



Office of the Washington State Climatologist

October 2019 Report and Outlook

October 15, 2019

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

September Event Summary

Mean September temperatures were near-normal throughout most of WA state, with some isolated exceptions (more detail in the “Climate Summary” section). September precipitation, on the other hand, was above normal statewide. Averaged statewide, September tied 1911 as the 10th wettest September (since 1895) with an anomaly of +2.06 compared to the 1981-2010 normal.

September was a rather eventful month weather wise. Figure 1 shows the monthly temperatures and precipitation compared to the normal ranges for Spokane Airport, illustrating steady rain east of the Cascade crest and some large temperature swings. In short, September had something for everybody.

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The first notable event was the widespread series of western WA thunderstorms on the evening of the 7th. These storms brought abundant lightning to the region, as illustrated in Figure 2, showing the lightning strikes for the 24 hours ending at 1 am PDT on the 8th. The amount of lightning on the I-5 corridor - a place not typically known for

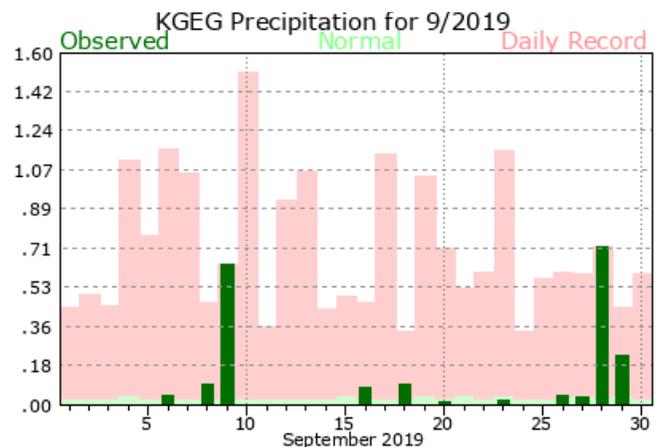
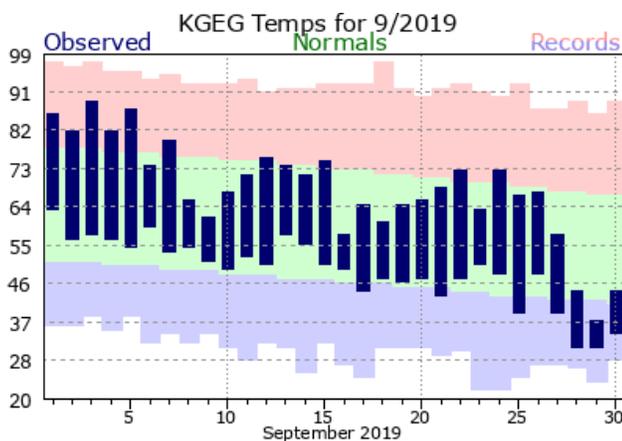


Figure 1: Daily September (left) maximum and minimum temperatures and (right) total precipitation for Spokane International Airport compared to normal (green envelope) and historical records (red and blue envelopes). [NWS](#)

its lightning - is very impressive. The National Weather Service reported about 2,200 cloud-to-ground lightning strikes in western WA, many of which occurred in a 5-hour period on the evening of the 7th. There were widespread impacts from these thunderstorms, with airport delays and plane diversions, power outages, urban flooding from heavy rain, at least a 3 hour long delay for the UW Husky football game, and even some fire starts in Whatcom county and Orcas Island.

The wet month included the setting of many maximum daily rainfall records. For example, Spokane Airport (0.64") and Omak (0.47") set records on the 9th, while the coast (Quillayute - 2.51"; Hoquiam - 1.02") set rainfall records on the 12th. The rain on the 12th was associated with some more thunderstorms in western WA. More maximum rainfall records were set on the 14th (Quillayute - 1.59") and 15th (Bellingham - 1.75"), and some of the heaviest rain that fell in north central WA occurred on the 17th and 18th. Omak set a daily rainfall record on the 18th (1.03").

