Under the Big Sky e-Letter

November 2021

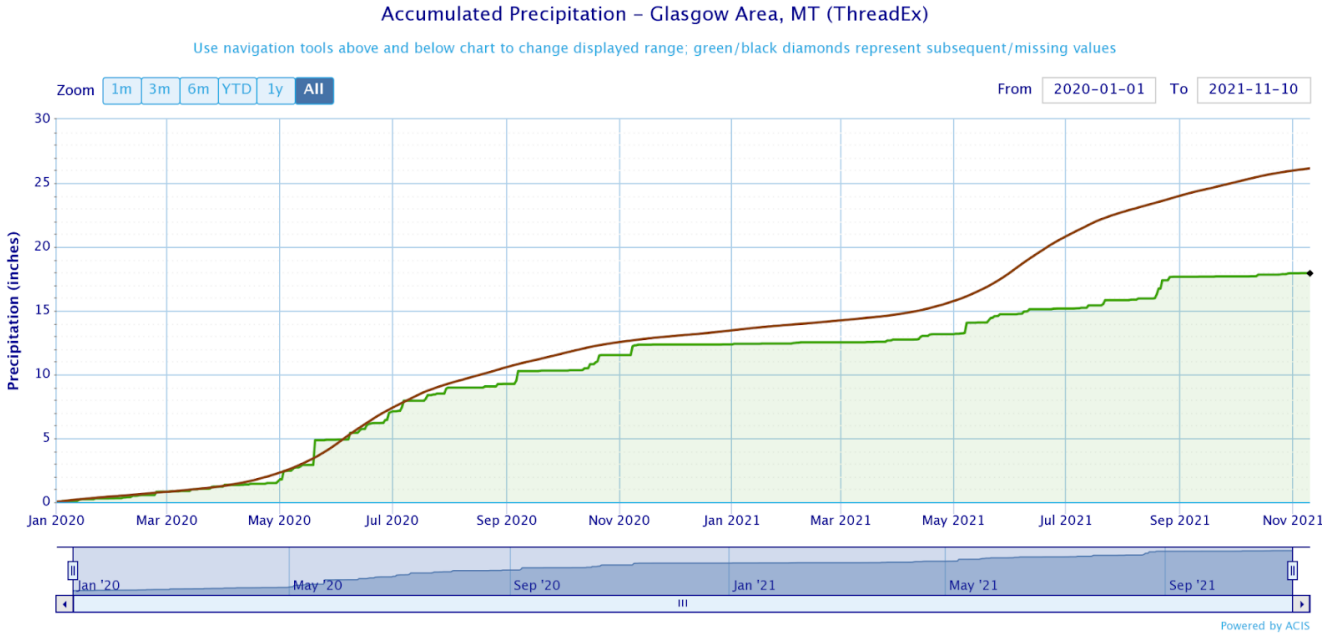
National Weather Service

Glasgow, MT

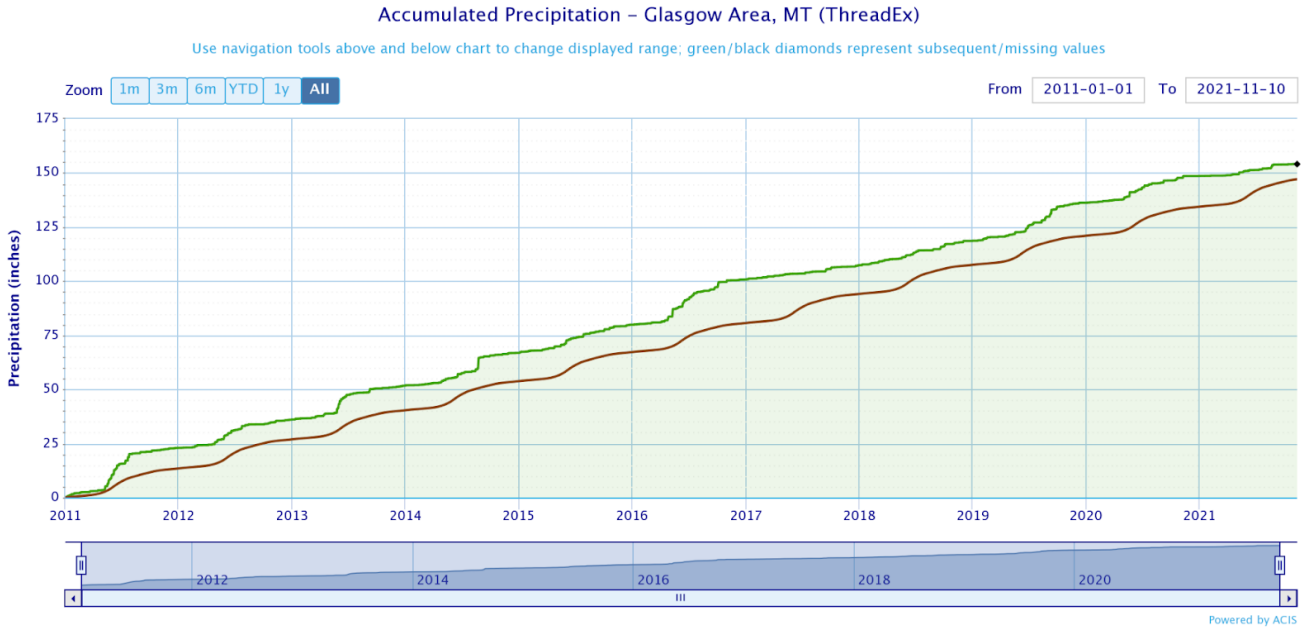
A Peak Inside:

MIC ponders this past year in weather, lack of water and the climate in Northeast Montana
Tanja Fransen, Meteorologist in Charge (MIC)

I think climate, more than weather, impacted us this past year in the region. I often say you need moisture to make moisture, and we haven't had much of that in a very long time. This graphic depicts the precipitation at NWS Glasgow from Jan 2020 through Nov 10th, 2021. I'm picking Glasgow because it has a very long record, and it's close to the center area of NE Montana. The green is accumulated measured precipitation and the brown line is the 30 year normal precipitation. You can see that starting the summer of 2020, we started missing out on precipitation. At this point on Nov 10th, we are 8 inches behind what we normally should have.



