Office of the Washington State Climatologist

October 2023 Report and Outlook

November 14, 2023

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

October Event Summary

Mean October temperatures were above normal across most of Washington State. Averaged statewide, October temperatures tied 1929 as the 19th warmest on record, 1.9°F above the 1991-2020 normal. Total October precipitation was below normal for most of the state, with some exceptions, as is often the case. Averaged statewide, it was the 36th driest since records began in 1895 (with 63% of normal). More information on the October precipitation is provided in the "Climate Summary" below.

Figure 1 shows the October daily temperatures and precipitation at Olympia Airport. A period of above normal temperatures early in the month, then again mid-month, and below normal minimum temperatures later in the month are notable features common at weather stations around the state for the past month. On the 6th,

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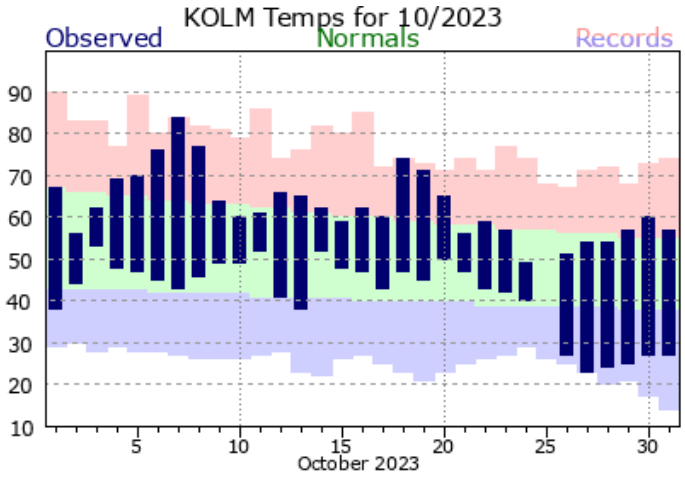


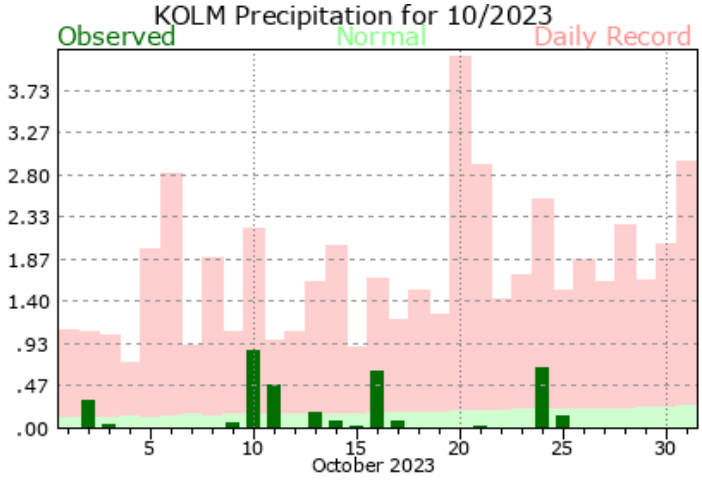


Figure 1: October 2023 daily temperatures (left) and precipitation (right) for Olympia Airport compared to the 1991-2020 normal (green envelope) and previous records (blue and red envelopes; NWS).

record high maximum temperatures were set on the coast (e.g., Quillayute; 84°F and Hoquiam; 81°F - tie). On the 7th, Olympia (84°F), Quillayute (80°F), SeaTac Airport (79°F), the Seattle Weather Forecasting Office (79°F), and Bellingham (77°F) set record high maximum temperatures.

Heavy precipitation fell at Olympia Airport and across the rest of the state on the 10th (Figure 2). According to volunteer CoCoRaHS observers, more than an inch fell in the 24 hours ending the morning of the 11th in southwest WA and the Olympic Peninsula. The National Weather Service also confirmed a weak tornado near La Center in Clark County on the afternoon of the 11th. The 16th was another heavy precipitation day for parts of western WA. Dallesport tied a record maximum rainfall the following day (10/17) with 0.11".

Temperatures were above normal for a part of the 3rd week of the month. On the 18th, record high maximum temperatures were set at Olympia (74°F) and SeaTac (71°F). Eastern WA saw record high maximum temperatures on the 19th (Pullman - 77°F; Spokane AP - 76°F; Yakima - 76°F; Walla Walla - 76°F tie; Ephrata - 72°F tie) and 20th (Ellensburg - 79°F; Ephrata - 77°F; Yakima - 77°F tie; Wenatchee - 74°F).

The end of the month finally saw snow in the mountains and colder than normal temperatures. In the lowlands, record low minimum temperatures were set at Pullman (17°F - tie), Bellingham (23°F), Hoquiam (27°F), and the Seattle Weather Forecasting Office (31°F). The mountain snow was short-lived as warmer and wetter than normal conditions kicked off November, the climatologically wettest month of the year in WA.

