Office of the Washington State Climatologist

November 2020 Report and Outlook

November 5, 2020

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

October Event Summary

Mean October temperatures were warmer than normal from the Olympic Peninsula through the southern portion of WA. Temperatures in the northern tier of the state were near-normal. Precipitation was also variable, with the Cascade Mountains, north-central WA, and northeastern WA receiving above normal precipitation, with the rest of the state receiving below normal precipitation.

An upper level ridge dominated our weather during the beginning of October, bringing relatively warm and dry conditions around the state. For western WA, morning fog was common, but afternoon skies were sunny. Wenatchee Pangborn Field measured a daily record high temperature of 83°F on the 4th. Figure 1 shows the October daily temperature and precipitation time series for Bellingham Airport. There was a pattern shift on the 9th, as a series of frontal systems brought precipitation around the state. Bellingham Airport recorded a maximum daily rainfall record of 0.89" on the 11th, for example. There was even an EF-1 tornado (winds estimated at 90 mph) that touched down for 0.5 mile in the early morning hours on the 10th in Grays Harbor county. Thankfully no injuries were reported.

In this Issue

The other notable weather for October was the cold snap that began on the 21st and lasted through the 26th or 27th, depending on the location. With the colder than normal temperatures, there was also a widespread snow event in eastern WA on the 23rd. Spokane International Airport measured 6.9" of snow on the 23rd, which was not only a record maximum for the day, but also the snowiest October day on record (going all the way back to 1881). Figure 2 shows 24-hr snowfall totals from CoCoRaHS observers measured on the morning of October 24, illustrating snowfall between 3 and 10" in north central and northeastern WA. Sites in eastern Washington set daily low temperature records on the 23rd at Walla Walla (28°F) and Yakima (23°F), and again on the 25th at Walla Walla (22°F) and

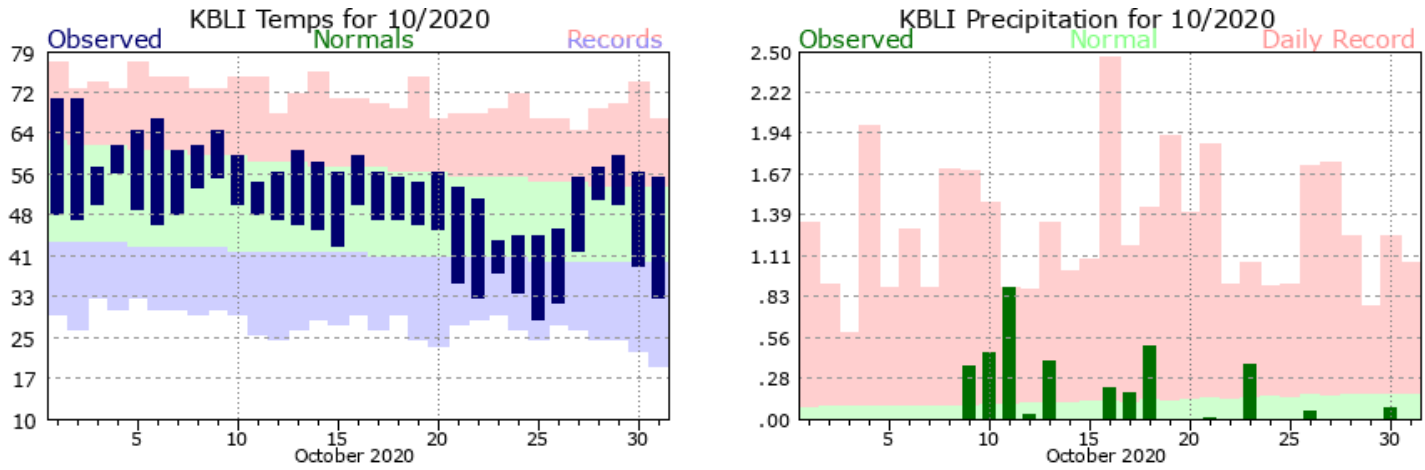

Figure 1: Daily October 2020 maximum and minimum temperatures (left) and precipitation (right) for Bellingham International Airport compared to normal (green envelope) and historical records (red and blue envelopes).