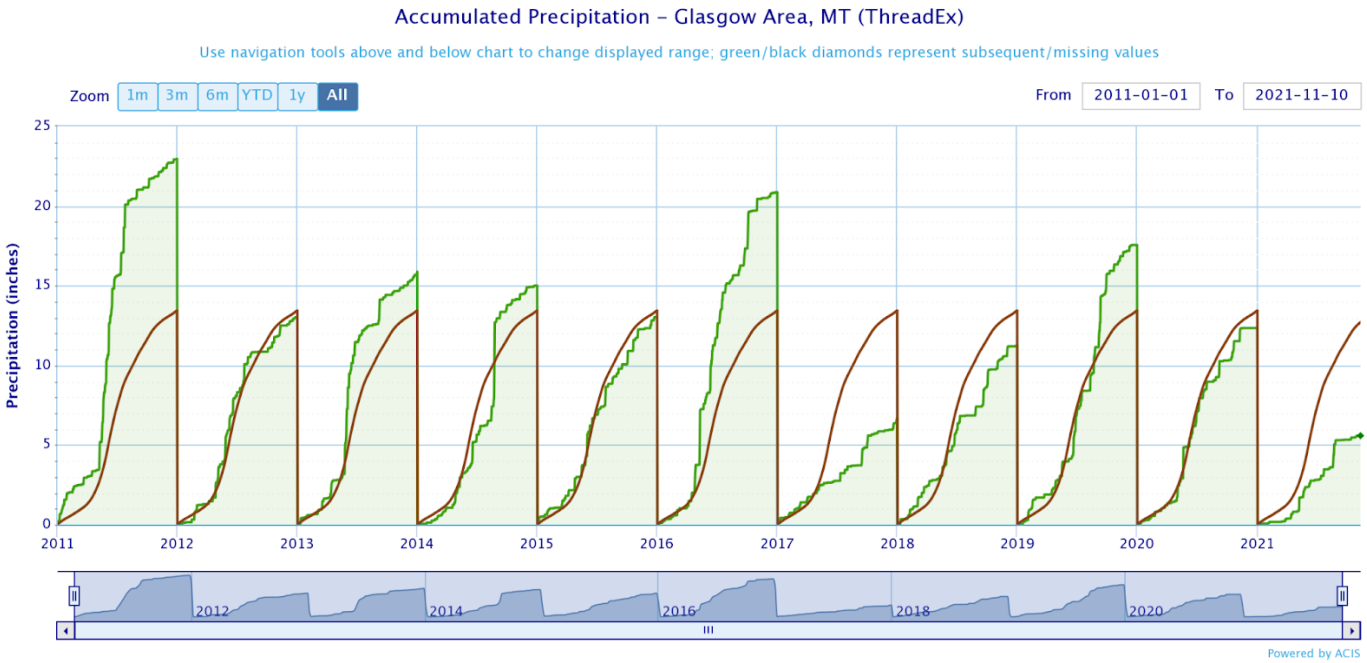
But, if we look at the last decade in the graphic below, we are actually ahead by 7 inches (thanks to a very wet 2011!). That's not much solace for a region that is always two weeks from a drought or a flood though!



MIC ponders this past year in weather, lack of water and the climate in Northeast Montana (Continued)
Tanja Fransen, Meteorologist in Charge (MIC)

My college statistics final exam had one question. We could answer it in a word, or a sentence, but if we went more than a paragraph, we would fail. Thankfully, I had the answer in my one sentence and passed with an A, but I'll never forget that statistics is the study of ***variability.***

So, let's look at that variability at Glasgow in the past decade. We had the wettest year on record (2011), and the driest year on record (2017) based on ~130 years of data collected here. And, this is just the precipitation, we haven't even touched temperatures, including the 24 record temperatures we had (23 record warmest highs and lows, and one record coldest high).



This year has several events that stand out to me, some were short term, some were several days, and of course the drought and wildfire season were on a longer time scale. Here's my top 5 picks of 2021 that will stand out in my mind:

1. **February arctic outbreak.** We've had worse, and had been feeling pretty spoiled temperature-wise until that cold weather hit and reminded us to dig out our heavier jackets. It was interesting watching how we handle it in the high plains, vs how it was handled in the southern plains.
2. **June 8-9-10th severe weather events.** This seemed like it was pretty much our severe weather season, three days in a row. The thunderstorm wind damage on 6/10/21 to the power infrastructure from Prairie, McCone, Dawson and Richland Counties was pretty significant, resulting in millions of dollars in damages.
3. **Summer heat (June-July-August):** There were a lot of record high temperatures in the U.S. this summer. Rather than summarizing each one in our area (there would be hundreds of them at all our climate stations), I'll share that it was the 2nd warmest on record for Montana, and 3rd warmest for North Dakota.
4. **Drought and Wildfires:** In 2017 we have a "Billion Dollar Disaster" with the drought, and I would guess this year will end up in that category again. Between the crop losses, and lack of hay and forage for livestock, this certainly has been a difficult year for farmers and ranchers. Our firefighters, especially our volunteers, were run pretty hard this year too. It was also particularly devastating to our staff to hear that three federal firefighters were burned over with winds from the outflow of a thunderstorm on the Devils Creek Fire. We treat ongoing wildfires as we would a tornado event, it gets our top attention. If you get a chance, thank a firefighter! (And a farmer and rancher!)

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5. **October 10-12, 2021 winter storm in the Yellowstone River Valley** - we had reports up to 11" of snow in the higher terrain areas. That rain and the snowfall was much appreciated by the soil as it melted and soaked in, but it missed the area from Glasgow to Jordan and westward for the most part. Weather Spotter and CoCoRaHS observer Charity Schmeier in Savage, MT posted these photos of the event, in which she measured 2.44" of moisture!

During the event a beautiful October green up two days later!