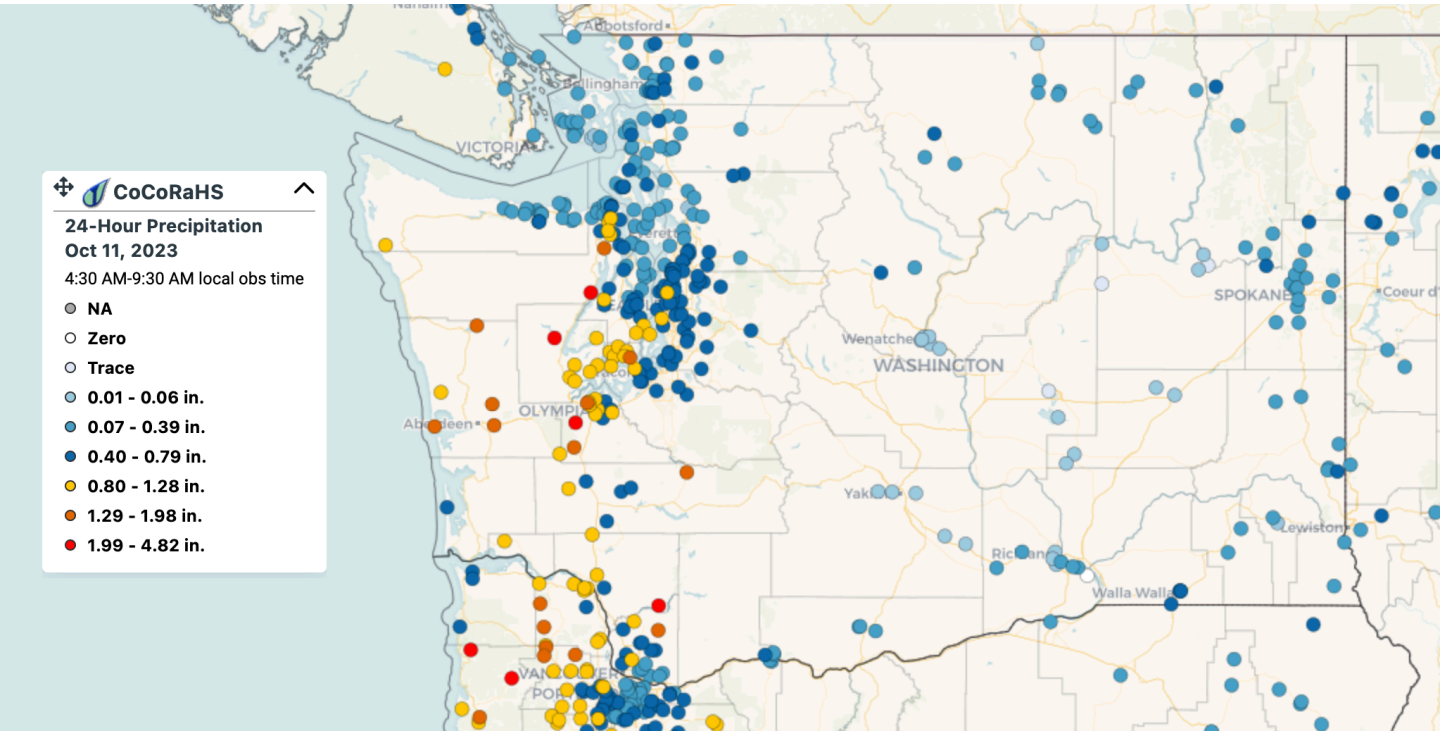


Figure 2: 24-hour precipitation totals on the morning of October, 11 2023 from CoCoRaHS observers.

Streamflow and Drought Summary

As of November 1, measurable snowpack in our mountains was lacking (Figure 3). At the end of October, there were a few occasions of snow falling at higher elevations, but that didn't stick around with warmer and wetter systems that moved into our state in early November. October typically isn't a big snow building month in our region so there's no need to panic about the lack of snowpack at this point. Nevertheless, we generally experience greater recovery in our streamflows at this time of year.

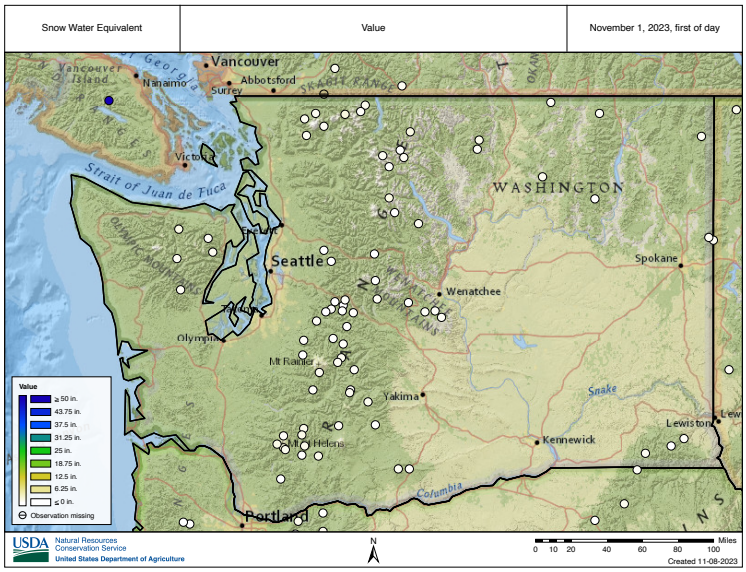


Figure 3: The snow water equivalent value (in inches) as of November 1, 2023. White circles represent no snow (NRCS).

