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: ROTHSAY, MN **COOP ID: 217149**

Climate Division: MN 4 **NWS Call Sign:** **Elevation: 1,236 Feet** **Lat: 46˚29N** **Lon: 96˚17W**

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	14.9	-4.5	5.2	55	1981	24	20.4	1990	-39	1977	16	-7.2	1982	1855	0	.0	.0	.1	26.8	31.0	17.6
Feb	22.7	3.5	13.1	55	1976	24	27.2	1987	-37	1996	2	-1.3	1979	1453	0	.0	.0	.2	19.1	27.7	10.8
Mar	34.8	16.6	25.7	81	1963	31	35.3	1973	-26	1962	1	16.0	1996	1219	0	.0	.0	4.2	9.9	27.0	3.6
Apr	53.8	31.6	42.7	98	1980	21	51.8	1987	-5	1975	1	35.3	1975	671	3	.0	.1	20.2	.9	15.0	.2
May	68.7	45.6	57.2	97	1969	27	66.9	1977	18+	1967	3	49.8	1979	283	40	.0	.5	30.1	.0	2.6	.0
Jun	76.9	55.2	66.1	99	1979	14	73.7	1988	32	1969	20	60.2	1985	80	112	.0	1.9	30.0	.0	.0	.0
Jul	81.3	59.6	70.5	102+	1988	27	75.4	1988	40+	1972	3	63.0	1992	32	201	.3	4.4	31.0	.0	.0	.0
Aug	80.2	57.8	69.0	105	1976	19	75.0	1976	35	1982	27	63.7	1977	47	170	.2	3.9	31.0	.0	.0	.0
Sep	69.9	46.2	58.1	99	1959	8	63.9	1978	20	1965	26	53.3	1993	234	26	.0	1.2	29.4	.0	1.5	.0
Oct	56.2	33.8	45.0	95	1963	5	51.7	1973	10+	1991	30	41.4	1991	620	0	.0	.0	22.9	.4	11.1	.0
Nov	35.3	18.3	26.8	77	1978	8	37.7	1999	-21	1985	29	16.2	1985	1146	0	.0	.0	4.6	12.0	26.4	2.2
Dec	20.4	3.1	11.8	56	1962	1	23.5	1979	-34	1976	30	-3.0	1983	1650	0	.0	.0	.3	24.5	30.8	12.1
Ann	51.3	30.6	40.9	105	Aug 1976	19	75.4	Jul 1988	-39	Jan 1977	16	-7.2	Jan 1982	9290	552	.5	12.0	204.0	93.6	173.1	46.5

\+ 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: 1959-2001

(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	.73	.60	1.78	1996	18	2.61	1975	.00+	1988
Feb	.50	.37	.52	1991	23	1.42	1991	.00+	1988
Mar	1.24	1.07	1.71	1975	24	3.08	1982	.00	1986
Apr	1.62	1.52	2.25	1993	24	5.38	1986	.00	1983
May	2.88	2.57	2.55	1985	31	6.18	1985	.33	1984
Jun	3.50	3.35	3.63	1967	14	7.62	1975	.86	1988
Jul	3.82	3.26	5.20	1985	18	9.18	1983	1.04	1992
Aug	2.88	2.81	3.50	1981	24	5.80	1981	.10	1976
Sep	2.31	2.27	2.91	1961	10	5.25	1977	.40	1979
Oct	2.02	1.54	1.86	1984	15	6.85	1984	.15	1978
Nov	1.08	.98	1.30	1987	15	4.01	1977	.00+	1999
Dec	.47	.40	.84	1977	17	1.17	1972	.00+	2000
Ann	23.05	23.29	5.20	Jul 1985	18	9.18	Jul 1983	.00+	Dec 2000

Mean Number of Days (3)

