Office of the Washington State Climatologist

September 2022 Report and Outlook

September 13, 2022

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

August Event Summary

Mean average August temperatures were above normal statewide, with temperature anomalies in central and eastern WA between 4 and 6°F above normal. Averaged statewide, mean August temperatures ranked as the warmest on record since 1895, specifically 4.5°F above the 1991-2020 normal. Average minimum temperatures were also the warmest for August on record (+3.7°F), and the overnight warmth was likely noticeable for many of our readers. August precipitation was below normal for much of the state, and even the few areas that received above normal precipitation (parts of north central and southeastern WA) still had relatively low monthly totals. Averaged statewide, August tied 1974 as the 16th driest with many locations receiving just a "trace" of precipitation.

Figure 1 shows the daily August temperatures at SeaTac Airport compared to normal (the meager precipitation isn't worth showing). There were several heat waves throughout the month, the first of which began on August 6. Several daily high temperature records were set around the state. For example, Vancouver set a daily maximum temperature record of 99°F on the 7th and Omak set a record with 102°F on the 8th. Following the period of warm temperatures, atmospheric instability caused widespread thunderstorms on the 10th. Figure 2 shows the location of over 900

In this Issue

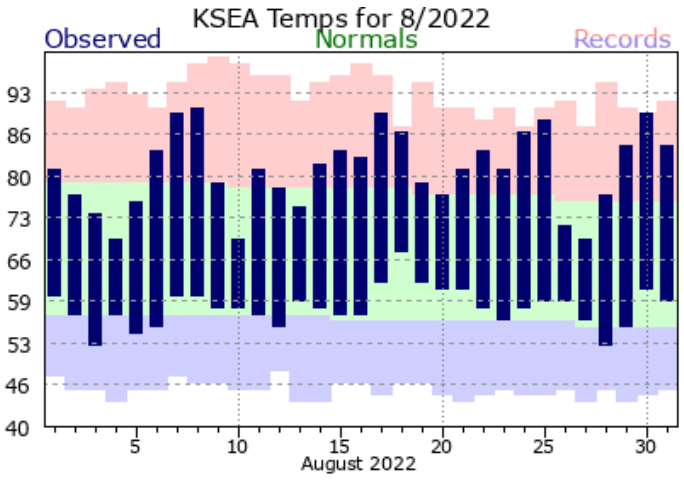


Figure 1: August 2022 daily temperatures for SeaTac Airport compared to the 1991-2020 normal (green envelope) and previous records (blue and red envelopes; NWS).

lightning strikes in the Puget Sound region. Some heavy rain was associated with the line of thunderstorms, which were also accompanied by power outages (Fox Weather).

Another heat wave started on the 17th, and high overnight temperatures were associated with this event (Figure 1). Record daily high temperatures were also set. For example, on the 18th, Ephrata (108°F), Omak (104°F - tie), Yakima (103°F - tie), Ellensburg (102°F - tie), and Olympia (96°F) set daily high records. Perhaps more notably, record high minimum temperatures were set on the 18th as well. Vancouver set a new daily record with 71°F. Tolt South Fork Reservoir (73°F), Renton (71°F), Seattle Weather Forecasting Office (69°F), and Olympia (65°F) set high minimum temperature records for the whole month of August.

