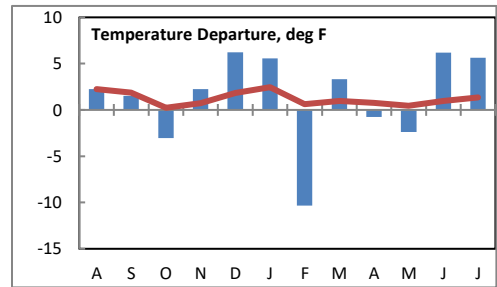
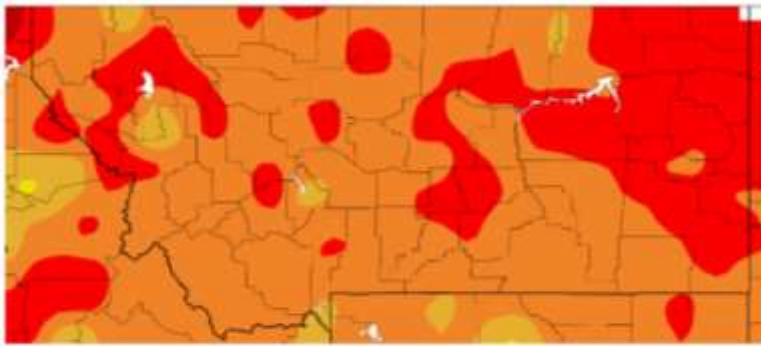


Montana Weather/Precipitation Summary

July 2021 NOAA's National Weather Service Great Falls Montana

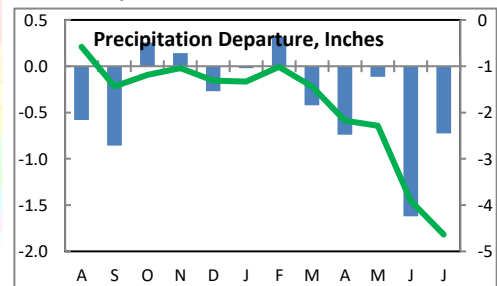
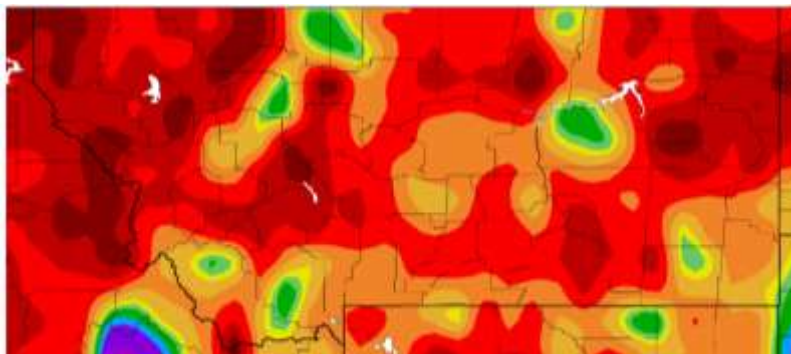
A ridge of high pressure aloft was centered over Montana for most of July (Fig. 1). Although this is normal for July, this year's ridge was much stronger. In Montana temperatures averaged well above normal, with several records for extreme heat. Precipitation was below normal, at record dryness at several locations. Winds averaged near to below normal.

July temperature anomalies ranged from 2.4°F above normal at West Yellowstone to 7.8°F above normal at Mullan Pass. The map below shows the variation in departures. The warmest average temperatures were in northwest Montana. The warmest average of 81.3°F was at Dry Blood Creek RAWs (Petroleum), while the coolest was 54.8°F at Placer Basin (Sweet Grass). The highest temperature was 111°F at the National Weather Service Office in Billings on the 19th. This was the warmest temperature in July since 111°F occurred at Glendive and Wolf Point in 2007. In June 2021, 112°F was reported at Sweeney Creek. The coldest was 27°F at Gates Park on the 23rd. This range of 84°F is above the July average range of 80°F and the largest since 2016. The statewide temperature average of 74.2°F was 5.9°F above normal and the 4th warmest of record. It was the warmest since 2007. The red line on the graph shows the cumulative 12-month departure from normal, which was 1.5°F above normal. See the state summary and temperature tables below for more details.



