Office of the Washington State Climatologist

May 2021 Report and Outlook

May 6, 2021

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

April Event Summary

Average April temperatures were above normal for a majority of WA State, though there were a few locations with near-normal or below normal temperatures. Precipitation, on the other hand, was consistently below normal for April throughout the state, and set records. Table 1 shows a sampling of weather stations in which April 2021 precipitation ranked among the top 10 driest on record. Notably, several stations in the Lower Columbia Basin (Richland, Pasco, Lind) had their driest April on record. But it was dry in western WA too, and Table 1 shows a sample of western WA stations that ranked between the 2nd and 8th driest April on record.

If you feel like you have déjà vu reading that first paragraph, it's not just you. The last edition of our newsletter reported on the remarkably dry March conditions, with plenty of stations with totals ranking among the top ten driest. As a result, the last 2 months have been record dry in parts of WA. Figure 1 shows that nearly the entire state ranks in the bottom 10% of the record for March-April 2021 precipitation.

While the lack of April precipitation is certainly the biggest climatological story to report on, there were also two notable temperature events, on opposite sides of the spectrum. Both of these can be illustrated by a time series of daily

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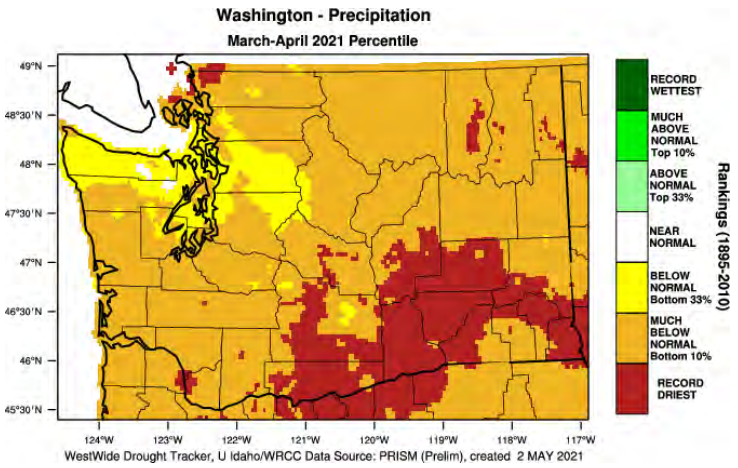


Figure 1: March-April 2021 precipitation percentiles compare to the 1895-2010 record for WA (WestWide Drought Tracker).

Station	April Precipitation (in)	Rank	Record (Amount; Year)	Records Began
Richland	0	1		1945
Pasco Tri Cities AP	T	1		1998
Lind 3 NE	0.03	1 (tie)	0.03"; 1949	1931
Hoquiam	1.57	2	0.78"; 1956	1954
Pullman 2 NW	0.27	3	0.16"; 1956	1941
Olympia AP	0.92	3	0.37"; 1956	1942
Quillayute AP	2.43	3	1.78"; 2004	1966
Walla Walla AP	0.22	3	0.15"; 1956	1949
Wenatchee Pangborn	0.02	3 (tie)	T; 1977 & 1966	1960
Bellingham AP	1.10	4	0.35"; 2004	1949
SeaTac AP	1.03	8	0.33"; 1956	1945
Spokane AP	0.21	9	0.08"; 1956	1956

Table 1: April 2021 precipitation rankings (driest to wettest) for selected WA stations.

temperatures at Yakima Airport for the month (Figure 2). Cold and below freezing overnight temperatures were reported around the state in the second week of the month. On the 11th, record low morning temperatures were reported at Pullman (21°F), Yakima (21°F), Pasco (23°F), Spokane (23°F), Olympia (27°F - tie), Walla Walla (27°F), Vancouver (28°F - tie), Bellingham (29°F), Wenatchee (29°F - tie), Hoquiam (30°F), and SeaTac AP (34°F). This was due to a high pressure set up that brought a clear night with calm winds that allowed the overnight temperatures to drop as much as they did.

A warm spell for the region several days later was also associated with high pressure, in this case over British Columbia, resulting in northeasterly flow and subsidence heating. High temperatures records were broken over several days. For example, high temperatures records were set at Quillayute (72°F) on the 14th and at Olympia (76°F - tie), SeaTac AP (75°F), and Bellingham (70°F) on the 15th. On the 18th, Yakima (85°F), Olympia (82°F), SeaTac (80°F - tie), Hoquiam (80°F - tie), Quillayute (79°F), and Bellingham (74°F) set high temperature records. This warm event also heralded the start of significant melting of the snowpack in our mountains for the season.