Ephrata (20˚F) with further daily low temperature records coming on the 26th and 27th. Cold temperatures weren't isolated to east of the crest, western WA had low temperatures in the 20s and 30s as well. On the 25th, for example, record low daily temperatures were set at Hoquiam (31˚F), Olympia (26˚F). Temperatures rebounded to closer to normal at the end of the month, again illustrated by the Bellingham time series in Figure 1, and the 29th was warmer than normal around the state. Walla Walla set a record high temperature of 72˚F on the 29th, quite a temperature swing from a high of 33˚F just 4 days prior.

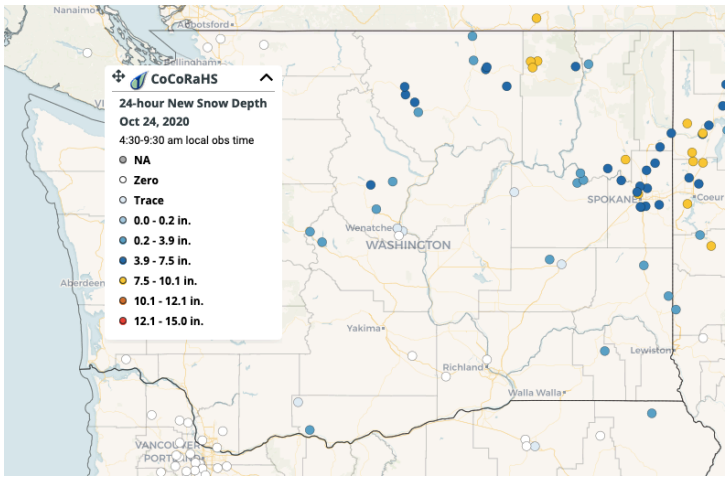

Figure 2: 24-hr snowfall observations from the morning of October 24, 2020 from the CoCoRaHS network.

Drought Monitor Update

There were a few instances of high elevation snow during October, but as of November 2, snow water equivalent is still below 5" even at the highest elevations monitored in WA state. Little mountain snow is typical for this time of year, which is why the snow water equivalent percent of normal plot is not shown here this early in the season. The higher than normal precipitation across the north and central Cascades and the northern half of the state did prompt a scaling back of the drought categories on the U.S. Drought Monitor (Figure 3), however. The areas of "abnormally dry", "moderate drought", "severe drought", and "extreme drought" were reduced east of the Cascades since our last newsletter. The drought depiction in the U.S Drought Monitor closely matches the precipitation deficits for the last water year (Oct 1, 2019-Sept 30, 2020), as shown in Figure 4.

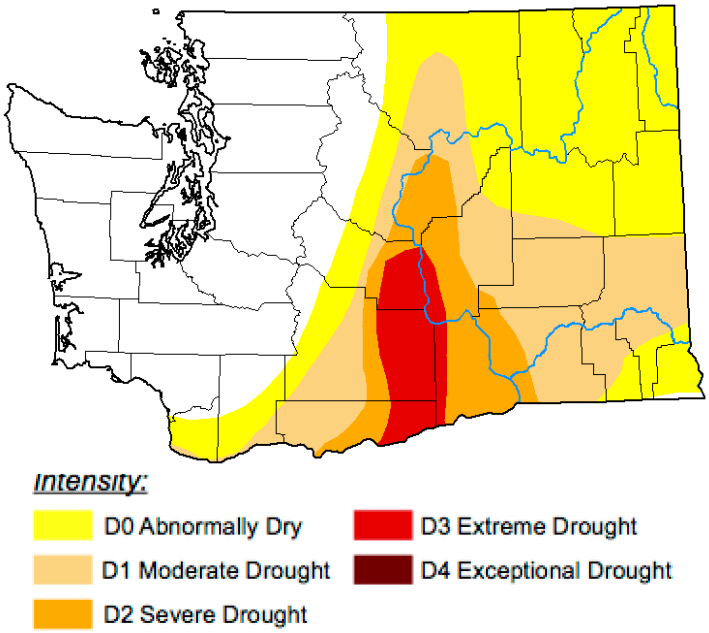

Figure 3: The 29 October 2020 edition of the U.S. Drought Monitor.

