Under the Big Sky e-Letter December 2021

Photo Credit: Ryan Bernhart

National Weather Service Glasgow, MT

A Peak Inside:

National Weather Service

Glasgow, MT

2021 Highlights

As 2021 enters the rear-view mirror, we thought it would be worth a look at the top highlights as we get started into 2022.

1) 2021 went down as the driest year on record for Glasgow, MT. Exceptional drought was a major theme.

Figure 1: NWS Glasgow social media post showing historical annual precipitation rankings for select locations.

2) Glasgow, MT had the second warmest year on record with an average temperature of 46.9 °F.

Maximum 1-Year Mean Avg Temperature for Glasgow Area, MT (ThreadEx)

Click column heading to sort ascending, click again to sort descending.

Rank	Value	Ending Date	Missing Days
1	47.6	1987-12-31	0
2	46.9	2021-12-31	0
3	46.8	1981-12-31	0
4	46.1	2015-12-31	0
5	46.1	2006-12-31	0
6	45.9	1931-12-31	0
7	45.9	2016-12-31	0
8	45.7	1998-12-31	0
9	45.6	1988-12-31	0
10	45.6	1953-12-31	0
Period of record: 1893-10-01 to 2021-12-31			

Figure 2: Graphic showing Glasgow, MT having the second warmest year on record.

3) A late season snow storm dumped nearly a foot of snow over the Little Rockies (April 12-14).

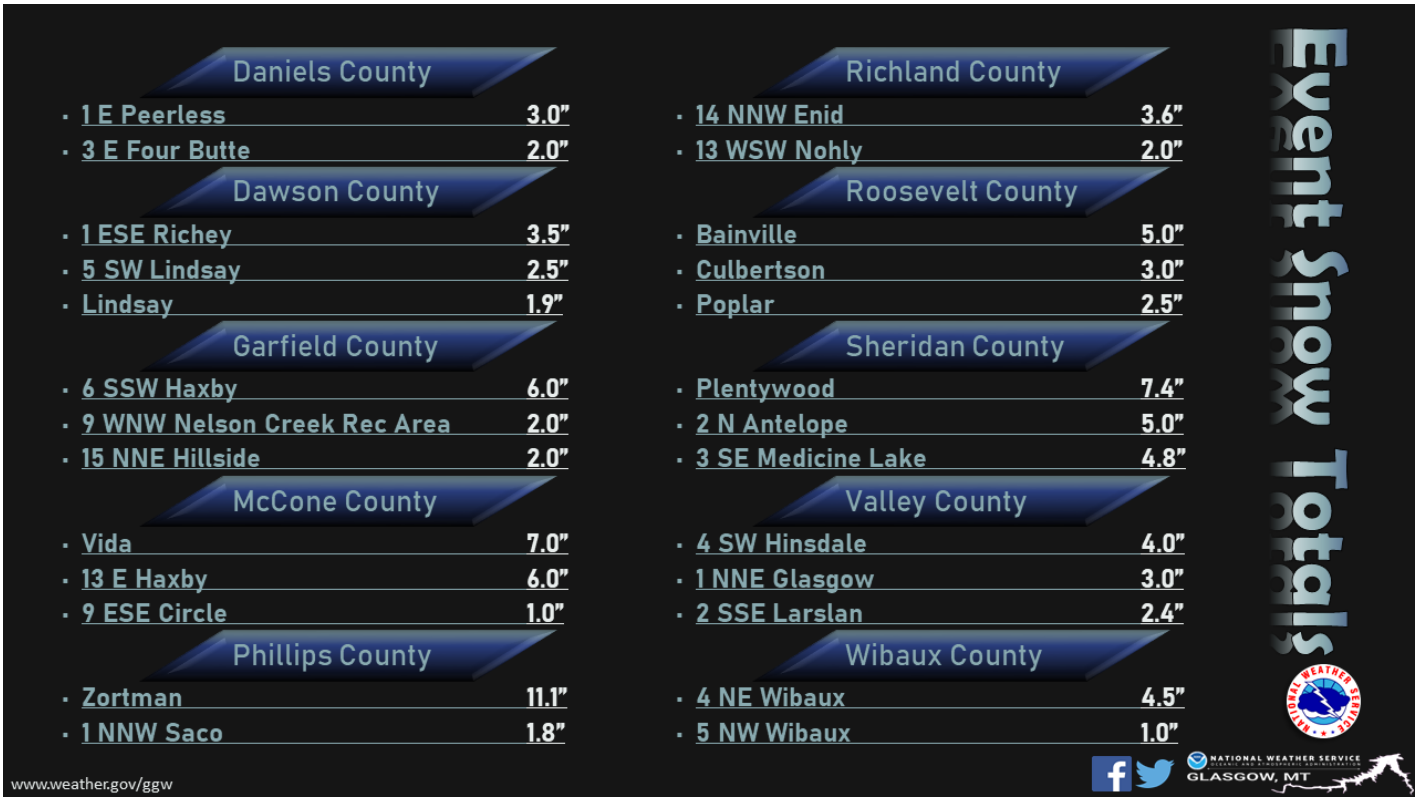

Figure 3: NWS Glasgow social media post showing snowfall totals (April 12-14).

