USDA United States Department of Agriculture

Natural Resources Conservation Service

Montana Water Supply Outlook Report

February 1, 2024

The rolling hills of the Boulder Mountains south of Helena were mostly bare during February 1 snow surveys. Half of the survey points on Chessman Reservoir Snow Course, about a half mile from where this picture was taken, were bare ground and the snow course total was 22% of normal snow water equivalent for February 1. In many parts of the state, it feels like winter hasn't started yet, and a majority of NRCS SNOTEL sites and snow courses in Montana have either the lowest or second lowest snowpack on record. There is still time for improvement, but snowpack deficits grow with each snowless day. (Photo: Lauren Austin, 1/30/2024)

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For more water supply information, contact:

Eric Larson
Water Supply Specialist
USDA NRCS Montana Snow Survey
eric.larson@usda.gov

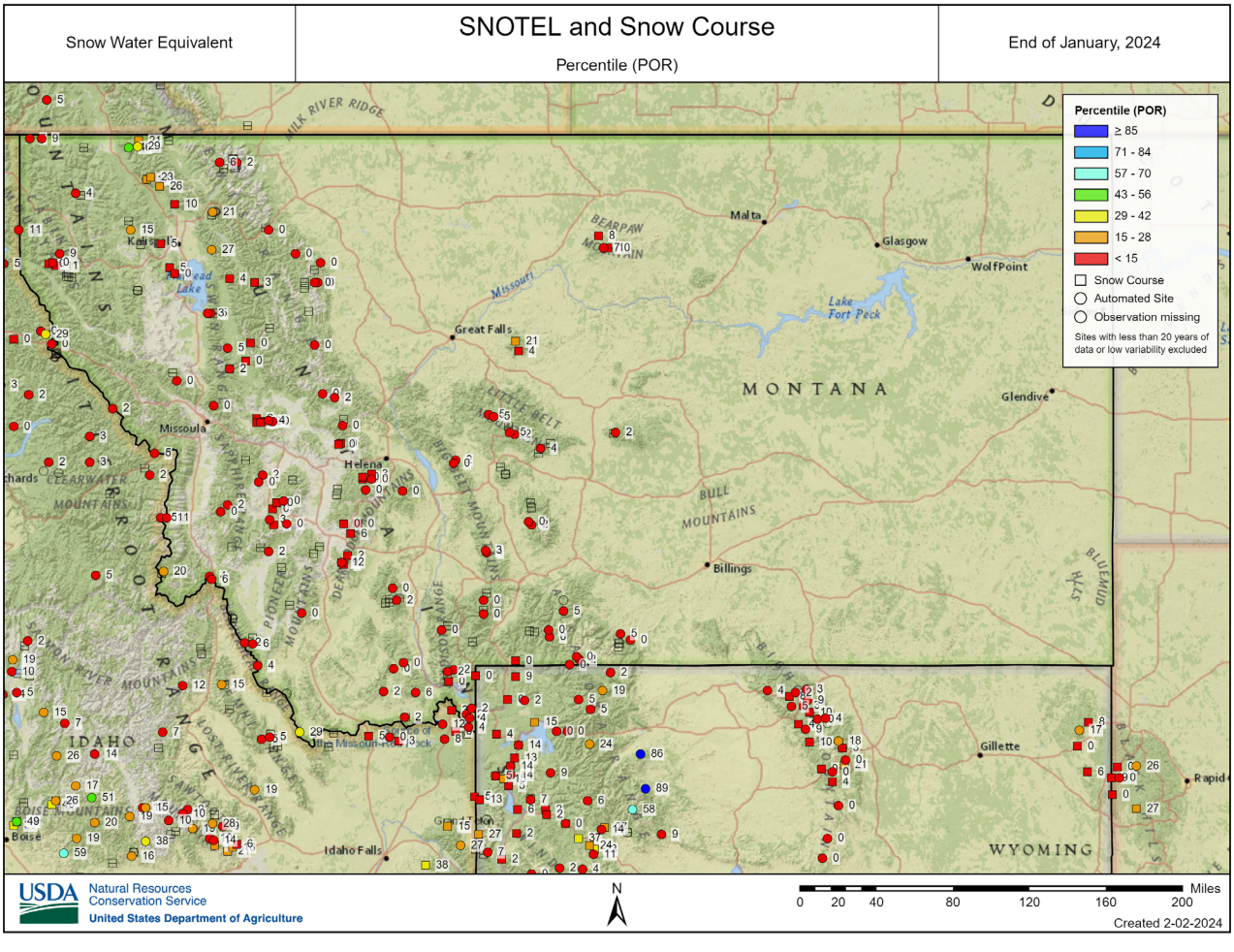
Statewide Overview

Summary

On January 1, 2024, more than half of NRCS snow monitoring stations in Montana and surrounding watersheds reported their lowest snowpack on record. An early January storm brought hope that normal winter weather had finally arrived. After record setting cold temperatures settled in mid-month for about a week, well above normal temperatures accompanied by dry weather returned and persisted during the last two weeks of January in all but the northern Flathead and Kootenai River basins.

Most basin wide snowpack percentages haven't changed much since January 1, and are still well below normal. Above normal precipitation was needed to make significant gains on the snowpack deficit, yet January precipitation was below normal in all but the Kootenai River basin. Currently, all snowpack percentages are below normal. More than half of NRCS snow monitoring stations recently measured for February 1 remain at either their lowest or second lowest snowpack on record. The snowpack at over 150 of those 200+ stations measured on February 1 rank in the 10th percentile or lower for period of record. Many of those records date back 40-60 years, but some have 90 years of record.

Two to three months remain of the normal snowpack accumulation season. For the snowpack to recover to normal conditions by May 1, given the current deficit, will require well above normal precipitation over the next three months. Even normal precipitation over the next three months would result in a record low snowpack at many locations across Montana. If that occurs, water supply during the summer months will likely need to be supplemented by above normal spring and summer precipitation. The following map shows the February 1, 2024, snowpack at NRCS SNOTEL sites and snow courses as a period of record percentile.



Statewide Overview

Precipitation

January began with a storm that brought snow to all of western Montana. During the first week and a half of the month, upper elevation SNOTEL sites west of the Continental Divide received 3-5 inches of precipitation. The largest totals occurred in the northern Whitefish Mountains where snow depth nearly doubled from 35 to 70 inches at 6,000 feet during that time. East of the Divide precipitation totals were about 1-2 inches or less during the first week of January. After a mid-month break from active weather, snowfall continued but was only significant again in northwest Montana where upper elevations received about 2-3 inches of precipitation from January 16 to 23. Other mountain ranges received less than 2 inches from that storm. Total precipitation in January ranged from over 12 inches in northwest Montana to about 3 inches across the rest of the state. Several SNOTEL sites in northern Wyoming reported less than 1 inch of precipitation during the entire month of January.

Basin wide precipitation during January was near normal in the Kootenai River basin and about 70-90% of normal in all other basins west of the Continental Divide, and also the Saint Mary River basin. East of the Continental Divide the southern Rocky Mountain Front, central Montana, and part of southwest Montana only received about 60-70% of normal January precipitation. The Gallatin, Upper Yellowstone, Bighorn, Powder, and Tongue River basins received less than 60% of normal January precipitation. Unfortunately, precipitation during November and December was less than normal across most of Montana and total water year precipitation is about 60-80% in most locations. Exceptions include the northern Kootenai and Flathead which after a relatively dry October has received consistent precipitation and is near normal for the water year. The southern Absaroka, Wind River, and northern Bighorn Mountains received so much precipitation from one storm in mid-October, that despite three months of well below normal precipitation are still reporting 90-100% of normal total water year precipitation.

January - Highest Total Accumulated Precipitation - SNOTEL/SNOLITE

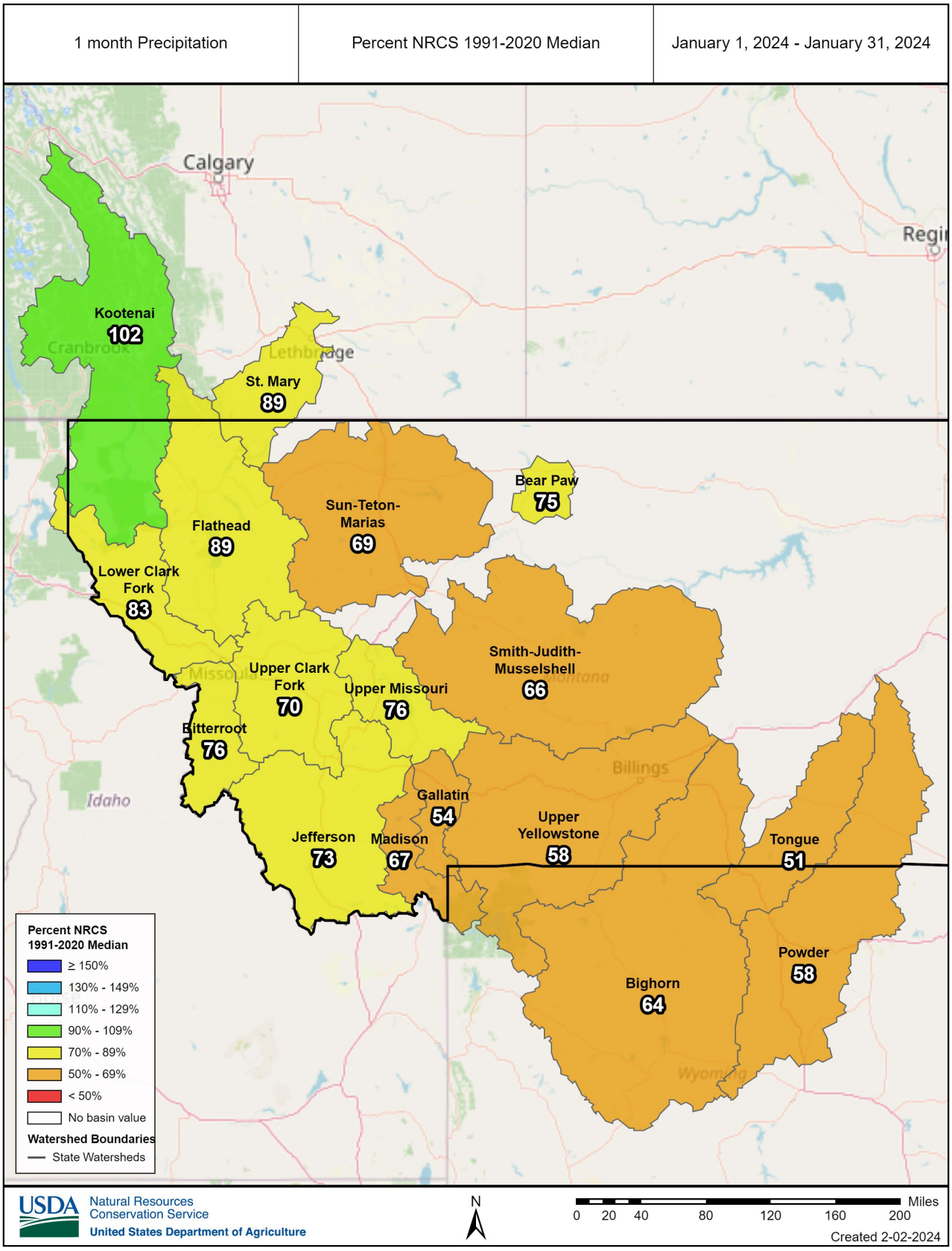
Station	Precipitation (Inches)	Median (Inches)	Elevation	Basin
Bear Mountain	12.9	12.0	5400	Lower Clark Fork, Kootenai
Flattop Mtn.	9.1	9.6	6300	Flathead, St. Mary
Chicago Ridge	8.8	-	5800	Lower Clark Fork
Noisy Basin	8.7	9.0	6040	Flathead
Stahl Peak	8.7	7.2	6030	Flathead, Kootenai

January - Lowest Total Accumulated Precipitation- SNOTEL/SNOLITE

Station	Precipitation (Inches)	Median (Inches)	Elevation	Basin
St. Lawrence Alt	0.4	-	8620	Bighorn
Middle Powder	0.4	1.1	7760	Bighorn, Powder
Big Goose	0.5	1.0	7990	Tongue
Cole Creek	0.5	1.2	7850	Upper Yellowstone
Townsend Creek	0.5	1.2	8700	Bighorn

Statewide Overview

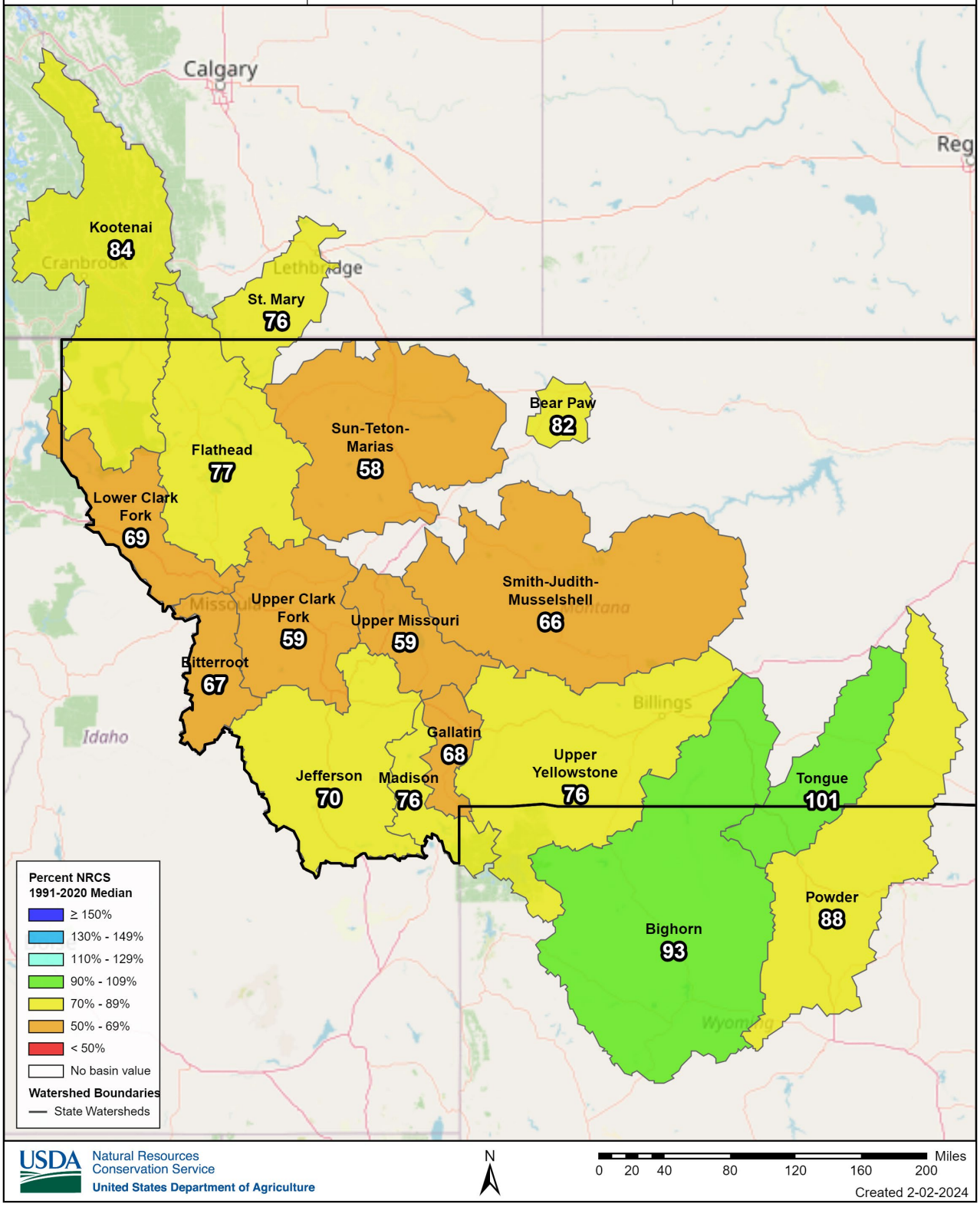
Precipitation (Continued)



Statewide Overview

Precipitation (Continued)

Water Year to Date Precipitation	Percent NRCS 1991-2020 Median	October 1, 2023 - January 31, 2024



Statewide Overview

Snowpack

As of February 1, snowpack percentages are still well below normal in all Montana river basins, however they did not decrease significantly since January 1 in any basin. Currently the Kootenai and northern Flathead River basin snowpack is highest at 70% of normal. All other basins have a snowpack that is between 40-60% of normal, with the exception of the Upper Missouri and Rocky Mountain Front snowpack which are measuring between 35-45% of normal. The maximum snow depth in Montana is about 65 inches at 6000 feet in the Whitefish and Swan Mountain Ranges. That is about 20 inches of snow water equivalent and 70-80% of normal for February 1. Maximum snow depth outside of northwest Montana is about 55 inches near West Yellowstone at 8200 feet, which is close to 15 inches of snow water equivalent and 60% of normal.

Dupuyer Creek SNOTEL (5750 ft) on the Rocky Mountain Front and Taylor Road Snow Course (4080 ft) in the Bears Paw Mountains are snow free. Taylor Road was snow free on February 1 in 2015, 2005, 2003, and 1973, but Dupuyer Creek has not been snow free on February 1 since it was first measured in 1984, however it did only have 1 inch of snow on February 1, 2005. Current snow water equivalent deficits range from about 7-11 inches at upper elevations and 3-5 inches at lower elevations across Montana. Hoodoo Basin SNOTEL (6050 ft) near Superior, Montana is currently measuring near 13 inches of snow water equivalent below normal (1991-2020). Considering fresh snow falls at roughly 10% density, that is about 130 inches of snowfall behind normal.

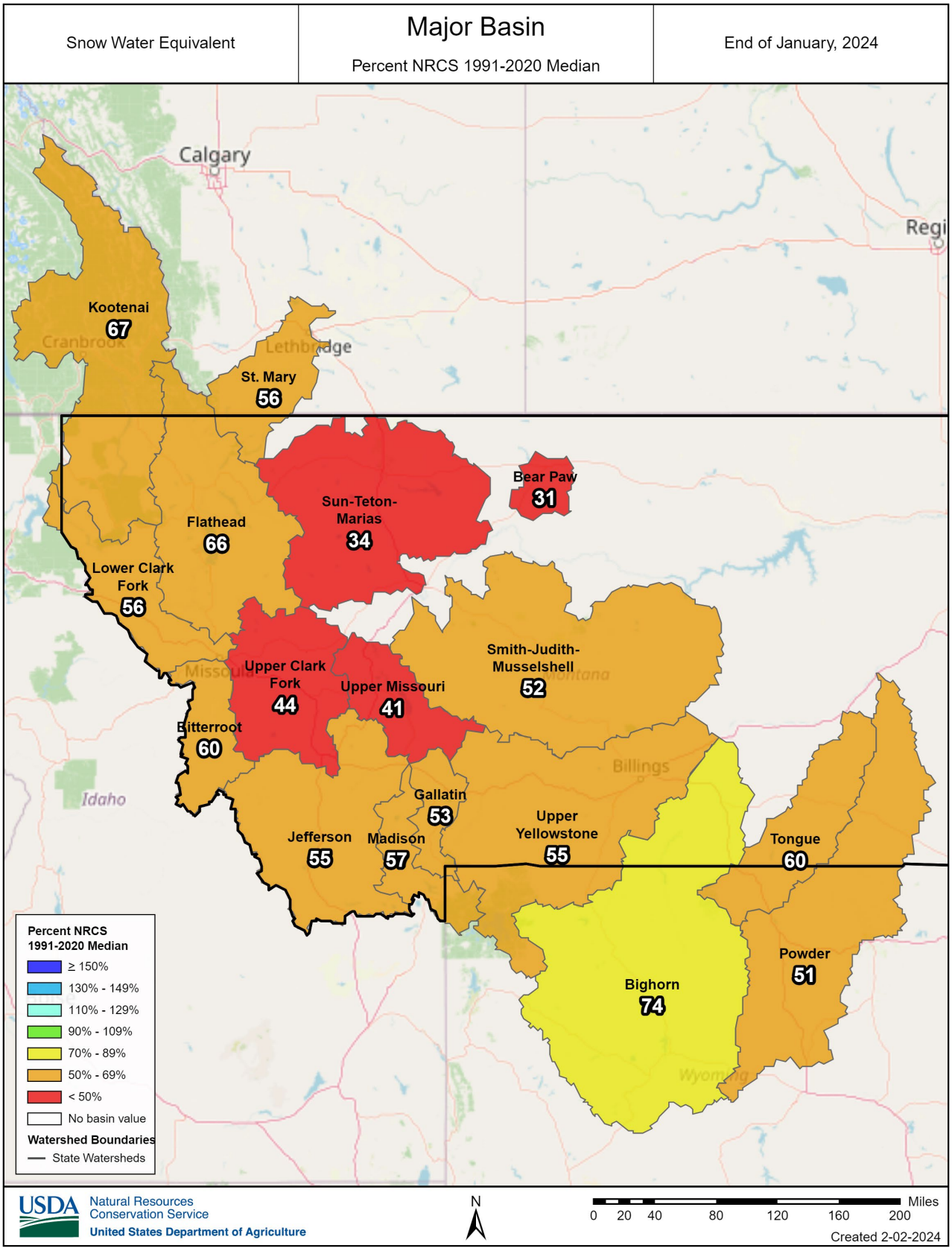
In the remaining two to three months of the normal snowpack accumulation season it is going to take a major change in weather to rebound from some of those deficits. In recent history, 2018, 2017, 2014, 2011, and 2003 brought well above normal precipitation during February-March-April in Montana. A three month repeat from one those years will be necessary to recover by May 1. Other years that had a relatively low February 1 snowpack include 2005, 2001, 1981, and 1977. The snowpack never fully recovered statewide in any of those years. However, in 1981 and 2005 above normal spring and summer precipitation helped improve June-September streamflows across much of the state.