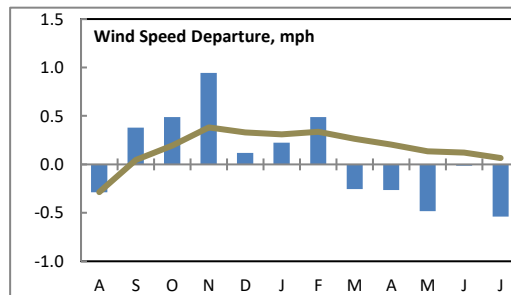
Temperature departure from normal (HPRCC)

Precipitation was heaviest portions of central and southeast Montana. Much of the rest of the state continued very dry. Some of these areas received less than one-quarter inch of rain. The highest amount (2.42-inches) fell near Roundup, with 2.41-inches near Baker. The highest amount at higher elevations was 2.40-inches at Short Creek SNOTEL (Madison). The month's statewide composite of 0.63" was 0.73" below normal. This ranks as the 16th driest July of record for Montana, and the driest since 2017. The green line on the precipitation graph (right) shows the cumulative 12-month departure from normal, which is now 4.64" below normal, and the driest 12-month period since 1934.

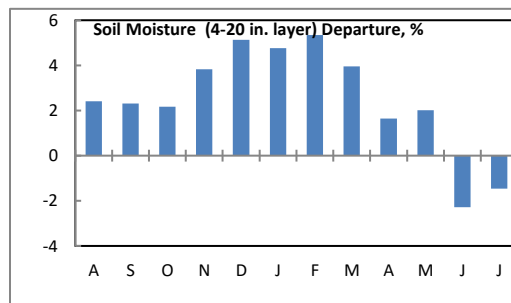


Precipitation percent of normal (gauge only)

Wind speed averages were generally below normal. Statewide, the month ranked as the 7th calmest July, with an average speed of 7.4-mph, or 0.6-mph below normal. The strongest averages were along the Rocky Mountain and portions of northeast Montana. The brown line of the wind graph to the right shows the 12-month cumulative statewide wind departure from normal, which is 0.1-mph above normal.



Persistent dryness and above normal temperatures have continued to dry out soil moisture. July ranked 7th driest and the driest July soils since 2017 (records since 1995).



Refer to NCEI’s State of the Climate report for the latest monthly discussion:
<http://www.ncdc.noaa.gov/sotc/>

Overall, July’s temperatures averaged above normal. There were a couple of short periods with below normal temperatures. The month started warm, with temperatures pushing into the 90s over much of eastern Montana. Daily thunderstorms from the 1st through 7th produced a variety of severe weather. A gust to 64-mph on the 1st was Missoula’s highest July gust of record. Their old record was 61-mph set in 1998. On the 2nd, a gust of 70-mph was recorded near Ekalaka. Hot temperatures across the state produced the warmest average temperature in Montana since August 2014. An average of 20 locations across the state was 79.2°F, which was the 47th warmest day since records began in the 1880s. On the 6th, golf-ball size hail fell near Hays and Hysham. A weak cold front brought thunderstorms to eastern Montana on the 5th. Thunderstorm gusts reached 73-mph at Lewistown. This was an all-time July record gust for Lewistown. Their old record was 72-mph set in 2002. One-inch hail also fell in Lewistown. As thunderstorms continued moving across eastern Montana, a gust of 82-mph was recorded at Mizpah (Custer). After a break, isolated thunderstorms caused severe weather over north central Montana. On the 11th, Cut Bank recorded their highest gust, 63-mph, in July since 2011. These storms caused a gust of 77-mph west of Big Sandy. Warm and dry conditions continued. On the 14th, Bozeman recorded their 7th lowest all-time relative humidity (6.0-percent). This was their lowest relative humidity value since August 10, 2018.