4) Excessive heat brought 5 consecutive days with highs above 100 °F for Glasgow, MT. Glasgow saw a high of 110 °F on Monday July 19th, tying the 3rd highest temperature on record for Glasgow, MT.

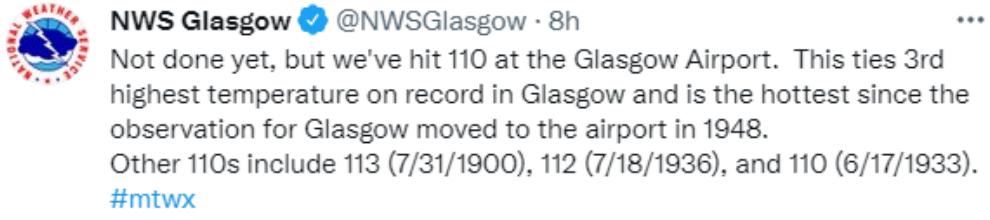

Figure 4: NWS Glasgow tweet image showing Glasgow, MT tying 3rd highest recorded temperature.

5) Severe weather season brought several instances of damaging wind and large hail reports. Hail up to 4 inches was reported with thunderstorms on 6/8 in Dawson County. Storms on 6/10 produced wind gusts to 90 mph.

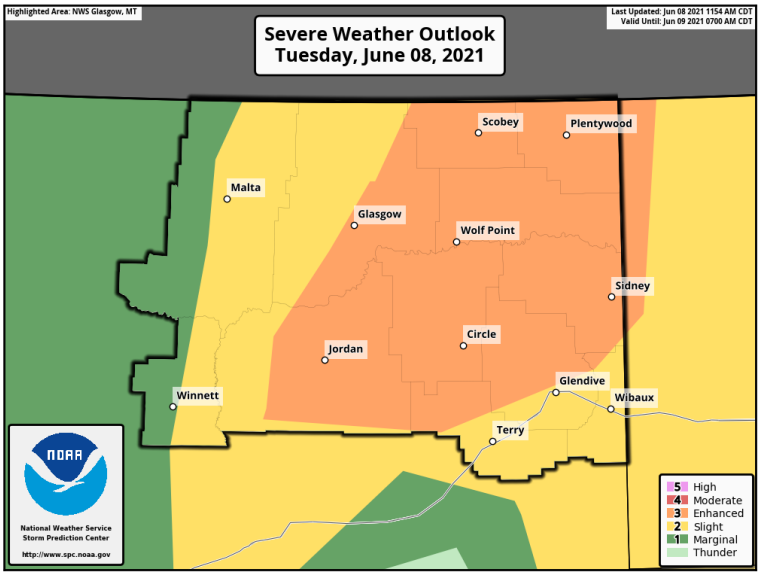

Figure 5 (right): SPC Convective Outlook for June 8, 2021 for Glasgow, MT CWA.

3) While drought was surely the major event in 2021 that everyone will remember, there were a few periods that did buck the trend. For instance, an upper level low pressure system dumped several inches of snow over higher terrain across NE Montana, and for lower elevations up to an inch of rain (May 8-9). Here is a PNS that NWS Glasgow issued following the event that shows liquid precipitation totals across the area.

Public Information Statement
National Weather Service Glasgow MT
825 AM MDT Mon May 10 2021

...PRECIPITATION REPORTS...

