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: BILLINGS WATER PLANT, MT **COOP ID: 240802**

Climate Division: MT 5 **NWS Call Sign:** **Elevation: 3,097 Feet** **Lat: 45˚46N** **Lon: 108˚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	37.3	13.3	25.3	75	1897	18	37.5	1986	-39	1930	17	8.5	1979	1230	0	.0	.0	6.6	9.5	29.4	7.1
Feb	44.2	18.3	31.3	76	1932	27	41.7	1991	-49	1899	11	16.0	1989	946	0	.0	.0	11.5	5.7	25.9	3.7
Mar	53.2	25.4	39.3	82+	1910	22	48.6	1986	-34	1920	6	30.7	1996	798	0	.0	.0	20.0	2.0	24.7	1.2
Apr	62.7	33.8	48.3	92	1910	25	55.2	1987	-5	1936	2	39.8	1975	505	2	.0	.1	25.9	.4	13.7	.0
May	71.7	43.1	57.4	99	1901	16	62.4	1985	14	1954	3	52.8	1996	253	17	.0	.9	30.1	.0	2.2	.0
Jun	81.1	51.2	66.2	108	1900	21	75.0	1988	26	1903	1	60.1	1998	81	115	.4	5.6	30.0	.0	@	.0
Jul	88.4	56.2	72.3	112	1901	31	75.9	2000	37+	1972	4	64.1	1993	17	244	1.5	14.9	31.0	.0	.0	.0
Aug	87.8	54.8	71.3	107	1934	3	76.8	1971	28	1910	25	66.1	1980	31	226	.6	14.1	31.0	.0	.0	.0
Sep	77.1	44.9	61.0	100+	1983	2	68.5	1998	18	1926	24	55.7	1984	174	54	.1	3.0	29.4	.0	1.8	.0
Oct	65.3	35.3	50.3	95+	1922	3	54.0	1974	-11	1919	27	45.5	1984	456	0	.0	.1	28.1	.4	11.5	@
Nov	47.9	24.0	36.0	80	1999	12	46.6	1999	-28	1959	16	18.8	1985	872	0	.0	.0	14.6	3.9	25.1	1.2
Dec	39.1	15.8	27.5	75	1896	30	37.5	1999	-41	1983	24	9.4	1983	1164	0	.0	.0	6.9	7.4	28.9	4.5
Ann	63.0	34.7	48.9	112	Jul 1901	31	76.8	Aug 1971	-49	Feb 1899	11	8.5	Jan 1979	6527	658	2.6	38.7	265.1	29.3	163.2	17.7

\+ 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: 1894-2001

(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	.62	.54	1.45	1972	2	2.09	1972	.04	1992
Feb	.49	.40	.74	2000	25	2.06	1978	.00	1977
Mar	.87	.78	.95	1946	21	2.21	1995	.10	1993
Apr	1.55	1.55	4.68	1941	17	3.53	1976	.09	1980
May	2.39	1.88	2.98	1942	13	7.77	1978	.67	1979
Jun	1.98	1.65	3.00	1997	9	6.42	1982	.24	1977
Jul	1.19	.78	2.30	1993	3	5.35	1993	.00	1976
Aug	.92	.66	2.44	1906	31	2.51	1999	.00	1994
Sep	1.42	1.21	2.06	1941	7	4.32	1978	.04	1990
Oct	1.32	.95	4.40	1931	26	3.71	1971	.01	1987
Nov	.64	.49	.96	1922	2	2.11	1978	.00	1997
Dec	.57	.51	1.20	1910	4	1.57	1973	.07	1986
Ann	13.96	13.46	4.68	Apr 1941	17	7.77	May 1978	.00+	Nov 1997

Mean Number of Days (3)

Daily Precipitation

Month	>= 0.01	>= 0.10	>= 0.50	>= 1.00
Jan	6.3	2.1	.1	@
Feb	4.5	1.9	.1	.0
Mar	5.9	2.6	.4	.0
Apr	7.5	4.5	.8	.1
May	9.4	5.4	1.6	.4
Jun	9.7	5.2	.9	.2
Jul	6.0	2.8	.6	.2
Aug	5.3	2.5	.4	.1
Sep	6.0	3.5	.8	.2
Oct	5.9	3.3	.7	.1
Nov	4.9	2.4	.1	.0
Dec	5.1	2.3	.1	.0
Ann	76.5	38.5	6.6	1.3

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	.10	.15	.24	.32	.41	.51	.62	.75	.93	1.23	1.51
Feb	.03	.08	.15	.22	.30	.39	.48	.61	.77	1.04	1.31
Mar	.21	.29	.41	.53	.64	.76	.89	1.05	1.26	1.59	1.91
Apr	.24	.38	.60	.81	1.04	1.28	1.56	1.89	2.35	3.09	3.79
May	.59	.82	1.16	1.47	1.78	2.11	2.47	2.90	3.46	4.35	5.19
Jun	.36	.53	.82	1.09	1.37	1.66	2.00	2.41	2.96	3.84	4.68
Jul	.04	.12	.28	.45	.64	.86	1.12	1.45	1.91	2.68	3.44
Aug	.02	.08	.21	.33	.48	.65	.85	1.11	1.48	2.09	2.70
Sep	.20	.32	.52	.72	.92	1.15	1.41	1.73	2.17	2.87	3.56
Oct	.11	.19	.37	.55	.75	.98	1.26	1.61	2.09	2.90	3.69
Nov	.07	.15	.25	.35	.44	.54	.65	.79	.97	1.27	1.54
Dec	.08	.13	.21	.29	.37	.46	.56	.69	.87	1.15	1.43
Ann	8.83	9.78	11.02	11.97	12.83	13.67	14.55	15.53	16.72	18.48	20.03

