



Office of the Washington State Climatologist

March 2023 Report and Outlook

April 10, 2023

<http://www.climate.washington.edu/>

March Event Summary

Mean March temperatures were colder than normal throughout the entire state, tying 1985 as the 32nd coldest March since records began in 1895 (-2.9°F below the 1991-2020 normal). Temperatures were even more anomalous for other parts of the Pacific Northwest; Figure 1 shows March temperature anomalies between 4 and 10°F below normal for most of Oregon and Idaho. For Washington, total March precipitation was below normal for nearly the entire state. Averaged statewide, March ranked as the 41st driest with total precipitation 1.39” below normal.

March was relatively quiet in terms of station records. The month started with a substantial cold snap; Figure 2 shows the daily maximum and minimum temperatures and total precipitation at Hoquiam, where both minimum and maximum temperatures were below normal for nearly every day through the 15th. East of the Cascade Mountains was chilly too. Walla Walla set a record low minimum temperature of 25°F on the 7th, for example. Low elevation snow was common statewide from the start of March through the 11th. On the 10th, Spokane International Airport recorded a maximum snowfall record of 4.8” for

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the day. Precipitation that day fell as rain at Pasco, and set a daily maximum rainfall record of 0.34”.

Mean Daily Temperature Anomaly, Last Full Month
2023/03/01 - 2023/03/31

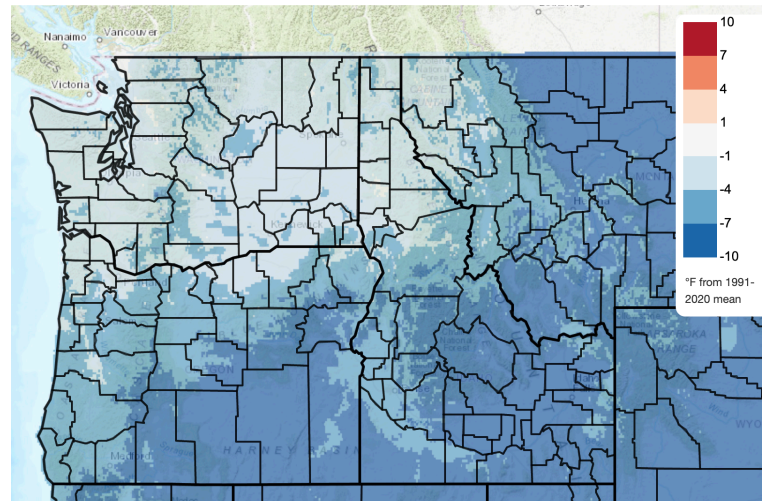


Figure 1: Mean March temperature anomalies for the Pacific Northwest relative to the 1991-2020 normal period ([Climate Toolbox](#)).

Temperatures warmed up just before St. Patrick’s Day, with widespread high temperatures reaching the 60s in western WA and 50s in eastern WA and a lack of precipitation. The spring-like respite lasted through the 22nd, long enough for seasonal allergy sufferers, this author included, to really notice the season change.

It was short-lived, however. Cooler than normal temperatures returned for the remainder of the month, with both isolated rain and snow showers around the state. Yakima tied a record daily minimum temperature of 21°F on the 26th. The exception to the overall light precipitation was the last day of the month, where heavy precipitation fell in western WA. Quillayute set a maximum daily rainfall record for the 31st with 1.40”.