Water Year 2024 - Major Basin - Snowpack Percent of Normal ('91-'20)

Basin	Nov 1	Dec 1	Jan 1	Feb 1	Mar 1	Apr 1	May 1	Jun 1
Kootenai	62	64	62	67	-	-	-	-
Flathead	67	63	53	66	-	-	-	-
Upper Clark Fork	116	37	36	44	-	-	-	-
Bitterroot	144	35	50	60	-	-	-	-
Lower Clark Fork	90	58	47	56	-	-	-	-
Jefferson	91	48	51	55	-	-	-	-
Madison	86	58	54	57	-	-	-	-
Gallatin	81	52	54	53	-	-	-	-
Upper Missouri	125	41	33	41	-	-	-	-
Smith-Judith-Musselshell	116	63	49	52	-	-	-	-
Sun-Teton-Marias	121	48	26	34	-	-	-	-
St. Mary	77	72	51	56	-	-	-	-
Bear Paw	-	-	41	31	-	-	-	-
Upper Yellowstone	103	60	55	55	-	-	-	-
Bighorn	117	85	75	74	-	-	-	-
Powder	93	60	51	51	-	-	-	-
Tongue	154	87	59	60	-	-	-	-

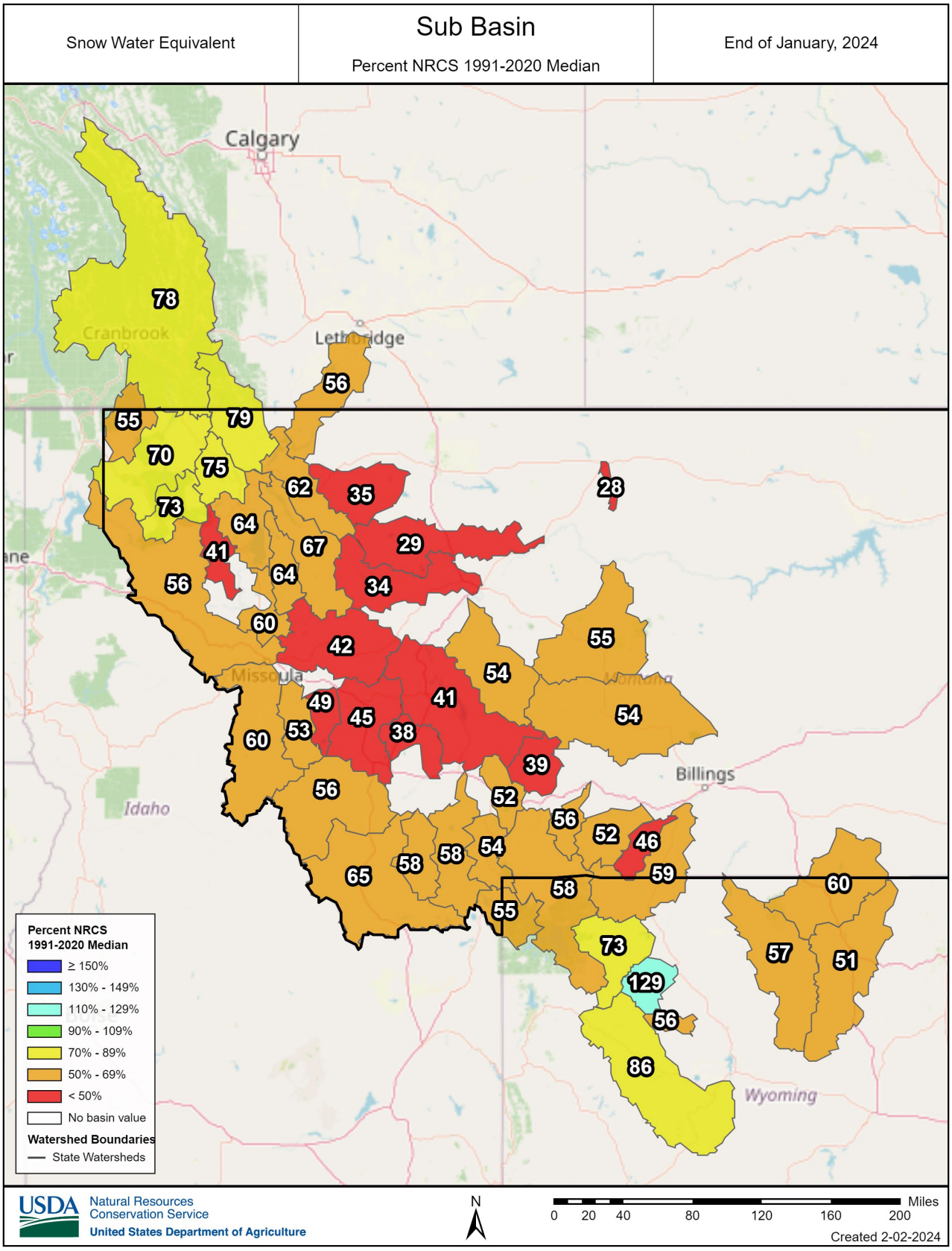
Statewide Overview

Snowpack (Continued)



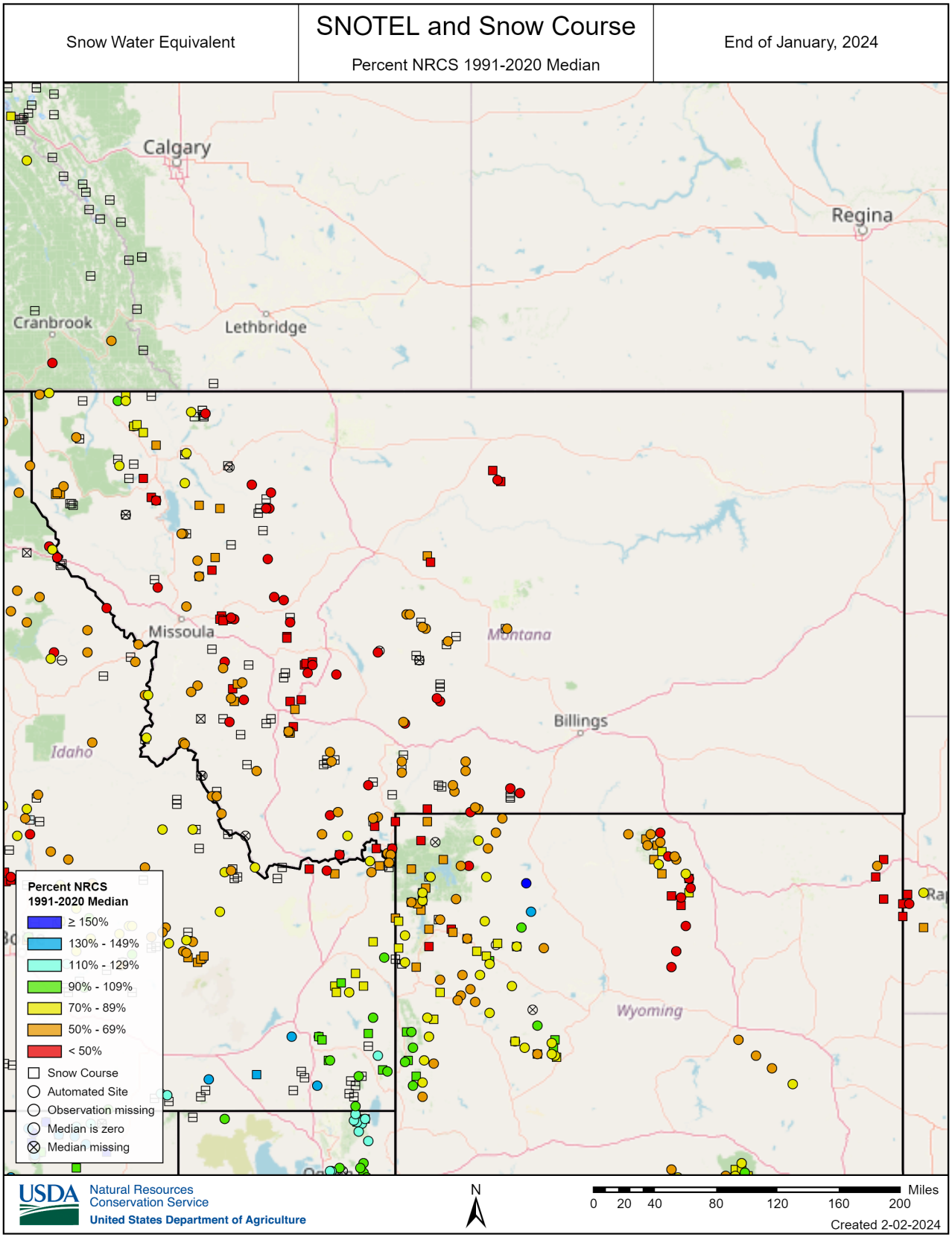
Statewide Overview

Snowpack (Continued)



Statewide Overview

Snowpack (Continued)



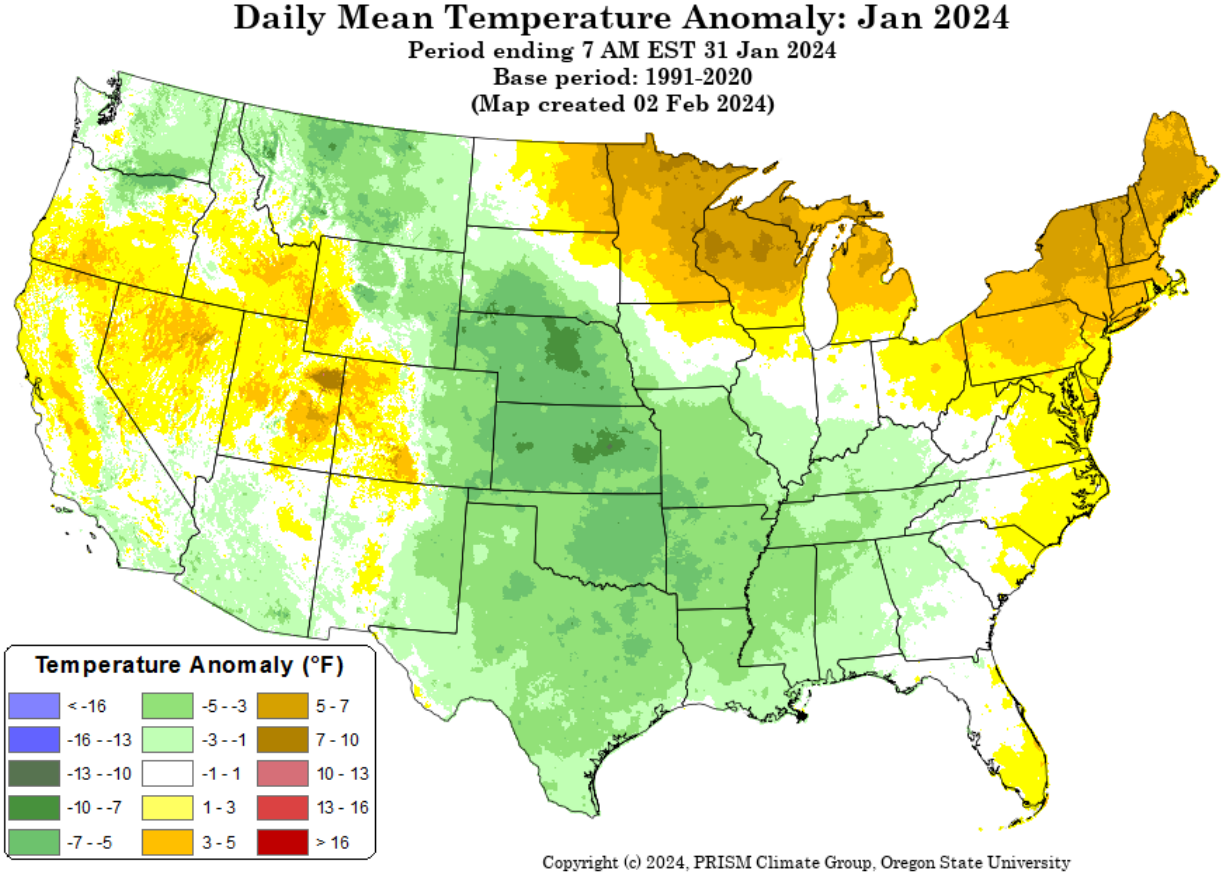
Statewide Overview

Temperature

January temperatures in Montana were a study in extremes. The beginning of the month started out warmer than normal, ringing in the new year with mild temperatures and sunny weather, before plunging to well below normal during the middle of the month. Low temperatures peaked during the time between January 11-13 when sixteen SNOTEL sites recorded temperatures below -40˚ F and most SNOTELs dipped below -30˚ F. High temperatures during the day on January 12 peaked below 0˚ F across much of the state. Average temperatures remained below normal for the ten day period surrounding the coldest lows.

This contrasts starkly with the end of the month, which has been increasingly warm and springlike. Most SNOTELs in Montana recorded temperatures that did not dip below freezing for the last five days in January. Dozens of stations exceeded 50˚ F between January 27-31 and four exceeded 60˚ F. One of those four, Burnt Mtn SNOTEL (5880 ft) in the northern Beartooth Mountains, recorded a temperature range of more than 100˚ F in just over two weeks.

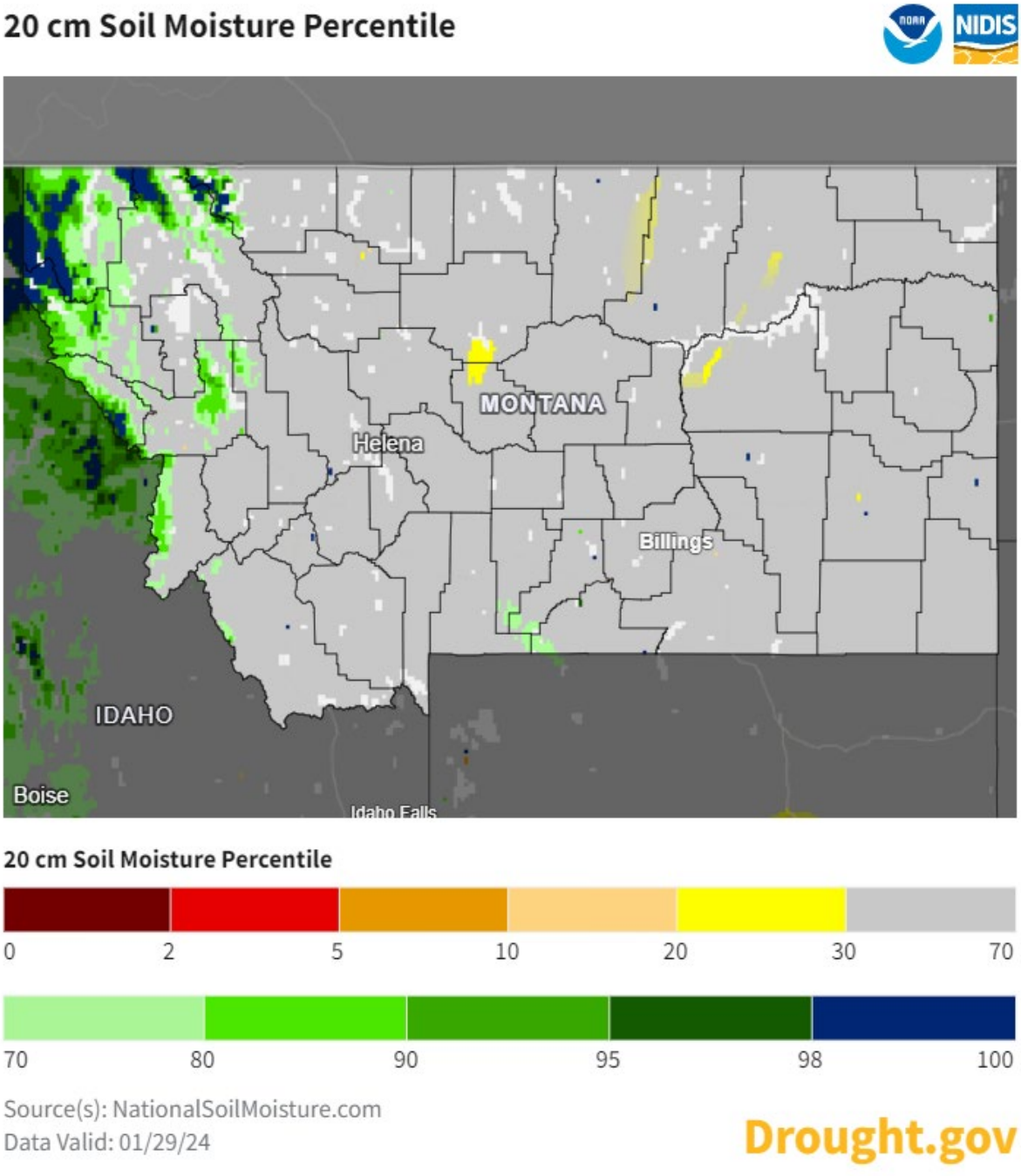
With valley and lower mountain elevation snow melting over the past week, it would be easy to conclude that January on the whole was warmer than normal; however, the extreme cold of mid-month tilted average temperatures into the range of slightly below normal. But as anyone watching the shrinking snowpack can attest, it is more than just the average temperature that counts.



Statewide Overview

Soil Moisture

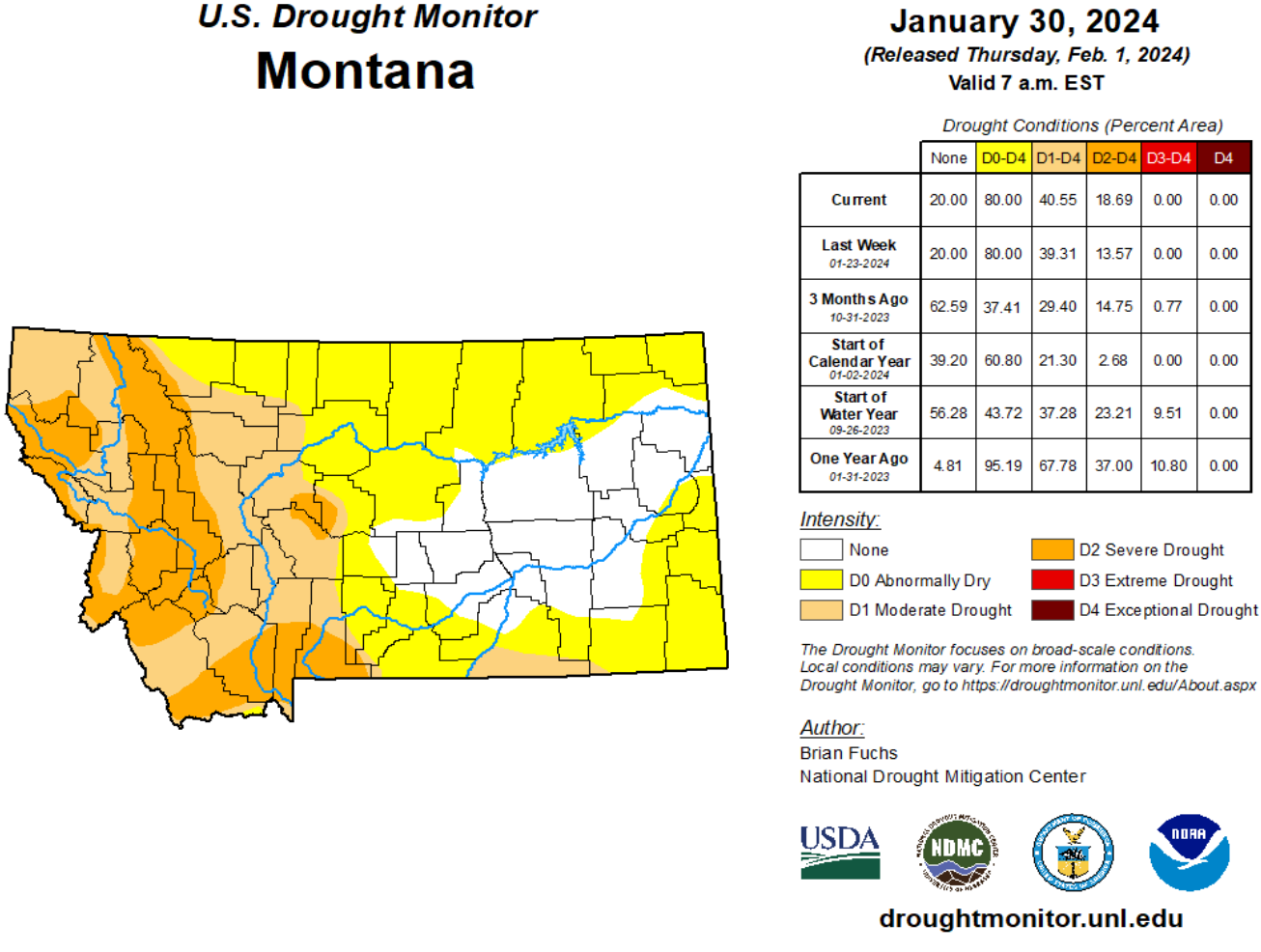
Soil moisture in the top 20 cm across Montana has improved markedly since last month. The northwest corner of the state still has the highest relative soil moisture, above normal between the 80th and 100th percentile, while the rest of the state is mostly near normal in the 30th to 70th percentile range. There are a few small pockets of 20th to 30th percentile around the Upper Missouri River and Fort Peck Reservoir. Precipitation over the next few months is essential to continued improvement of soil moisture levels as we move into spring.



Statewide Overview

Drought Monitor

Since last month, drought conditions have expanded across Montana as the region grapples with below normal precipitation and snowpack. According to the most recent U.S. Drought Monitor map published on January 30, 2024, 80% of Montana is classified as being in the D0 (abnormally dry conditions) to D2 (severe drought) range, which is an increase over last month's 56%. Severe drought conditions that were confined mostly to Sanders County last month have expanded to include wide swaths of western Montana, and the entire region west of the Rocky Mountains is in either moderate or severe drought. East of the Rocky Mountain Front is mostly classified as abnormally dry, except for the central part of eastern Montana from the Missouri River near Fort Peck south to the lower Yellowstone River basin, which is not currently classified as in drought status.

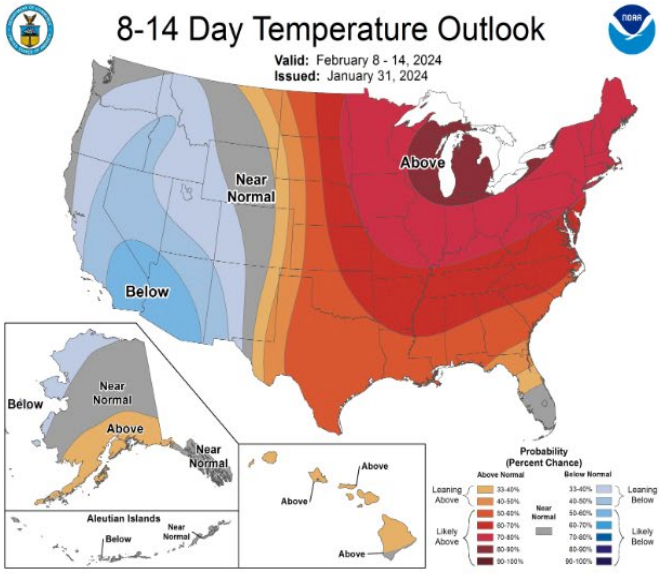


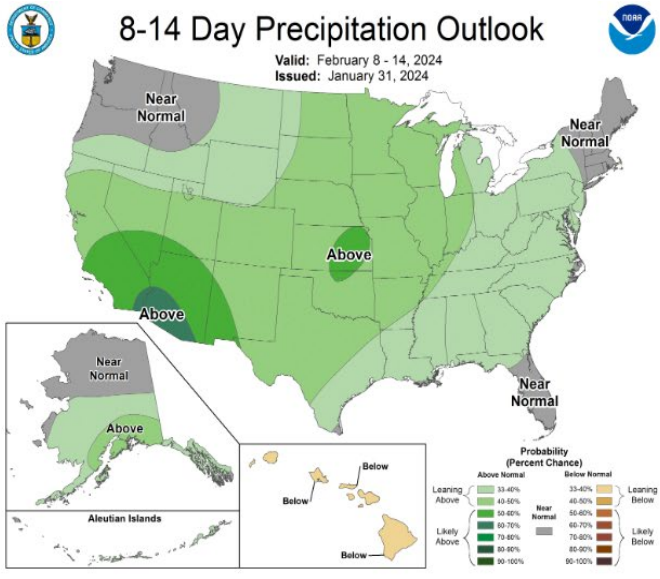
Statewide Overview

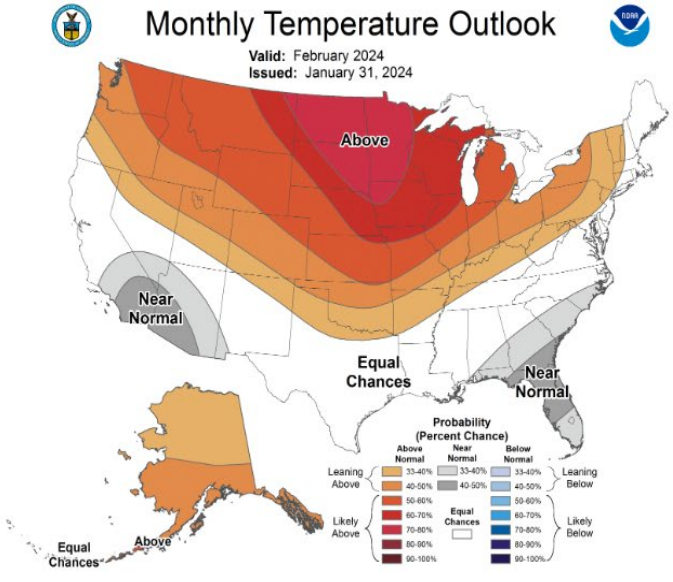
Weather Outlook

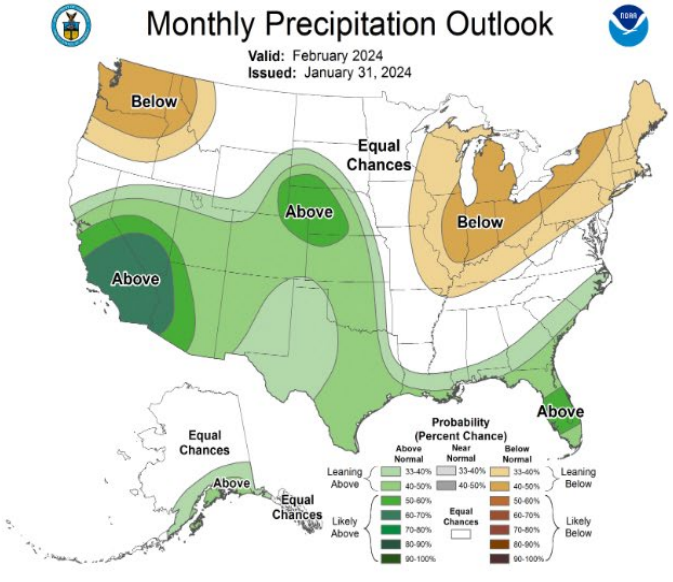
According to the NOAA Climate Prediction Center temperatures are likely to be near normal over the next 8-14 days across most of Montana. The western quarter of the state is leaning slightly toward below normal temperatures for that time period and the northeast corner leans slightly towards above normal, while most of the state has equal chances. For 8-14 day precipitation, the western third of the state is predicted to be near normal and the eastern two-thirds is leaning slightly toward above normal precipitation. Any amount of precipitation would help the current dry conditions.