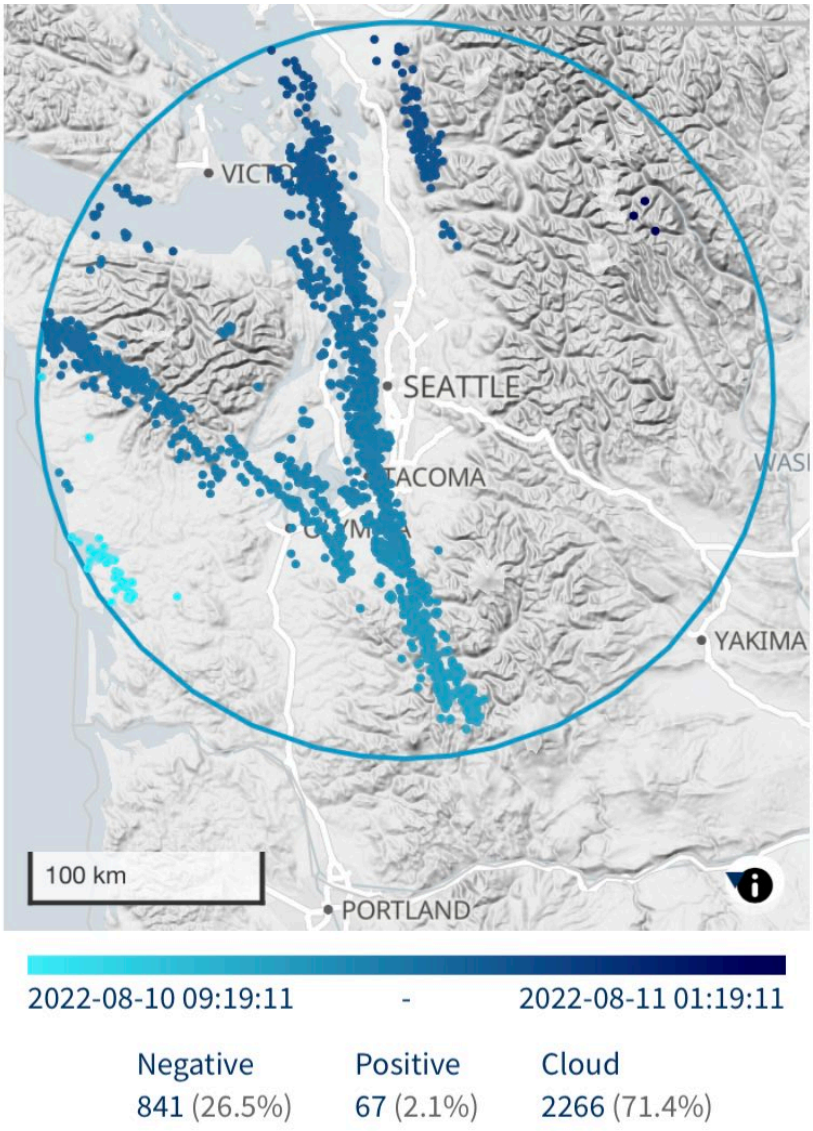


Figure 2: Lightning strikes on the August 10 for the Puget Sound region from the National Lightning Detection Network. Graphic reposted by Fox Weather but originally from meteorologist Chris Vagasky.

Despite last month's highlight showing the likelihood of WA heat waves decreasing in the second half of August, we still managed to have yet another right at the end of the month. Record daily high temperatures were set at Dallesport (104°F), Vancouver (98°F), Olympia (92°F), SeaTac (90°F), and Hoquiam (88°F) on the 30th, with SeaTac tying 2015 with highest number of 90+ days (12 days). At the time of this writing, SeaTac has since surpassed that record with another 90°F in September. More daily high temperature records were set on the 31st at Pullman Moscow AP (101°F), Ephrata (101°F - tie), Ellensburg (100°F), Spokane (100°F - tie), and Yakima (98°F).

Finally, we end with a note on the temperature swings between spring and summer. Averaged statewide, July-August was the warmest on record, with a +3.6°F anomaly from the 1991-2020 normal (Table 1). Recall that April-May ranked as the 3rd coldest on record (-4.5°F) averaged statewide so while summer started slowly this year, it has been intense since its arrival.