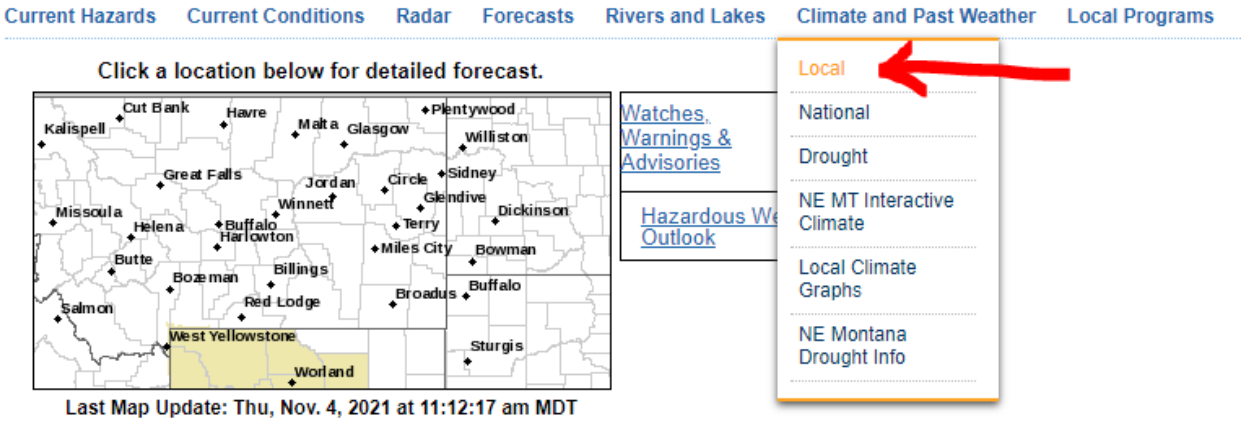
Past Weather and Climate Data

By Ted Jamba - Lead Forecaster and Climate Program Manager

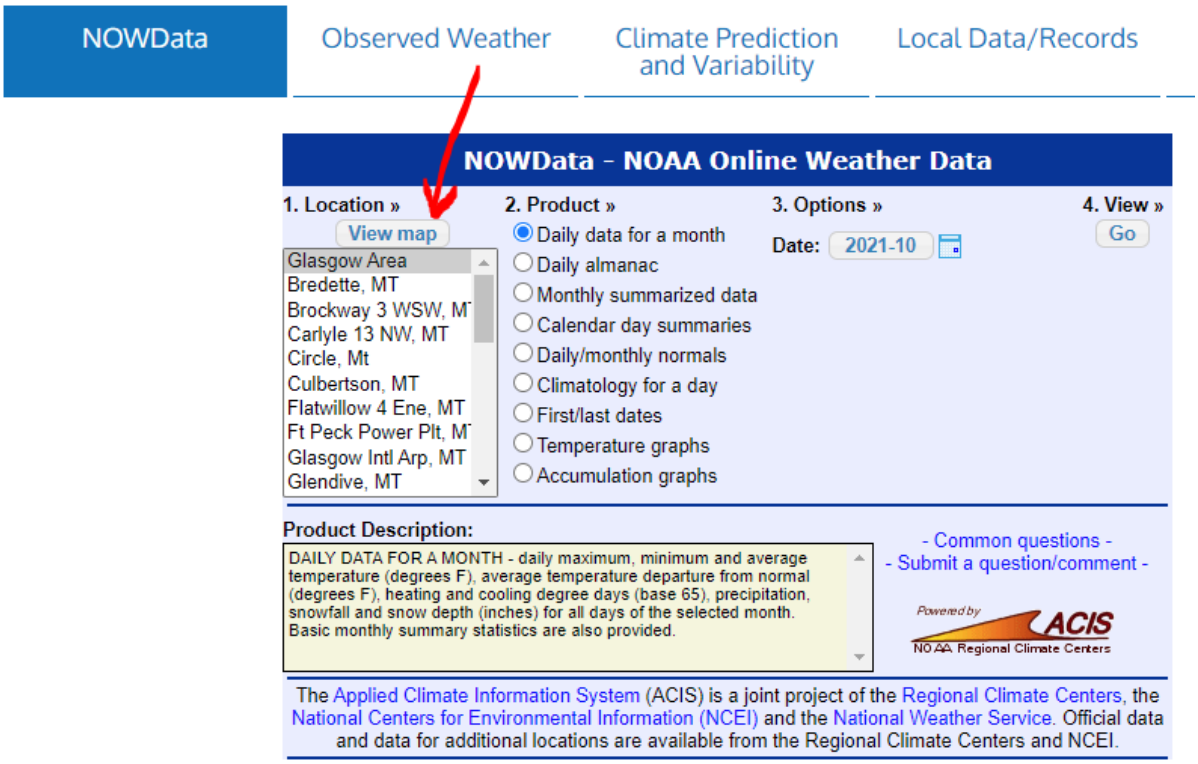
With the holidays coming and people gathering together, we figured you might be discussing the weather for this past year. And we have that tool that can give you an advantage if these conversations go into a debate.

We get weather reports from volunteers and automated stations across the area. They are stored in a place called NOWData (which stands for NOAA Online Weather Data) and it's as easy as a few mouse clicks to obtain them.