The monthly outlook is less indicative of a lasting pattern change. Temperatures are likely to be above normal and likely precipitation ranges from equal chances across most of the state to below normal in the northwest corner.



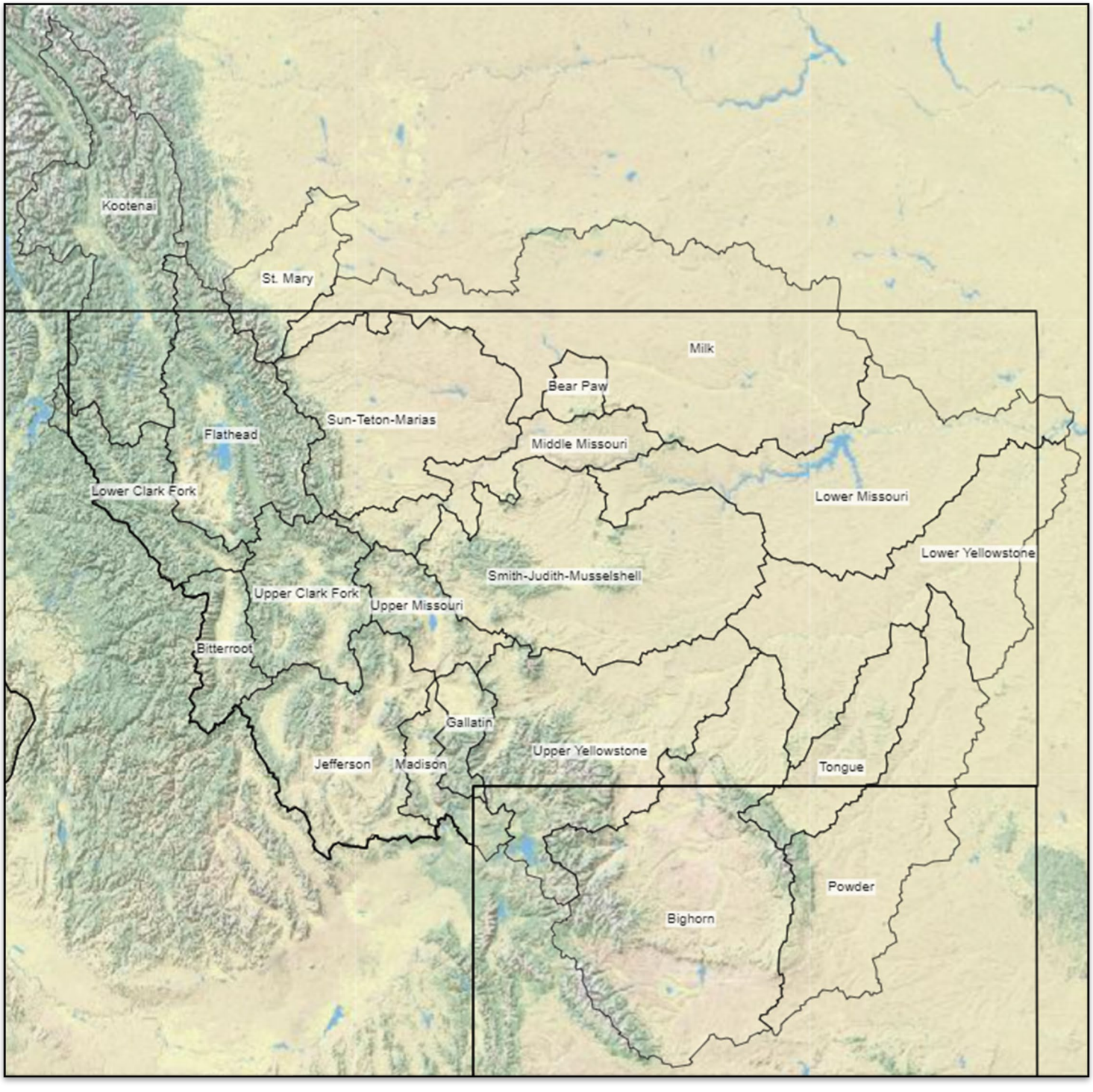






Basin Overview

Montana River Basin Definitions

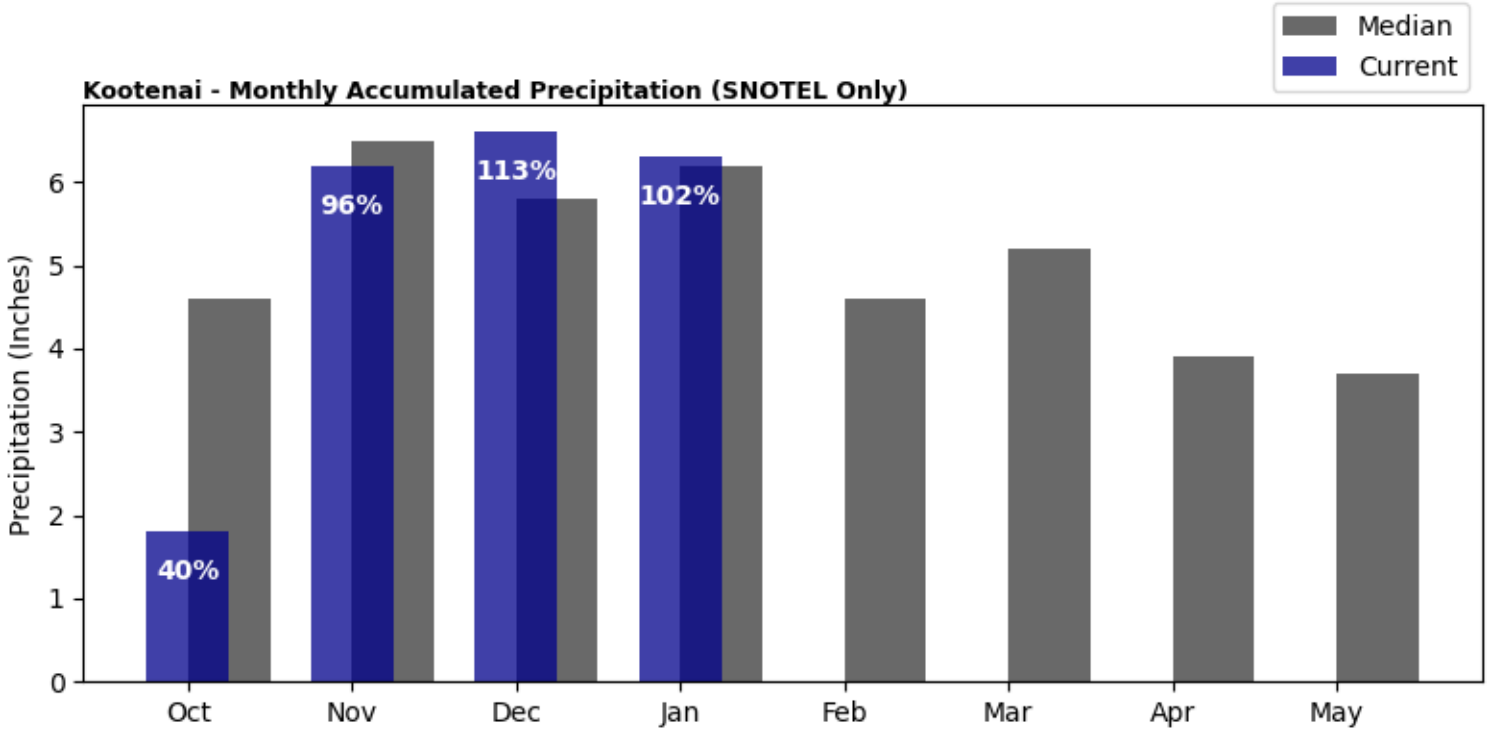


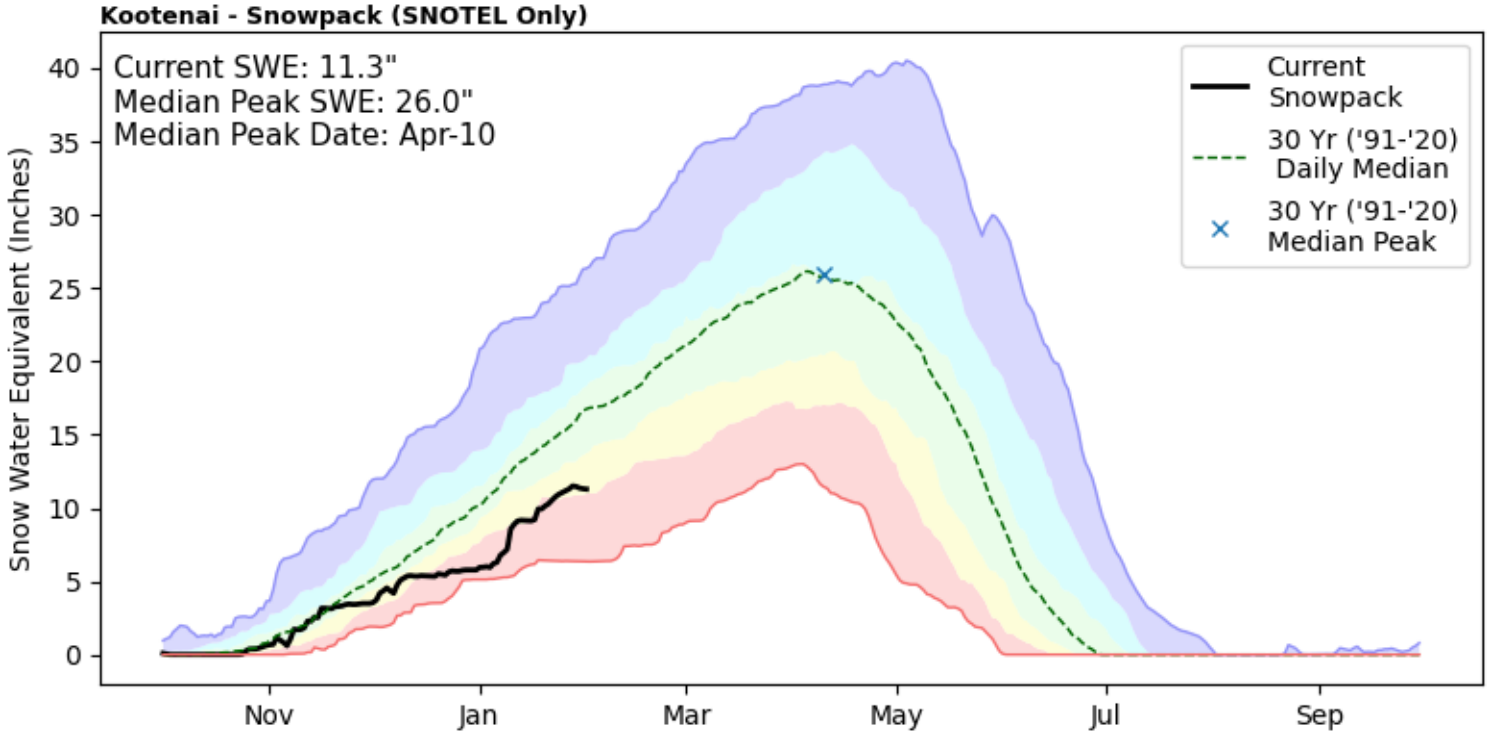
The following basin overview sections only include basins that have SNOTEL sites. For example, there is no basin overview for the Lower Yellowstone, because there are no SNOTEL sites associated with that basin. Water supply information for basins not included in the following sections can be found at https://nwcc-apps.sc.egov.usda.gov/

Basin Overview

Kootenai

Precipitation in January was near normal at 102%, which brings the seasonal accumulation (October-January) to 84% of median. The snowpack in the Kootenai is well below normal at 67% of median, compared to 82% at this time last year.

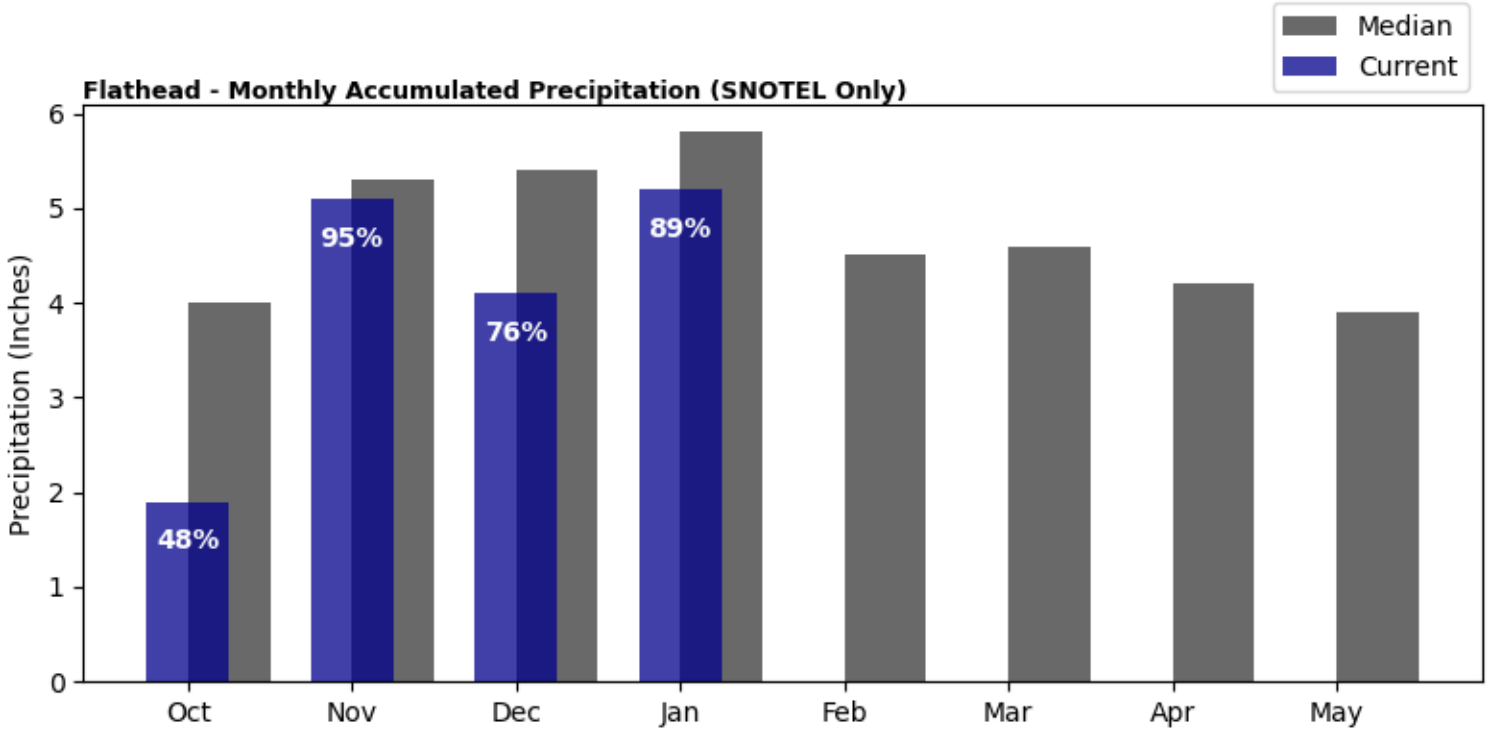


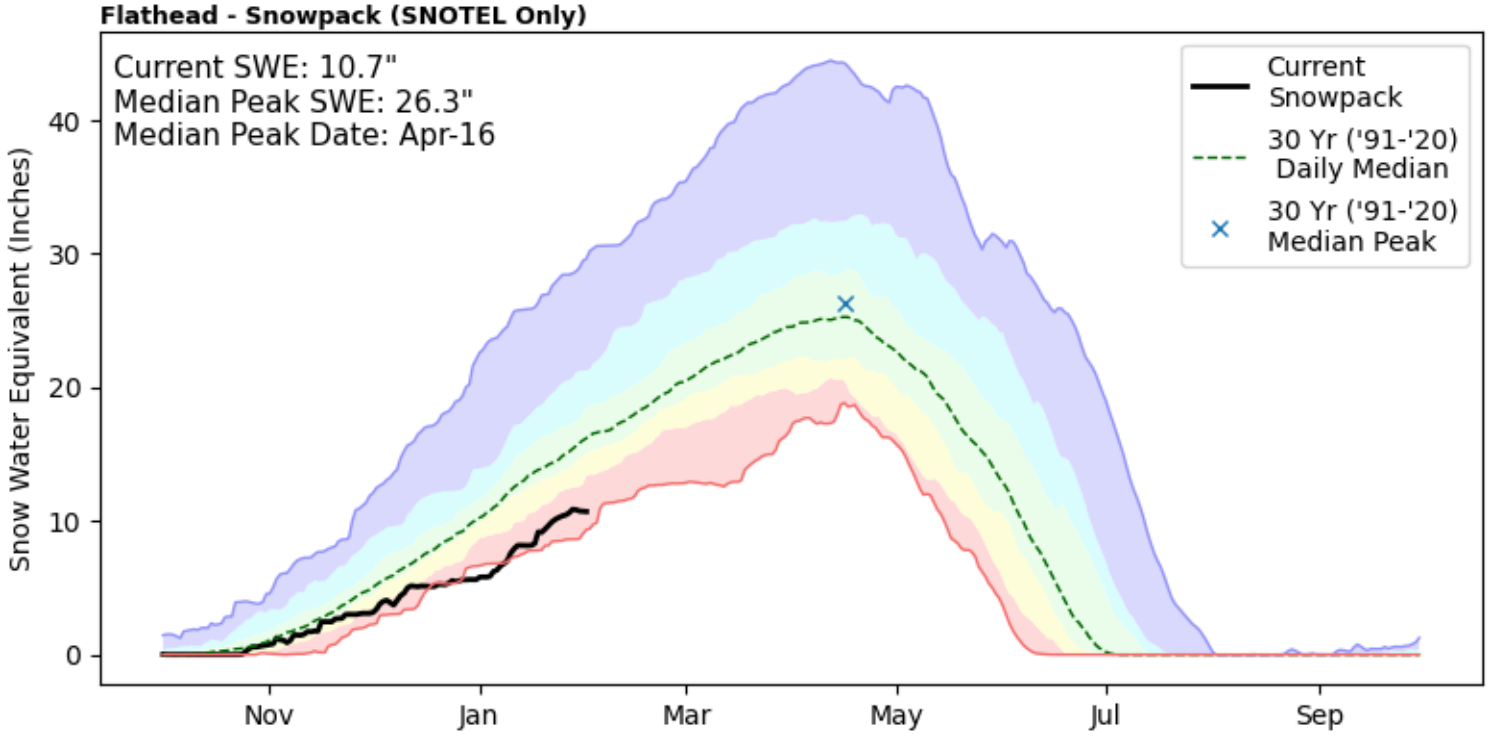


Basin Overview

Flathead

Precipitation in January was below normal at 89%, which brings the seasonal accumulation (October-January) to 77% of median. The snowpack in the Flathead is well below normal at 66% of median, compared to 90% at this time last year.

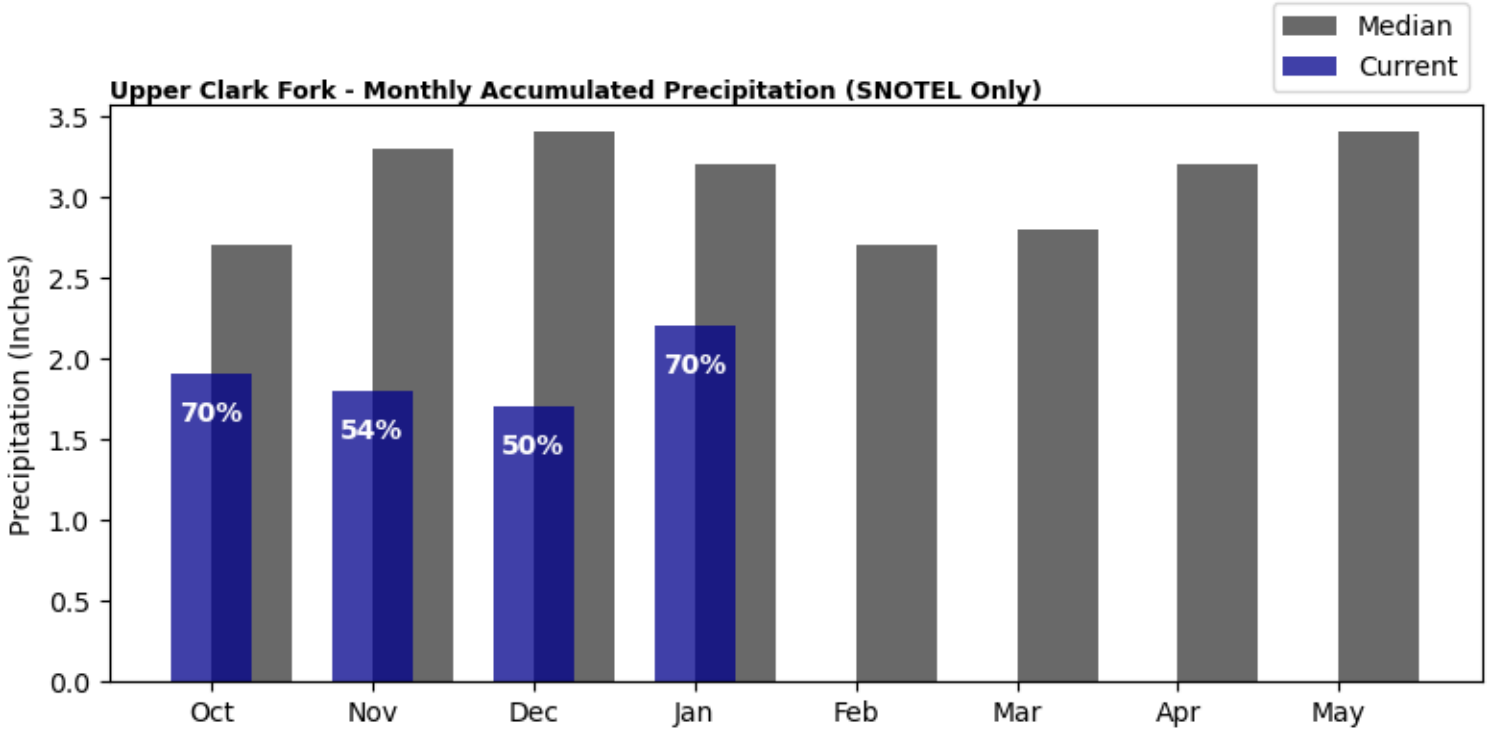


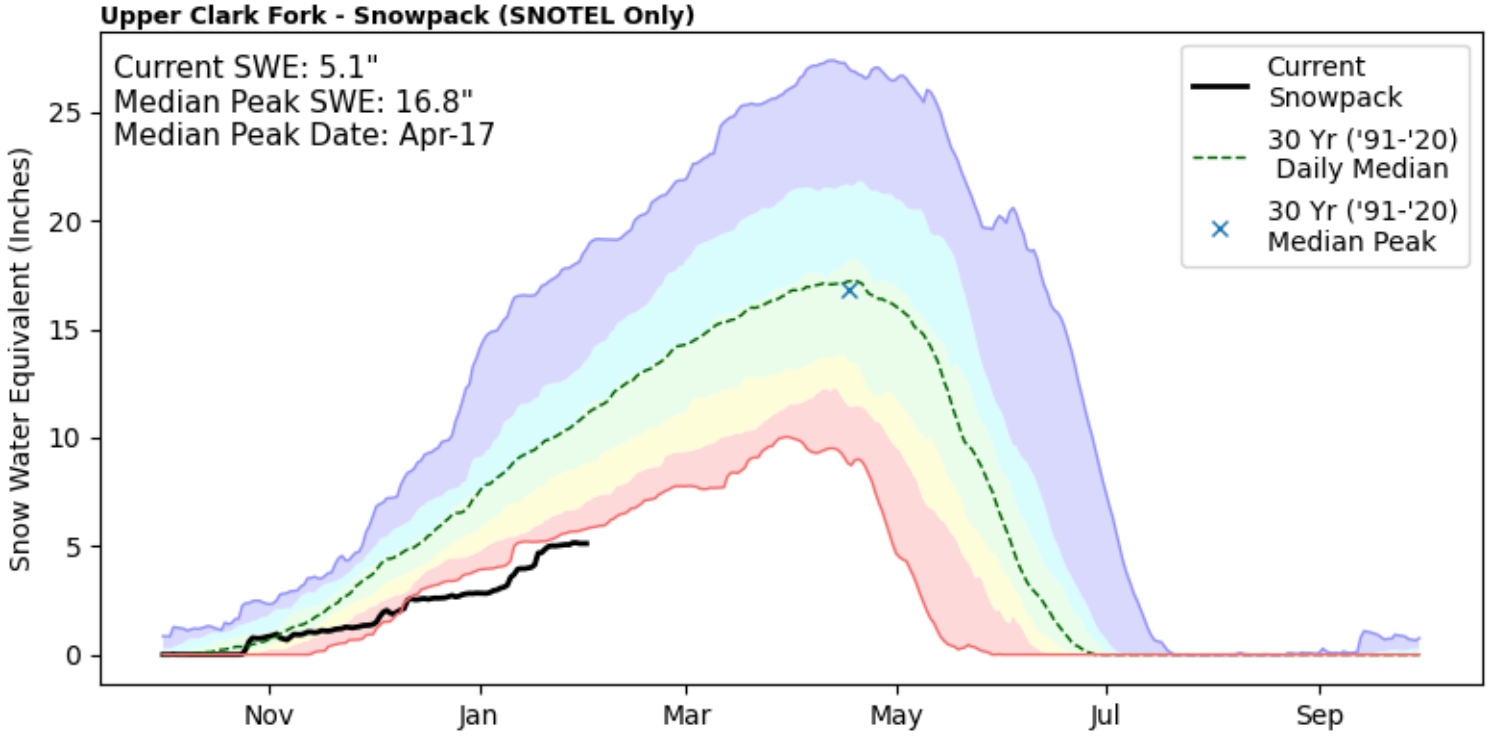


Basin Overview

Upper Clark Fork

Precipitation in January was well below normal at 70%, which brings the seasonal accumulation (October-January) to 59% of median. The snowpack in the Upper Clark Fork is well below normal at 44% of median, compared to 95% at this time last year.