Figure 4 shows the average October streamflows, many of which were still in the "below normal" to "much below normal" categories. Southwestern and southeastern WA were the exceptions with percentiles in the normal range for the month. Figure 5 shows the percentage of stream gauges in each percentile category over the last 45 days. There were ups and downs throughout the month with more than 50% of the stream gauges in WA measuring much below normal percentiles at times and other times more than 50% of the stream gauges in the normal percentile range. These corresponded to the precipitation events, of course. It remains to be seen whether the normal streamflow values from heavy rain at the beginning of November will persist through the month.

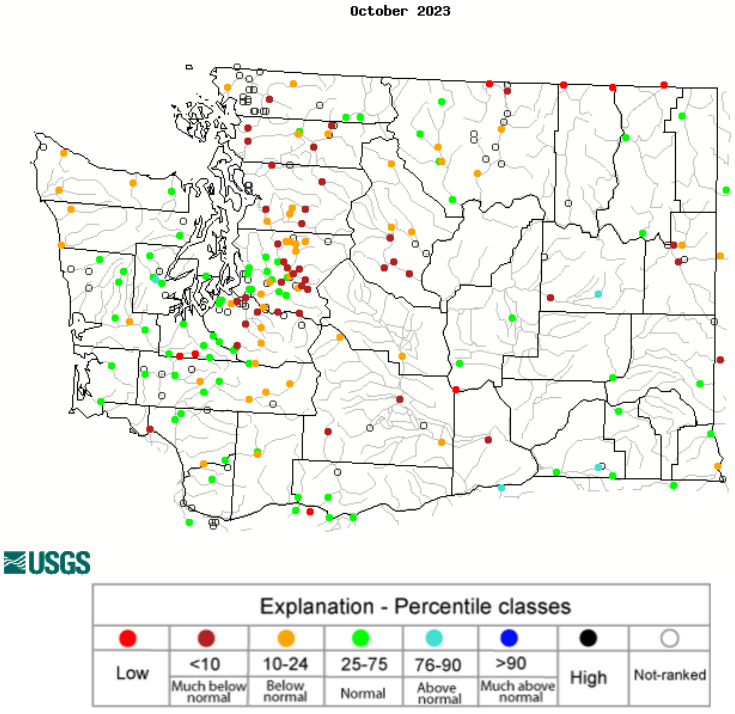


Figure 4: October 2023 average streamflow percentiles (USGS).

The most recent drought depiction of the U.S. Drought Monitor (valid on November 7) is shown in Figure 6. There have been a few improvements since the last edition of our newsletter, namely where precipitation was above normal in October in central WA and southeastern WA. In addition, streamflows in the central Puget Sound have appeared to be consistently in the normal range so

there has been improvement in that area as well. The drought declared by the Washington State Department of Ecology in 12 watersheds on July 24 (press release) is still in effect. Seattle Public Utilities request for voluntary efforts to conserve water is also still in effect.

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 these reports help experts assess drought impacts for both the U.S. Drought Monitor depiction and on the state level.

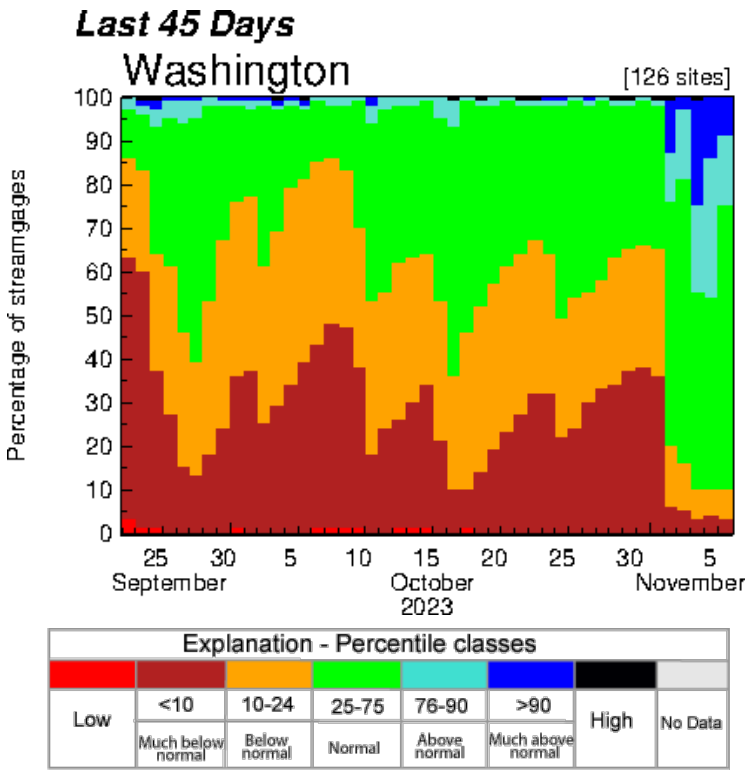


Figure 5: The percentage of stream gauges in WA in each percentile category from late September through early November (USGS).