Location	Amount	Time/Date	Provider
POPLAR RIVER WOLF POINT 29 E	1.36 in	0600 AM 05/10	HADS
13.4 NW Enid	1.34 in	0700 AM 05/10	COOP
FORT PECK MORGAN WOLF POINT	1.23 in	0500 AM 05/10	HADS
Poplar Raws	1.19 in	0718 AM 05/10	RAWS
Lambert	1.15 in	0816 AM 05/10	CWOP
Crane	1.04 in	0816 AM 05/10	CWOP
Glendive 16.9 WSW	1.01 in	0700 AM 05/10	COCORAHS
FORT PECK MORGAN WOLF POINT	1.00 in	0600 AM 05/10	HADS
POPLAR RIVER WOLF POINT 29 E	0.93 in	0500 AM 05/10	HADS
Wolf Point Airport	0.92 in	0753 AM 05/10	ASOS
1.5 E Wibaux	0.86 in	0700 AM 05/10	COOP
Circle	0.85 in	0817 AM 05/10	CWOP
Badger Creek	0.85 in	0816 AM 05/10	CWOP
Culbertson	0.82 in	0815 AM 05/10	CWOP
Sidney Airport	0.80 in	0756 AM 05/10	AWOS
Savage 1.0 S	0.71 in	0700 AM 05/10	COCORAHS
Sidney	0.67 in	0816 AM 05/10	CWOP
Nashua 0.3 N	0.67 in	0700 AM 05/10	COCORAHS
Glendive	0.65 in	0816 AM 05/10	CWOP
Whitewater (school)	0.65 in	0820 AM 05/10	AWS
Glasgow Airport (ASOS)	0.64 in	0753 AM 05/10	ASOS
Glasgow 0.3 N	0.63 in	0800 AM 05/10	COCORAHS
Nashua	0.63 in	0800 AM 05/10	CWOP
Froid	0.62 in	0816 AM 05/10	CWOP
King Coulee	0.62 in	0744 AM 05/10	RAWS
3.9 SE Glasgow	0.61 in	0800 AM 05/10	HADS
Wibaux (school)	0.59 in	0820 AM 05/10	AWS
Landusky	0.53 in	0815 AM 05/10	CWOP
Hoyt 16ESE/Pine Hill	0.53 in	0724 AM 05/10	RAWS
Thoeny 1WSW/Bluff Creek	0.52 in	0744 AM 05/10	RAWS
Zortman	0.51 in	0700 AM 05/10	COOP
Jordan	0.48 in	0748 AM 05/10	ASOS
14.1 NW Hell Creek Rec Area	0.46 in	0744 AM 05/10	HADS
Zortman 1E	0.43 in	0732 AM 05/10	RAWS
Medicine Lake 1ESE	0.41 in	0758 AM 05/10	RAWS
Richey	0.40 in	0816 AM 05/10	CWOP
Winnett 16N/Dry Blood Creek	0.39 in	0741 AM 05/10	RAWS
Devils Creek Rec Area 6ese	0.35 in	0808 AM 05/10	RAWS
1.3 W Thoeny	0.29 in	0744 AM 05/10	HADS
Mccloud 13WNW/Big Sheep Mtn	0.29 in	0808 AM 05/10	RAWS
Sand Springs	0.26 in	0816 AM 05/10	CWOP
Manning Corral Dogtown	0.21 in	0741 AM 05/10	RAWS
3.2 NE Bredette	0.20 in	0940 PM 05/09	COOP
Lewistown Port No. 2	0.20 in	0715 AM 05/10	RAWS
Lustre	0.18 in	0815 AM 05/10	CWOP
Glendive Airport	0.16 in	0756 AM 05/10	AWOS
15.0 S Zortman	0.16 in	0741 AM 05/10	HADS
Scobey	0.10 in	0816 AM 05/10	CWOP
Glasgow 4 N	0.08 in	0715 AM 05/10	CWOP
Plentywood	0.06 in	0815 AM 05/10	AWOS
Mosby	0.03 in	0745 AM 05/10	HADS

Figure 6: Public Information Statement with precipitation totals issued 5/10.

Montana All-Time December Record High Tie

*Information adapted from a review shared by Tanja Fransen, Meteorologist In Charge at NWS Glasgow. NWS Glasgow and the Montana State Climate Office at the University of Montana conducted a review of the event.

The Jordan ASOS weather observation site reported a high temperature of 78 degrees on December 1, 2021. This ties the previous record high for the state. Chinook winds gusting as high as 60 mph were taking place when the temperature was recorded. Prior, the Montana December record high of 78 degrees was held back on December 5, 1939 at the Crow Agency.

Date (MST)	Temp (F)	Dew Point (F)	Relative Humidity (%)	Wind Chill (F)	Wind Direction	Wind Speed (MPH)
02 Dec 11:48 am	58	41	53		W	12
02 Dec 10:48 am	49	33	54		WNW	7
02 Dec 9:48 am	44	29	55		N	CALM
02 Dec 8:48 am	44	27	51		E	3
02 Dec 7:48 am	42	26	53		NE	6
02 Dec 6:48 am	40	26	57	36	E	5
02 Dec 5:48 am	40	25	55	35	E	7
02 Dec 4:48 am	38	24	57		N	CALM
02 Dec 3:48 am	35	23	61		N	CALM
02 Dec 2:48 am	32	21	63		N	CALM
02 Dec 1:48 am	30	20	66		N	CALM
02 Dec 12:48 am	30	20	66		N	CALM
01 Dec 11:48 pm	32	22	66		N	CALM
01 Dec 10:48 pm	35	23	61		N	CALM
01 Dec 9:48 pm	42	26	53		ENE	6
01 Dec 8:48 pm	42	28	57		N	9
01 Dec 7:48 pm	47	30	52		NNE	9
01 Dec 6:48 pm	51	33	50		NNE	13
01 Dec 5:48 pm	61	36	39		NNE	12
01 Dec 4:48 pm	72	38	29		W	21G35
01 Dec 3:48 pm	74	37	26		W	26G56
01 Dec 2:48 pm	76	37	25		W	41G61
01 Dec 1:48 pm	78	38	24		W	31G58
01 Dec 12:48 pm	76	38	25		W	23G38
01 Dec 11:48 am	70	39	32		N	CALM
01 Dec 10:48 am	63	39	41		N	CALM
01 Dec 9:48 am	61	38	42		N	CALM
01 Dec 8:48 am	54	37	53		W	7

Figure 7: Strong wind gusts and a temperature of 78 degrees at the Jordan ASOS on December 1, 2021.