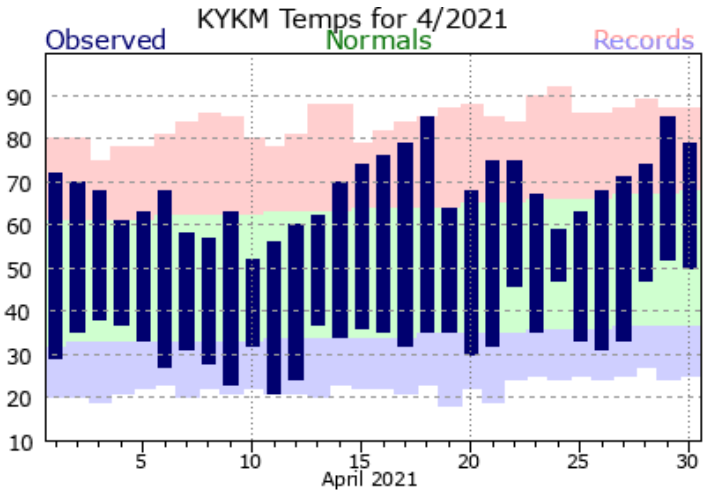


Figure 2: April 2021 daily temperature and precipitation for Yakima Airport compared to normal (green envelope). NWS

Snowpack and Drought Monitor Summary

Even with warm and dry April conditions, the snowpack has remained healthy throughout most of WA. The basin average snow water equivalent (SWE) percent of normal from the Natural Resources Conservation Service (NRCS) as of May 1 is shown in Figure 3. The Olympic Mountains, North Cascades and Central Cascades, and the west slopes of the Southern Cascades still have between 108 and 187% of normal SWE. The Lower Yakima, however, was impacted more by the warm spell in mid-April, and the snowmelt has been faster than average there, resulting in a basin average SWE of 57% of normal. The 2021 water year precipitation and SWE trace for Green Lake (5920') in that basin (Figure 4) shows SWE building through April 15, but then a steep drop off as melt began. The Lower Pend Oreille, Spokane, and Lower Snake-Walla-Walla are also below normal (between 67 and 80% of normal) as of May 1.

As a result of the dry March and April conditions, there has been continued degradations made to the U.S. Drought Monitor (Figure 5). There is now "abnormally dry" and "moderate drought" conditions shown in western WA and the areas of "abnormally dry", "moderate drought", and "severe drought" have expanded in eastern WA. The area of D2 (severe drought) in Figure 5 closely matches the record dry March-April map shown in Figure 1, but there are also longer term dry conditions in this region. The good news is that the latest forecast out of the Bureau of Reclamation is still expecting that both the Yakima River Basin senior and junior water users will receive 100% of their water allotment due to the healthy snowpack at higher elevations.

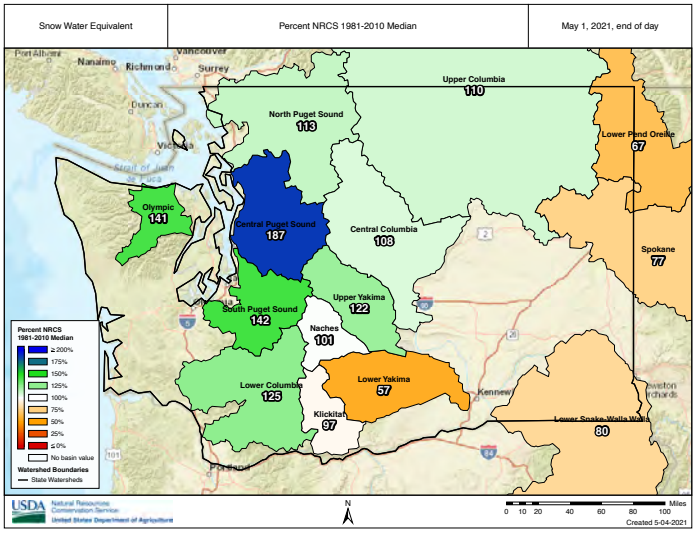


Figure 3: Snowpack (in terms of snow water equivalent) percent of normal for Washington as of May 1, 2021 (from NRCS).

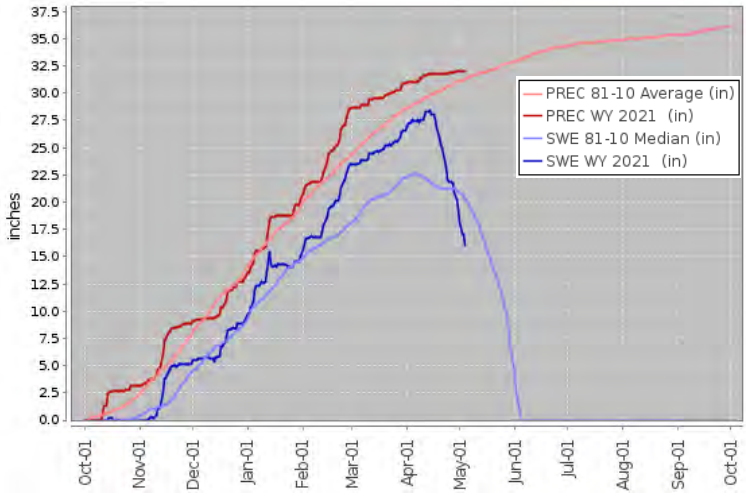


Figure 4: 2021 water year precipitation (dark red) and snow water equivalent (dark blue) compared to normal (light red and light blue, respectively) for the Green Lake NRCS Snotel station (NRCS).

