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: SANDY LAKE DAM LIBBY, MN **COOP ID: 217460**

Climate Division: MN 6 **NWS Call Sign:** **Elevation: 1,234 Feet** **Lat: 46˚48N** **Lon: 93˚19W**

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	16.9	-5.9	5.5	51+	1987	13	18.7	1990	-49	1972	15	-6.9	1982	1847	0	.0	.0	.2	26.9	31.0	18.2
Feb	25.3	1.6	13.5	57+	1981	19	27.9	1998	-44	1996	2	2.8	1989	1443	0	.0	.0	.6	17.9	27.9	12.2
Mar	37.1	15.1	26.1	73	1968	30	34.8	2000	-40	1962	1	17.8	1996	1206	0	.0	.0	4.8	8.4	28.7	4.8
Apr	53.0	29.2	41.1	90+	1980	22	49.4	1987	-7	1970	1	34.3	1975	716	0	.0	.1	19.0	.7	19.6	.2
May	67.4	42.5	55.0	91	1986	30	62.0	1977	17	1967	3	48.5	1979	334	21	.0	.1	29.7	.0	3.9	.0
Jun	76.0	51.6	63.8	95+	1995	22	69.0	1995	29	1964	1	57.1	1982	107	72	.0	.8	30.0	.0	.1	.0
Jul	79.9	56.5	68.2	102	1988	28	72.6	1983	36	1972	4	61.7	1992	42	141	.1	2.5	31.0	.0	.0	.0
Aug	77.6	54.9	66.3	101	1976	18	72.2	1983	28	1982	27	59.7	1977	72	111	@	1.0	31.0	.0	.1	.0
Sep	67.7	45.4	56.6	95	1976	7	61.7	1998	19	1965	26	51.6	1993	265	11	.0	.3	29.3	.0	1.9	.0
Oct	54.9	33.5	44.2	86	1963	5	50.3	1973	3	1976	27	38.4	1976	645	0	.0	.0	21.5	.4	13.5	.0
Nov	36.5	19.1	27.8	74	1978	3	36.8	1999	-25	1976	28	20.5	1996	1117	0	.0	.0	4.5	11.4	26.7	1.9
Dec	21.4	1.9	11.7	60	1962	1	22.7	1997	-40	1983	19	-.7	1983	1654	0	.0	.0	.2	24.3	30.9	13.1
Ann	51.1	28.8	40.0	102	Jul 1988	28	72.6	Jul 1983	-49	Jan 1972	15	-6.9	Jan 1982	9448	356	.1	4.8	201.8	90.0	184.3	50.4

\+ 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	.84	.65	1.26	1975	11	3.56	1975	.16	1981
Feb	.56	.42	2.14	1971	27	3.07	1971	.07	1988
Mar	1.21	1.01	1.23	1966	4	3.03	1979	.25	1996
Apr	1.75	1.52	2.35	2001	23	4.21	1981	.18	1987
May	3.04	3.14	2.95	1978	29	5.58	1999	1.17	1976
Jun	4.55	4.70	4.03	1990	3	7.47	1998	1.72	1995
Jul	4.63	4.36	4.65	1972	28	11.04	1972	1.33	1984
Aug	3.99	3.32	4.23	1989	31	9.94	1978	1.44	1971
Sep	3.05	2.72	4.24	1986	1	10.67	1986	.50	1976
Oct	2.36	2.08	4.33	1995	2	6.80	1995	.30	1992
Nov	1.24	1.21	1.37	1974	1	2.87	2000	.19	1976
Dec	.70	.64	.90	1984	16	1.74	1984	.17	1979
Ann	27.92	27.67	4.65	Jul 1972	28	11.04	Jul 1972	.07	Feb 1988

Mean Number of Days (3)

Daily Precipitation

Month	>= 0.01	>= 0.10	>= 0.50	>= 1.00
Jan	8.4	2.6	.2	@
Feb	5.5	1.7	.1	@
Mar	7.5	3.3	.5	.1
Apr	7.9	4.7	.8	.2
May	11.1	6.8	1.8	.4
Jun	13.1	8.0	3.1	1.1
Jul	12.4	7.7	3.2	1.2
Aug	10.9	6.5	2.5	1.2
Sep	10.9	6.4	2.0	.5
Oct	8.8	4.7	1.5	.6
Nov	7.8	3.6	.6	.1
Dec	7.3	2.2	.1	.0
Ann	111.6	58.2	16.4	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	.17	.25	.37	.48	.60	.72	.86	1.03	1.25	1.60	1.93
Feb	.06	.10	.18	.26	.34	.43	.55	.68	.87	1.19	1.49
Mar	.31	.42	.59	.75	.90	1.07	1.25	1.46	1.74	2.18	2.60
Apr	.31	.46	.72	.96	1.20	1.46	1.77	2.13	2.62	3.40	4.15
May	1.30	1.58	1.96	2.28	2.57	2.87	3.19	3.56	4.02	4.73	5.37
Jun	2.16	2.56	3.10	3.53	3.94	4.34	4.77	5.26	5.88	6.81	7.65
Jul	1.63	2.07	2.70	3.24	3.75	4.27	4.84	5.50	6.35	7.66	8.87
Aug	1.29	1.67	2.23	2.70	3.16	3.63	4.15	4.76	5.54	6.76	7.88
Sep	.78	1.07	1.51	1.90	2.29	2.70	3.15	3.69	4.39	5.50	6.54
Oct	.32	.52	.85	1.18	1.53	1.91	2.35	2.89	3.61	4.81	5.96
Nov	.28	.39	.58	.74	.90	1.08	1.27	1.51	1.82	2.31	2.77
Dec	.21	.28	.38	.46	.54	.63	.72	.83	.97	1.20	1.40
Ann	19.85	21.42	23.42	24.94	26.28	27.59	28.94	30.42	32.23	34.85	37.11