But an even more interesting climate story is the early season snowfall in the Spokane area. Spokane Airport recorded 3.3" of snow over the 28th and 29th. This is not the earliest instance of September snow in the long record (that happened on 9/23 in 1926) but it does rank as the highest September snow total on record for Spokane. The 29th also set record cold maximum temperatures for many eastern WA locations; records were set at Spokane Airport (38°F), Pullman-Moscow Regional Airport (41°F), Wenatchee (43°F), Yakima (45°F), Omak (46°F), and Walla Walla (48°F), for example. This cold

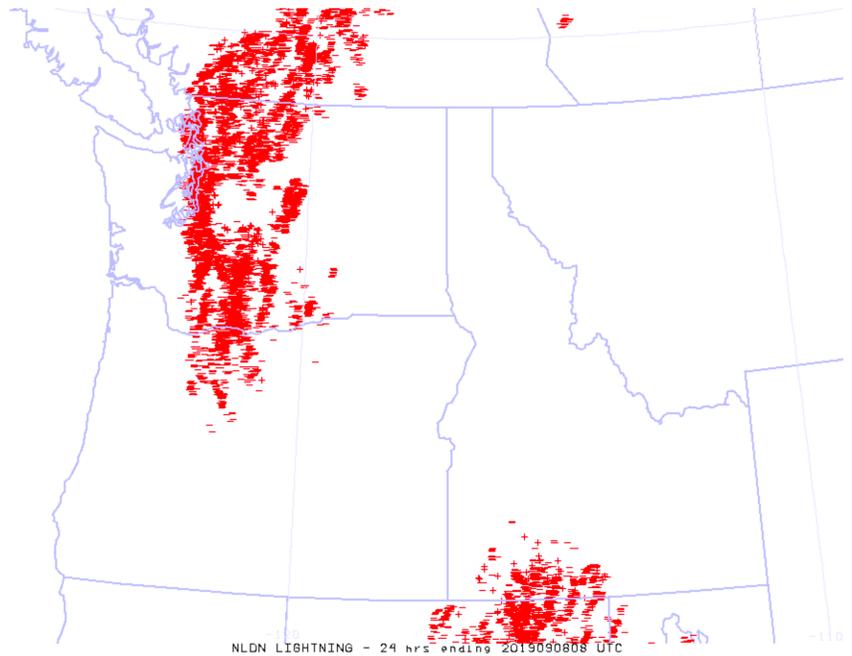


Figure 2: Lightning strikes for the 24 hours ending on 9/8 1 am PDT (from the [NLDN Lightning](#)).

snap is impressive especially in light of the large temperature difference for the month (Figure 1). Spokane recorded a high temperature of 89°F on the 3rd and a high temperature of 38°F on the 29th - a 51°F difference in high temperatures. That difference is the greatest in the September record extending all the way back to 1881.

Drought Update

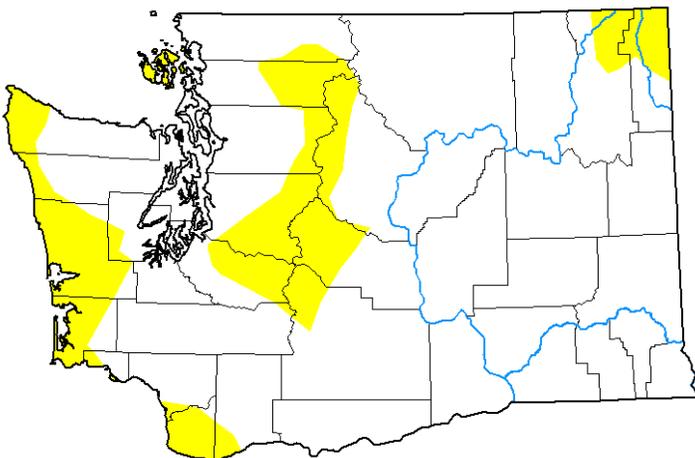
With the above normal September precipitation and near-normal temperatures, large improvements were made to the U.S. Drought Monitor over the last 6 weeks (Figure 3). The current WA depiction eliminates both the “severe drought” and “moderate drought” that were shown over a large portion of WA in last month’s newsletter. There are now some sparse areas of “abnormally dry” - D0 - conditions on the coast, central WA, San Juans, southwestern WA, and northeastern WA. With continued precipitation, we expect the improvement to continue. Streamflows were remarkably low over the summer, but the recent 28-day streamflow (Figure 4) shows vast improvements statewide, and was a major factor in the Drought Monitor improvements.