From our homepage, under ***Climate and Past Weather,*** *click on* ***Local:***

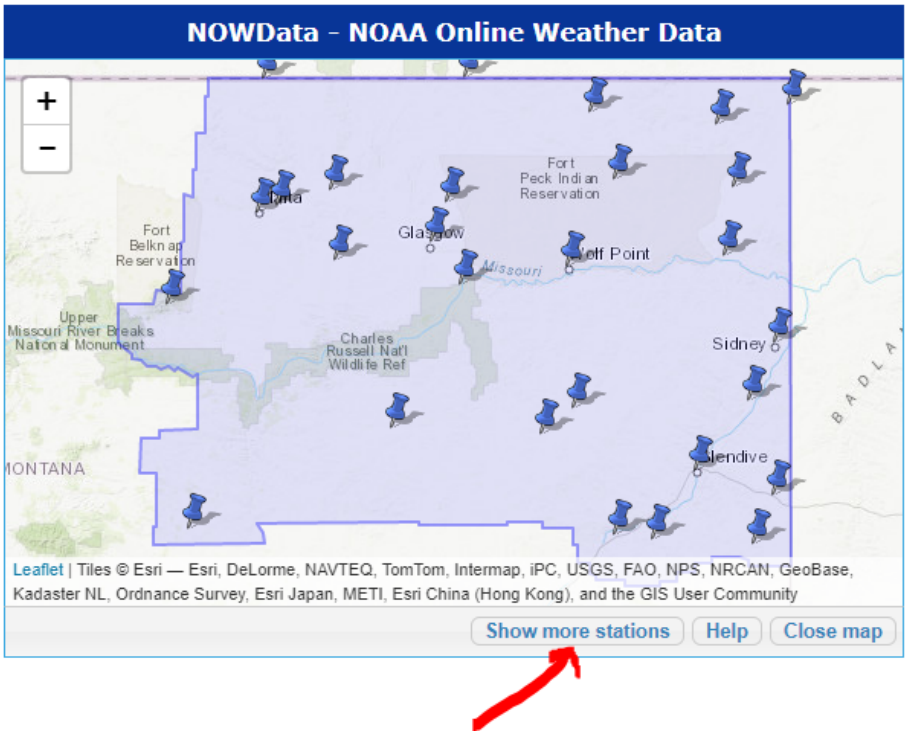


A blue box then opens up to where you can select a station on the left side under ***1. Location***
Or you can select ***View map****:*



Past Weather and Climate Data (Continued)
By Ted Jamba - Lead Forecaster and Climate Program Manager

To view more stations, click on ***Show more stations*** *at the bottom (see graphic to the right):*



For an example, here's a look at Sidney's data from July on the right. As you can see, Sidney got to **104** but maybe more importantly, only **0.01"** of rainfall fell that month (shown if you scroll to the bottom).

NOWData - NOAA Online Weather Data Enlarge results Print

Climatological Data for SIDNEY, MT - July 2021

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

Date	Temperature				HDD	CDD	Precipitation	New Snow	Snow Depth
	Maximum	Minimum	Average	Departure					
2021-07-01	M	M	M	M	M	M	0.00	0.0	0
2021-07-02	M	M	M	M	M	M	0.00	0.0	0
2021-07-03	M	M	M	M	M	M	0.00	0.0	0
2021-07-04	M	M	M	M	M	M	0.00	0.0	0
2021-07-05	M	M	M	M	M	M	0.00	0.0	0
2021-07-06	M	M	M	M	M	M	0.00	0.0	0
2021-07-07	M	M	M	M	M	M	0.01	0.0	0
2021-07-08	90	M	M	M	M	M	0.00	0.0	0
2021-07-09	90	56	73.0	2.1	0	8	0.00	0.0	0
2021-07-10	88	61	74.5	3.4	0	10	0.00	0.0	0
2021-07-11	98	61	79.5	8.2	0	15	0.00	0.0	0
2021-07-12	98	61	79.5	8.0	0	15	0.00	0.0	0
2021-07-13	86	52	69.0	-2.7	0	4	0.00	0.0	0
2021-07-14	88	61	74.5	2.6	0	10	0.00	0.0	0
2021-07-15	93	65	79.0	6.9	0	14	0.00	0.0	0
2021-07-16	96	64	80.0	7.7	0	15	0.00	0.0	0
2021-07-17	95	65	80.0	7.5	0	15	0.00	0.0	0
2021-07-18	102	67	84.5	11.9	0	20	0.00	0.0	0
2021-07-19	103	67	85.0	12.2	0	20	0.00	0.0	0
2021-07-20	104	67	85.5	12.6	0	21	0.00	0.0	0
2021-07-21	95	66	80.5	7.5	0	16	0.00	0.0	0
2021-07-22	96	65	80.5	7.4	0	16	T	0.0	0
2021-07-23	92	63	77.5	4.3	0	13	T	0.0	0

Past Weather and Climate Data (Continued)
By Ted Jamba - Lead Forecaster and Climate Program Manager

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2021-07-05	M	M	M	M	M	M	0.00	0.0	0
2021-07-06	M	M	M	M	M	M	0.00	0.0	0
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2021-07-16	96	64	80.0	7.7	0	15	0.00	0.0	0
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2021-07-21	95	66	80.5	7.5	0	16	0.00	0.0	0
2021-07-22	96	65	80.5	7.4	0	16	T	0.0	0
2021-07-23	92	63	77.5	4.3	0	13	T	0.0	0

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? No problem! We'll be posting the training video on social media and will feature it in an upcoming newsletter, so be sure to check it out!

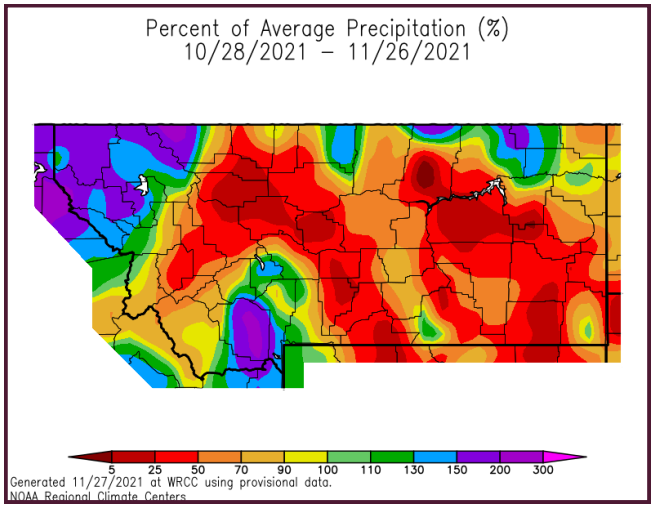

Figure 1: 30-day percent of normal precipitation across Montana.

