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: WORCESTER RGNL AP, MA **COOP ID: 199923**

Climate Division: MA 2 **NWS Call Sign: ORH** **Elevation: 986 Feet** **Lat: 42˚16N** **Lon: 71˚53W**

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	31.4	15.8	23.6	67	1950	26	31.6	1990	-13+	1968	9	15.5	1981	1284	0	.0	.0	2.2	17.2	29.1	2.9
Feb	34.1	17.8	26.0	67	1985	24	33.5	1984	-12+	1958	18	16.0	1979	1094	0	.0	.0	2.2	13.1	25.9	1.4
Mar	43.0	25.6	34.3	84	1998	31	40.6	1973	-6	1950	4	28.7	1984	952	0	.0	.0	8.2	4.4	24.2	.1
Apr	54.4	35.5	45.0	91	1976	19	48.8	1976	11	1982	7	40.1	1972	601	0	.0	.1	19.8	.3	9.9	.0
May	66.3	46.2	56.3	92	1962	19	61.6	1991	28+	1956	8	51.8	1990	278	7	.0	.1	29.5	.0	.4	.0
Jun	74.4	55.0	64.7	98	1952	26	67.9	1999	36	1986	3	61.1	1985	74	64	.0	.6	30.0	.0	.0	.0
Jul	79.3	60.8	70.1	96+	1952	23	73.4	1994	43	1988	1	66.4	1992	9	166	.0	1.6	31.0	.0	.0	.0
Aug	77.1	59.5	68.3	98	1948	26	71.9	1988	38	1965	30	65.5	1982	20	122	.0	.7	31.0	.0	.0	.0
Sep	69.0	51.3	60.2	99	1953	2	64.5	1983	30+	1957	27	57.1	1975	158	12	.0	@	29.9	.0	.1	.0
Oct	58.4	40.7	49.6	85+	1956	15	56.4	1971	20	1969	24	44.7	1972	478	0	.0	.0	26.1	.0	4.5	.0
Nov	47.1	32.0	39.6	79	1950	2	45.3	1975	6	1989	24	34.7	1976	764	0	.0	.0	11.6	1.8	16.8	.0
Dec	36.2	21.6	28.9	72	1998	7	35.7	1998	-13	1962	30	15.5	1989	1119	0	.0	.0	3.4	11.2	27.3	.6
Ann	55.9	38.5	47.2	99	Sep 1953	2	73.4	Jul 1994	-13+	Jan 1968	9	15.5+	Dec 1989	6831	371	.0	3.1	224.9	48.0	138.2	5.0

\+ 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: 1948-2001

(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	4.07	3.63	2.49	1978	9	11.16	1979	.93	1981
Feb	3.10	2.77	2.45	1973	2	8.37	1981	.25	1987
Mar	4.23	3.93	4.55	1987	31	7.96	1972	.74	1981
Apr	3.92	3.77	3.23	1996	16	8.79	1987	1.21	1999
May	4.35	4.15	3.03	1967	25	9.94	1984	1.55	1987
Jun	4.02	3.04	3.50	1986	6	12.17	1982	.79	1979
Jul	4.19	3.83	3.87	1985	31	7.90	1981	.74	1987
Aug	4.09	3.87	6.38	1955	19	8.01	1991	1.03	1981
Sep	4.27	3.80	5.05	1954	11	13.13	1974	.69	1986
Oct	4.67	4.27	3.72	1990	13	10.19	1990	1.24	1994
Nov	4.34	4.16	2.63	1993	28	10.40	1972	.67	1976
Dec	3.80	3.38	2.47	1973	21	9.83	1973	.74	1989
Ann	49.05	48.88	6.38	Aug 1955	19	13.13	Sep 1974	.25	Feb 1987

Mean Number of Days (3)

Daily Precipitation

Month	>= 0.01	>= 0.10	>= 0.50	>= 1.00
Jan	11.9	7.0	2.7	.9
Feb	10.6	5.4	2.0	.9
Mar	11.9	7.0	2.4	1.0
Apr	11.9	7.3	2.5	.9
May	12.3	7.9	2.9	1.1
Jun	11.3	6.8	2.4	.9
Jul	9.7	6.1	2.5	1.2
Aug	9.1	6.1	2.8	1.2
Sep	9.5	6.2	2.5	1.1
Oct	8.9	5.9	2.8	1.5
Nov	10.8	6.7	2.9	1.2
Dec	12.2	6.7	2.4	1.0
Ann	130.1	79.1	30.8	12.9

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	1.05	1.44	2.03	2.55	3.06	3.60	4.20	4.91	5.84	7.31	8.69
Feb	.93	1.22	1.66	2.04	2.41	2.80	3.22	3.72	4.36	5.37	6.31
Mar	1.46	1.86	2.44	2.94	3.41	3.89	4.42	5.03	5.82	7.04	8.16
Apr	1.36	1.73	2.27	2.72	3.16	3.60	4.09	4.66	5.39	6.51	7.55
May	1.68	2.09	2.66	3.14	3.60	4.06	4.56	5.14	5.87	7.00	8.03
Jun	.81	1.17	1.76	2.30	2.84	3.43	4.09	4.89	5.94	7.62	9.22
Jul	1.59	1.98	2.54	3.00	3.44	3.89	4.38	4.95	5.67	6.78	7.79
Aug	1.40	1.79	2.35	2.83	3.28	3.75	4.27	4.86	5.63	6.82	7.91
Sep	.89	1.28	1.91	2.48	3.05	3.67	4.36	5.19	6.29	8.05	9.72
Oct	1.82	2.26	2.87	3.38	3.86	4.36	4.89	5.50	6.28	7.48	8.58
Nov	1.47	1.88	2.48	2.99	3.48	3.98	4.52	5.16	5.98	7.25	8.42
Dec	.88	1.24	1.79	2.29	2.79	3.32	3.91	4.61	5.54	7.01	8.39
Ann	37.42	39.73	42.66	44.85	46.79	48.65	50.56	52.66	55.19	58.83	61.95

