dec	.46	.32	1.66	1959	28	2.34	1972	.00+	1986
Ann	24.41	24.40	4.47	Jun 1992	17	8.81	Jun 1992	.00+	Dec 1986

Mean Number of Days (3)

Daily Precipitation

Month	>= 0.01	>= 0.10	>= 0.50	>= 1.00
Jan	5.1	2.2	.2	@
Feb	3.8	1.9	.2	.1
Mar	6.3	3.8	.9	.1
Apr	7.7	5.0	1.2	.4
May	9.3	6.8	2.1	.5
Jun	9.9	6.8	2.4	1.0
Jul	8.5	6.0	2.3	1.1
Aug	8.3	5.5	2.0	.9
Sep	7.4	4.8	1.1	.4
Oct	6.0	3.9	1.4	.6
Nov	5.0	3.1	.8	.3
Dec	3.8	1.4	.2	@
Ann	81.1	51.2	14.8	5.4

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	.02	.07	.17	.28	.40	.54	.70	.91	1.21	1.71	2.20
Feb	.08	.14	.23	.32	.42	.52	.64	.79	1.00	1.33	1.65
Mar	.23	.36	.58	.78	.99	1.22	1.49	1.81	2.25	2.96	3.63
Apr	.46	.66	.98	1.27	1.57	1.88	2.24	2.67	3.23	4.14	5.00
May	.65	.92	1.35	1.74	2.13	2.55	3.01	3.58	4.31	5.49	6.60
Jun	.71	1.05	1.61	2.12	2.64	3.19	3.83	4.60	5.61	7.25	8.80
Jul	.80	1.13	1.64	2.10	2.57	3.06	3.61	4.26	5.13	6.50	7.80
Aug	1.08	1.35	1.74	2.07	2.38	2.69	3.04	3.44	3.95	4.73	5.45
Sep	.39	.58	.89	1.19	1.49	1.81	2.18	2.62	3.21	4.16	5.07
Oct	.09	.27	.60	.93	1.30	1.71	2.20	2.81	3.65	5.06	6.44
Nov	.04	.13	.31	.49	.70	.94	1.22	1.59	2.09	2.94	3.78
Dec	.00	.02	.07	.14	.21	.30	.41	.55	.75	1.09	1.44
Ann	14.67	16.43	18.76	20.57	22.21	23.82	25.50	27.39	29.71	33.14	36.16

\+ 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	8.3	5.4	5	4
Feb	6.8	6.6	4	2
Mar	8.6	7.0	1	#
Apr	2.2	.9	#	0
May	.0	.0	#	0
Jun	.0	.0	0	0
Jul	.0	.0	0	0
Aug	.0	.0	0	0
Sep	#	.0	0	0
Oct	.5	.0	#	0
Nov	5.3	5.1	1	#
Dec	5.3	4.0	3	1
Ann	37.0	29.0	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	8.5	1996	18	23.1	1979	19	1976	27	16	1976
Feb	8.4	1997	3	14.4	1994	30	1975	20	26	1975
Mar	12.0	1985	3	29.4	1989	21	1975	1	13	1975
Apr	11.8	1995	12	14.0	1995	15	1975	2	4	1975
May	.4	1979	9	.4	1979	#	1976	2	#	1976
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	#	1991	18	#	1991	0	0	0	0	0
Oct	2.6	1995	31	4.2	1995	2	1971	28	#+	2000
Nov	9.8	1998	10	15.7	1991	12	1977	30	6	1977
Dec	6.8	2000	1	16.2	1996	12	1973	31	7	1971
Ann	12.0	Mar 1985	3	29.4	Mar 1989	30	Feb 1975	20	26	Feb 1975

Mean Number of Days (1)

Snow Fall >= Thresholds

Month	0.1	1.0	3.0	5.0	10.0
Jan	5.2	2.5	1.1	.3	.0
Feb	4.0	2.1	.8	.2	.0
Mar	3.8	2.2	1.0	.4	.1
Apr	1.4	.7	.2	.1	@
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	.4	.3	.0	.0	.0
Nov	2.9	1.9	.7	.3	.0
Dec	3.9	1.8	.5	.2	.0
Ann	21.6	11.5	4.3	1.5	.1