Avg. Temp Departure from Normal (Montana)

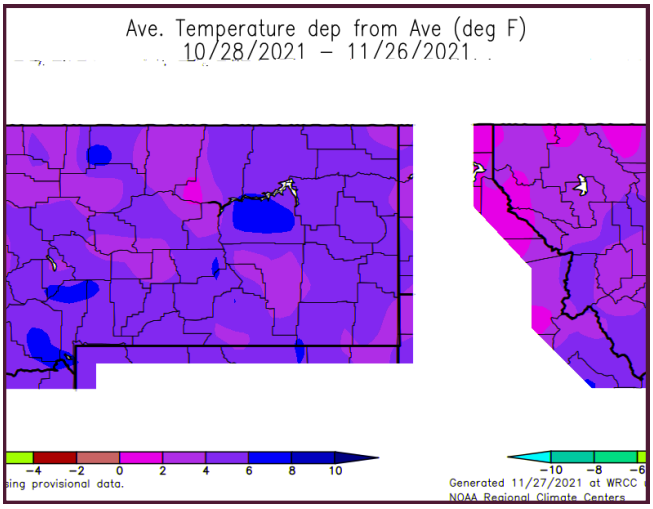

Figure 2: 30-day temperature anomalies across Montana.

Summary: The recent 30 day history shows well below average precipitation for most portions of the state. Some exceptions include NW Montana, and isolated areas over both northern and southwestern parts of the state. Meanwhile, temperatures have generally trended near to above average for the last 30 days.

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

It was a wet month across the southeast part of the region and a drier than normal month in the west. In the southeast, most of the precipitation in October occurred in a storm system that brought a mix of rain and snow between the 12th and the 14th. Some locations like Wibaux received heavy snow (12 inches) from the storm. Other locations like Sidney received heavy rain (1.28 inches). The wet spots for the month were Glendive with 3.76 inches, Terry with 3.03 inches, and Carlyle with 2.93 inches. Meanwhile, most areas in the west received less than 50 percent of their normal precipitation. The dry spots were Malta with 0.10 inch, Glasgow 14 NW with 0.20 inch, and Glasgow with 0.25 inch, which was only 27 percent of normal. Temperatures varied from 2 to 6 degrees above normal across the region. Glasgow averaged 50.0 degrees which was 4.8 degrees above normal.

The precipitation in the southeast brought some improvement in the drought from exceptional to severe. The lack of precipitation elsewhere allowed the extreme to exceptional drought to continue.

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 2227.1 feet during the month. The reservoir was at 73 percent of capacity and 91 percent of the mean pool.

CPC Three Month Outlook:

The Climate Prediction Center released its latest three month outlook on November 18, 2021 for the months of December 2021 through February 2022.

On one hand, the outlook favors below normal temperatures across the region over the period. Meanwhile, eastern Montana is painted on the eastern edge of an outlook favoring above normal precipitation. A slight shift one way or another could make an appreciable difference. This outlook likely takes into account likely effects of La Niña. With that in mind, conditions across the state can still vary among La Niña years, lending to uncertainty.

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.

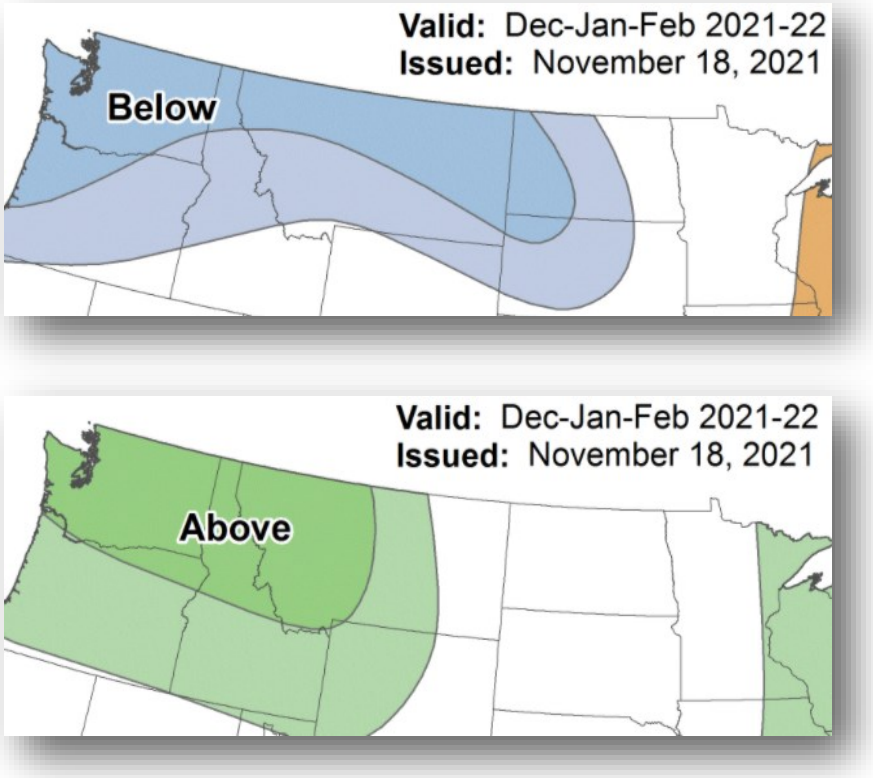

Figure 3: Climate Prediction Center three month temperature (top) and precipitation (bottom) outlook for December 2021 through February 2022.

U.S. Drought Monitor:

The latest U.S. Drought Monitor was released on Thursday December 2, 2021. Extreme to exceptional drought conditions continue for much of Montana, including NE Montana. Southeast portions of the state have some severe drought and conditions range from moderate to severe drought across northwest portions of the state. This outlook is updated weekly. Please feel free to check out the latest **here.**