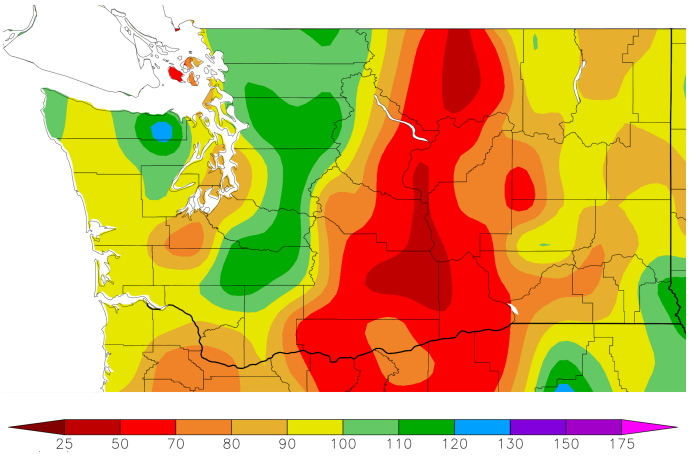

Figure 4: Precipitation percent of normal for the 2020 Water Year (Oct 1, 2019-September 30, 2020).

The CoCoRaHS Corner

photo by Henry Reges, CoCoRaHS

Last month, a total of 10,681 CoCoRaHS precipitation reports were submitted, which is a healthy increase from 10,109 reports seen in September. Not so striking with the beginning of the seasonal wet period, there were 12 single day precipitation reports of greater than 2"with a 2.67" on 10/12 at Snoqualmie 2.6 SSE that topped the charts. Surprisingly, all of reports of greater than 2" were spread amongst a single wet period, which lasted from October 10th to the 14th, but did not favor any particular day. While high precipitation totals are not so unfamiliar for October in our region, generally most any hint of snowfall waits until November. Yet, 44 stations on 10/23 (as

shown on page 2) were treated to snow, and provided valuable reports that give a much more accurate depiction. This system was far from a dusting as Republic 8.4 NNE recorded 8.5".

A Tale of Two Sea Surface Temperatures

A message from the State Climatologist

There is a strong indication that at least moderate, and possibly strong, La Niña conditions will be present during the upcoming winter of 2020-21. Many readers of this newsletter know of the implications for WA state, namely improved odds of seasonal mean weather on the wet and cool side and healthy snow totals in the mountains at the end of winter. The sea surface temperature (SST) in the eastern and central equatorial Pacific is already considerably colder than normal, as shown in Figure 5. But wait a minute. Note that the upper ocean is warmer than normal off the coast of the Pacific Northwest and conceivably that loads the dice for a toasty winter. We explore that a bit here.

To begin, we consider the prospects for our winter associated with La Niña. The coupled ocean-atmosphere climate models used for seasonal weather prediction can account for the state of the tropical Pacific and as a group, reflect a robust atmospheric response over the North Pacific Ocean and North America that is typical of La Niña. An international multi-model ensemble mean prediction of the sea level pressure (SLP) anomaly distribution during December through February, based on October model runs, is shown in Figure 6. Of significance to our winter weather is the higher than normal SLP forecast south of western Alaska, i.e., an abnormally weak Aleutian low. The circulation associated with this kind of SLP anomaly distribution features NW low-level flow for the Pacific NW and a tendency for more weather disturbances out of the Gulf of Alaska, often accompanied by cool and wet weather. It is also