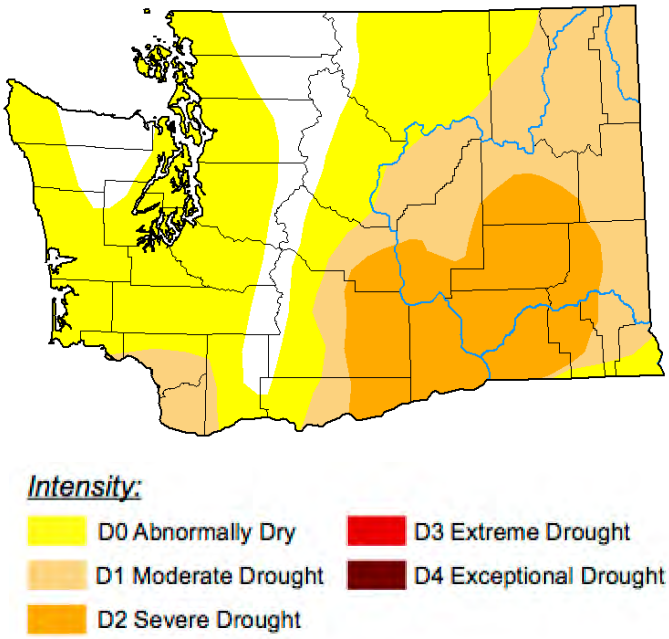


Figure 5: The May 6, 2021 edition of the U.S. Drought Monitor.

Report Your Drought Impacts

Are you experiencing a drought impact? Your on-the-ground observations are critical in helping us understand the broad picture of drought in the state. The National Drought Mitigation Center and partners have developed Condition Monitoring Observer Reports on Drought (CMOR-drought), a short survey that allows the public to enter their observations regarding crops, water supply, fire, etc. We would greatly appreciate your input, and there's now a mobile app to make reporting easier!

Localized Projections of Heavy Rain Events

Our colleagues at the University of Washington Climate Impacts Group, in collaboration with many others, have released a new tool to help stormwater and wastewater managers design and operate with climate change in mind. The tool allows easy viewing of localized projections of changing heavy rain events through the end of the 21st century for the Northwest.

We are posting this here because UW Climate Impacts Group scientists Harriet Morgan and Guillaume Mauger, as well as King County's Bob Swarner, are hosting an informational webinar on the tool that may be of interest to our readers, particularly if you are a water utility manager. An introduction to the tool will be given, and Bob Swarner will describe how King County is using the projections in wastewater planning.

Webinar:
Thursday, May 20, 2021
4-5 pm
Register

A Review of Winter 2020-21

A message from the State Climatologist

As we head toward warmer temperatures, this is the time of year where we like to look back and review the WA state winter conditions. A moderate La Niña event developed early in fall of 2020, and the Climate Prediction Center (CPC) seasonal forecasts were calling for warmer and wetter than normal conditions for WA for the fall months. By November and December, however, a more typical La Niña response was predicted, with cooler and wetter conditions forecast for December through February (DJF) and January through March (JFM). So how did the winter actually play out? Here we summarize the winter ENSO conditions, average temperature and precipitation anomalies for WA, and corresponding snowpack with the current implications for summer water supplies.

La Niña conditions developed early in fall of 2020, and a moderate event persisted through the winter. Figure 6 shows the 3-month running mean of the sea-surface temperature (SST) anomalies for the Nino3.4 region of the equatorial Pacific Ocean (known as the Oceanic Nino Index) from 2013 through early 2021. The CPC issued a "La Niña Advisory" in September 2020, which happens to be still in effect at the time of this writing, and the SST anomalies in the equatorial Pacific Ocean were below -1°C for much of the winter. Currently, there is an expectation that the La Niña will transition to neutral conditions over the next several months. Early indications show about an equal chance of either La Niña or neutral conditions for winter 2021-22; we will be monitoring the state of the tropical Pacific because of its importance to the seasonal weather of the Pacific Northwest.