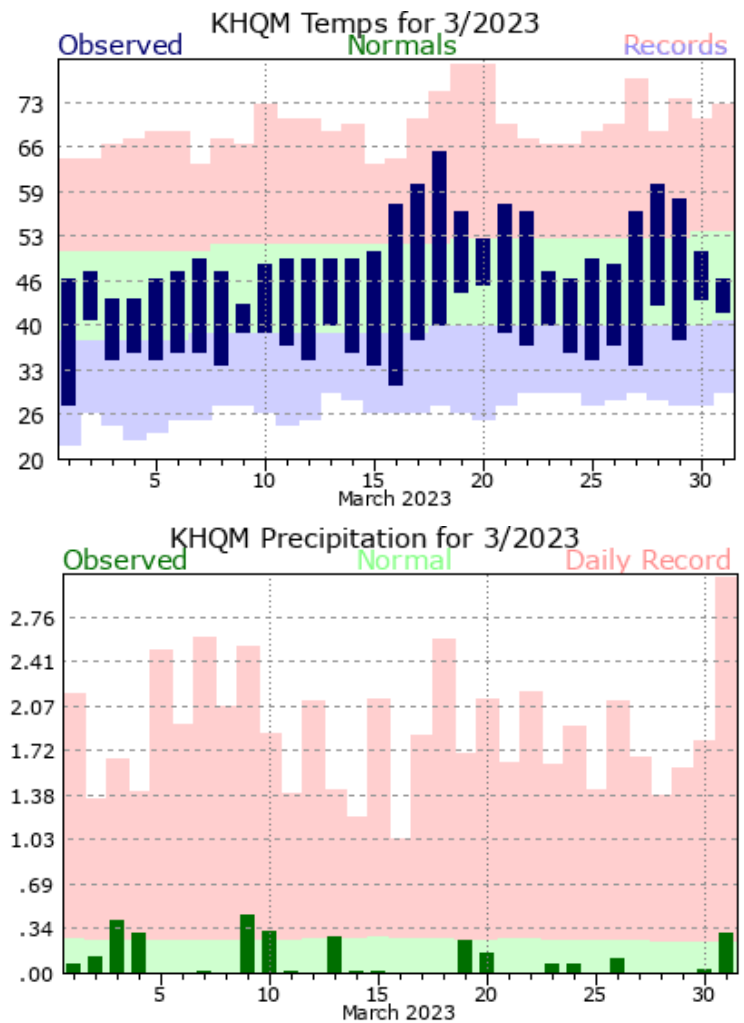


Figure 2: March 2023 daily temperatures for Hoquiam Bowerman Airport compared to the 1991-2020 normal (green envelope) and previous records (blue and red envelopes; [NWS](#)).

Snowpack and Drought Summary

Despite drier than usual March conditions, the colder than normal temperatures helped build and retain mountain snowpack. The Natural Resources Conservation Service (NRCS) basin average map as of April 5 (Figure 3) shows normal to above normal snowpack for almost all Washington basins. The Lower-Snake Walla Walla basin is particularly high with 131% of median. On the other hand, the North Puget Sound basin average snowpack is 85% of median. It seems unlikely that the western slopes of the northern

Cascades will improve to near-normal snowpack at this point in the season. This is an area that will be closely monitored for any potential signs of trouble, particularly for freshwater ecosystems later in the summer.

There have been some small changes to the U.S. Drought Monitor map (Figure 4) since the last edition of the OWSC newsletter. Some of the “abnormally dry” conditions were removed in western and central WA due to favorable water