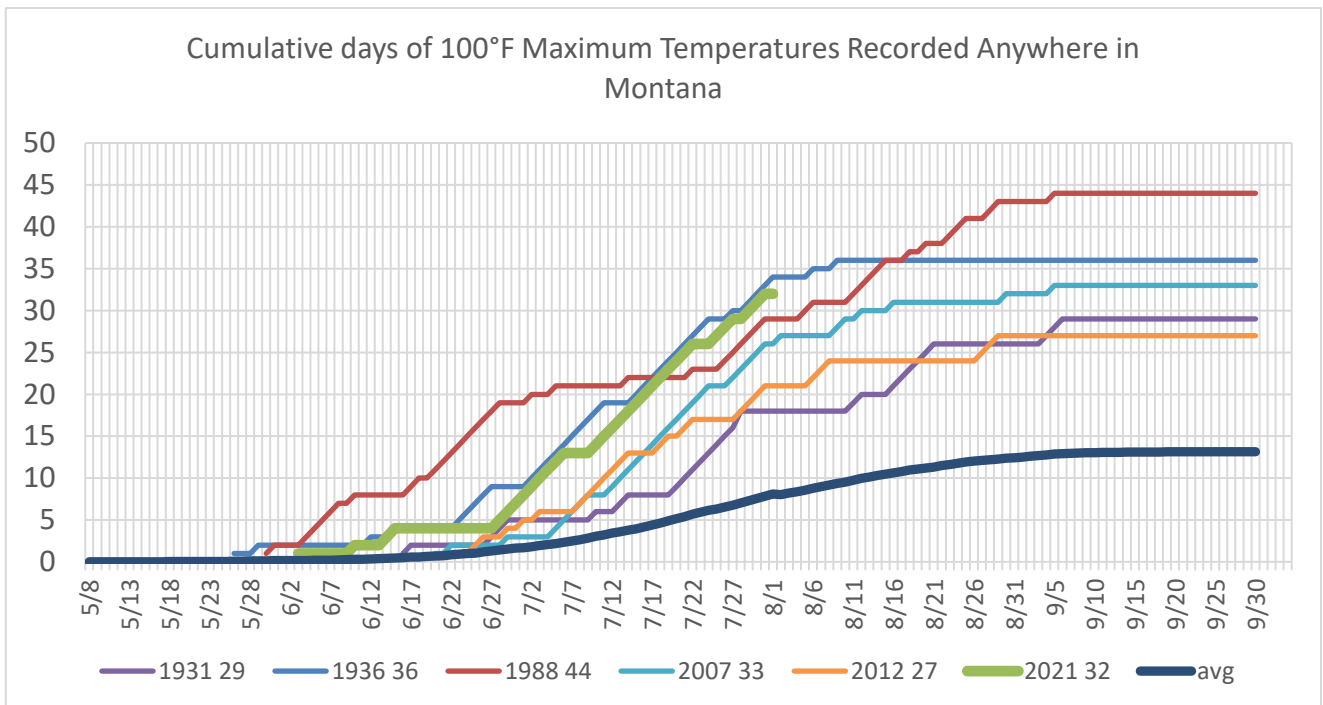
A slightly cooler air mass brought cool temperatures to some valley locations on the 16th. A low of 28°F was recorded near Libby. Hot conditions returned quickly. On the 19th, the Billings NWS office recorded a high temperature of 111°F. While a 112°F was observed near Sweeney Creek in June, this was the warmest July temperature in Montana since 111°F was observed at Glendive and Wolf Point in 2007. Weak disturbances brought isolated thunderstorms to the state on the 20th and 22nd. On the 20th, rainfall amounts of 1.83-inches and 1.27-inches were recorded near Choteau and Clancy, respectively. Hail to 1.75-inches fell near Ovando. On the 22nd, the thunderstorms produced wind gusts to 75-mph at McDonalds (Roosevelt) and 73-mph at Beaver Hill (Dawson). At Bozeman, thunderstorm gusts to 68-mph were the strongest in July since 1957...and their strongest gust since May 2010. Dry air on the 23rd caused Havre’s 8th lowest all-time relative humidity. A value of 6.9-percent was their lowest since August 2018.

Smoke was an overwhelming topic in July. Its presence began around the 8th, and stayed for the month. At Great Falls, with smoke only through July, this has caused this year to have the third highest visibility restriction of less than 10 miles since records began in 1994. There have been nearly 240 hours with less than 10-miles visibility recorded at Great Falls this season. The previous high through July was 42-hours in 2007. The following table summarizes smoke hours for sites across Montana during July.

Location	July 2021 hours of smoke vsby <10 miles	Previous record	Record began
Billings	111 hours	33 hours in 2015	1998
Glasgow	112	128 in 2015	1994
Great Falls	236	42 in 2007	1994
Missoula	397	48 in 2017	1998

Billings' total of 111 hours ranks 4th highest overall for an entire season. Glasgow's total of 112 hours also ranks 4th highest for an entire season. Missoula's monthly total of 397 hours ranks 3rd highest for an entire season.

A high temperature of 100°F or higher was recorded on 24 days anywhere in the state. This matches the record set in 1936. The following chart shows the accumulation, along with other years with high accumulations. This year is just one day behind the record year of 1936.



The highest daily temperatures in July occurred on six days near Troy. Gates Park had the state's lowest temperature on 17 days. For the year through July, Troy has been the state's warmest on 30 days and West Yellowstone has been coolest on 39 days.

