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: MANDAN EXPERIMENT STN, ND **COOP ID: 325479**

Climate Division: ND 8 **NWS Call Sign:** **Elevation: 1,750 Feet** **Lat: 46˚49N** **Lon: 100˚55W**

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	20.4	-.5	10.0	63	1981	24	24.7	1990	-43+	1916	14	-5.2	1982	1708	0	.0	.0	.3	22.6	30.9	15.8
Feb	27.2	7.2	17.2	68	1958	26	29.5	1998	-46	1936	16	-.8	1979	1338	0	.0	.0	1.7	16.8	27.8	9.7
Mar	38.6	18.4	28.5	82	1967	30	37.4	1986	-30	1962	1	18.6	1996	1132	0	.0	.0	7.4	9.8	28.5	3.4
Apr	54.4	31.0	42.7	94	1980	22	50.6	1987	-8	1975	1	33.7	1975	670	1	.0	.2	19.2	1.5	17.1	.1
May	67.9	43.4	55.7	102+	1934	30	64.2	1977	13	1967	3	49.5	1979	310	21	.0	.5	29.0	.0	3.6	.0
Jun	76.5	52.6	64.6	108	1921	30	75.8	1988	28	1969	2	59.1	1985	111	97	.2	2.3	30.0	.0	@	.0
Jul	82.8	57.5	70.2	115	1936	6	75.3	1989	36	1972	4	62.7	1992	33	193	.6	6.5	31.0	.0	.0	.0
Aug	81.9	55.4	68.7	109	1941	5	73.6	1983	32+	1935	28	62.4	1977	61	173	.4	6.7	31.0	.0	.0	.0
Sep	70.5	44.1	57.3	104+	1959	9	63.8	1998	14	1974	30	52.3	1984	257	26	.2	1.5	28.8	.0	2.6	.0
Oct	57.3	32.0	44.7	96	1963	5	48.7	1973	-14	1919	26	40.0	1976	630	0	.0	.1	22.7	.9	15.7	@
Nov	37.8	18.0	27.9	80	1999	8	39.2	1999	-26	1985	24	15.5	1985	1112	0	.0	.0	6.4	10.9	28.0	2.1
Dec	25.0	5.2	15.1	66+	1979	5	28.1	1997	-46	1916	28	-2.2	1983	1547	0	.0	.0	1.2	20.1	30.8	10.9
Ann	53.4	30.4	41.9	115	Jul 1936	6	75.8	Jun 1988	-46+	Feb 1936	16	-5.2	Jan 1982	8909	511	1.4	17.8	208.7	82.6	185.0	42.0

\+ 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: 1913-2001

(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	.38	.39	.67	1933	16	.96	1999	.01	1974
Feb	.37	.23	1.15	2000	26	1.62	2000	.02	1985
Mar	.58	.46	1.05	1950	24	1.53	1983	.11	1973
Apr	1.52	1.28	1.96	1940	29	6.36	1975	.05	1987
May	2.41	2.18	2.86	1985	12	6.81	1995	.28	1984
Jun	2.91	2.61	3.96	1960	20	5.69	2000	.71	1973
Jul	2.90	2.17	4.44	2001	27	13.43	1993	.61	1975
Aug	2.02	1.61	2.90	1915	1	6.09	1999	.11	1971
Sep	1.56	1.10	3.00	1977	18	7.39	1977	.19	1974
Oct	1.41	1.11	2.00	1998	5	5.81	1994	.00	1993
Nov	.62	.44	1.29	1944	14	1.96	1986	.00+	1990
Dec	.36	.36	.73	1916	26	.82	1977	.01	1986
Ann	17.04	16.61	4.44	Jul 2001	27	13.43	Jul 1993	.00+	Oct 1993

Mean Number of Days (3)