Station	July-August Average Temperature (°F)	Rank	Records Began
Dallesport	80.1	1	1948
Pasco Tri Cities	78.8	1	1998
Vancouver Pearson AP	73.0	1	1998
Spokane AP	75.1	1	1881
Ephrata	79.0	1	1949
Bellingham AP	66.5	1 (tie)	1949
Omak	77.5	2	1998
Yakima AP	76.0*	2 (tie)	1947
Olympia	67.0	3	1941
Wenatchee Pangborn AP	78.2	3	1960
SeaTac AP	69.6^	3	1945
Quillayute	62.0*	3	1967

Table 1: July-August average temperature rankings (warmest to coldest) for selected WA locations. ^2 days are missing. *3 days are missing.

Streamflow and Drought Summary

Despite the dry August, average August streamflow was normal to above normal for a majority of the state (Figure 3). There were some notable exceptions. In western WA, the Hoh River, Quinault, and Skookumchuck dropped below the 25th percentile. In eastern WA, the Little Spokane and Spokane River also dropped into that lower percentile.

Only minor changes were made to the U.S. Drought Monitor (Figure 4) since the last edition of this newsletter. The changes were made to better represent the longer-term precipitation deficits and the dry August conditions have yet to prompt any additional degradation on the Drought Monitor. To help ground the Drought Monitor to local conditions, reports to the CMOR-Drought can be made at any time, whether the reports are noting dry or wet conditions.

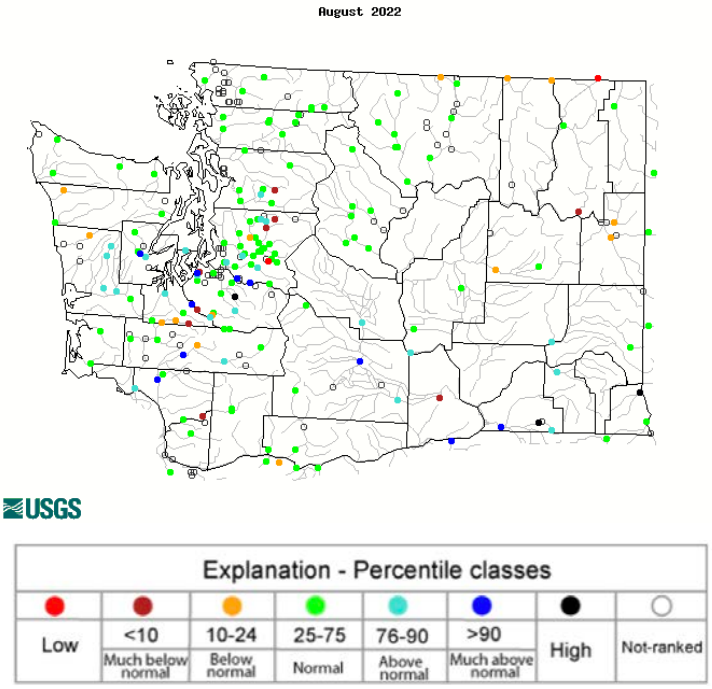


Figure 3: August 2022 average streamflow for WA (USGS).