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	7.2	3.1	1.8	.4
Apr	1.3	1.1	.9	.3
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	.1	.0	.0	.0
Nov	6.4	2.8	1.4	.0
Dec	18.2	11.8	10.2	.7
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	5/22	5/18	5/16	5/14	5/12	5/09	5/07	5/05	5/01
32	5/17	5/12	5/09	5/07	5/04	5/02	4/29	4/26	4/21
28	5/08	5/03	4/29	4/25	4/22	4/19	4/16	4/12	4/06
24	4/26	4/21	4/17	4/14	4/12	4/09	4/06	4/02	3/29
20	4/16	4/12	4/09	4/06	4/03	4/01	3/29	3/26	3/21
16	4/10	4/05	4/01	3/29	3/26	3/24	3/21	3/17	3/12

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	9/09	9/12	9/14	9/16	9/18	9/20	9/22	9/24	9/28
32	9/14	9/19	9/22	9/25	9/27	9/30	10/03	10/06	10/11
28	9/23	9/27	9/30	10/03	10/06	10/09	10/11	10/15	10/19
24	10/04	10/09	10/13	10/16	10/19	10/22	10/25	10/29	11/03
20	10/13	10/18	10/22	10/25	10/28	10/31	11/03	11/07	11/12
16	10/19	10/25	10/29	11/01	11/05	11/08	11/11	11/15	11/21

Freeze Free Period

Temp (F)	Probability of longer than indicated freeze free period (Days)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	145	139	135	132	129	126	123	119	113
32	166	159	154	150	146	142	137	132	125
28	187	180	175	170	166	162	158	152	145
24	212	204	199	194	190	185	181	175	168
20	228	221	216	211	207	203	199	193	186
16	246	238	232	227	222	218	213	207	198

***** 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	1702	1333	1114	618	251	67	22	46	195	555	1052	1533	8488
60	1547	1193	959	476	149	24	6	14	97	402	902	1378	7147
57	1454	1109	866	396	102	12	0	5	56	315	812	1285	6412
55	1392	1053	804	345	76	6	0	2	36	261	752	1223	5950
50	1237	913	652	234	32	0	0	0	8	146	607	1068	4897
32	713	466	209	22	0	0	0	0	0	4	189	555	2158

Base	Cooling Degree Days (1)												
Above	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
32	34	58	118	397	810	1075	1249	1158	826	472	127	45	6369
55	0	0	0	30	174	391	536	447	172	16	0	0	1766
57	0	0	0	21	137	337	474	388	132	8	0	0	1497
60	0	0	0	11	91	259	387	304	83	2	0	0	1137
65	0	0	0	3	38	152	248	181	31	0	0	0	653
70	0	0	0	0	12	75	140	93	8	0	0	0	328

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	3	42	247	626	878	1035	953	646	316	47	0	0	3	45	292	918	1796	2831	3784	4430	4746	4793	4793
45	0	1	15	146	474	728	880	798	498	199	16	0	0	1	16	162	636	1364	2244	3042	3540	3739	3755	3755
50	0	0	1	76	334	578	725	643	355	109	5	0	0	0	1	77	411	989	1714	2357	2712	2821	2826	2826
55	0	0	0	39	208	428	570	488	229	52	1	0	0	0	0	39	247	675	1245	1733	1962	2014	2015	2015
60	0	0	0	16	111	287	415	335	128	18	0	0	0	0	0	16	127	414	829	1164	1292	1310	1310	1310
Base	Growing Degree Units for Corn (Monthly)												Growing Degree Units for Corn (Accumulated Monthly)											
50/86	0	2	37	174	399	572	684	625	415	212	35	0	0	2	39	213	612	1184	1868	2493	2908	3120	3155	3155

(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:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

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