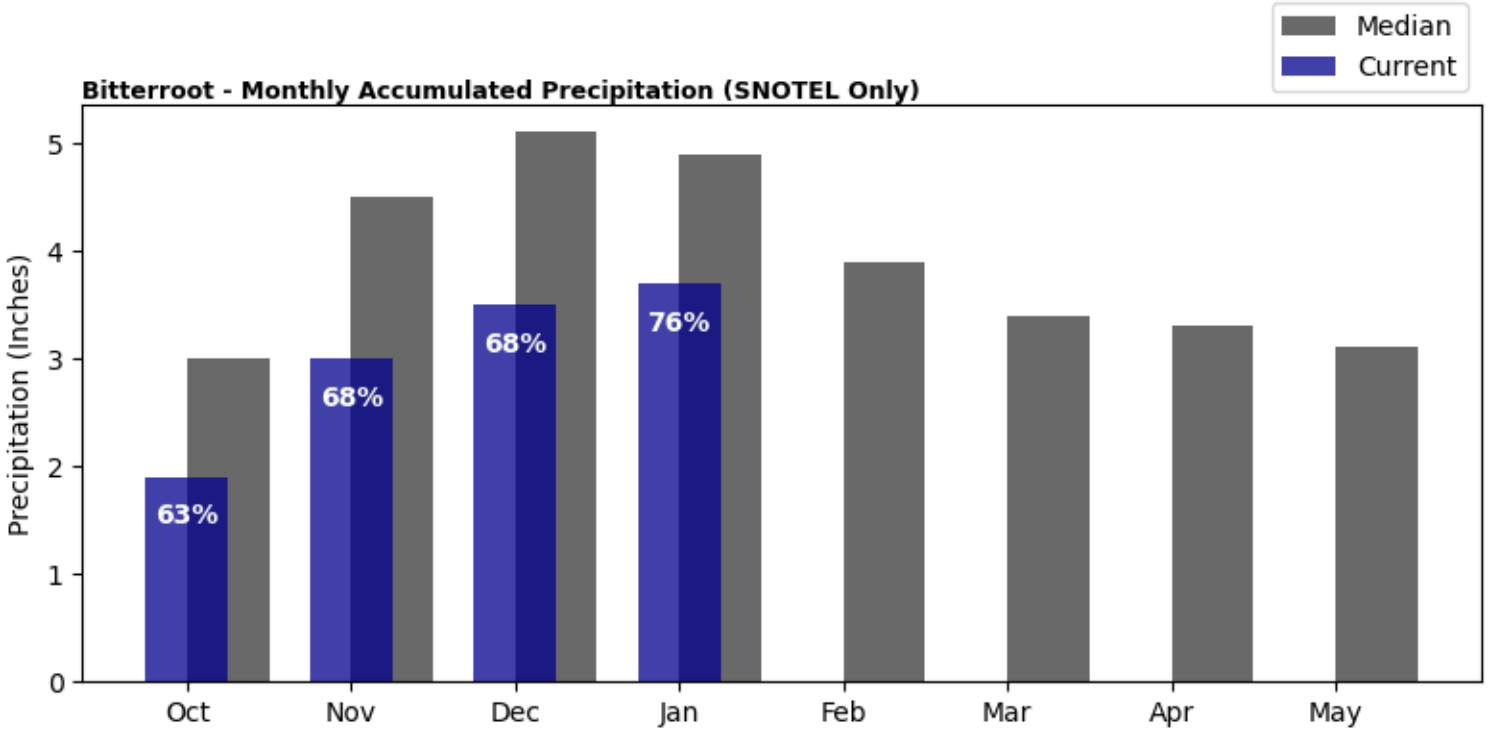


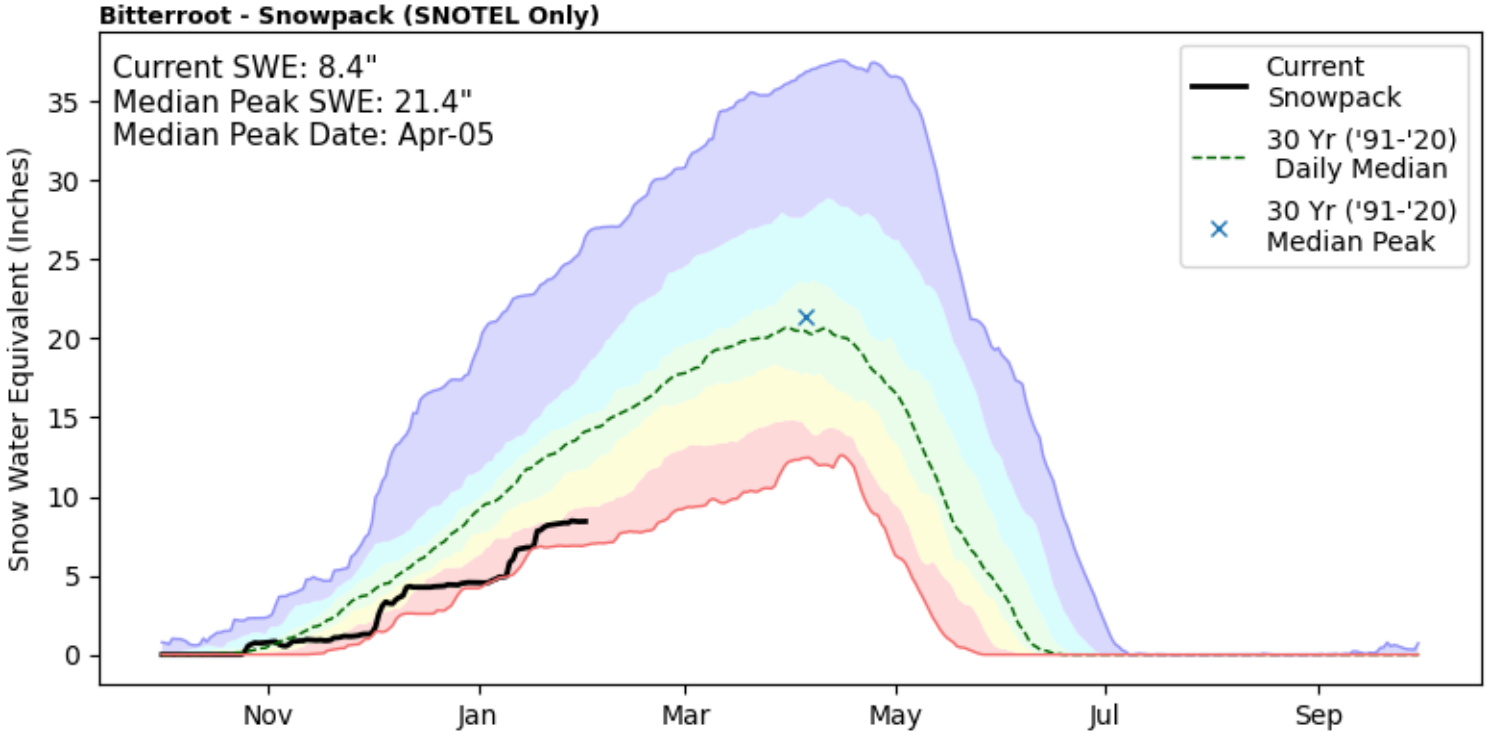


Basin Overview

Bitterroot

Precipitation in January was well below normal at 76%, which brings the seasonal accumulation (October-January) to 67% of median. The snowpack in the Bitterroot is well below normal at 60% of median, compared to 82% at this time last year.

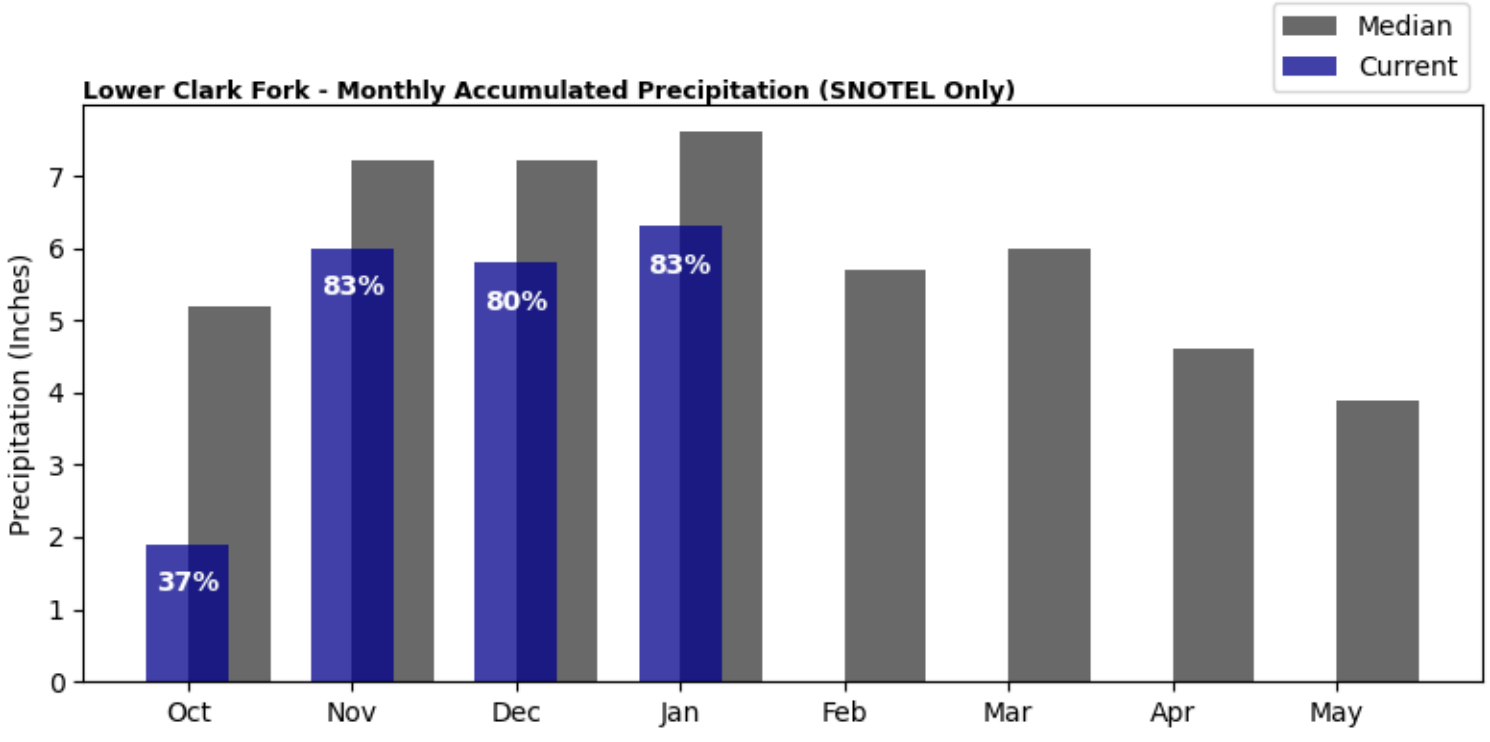


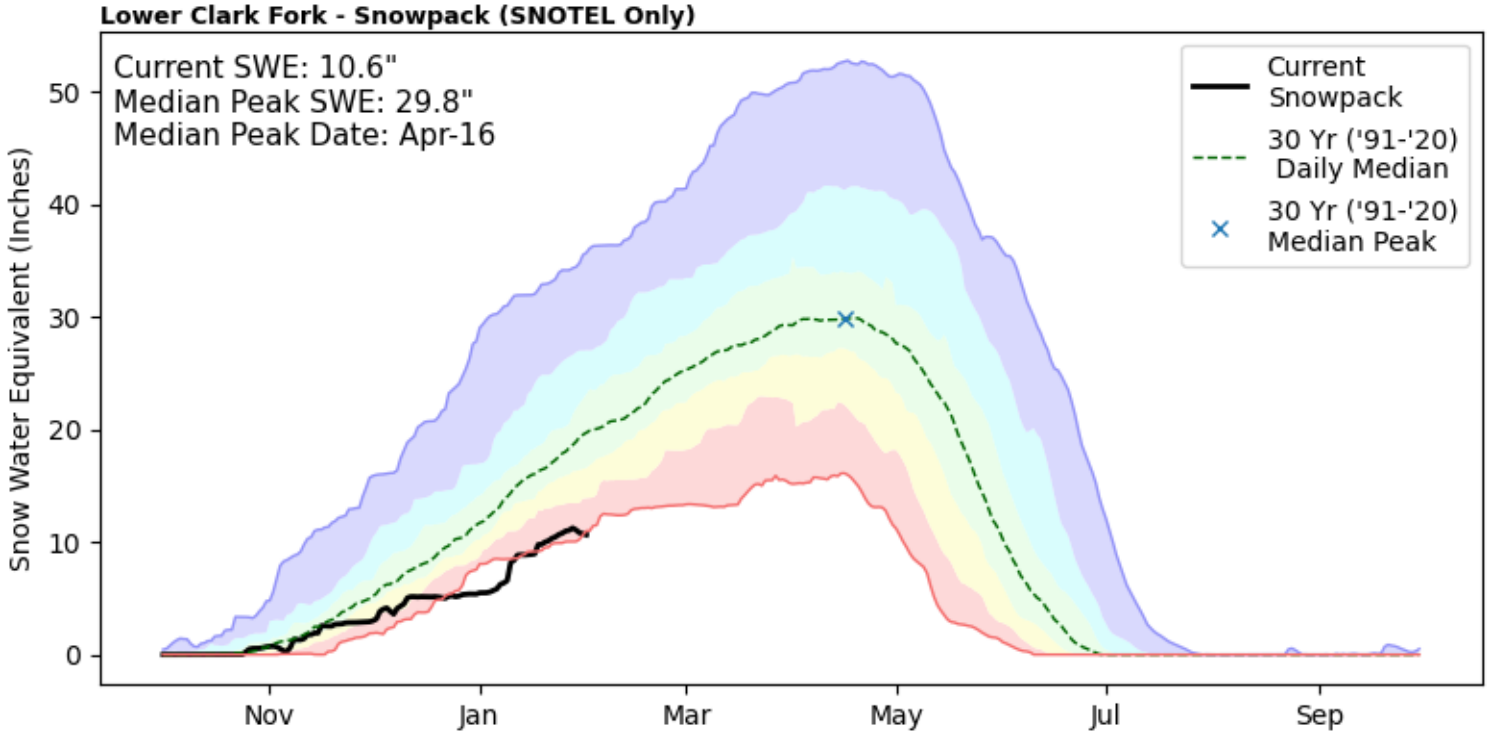


Basin Overview

Lower Clark Fork

Precipitation in January was below normal at 83%, which brings the seasonal accumulation (October-January) to 69% of median. The snowpack in the Lower Clark Fork is well below normal at 56% of median, compared to 86% at this time last year.

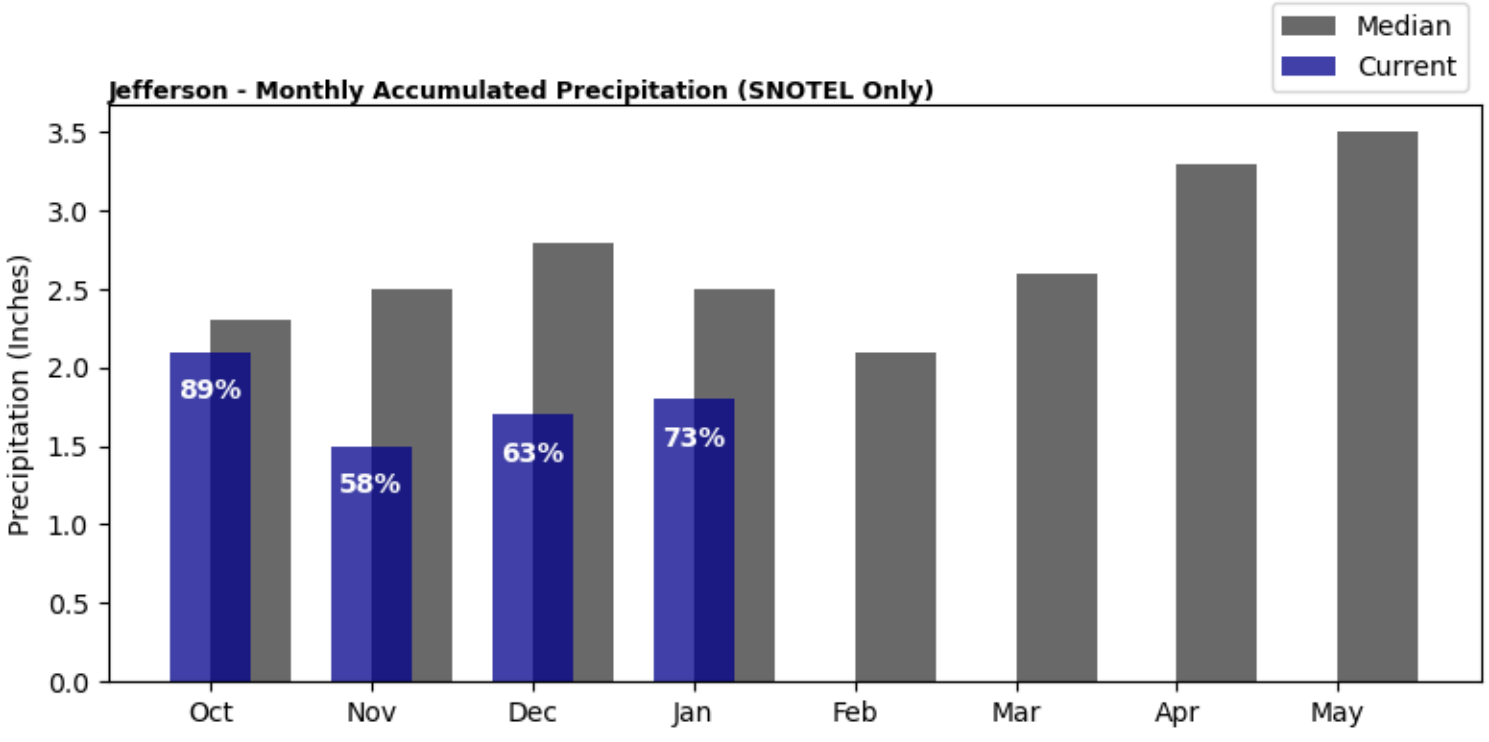


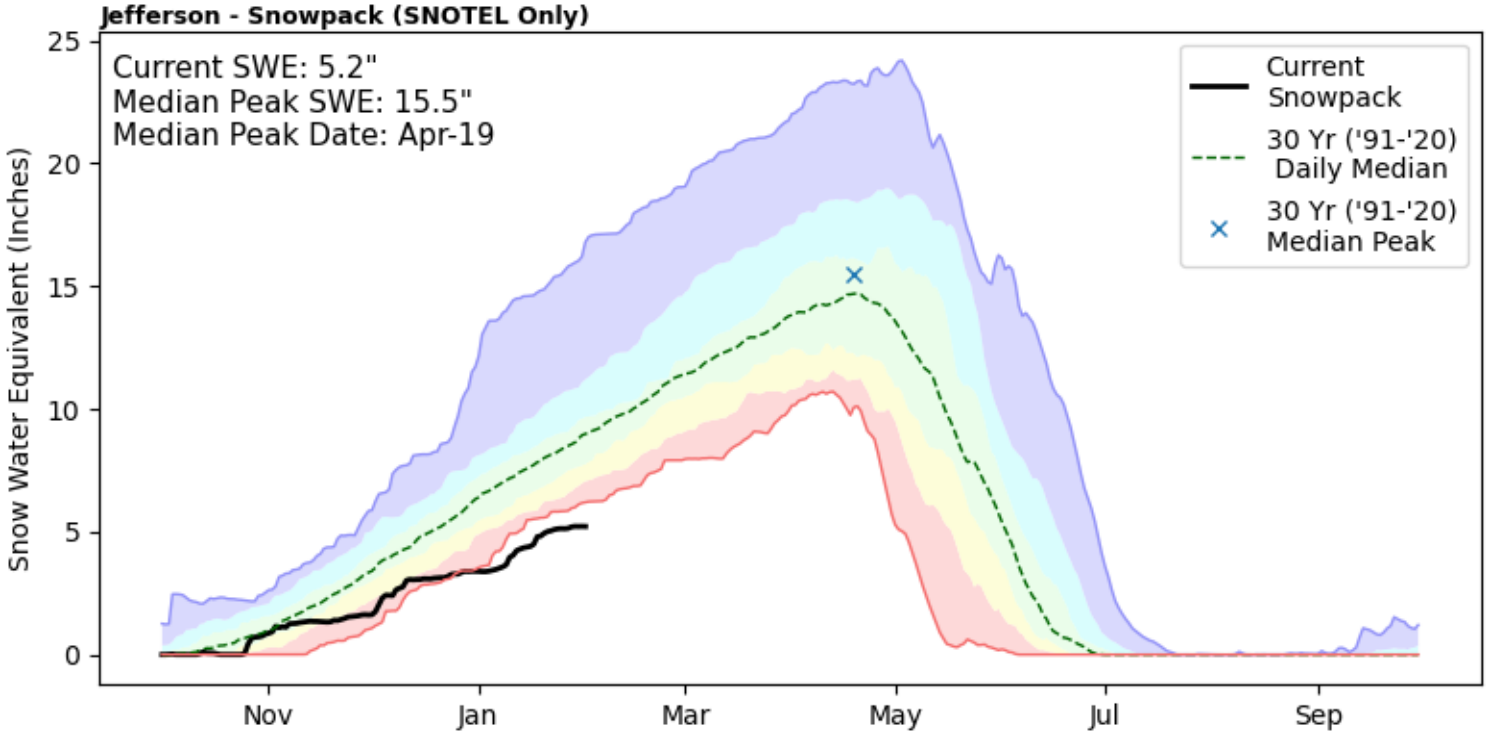


Basin Overview

Jefferson

Precipitation in January was well below normal at 73%, which brings the seasonal accumulation (October-January) to 70% of median. The snowpack in the Jefferson is well below normal at 55% of median, compared to 105% at this time last year.

