Office of the Washington State Climatologist

September 2021 Report and Outlook

September 10, 2021

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

August Event Summary

Average August temperatures were above normal for a majority of WA State. Precipitation was mixed. Southern, western, and parts of eastern WA had much below normal precipitation. Central, northern, and northeastern WA, on the other hand, had normal to well above normal precipitation.

The above normal temperatures for August marks the third consecutive month with above normal temperatures. Another heat wave sent temperatures above 90°F in parts of western WA between the 11th and the 13th of the month, with temperatures in the triple digits east of the crest. Portland, OR bore the brunt of the heat wave compared to western Cascade locations in WA, logging two days above 100°F.

Figure 1 shows the 500 hPa geopotential height anomaly on the worst day of the heat wave for Seattle and Portland residents, August 12th. The color bar on this graph is not scaled for the anomaly pictured, but rather to provide ease of comparison between this figure and the top half of Figure 2 in July's newsletter. A few differences between this heat wave and the June heat wave become immediately apparent when the two are

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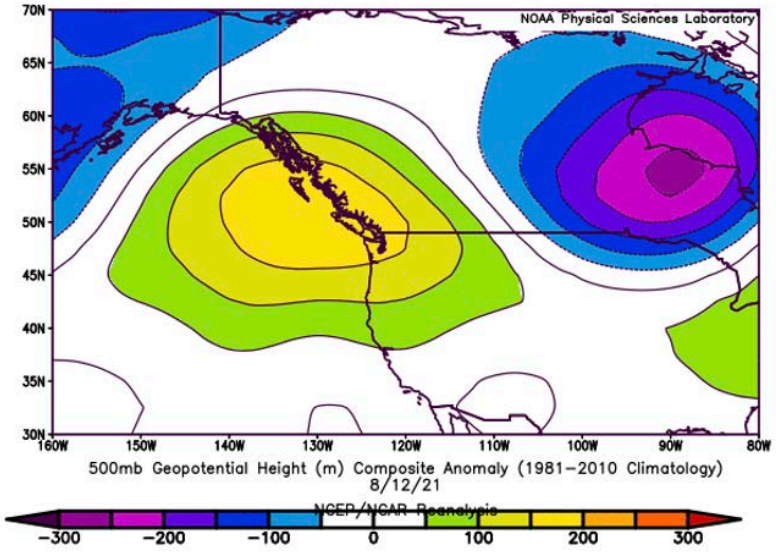


Figure 1: 500 hPa geopotential height anomalies on August 11, 2021 (ESRL).

compared. First, this geopotential height anomaly is much smaller in magnitude. Second, this anomaly was centered southwest of the June anomaly, allowing Canada to dodge the worst of it and shifting Portland onto the front lines. Third, one can already see a lower than normal heights (representing low pressure) creeping towards the PNW in the northwestern corner of this map. Seattle spent just two days above 90°F during August's heat wave and was back down to the mid-70s just three days later. In contrast, there was an extended period of above normal temperatures following the June heat wave, particularly for locations in eastern WA. Though shorter in duration and less intense than this summer's previous heat waves, the human impact of August's event remains to be seen. Perhaps September will grace us with some overcast, blustery days soon.

The scant summer precipitation totals continued with another arid month for many parts of the state. Western, southern, and eastern WA all saw precipitation totals well below the normal. Seattle, Tacoma, Olympia, and Vancouver logged this month as one of their top ten driest Augusts in the period of record (Table 1). In contrast, central, northern, and northeastern parts of the state were among the wettest Augusts on record. However, the areas that saw above-normal precipitation typically get very close to no precipitation during the month of August, so in many cases, a single rainy day or two brought monthly precipitation totals soaring above the normal.

Several wildfires began during the month of August, resulting in and poor air quality for parts of the state and some evacuations. The Whitmore Fire began 7 miles west of Nespelem on August 3rd; the Walker Creek Fire began on the same day due to unknown causes 13 miles east/northeast of Tonasket, eventually merging with the Spur Fire; the Schneider Springs Fire 18 miles northwest of Naches began on August 4th due to lightning; and the Twenty-Five Mile Fire began on August 15th due to unknown causes and caused a countywide state of emergency to be declared.

Only a handful of record high daily temperatures were broken this month. Record high daily temperatures were set at Olympia (95°F) and Seattle WFO (93°F) on the 13th, at Wenatchee Pangborn Field (102°F-tie) on the 14th, and at Pasco (104°F) and Yakima (103°F) on the 15th.