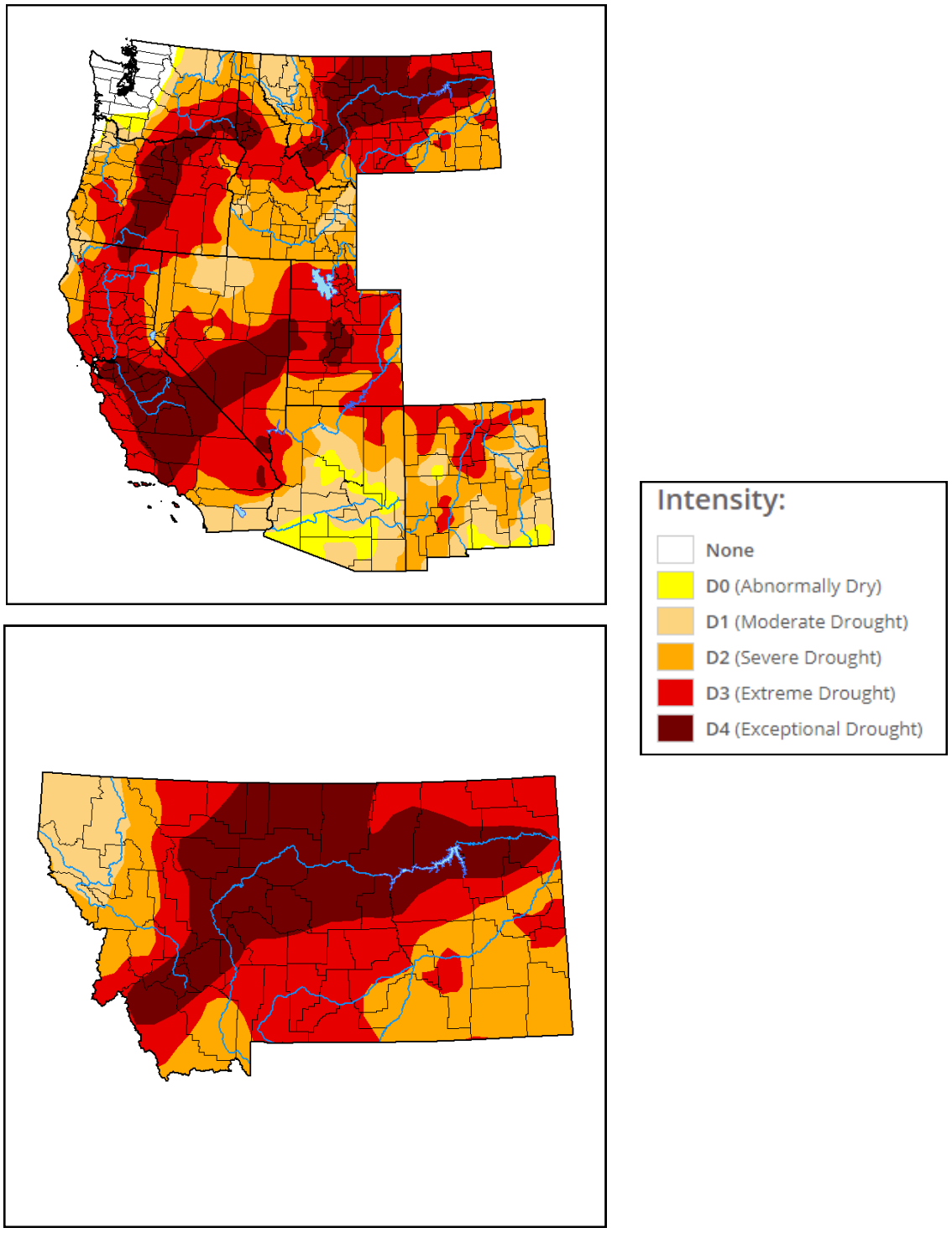

Figure 4: U.S. Drought Monitor updated December 2, 2021

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

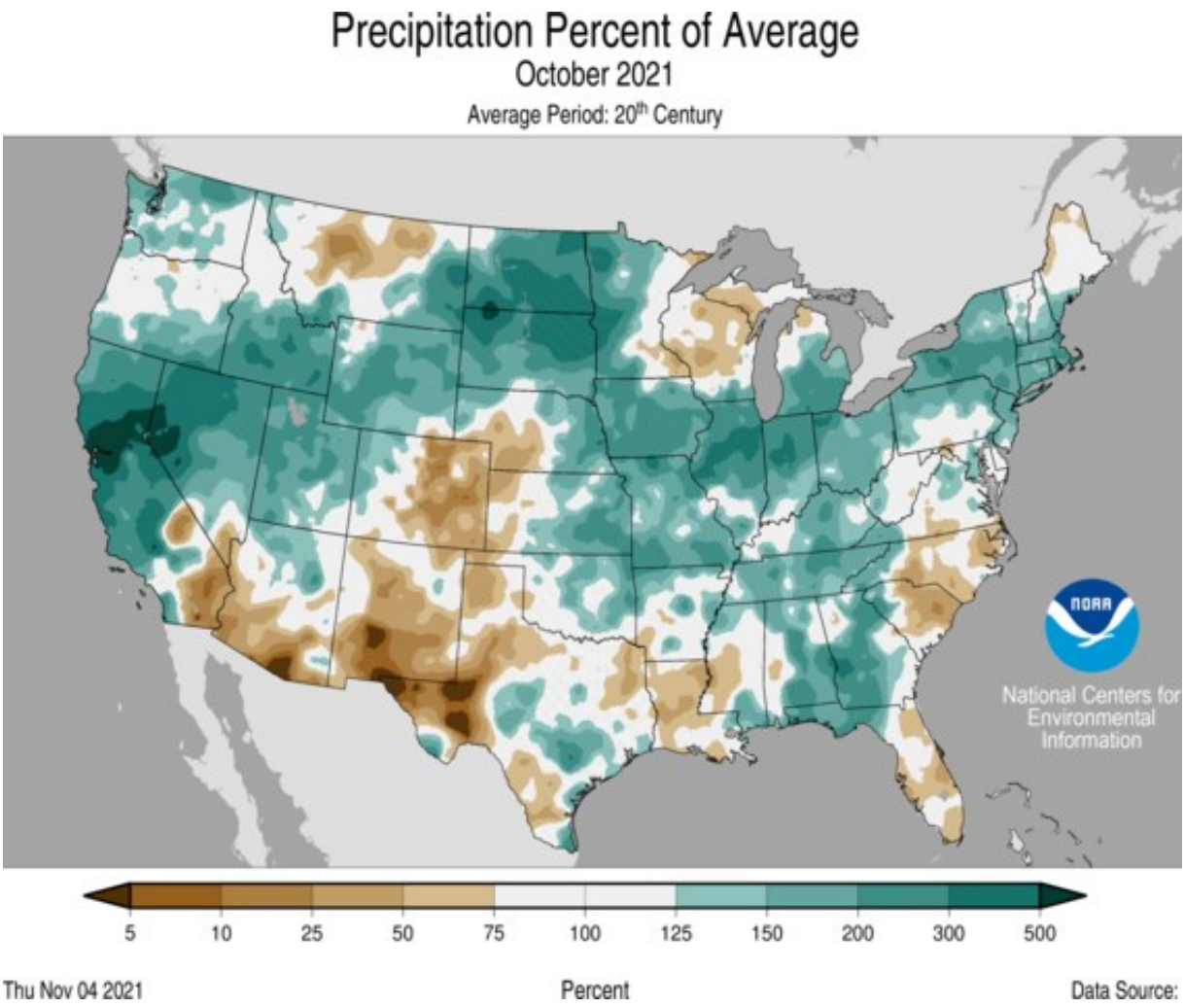

Figure 5: October 2021 Percent of Average Precipitation (U.S.).