The state drought declaration remains in effect for the 27 watersheds as declared in April and May of

this year. Whether the drought declaration will be allowed to run out to its designated deadline or ended early remains to be seen. The [deadline](#) for emergency drought relief grant applications expired on October 2.

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 has developed a [Drought Impact Reporter](#) that allows the public to enter their observations regarding crops, water supply, fire, etc. in a short survey and we would appreciate your input.

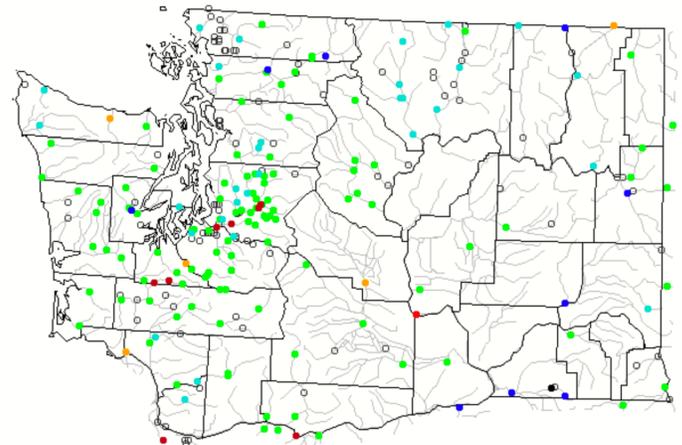


Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

Figure 3: The 10 October 2019 edition of the [U.S. Drought Monitor](#).

Sunday, October 13, 2019



Explanation - Percentile classes							
●	●	●	●	●	●	●	
Low	<10 <small>Much below normal</small>	10-24 <small>Below normal</small>	25-75 <small>Normal</small>	76-90 <small>Above normal</small>	>90 <small>Much above normal</small>	High	Not-ranked

Figure 4: Average streamflow averaged over the last 28-days ending 13 October 2019 (USGS).

The Warm Nights of Summer 2019

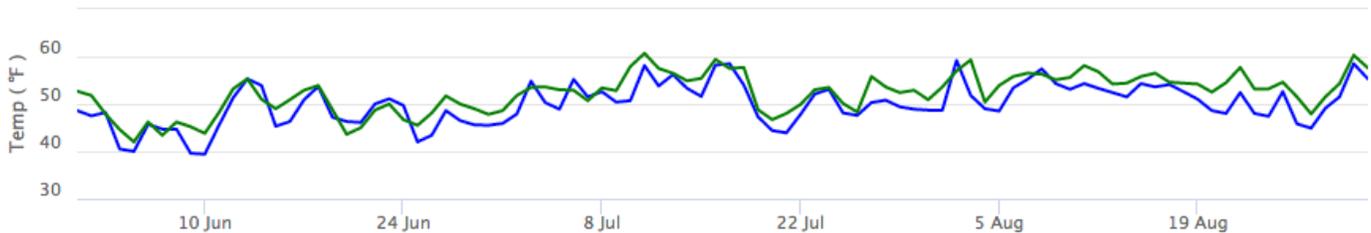
A message from the State Climatologist

The summer of 2019 included very near-normal daytime temperatures for Washington state. The mean maximum temperature anomaly for the state as a whole for the months of June through August was 0.3°F (relative to 1981-2010). Minimum temperatures were a different story, with consistently warm nights, especially west of the Cascades. For example, the night of 19 July was the single instance between the last week of June and the last week of August during which the temperature dipped below normal at SeaTac Airport (KSEA). Other places were not as extreme, but for the most part, cool nights were rare. Keen observers also noticed that it seemed on the humid side, and not just during the occasional periods of rain we enjoyed during the past summer. The objective of the present piece is to examine the day-to-day variations in minimum

temperature (hereafter, T_{min}) and dewpoint (T_d) during the past summer, with comparison of conditions on the west side with those on the east side of the Cascades. It represents a follow-up to the article in the [August 2015 edition](#) of this newsletter, which considered a similar topic for the state as a whole.

