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: BIG RAPIDS WATERWORKS, MI **COOP ID: 200779**

Climate Division: MI 6 **NWS Call Sign:** **Elevation: 930 Feet** **Lat: 43˚42N** **Lon: 85˚29W**

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	28.9	11.5	20.2	61+	1944	26	28.7	1990	-30	1951	30	11.1	1977	1390	0	.0	.0	.4	20.0	30.3	6.1
Feb	32.6	12.8	22.7	64	2000	26	33.1	1998	-36	1899	11	13.7+	1979	1184	0	.0	.0	1.1	14.1	27.4	5.3
Mar	42.4	21.0	31.7	82	1910	29	40.3	2000	-24	1943	3	24.9	1984	1033	0	.0	.0	7.3	5.4	27.1	1.5
Apr	55.8	32.1	44.0	87	1899	29	49.1	1977	1	1982	7	38.9	1982	631	0	.0	.0	20.6	.5	16.4	.0
May	69.3	43.2	56.3	92+	1911	26	63.2	1982	20+	1900	5	48.7	1997	305	34	.0	.2	30.2	.0	3.8	.0
Jun	77.7	52.0	64.9	99	1971	27	69.8	1971	28	1901	9	59.8	1982	86	82	.0	1.5	30.0	.0	.2	.0
Jul	82.1	56.9	69.5	103+	1916	30	73.8	1983	36	1945	11	64.5	1992	19	159	.1	4.0	31.0	.0	.0	.0
Aug	79.3	55.2	67.3	101	1988	17	72.8	1995	32+	1904	30	62.6	1992	57	127	@	1.4	31.0	.0	@	.0
Sep	70.9	46.9	58.9	97+	1913	2	64.1	1998	16	1989	23	54.1	1993	200	16	.0	.4	29.9	.0	1.5	.0
Oct	58.6	36.4	47.5	88	1947	15	55.9	1971	15	1907	26	42.5	1988	544	0	.0	.0	25.0	.0	10.7	.0
Nov	44.2	27.8	36.0	76	1950	1	42.4	1975	-8	1950	25	28.9	1995	870	0	.0	.0	8.7	2.9	22.2	.1
Dec	33.1	17.7	25.4	66	2001	5	32.8	1982	-18	1976	31	15.0	1989	1228	0	.0	.0	1.4	14.5	29.4	2.4
Ann	56.2	34.5	45.4	103+	Jul 1916	30	73.8	Jul 1983	-36	Feb 1899	11	11.1	Jan 1977	7547	418	.1	7.5	216.6	57.4	169.0	15.4

\+ 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: 1899-2001

(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	2.15	2.05	1.80+	1907	19	3.59	1985	.60	1981
Feb	1.56	1.24	2.51	1922	22	4.23	1997	.28	1987
Mar	2.38	2.21	2.22	1991	27	5.58	1976	.64	1978
Apr	2.95	2.83	2.47	1925	19	4.80	1991	.92	1977
May	3.20	2.76	2.62	1929	11	6.49	1990	.67	1977
Jun	3.19	3.05	4.00	1942	12	6.39	1993	.77	1988
Jul	2.68	2.14	3.94	1982	18	8.03	1982	.57	1998
Aug	4.29	3.48	4.55	1975	31	11.32	1975	.84	1971
Sep	3.88	3.03	7.64	1986	11	19.05	1986	.05	1979
Oct	2.97	2.88	3.07	1954	3	7.70	1991	.84	1971
Nov	2.99	2.78	2.68	1960	15	6.34	1988	.64	1986
Dec	2.35	2.14	2.13	1982	2	5.28	1984	.77	1993
Ann	34.59	34.18	7.64	Sep 1986	11	19.05	Sep 1986	.05	Sep 1979

Mean Number of Days (3)

Daily Precipitation

Month	>= 0.01	>= 0.10	>= 0.50	>= 1.00
Jan	17.0	5.9	.7	.1
Feb	12.0	4.5	.5	.1
Mar	11.4	6.2	1.4	.2
Apr	12.5	7.1	1.8	.4
May	11.3	7.0	2.1	.6
Jun	10.3	6.2	2.0	.8
Jul	9.4	5.4	1.7	.6
Aug	10.4	6.6	2.6	1.1
Sep	12.2	7.4	2.3	.6
Oct	12.8	6.7	1.7	.5
Nov	13.9	6.9	1.9	.4
Dec	15.6	6.2	.9	.2
Ann	148.8	76.1	19.6	5.6

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	.93	1.12	1.39	1.61	1.82	2.03	2.26	2.52	2.84	3.34	3.79
Feb	.30	.44	.67	.88	1.09	1.32	1.58	1.90	2.31	2.97	3.60
Mar	.70	.92	1.26	1.56	1.84	2.14	2.47	2.86	3.36	4.15	4.88
Apr	1.22	1.49	1.87	2.18	2.48	2.77	3.09	3.46	3.93	4.64	5.29
May	.81	1.11	1.58	1.99	2.39	2.82	3.30	3.87	4.61	5.78	6.87
Jun	1.09	1.39	1.83	2.20	2.56	2.93	3.33	3.79	4.39	5.32	6.17
Jul	.60	.85	1.24	1.60	1.95	2.33	2.75	3.25	3.92	4.98	5.97
Aug	1.15	1.56	2.18	2.72	3.25	3.81	4.43	5.17	6.13	7.63	9.03
Sep	.55	.87	1.42	1.96	2.53	3.15	3.86	4.74	5.92	7.85	9.72
Oct	1.04	1.32	1.73	2.07	2.40	2.73	3.10	3.53	4.07	4.92	5.69
Nov	.90	1.18	1.61	1.97	2.33	2.70	3.11	3.59	4.21	5.17	6.07
Dec	.72	.94	1.27	1.56	1.84	2.13	2.45	2.82	3.31	4.06	4.76
Ann	25.72	27.46	29.68	31.36	32.84	34.27	35.73	37.35	39.29	42.11	44.53