Record Low Precipitation				
Station	**Total August Precipitation (in)**	**Rank**	**Previous Record; Year**	**Records Began**
Vancouver	0.02	3	T; 1998/2012	1998
Olympia	0.01	3	T; 1967/1968	1941
Tacoma	0.05	6	0; 2017	1982
Seattle WFO	0.28	9	0; 2012	1987
	Record High Precipitation			
Omak	0.52	6	1.32; 2013	1998
Ephrata	0.76	9	1.21; 1999	1949

Table 1: August 2021 precipitation total historical rankings at selected stations. The stations in the top (bottom) section are ranked driest to wettest (wettest to driest).

Streamflow and Drought Summary

Overall, more stream gauges are showing below normal to much below normal streamflows averaged for the month of August, even in locations that were wetter compared to normal. Figure 2 shows the streamflow percentiles averaged for August. Compared to July, rivers in the Olympic Peninsula, northern Puget Sound, and Chelan county have streamflows that have dropped compared to normal and are now below normal or much below normal. On the Canadian border, the Kettle, Similkameen, and Okanogan Rivers are reporting record low flows at the 1st percentile.

The drought depiction on the U.S. Drought Monitor (Figure 3) has worsened in southwest WA with D1 ("moderate drought") and D2 ("severe drought") expanded. With much of eastern WA already being at the worst drought category (D4: "exceptional drought"), there have been no additional changes since our last newsletter edition. The precipitation that did fall in eastern WA was certainly not enough to be a drought-buster. The "Drought Emergency" declared by Governor Inslee on July 14 for most of the state is 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.

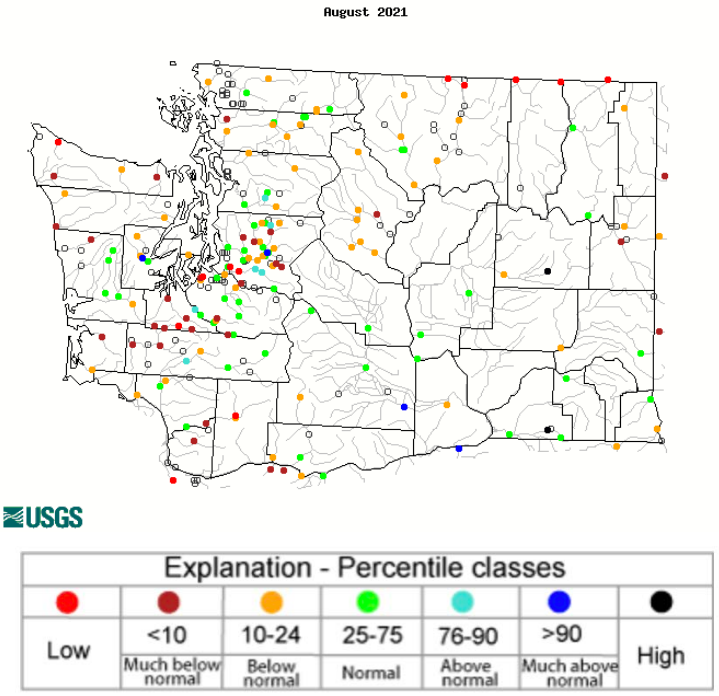


Figure 2: August average streamflow for WA (from USGS).

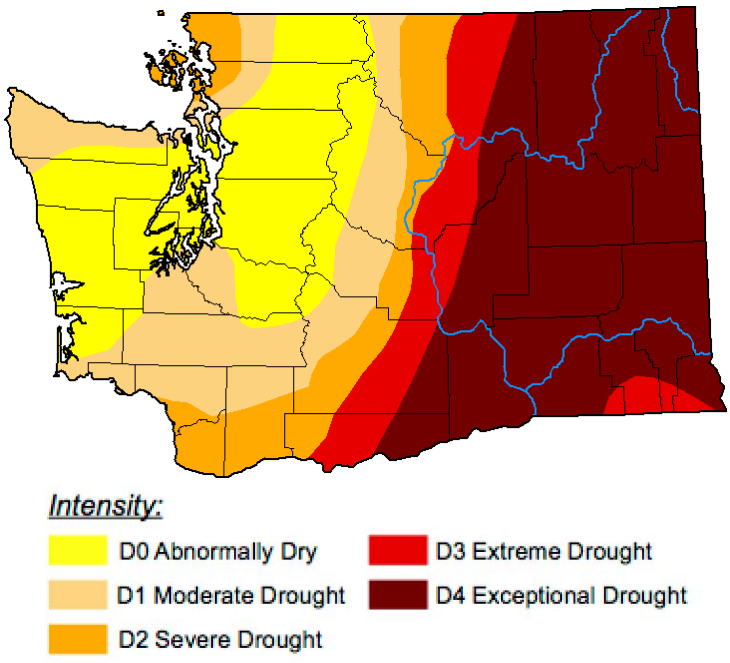


Figure 3: The September 9, 2021 edition of the U.S. Drought Monitor.