Daily Precipitation

Month	>= 0.01	>= 0.10	>= 0.50	>= 1.00
Jan	5.4	1.3	.0	.0
Feb	4.5	1.1	.1	@
Mar	4.9	2.1	.1	.0
Apr	6.7	3.8	.9	.2
May	8.7	5.2	1.5	.4
Jun	10.4	6.5	2.1	.7
Jul	9.3	5.6	1.7	.6
Aug	7.5	4.0	1.1	.4
Sep	7.0	3.8	.6	.2
Oct	5.5	2.9	.8	.3
Nov	5.0	1.8	.1	@
Dec	5.6	1.3	.0	.0
Ann	80.5	39.4	9.0	2.8

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	.04	.07	.12	.17	.23	.29	.37	.46	.59	.80	1.01
Feb	.04	.06	.11	.16	.22	.28	.36	.45	.58	.79	1.00
Mar	.08	.12	.21	.29	.37	.47	.58	.71	.90	1.20	1.49
Apr	.09	.18	.37	.58	.81	1.08	1.41	1.83	2.42	3.42	4.42
May	.47	.69	1.04	1.37	1.70	2.05	2.45	2.94	3.58	4.61	5.58
Jun	.83	1.11	1.53	1.89	2.24	2.61	3.02	3.50	4.12	5.10	6.01
Jul	.41	.65	1.07	1.47	1.89	2.36	2.89	3.55	4.43	5.87	7.26
Aug	.19	.33	.60	.88	1.19	1.53	1.94	2.46	3.16	4.34	5.50
Sep	.22	.35	.57	.78	1.01	1.26	1.55	1.90	2.38	3.16	3.91
Oct	.01	.07	.21	.39	.62	.89	1.23	1.68	2.33	3.45	4.60
Nov	.00	.04	.13	.22	.33	.44	.58	.76	1.00	1.41	1.81
Dec	.07	.10	.15	.20	.25	.30	.36	.43	.53	.68	.83
Ann	10.30	11.52	13.13	14.38	15.51	16.62	17.79	19.09	20.69	23.06	25.14

\+ 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: 1913-2001
(3) Derived from 1971-2000 serially complete daily data

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Snow (inches)

Snow Totals

Means/Medians (1)

Extremes (2)

Mean Number of Days (1)

Snow Fall >= Thresholds

Snow Depth >= Thresholds

Month	Snow Fall Mean	Snow Fall Median	Snow Depth Mean	Snow Depth Median	Highest Daily Snow Fall	Year	Day	Highest Monthly Snow Fall	Year	Highest Daily Snow Depth	Year	Day	Highest Monthly Mean Snow Depth	Year	0.1	1.0	3.0	5.0	10.0	1	3	5	10
Jan	7.6	9.4	7	7	8.0	1988	12	12.5	1989	18+	1978	1	18	1978	3.6	2.8	.6	.3	.0	-9.9	-9.9	-9.9	-9.9
Feb	5.4	4.2	6	5	7.0	1982	24	18.0	1987	25	1978	21	22	1978	3.2	2.6	.6	.2	.0	-9.9	-9.9	-9.9	-9.9
Mar	5.2	4.0	2	1	12.9	1982	20	24.2	1975	25	1975	31	11	1996	2.5	2.0	.8	.4	@	8.0	3.8	1.5	.3
Apr	1.8	.0	#	0	9.0	1984	28	15.0	1984	25	1975	1	8	1975	.8	.6	.2	.1	.0	1.8	1.2	.8	.5
May	.2	.0	#	0	4.0	1991	4	6.0	1991	2	1991	3	#	1991	.1	.1	@	.0	.0	.1	.0	.0	.0
Jun	.0	.0	0	0	.0	0	0	.0	0	0	0	0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Jul	.0	.0	0	0	.0	0	0	.0	0	0	0	0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Aug	.0	.0	0	0	.0	0	0	.0	0	0	0	0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Sep	.1	.0	0	0	4.0	1984	24	4.0	1984	0	0	0	0	0	@	@	@	.0	.0	.0	.0	.0	.0
Oct	.4	.0	#	0	9.0	1991	29	9.0	1991	16	1991	30	2	1991	.4	.4	.1	.1	.0	.8	.3	.2	.1
Nov	3.4	3.0	1	#	11.0	1993	24	13.5	1998	29	1993	27	11	1993	2.8	2.2	.9	.4	@	-9.9	-9.9	-9.9	-9.9
Dec	6.4	7.1	4	4	6.0	1988	27	10.8	1972	20	1977	11	18	1977	3.4	2.6	.6	.1	.0	-9.9	-9.9	-9.9	-9.9
Ann	30.5	27.7	N/A	N/A	12.9	Mar 1982	20	24.2	Mar 1975	29	Nov 1993	27	22	Feb 1978	16.8	13.3	3.8	1.6	@	-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	6/09	6/03	5/29	5/26	5/22	5/19	5/15	5/11	5/05
32	5/26	5/21	5/18	5/16	5/13	5/11	5/08	5/05	5/01
28	5/18	5/13	5/10	5/07	5/04	5/01	4/28	4/25	4/20
24	5/07	5/02	4/28	4/25	4/22	4/19	4/16	4/13	4/08
20	4/25	4/20	4/17	4/14	4/11	4/08	4/05	4/02	3/28
16	4/19	4/14	4/10	4/07	4/04	4/01	3/29	3/25	3/20