Water Year-to-date

For the water-year through July, the state composite temperature averaged 41.2°F, which was 1.6°F above normal. This has been the warmest water year since 2016. Precipitation totaled 9.40-inches, which was 3.20" below normal and 12th driest. This was the driest since 1988. Winds averaged 9.1-mph, which is 0.1-mph higher than normal, ranking 23rd calmest.

Calendar Year-to-date

The calendar year has produced a composite temperature average of 44.3°F, which was 1.5°F above normal. Precipitation totaled 6.42-inches, which was 3.30" below normal and driest since 1985. This has been the 5th driest start to a year. Statewide winds averaged 8.9-mph, which is 0.1-mph below normal. This was the 17th lowest average of record.

June-July

Persistently warm temperatures during the past two months has caused the warmest June and July combined in 33 years. The average temperature for Montana for these two months in 2021

was 66.7°F, which was the 7th warmest of record, and warmest since the record warmest 70.7°F set in 1988. In 2021, these two months have been the second driest of record (1.43"). Only 1919 had less precipitation in the state for these two months (1.32").

Precipitation/convection

Severe convective weather occurred on 13 days in July which is one above normal. Thunderstorm gusts reached 90 mph at Brorson (Richland) on the 19th, and 4-inch hail fell near Glendive on the 8th.

July information:

High Temperature	111°F at Billings Natl Wx Service (19 th)	Greatest Precip	2.42" near Roundup
Low Temperature	27°F at Gates Park (23 rd)		2.40" at Short Creek SNOTEL (Madison)
Warmest Ave Temp	81.3°F at Dry Blood Creek (Petroleum)	Peak Wind Gust	82 mph at Mizpah (Custer) (7 th)
Coollest Ave Temp	54.8°F at Placer Basin (Sweet Grass)		
Range of Temp departures	+2.4°F at West Yellowstone to +7.8°F at Mullan Pass	Highest Ave Wind	13.2 mph at Deep Creek RAWS 12.3 mph at Glasgow
21 city mean monthly Temperature/Nrml	74.2/68.3F normal. 4 th warmest of record (since 1880). 97 th percentile.	20 city mean monthly wind speed/Nrml	7.4 mph/8.0 mph; 7 th calmest of record (since 1936). 9 th percentile.
22 city mean monthly precipitation/Nrml	0.63"/1.36" – 46% of normal. 16 th driest of record (since 1880). 11 th percentile.		

**Historical Rank of Precipitation (inches)
for the Current Month and Water Year to Date**

Location	Jul	% of Norm	Rank	Pcntl	Oct 1 - Jul	% of norm	Rank	Pcntl	Years
	Baker	1.66	85%	44	16	5.03	42%	92	98
Billings	0.16	13%	114	93	7.85	65%	90	75	120
Belgrade	0.69	64%	45	52	7.76	68%	81	96	84
Butte	0.43	36%	105	82	5.04	48%	123	97	127
Cut Bank	0.03	2%	111	96	7.26	83%	84	74	113
Dillon WMU	0.52	57%	94	77	6.42	68%	112	93	121
Glasgow	0.66	34%	89	71	6.26	56%	110	91	121
Great Falls	0.32	26%	110	84	10.53	86%	88	68	129
Havre	0.52	34%	106	74	6.33	64%	131	93	141
Helena	0.09	8%	140	98	7.77	83%	110	77	142
Jordan	1.65	104%	33	32	5.94	56%	83	88	94
Kalispell	0.20	18%	117	91	13.36	90%	66	52	127
Lewistown	1.38	78%	73	58	8.94	63%	121	97	125
Livingston	0.95	73%	63	53	9.13	74%	96	83	115
Miles City	0.65	43%	108	75	5.97	55%	137	95	144
Missoula	0.22	26%	121	85	10.54	86%	94	69	136
Mullan Pass	0.15	16%	63	75	39.96	109%	25	30	82
Wolf Point	0.81	45%	66	67	7.18	74%	62	85	73
Glendive	1.12	51%	88	70	6.07	51%	115	96	120
Sidney	0.01	0%	82	101	5.81	48%	78	96	81
BZN-MSU	1.04	83%	80	54	13.29	79%	114	80	142
W Yellowstone	1.48	111%	42	36	17.51	90%	61	62	98

Rankings and Percentiles are 1=wettest, higher numbers=drier.