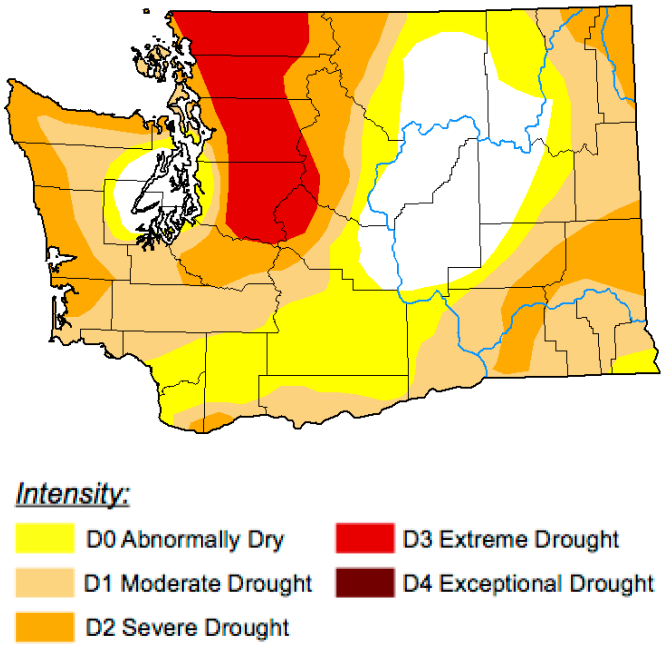


Figure 6: The November 7, 2023 edition of the U.S. Drought Monitor.

Winds in Washington State during El Niño

A Message from the State Climatologist

The upcoming winter of 2023-24 will include El Niño in the tropical Pacific. The vast majority of the readers of this newsletter are aware that El Niño winters tend to be on the warm side, and often but not as consistently on the dry side, with important implications for our end-of-winter mountain snowpack. But we expect that our readers are less familiar with how El Niño impacts our day-to-day winter winds – and there is no shame there, in that we were also unsure the extent to which ENSO influences our winds. So we took a quick look.

Our approach has been to take advantage of cli-MATE application hosted by the Midwestern Regional Climate Center yet again, making use of its capability to produce wind roses for specified intervals. Wind roses represent a compact way to illustrate the frequencies of winds in various speed ranges over the entire compass of possible directions. We created wind roses for SeaTac Airport and Spokane International Airport based on the hourly reports for the months of November through March for the years of 1991 through 2020 to represent the climatology. We also created wind roses for these two locations