photo by Henry Reges, CoCoRaHS

Community, Collaborative Rain, Hail, and Snow (CoCoRaHS) Corner

CoCoRaHS stations made a total of 9,958 observations – 179 more than in July. Of those entries, 19% recorded precipitation of some amount, up from less than 4% last month.

CoCoRaHS data provide a finer level of spatial resolution than what can be provided by other precipitation datasets, but the data do not go far enough back in many less-populated towns to reliably pick out any particular month as anomalous in comparison to a 1991-2021 normal. We can still, however, compare CoCoRaHS data to the data used to create in the maps in the "Climate Summary" section and see some of the same patterns reflected. CoCoRaHS observers in central or northeastern WA towns like Twisp, Winthrop, Kettle Falls, Elk, Evans, East Wenatchee, and Newport recorded some of the highest one-day precipitation totals for the month. These one-day totals mostly ranged between 0.60" and 1.00". Though it's hard to pick out anomalies in these remote areas right now, just imagine how much historical data we'll have twenty years from now thanks to today's diligent CoCoRaHS contributors!

Similar to July, 49 Condition Monitoring Reports submitted across 15 counties throughout August spoke of severely dry conditions, fire danger, and wilting vegetation. Small precipitation events reportedly provided brief respites for plants and wildlife, but not enough rain to rejuvenate browning lawns and crops. A few stations in San Juan County described wells drying up and non-irrigated crops suffering. How are dry conditions affecting where you live? Be sure to let us know!

La Niña Redux and the Present Drought

Message from the State Climatologist

There are indications that La Niña may be present in the tropical Pacific during the upcoming winter of 2021-22 (see the "Climate Outlook" below). This was the case during the past winter of 2020-21, and more often than not, La Niña events come in pairs. The models used to predict El Niño /Southern Oscillation (ENSO) yield outcomes ranging from near-normal to decidedly cold conditions with the consensus indicating a weak La Niña. As is hopefully apparent to the readers of this newsletter, most of Washington state is in drought, and presumably the prospect of La Niña is good news.

What is the early half of the water year like in Washington state during the second year of back-to-back La Niña events? We previously addressed that topic in the October 2011 newsletter, and here follow-up with the additional events in the record, and by taking a somewhat different tack through consideration of the variability in statewide temperature and precipitation anomalies from case to case. We consider the months of October through December separately from the months of January through March, in recognition that the effects of ENSO appear to be more robust in WA state during late winter. Before examining the results for the individual events, it seems worthwhile to briefly examine the overall atmospheric circulation patterns during the 1st and 2nd La Niña events in the historical record. This is accomplished using – you guessed it – 500 hPa geopotential height anomaly maps for the two sets of years, as plotted in Figures 4a and b. These maps are composites for November through March under the assumption that October represents a month of transition into the cool season and maybe should not be lumped in with the others. At any rate, the two composite anomaly maps strongly resemble one another. The 500 hPa geopotential heights are somewhat lower over WA state during the first year La Niña events, but the sense of the implied flow anomalies tends to be a bit more out of the north during the second year La Niña events, and it is