The results presented below use data from the PRISM 4 km gridded data set of daily values of T_{min} and T_d, available via the “Explorer” interactive tool (<http://www.prism.oregonstate.edu/explorer/>). The values of T_{min} and T_d are based on station data and a method termed climatologically-aided interpolation (CAI). We focus on two lowland and relatively rural locations, one near Olympia representing the Puget Sound Climate Division

Latitude: 46.9195 Longitude: -122.9127 Elevation: 223ft (68m) 4km PRISM cells / not interpolated
Min temp, Mean dewpoint English units / Daily values
01 June 2019 - 31 August 2019 (the PRISM day spans 24 hours ending at 1200 UTC on the day shown) Data stability: provisional



Latitude: 47.1229 Longitude: -118.3740 Elevation: 1857ft (566m) 4km PRISM cells / not interpolated
Min temp, Mean dewpoint English units / Daily values
01 June 2019 - 31 August 2019 (the PRISM day spans 24 hours ending at 1200 UTC on the day shown) Data stability: provisional

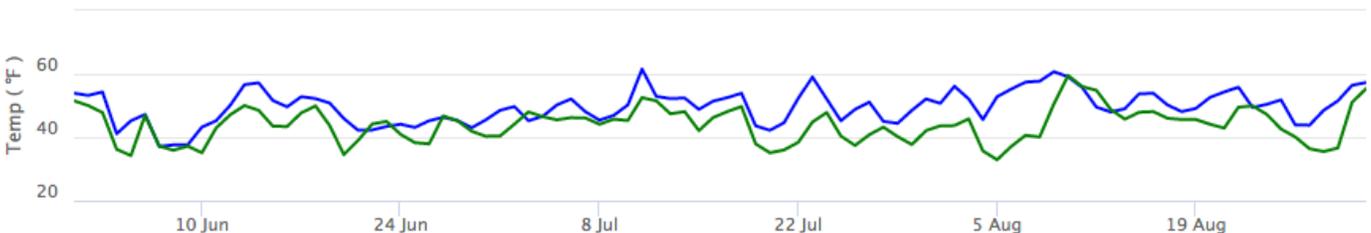


Figure 5: Time series of T_{min} (blue line) and T_d (green line) for June-August 2019 from PRISM for a location near (top) Olympia Airport and (bottom) Ritzville.

(#3) and one near Ritzville representing Central Basin Climate Division (#8). Their time series are shown in Figure 5.

A strong correspondence is evident between T_{min} and daily mean T_d at Olympia. At that location, the T_{min} was actually often less than T_d, which may seem odd at first blush in that the atmosphere simply never becomes supersaturated by anything more than at most a very tiny extent. Olympia Airport is known to be one of the cooler locations in the Puget Sound during the late night and early morning hours. What often happens is that the formation of dew (or frost in the winter) represents a sink for atmospheric water vapor near the surface, resulting in a temporary lowering of the T_d, allowing surface air temperatures to also drop. While the T_d is not strictly a lower limit, it can serve as essentially a floor for the T_{min}, which seems to be also the case at other locations in the vicinity of Puget Sound. Note that there also was a positive relationship between T_{min} and T_d at Ritzville during the summer of 2019, but it was not quite as strong. At that location T_{min} rarely dropped below the daily mean T_d; our interpretation is that the humidity is not as strong of a determinant because the relative humidity on the east side tends to be less than on the west side. We tested this conjecture using summer T_{min} and T_d data for the years of 1948-2018, averaging PRISM data for four locations each in Climate Division 3 and 8 to estimate values for the summers as a whole in each region. The linear correlation coefficient between summer mean

values of T_{min} and T_d for the Puget Sound region is about 0.73, and for the Central Basin is about 0.47, implying that T_d “explains” more than twice the amount of variance in the year to year variations of T_{min} in the former as compared with the latter. To be precise, we are not trying to make any strict claims concerning attribution but rather just that there is a stronger association between T_{min} and T_d on the west side.

While on the subject of T_{min} in summer, we felt it worthwhile to update some of the information that was presented in the August 2015 edition of this newsletter. Figure 6 illustrates the summer (June-August) mean values of T_{min} for WA Climate Divisions 3 and 8 for the years of 1895 through 2019, from NOAA’s “Climate at a Glance” website. The increases in this variable for both regions of WA state are obvious, even striking, in their consistency compared to most climate time series. The bottom line is that if your residence lacks air conditioning, you may be well-advised to at least get a decent fan before next summer rolls around...while our summer nights are pleasantly cool compared to much of the rest of the country they are getting warmer and slightly stickier.