+ 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: 1894-2001
(3) Derived from 1971-2000 serially complete daily data

Complete documentation available from:
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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	5.7	-99.9	3	1
Feb	1.6	-99.9	1	#
Mar	2.0	-99.9	#	0
Apr	4.0	.0	#	0
May	#	.0	0	0
Jun	.0	.0	0	0
Jul	.0	.0	0	0
Aug	.0	.0	0	0
Sep	.7	.0	#	0
Oct	#	.0	#	0
Nov	1.0	-99.9	1	#
Dec	6.0	-99.9	2	#
Ann	21.0	-9.9	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	17.0	1972	2	17.0	1972	17	1972	2	11	1972
Feb	8.0	2000	25	8.0+	2000	10	1972	1	10	1972
Mar	6.0	1999	5	6.0	2000	12	1998	10	1+	1999
Apr	7.0	1997	5	22.1	1997	2	1999	2	#+	1999
May	#	1983	10	#	1983	0	0	0	0	0
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	6.0	2000	22	9.0	2000	6	2000	22	#	2000
Oct	#	1997	13	#	1997	1	1996	29	#+	1997
Nov	4.0	2000	15	4.0	2000	8	1973	4	7	1973
Dec	6.0	1996	25	6.0	1996	16	1996	29	10	1984
Ann	17.0	Jan 1972	2	22.1	Apr 1997	17	Jan 1972	2	11	Jan 1972

Mean Number of Days (1)

Snow Fall >= Thresholds

Month	0.1	1.0	3.0	5.0	10.0
Jan	-9.9	-9.9	-9.9	-9.9	-9.9
Feb	.6	.4	.2	.1	.0
Mar	-9.9	-9.9	-9.9	-9.9	-9.9
Apr	1.0	.9	.4	.3	.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	.2	.1	.1	.1	.0
Oct	.0	.0	.0	.0	.0
Nov	-9.9	-9.9	-9.9	-9.9	-9.9
Dec	1.2	.9	.4	.1	.0
Ann	-9.9	-9.9	-9.9	-9.9	-9.9

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	.3	.0	.0	.0
May	.0	.0	.0	.0
Jun	.0	.0	.0	.0
Jul	.0	.0	.0	.0
Aug	.0	.0	.0	.0
Sep	.1	.1	@	.0
Oct	.0	.0	.0	.0
Nov	-9.9	-9.9	-9.9	-9.9
Dec	-9.9	-9.9	-9.9	-9.9
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

Complete documentation available from:
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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	6/04	5/30	5/26	5/24	5/21	5/18	5/15	5/11	5/07
32	5/24	5/19	5/15	5/11	5/08	5/05	5/01	4/27	4/22
28	5/12	5/06	5/02	4/29	4/25	4/22	4/19	4/15	4/09
24	4/29	4/24	4/20	4/17	4/14	4/12	4/09	4/05	3/31
20	4/20	4/15	4/11	4/07	4/04	4/01	3/28	3/24	3/19
16	4/10	4/03	3/29	3/25	3/21	3/17	3/13	3/08	3/01

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

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	132	127	123	119	114	110	105	97
32	163	156	150	146	141	137	132	127	119
28	188	180	173	168	163	158	153	146	138
24	208	200	194	189	185	180	175	170	162
20	227	220	216	211	207	204	199	194	188
16	261	253	246	241	236	231	225	219	210

***** 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	1230	946	798	505	253	81	17	31	174	456	872	1164	6527
60	1076	814	643	365	139	29	3	8	87	304	727	1009	5204
57	987	735	553	287	88	13	0	3	50	219	643	919	4497
55	932	683	496	240	62	7	0	1	32	168	587	864	4072
50	786	557	356	142	20	0	0	0	8	74	454	719	3116
32	347	213	52	4	0	0	0	0	0	1	127	292	1036

Cooling Degree Days (1)

Base Above	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
32	140	191	277	491	787	1025	1249	1218	869	568	245	151	7211
55	12	17	9	37	136	342	536	506	211	22	16	11	1855
57	5	14	4	24	100	288	474	446	169	11	12	4	1551
60	1	8	0	12	58	213	384	358	116	2	6	0	1158
65	0	0	0	2	17	115	244	226	54	0	0	0	658
70	0	0	0	0	3	49	132	123	19	0	0	0	326

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	14	44	118	275	538	781	1002	966	627	337	76	21	14	58	176	451	989	1770	2772	3738	4365	4702	4778	4799
45	0	11	50	163	391	631	847	811	481	212	30	3	0	11	61	224	615	1246	2093	2904	3385	3597	3627	3630
50	0	0	13	79	254	482	692	656	340	111	11	0	0	0	13	92	346	828	1520	2176	2516	2627	2638	2638
55	0	0	0	31	134	337	537	501	211	40	0	0	0	0	0	31	165	502	1039	1540	1751	1791	1791	1791
60	0	0	0	8	58	206	385	350	107	11	0	0	0	0	0	8	66	272	657	1007	1114	1125	1125	1125
Base	**Growing Degree Units for Corn (Monthly)**												**Growing Degree Units for Corn (Accumulated Monthly)**											
50/86	18	52	117	216	349	491	626	607	416	256	71	23	18	70	187	403	752	1243	1869	2476	2892	3148	3219	3242

(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