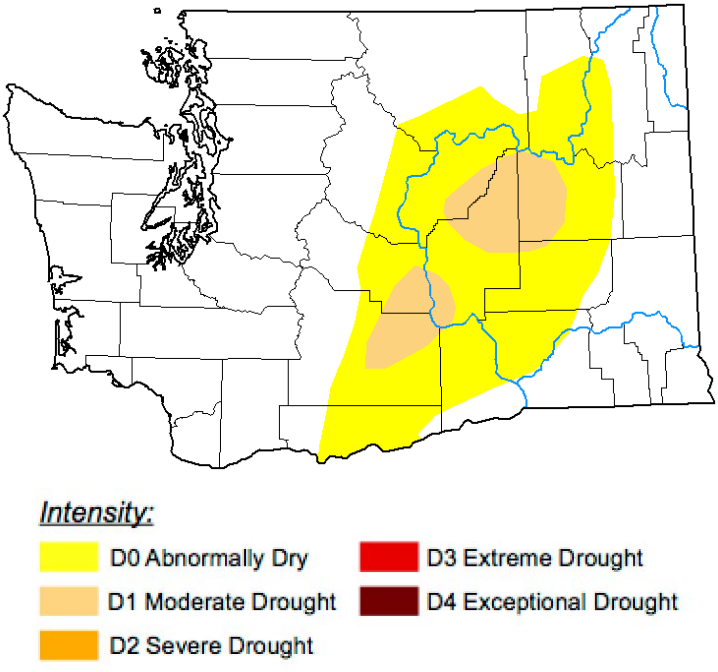


Figure 4: The September 8, 2022 edition of the U.S. Drought Monitor.

Ready for Fall Rains?

A Message from the State Climatologist

This piece is intended to complement last month's piece on the decline of the frequency of heat waves in WA state during the late summer. More specifically, here we describe how soon we can expect to begin enjoying our fall rains, based on historical data. In our experience, perspectives on the onset of fall rains range widely with many western Washingtonians dreading the return of our gloomy season and others eagerly anticipating it. The anticipation generally comes from those that monitor our rivers and reservoirs, with a tendency to rejoice when those first significant rains fall. Regardless of your perspective, let's take a look at the data.

We considered daily precipitation records at 5 stations in WA state over the period of 1971-2020, with a start date of 1 September. We calculated the frequency of years for which a daily precipitation total of 0.10" and greater, and 0.25" and greater, have been observed by 1, 7, 14, 21, and 28 September, and 5 October. In other words, we specify the onset of the rainy season by arbitrarily defining that timing as the first day with rainfall reaching the thresholds of 0.1" and 0.25". The smaller value might plausibly constitute enough rain to qualify as a "rainy" day. But perhaps that is barely enough to wet the whistle, and so we repeated the procedure using the higher bar of a 0.25" threshold. Rainfall of that amount in September can mean the end of dragging the hose around the yard. The five stations examined are Hoquiam (HQM), Sea-Tac (SEA), Wenatchee (EAT), Walla Walla (ALW) and Spokane (GEG).

The results for the 0.10" daily rainfall threshold are plotted in Figure 5. It turns out that the 1st of September has been unusually rainy in western WA for the time of year, with probabilities of that threshold being met commensurate with those in the middle of the month. At any rate, it should be absolutely no surprise that HQM leads the pack with the highest probability of 0.10" falling throughout the entire 5-week period. We do think it is interesting that SEA almost catches up, by this measure, by the latter part of September. Folks near ALW and GEG need to typically wait longer for a 0.10" day, but their patience is rewarded with a 75-80% chance of that happening by the end September/early October. Wenatchee is in the shadow of the Cascade Mountains, and has only about a 50% chance of a wet day – by our definition of course – by the end of the month.

The corresponding probability curves for the 0.25" daily total are shown in Figure 6. Again, the high frequency of this threshold being met at HQM on 1 September is a fluke. For the interval of 1 through 7 September, SEA has actually had a higher frequency of 0.25" days than HQM, due to the odd outcome that HQM has not had many of these days during the first week of the month if it did not have one on the 1st. We also note that ALW checks in with generally greater frequencies of 0.25" days than GEG; the opposite occurred with respect to the 0.1" days. For context, the mean precipitation totals for the Septembers of 1971-2020 in ALW and GEG are 0.75" and 0.68", respectively. EAT is again a laggard with only about a 35% of 0.25" or greater by the end of the period examined; gutter cleaning services must not be in high demand.