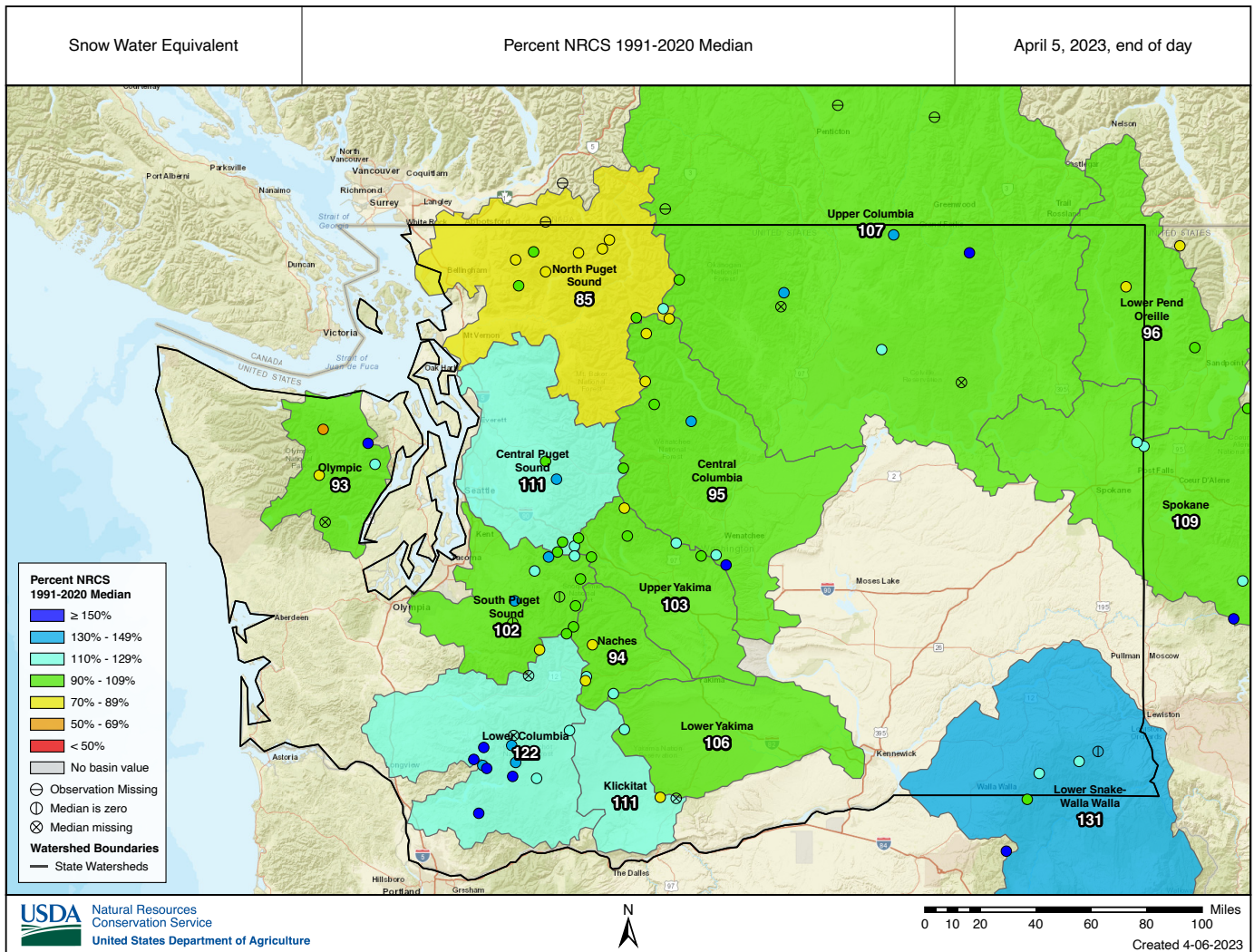


Figure 3: Snowpack (in terms of snow water equivalent) percent of normal for Washington as of April 5, 2023.

year-to-date totals. But there was also expansion of an area of “abnormally dry” in far eastern WA along the Idaho border and the introduction of “moderate drought” in northeastern WA. While snowpack is mostly favorable, the lack of precipitation has resulted in lower reservoir levels than usual. The Yakima basin, for example, [announced](#) on April 6 that junior water right holders will receive 82% of their April-Sept water supply. This forecast will be updated again in May. More on how the drier than usual conditions have impacted soil moisture is included in our feature piece below (page 4).

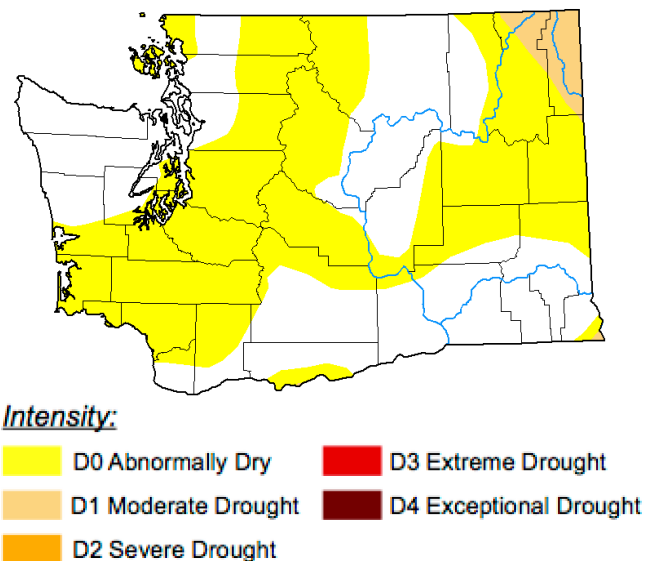


Figure 4: The April 6, 2023 edition of the [U.S. Drought Monitor](#).