Daily Precipitation

Month	>= 0.01	>= 0.10	>= 0.50	>= 1.00
Jan	5.4	2.3	.2	@
Feb	4.6	2.0	.1	.0
Mar	6.3	3.5	.6	.1
Apr	6.1	4.0	.9	.2
May	8.3	6.6	2.1	.4
Jun	9.6	7.1	2.5	.7
Jul	8.7	6.3	2.4	1.1
Aug	7.6	5.5	1.8	.6
Sep	6.2	4.3	1.4	.5
Oct	6.6	4.2	1.3	.5
Nov	5.1	3.1	.6	.1
Dec	4.9	1.8	.1	.0
Ann	79.4	50.7	14.0	4.2

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	.00	.00	.10	.23	.37	.52	.70	.92	1.23	1.73	2.23
Feb	.00	.05	.13	.21	.30	.39	.50	.63	.81	1.10	1.39
Mar	.26	.43	.64	.81	.97	1.13	1.31	1.52	1.79	2.22	2.61
Apr	.14	.32	.58	.82	1.06	1.33	1.63	2.00	2.50	3.30	4.07
May	.64	.90	1.32	1.71	2.09	2.49	2.95	3.50	4.22	5.36	6.44
Jun	1.18	1.51	2.00	2.41	2.81	3.21	3.66	4.18	4.84	5.87	6.82
Jul	.91	1.26	1.82	2.32	2.82	3.34	3.93	4.63	5.55	7.01	8.38
Aug	.68	.95	1.37	1.75	2.12	2.52	2.96	3.49	4.18	5.28	6.31
Sep	.47	.68	1.02	1.33	1.64	1.98	2.36	2.81	3.41	4.37	5.28
Oct	.16	.29	.55	.83	1.14	1.49	1.92	2.45	3.19	4.44	5.67
Nov	.00	.00	.27	.46	.65	.85	1.08	1.37	1.75	2.37	2.98
Dec	.00	.11	.21	.28	.35	.42	.50	.59	.71	.89	1.07
Ann	15.02	16.53	18.48	19.99	21.34	22.66	24.03	25.55	27.42	30.15	32.53

\+ 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: 1959-2001
(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	9.5	8.9	7	5
Feb	6.5	6.0	7	5
Mar	8.0	6.3	4	2
Apr	2.3	.5	#	#
May	#	.0	#	0
Jun	.0	.0	0	0
Jul	.0	.0	0	0
Aug	.0	.0	0	0
Sep	#	.0	#	0
Oct	.8	.0	#	0
Nov	6.8	5.0	1	1
Dec	6.8	5.8	3	2
Ann	40.7	32.5	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	14.9	1996	18	23.7	1996	36	1997	10	31	1997
Feb	7.0	1991	23	19.0	1979	32	1997	4	29	1997
Mar	10.0	1975	24	25.0+	1997	41	1997	14	30	1997
Apr	8.0	1998	1	8.0	1998	14	1975	1	2	1975
May	#	1997	12	#+	1997	#+	1997	12	#+	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	#	1995	21	#+	1995	#	1995	21	#	1995
Oct	5.0	1995	24	5.0	1995	3	1981	21	#+	1997
Nov	11.6	1993	25	24.8	1993	17	1993	27	6	1993
Dec	5.0	1983	13	16.6	1996	23	1996	30	17	1996
Ann	14.9	Jan 1996	18	25.0+	Mar 1997	41	Mar 1997	14	31	Jan 1997

Mean Number of Days (1)

Snow Fall >= Thresholds

Month	0.1	1.0	3.0	5.0	10.0
Jan	5.1	3.3	1.0	.3	@
Feb	3.8	2.3	.8	.2	.0
Mar	3.0	2.4	1.0	.4	@
Apr	.7	.6	.3	.1	.0
May	.0	.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	.3	.3	.1	@	.0
Nov	3.2	2.5	.9	.2	@
Dec	4.4	2.4	.5	@	.0
Ann	20.5	13.8	4.6	1.2	@