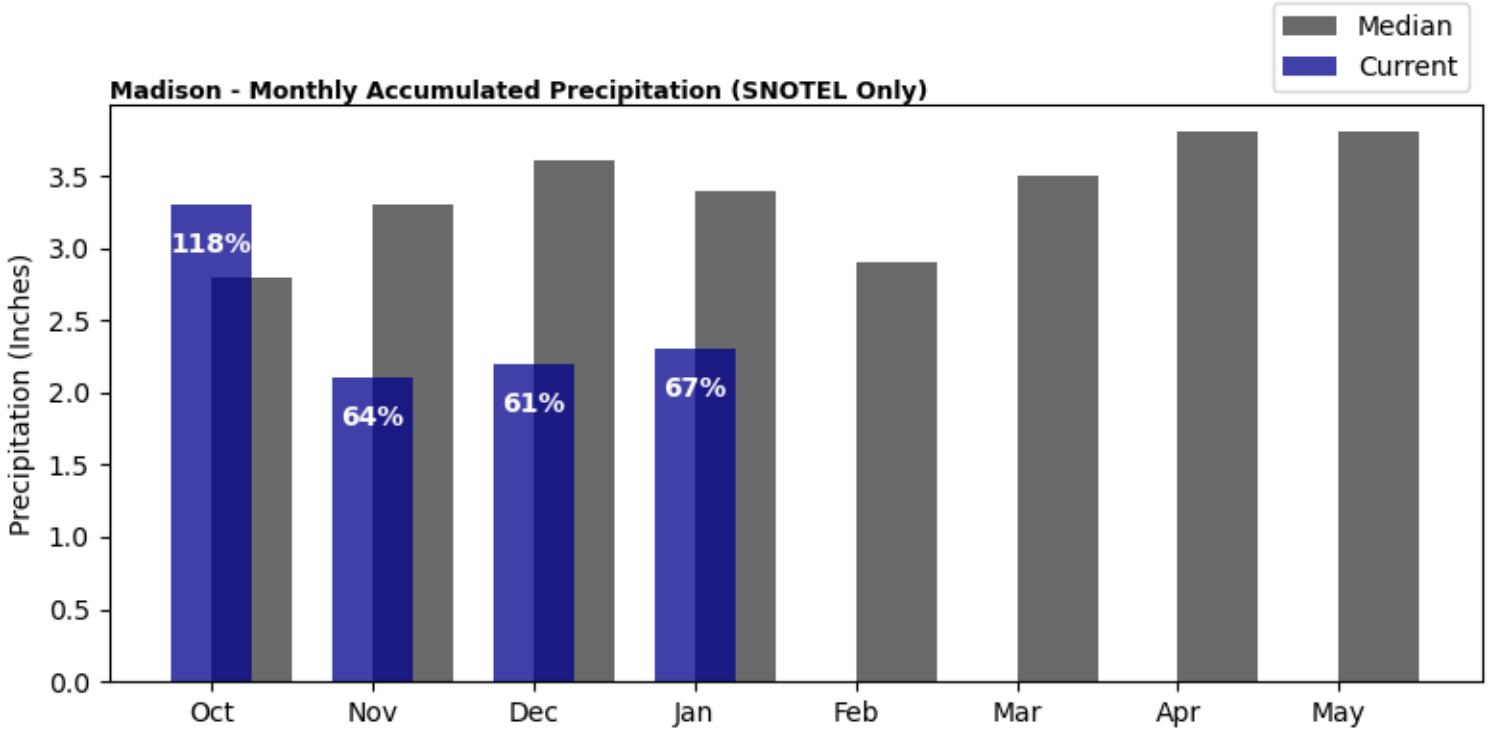


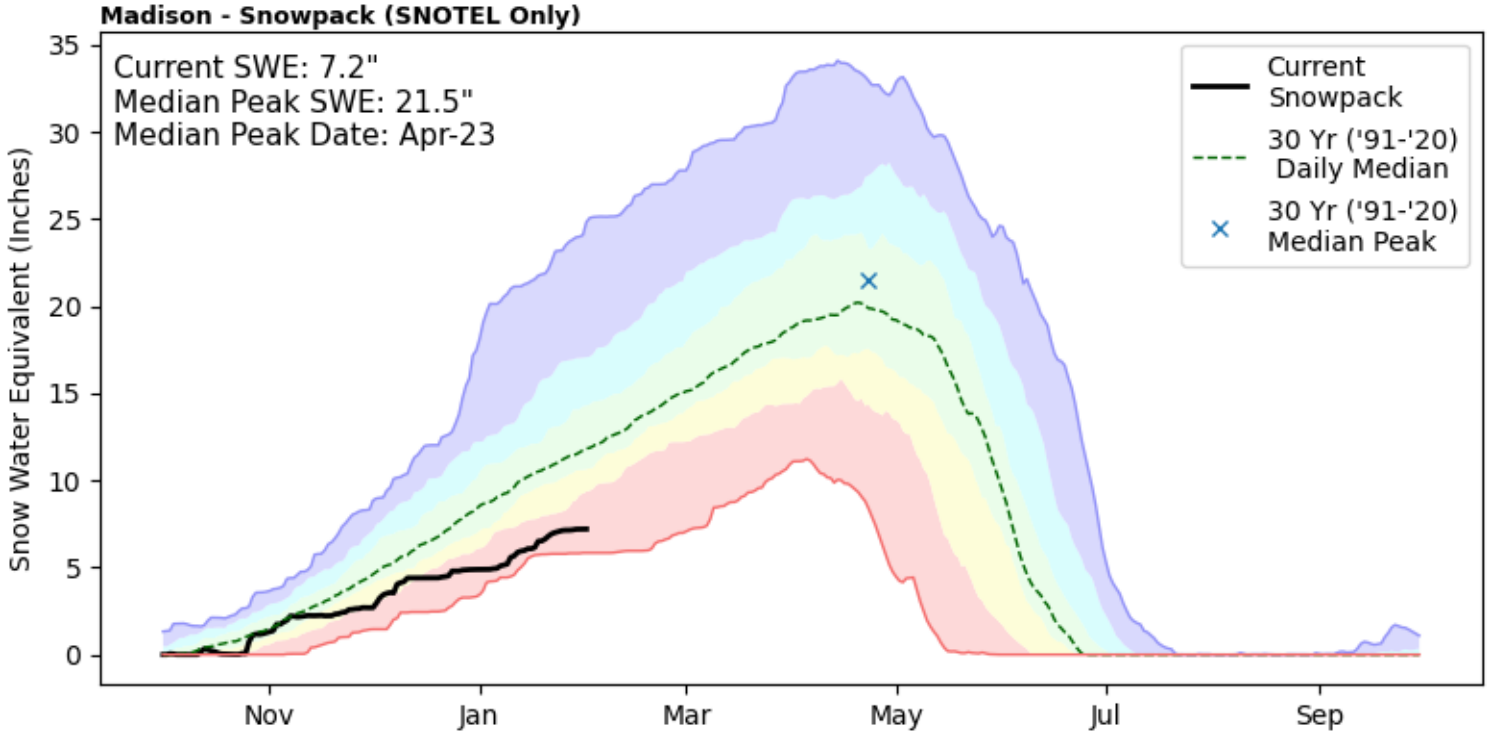


Basin Overview

Madison

Precipitation in January was well below normal at 67%, which brings the seasonal accumulation (October-January) to 76% of median. The snowpack in the Madison is well below normal at 57% of median, compared to 121% at this time last year.

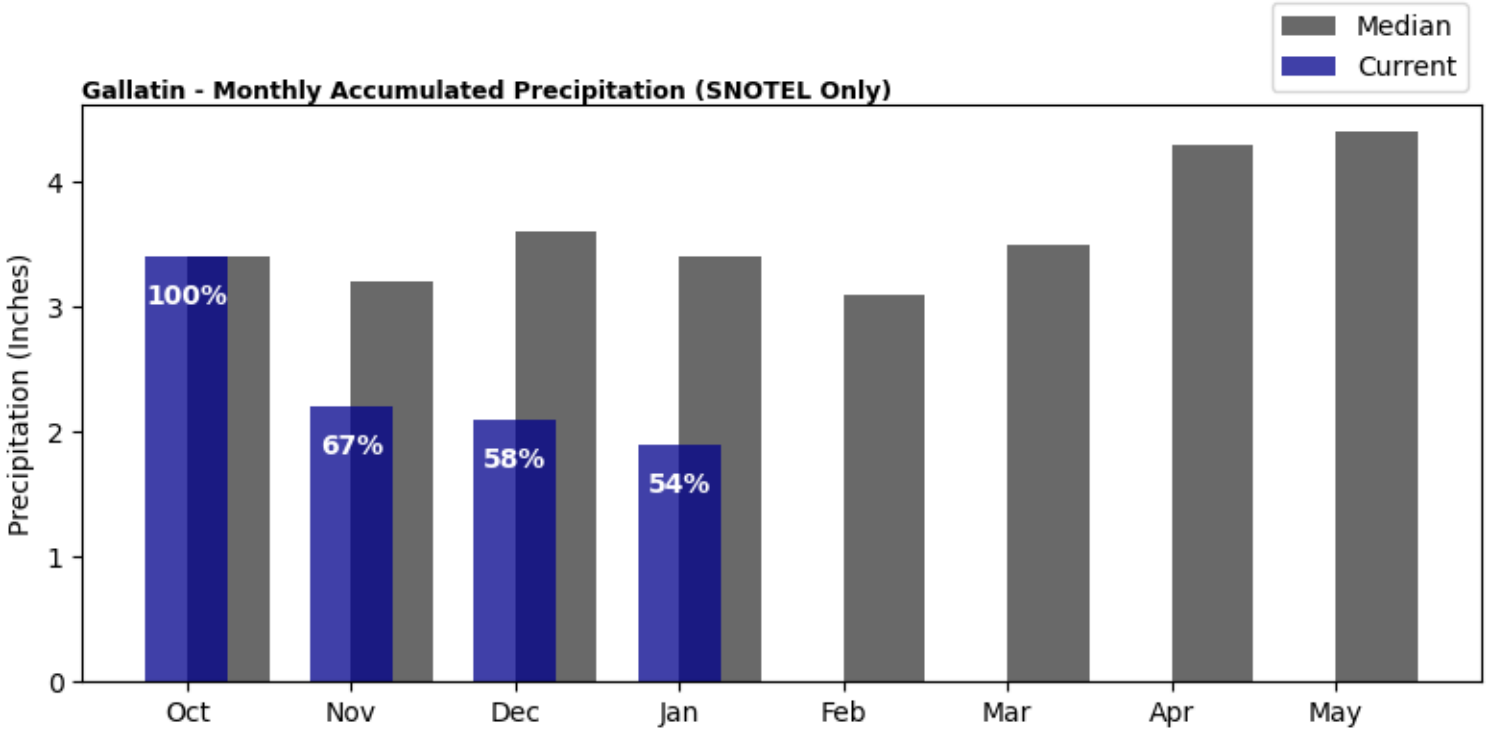


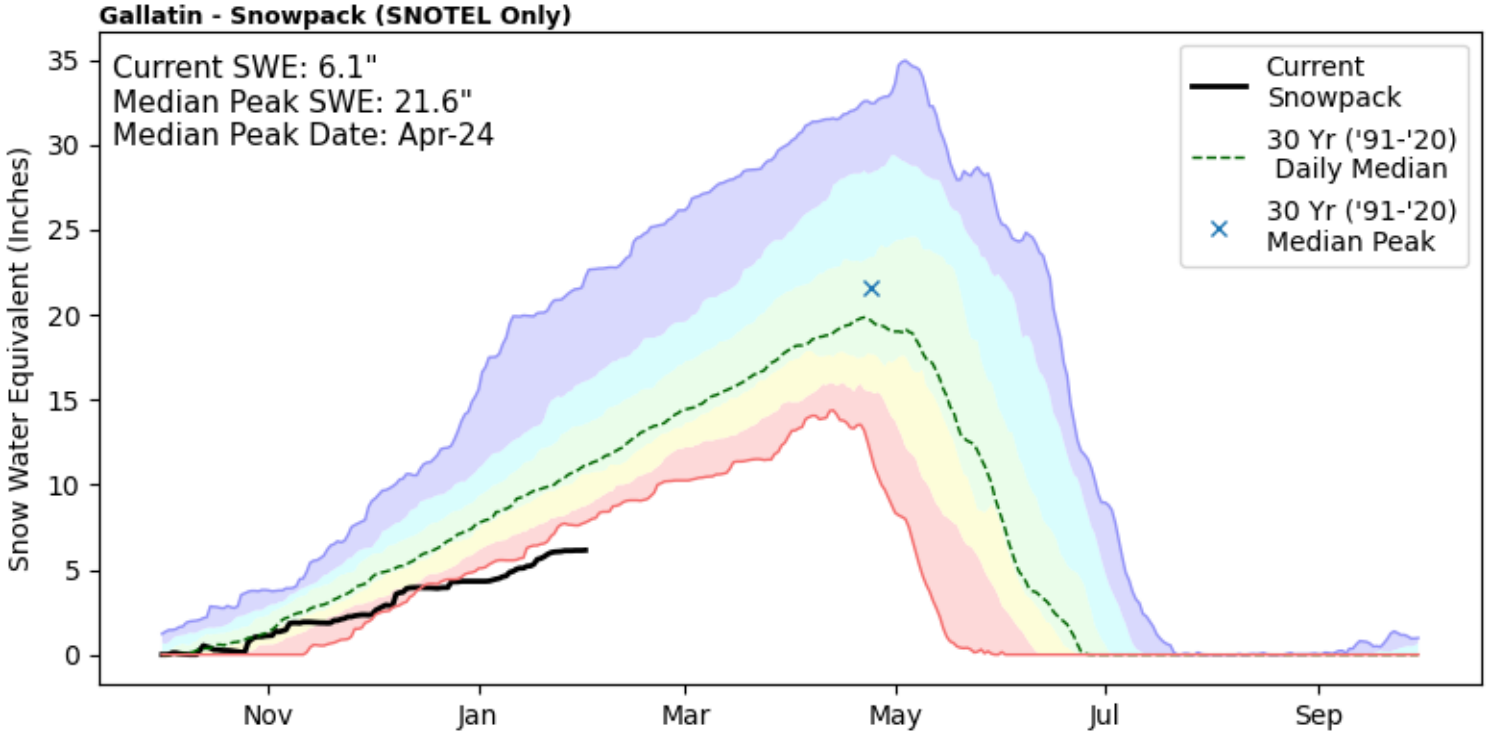


Basin Overview

Gallatin

Precipitation in January was well below normal at 54%, which brings the seasonal accumulation (October-January) to 68% of median. The snowpack in the Gallatin is well below normal at 53% of median, compared to 109% at this time last year.

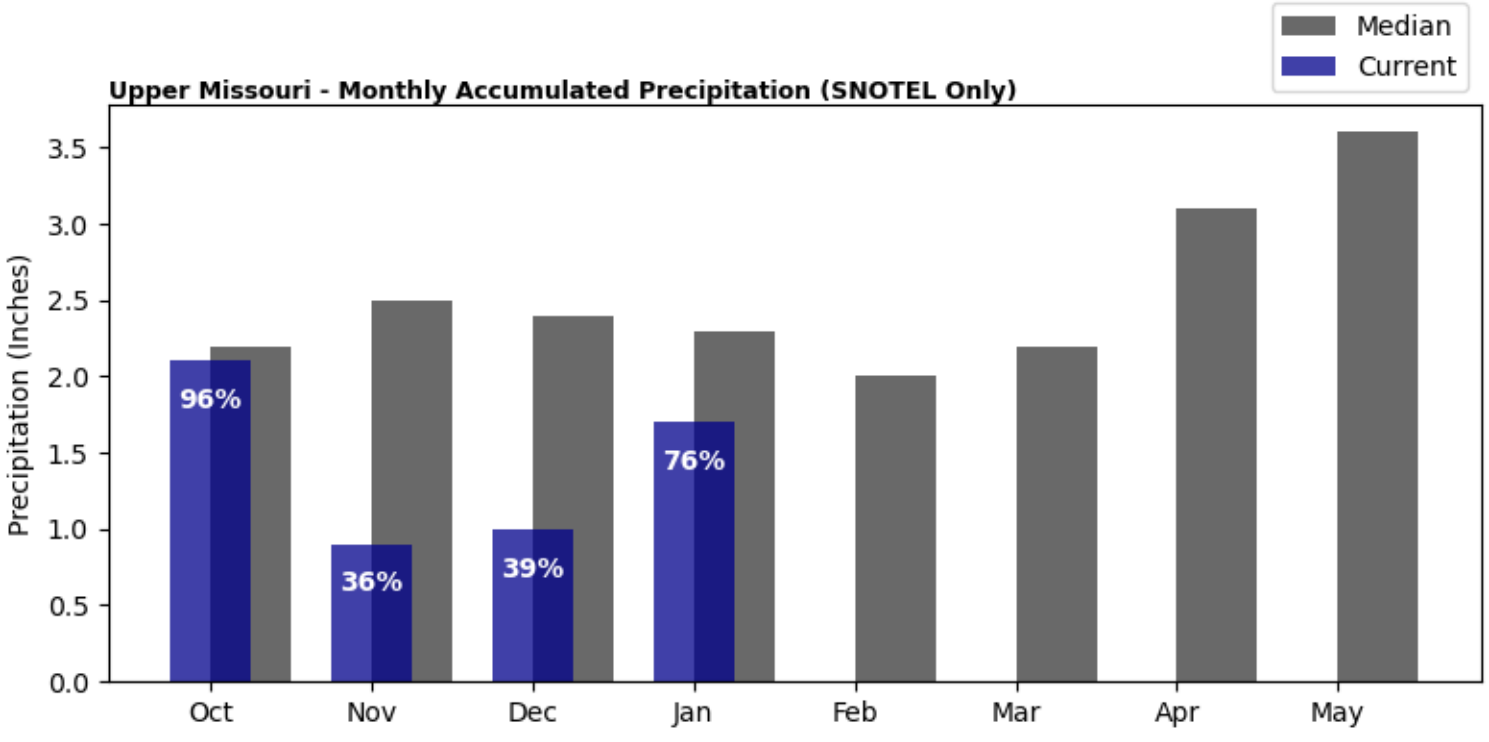


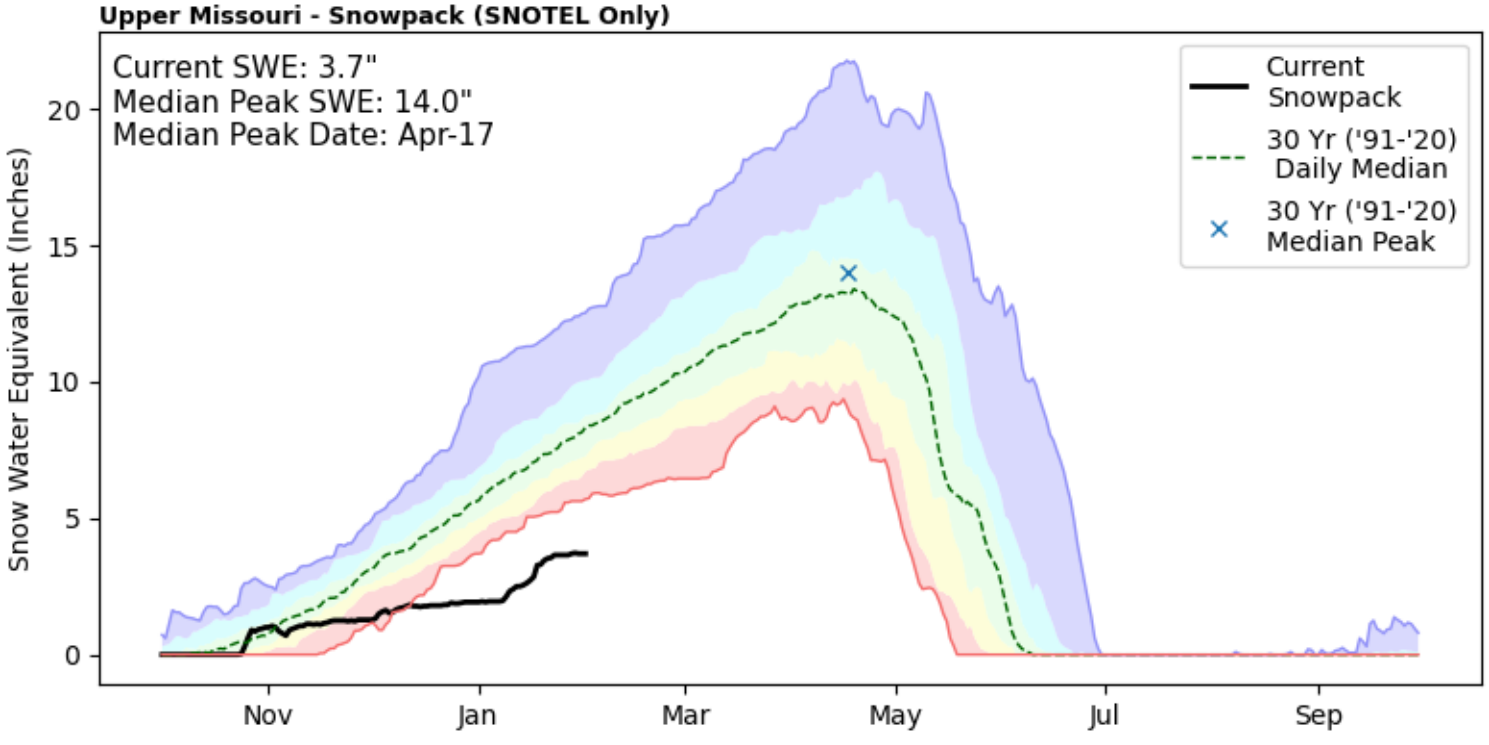


Basin Overview

Upper Missouri

Precipitation in January was well below normal at 76%, which brings the seasonal accumulation (October-January) to 59% of median. The snowpack in the Upper Missouri is well below normal at 41% of median, compared to 110% at this time last year.