Join CoCoRaHS Today!

CoCoRaHS is a grassroots organization with a network of highly committed observers who report daily precipitation such as rain, hail, or snow from all across the country. The data are used by meteorologists, insurance adjusters, mosquito control, and even by those in academia.

Participating in the CoCoRaHS program is a great way to make a difference in your community. Check out the **CoCoRaHS main page** to learn more! We are still accepting new observers so feel free to join through the main CoCoRaHS website today. All you'll need is a ruler and a rain gage to get started!

Were you unable to attend our recent Montana CoCoRaHS Virtual Winter Training held on December 1? No problem, you can check it out **here**!

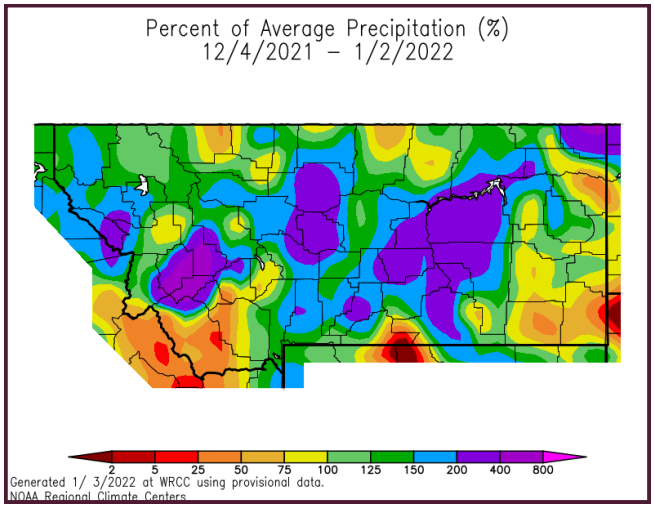

Figure 8: 30-day percent of normal precipitation across Montana.

Avg. Temp Departure from Normal (Montana)

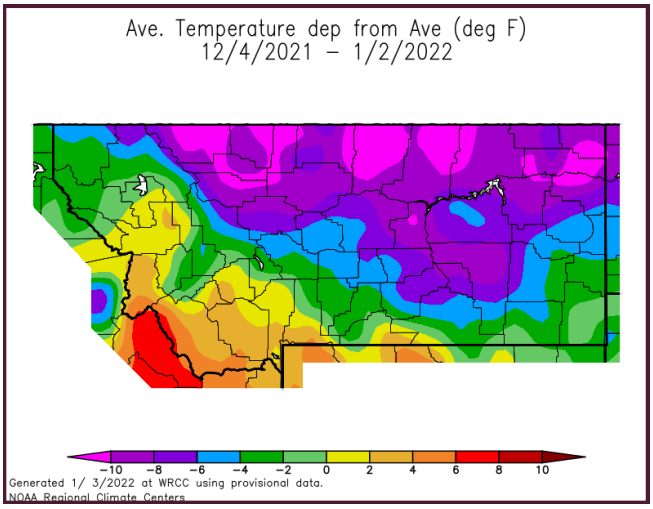

Figure 9: 30-day temperature anomalies across Montana.

Summary: The recent 30 day history is bucking the trend of warm and dry conditions across the region. This time around, the prior month has largely trended cooler and wetter than normal. That said, there were some locations in eastern Montana that were near or below normal for precipitation, and parts of southwest Montana that saw above average temperatures.

Hydrologic Summary for November 2021, By Greg Forrester, Lead Forecaster at NWS Glasgow:

It was a warm and dry month across Northeast Montana. The wet spots for the month were Opheim with 0.61 inch, Port of Morgan with 0.59 inch, and 0.40 inch at Culbertson. The dry spots were Cohagen 22SE with 0.03 inch, Circle with 0.04 inch, and Cohagen, Hoyt, and Malta with 0.07 inch. Glasgow received 0.19 inch which was 40 percent of normal. Temperatures varied from 6 to 10 degrees above normal across the region. Glasgow averaged 36.9 degrees which was 6.7 degrees above normal.

The lack of precipitation allowed severe to exceptional drought to continue across the area.

Stream flow on the Milk, Poplar, Yellowstone, and Missouri Rivers was below normal for the entire month.

The Fort Peck Reservoir elevation fell slightly to 2226.6 feet during the month. The reservoir was at 72 percent of capacity and 90 percent of the mean pool.