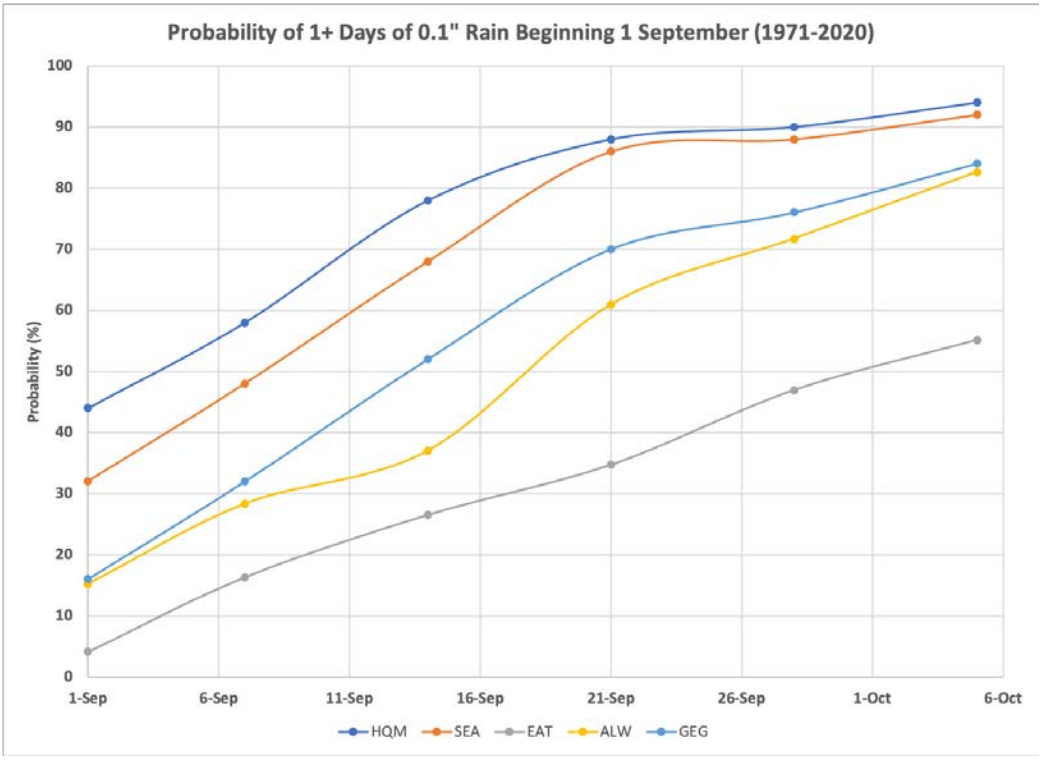


Figure 5: Accumulated probabilities of Hoquiam (HQM), SeaTac (SEA), Wenatchee (EAT), Walla Walla (ALW), and Spokane (GEG) receiving 0.10" of precipitation or more by 1, 7, 14, 21, 28 September, and 5 October (circles). The probabilities are accumulated so each circle must be higher as the days progress. Curves are smoothed.