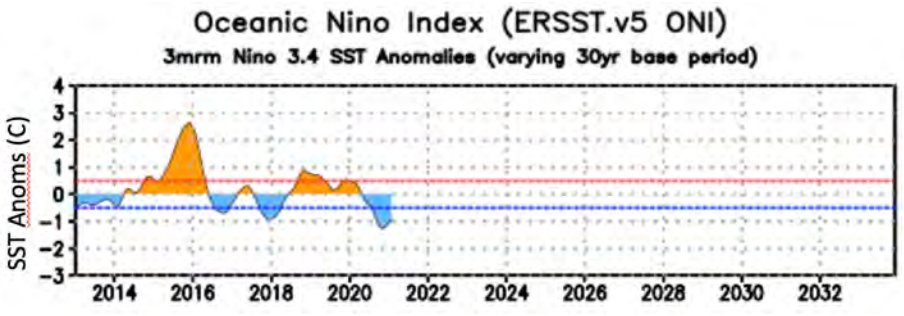


Figure 6: The 3-month Oceanic Niño Index based on the sea-surface temperatures in the Niño3.4 region of the equatorial Pacific Ocean from 2013 through 2021 (from Climate Prediction Center).

Figure 7 shows the departure from average temperature and percent of normal precipitation across the state from October 2020 through March 2021. Averaged statewide, both temperatures and precipitation were near-normal, with temperatures +0.9°F above the 1981-2010 normal and precipitation at 102% of normal. Ranking 126 historical Oct-Mar periods, temperatures were in the warmest quarter historically, specifically as the 22nd warmest. As shown in Figure 7, temperatures were generally warmer than normal east of the Cascade crest, ranging between 1 and 3°F above normal. Parts of the northern Puget Sound region were cooler than normal for Oct-Mar. There was some variability in precipitation as well, with some of the Lower Columbia Basin only receiving between 55 and 85% of normal precipitation. This region is the same area that experienced precipitation deficits last winter (2019-20) and is therefore experiencing both short and long-term dryness.

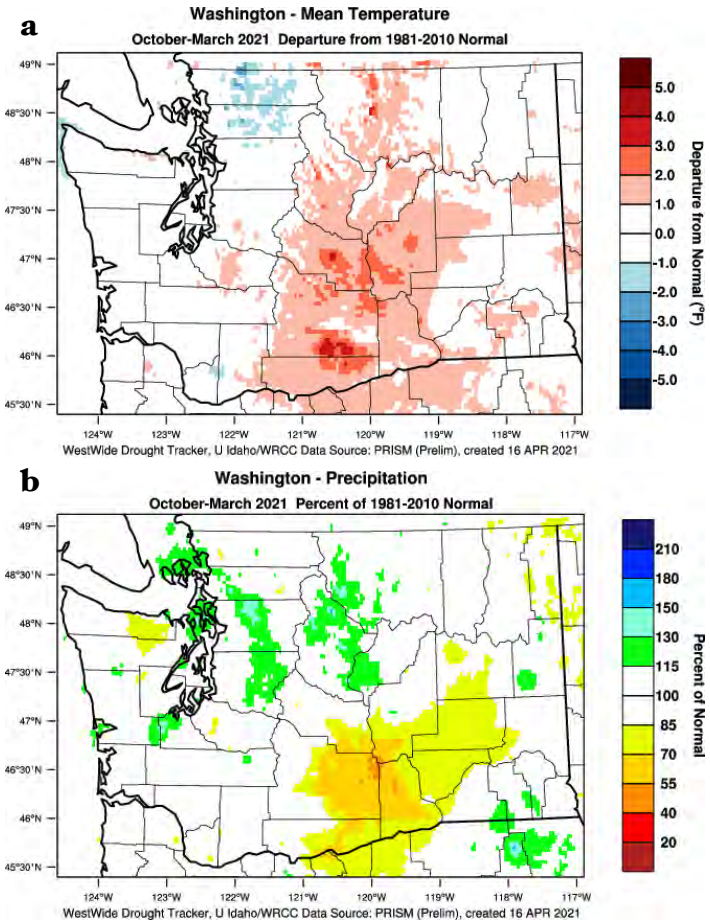


Figure 7: October 2020 through March 2021 (a) average temperature departure from the 1981-2010 normal and (b) precipitation percent of normal for WA state (from Westwide Drought Tracker).