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	8/30	9/03	9/07	9/10	9/12	9/15	9/18	9/21	9/25
32	9/11	9/15	9/18	9/20	9/23	9/25	9/27	9/30	10/04
28	9/16	9/21	9/25	9/28	10/01	10/04	10/07	10/10	10/15
24	9/25	9/30	10/04	10/07	10/10	10/13	10/16	10/20	10/25
20	9/30	10/05	10/09	10/13	10/16	10/19	10/23	10/27	11/02
16	10/08	10/15	10/20	10/24	10/28	11/01	11/05	11/10	11/17

Freeze Free Period

Temp (F)	Probability of longer than indicated freeze free period (Days)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	134	126	121	116	112	108	103	98	90
32	149	143	139	135	132	128	125	120	115
28	170	163	157	153	149	145	140	135	128
24	187	181	177	173	170	166	163	158	153
20	211	203	197	192	187	183	178	172	164
16	230	222	216	211	206	202	197	191	182

***** 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	1708	1338	1132	670	310	111	33	61	257	630	1112	1547	8909
60	1553	1198	977	526	193	48	9	22	147	475	962	1392	7502
57	1460	1114	884	443	137	25	2	10	95	383	872	1299	6724
55	1398	1058	822	390	105	15	0	5	68	324	812	1237	6234
50	1244	929	678	271	47	3	0	1	22	190	668	1082	5135
32	732	487	239	32	0	0	0	0	0	6	234	575	2305

Cooling Degree Days (1)

Base Above	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
32	47	73	130	353	734	976	1182	1135	759	399	111	52	5951
55	0	0	0	21	126	301	470	427	137	4	0	0	1486
57	0	0	0	14	95	250	409	370	105	1	0	0	1244
60	0	0	0	7	58	183	323	289	67	0	0	0	927
65	0	0	0	1	21	97	193	173	26	0	0	0	511
70	0	0	0	0	5	38	99	90	8	0	0	0	240

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	2	28	178	502	745	942	896	531	215	26	0	0	2	30	208	710	1455	2397	3293	3824	4039	4065	4065
45	0	0	7	99	359	595	787	741	390	125	9	0	0	0	7	106	465	1060	1847	2588	2978	3103	3112	3112
50	0	0	1	46	230	447	632	586	260	58	0	0	0	0	1	47	277	724	1356	1942	2202	2260	2260	2260
55	0	0	0	21	132	302	478	434	158	19	0	0	0	0	0	21	153	455	933	1367	1525	1544	1544	1544
60	0	0	0	8	63	178	328	291	80	5	0	0	0	0	0	8	71	249	577	868	948	953	953	953
Base	**Growing Degree Units for Corn (Monthly)**												**Growing Degree Units for Corn (Accumulated Monthly)**											
50/86	0	1	28	126	304	457	609	568	329	160	25	1	0	1	29	155	459	916	1525	2093	2422	2582	2607	2608

(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