Hydrologic Summary for December 2021, By Greg Forrester, Lead Forecaster at NWS Glasgow:

It was a cold and wet month across Northeast Montana. The wet spots for the month were Glasgow 46SW with 2.19 inches, Plentywood with 1.62 inches, and Zortman with 1.00 inches. The dry spots were Sidney 2S with 0.33 inch, Malta with 0.36 inch, and Wolf Point with 0.37 inch. Glasgow received 0.86 inch which was 200 percent of normal. Temperatures varied from 5 to 9 degrees below normal across the region. Glasgow averaged 11.9 degrees which was 6.6 degrees below normal.

The above normal precipitation was not enough to diminish the severe to exceptional drought across the area.

The Milk, Poplar, Yellowstone, and Missouri Rivers all froze during the month. Streamflow was below normal before the rivers froze.

The Fort Peck Reservoir elevation fell to 2225.0 feet during the month. The reservoir was at 70 percent of capacity and 88 percent of the mean pool.

CPC Three Month Outlook:

The Climate Prediction Center released its latest three month outlook on December 16, 2021 for the months of January through March 2022.

The outlook favors below normal temperatures across the region over the period with decreasing probabilities further east. Meanwhile, above normal precipitation is favored across the region through the next three months. That said, probabilities do drop further east and the far eastern Montana into the Dakotas have equal chances for above normal, normal, or below normal precipitation.

The latest outlook is always available here. In addition, you can check out the Climate Prediction Center Interactive site! You can zoom in on our area, and navigate to see the climate outlook for your specific location.

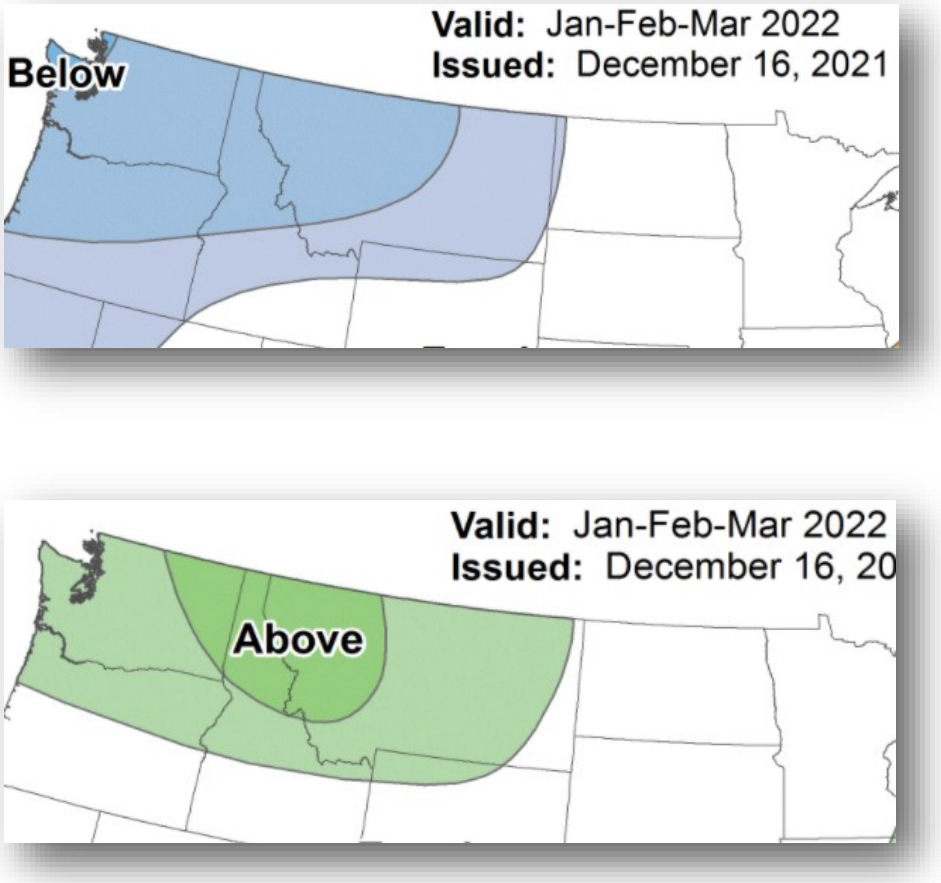

Figure 10: Climate Prediction Center three month temperature (top) and precipitation (bottom) outlook for January 2022 through March 2022.