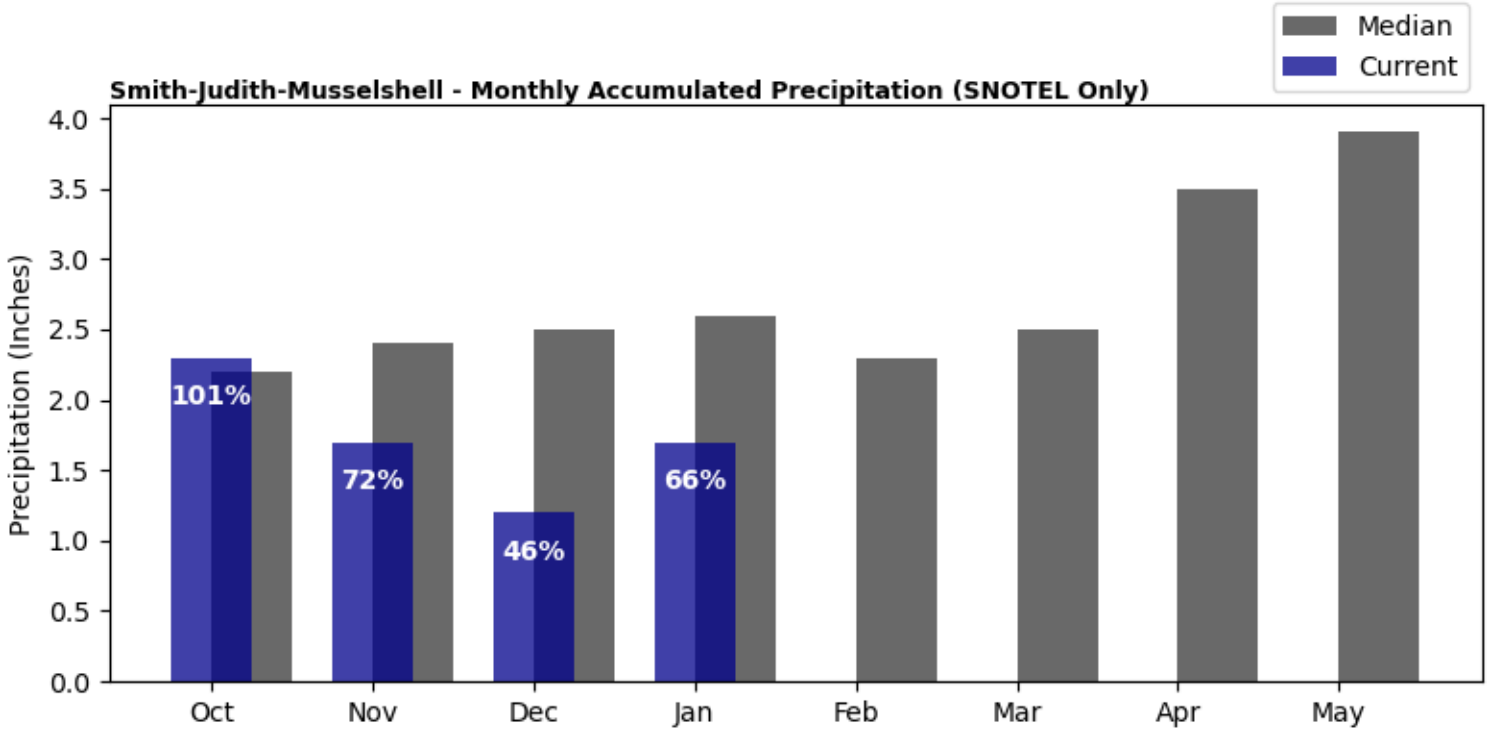


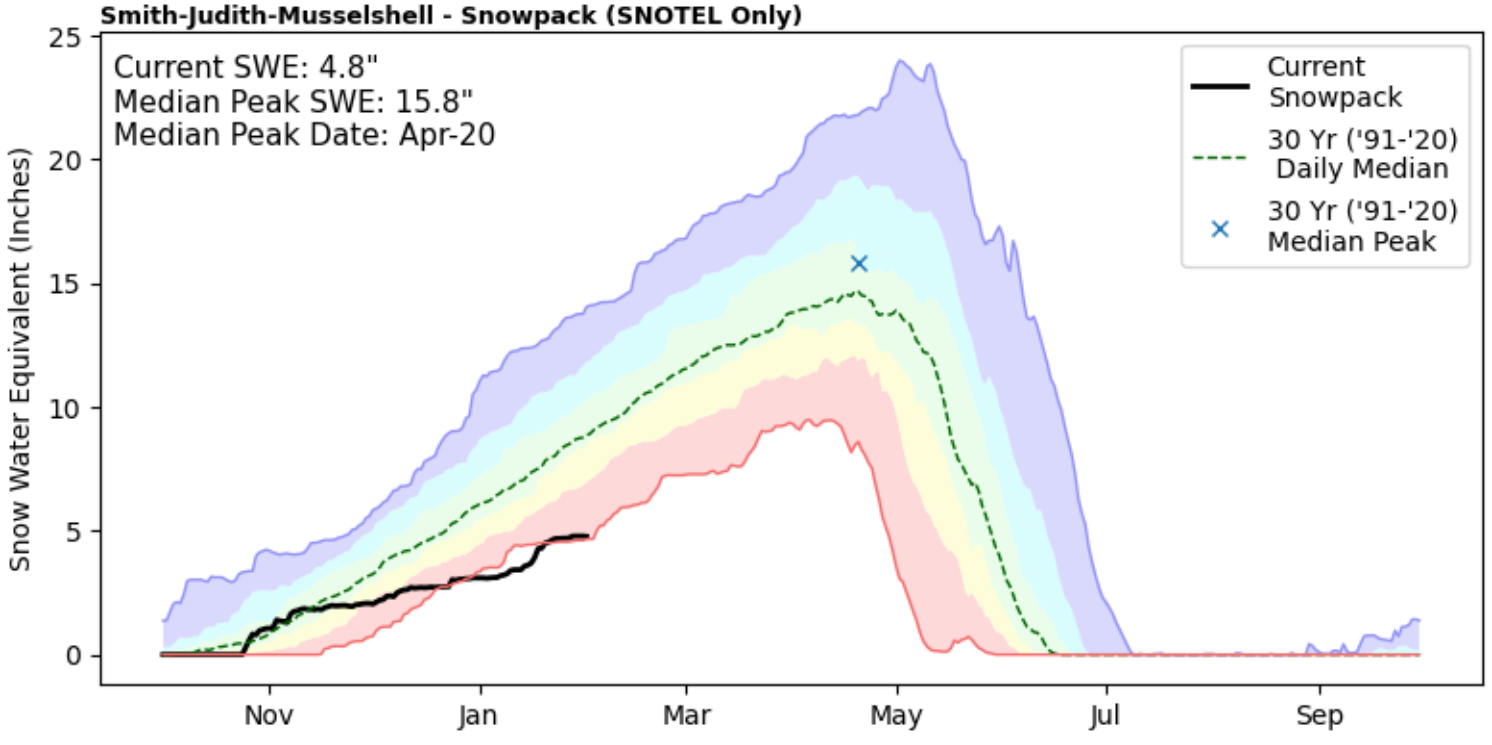


Basin Overview

Smith-Judith-Musselshell

Precipitation in January was well below normal at 66%, which brings the seasonal accumulation (October-January) to 66% of median. The snowpack in the Smith-Judith-Musselshell is well below normal at 52% of median, compared to 123% at this time last year.

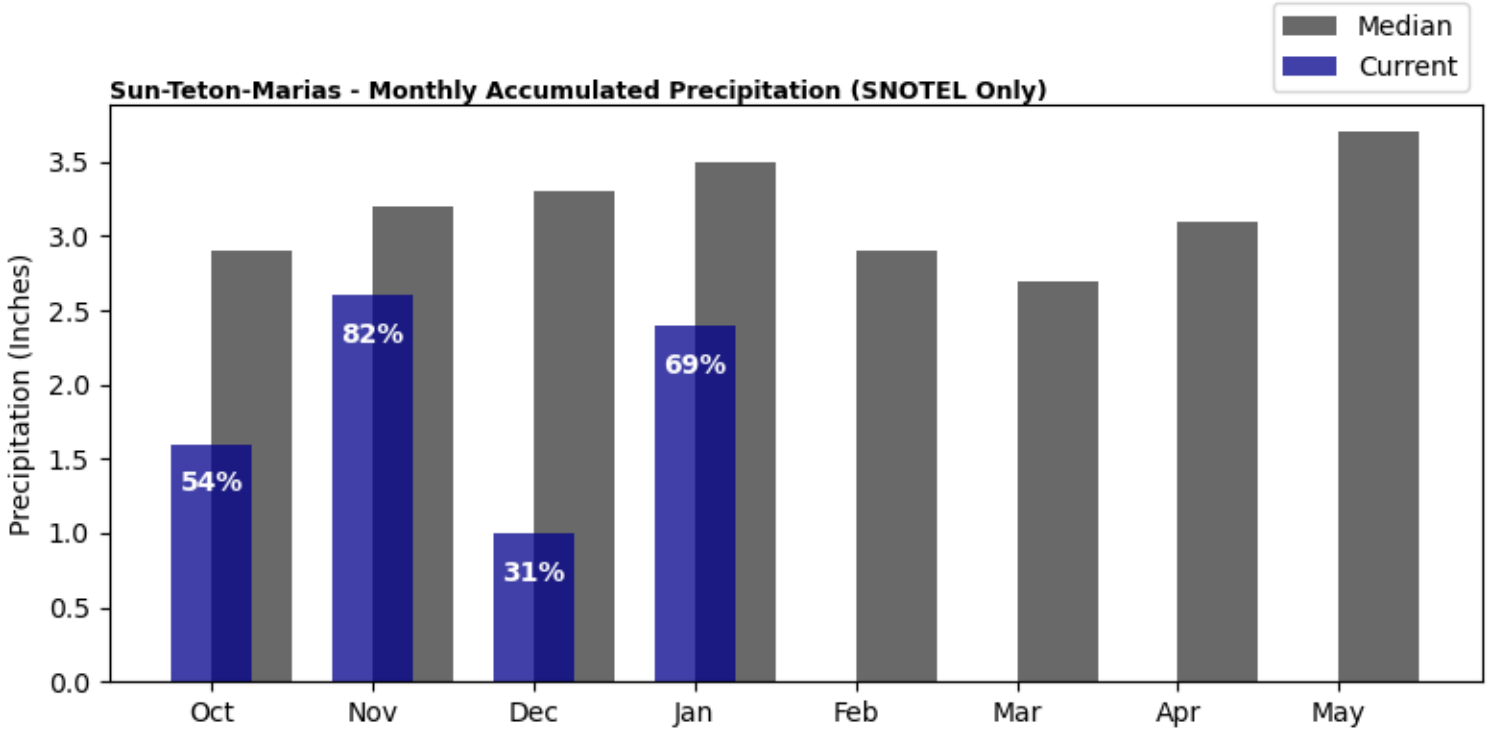


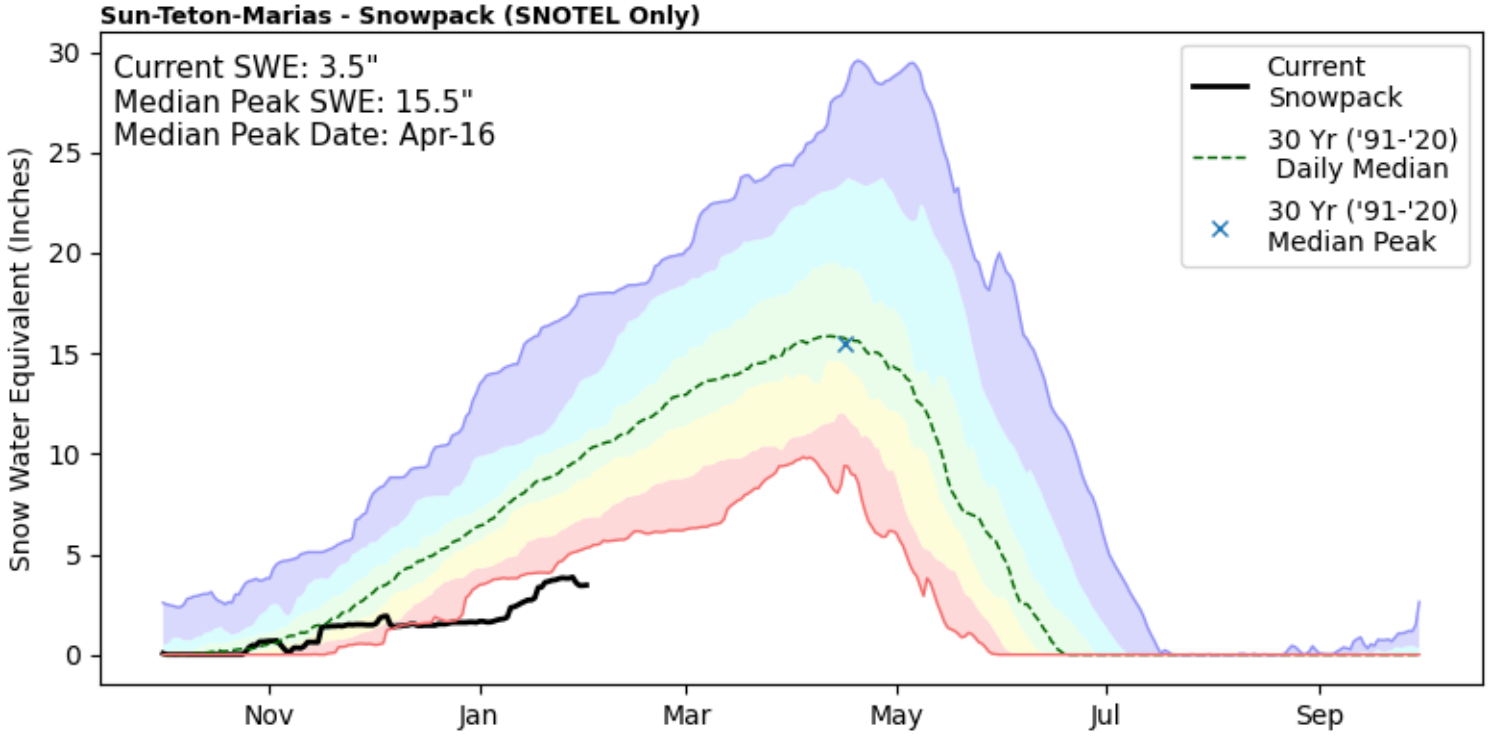


Basin Overview

Sun-Teton-Marias

Precipitation in January was well below normal at 69%, which brings the seasonal accumulation (October-January) to 58% of median. The snowpack in the Sun-Teton-Marias is well below normal at 34% of median, compared to 86% at this time last year.

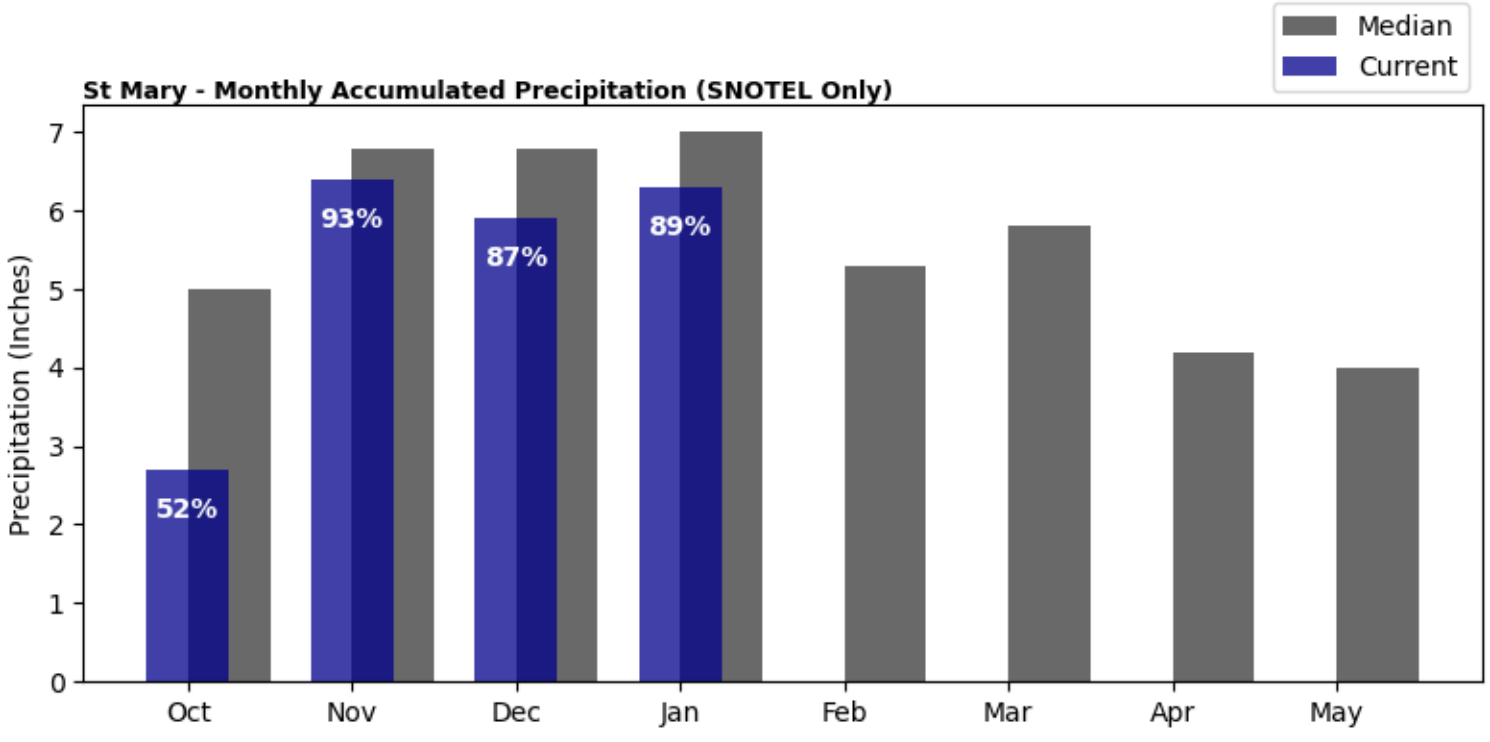


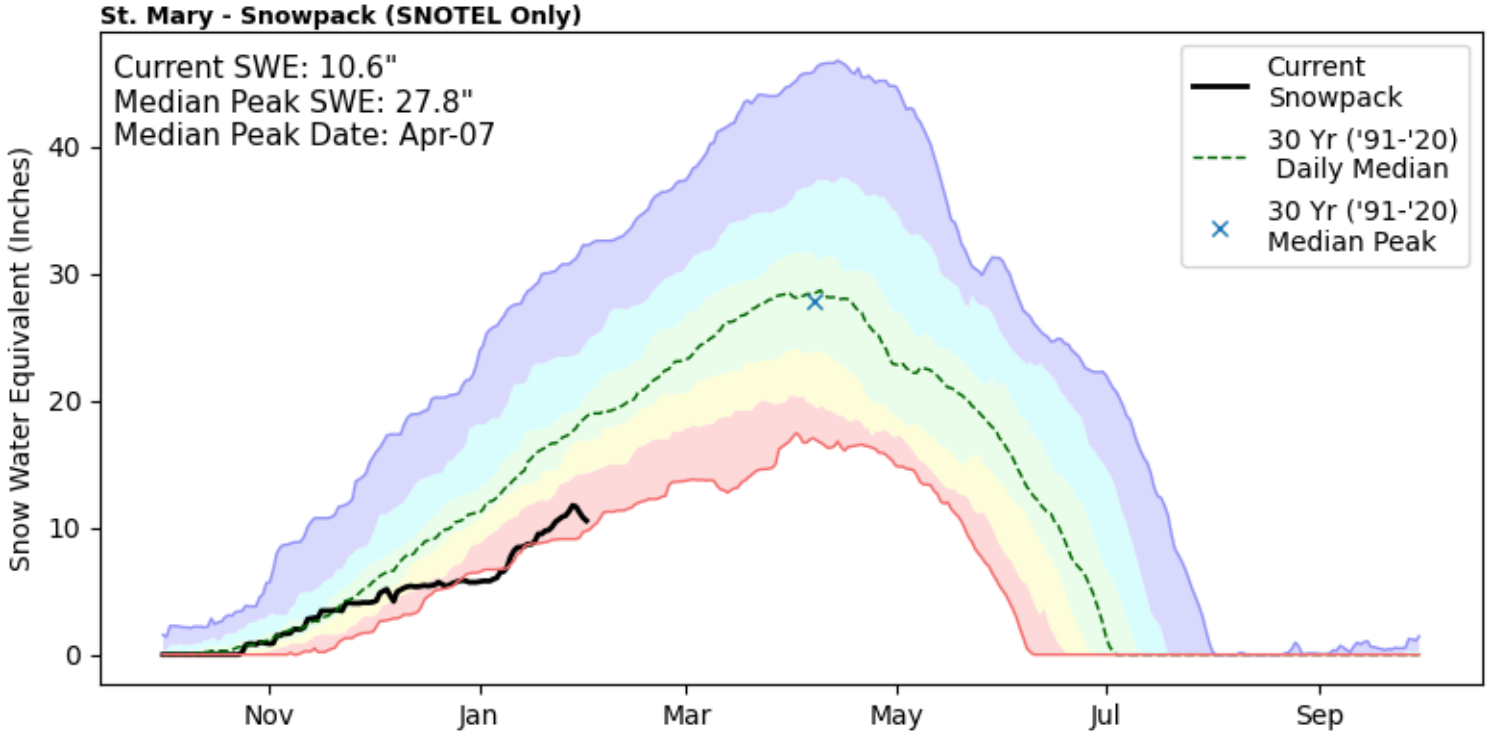


Basin Overview

St. Mary

Precipitation in January was below normal at 89%, which brings the seasonal accumulation (October-January) to 76% of median. The snowpack in the St. Mary is well below normal at 56% of median, compared to 85% at this time last year.