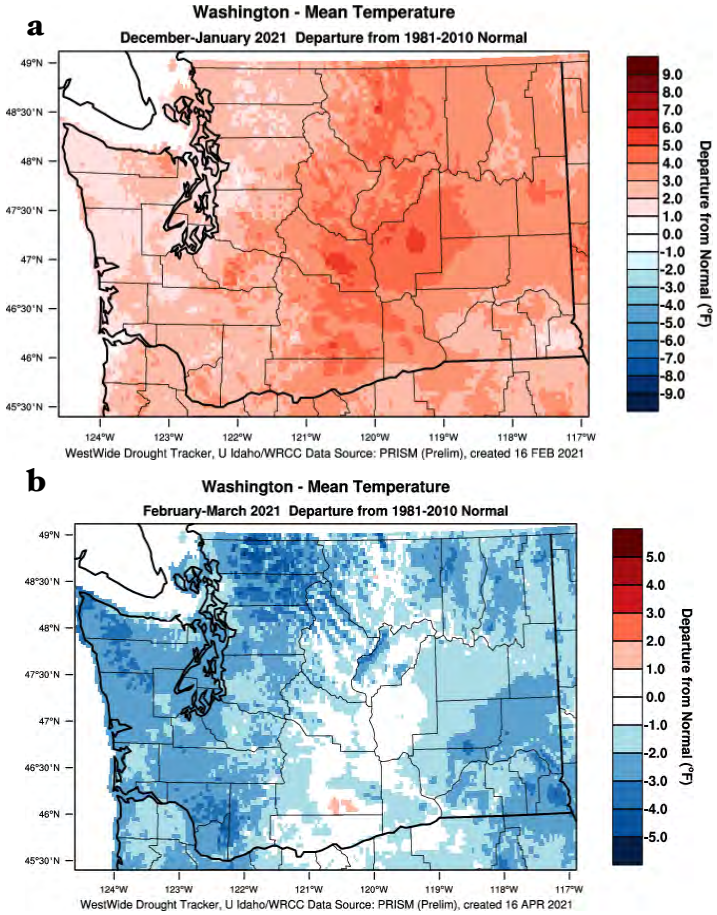


Figure 8: Temperature departures from the 1981-2010 normal for a) December-January 2020/21 and b) February-March 2021 in WA (from Westwide Drought Tracker).

There was also some substantial monthly variability within the winter. Statewide average temperatures were near-normal for October and November with a mix of wet and dry regions. December and January were considerably warmer than normal. Together, the two-month period ranked as the 10th warmest on record, with temperatures ranging between 1 and 5°F above normal (Figure 8a). For precipitation, those two months were wetter than normal for most of the state (not shown), so despite the warmth, snowpack was still able to build. The exception was the Lower Columbia Basin, where drier than normal conditions prevailed. A transition occurred near the end of January to below normal temperatures and above normal precipitation with a fairly strong rainshadow effect east of the Cascades. Figure 8b shows February-March 2021 temperature departure from normal, with temperatures between 1 and 4°F below normal. The near-normal temperatures just east of the Cascade crest are a result of colder than normal February temperatures and warmer than normal March temperatures essentially cancelling each other out for that particular area. As illustrated in Figure 9, the contrast between the relative warmth of the early part of our winter versus its latter portion is associated with a change in the

regional circulation. December and January in the mean had anomalous south to south-southwesterly flow aloft over WA, and hence a tendency for a warm source for our air masses. That switched in February, as the anomalous northwesterly flow over WA in Feb-March favored cooler and wetter conditions, which more typically accompanies La Niña.

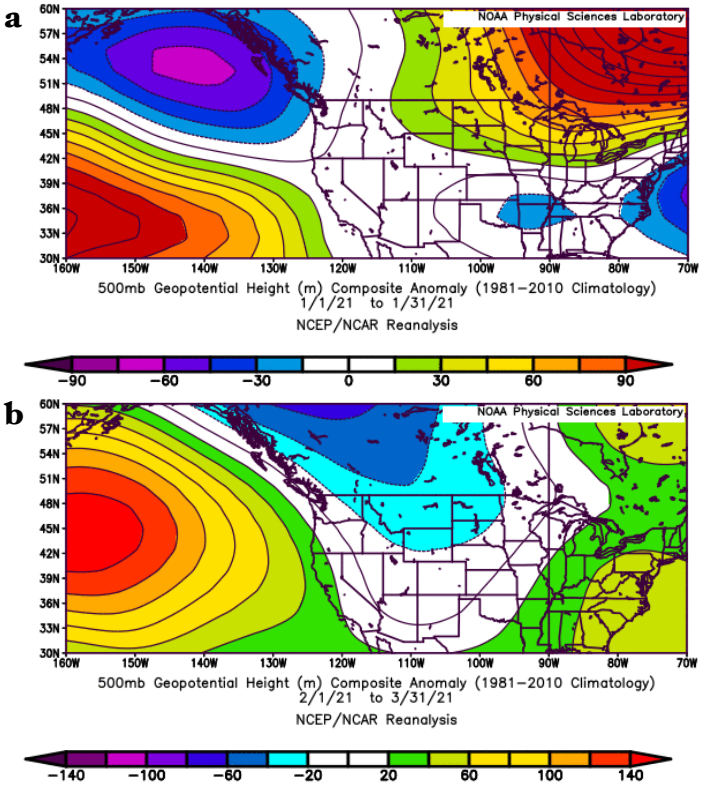


Figure 9: 500 hPa geopotential height anomalies for a) January 2021 and b) February/ March 2021 from the NCEP/NCAR Reanalysis (from ESRL).