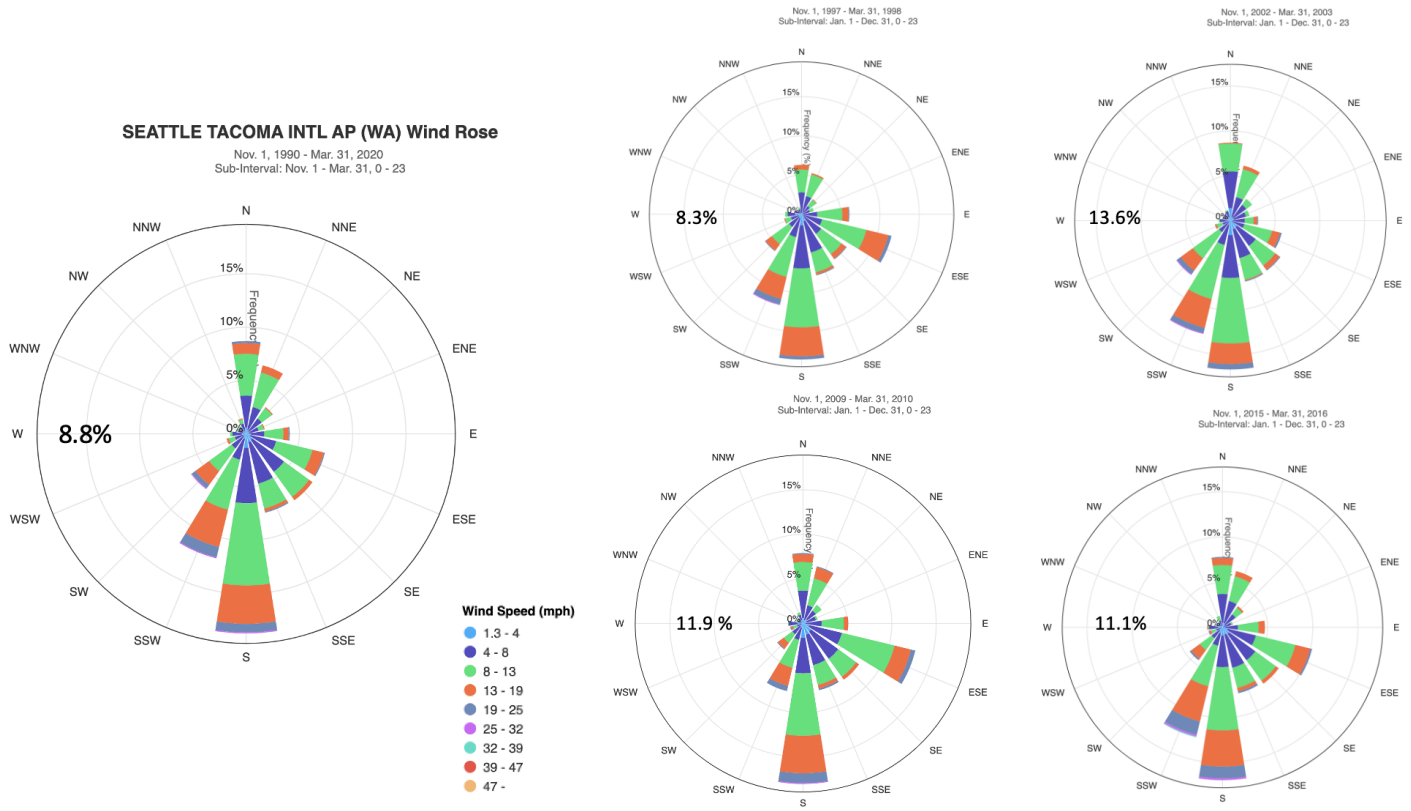


Figure 7: Wind roses for SeaTac Airport, with the 30-year climatology (1991-2020) of November through March winds on the left-hand side, and individual wind roses for four El Niño winters on the right. The winters are 1997-98 (top left), 2002-03 (top right), 2009-2010 (bottom left), and 2015-16 (bottom right). The percentages on the left of each wind rose are the percentage of calm winds for the climatology and winter, respectively (cli-MATE).

separately for the last 4 moderately strong to strong El Niño winters, specifically 1997-98, 2002-03, 2009-10 and 2015-16. The idea here is to see if an ENSO signal is apparent in the data, and how much if any this expression varies among this handful of recent events.

Sets of wind roses for the 30-year climatologies, alongside those for the 4 El Niño winters separately, are shown for SeaTac and Spokane in Figures 7 and 8, respectively. Our overwhelming impression is that the winds during these El Niño winters were not much different from their climatological averages. Three out of the four El Niño winters considered here included a greater percentage of reports with calm winds than is typical at both SeaTac and Spokane, with the winter of 1997/98 representing an exception. SeaTac tends to have a bit more wind from the east-southeast (ESE) during these recent El Niño events, but that signal is slight. We were expecting a greater percentage of winds from the south during El Niño. The mean flow at 850 mb (~1.5 km) includes southerly wind anomalies of about 1 m s^{-1} over SeaTac during El Niño winters (not shown) – but that does not seem to be manifested in terms of the surface winds. Similarly, a weak at best signal was found for Spokane. The El Niño winters of 1997/98 and 2009/10 included more winds from the northeast and less frequent winds from the southwest than in the climatology, but that distinction did not occur in the other two winters. We would not have been surprised if the El Niño winters had included a bit more flow from the east since the mean sea level pressure anomaly pattern during those periods generally includes relatively low pressure over the Pacific versus the interior of the PNW. It is interesting that both locations rarely experience winds from the northwest in winter irrespective of El Niño.