Soil Moisture Contents in Washington State

A Message from the State Climatologist

As the readers of this newsletter are well aware, and for that matter everyone that was paying any kind of attention, the wet season last fall got a late start. Moreover, almost all of Washington state has received less precipitation than normal since the beginning of the calendar year, with the exception being a small region in the central portion of the state near the Columbia River. This was not anticipated given the presence of La Nina, which is usually – but importantly, not always – associated with relatively wet winters, especially on the west side of the Cascade Mountain crest.

But it is what it is, and going into spring 2023, the question is whether there are liable to be water

shortages during the upcoming dry summer season. On the other hand, the winter has also been on the cool side, resulting in a higher proportion of snow versus rain in the mountains than otherwise. An important consequence is that despite the reduced precipitation totals, our snowpack is in decent if not great shape, as reviewed above. From a summer water supply perspective we would like to point out that there is an additional factor, namely soil moisture conditions.

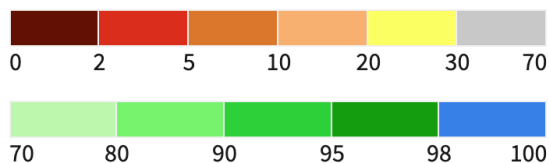
A map of soil moisture conditions for the Pacific Northwest for 30 March 2023 is shown in Figure 5. This analysis is from NASA's Short-term

Current Soil Moisture Conditions

[0–100 cm Soil Moisture Percentile](#) [20 cm Soil Moisture Percentile](#)

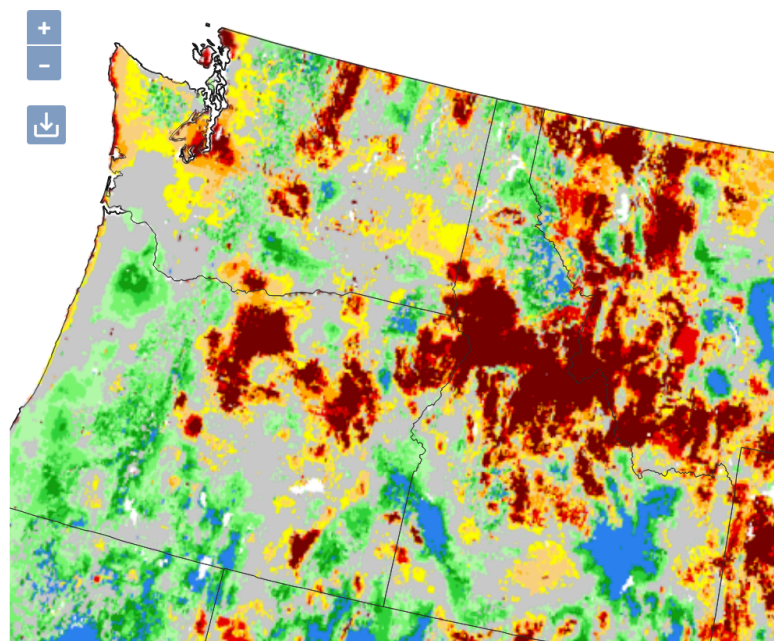
NASA's Short-term Prediction and Transition Center – Land Information System (SPoRT-LIS) provides high-resolution (about 3-km) gridded soil moisture products in real-time to support regional and local modeling and improve situational awareness. The 0–100 cm soil moisture percentile data has shown to be a utility for drought monitoring. The near-surface (0–10 cm) layer responds quickly to heavy precipitation and rapidly drying events. In deeper layers, soil moisture evolves more slowly and has demonstrated greater utility overall for drought monitoring purposes since drought evolves typically on timescales of weeks to years. [Learn more.](#)

0–100 cm Soil Moisture Percentile



*Currently, data are only available for the contiguous U.S.

Source(s): [NASA](#)



Updates Daily - 03/30/23

Figure 5: Soil moisture percentiles as of March 30, 2023 for the PNW from NASA's SPoRT-LIS and hosted on the [NIDIS website](#).