For an automated version of this chart, updated daily, go to

<http://www.wrh.noaa.gov/tfx/dx.php?wfo=tfx&type=&loc=products&fx=PCPNTOTALS>

**Historical Rank of Average Temperature (°F)
for the Current Month and Water Year to Date**

Location	Jul	Normal	Rank	Pcntl	Oct 1 - Jul	Normal	Rank	Pcntl	Years
	Baker	76.6	67.4	4	3	42.1	39.0	15	13
Billings	77.3	73.3	9	6	45.8	44.5	12	9	119
Belgrade	72.9	67.4	2	1	40.5	39.3	16	18	86
Butte	68.6	63.6	4	2	37.7	36.7	44	34	127
Cut Bank	70.7	64.9	4	3	39.5	38.4	27	23	112
Dillon	70.2	64.9	5	5	39.8	38.4	32	41	77
Glasgow	79.2	72.0	2	1	42.5	39.6	8	6	125
Great Falls	73.7	67.9	4	2	42.3	41.1	49	39	124
Havre	75.5	69.8	4	2	41.6	39.7	25	17	141
Helena	77.6	70.6	2	1	44.1	41.9	7	4	141
Jordan	78.5	71.3	3	2	42.9	40.2	15	15	97
Kalispell	71.5	64.9	2	1	42.1	39.9	40	33	120
Lewistown	72.7	66.1	2	1	40.6	39.6	33	28	117
Livingston	73.2	67.9	4	3	43.6	42.2	26	22	115
Miles City	80.5	74.2	5	3	43.9	42.0	22	15	139
Missoula	74.9	68.4	2	1	43.4	41.7	19	14	127
Mullan Pass	68.7	60.7	1	1	36.8	34.8	4	7	44
Wolf Point	77.6	71.3	1	1	40.6	38.7	19	25	72
Glendive	78.3	73.7	8	6	42.0	42.2	46	38	120
Sidney	77.5	71.4	2	2	41.1	40.5	41	42	98
W Yellowstone	62.7	59.2	10	9	31.5	31.5	51	43	118

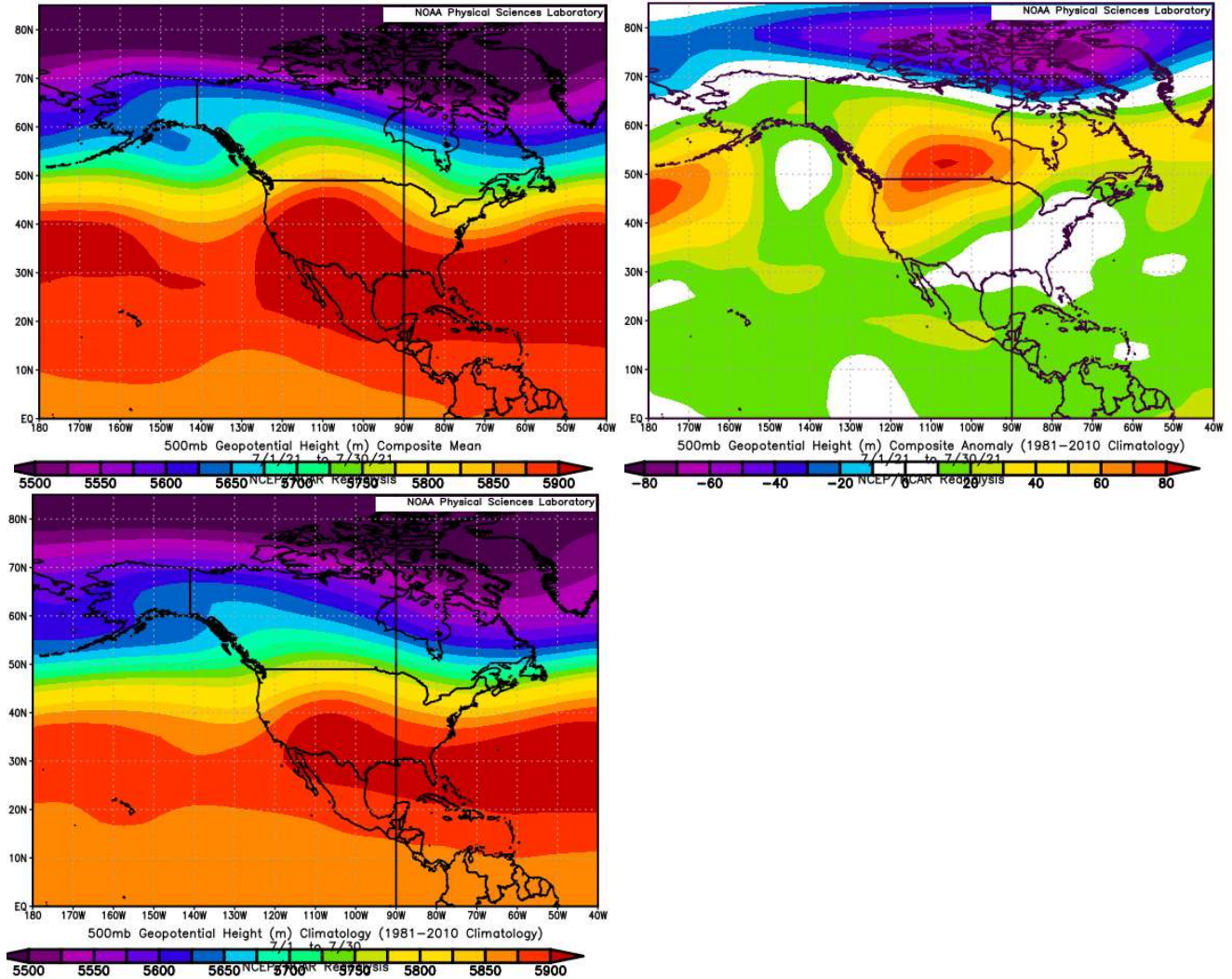
Rankings and Percentiles are 1=coldest, higher numbers=warmer.