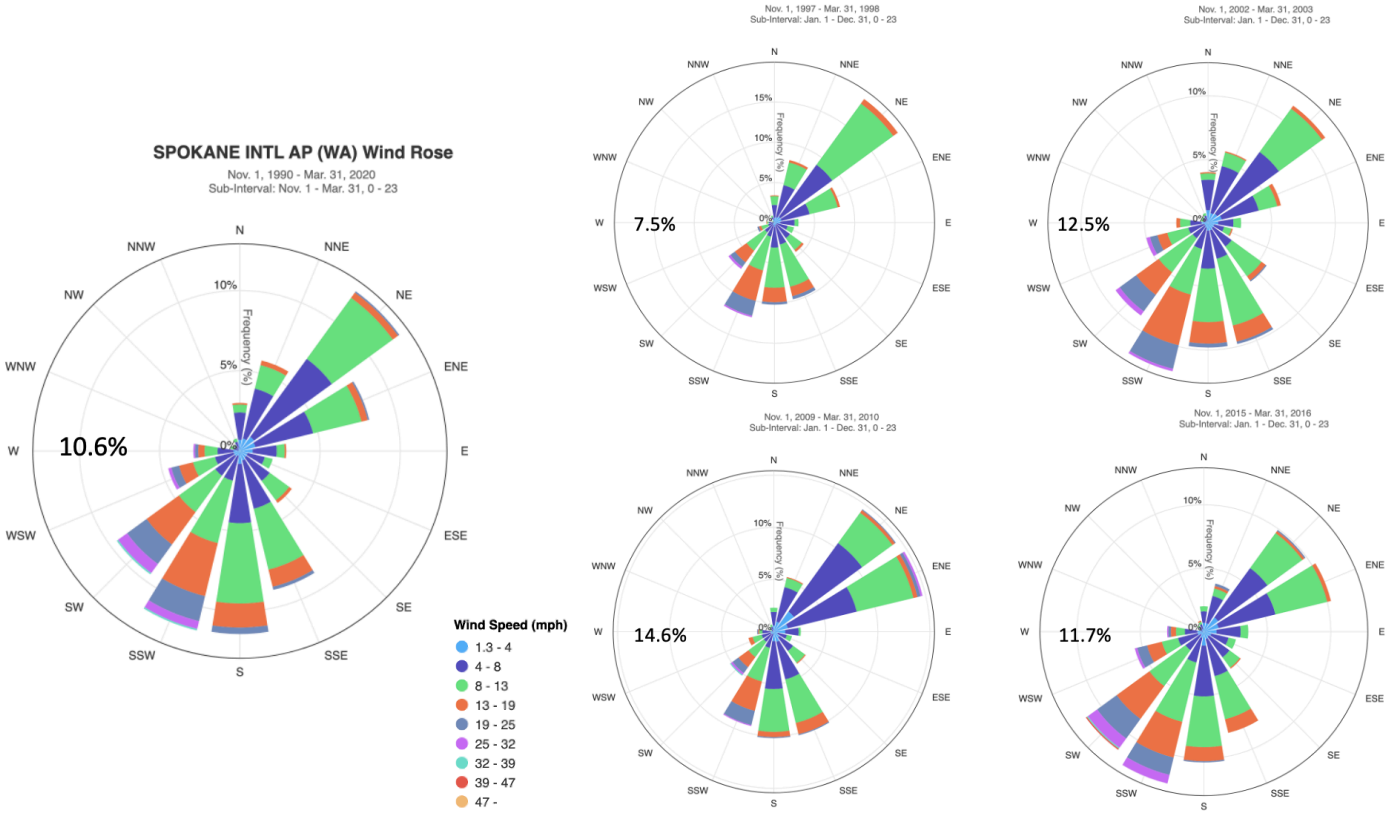


Figure 8: As in Figure 7, except for Spokane International Airport.

Perhaps this makes sense given the usual path of the low pressure centers moving in off the Pacific, which end up much more often in BC than Idaho.

While these results on the effects of El Niño are rather unimpressive, we thought our readers might be interested in another type of comparison using wind roses, and that is an example of small-scale spatial variations in the winds. Towards that end, we also created a climatological (1991-2020) winter wind rose for Boeing Field in Seattle. The two airports are separated by only about 5 miles. But SeaTac is situated on a bluff between the Green River and Puget Sound while Boeing Field is nestled in the Green/Duwamish River valley with the higher terrain of Beacon Hill immediately to its east, and a spine of higher elevations from West Seattle to White Center also to its west. In other words, Boeing Field might be expected to be prone to more channeling than SeaTac. As illustrated in Figure 9, that is indeed the case, with the wind rose for Boeing Field featuring a strong tendency for wind directions between out of the south and out of the southeast. With the prevalence for an east component to the winds, it makes sense that the runways at Boeing Field are oriented along 140/320 degrees while their counterparts at SeaTac are oriented along 160/340 degrees. An intriguing factoid here is that runway orientations are referenced to magnetic north to the nearest 10 degrees rather than true north, perhaps more due to tradition than modern navigation systems. Presently magnetic north is about 15 degrees to the right of true north in the local area. The location of the magnetic north pole has been moving about 40 miles a year, and it has shifted far enough that Boeing Field's runways transitioned from 130/310 to their present designations in 2017. And according to an article by Dominic Gates of the Seattle Times, old photos of Boeing Field show markings for runways oriented along 120/300 degrees. We encourage our readers to take advantage of this information on the change in Boeing Field runway orientation...it seems like the right kind of fodder for a bar bet...