Prediction and Transition Center – Land Information System (SPoRT-LIS) and represents moisture contents in terms of percentiles over the 0-100 cm layer. There are patches of particularly low soil moisture right along the Pacific coast, in the vicinity of Puget Sound (especially the south part) and a north-south oriented strip along the eastern flank of the Cascades from the upper Yakima Valley into the Okanogan. Relatively dry soils are also present across much of the Palouse in the southeastern portion of the state, with potential implications for the wheat grown there, which is typically not irrigated. We note that there are a variety of real-time soil moisture analyses available, and there can be noticeable differences between them, but those distinctions are not the focus of the present piece. We also will not comment on the contributions of the extended summer of 2022 versus more recent lack of precipitation to the distribution of soil moisture in Figure 5, though it is likely that both factors are at play.

Instead we simply wish to point out that the lack of soil moisture in parts of the state may serve to delay and reduce the runoff from the snowpack. Relatively dry soil will wick up that much more melt water than usual as it moves from the surface down to the water table, resulting in lower streamflows. The effects of soil moisture are included in the Ensemble Prediction System (ESP) used by the Northwest River Forecast Center to make water supply forecasts, and are liable to be a significant if not necessarily dominant factor in their forecasts of reduced summer flows for some of our streams. The current natural April-September water supply forecast (Figure 6) shows below normal streamflows in Okanogan and Spokane counties (between 55 and 71% of normal). April-September water supply forecasts are between 80 and 89% of normal for many more rivers throughout the state. But the atmospheric faucet is not due to be shut off quite yet, and at least from a water perspective, here's hoping for some decent rains over the next couple of months, and especially nothing like the exceptionally dry spring of 2021.