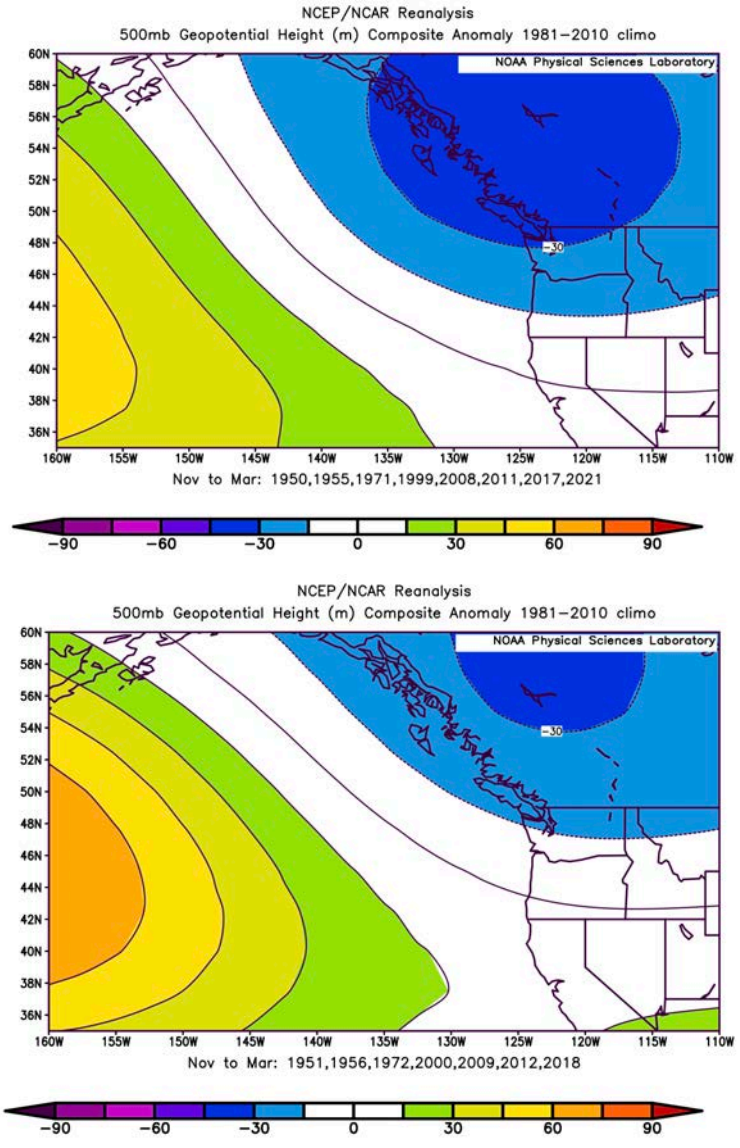


Figure 4: A composite of 500 hPa geopotential heights for the first year La Niña events (top) and the second year La Niña events (bottom; ESRL).

not obvious how our weather might differ between the two sets of years based on these maps.

Towards resolving that burning question, we have itemized the statewide temperature and precipitation anomalies for the two sets of years in Tables 2-5. It tends to be on the wet and cool side during La Niña in general, as shown in the tables here, with the temperature anomalies often being more prominent in January through March versus the October through December period of the year before. There is also some tendency for the 2nd of the back-to-back La Niña events to include a stronger cool and wet signal early, and a weaker signal late, relative to the first-year events. That being said, there is plenty of variability in the temperatures and precipitation totals among the events that is not strictly related to the strength of La Niña, and so of course there is no guarantee that the upcoming cool season will get off to a great start. Moreover, the present drought is especially a problem in the non-irrigated regions of eastern WA. If atmospheric circulation patterns run true to form with enhanced westerly to northwesterly flow, the result would be copious precipitation mostly from the coast to the Cascade Mountains with the lower elevations of eastern WA not necessarily doing as well relative to normal. We'll see.

Winter	Oct-Dec (°F)	Jan-Mar (°F)
1949-50	0.1	-9.1
1954-55	0.9	-4.8
1970-71	-1.8	-2.2
1998-99	0.3	0.6
2007-08	-1.1	-2.1
2010-11	-0.2	-1.5
2016-17	0.2	-3.7
2020-21	1.3	-0.1
Average	0.0 +/- 1.0	-2.9 +/- 3.1

Table 2: Statewide temperature anomalies (compared to 1991-2020) during the first-year La Niña events.

Winter	Oct-Dec (°F)	Jan-Mar (°F)
1950-51	0.5	-3.9
1955-56	-4.1	-5.6
1971-72	-2.1	-2.5
1999-00	2.2	-0.5
2008-09	-0.9	-2.6
2011-12	-0.8	-1.1
2017-18	-0.7	0.1
2021-22	?	?
Average	-0.8 +/1 2.0	-2.3 +/- 2.0

Table 3: Statewide temperature anomalies (compared to 1991-2020) during the second-year La Niña events.