U.S. Highlights for October 2021

1) The contiguous U.S. average temperature for October 2021 was 57.0 °F, 6th warmest on record
2) The average October precipitation total for the contiguous U.S. came in at 3.11 inches. This ranks as the 9th wettest on record.

Global Highlights for October 2021

1) The October 2021 global surface temperature was the 3rd hottest on record for October.
2) The ten warmest Octobers have all unfolded since 2003.
3) Precipitation anomalies varied considerably around the world in October 2021, which is fairly typical.

Featured Social Media Highlight

- A high wind event on 11/16 brought widespread damaging wind gusts to NE Montana. Here's a social media post shared summarizing some of the preliminary peak wind gusts that occurred on that day.

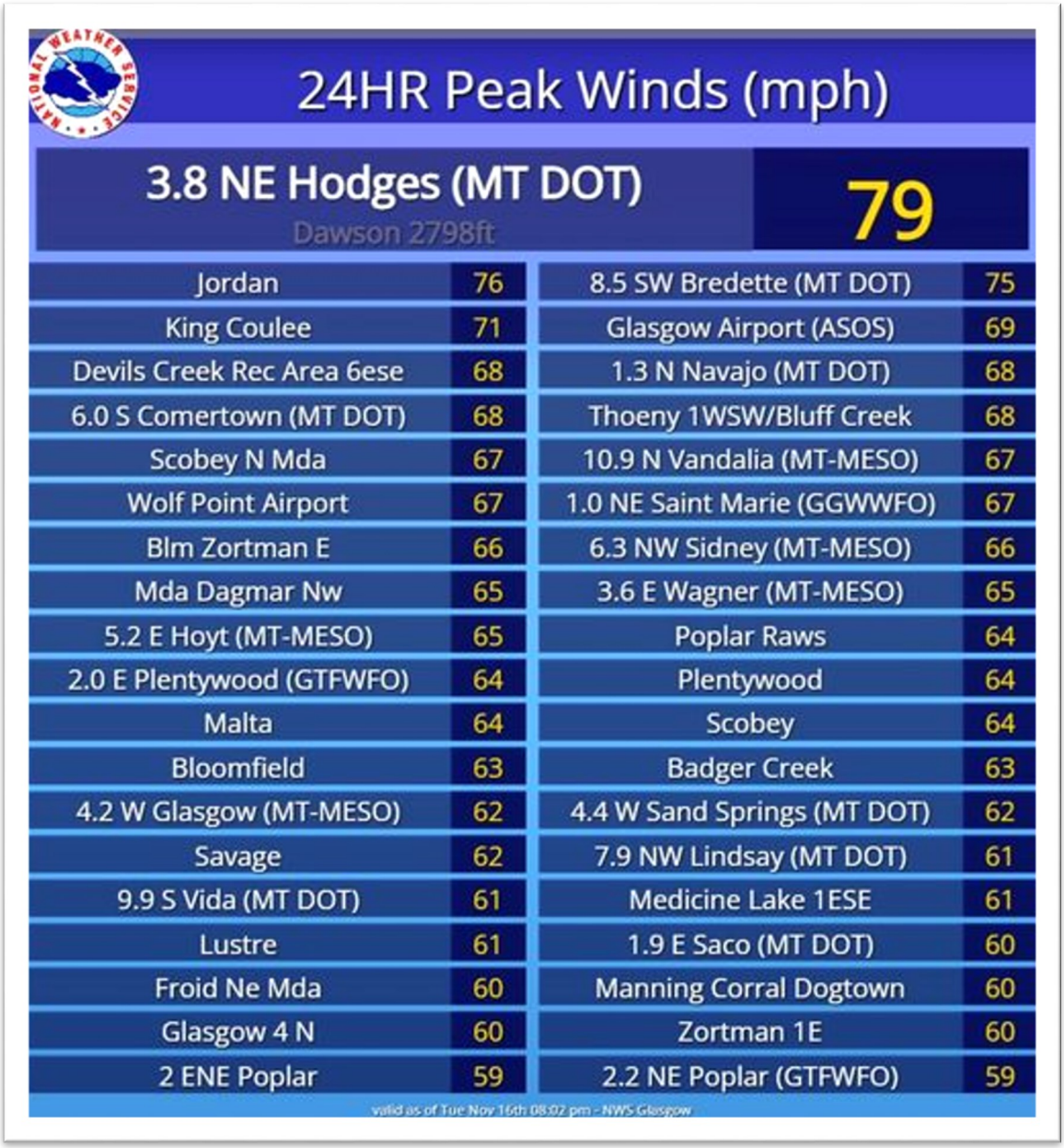

Figure 6: Peak wind gusts, occurring 11/16.

Links You May Like:

[ENSO Update]

[4th Warmest October]

[CO2 rises each year, why doesn't temp?]