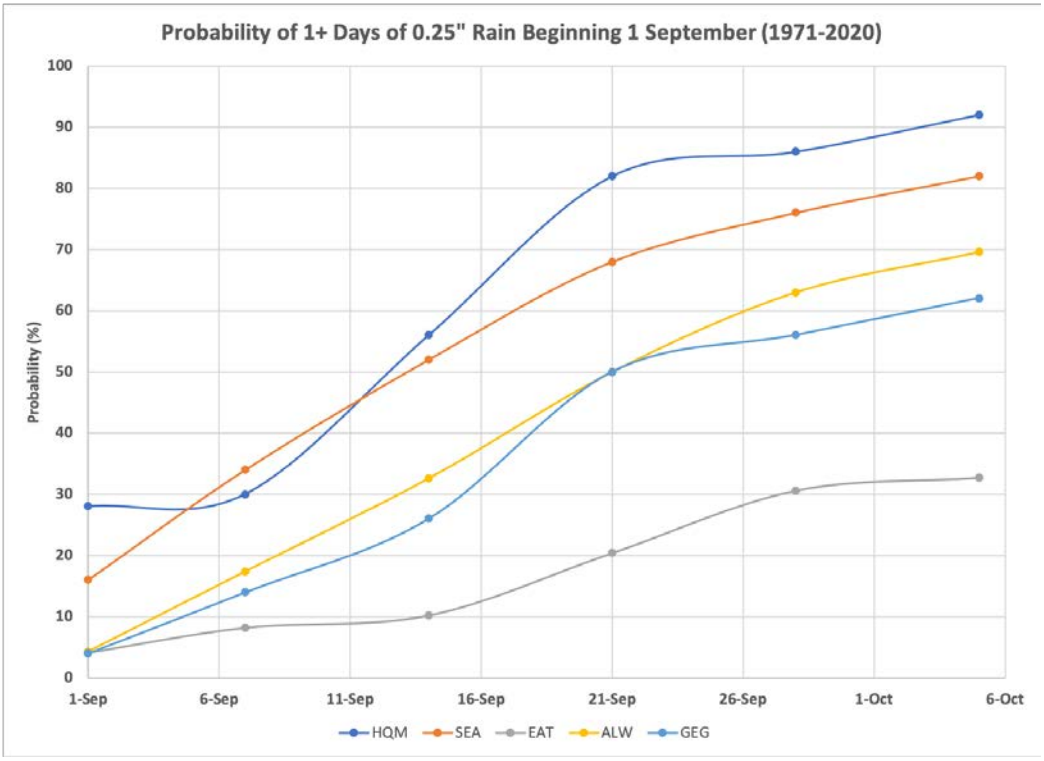


Figure 6: As in Figure 5, except for the threshold of 0.25".

We conclude with a couple of thoughts about time series of daily rainfall amounts. First, we used a record of 50 years length, despite climatological norms often being computed over periods of 30 years. While 50 years is long enough for manifestation of meaningful trends in the climate, for the present application we assumed that it would be preferable to consider a relatively long interval from a statistical standpoint. Second, our method accounts for the temporal autocorrelation in daily rainfall on short time scales. It would have been easier to use the historical records of the probabilities of the two precipitation amounts on each day of the year of interest, and simply accumulate the probability of reaching those thresholds with day of the year. But that technique tacitly assumes that the probabilities of days within a year are independent of one another, which is definitely not the case. Instead, there are extended wet and dry streaks, with the latter resulting in occasional long waits for a

rainy day. An example from the present analysis is telling. Given the daily probabilities at SEA from 1 through 14 September, the 0.10" threshold would be reached by 14 September during about 85% of the years, when in actually it has happened only 68% of the time. Perhaps Hoquiam represents an even more striking difference in that the probability of failing to have a day with 0.10" by 28 September is only about 0.2% considering each date independently, while such a failure has occurred 10% of the time. We are unsure if we should apologize to our readers for this digression, but the statistics geeks might not mind.

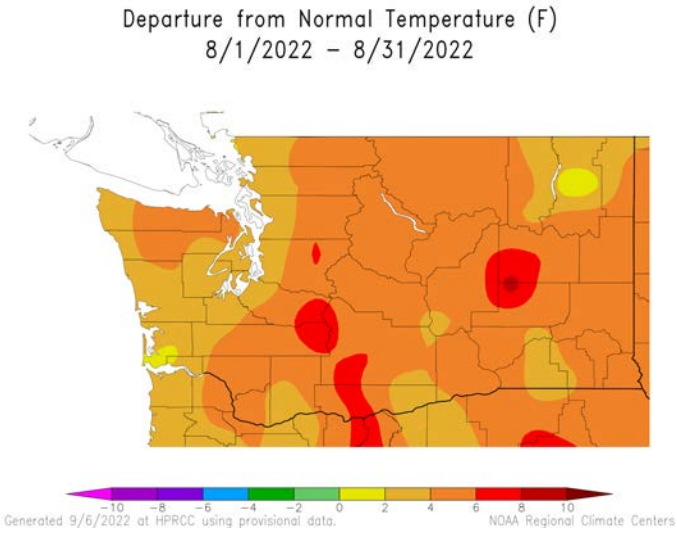
Registration Open for OR/ WA Water Year Meeting!