Winter	Oct-Dec (in)	Jan-Mar (in)
1949-50	1.24	6.35
1954-55	-2.13	-3.31
1970-71	0.47	5.22
1998-99	5.94	6.83
2007-08	-0.08	-1.67
2010-11	0.85	3.29
2016-17	5.17	4.20
2020-21	-0.48	0.39
Average	1.4 +/- 2.8	2.7 +/- 3.8

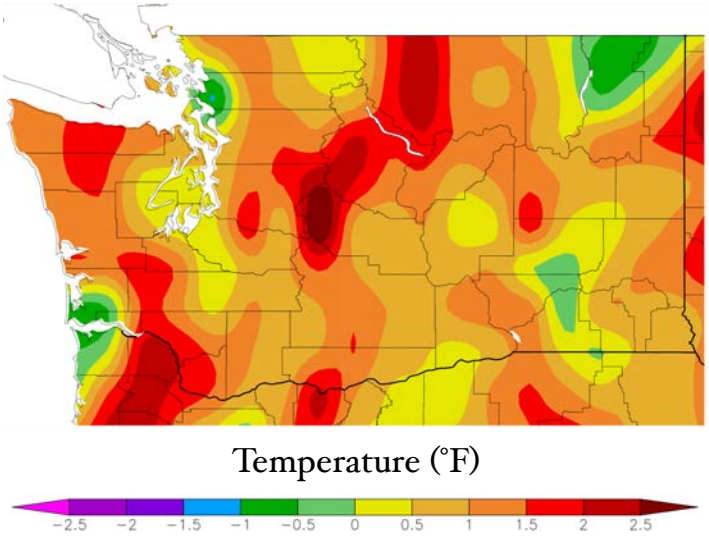
Table 4: Statewide precipitation anomalies (compared to 1991-2020) during the first-year La Niña events.

Winter	Oct-Dec (in)	Jan-Mar (in)
1950-51	5.67	4.12
1955-56	8.14	3.43
1971-72	0.13	6.46
1999-00	1.94	-0.83
2008-09	-2.01	-2.04
2011-12	-4.28	3.84
2017-18	2.09	0.28
2021-22	?	?
Average	1.7 +/- 4.3	2.2 +/- 3.1

Table 5: Statewide precipitation anomalies (compared to 1991-2020) during the second-year La Niña events.

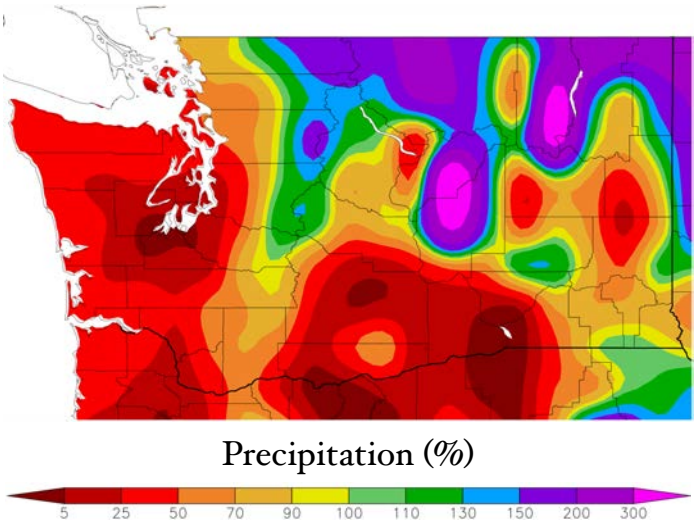
Climate Summary

Average August temperatures were above normal in the majority of the state. According to the map from the High Plains Regional Climate Center, most of Washington saw temperatures between 0.1 and 1.5°F above normal. Chelan County and the western half of Okanogan County were the warmest places relative to normal in the state, with temperatures between 1.5 and 2.5°F above normal. The greater Portland area saw similarly warmer than normal temperatures, with Vancouver averaging 2.3°F above normal for August (Table 6). A few isolated areas of the state were closer to or slightly cooler than the normal – most notably Stevens County, where temperatures were about 1.0°F below normal. Other cooler regions include parts of southeastern WA, the northeastern banks of the Puget Sound, and the Columbia River delta.



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

Two halves of Washington experienced two very different Augusts in terms of monthly precipitation totals. Western and southern Washington were much drier than average – as examples, Olympia and Vancouver recorded 0.01 and 0.02 inches of rain for the entire month, respectively (Table 6). Stations farther east, like Hanford and Pasco, similarly recorded less than 10% of normal precipitation. In contrast, many parts of central, northern, and northeastern WA received near or above normal precipitation. Many of these areas saw totals well above 150% of normal precipitation. Ephrata totaled 0.76 inches of rain over the course of the month, which amounts to a whopping 422% of normal precipitation!