U.S. Drought Monitor:

The latest U.S. Drought Monitor was released on Thursday January 13, 2022. The exceptional drought has been pared back recently, but most of NE Montana falls under extreme drought. Southeast Montana is now under severe drought conditions. No doubt, recent precipitation has played a role in helping out the situation, we'll see if that trend continues. This outlook is updated weekly. Please feel free to check out the latest **here.**

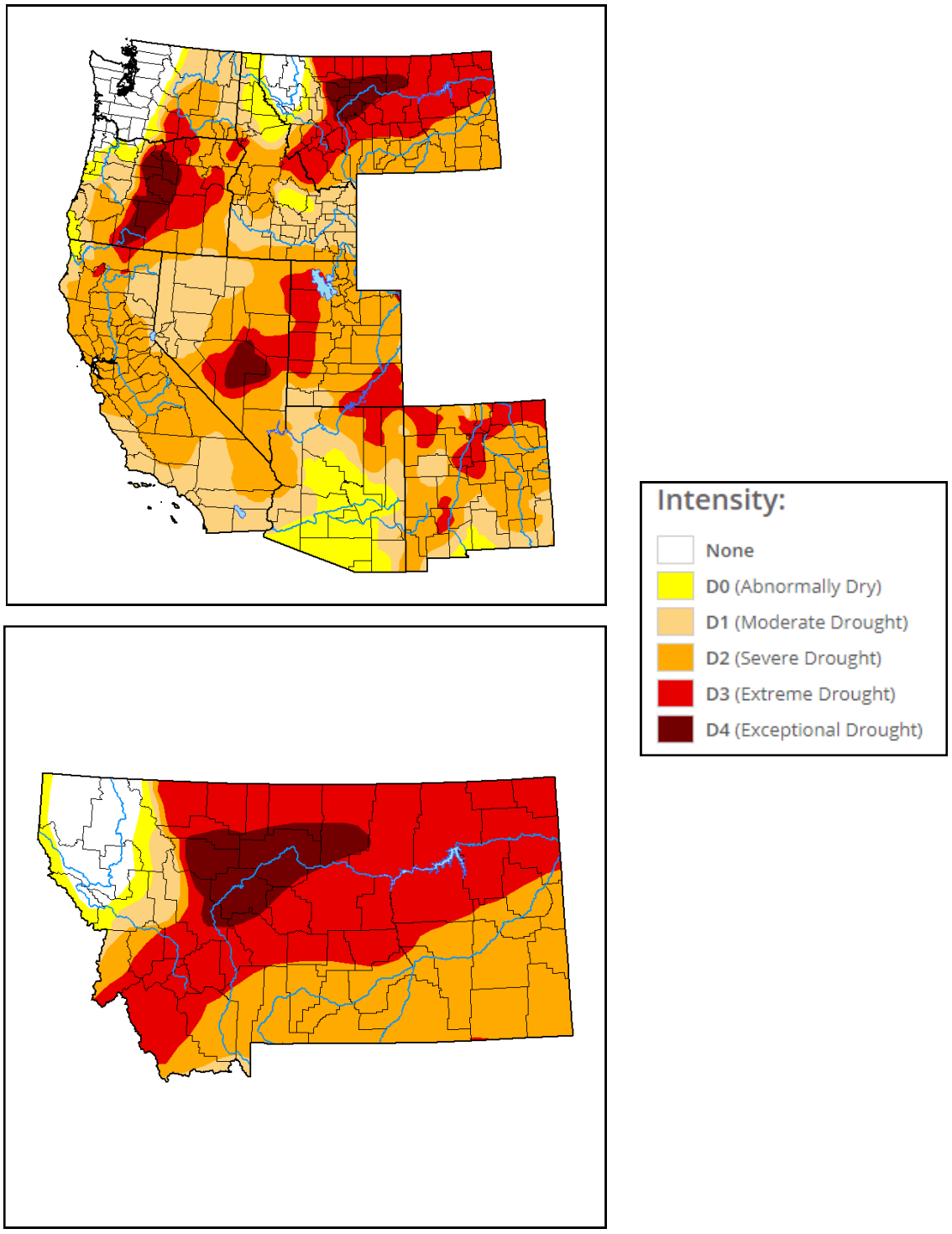

Figure 11: U.S. Drought Monitor updated January 13, 2022.

U.S. & Global Climate Highlights (November): The U.S. & Global climate highlights for November 2021 have been released, the latest month for which data was available. A few points for you to take home are provided below.