Snow Depth >= Thresholds

Month	1	3	5	10
Jan	28.9	22.5	14.6	2.8
Feb	19.8	14.7	8.8	4.2
Mar	11.9	7.2	3.8	1.9
Apr	1.5	.4	.2	.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	.2	.0	.0	.0
Nov	9.0	4.1	1.7	.6
Dec	19.5	12.9	8.4	2.4
Ann	90.8	61.8	37.5	12.0

+ 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	5/31	5/27	5/24	5/21	5/19	5/16	5/13	5/10	5/06
32	5/21	5/17	5/13	5/10	5/08	5/05	5/02	4/29	4/24
28	5/13	5/08	5/04	5/01	4/28	4/26	4/23	4/19	4/14
24	4/28	4/23	4/20	4/17	4/14	4/11	4/08	4/05	3/31
20	4/21	4/17	4/14	4/11	4/08	4/06	4/03	3/31	3/26
16	4/11	4/06	4/03	3/31	3/29	3/26	3/23	3/20	3/16

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	9/08	9/11	9/14	9/16	9/18	9/21	9/23	9/25	9/29
32	9/14	9/18	9/22	9/24	9/27	9/29	10/02	10/05	10/10
28	9/24	9/28	10/01	10/04	10/07	10/09	10/12	10/15	10/20
24	10/01	10/06	10/11	10/14	10/17	10/21	10/24	10/29	11/03
20	10/14	10/19	10/22	10/26	10/29	10/31	11/04	11/07	11/12
16	10/21	10/26	10/29	11/01	11/04	11/07	11/10	11/13	11/18

Freeze Free Period

Temp (F)	Probability of longer than indicated freeze free period (Days)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	140	134	129	126	122	119	115	110	104
32	163	155	150	146	141	137	132	127	120
28	180	173	168	164	161	157	153	148	142
24	209	201	196	191	186	181	176	171	162
20	224	217	211	207	202	198	194	188	181
16	241	234	229	224	220	215	211	205	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)

Heating Degree Days (1)

Base Below	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
65	1855	1453	1219	671	283	80	32	47	234	620	1146	1650	9290
60	1700	1313	1064	529	180	28	9	14	129	466	996	1495	7923
57	1607	1229	971	447	130	13	2	5	81	376	906	1402	7169
55	1545	1173	909	396	102	7	0	2	56	318	846	1340	6694
50	1390	1033	757	280	49	1	0	0	17	192	699	1185	5603
32	851	571	293	38	0	0	0	0	0	8	257	664	2682

Cooling Degree Days (1)

Base Above	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
32	19	42	97	359	780	1022	1192	1146	782	411	101	38	5989
55	0	0	0	27	168	339	479	435	148	8	0	0	1604
57	0	0	0	19	134	285	419	376	113	4	0	0	1350
60	0	0	0	10	91	210	333	292	71	1	0	0	1008
65	0	0	0	3	40	112	201	170	26	0	0	0	552
70	0	0	0	0	14	45	106	84	7	0	0	0	256

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	20	202	568	807	966	917	587	251	22	0	0	0	20	222	790	1597	2563	3480	4067	4318	4340	4340
45	0	0	4	118	421	657	811	762	438	149	11	0	0	0	4	122	543	1200	2011	2773	3211	3360	3371	3371
50	0	0	0	62	289	508	656	607	305	76	2	0	0	0	0	62	351	859	1515	2122	2427	2503	2505	2505
55	0	0	0	26	172	361	501	452	189	32	0	0	0	0	0	26	198	559	1060	1512	1701	1733	1733	1733
60	0	0	0	9	86	225	347	302	97	10	0	0	0	0	0	9	95	320	667	969	1066	1076	1076	1076
Base	**Growing Degree Units for Corn (Monthly)**												**Growing Degree Units for Corn (Accumulated Monthly)**											
50/86	0	0	11	132	354	516	642	596	357	148	15	0	0	0	11	143	497	1013	1655	2251	2608	2756	2771	2771

(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