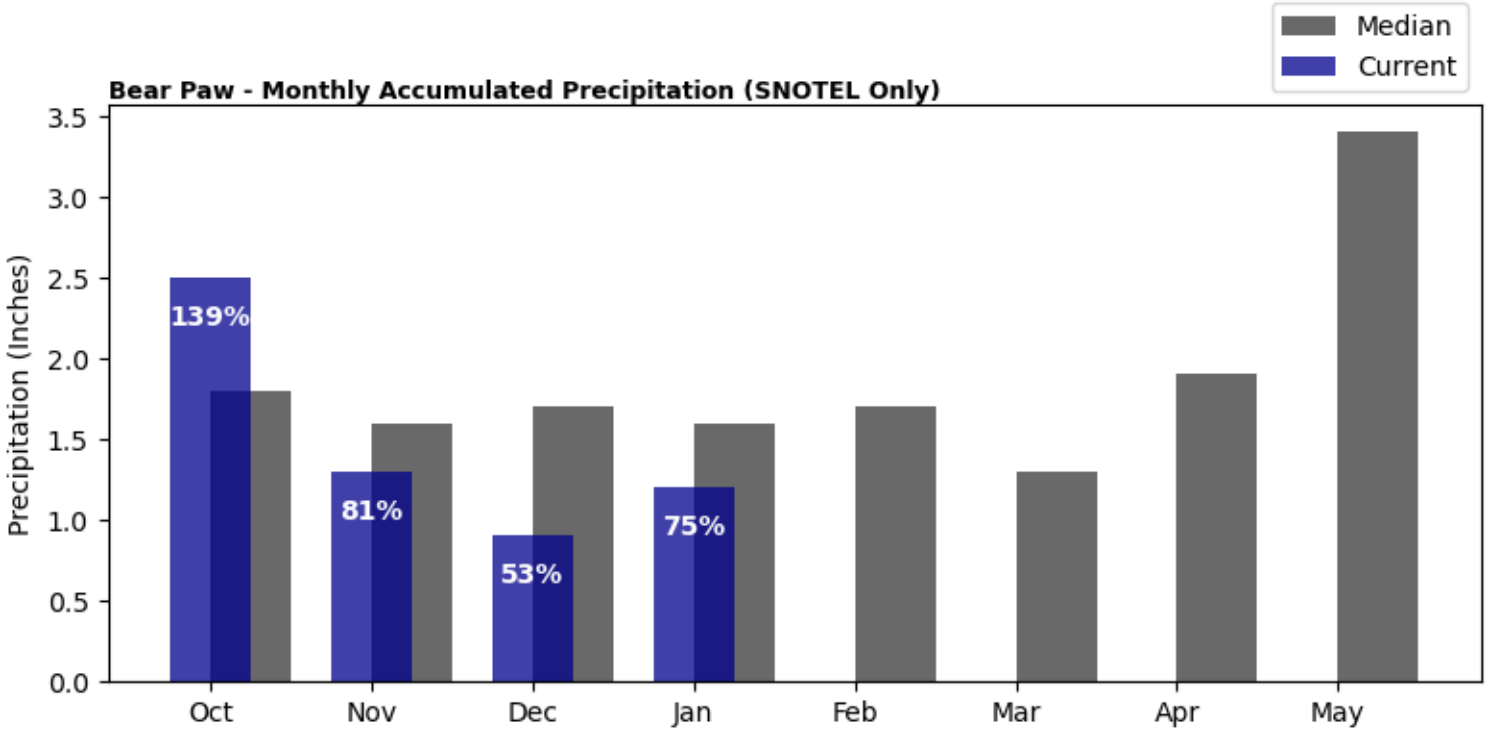


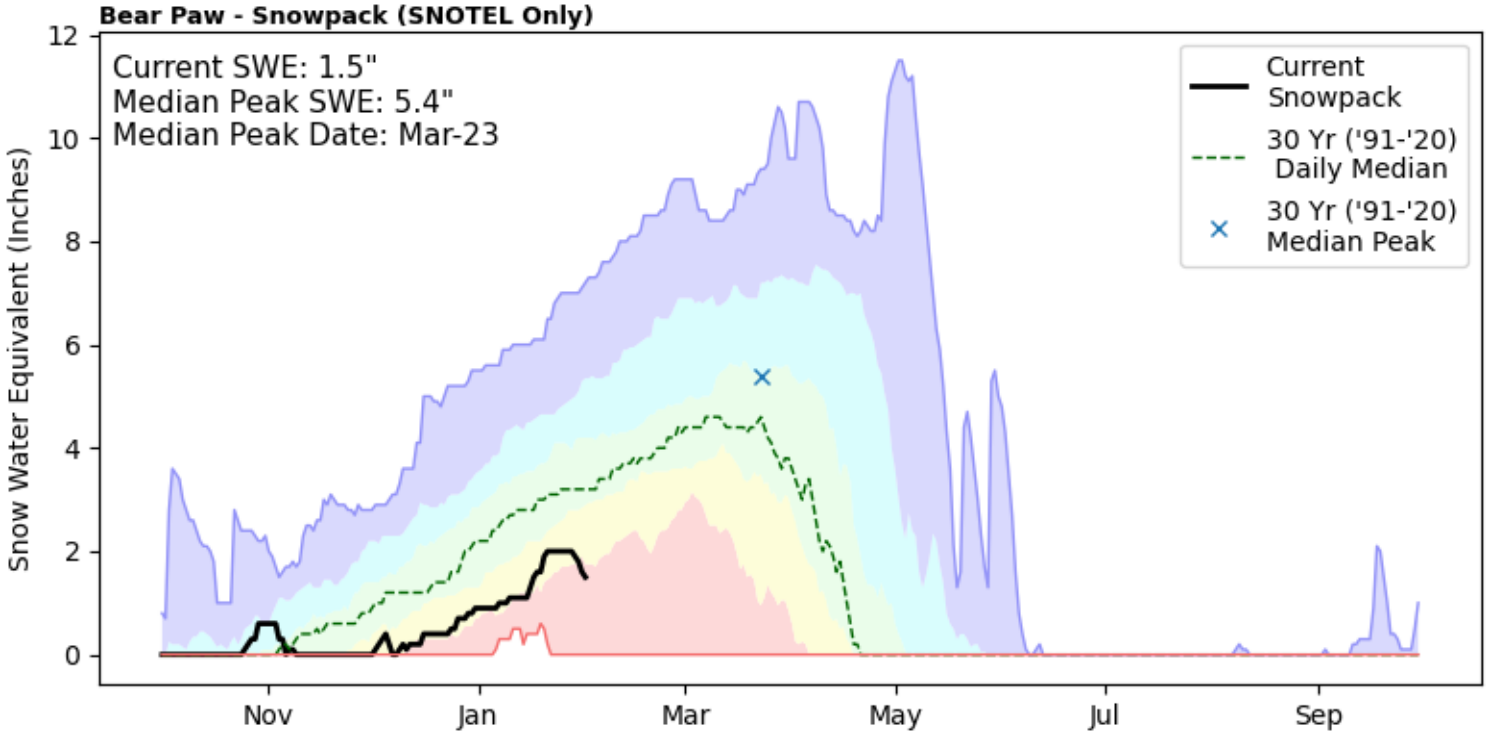


Basin Overview

Bear Paw

Precipitation in January was well below normal at 75%, which brings the seasonal accumulation (October-January) to 82% of median. The snowpack in the Bear Paw is well below normal at 31% of median, compared to 172% at this time last year.

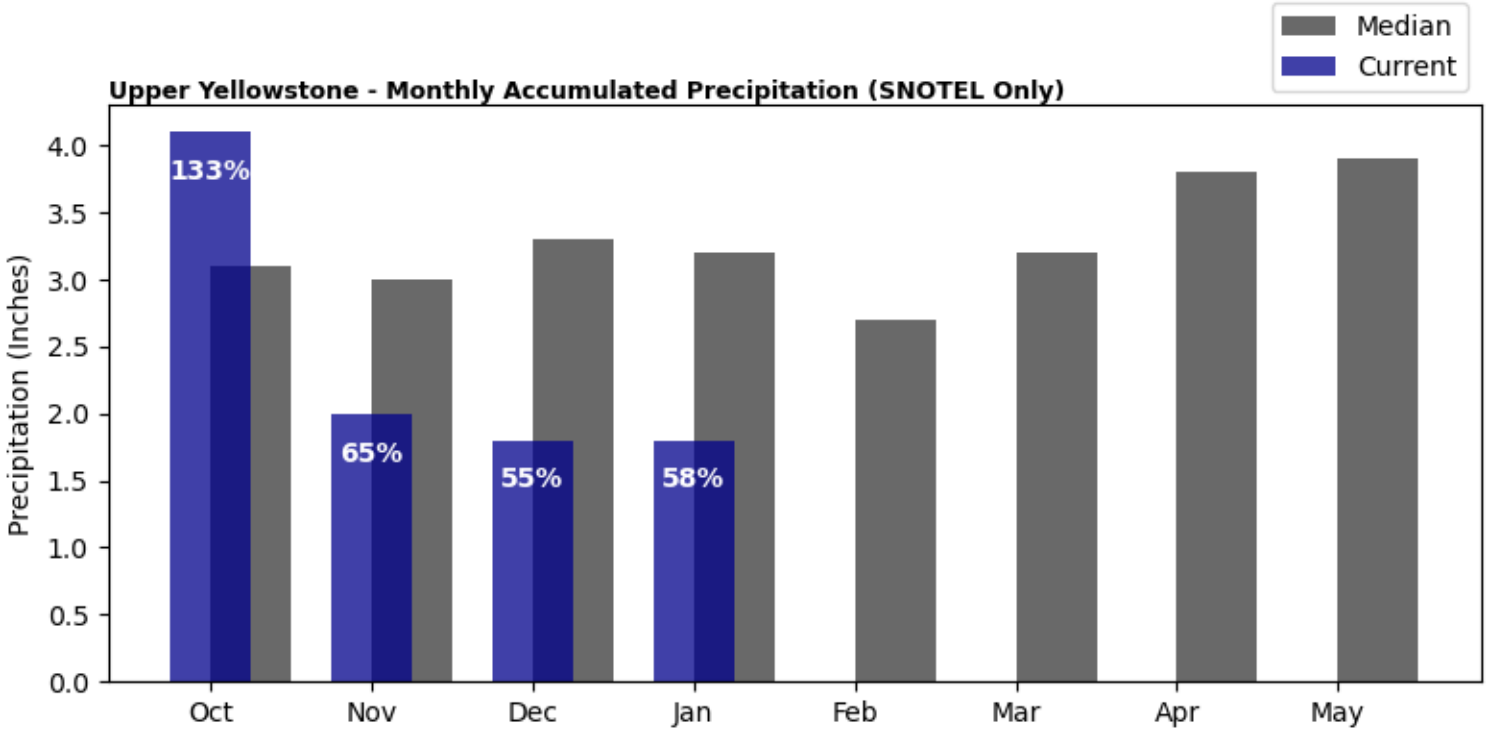


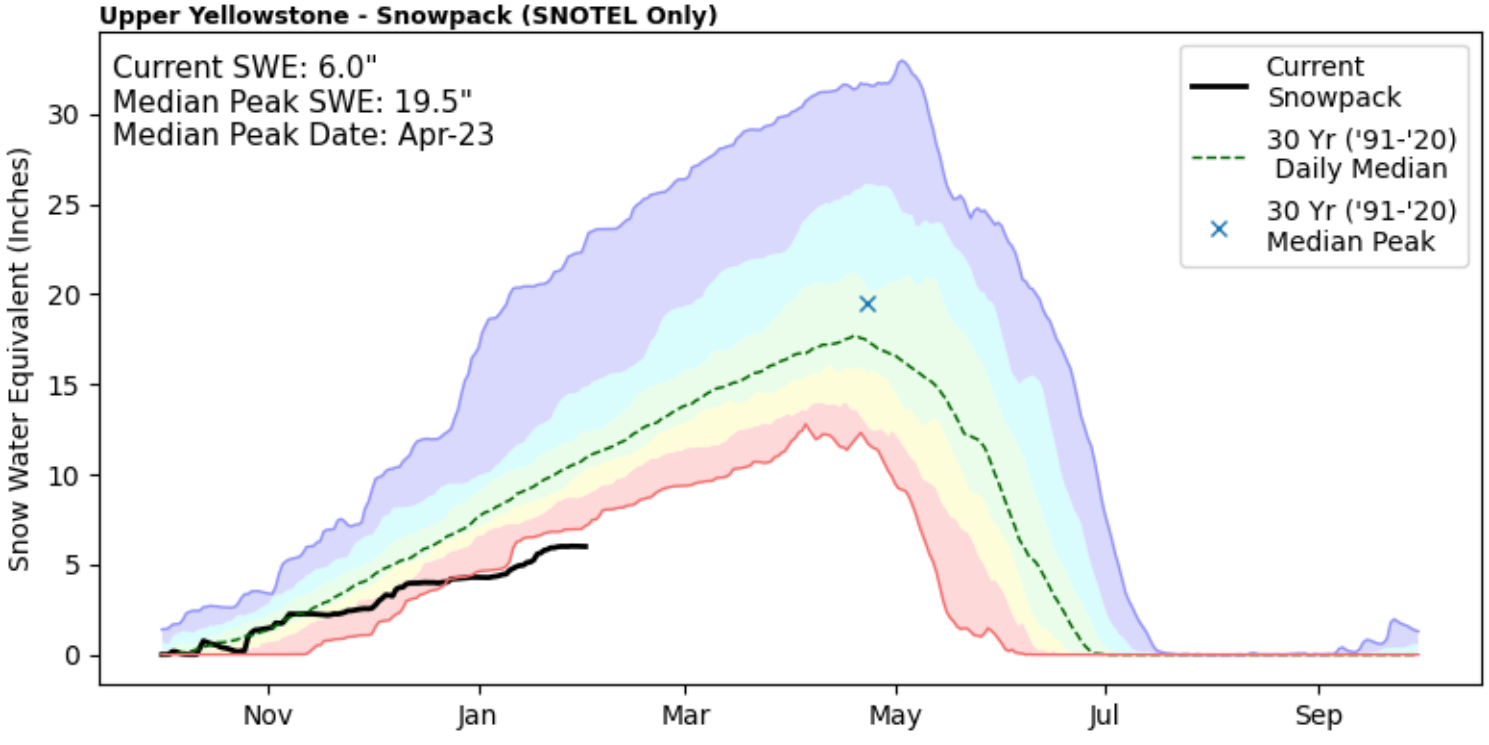


Basin Overview

Upper Yellowstone

Precipitation in January was well below normal at 58%, which brings the seasonal accumulation (October-January) to 76% of median. The snowpack in the Upper Yellowstone is well below normal at 55% of median, compared to 100% at this time last year.

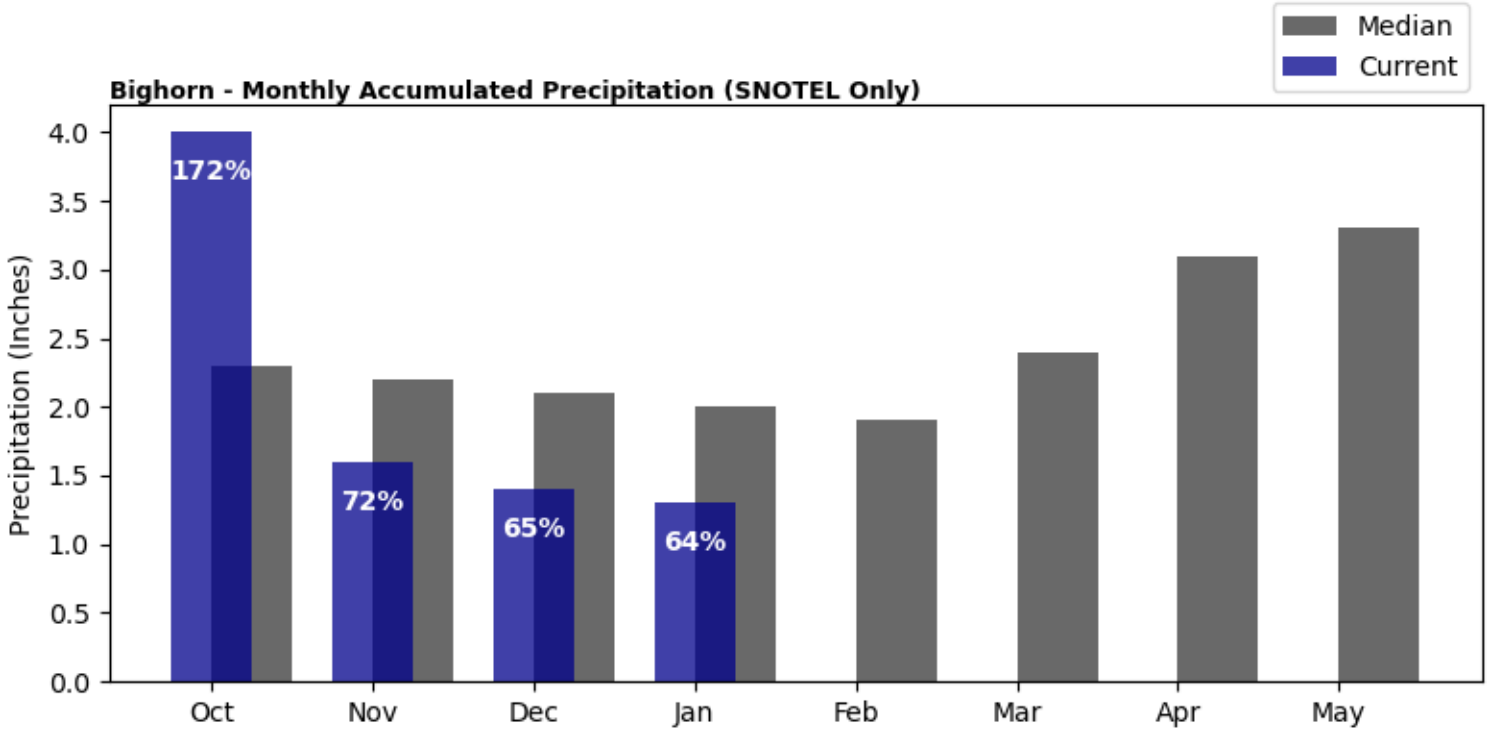


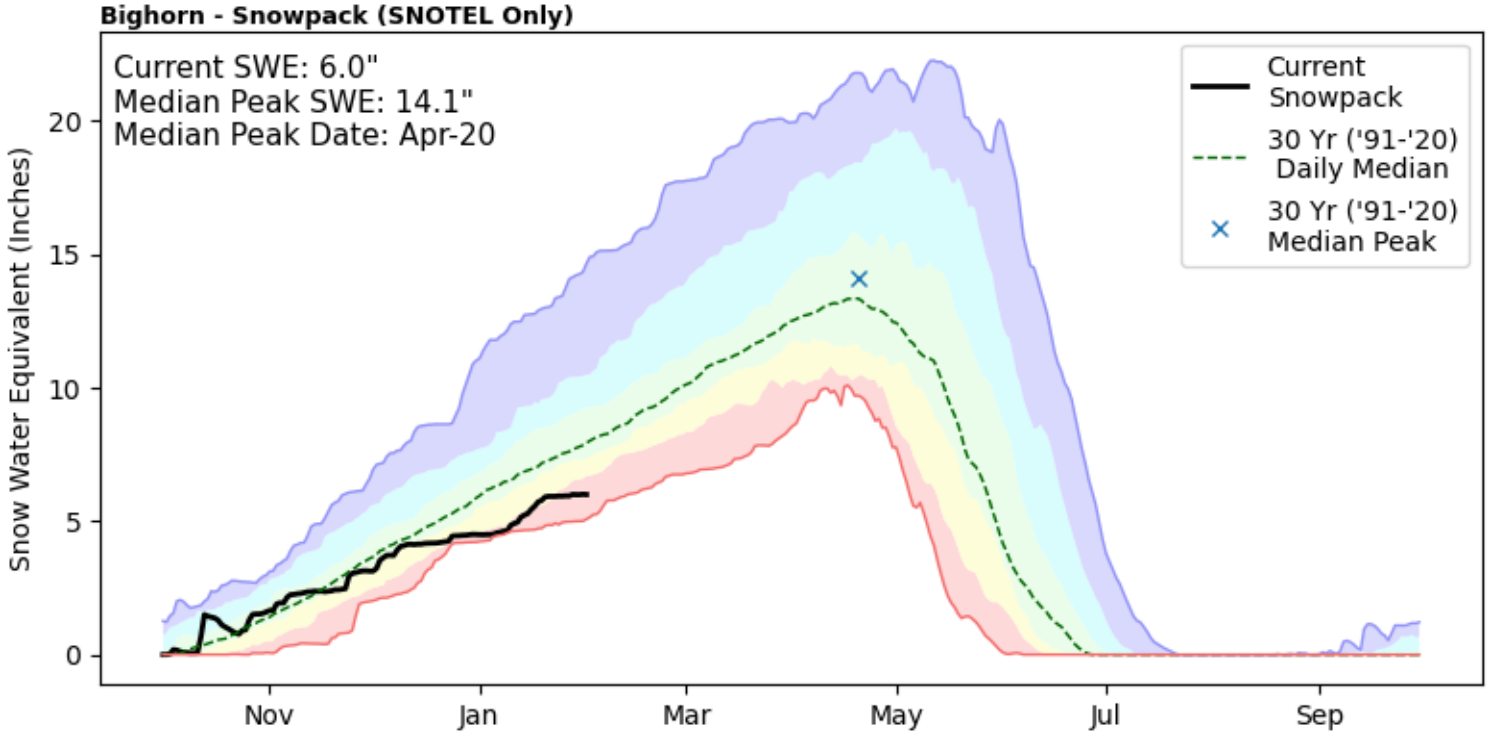


Basin Overview

Bighorn

Precipitation in January was well below normal at 64%, which brings the seasonal accumulation (October-January) to 93% of median. The snowpack in the Bighorn is well below normal at 74% of median, compared to 115% at this time last year.

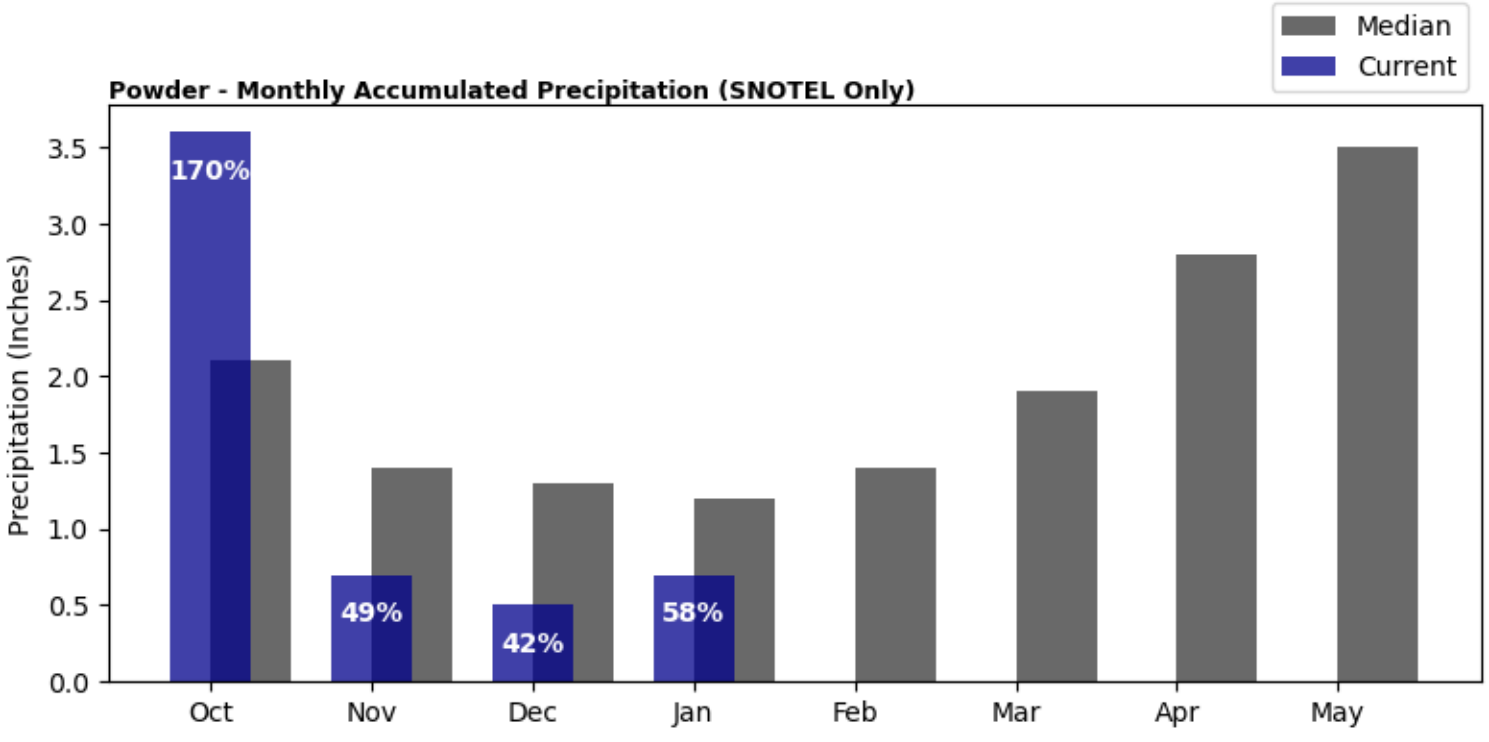


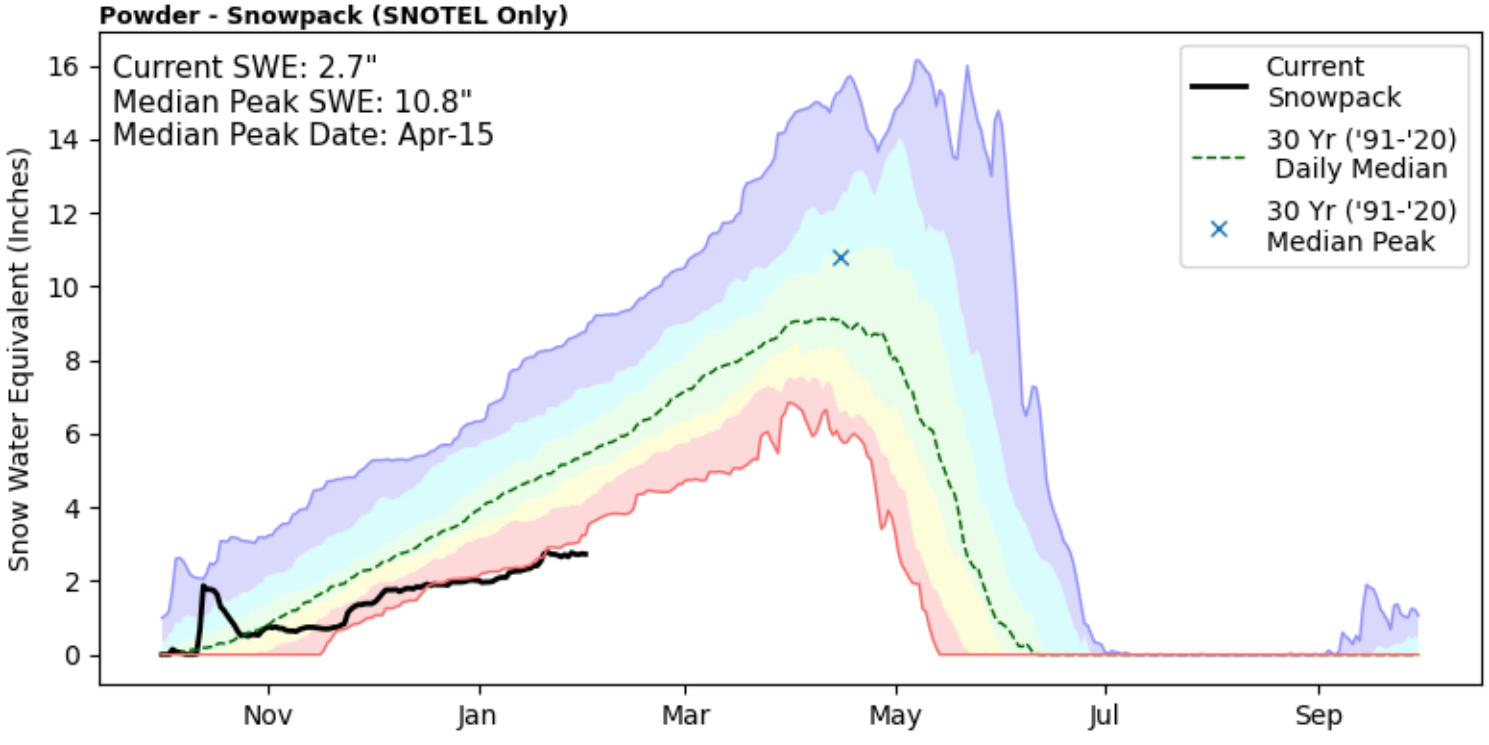


Basin Overview

Powder

Precipitation in January was well below normal at 58%, which brings the seasonal accumulation (October-January) to 88% of median. The snowpack in the Powder is well below normal at 51% of median, compared to 114% at this time last year.