[Antarctic ozone hole 2021]

COOP 2021 Precipitation Totals for October 2021 (Preliminary)

Station	Precipitation	Location
BAYM8	M	Baylor
BRDM8	0.52	Bredette
BTNM8	M	Brockton 17 N
BKNM8	0.86	Brockton 20 S
BKYM8	1.45	Brockway 3 WSW
BRSM8	0.36	Brusette
CLLM8	2.93	Carlyle 13 NW
CIRM8	1.52	Circle
CHNM8	0.96	Cohagen
COM8	1.89	Cohagen 22 SE
CNTM8	0.30	Content 3 SSE
CULM8	0.72	Culbertson
DSNM8	M	Dodson 11 N
FLTM8	0.27	Flatwillow 4 ENE
FPKM8	0.42	Fort Peck PP
GLAM8	0.20	Glasgow 14 NW
GGWM8	0.25	Glasgow WFO
GGSM8	0.39	Glasgow 46 SW
GNDM8	3.76	Glendive WTP
HRBM8	M	Harb
HINM8	0.16	Hinsdale 4 SW
HNSM8	0.28	Hinsdale 21 SW
HOMM8	0.13	Homestead 5 SE
HOYM8	2.95	Hoyt
JORM8	M	Jordan
LNDM8	1.85	Lindsay
MLAM8	0.10	Malta
MLTM8	0.41	Malta 7 E
MTAM8	0.42	Malta 35 S

Station	Precipitation	Location
MDCM8	0.45	Medicine Lake 3 SE
MLDM8	2.95	Mildred 5 N
MSBM8	0.36	Mosby 4 ENE
OPNM8	0.17	Opheim 10 N
OPMM8	0.26	Opheim 12 SSE
PTYM8	0.61	Plentywood
PTWM8	0.46	Plentywood 1 NE
POGM8	0.40	Port of Morgan
RAYM8	0.40	Raymond Border Station
SAOM8	0.59	Saco 1 NNW
SMIM8	0.32	St. Marie
SAVM8	M	Savage
SCOM8	1.02	Scobey 4 NW
SDYM8	1.71	Sidney
SIDM8	1.72	Sidney 2S
TERM8	3.03	Terry
TYNM8	M	Terry 21 NNW
VIDM8	M	Vida 6 NE
WSBM8	M	Westby
WTRM8	0.30	Whitewater
WHIM8	M	Whitewater 18 NE
WBXM8	2.77	Wibaux 2 E
WTTM8	0.23	Winnett
WNEM8	0.27	Winnett 6 NNE
WNTM8	0.41	Winnett 8 ESE
WITM8	M	Winnett 12 SW
WLFM8	1.05	Wolf Point
ZRTM8	0.52	Zortman

Monthly Trivia:

Last time we asked…

With winter coming, soon we'll be dealing with colder temperatures, and that means bitter cold wind chills. What's the science behind why it "feels colder" on windy days in the winter time? We'll take a deeper look at the science next month, and explore some safety tips to help you and your loved ones through all season long.

Answer: In short, usually heat is radiated from the body under calm conditions. This creates a warm layer between our skin and the colder environment. When it's windy, this insulating layer is broken up, speeding up heat loss. This is summarized nicely by the graphic below. You can read up more on winter safety here..

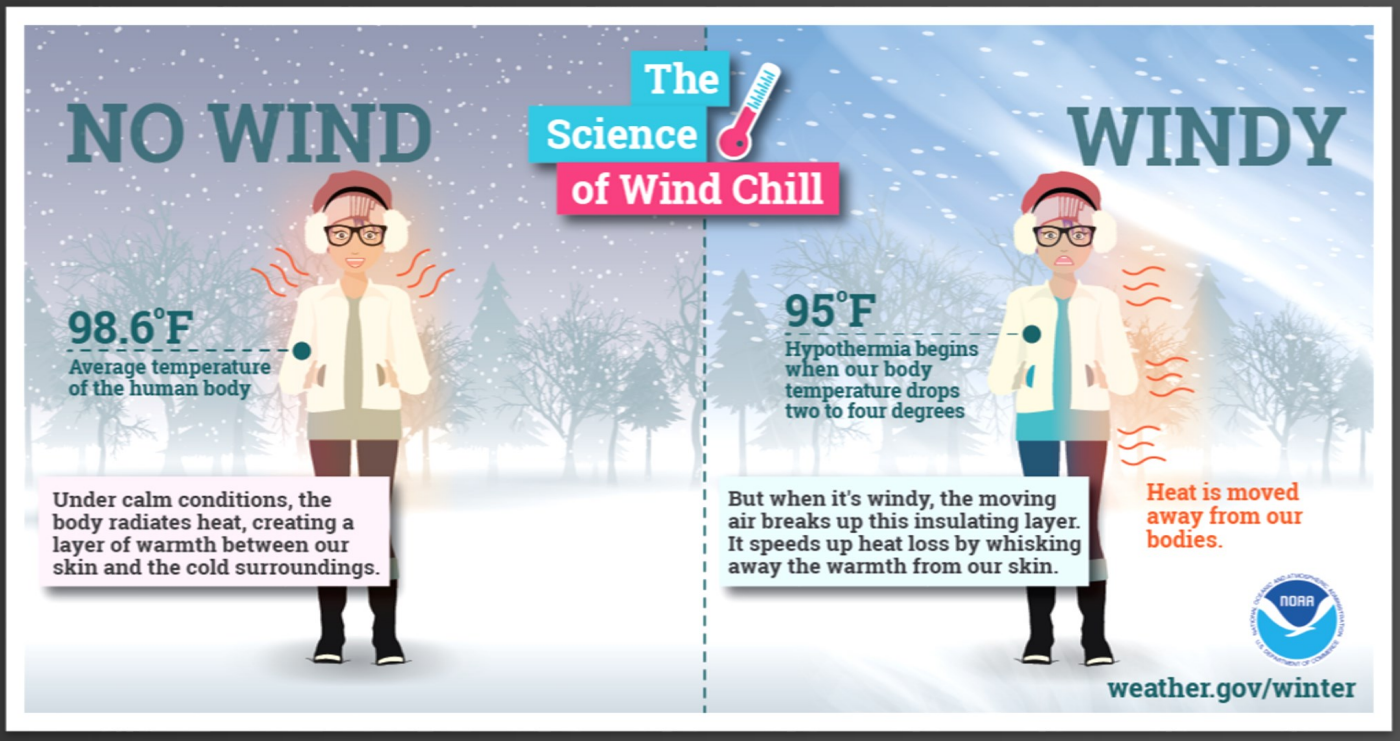

Figure 7: Graphic depicting the science of wind chill.

New Question: 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?

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