Registration is now open for the Oregon-Washington Water Year 2022 Recap and 2023 Outlook meeting that will take place virtually on the mornings of October 25 and 26, 2022. The goal of this meeting is to share and gather information regarding climate impacts of the 2022 water year. Some areas experienced continued drought while others dealt with flooding. The exceptionally wet spring and its impacts will also be a focus. An end-of-the-water year survey will be available soon to record impacts and actions taken to minimize those impacts, and will be discussed at the workshop. We encourage participation from a wide range of sectors. This event is hosted by NOAA NIDIS, UW CIG, and OWSC.

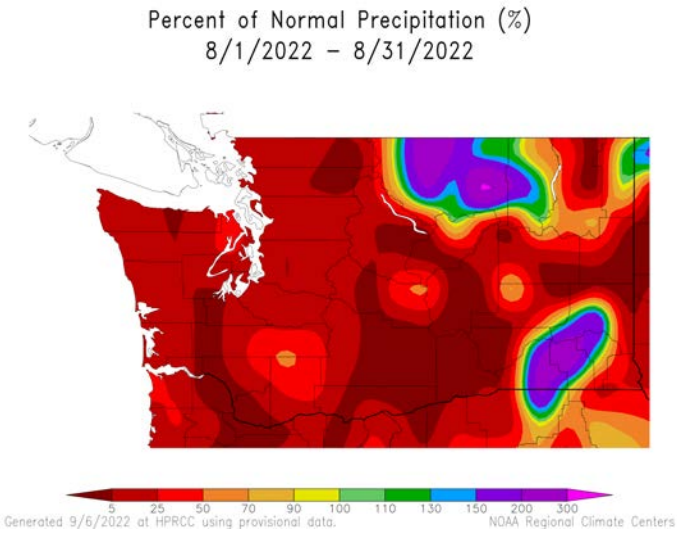
Climate Summary

Average August temperatures were above normal statewide, with temperatures between 4 and 6°F above normal for a large portion of the state. For example, Omak, Spokane, and Hanford were 5.6, 5.7, and 5.9°F above normal (Table 2). Some locations on the Olympic Peninsula were also in that temperature range, with Hoquiam measuring 4.4°F above normal. Otherwise, the Puget Sound region and the southern Olympic Peninsula were not as unusually warm, with average August temperatures between 2 and 4°F above normal.

August precipitation was much below normal for most of the state. Spokane, Wenatchee, Ephrata, Pasco, and Hanford recorded only a "trace" of precipitation this month (Table 2), which is not that unusual for August. Western WA precipitation was also quite low, with several stations recording less than 10% of normal precipitation (e.g., Olympia, Seattle, Hoquiam, and Vancouver). There are a few exceptions here. Some areas of north central or southeastern WA observed greater precipitation totals thanks to some summer thunderstorms. Omak, for example, received 0.25", which is by no means impressive but enough to represent 93% of normal.



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



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

Station	Mean Temperature (°F)			Precipitation (inches)		
	Average	Normal	Departure from Normal	Total	Normal	Percent of Normal
Western Washington						
Olympia	67.5	64.2	3.3	0.05	0.96	5
Seattle WFO	70.5	67.1	3.4	0.07	1.00	7
SeaTac AP	70.0	67.4	2.6	0.05	0.97	5
Quillayute	62.6	60.0	2.6	0.50	2.64	19
Hoquiam	65.4	61.0	4.4	0.11	1.35	8
Bellingham AP	67.0	63.9	3.1	0.28	1.13	25
Vancouver AP	73.7	69.4	4.3	0.01	0.52	2
Eastern Washington						
Spokane AP	76.0	70.3	5.7	T	0.47	0
Wenatchee	78.7	73.7	5.0	T	0.23	0
Omak	78.4	72.8	5.6	0.25	0.27	93
Pullman AP	71.2	66.9	4.3	0.10	0.49	20
Ephrata	79.1	73.7	5.4	T	0.18	0
Pasco AP	78.6	73.2	5.4	T	0.27	0
Hanford	82.4	76.5	5.9	T	0.25	0

Table 2: August 2022 climate summaries for locations around Washington with a climate normal baseline of 1991-2020.