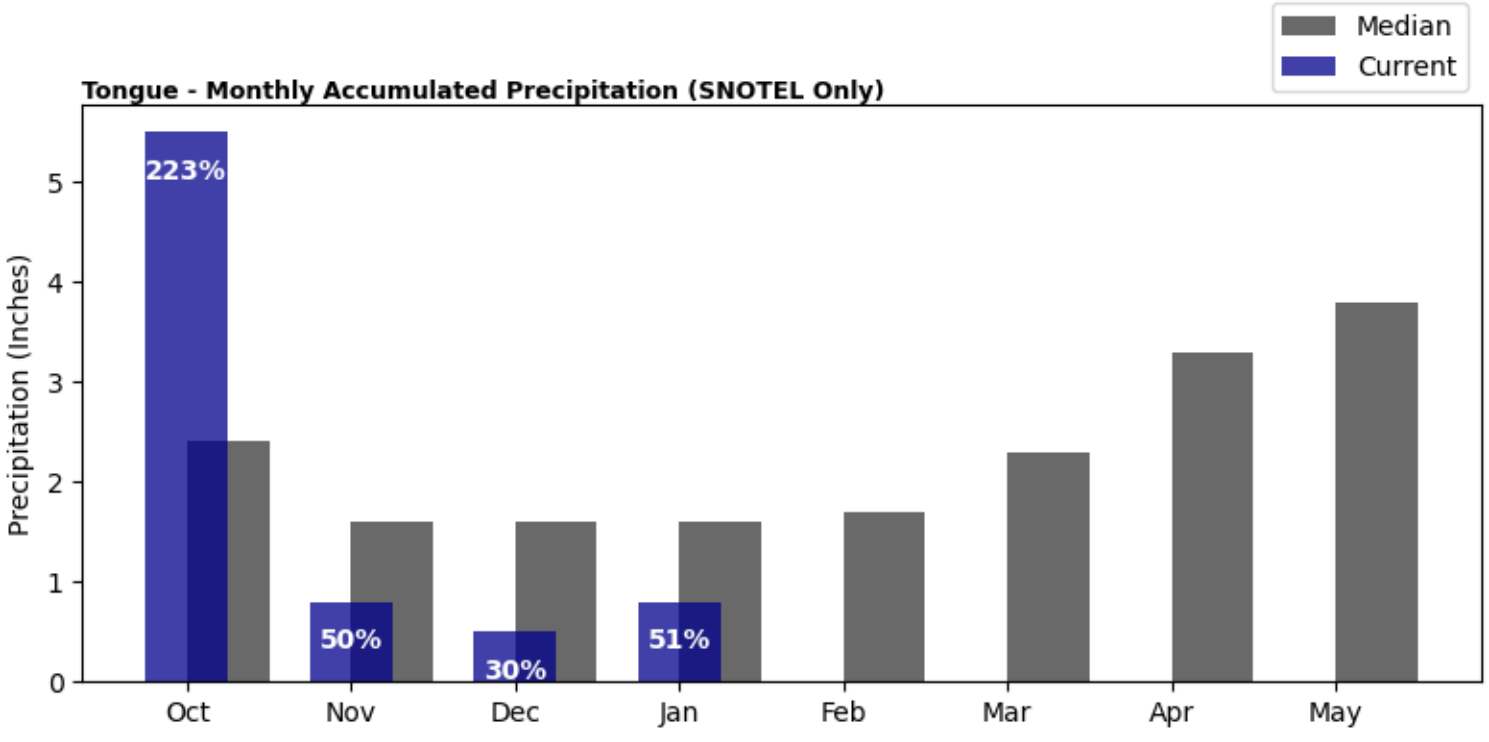


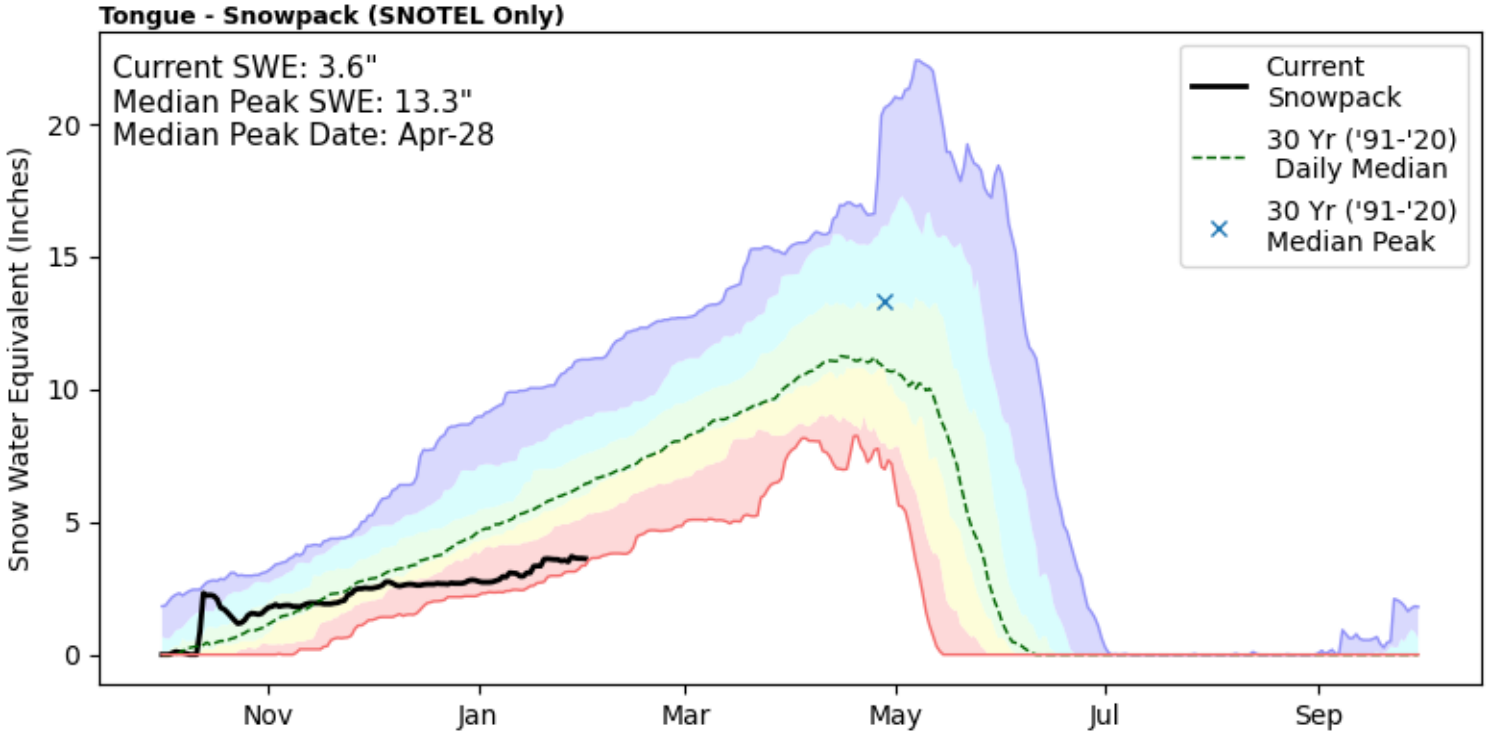


Basin Overview

Tongue

Precipitation in January was well below normal at 51%, which brings the seasonal accumulation (October-January) to 101% of median. The snowpack in the Tongue is well below normal at 60% of median, compared to 108% at this time last year.



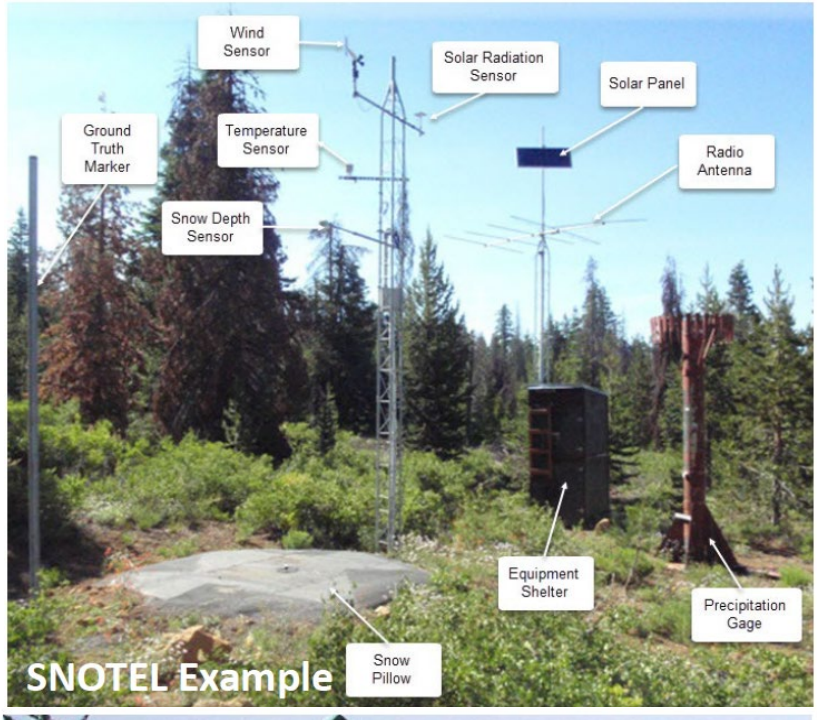


Appendix

Monitoring Station Overview

SNOTEL

The NRCS operates an extensive, automated data collection network called SNOTEL (short for Snow Telemetry). SNOTEL sites are designed to operate unattended in remote mountain locations. Data are collected and transmitted hourly and available on the internet. Daily data (midnight values) are quality checked by NRCS hydrologists on at least a weekly basis. SNOTEL sites provide snowpack water content data via a pressure-sensing snow pillow. Other data include snow depth, water year precipitation accumulation, air temperature with daily maximums, minimums, and averages. The earliest NRCS SNOTEL sites have data back to the mid-1970s.



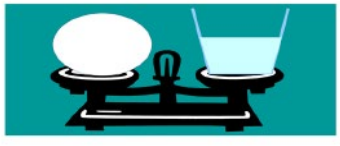
Snow Course

Snow courses are measurement transects where snow tubes are used by snow surveyors during the winter season to determine the depth and water content of the snowpack. Hollow snow tubes are used to vertically core the snowpack. The tubes are then weighed to determine the water content of the snow. Generally, snow courses are situated in meadows or forest openings protected from the wind. A snow course measurement is the average of a number of sample points, typically 5 or 10. Snow courses are measured on a monthly basis typically between January 1 and June 1. Snow courses provide a longer record than SNOTEL. The earliest snow courses in the Montana have data back to the 1920s.

Snow Water Equivalent (SWE)

Sometimes also called snow water content, this is the amount of water contained within the snowpack. It can be thought of as the depth of water (in inches) that would result if you melted the snowpack. For example, if a snowpack containing 12 inches of SWE melted instantaneously, there would be a puddle of water 12 inches deep on the ground.

SWE measurements made by snow pillows or snow tubes rely on the fact that water weighs the same whether it is liquid or frozen.



Weight of frozen water = Weight of liquid water

Snow core inside snow tubes

Appendix

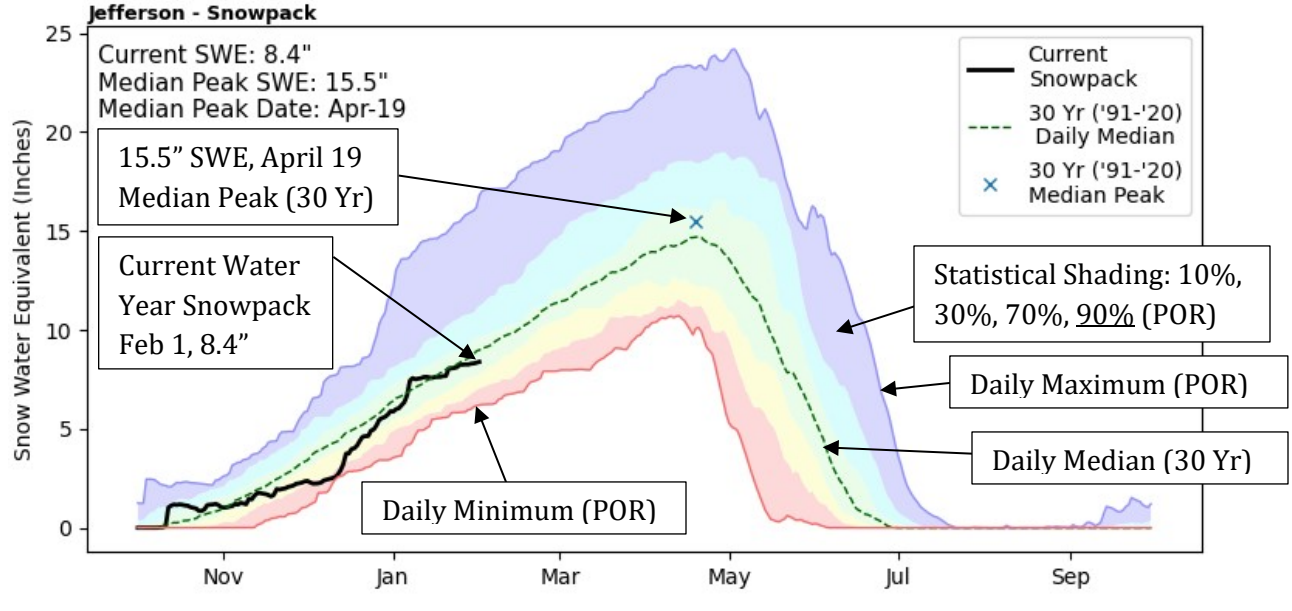
Additional Information

Climatic and Hydrologic Normals

The Snow Survey and Water Supply Forecasting (SSWSF) normals are site-specific measures of central tendency (either the median or average) for a data type, such as snow water equivalent (SWE). The statistics are calculated over a 30-year period and updated each decade, in agreement with World Meteorological Organization (WMO) standards. This 30-year reference period was chosen to characterize the current hydroclimatology at each station. The most recent medians and averages have been updated to include data for the water years 1991-2020. The National Water and Climate Center (NWCC) also provides medians and averages for the 1981-2010 and 1971-2000 reference periods for stations with sufficient data. The normals available from the NWCC include the median and average for SWE, snow depth (snow courses only), precipitation, volumetric streamflow, and reservoir storage. Values are calculated from data collected by NRCS-managed stations and external agencies such as the U.S. Geological Survey (USGS), National Weather Service (NWS), state agencies, and private organizations. Normal is calculated for various durations including daily, month-to-date, semi-monthly, monthly, seasonal, and annual based on the data type. More information is available here: https://www.nrcs.usda.gov/resources/data-and-reports/climatic-and-hydrologic-normals

Interpreting Snowpack Charts

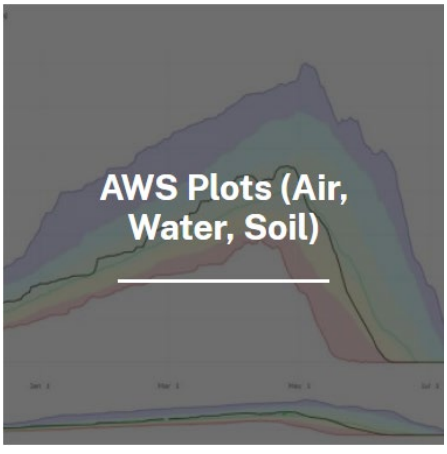
Snowpack charts displayed in this report are created using daily (midnight) snow water equivalent (SWE) values at SNOTEL sites determined to represent the basin. Snow Course data is not included. Plotted lines are the average of each SNOTEL's individual values. For example, the "Current Snowpack" on January 1st is the average all SNOTEL SWE values in that basin for that day. The "30 Yr. ('91-'20) Daily Median" is the average of each SNOTEL's median SWE value for a given day. The upper and lower extent (blue/red lines) show the maximum/minimum daily SWE values, which is determined using the "Current Snowpack" SWE value for all days in the period of record (POR). Snowpack peak SWE dates differ from season to season, as a result the high point on the "30 Yr. ('91-'20) Daily Median" line is not the true median peak SWE. The point "X" is plotted by calculating the median peak date and median peak value independently. Similar charts with other basin definitions are available here: https://nwcc-apps.sc.egov.usda.gov/basin-plots/#mt

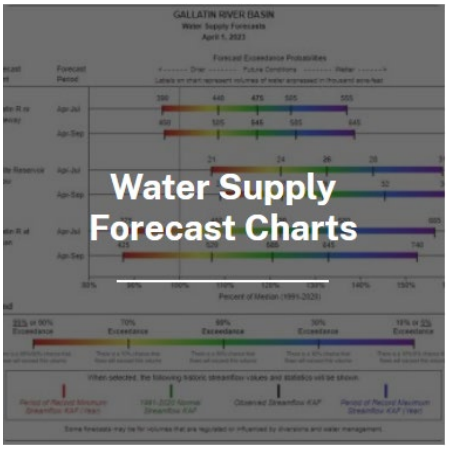


Appendix

Links and Resources

Products and Reports (click image)





Interactive Map Predefined Links

Snow

- Snow Water Equivalent > Daily > Percent of 1991-2020 Median > **Stations** | **Basins**
- Snow Water Equivalent > End of Previous Month (SNOTEL and Snow Course) > Percent of 1991-2020 Median > **Stations** | **Basins**
- Snow Depth > Daily > **Stations**
- Snow Density > End of Previous Month (SNOTEL and Snow Course) > **Stations**

Precipitation

- Month-to-Date > Daily > **Stations**
- Water Year-to-Date > Daily > Percent of 1991-2020 Median > **Stations** | **Basins**
- Previous Month > Percent of 1991-2020 Median > **Stations** | **Basins**
- Previous 3 Months > Percent of 1991-2020 Average > **Stations** | **Basins**

Streamflow

- Observed (Adjusted Volume) > Previous Month > Percent of 1991-2020 Median > **Stations** | **Basins**
- Forecast (Adjusted Volume) > Most Recent (Available March 1 through June 1) > Percent of 1991-2020 Median > **Stations** | **Basins**

Reservoir Storage

- End of Previous Month > Percent of 1991-2020 Median > **Stations**

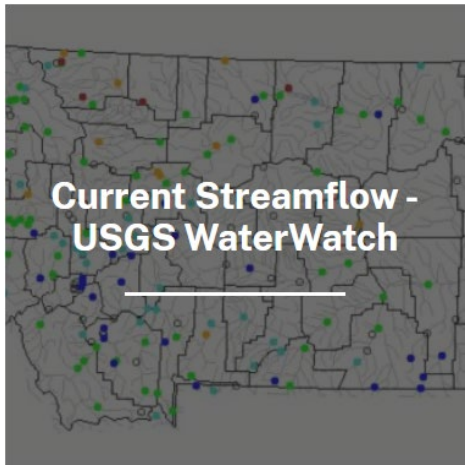
Other

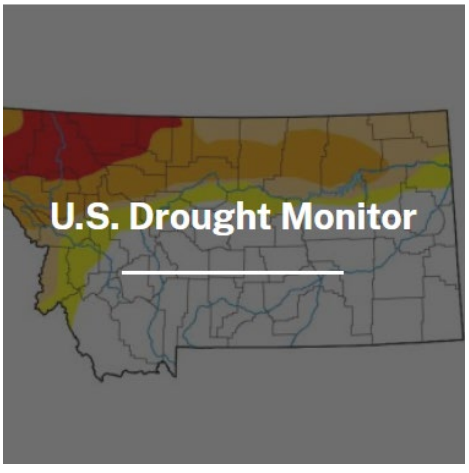
- Snow Water Equivalent > Daily > Compared to POR > **Stations**
- Snow Water Equivalent > End of Previous Month (SNOTEL and Snow Course) > Percentile > **Stations**
- Water Year-to-Date Precipitation > Daily > Compared to POR > **Stations**

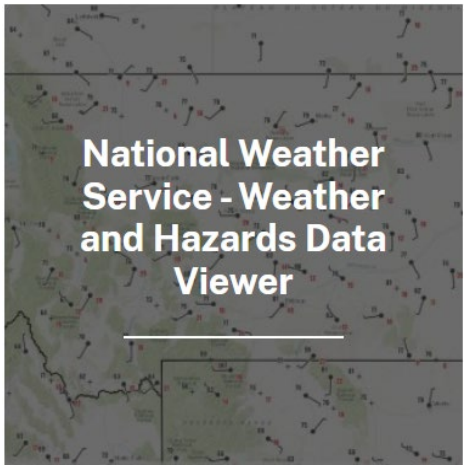
Appendix

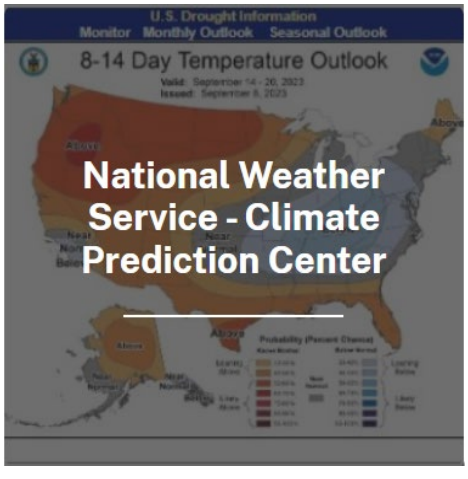
Links and Resources (Continued)

External Agencies (click image)









Additional Drought Information

- U.S. Drought Monitor
- National Integrated Drought System (Drought.gov)
- USDA Drought Portal (News and Resources)
- Farm Services Agency Montana News Releases (Information on Programs and Deadlines)
- Farm Services Agency Disaster Assistance Programs
- Montana Department of Natural Resources and Conservation Drought Management

Snow Survey Program FAQ

Frequently Asked Snow Survey Questions - Montana | Natural Resources Conservation Service (usda.gov)

Issued by:

Terry Cosby

Chief

Natural Resources Conservation Service

U.S. Department of Agriculture

Released by:

Tom Watson

State Conservationist

Natural Resources Conservation Service

Bozeman, Montana

Report Created by:

Montana Snow Survey Staff

Bozeman, Montana

mt-nrcs-snow@usda.gov

https://www.nrcs.usda.gov/montana/snow-survey

Montana Water Supply Outlook Report

Natural Resources Conservation Service