The cooler and wetter pattern that began in February brought huge gains in snowpack in the mountains. By April 1 (Figure 10), snowpack was above normal (119-152% of normal) throughout the Cascade and Olympic Mountains. However, the picture isn't all completely rosy. March and April were exceptionally dry; March ranked as the 11th driest on record and the two months combined (Figure 11) only received between 5 and 50% of normal precipitation for a majority of the state.

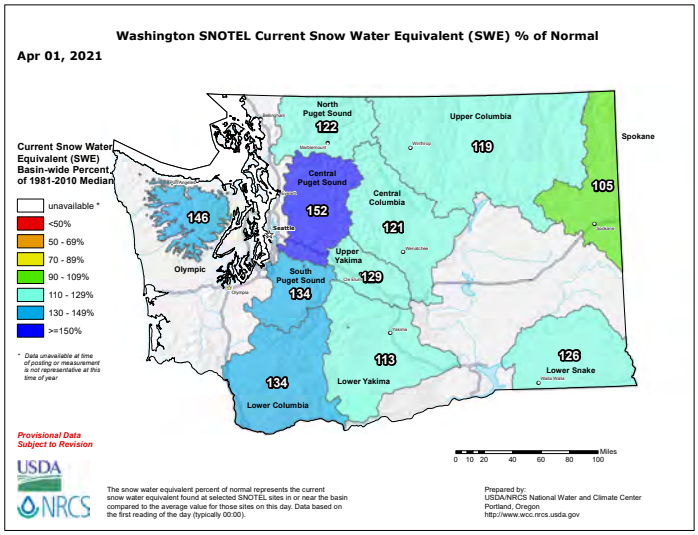


Figure 10: Basin-average snow water equivalent (SWE) on April 1, 2021 for WA (from NRCS).

March and April are still relatively wet months climatologically, and the precipitation deficits range between 3 and 12" of precipitation for the two months combined. In addition, a warm spell in mid-April caused a period of pronounced melting of our mountain snow around the state. Temperatures in the coming weeks will dictate whether we see early meltout, or whether cooler temperatures cause a more typical meltout curve through May and June. The Apr-Sept streamflow natural forecast as of April 29 indicates below normal streamflow in southwest and southeast WA. Low forecasts that range between 40 and 49% of normal streamflow are shown for the South Fork of the Palouse at Pullman, as well as the Newaukum near Chehalis, and the Chehalis near Centralia, Grand Mound, and Doty. The rivers on the coast and in southwest and southeast WA that have below normal forecasts are primarily rainfed, and are responding to the recent drier than normal weather. The snowmelt driven rivers throughout the Cascades and Olympics have normal to above normal Apr-Sept streamflow predicted.

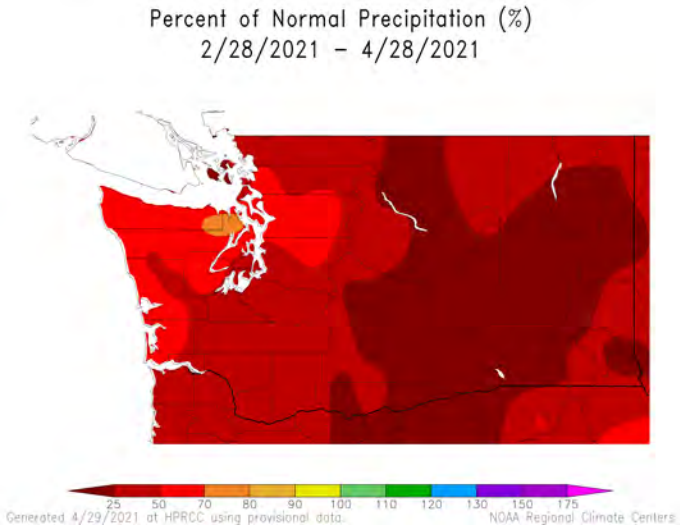


Figure 11: Percent of normal precipitation for 60 days (Feb 28-Apr 28) in WA (from HPRCC).