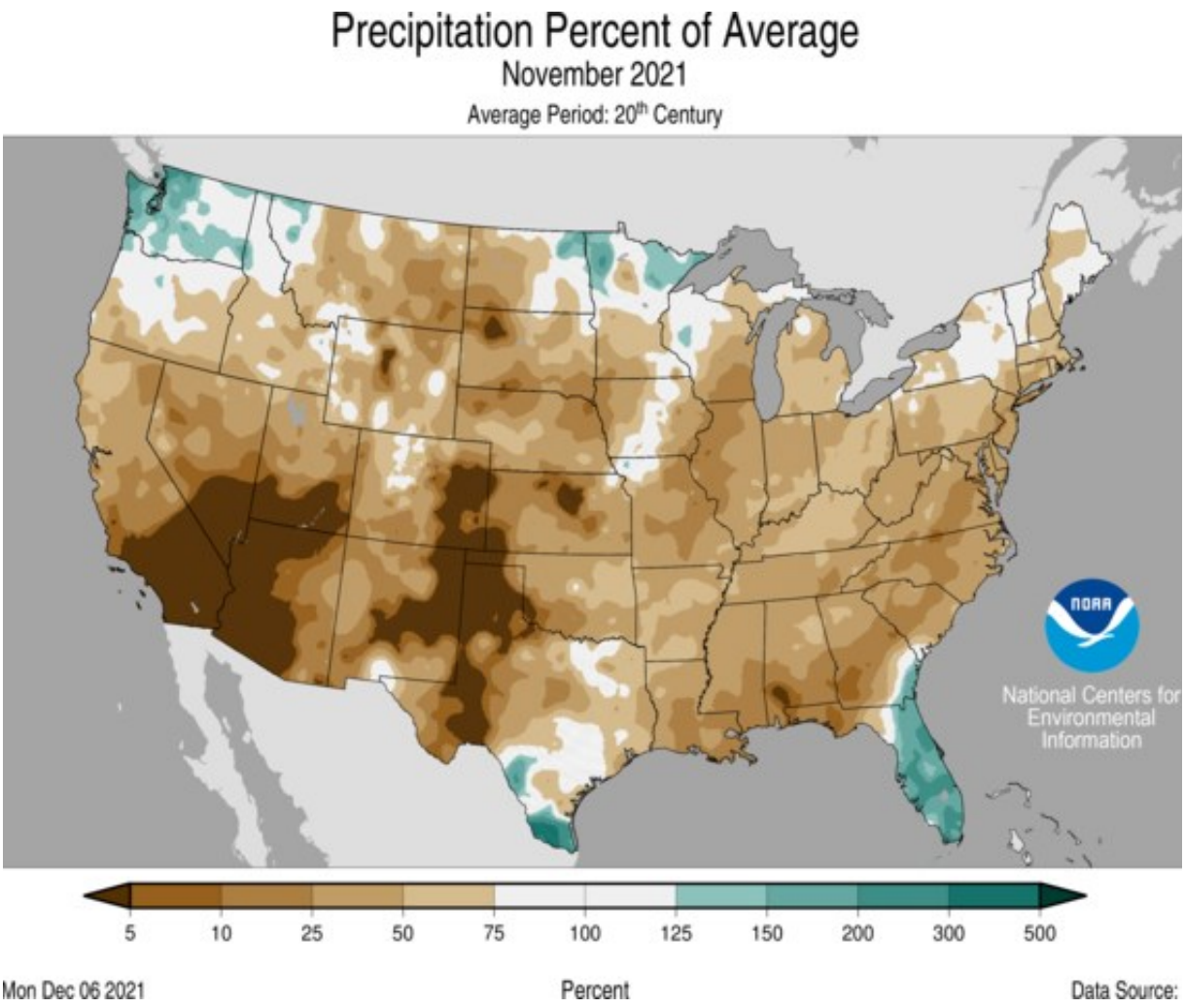

Figure 12: November 2021 Percent of Average Precipitation (U.S.).

U.S. Highlights for November 2021

1) The contiguous U.S. average temperature for November 2021 was 45.2 °F, 7th warmest on record
2) The average November precipitation total for the contiguous U.S. came in at 1.28 inches. This ranks as the 8th wettest on record.

Global Highlights for November 2021

1) The November 2021 global surface temperature was the 4th highest on record for November.
2) The ten warmest November have all unfolded since 2004.
3) Precipitation anomalies varied considerably around the world in November 2021, which is fairly typical.

Featured Social Media Highlight

- Recent Arctic temperatures have started the ice over of Fort Peck Lake—here's some satellite imagery.

Figure 13: MODIS Imagery from January 1, 2022 of Fort Peck Lake.

Links You May Like:

ENSO Update

Climate Change & Recent Weather Events

Arctic Sea Ice Thinnest Ever?

COOP 2021 Precipitation Totals for November 2021 (Preliminary)

Station	Precipitation	Location
BAYM8	0.73	Baylor
BRDM8	0.35	Bredette
BTNM8	M	Brockton 17 N
BKNM8	0.24	Brockton 20 S
BKYM8	0.14	Brockway 3 WSW
BRSM8	0.36	Brusette
CLLM8	0.26	Carlyle 13 NW
CIRM8	0.04	Circle
CHNM8	0.07	Cohagen
COM8	0.03	Cohagen 22 SE
CNTM8	0.16	Content 3 SSE
CULM8	0.40	Culbertson
DSNM8	0.15	Dodson 11 N
FLTM8	0.12	Flatwillow 4 ENE
FPKM8	0.12	Fort Peck PP
GLAM8	0.25	Glasgow 14 NW
GGWM8	0.19	Glasgow WFO
GGSM8	0.29	Glasgow 46 SW
GNDM8	0.30	Glendive WTP
HRBM8	M	Harb
HINM8	0.24	Hinsdale 4 SW
HNSM8	0.19	Hinsdale 21 SW
HOMM8	0.11	Homestead 5 SE
HOYM8	0.07	Hoyt
JORM8	M	Jordan
LNDM8	0.11	Lindsay
MLAM8	0.07	Malta
MLTM8	0.09	Malta 7 E
MTAM8	M	Malta 35 S