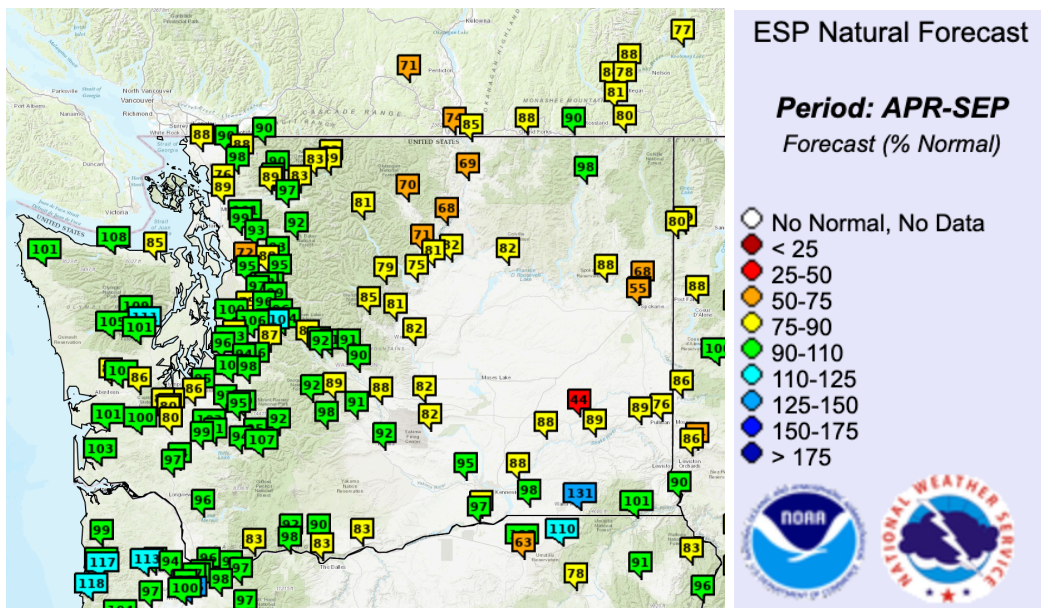


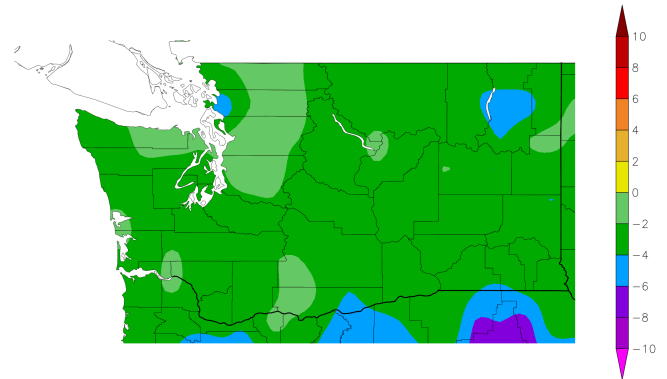
Figure 6: April-September 2023 natural water supply forecast in percentage of normal for WA as of March 30, 2023 from the NWS Northwest River Forecast Center. [Forecasts](#) are updated daily.

Climate Summary

Similar to February, average March temperatures were below normal statewide. According to the map from the High Plains Regional Climate Center and Table 1, average March temperatures were between 2 and 4°F below normal across most of the state. Pullman was the coldest location relative to its normal of the stations listed in Table 1, with mean temperatures 4.0°F below normal. Temperature anomalies for some of the Puget Sound locations were not as great. Bellingham, for example, was 1.4°F below normal for the month (Table 1).

Total March precipitation was also similar to February in that it was below normal for a majority of the state. Large portions of western, north central, and eastern Washington received only 25 to 70% of normal precipitation. Omak and Wenatchee, for example, measured only 34 and 52% of normal, respectively (Table 1). The southern border of the state received a bit more precipitation relative to normal, and eastern Yakima county actually received above normal March precipitation. A few other locations in eastern WA, namely eastern Okanogan and parts of Grant counties, enjoyed above normal precipitation.

Departure from Normal Temperature (F)
3/1/2023 – 3/31/2023

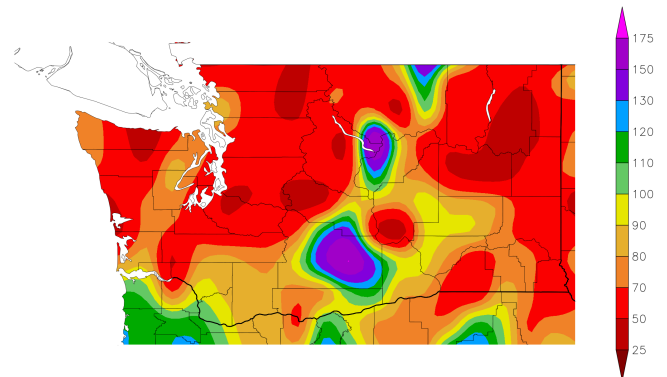


Generated 4/2/2023 at HPRCC using provisional data.

NOAA Regional Climate Centers

March temperature (°F) departure from normal relative to the 1991-2020 normal (HPRCC).

Percent of Normal Precipitation (%)
3/1/2023 – 3/31/2023



Generated 4/2/2023 at HPRCC using provisional data.

NOAA Regional Climate Centers

March total precipitation percent of 1991-2020 normal (HPRCC).

Station	Mean Temperature (°F)			Precipitation (inches)			Snowfall (inches)		
	Avg	Norm	Departure from Normal	Total	Norm	Percent of Normal	Total	Norm	Percent of Normal
Western Washington									
Olympia	41.6	44.1	-2.5	3.43	5.68	60	M	M	-
Seattle WFO	45.1	46.6	-1.5	2.93	3.86	76	0	0	0
SeaTac AP	44.4*	47.1	-2.7	2.56	4.17	61	T	0.4	0
Quillayute	41.9	43.9	-2.0	8.95	11.78	76	M	M	-
Hoquiam	44.6	45.8	-1.2	2.60*	7.74	34**	M	M	-
Bellingham AP	43.7	45.1	-1.4	1.77	3.36	53	M	M	-
Vancouver AP	43.9	47.2	-3.3	4.53	3.95	115	M	M	-
Eastern Washington									
Spokane AP	37.6	40.0	-2.4	1.11	1.83	61	9.1	3.9	233
Wenatchee	39.9	43.1	-3.2	0.38	0.73	52	M	M	-
Omak	39.1	41.8	-2.7	0.36	1.06	34	M	M	-
Pullman AP	37.1	41.1	-4.0	1.27	1.95	65	M	M	-
Ephrata	40.4	42.9	-2.5	0.52	0.70	74	M	M	-
Pasco AP	43.7	45.8	-2.1	0.60	0.69	87	M	M	-
Hanford	43.0	46.2	-3.2	0.50	0.55	91	0.5	0.5	100

Table 1: March 2023 climate summaries for locations around Washington with a climate normal baseline of 1991-2020. *One day of temperature is missing from SeaTac Airport. **Precipitation observations are missing for 2 days at Hoquiam.