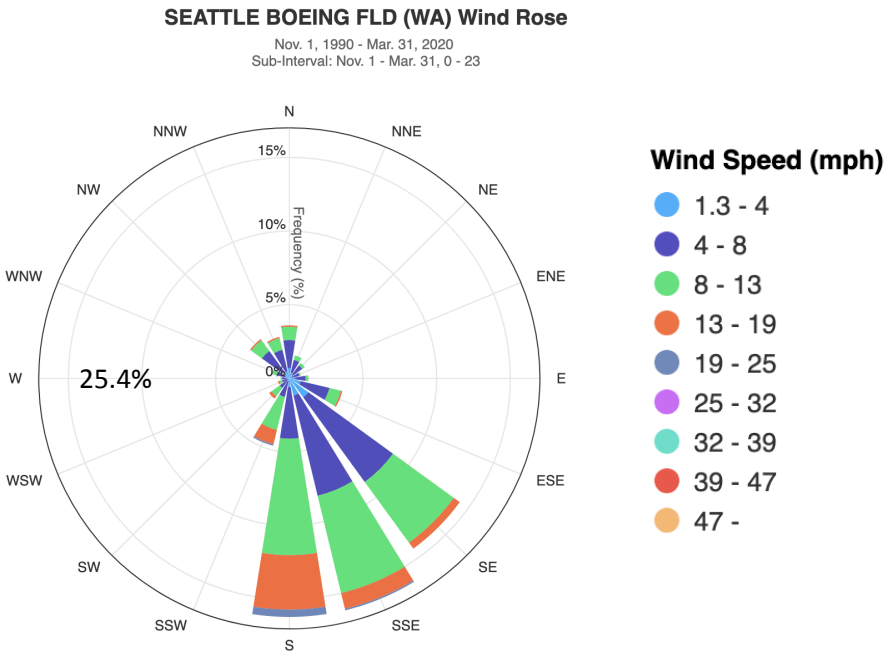
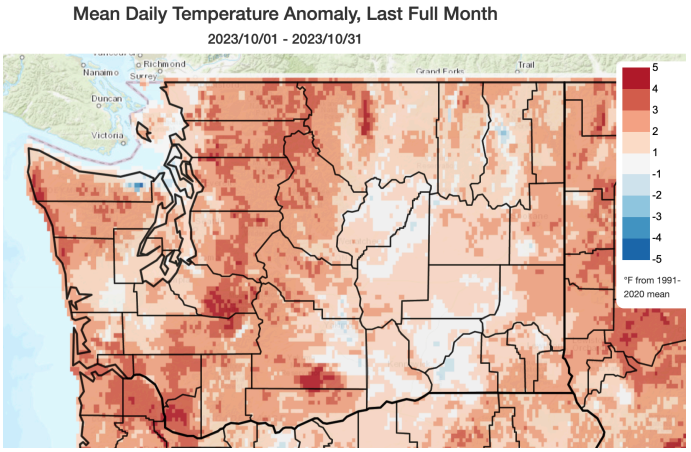


Figure 9: The wind rose Nov-March climatology (1991-2020) for Boeing Field (cli-MATE).

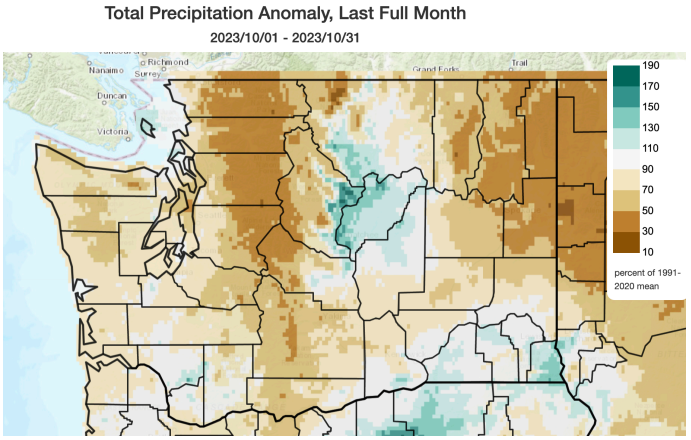
Climate Summary

Mean October temperatures were near-normal or above normal across the state. According to the map on the right-hand side, temperature anomalies tended to be larger in western WA compared to eastern WA. Quillayute, for example, recorded an average October temperature that was 4.6˚F above normal. While there were generally closer to normal temperatures east of the Cascade crest, there were warm exceptions too; Spokane Airport, for example, was 3.4˚F above normal (Table 1). Parts of the Puget Sound were also close to normal, with temperatures for SeaTac AP and Bellingham at 0.1 and 0.7˚F above normal, respectively.



October temperature (˚F) departure from normal relative to the 1991-2020 normal (Climate Toolbox).

Total October precipitation was generally below normal across WA, with larger deficits for the windward slopes of the central and northern Cascade Mountains and northeastern WA. Those areas received less than 50% of normal precipitation for the month. Spokane was included in the southernmost extent of that drier than normal area, receiving only 33% of normal October precipitation (Table 1). On the westside, Hoquiam received only 35% of normal precipitation. While still below normal, other locations weren't nearly as dry. SeaTac, Wenatchee, and Omak received 74, 77, and 85% percent of normal, respectively. There were a few wetter than normal exceptions around the state with parts of southeastern and north central WA receiving normal to above normal precipitation. For example, Pasco recorded 112% of normal (Table 1).



October total precipitation percent of 1991-2020 normal (Climate Toolbox).

Station	Mean Temperature (°F)			Precipitation (inches)		
	Average	Normal	Departure from Normal	Total	Normal	Percent of Normal
Western Washington						
Olympia	52.2	50.3	1.9	3.41	5.07	67
Seattle WFO	55.0	53.6	1.4	2.77	3.65	76
SeaTac AP	54.5	53.8	0.7	2.89	3.91	74
Quillayute	55.2	50.6	4.6	8.08	10.68	76
Hoquiam	54.0	52.5	1.5	2.43	6.91	35
Bellingham AP	51.2	51.1	0.1	3.25	3.85	84
Vancouver AP	56.4	54.2	2.2	2.56	3.41	75
Eastern Washington						
Spokane AP	51.3	47.9	3.4	0.45	1.37	33
Wenatchee	52.5	50.7	1.8	0.48	0.62	77
Omak	51.0	49.1	1.9	0.78	0.92	85
Pullman AP	50.4	48.4	2.0	1.11	1.59	70
Ephrata	52.2	50.9	1.3	0.43	0.66	65
Pasco AP	53.8	52.1	1.7	0.74	0.66	112
Hanford	54.9	53.4	1.5	0.33	0.62	53

Table 1: October 2023 climate summaries for locations around Washington with a climate normal baseline of 1991-2020.