Station	Precipitation	Location
MDCM8	0.18	Medicine Lake 3 SE
MLDM8	0.18	Mildred 5 N
MSBM8	0.10	Mosby 4 ENE
OPNM8	0.31	Opheim 10 N
OPMM8	0.61	Opheim 12 SSE
PTYM8	0.18	Plentywood
PTWM8	0.16	Plentywood 1 NE
POGM8	0.59	Port of Morgan
RAYM8	0.25	Raymond Border Station
SAOM8	0.17	Saco 1 NNW
SMIM8	0.32	St. Marie
SAVM8	0.17	Savage
SCOM8	0.15	Scobey 4 NW
SDYM8	0.27	Sidney
SIDM8	0.29	Sidney 2S
TERM8	0.09	Terry
TYNM8	M	Terry 21 NNW
VIDM8	M	Vida 6 NE
WSBM8	M	Westby
WTRM8	0.30	Whitewater
WHIM8	M	Whitewater 18 NE
WBXM8	M	Wibaux 2 E
WTTM8	0.15	Winnett
WNEM8	0.14	Winnett 6 NNE
WNTM8	0.24	Winnett 8 ESE
WITM8	0.35	Winnett 12 SW
WLFM8	0.21	Wolf Point
ZRTM8	0.22	Zortman

COOP 2021 Precipitation Totals for December 2021 (Preliminary)

Station	Precipitation	Location
BAYM8	M	Baylor
BRDM8	0.41	Bredette
BTNM8	M	Brockton 17 N
BKNM8	0.44	Brockton 20 S
BKYM8	0.25	Brockway 3 WSW
BRSM8	M	Brusette
CLLM8	0.67	Carlyle 13 NW
CIRM8	0.57	Circle
CHNM8	0.40	Cohagen
COM8	M	Cohagen 22 SE
CNTM8	0.85	Content 3 SSE
CULM8	0.40	Culbertson
DSNM8	M	Dodson 11 N
FLTM8	0.93	Flatwillow 4 ENE
FPKM8	M	Fort Peck PP
GLAM8	0.70	Glasgow 14 NW
GGWM8	0.86	Glasgow WFO
GGSM8	2.19	Glasgow 46 SW
GNDM8	0.59	Glendive WTP
HRBM8	M	Harb
HINM8	0.78	Hinsdale 4 SW
HNSM8	M	Hinsdale 21 SW
HOMM8	M	Homestead 5 SE
HOYM8	M	Hoyt
JORM8	M	Jordan
LNDM8	0.97	Lindsay
MLAM8	0.36	Malta
MLTM8	0.69	Malta 7 E
MTAM8	0.35	Malta 35 S

Station	Precipitation	Location
MDCM8	0.57	Medicine Lake 3 SE
MLDM8	0.55	Mildred 5 N
MSBM8	0.57	Mosby 4 ENE
OPNM8	M	Opheim 10 N
OPMM8	0.19	Opheim 12 SSE
PTYM8	1.62	Plentywood
PTWM8	M	Plentywood 1 NE
POGM8	0.65	Port of Morgan
RAYM8	0.50	Raymond Border Station
SAOM8	0.43	Saco 1 NNW
SMIM8	0.15	St. Marie
SAVM8	M	Savage
SCOM8	0.21	Scobey 4 NW
SDYM8	0.48	Sidney
SIDM8	0.33	Sidney 2S
TERM8	0.51	Terry
TYNM8	M	Terry 21 NNW
VIDM8	M	Vida 6 NE
WSBM8	M	Westby
WTRM8	0.30	Whitewater
WHIM8	M	Whitewater 18 NE
WBXM8	M	Wibaux 2 E
WTTM8	M	Winnett
WNEM8	0.63	Winnett 6 NNE
WNTM8	M	Winnett 8 ESE
WITM8	0.63	Winnett 12 SW
WLFM8	0.37	Wolf Point
ZRTM8	1.00	Zortman

Monthly Trivia:

Last time we asked…

Winter is on the way and that means colder temperatures and more snow. Snow ratio is the percentage of water within a sample of snow. This month we ask: what are the variables that affect snow ratio?

Answer: Snow ratio is the percentage of water within a sample of snow. It is affected by several factors, many of which are summarized in the graphic below. We often have a very high snow ratio, and that makes it susceptible to hazards like blowing and drifting. To read up on winter safety in these conditions, among others, go here.

Figure 14: Graphic showing the variables that affect the snow ratio.

New Question: With ice up underway on Fort Peck Lake, how thick does the ice have to be to support light activities such as walking? When do you avoid going onto the ice altogether?

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