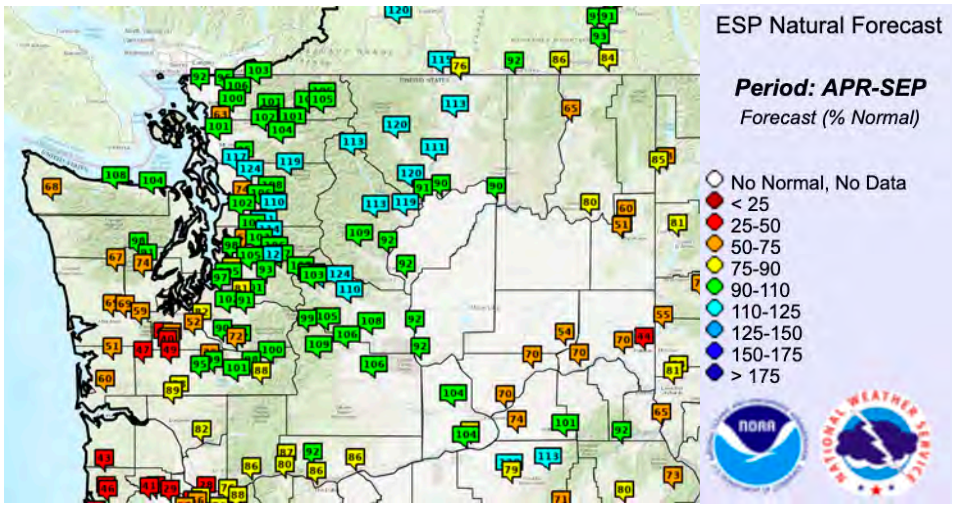


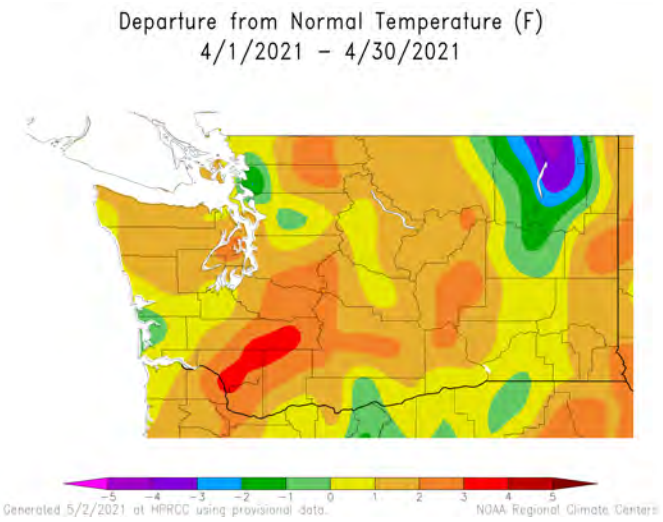
Figure 12: April through September 2021 natural water supply forecast in percentage of normal for WA as of April 29, 2021 from the NWS Northwest River Forecast Center. Forecasts are updated daily.

In summary, our wet season had near-normal temperatures and precipitation, averaged statewide. There was variability though; notably eastern WA had above normal temperatures and the Lower Columbia Basin was both warm and dry relative to normal. The CPC seasonal forecasts for December-February and January-March were right in calling for wetter than normal conditions, on average, though the below normal temperatures did not come into fruition until February, and for the season as a whole, conditions were on the warm side. The dry conditions experienced this spring so far, were also not predicted by the CPC. Both the recent dryness and the Northwest River Forecast Center's streamflow forecast indicate that conditions will need to be watched closely this spring and summer as some water supply issues may arise. In particular, there may be implications for dryland agriculture in the Lower Columbia Basin, where soil moisture is already low due to long-term dryness.

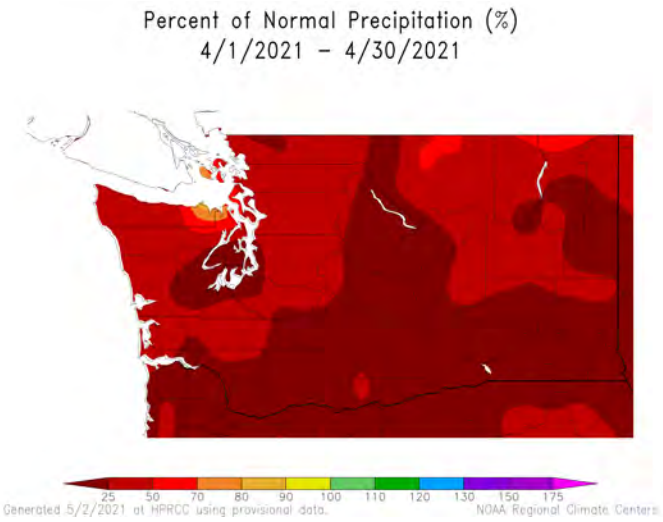
Climate Summary

Average April temperatures were above normal for a majority of WA state. According to the map from the High Plains Regional Climate Center, southwestern WA was an especially warm spot, with an area that had April temperatures between 3 to 4˚F above normal. Otherwise, a majority of the state had April temperatures 1 to 2˚F above normal, which is shown in both the map and in Table 2. An area covering most of Ferry and Stevens counties had below normal April temperatures.