**Historical Rank of Average Wind Speed (mph)
for the Current Month and Water Year to Date**

Location	Jul	Normal	Rank	Pcntl	Oct 1 -				
					Jul	Normal	Rank	Pcntl	Years
Baker	10.5	10.9	11	42	10.9	11.2	17	73	23
Billings	8.8	8.7	65	74	11.1	11.0	53	62	85
Belgrade	5.9	5.9	37	65	5.6	5.7	33	58	56
Butte	5.7	6.6	53	91	5.6	5.9	42	73	57
Cut Bank	9.8	10.8	59	76	13.6	13.6	40	50	79
Dillon	7.4	7.5	49	73	9.7	9.2	33	48	67
Glasgow	10.2	10.3	35	44	10.5	10.5	46	60	76
Great Falls	7.9	9.0	80	95	12.2	11.7	43	51	83
Havre	8.7	8.8	43	32	10.7	10.0	21	15	132
Helena	6.0	6.9	138	97	6.9	6.8	99	70	141
Jordan	7.9	8.0	18	46	8.8	8.3	5	11	37
Kalispell	4.8	5.4	114	93	5.4	5.2	105	86	122
Lewistown	7.3	7.7	64	82	9.4	9.6	58	73	79
Livingston	9.5	10.2	38	66	15.5	15.6	26	47	54
Miles City	9.1	9.6	60	46	9.7	10.1	63	48	130
Missoula	5.1	5.9	81	94	5.0	5.1	70	81	86
Mullan Pass	3.1	4.8	31	97	4.9	5.6	27	90	30
Wolf Point	7.1	7.7	17	73	7.9	8.2	18	77	23
Glendive	9.1	9.4	19	66	10.1	10.2	16	55	29
Sidney	7.6	7.7	14	62	9.1	9.0	16	50	32
W Yellowstone	4.3	5.5	12	100					6

Rankings and Percentiles are 1=windiest, higher numbers=calmer.

Figure 1. Mean flow at 500 millibars (~18,000 ft) for this month (left) and climatology for the month (right) (from [NOAA/ESRL Physical Sciences Laboratory](http://www.esrl.noaa.gov/psd/)). The third map shows the normal 500 millibar pattern for July.



For the latest information on mountain snowpack from the NRCS, go to: <https://www.nrcs.usda.gov/wps/portal/wcc/home/quicklinks/>

For the latest U.S. Drought Monitor, issued weekly by the National Drought Mitigation Center, USDA and NOAA, go to: <http://droughtmonitor.unl.edu/>

These data are preliminary and have not undergone final QC by NCEI. Therefore, these data are subject to revision. Final and certified climate data can be access at the National Centers for Environmental Information (NCEI) <http://www.ncei.noaa.gov>. Many more links are on the Drought Information Page of the NWS Great Falls web site at <http://www.wrh.noaa.gov/tfx/main/drought.php?wfo=txf>. The climatological record for normals is 1991-2020. The ranking period for temperature, precipitation and snowfall is since 1880. The ranking period for wind speeds is since 1936. The ranking period for soil moisture is since 1995.