Climate Outlook

According to the Climate Prediction Center (CPC), El Niño is present in the equatorial Pacific Ocean and an "El Niño Advisory" is in effect. Over the last month, the above normal sea surface temperatures (SSTs) have persisted, particularly in the eastern equatorial Pacific Ocean. ENSO models are virtually certain that El Niño will persist through the winter of 2023-24, with the dynamical and statistical model mean projections showing that it will likely be a moderate-to-strong event.

The CPC November temperature outlook (Figure 10) has increased chances (between 40 and 50% on the three-tiered scale) of above normal temperatures statewide. There are higher odds of above normal November precipitation across the state. The odds are relatively high with the forecast showing between a 50 and 60% chance on the three-tiered scale.

The November-December-January (NDJ) temperature outlook (Figure 11) is also calling for higher chances of above normal temperatures statewide. Odds of above normal temperatures are between 50 and 60% statewide. The NDJ precipitation outlook indicates slightly elevated chances of below normal precipitation for the eastern half of the state. Western WA has equal chances of below, equal to, or above normal precipitation for NDJ.

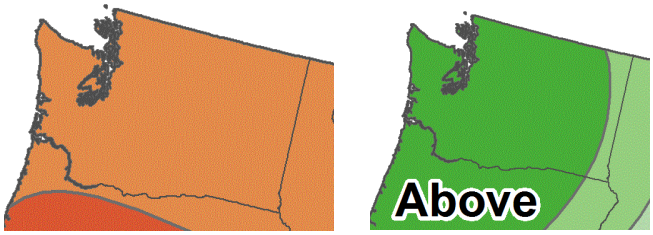


Figure 10: November outlook for temperature (left) and precipitation (right).

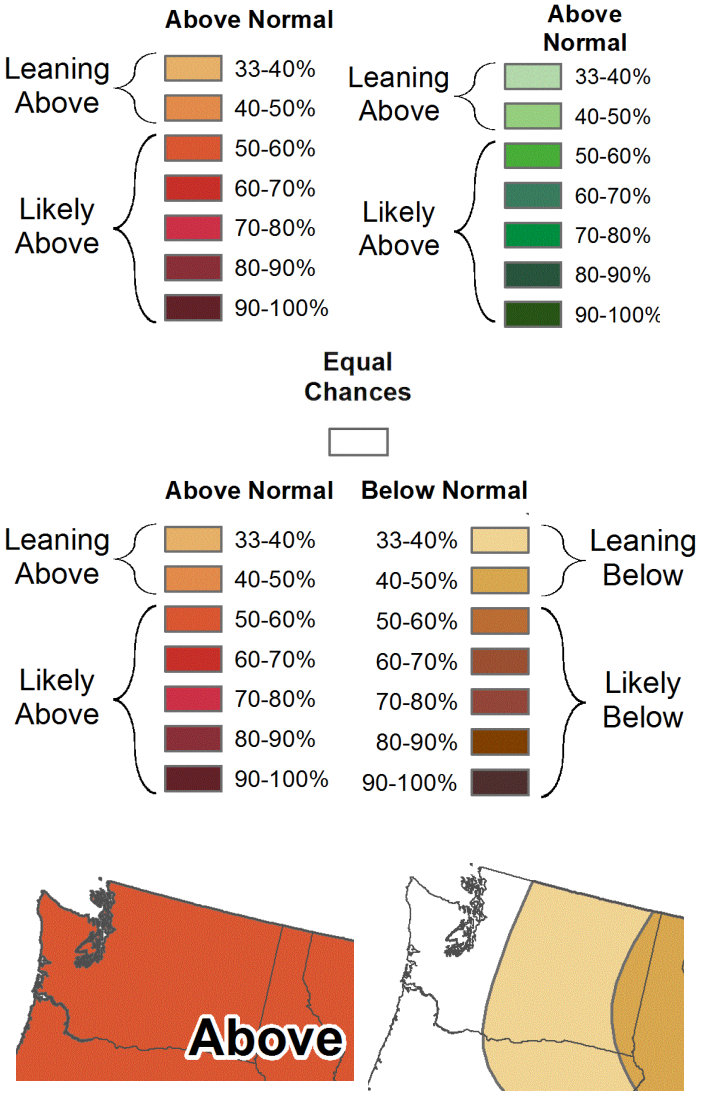


Figure 11: November-December-January outlook for temperature (left) and precipitation (right) (Climate Prediction Center).