The lack of April precipitation is the more interesting aspect of the month, because it was record-setting in many instances. The HPRCC map shows that nearly the entire state received less than 50% of normal April precipitation, with many locations below 25% of normal. Spokane Airport, Ephrata, and Wenatchee received a measly 16, 15, and 4% of normal precipitation, respectively (Table 2). Pasco reported only a trace, while Hanford didn't receive any rain at all for the month. Totals were bleak in western WA as well, with the stations listed in Table 2 only receiving about 30-40% of normal precipitation. Please note that the snowfall column was removed from the April summary as there was only one station with a report of a trace (Spokane AP).



April temperature (˚F) departure from normal relative to the 1981-2010 normal (HPRCC).



April total precipitation percent of 1981-2010 normal (HPRCC).

Station	Mean Temperature (°F)			Precipitation (inches)		
	Average	Normal	Departure from Normal	Total	Normal	Percent of Normal
Western Washington						
Olympia	49.2	48.3	0.9	0.92	3.54	26
Seattle WFO	52.1	50.5	1.6	0.96	2.77	35
SeaTac AP	53.0	50.3	2.7	1.03	2.71	38
Quillayute	47.6	46.7	0.9	2.43	7.85	31
Hoquiam	48.7	48.7	0.0	1.57	5.10	31
Bellingham AP	50.7	48.4	2.3	1.10	2.69	41
Vancouver AP	53.3	52.1	1.2	0.33	3.01	11
Eastern Washington						
Spokane AP	49.1	47.0	2.1	0.21	1.28	16
Wenatchee	53.0	51.6	1.4	0.02	0.46	4
Omak	51.5	50.0	1.5	0.48	1.04	46
Pullman AP	47.8	46.1	1.7	0.40	1.56	26
Ephrata	52.1	50.4	1.7	0.07	0.48	15
Pasco AP	54.0	52.9	1.1	T	0.65	0
Hanford	56.1	53.6	2.5	0.0	0.57	0

Table 2: April 2021 climate summaries for locations around Washington with a climate normal baseline of 1981-2010. The normal listed for the Hanford station is for the 1991-2020 period.

Climate Outlook

According to the Climate Prediction Center (CPC), La Niña conditions are still present in the equatorial Pacific Ocean but the transition to neutral conditions is expected to occur soon. There has been warming that has moderated the sea surface temperature (SST) anomalies in the equatorial Pacific Ocean over the last four weeks, though the SSTs are still below normal. ENSO forecast models indicate an 80% chance of a return to neutral conditions by May-June-July.

The CPC outlook for May (Figure 13) has equal chances of below, equal to, or above normal temperatures and precipitation for nearly the entire state. A small area in northeastern WA has slightly increased chances of above normal precipitation for May.

The three-month outlook for May-June-July (MJJ) (Figure 14) has increased chances of above normal temperatures for eastern WA. Western WA has equal chances of below, equal to, or above normal temperatures. For precipitation, there are increased chances of below normal precipitation for the entire state for MJJ, which is distressing in light of developing drought conditions, particularly in south-central WA.

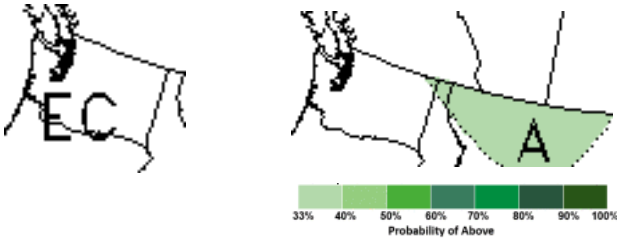


Figure 13: May outlook for temperature (left) and precipitation (right).

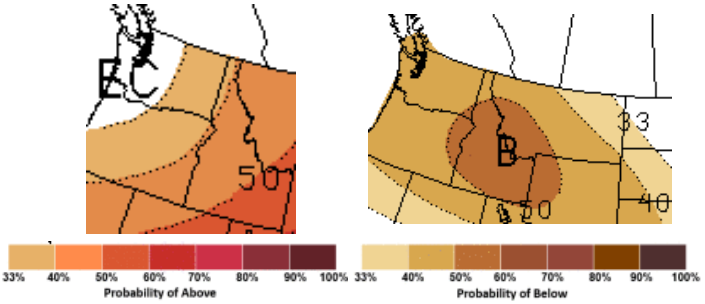


Figure 14: May-June-July outlook for temperature (left) and precipitation (right) (Climate Prediction Center).