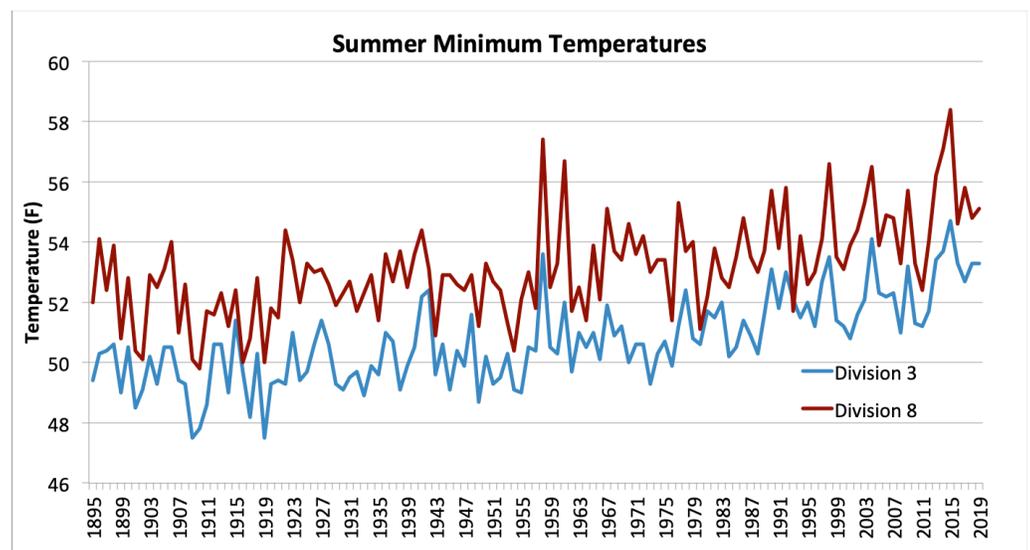
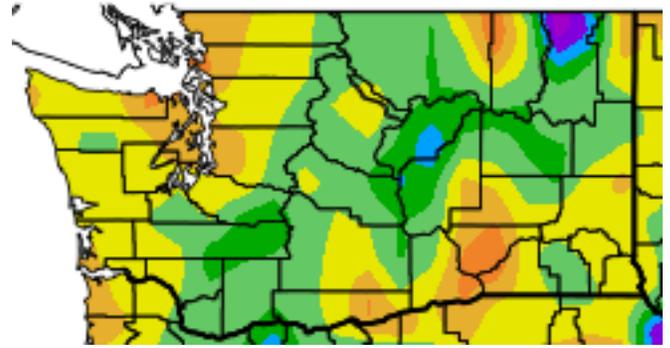


Figure 6: Time series of T_{min} for Div 3 and Div 8.

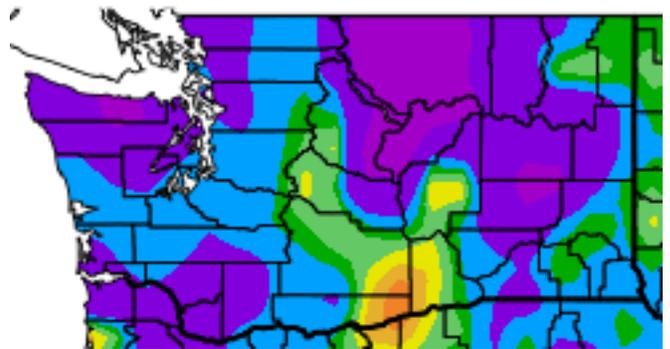
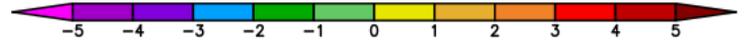
Climate Summary

Mean September temperatures were near-normal for a large area of the state, with monthly temperatures within 1°F of normal. For example, Olympia, Hoquiam, and Omak were within 0.4, 1.0, and -0.9°F of normal, respectively. There were exceptions to this, of course. In western WA, the northern Puget Sound region was about 2-3°F warmer than normal with Bellingham measuring September temperatures 3.4°F warmer than normal. Pasco, in eastern WA, was warmer than normal as well (Table 1). But there were also some cool anomalies. Wenatchee and Ephrata were 2.1 and 2.4°F below normal for the month, and northeastern WA was also a cooler spot.