\+ 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	15.7	13.0	13	12
Feb	8.4	7.1	16	14
Mar	10.3	9.5	12	10
Apr	2.3	1.1	2	#
May	.2	.0	#	0
Jun	.0	.0	0	0
Jul	.0	.0	0	0
Aug	.0	.0	0	0
Sep	#	.0	0	0
Oct	.9	.0	#	0
Nov	7.6	5.8	2	1
Dec	10.8	10.7	6	5
Ann	56.2	47.2	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	14.0	1972	12	43.6	1975	33	1975	29	24	1997
Feb	11.0	1971	27	25.3	1979	30+	1979	28	26	1975
Mar	8.0	1975	24	21.0	1997	32	1979	4	27	1997
Apr	7.5	1972	9	12.0	1972	26	1975	1	11	1975
May	3.8	1971	19	3.8	1971	1	1979	5	#+	1989
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	#	1981	28	#+	1981	0	0	0	0	0
Oct	3.0	1972	31	5.2	1987	3	1995	24	#+	1996
Nov	11.0	1988	27	29.5	1988	17	1983	30	8	1995
Dec	8.0	1988	14	19.2	1983	22+	1985	2	17	1983
Ann	14.0	Jan 1972	12	43.6	Jan 1975	33	Jan 1975	29	27	Mar 1997

Mean Number of Days (1)

Snow Fall >= Thresholds

Month	0.1	1.0	3.0	5.0	10.0
Jan	8.8	5.3	2.0	.6	.2
Feb	5.2	3.1	.8	.3	@
Mar	4.8	3.1	1.2	.4	.0
Apr	1.5	.9	.3	.1	.0
May	.1	.1	@	.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	.7	.5	.1	.0	.0
Nov	4.5	2.6	1.0	.3	@
Dec	7.3	3.9	.9	.4	.0
Ann	32.9	19.5	6.3	2.1	.2

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	2.2	1.0	.8	.3
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	.5	.1	.0	.0
Nov	10.1	4.9	2.5	.6
Dec	28.5	18.5	14.9	4.0
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	6/13	6/07	6/03	5/30	5/27	5/23	5/20	5/15	5/10
32	5/26	5/21	5/18	5/15	5/12	5/09	5/06	5/03	4/28
28	5/15	5/10	5/07	5/04	5/02	4/30	4/27	4/24	4/19
24	5/05	4/30	4/27	4/24	4/22	4/19	4/16	4/13	4/09
20	4/24	4/20	4/17	4/14	4/12	4/10	4/07	4/04	3/31
16	4/16	4/12	4/09	4/07	4/05	4/02	3/31	3/28	3/24

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	8/29	9/03	9/07	9/10	9/13	9/16	9/19	9/23	9/28
32	9/08	9/14	9/17	9/20	9/23	9/26	9/29	10/03	10/08
28	9/16	9/21	9/24	9/27	9/30	10/03	10/06	10/09	10/14
24	10/05	10/11	10/14	10/17	10/20	10/23	10/26	10/30	11/04
20	10/14	10/19	10/23	10/26	10/29	11/01	11/04	11/08	11/13
16	10/24	10/29	11/01	11/04	11/06	11/09	11/12	11/15	11/19

Freeze Free Period

Temp (F)	Probability of longer than indicated freeze free period (Days)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	132	124	118	113	108	104	99	93	84
32	153	146	141	137	133	129	125	120	113
28	169	163	158	154	150	147	143	138	132
24	200	193	189	185	181	177	173	168	162
20	221	214	208	204	199	195	190	185	177
16	234	228	223	219	215	211	207	202	196

***** 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	1847	1443	1206	716	334	107	42	72	265	645	1117	1654	9448
60	1692	1303	1051	570	215	42	10	22	147	491	967	1499	8009
57	1599	1219	958	485	158	20	3	9	93	402	877	1406	7229
55	1537	1163	896	430	125	12	0	4	64	345	817	1344	6737
50	1382	1023	743	304	62	2	0	0	20	218	668	1189	5611
32	836	549	270	38	0	0	0	0	0	11	214	655	2573

Cooling Degree Days (1)

Base Above	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
32	13	30	87	312	711	955	1122	1061	737	389	87	23	5527
55	0	0	0	14	123	277	409	352	111	10	0	0	1296
57	0	0	0	9	94	225	349	296	79	5	0	0	1057
60	0	0	0	4	58	157	264	216	44	1	0	0	744
65	0	0	0	0	21	72	141	111	11	0	0	0	356
70	0	0	0	0	6	22	59	42	2	0	0	0	131

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	15	146	492	724	881	820	518	209	22	0	0	0	15	161	653	1377	2258	3078	3596	3805	3827	3827
45	0	0	2	74	345	574	726	665	372	116	9	0	0	0	2	76	421	995	1721	2386	2758	2874	2883	2883
50	0	0	0	30	219	425	571	510	239	53	0	0	0	0	0	30	249	674	1245	1755	1994	2047	2047	2047
55	0	0	0	11	121	283	417	358	135	19	0	0	0	0	0	11	132	415	832	1190	1325	1344	1344	1344
60	0	0	0	1	57	156	272	217	63	0	0	0	0	0	0	1	58	214	486	703	766	766	766	766
Base	**Growing Degree Units for Corn (Monthly)**												**Growing Degree Units for Corn (Accumulated Monthly)**											
50/86	0	0	13	113	311	453	570	523	307	127	13	0	0	0	13	126	437	890	1460	1983	2290	2417	2430	2430

(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