\+ 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: 1899-2001
(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	20.6	18.4	8	7	14.0	1978	26	39.6	1982	38	1979	17	29	1979	14.9	7.2	1.9	.4	.1	27.9	24.1	19.5	8.7
Feb	13.8	15.9	7	6	8.0	1974	22	25.8	1974	33	1979	3	23	1979	9.4	4.4	1.5	.4	.0	23.4	19.5	13.8	6.3
Mar	9.4	7.0	3	2	10.2	1985	4	30.3	1974	23	1978	4	13	1978	5.4	3.1	1.0	.4	@	12.2	8.8	5.8	1.8
Apr	2.6	1.5	#	#	7.5	2000	7	10.0	1982	8+	2000	7	1	1982	1.6	.8	.3	.1	.0	1.4	.7	.3	.0
May	#	.0	0	0	#	1997	16	#+	1997	0	0	0	0	0	.0	.0	.0	.0	.0	.0	.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	#	.0	0	0	#	1993	28	#+	1993	0	0	0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Oct	.4	.0	#	0	4.0	1997	26	5.0	1997	4	1997	26	#+	2000	.3	.2	@	.0	.0	.1	.1	.0	.0
Nov	6.1	6.5	1	#	11.7	1985	9	16.9	1971	12	1985	9	3	1995	4.7	2.2	.7	.1	@	5.0	2.4	1.1	.1
Dec	16.8	17.7	4	3	12.0	2000	11	37.1	1978	21	1978	31	10	2000	11.3	5.9	1.9	.6	.2	20.5	14.4	8.7	1.5
Ann	69.7	67.0	N/A	N/A	14.0	Jan 1978	26	39.6	Jan 1982	38	Jan 1979	17	29	Jan 1979	47.6	23.8	7.3	2.0	.3	90.5	70.0	49.2	18.4

+ 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	6/14	6/10	6/06	6/03	6/01	5/29	5/26	5/22	5/18
32	6/06	5/31	5/26	5/22	5/19	5/15	5/11	5/07	5/01
28	5/14	5/10	5/07	5/04	5/02	4/30	4/27	4/24	4/20
24	5/04	4/29	4/26	4/23	4/20	4/18	4/15	4/11	4/07
20	4/19	4/15	4/12	4/09	4/07	4/05	4/02	3/30	3/26
16	4/12	4/08	4/05	4/02	3/30	3/28	3/25	3/22	3/18

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	9/06	9/09	9/12	9/15	9/18	9/21	9/26
32	9/13	9/17	9/20	9/23	9/25	9/27	9/30	10/03	10/07
28	9/25	10/01	10/05	10/08	10/11	10/14	10/17	10/21	10/26
24	10/08	10/14	10/18	10/22	10/25	10/29	11/01	11/05	11/11
20	10/20	10/26	10/30	11/03	11/06	11/10	11/13	11/17	11/23
16	10/30	11/06	11/11	11/15	11/19	11/23	11/28	12/03	12/10

Freeze Free Period

Temp (F)	Probability of longer than indicated freeze free period (Days)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	120	114	110	106	103	100	96	92	86
32	147	140	136	132	128	125	121	116	110
28	181	175	169	165	161	157	153	148	141
24	211	203	197	192	187	182	177	172	163
20	232	225	220	216	212	208	204	199	193
16	260	251	244	238	233	228	222	215	206

***** 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	1390	1184	1033	631	305	86	19	57	200	544	870	1228	7547
60	1235	1044	878	484	196	31	2	15	94	395	720	1073	6167
57	1142	960	785	397	142	14	0	6	52	312	630	980	5420
55	1080	904	723	342	112	8	0	2	33	261	570	918	4953
50	925	764	570	217	53	2	0	0	7	152	422	763	3875
32	396	301	138	7	0	0	0	0	0	3	51	271	1167

Cooling Degree Days (1)

Base Above	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
32	29	40	128	366	752	986	1163	1093	806	483	171	66	6083
55	0	0	0	11	151	304	450	382	148	27	0	0	1473
57	0	0	0	6	119	250	388	324	108	16	0	0	1211
60	0	0	0	2	80	177	297	240	60	7	0	0	863
65	0	0	0	0	34	82	159	127	16	0	0	0	418
70	0	0	0	0	12	25	64	52	2	0	0	0	155

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	1	42	187	513	756	924	856	575	259	57	5	0	1	43	230	743	1499	2423	3279	3854	4113	4170	4175
45	0	0	18	103	366	606	769	701	429	148	24	2	0	0	18	121	487	1093	1862	2563	2992	3140	3164	3166
50	0	0	8	50	237	456	614	546	291	72	9	0	0	0	8	58	295	751	1365	1911	2202	2274	2283	2283
55	0	0	1	26	138	312	459	393	173	31	1	0	0	0	1	27	165	477	936	1329	1502	1533	1534	1534
60	0	0	0	8	69	184	305	245	88	6	0	0	0	0	0	8	77	261	566	811	899	905	905	905
Base	**Growing Degree Units for Corn (Monthly)**												**Growing Degree Units for Corn (Accumulated Monthly)**											
50/86	0	1	33	135	331	482	608	552	355	159	32	1	0	1	34	169	500	982	1590	2142	2497	2656	2688	2689

(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