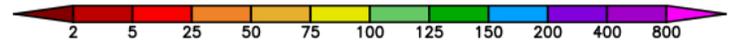
Total September precipitation was above normal for a majority of the state, with totals between 150 and 300% of normal. North central WA was remarkably wet, with Omak receiving 500% of normal precipitation. Omak recorded its wettest September on record, though admittedly the record is relatively short (beginning in 1998). A few stations in south central WA were the exception to the wet September, receiving near-normal precipitation to slightly below; Hanford, for example, only received 87% of normal precipitation.



Temperature (°F)



Precipitation (%)



September temperature (°F) departure from normal (top) and precipitation percent of normal (bottom). (High Plains Regional Climate Center; relative to the 1981-2010 normal).

	Mean Temperature (°F)			Precipitation (inches)		
	Average	Normal	Departure from Normal	Total	Normal	% of Normal
Western Washington						
Olympia	59.3	58.9	0.4	3.43	1.71	201
Seattle WFO	62.3	61.6	0.7	3.86	1.52	254
SeaTac AP	62.8	61.3	1.5	3.32	1.50	221
Quillayute	57.7	56.6	1.1	9.44	3.82	247
Hoquiam	59.7	58.7	1.0	4.46	2.28	196
Bellingham AP	60.6	57.2	3.4	4.73	1.78	266
Vancouver AP	63.2	63.6	-0.4	4.06	1.56	260
Eastern Washington						
Spokane AP	59.2	60.2	-1.0	1.98	0.67	296
Wenatchee	62.3	64.4	-2.1	1.14	0.34	335
Omak	61.7	62.6	-0.9	2.90	0.58	500
Pullman AP	59.3	58.2	1.1	1.05	0.78	135
Ephrata	61.4	63.8	-2.4	0.37	0.36	103
Pasco AP	66.1	63.4	2.7	0.55	0.40	138
Hanford	65.8	66.4	-0.6	0.27	0.31	87

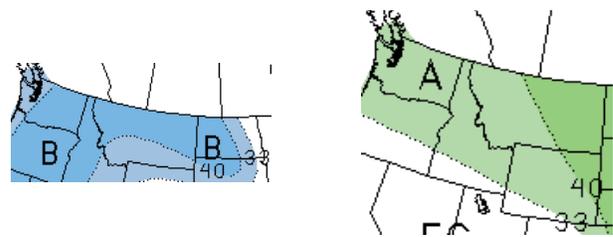
Table 1: September 2019 climate summaries for locations around Washington with a climate normal baseline of 1981-2010. Note that the Vancouver Pearson Airport and Seattle WFO 1981-2010 normals involved using surrounding stations in estimating the normal, as records for these station began in 1998 and 1986, respectively.

Climate Outlook

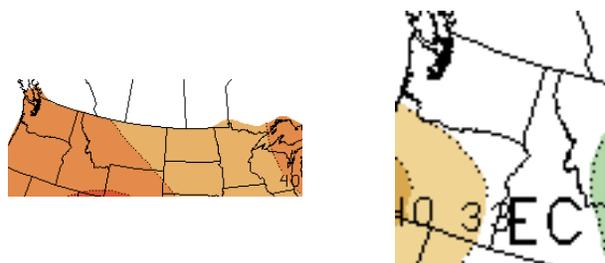
According to the Climate Prediction Center (CPC), neutral ENSO conditions are present in the equatorial Pacific. Over the last month, sea surface temperatures (SSTs) were above normal in the western Pacific and below normal in the eastern Pacific, though SSTs have warmed over the period. Models indicate a continuation of ENSO-neutral conditions into the fall and winter. Currently, the official CPC/IRI forecast indicates a 62% chance of neutral ENSO conditions, 29% chance of El Niño, and 9% chance of La Niña for the December 2019 through February 2020 period.

The CPC October temperature outlook calls for increased chances of below normal temperatures statewide, with the odds of below normal temperatures higher for eastern WA. For precipitation, there are slightly increased chances of above normal October precipitation statewide.

The CPC October-November-December (OND) seasonal temperature outlook is in contrast to the October outlook, showcasing the monthly variability that can still exist within the longer seasonal outlooks. For the OND period, warmer than normal temperatures are likely for all of WA state and the U.S. as a whole. Precipitation is uncertain, with equal chances of either below, equal to, or above normal precipitation statewide.



October outlook for temperature (left) and precipitation (right)



October-November-December outlook for temperature (left) and precipitation (right)

(Climate Prediction Center)