Climate Outlook

La Niña conditions are present in the Pacific Ocean and a "La Niña Advisory" remains in effect, according to the Climate Prediction Center (CPC). Over the last 4 weeks, negative sea surface temperature (SST) anomalies have persisted in the equatorial Pacific Ocean. La Niña is expected to continue through the fall and winter. According to ENSO models, there is a 89% chance of La Niña for the October through December period compared to 11% for neutral conditions. By January-February-March, the chances of La Niña persisting drop to 54%, but that that is still the most favored outcome.

The CPC outlook for September (Figure 7) shows increased chances of above normal temperatures statewide. Chances of above normal temperatures are slightly higher for the eastern one-third of the state. The odds of below normal precipitation are higher for the eastern half of WA State; western WA has equal chances of below, equal to, or above normal September precipitation.

The three-month outlook for September-October-November (SON) shown in Figure 8 has equal chances of below, equal to, or above normal temperatures for the majority of WA. The southernmost portion of the state has a higher likelihood of above normal SON temperatures. With regards to precipitation during the upcoming fall, western WA through north central WA have increased chances of above normal totals. The forecast for the remainder of eastern WA is uncertain, with equal chances of below, equal to, or above normal precipitation.

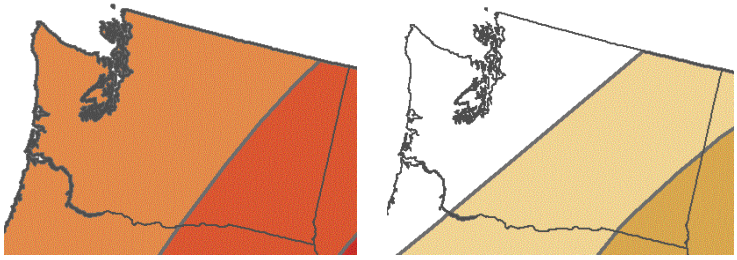
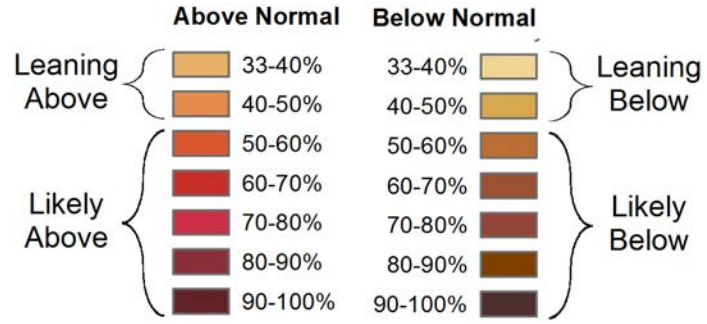


Figure 7: September outlook for temperature (left) and precipitation (right).



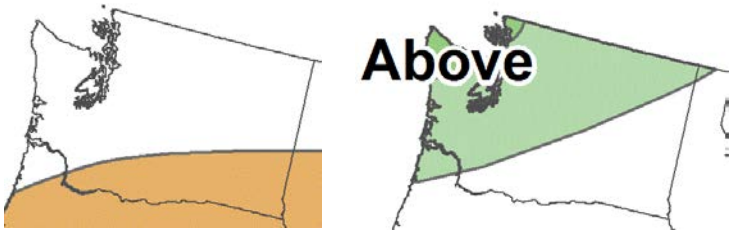


Figure 8: September-October-November outlook for temperature (left) and precipitation (right) (Climate Prediction Center).