Climate Outlook

According to the Climate Prediction Center (CPC), neutral El Niño-Southern Oscillation (ENSO) conditions are present in the equatorial Pacific Ocean. The long-lasting La Niña that began in the latter portion of 2020 finally ended last month. ENSO models indicate the probability of continuing neutral conditions at 83% during April-June and 49% for June-August. After that, there are higher chances of El Niño conditions, with a 63% chance by October-December 2023.

The CPC outlook for April (Figure 7) is calling for higher than usual odds of below normal temperatures statewide. April precipitation is expected to be above normal for the whole state, with higher odds of above normal precipitation in western WA (between 40 and 50%).

The three-month April-May-June (AMJ) temperature outlook is uncertain; there are equal chances of below, equal to, or above normal temperatures (Figure 8). The AMJ precipitation outlook is calling for below normal precipitation for the whole state. The odds of below normal precipitation are higher for western WA and north central WA, specifically between 40 and 50% on the three-tiered scale. The remainder of the state has a 33-40% chance of below normal precipitation.

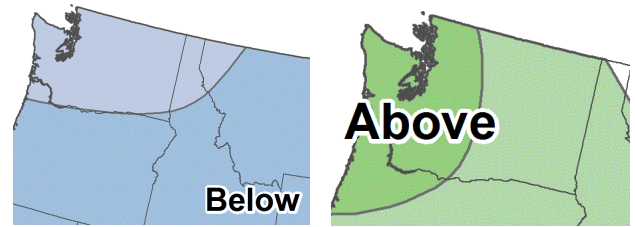


Figure 7: April outlook for temperature (left) and precipitation (right).

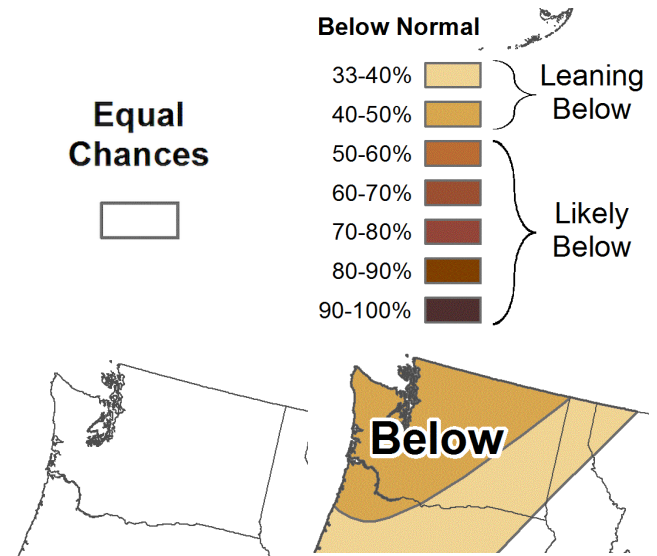
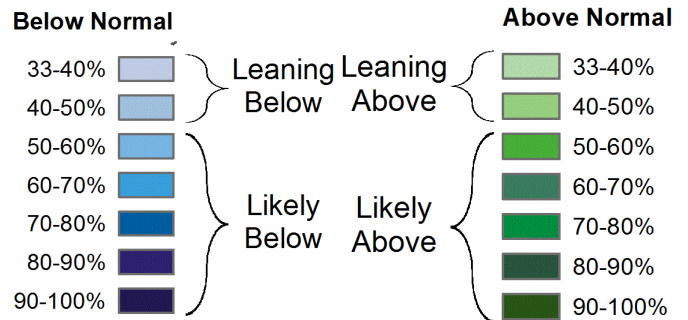


Figure 8: April-May-June outlook for temperature (left) and precipitation (right) (Climate Prediction Center).