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	65.6	64.2	1.4	0.01	0.96	1
Seattle WFO	68.3	67.1	1.2	0.28	1.00	28
SeaTac AP	67.5	67.4	0.1	0.11	0.97	11
Quillayute	60.9	60.0	0.9	0.80	2.64	30
Hoquiam	62.9	61.0	1.9	0.56	1.35	41
Bellingham AP	64.8	63.9	0.9	0.96	1.13	85
Vancouver AP	71.7	69.4	2.3	0.02	0.52	4
Eastern Washington						
Spokane AP	70.7	70.3	0.4	0.15	0.47	32
Wenatchee	75.0	73.7	1.3	0.18	0.23	78
Omak	73.9	72.8	1.1	0.52	0.27	193
Pullman AP	67.9	66.9	1.0	0.36	0.49	73
Ephrata	74.0	73.7	0.3	0.76	0.18	422
Pasco AP	74.5	73.2	1.3	0.01	0.27	4
Hanford	77.6	76.5	1.1	0.02	0.26	8

Table 6: August 2021 climate summaries for locations around Washington with a climate normal baseline of 1991-2020.

Climate Outlook

According to the Climate Prediction Center (CPC), neutral ENSO conditions are present in the Pacific Ocean, but a "La Niña Watch" is still in effect. Over the last 4 weeks, sea surface temperatures (SSTs) in most of the equatorial Pacific Ocean have been near or below average. The western and eastern reaches of the equatorial Pacific Ocean were slightly warmer than average. Neutral ENSO conditions are expected to persist through the end of summer (60% chance for the July-October season). La Niña conditions could potentially emerge during the fall and persist throughout the winter (67% chance during the October-December season). The chances of neutral conditions remaining instead are 32%, while the chances of El Niño conditions emerging during the same months are 1%.

The CPC outlook for September (Figure 5) shows increased chances of above normal temperatures for WA state. The probability of above normal temperatures is between 33 and 50% statewide. Similarly, the probability of below normal precipitation is between 33% and 50% statewide. Eastern WA is more likely to experience warmer and drier conditions compared to normal than western WA.

The three-month outlook for September-October-November (SON) shown in Figure 6 shows equal chances of above normal, below normal, and normal temperatures for most of the state. The southernmost portions of the state are more likely to see above normal temperatures, with chances between 33% and 40%. The Puget Sound and Olympic Peninsula have slightly higher odds (33% to 40% probability) of seeing above-normal precipitation in the coming months; the rest of the state shows equal chances of above normal, below normal, and normal precipitation.

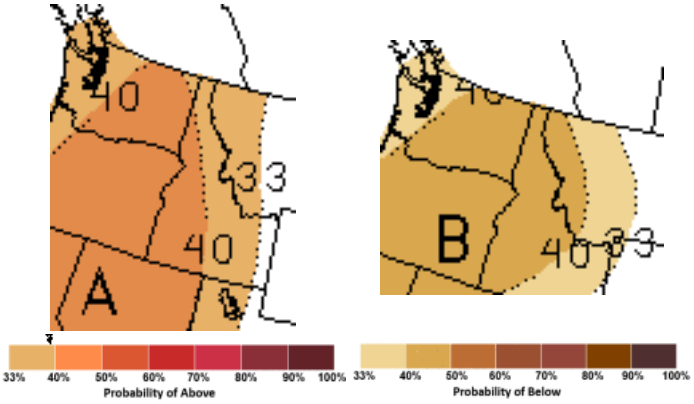


Figure 5: September outlook for temperature (left) and precipitation (right).

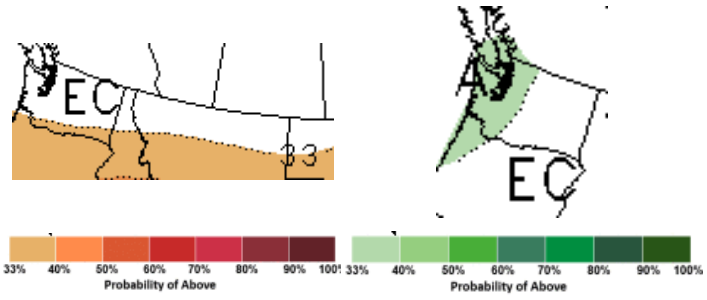


Figure 6: September-October-November outlook for temperature (left) and precipitation (right) (Climate Prediction Center).