\+ 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)

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	15.9	15.6	4	2	14.3	1978	20	46.8	1987	30	1978	22	16	1971	8.3	4.1	1.7	.9	.2	18.7	12.5	9.4	4.7
Feb	13.6	11.4	5	3	15.6	1983	7	35.0	1972	30	1978	8	19	1978	7.6	3.2	1.4	.7	.3	17.6	13.2	9.7	5.4
Mar	11.3	9.3	2	2	14.9	1984	29	44.1	1993	26+	1993	16	10+	1993	6.6	2.8	1.3	.6	.2	10.5	7.1	4.7	2.7
Apr	3.3	1.4	#	1	15.0	1987	28	21.0	1987	17	1987	29	2	1982	2.2	.8	.3	.1	.1	1.4	.8	.4	.2
May	.5	.0	#	0	11.4	1977	9	12.7	1977	10	1977	10	#	1993	.1	.1	@	@	@	.1	@	@	@
Jun	.0	.0	#	0	.0	0	0	.0	0	0	0	0	#	1977	.0	.0	.0	.0	.0	.0	.0	.0	.0
Jul	.0	.0	#	0	.0	0	0	.0	0	0	0	0	#	1995	.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	#	1992	30	#	1992	0	0	0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Oct	.3	.0	#	0	7.5	1979	10	7.5	1979	8	1979	10	#	1979	.1	.0	@	@	.0	.1	.1	.1	.0
Nov	4.4	2.1	#	0	14.8	1971	25	20.7	1971	15	1971	26	2	1971	2.3	1.2	.5	.2	@	2.8	1.2	.7	.2
Dec	11.7	12.2	1	1	17.3	1992	12	37.0	1992	29	1992	13	6	1992	7.7	3.2	1.2	.5	.1	11.9	6.6	2.9	.5
Ann	61.0	52.0	N/A	N/A	17.3	Dec 1992	12	46.8	Jan 1987	30+	Feb 1978	8	19	Feb 1978	34.9	15.4	6.4	3.0	.9	63.1	41.5	27.9	13.7

+ 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	5/17	5/14	5/11	5/08	5/05	5/03	4/29	4/24
32	5/07	5/03	5/01	4/28	4/26	4/24	4/22	4/19	4/15
28	4/23	4/20	4/17	4/15	4/13	4/11	4/09	4/07	4/03
24	4/16	4/11	4/08	4/05	4/03	3/31	3/28	3/25	3/20
20	4/08	4/03	3/31	3/28	3/25	3/23	3/20	3/16	3/11
16	4/02	3/28	3/25	3/22	3/19	3/16	3/13	3/09	3/04

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	9/22	9/26	9/28	9/30	10/02	10/04	10/06	10/08	10/11
32	9/29	10/04	10/08	10/11	10/14	10/17	10/20	10/24	10/29
28	10/08	10/14	10/18	10/22	10/25	10/28	11/01	11/05	11/11
24	10/26	11/01	11/04	11/08	11/11	11/14	11/17	11/21	11/26
20	11/09	11/14	11/17	11/20	11/22	11/25	11/28	12/01	12/05
16	11/18	11/23	11/26	11/29	12/02	12/05	12/09	12/12	12/17

Freeze Free Period

Temp (F)	Probability of longer than indicated freeze free period (Days)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	163	157	153	149	146	143	139	135	129
32	192	184	179	174	170	166	162	156	149
28	216	209	203	198	194	190	185	179	172
24	245	237	231	226	222	217	212	206	199
20	262	255	250	245	241	237	233	228	221
16	281	273	267	262	258	253	248	242	235

***** 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	1284	1094	952	601	278	74	9	20	158	478	764	1119	6831
60	1129	954	797	451	152	20	0	1	60	330	614	964	5472
57	1036	870	704	362	94	7	0	0	28	249	524	871	4745
55	974	814	642	305	63	3	0	0	15	201	464	809	4290
50	819	674	487	176	18	0	0	0	2	103	322	654	3255
32	303	220	75	2	0	0	0	0	0	0	23	196	819

Cooling Degree Days (1)

Base Above	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
32	39	50	152	397	755	977	1182	1129	844	547	249	75	6396
55	0	0	4	21	120	294	470	417	181	39	7	1	1554
57	0	0	3	14	90	241	408	356	139	25	4	0	1280
60	0	0	1	7	55	168	316	268	88	11	1	0	915
65	0	0	0	0	7	64	166	122	12	0	0	0	371
70	0	0	0	0	4	22	67	50	9	0	0	0	152

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	7	13	57	194	515	749	944	888	613	319	106	21	7	20	77	271	786	1535	2479	3367	3980	4299	4405	4426
45	0	1	28	102	363	599	789	733	463	191	53	5	0	1	29	131	494	1093	1882	2615	3078	3269	3322	3327
50	0	0	8	48	230	450	634	578	319	98	19	1	0	0	8	56	286	736	1370	1948	2267	2365	2384	2385
55	0	0	3	20	124	305	479	423	189	43	7	0	0	0	3	23	147	452	931	1354	1543	1586	1593	1593
60	0	0	1	6	54	178	326	277	97	11	0	0	0	0	1	7	61	239	565	842	939	950	950	950
Base	**Growing Degree Units for Corn (Monthly)**												**Growing Degree Units for Corn (Accumulated Monthly)**											
50/86	0	3	37	111	288	460	628	580	350	158	50	6	0	3	40	151	439	899	1527	2107	2457	2615	2665	2671

(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