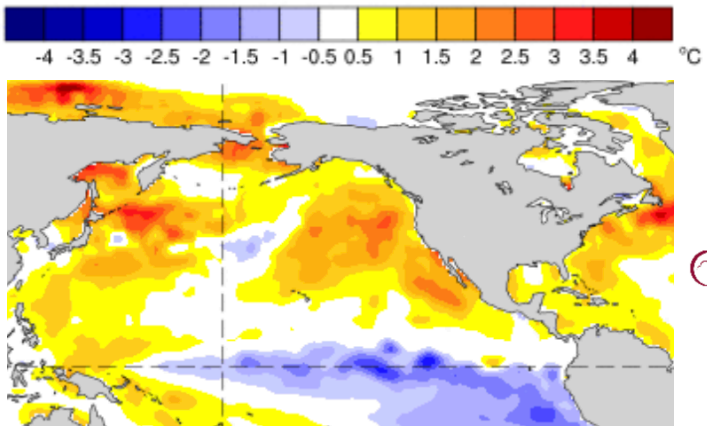

Fig 5: SST Anomaly (deg. C) for 18-24 October 2020.

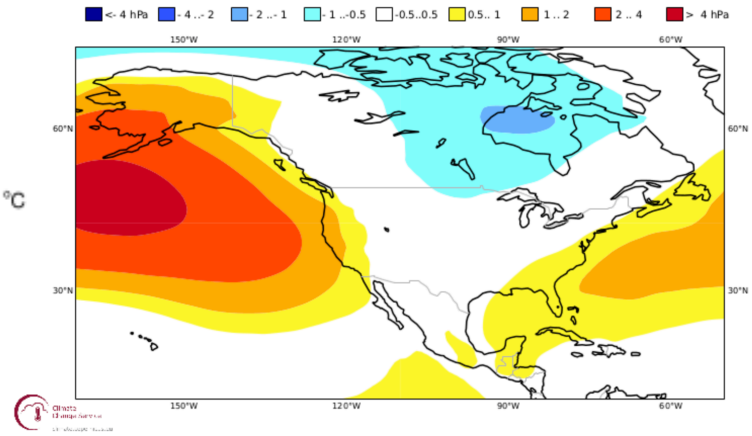

Fig 6: Mean model SLP anomaly (mb) prediction for December 2020 through February 2021. The models used in the composite are indicated in the upper right (Copernicus).

bad news for California and the desert Southwest, which experience substantially suppressed storminess and precipitation in this kind of situation. The idea that the climate models are effectively "buying in" to La Niña is indicated by comparing the composite SLP anomaly forecast of Figure 6 with the past atmospheric response to La Niña, as shown in the regression between the observed winter SLP and the NINO3.4 index included here as Figure 7. There is a close

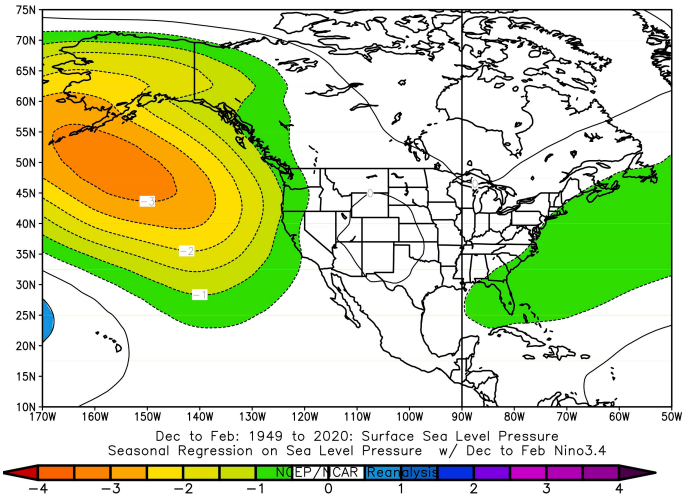

Figure 7: Regression of SLP with the NINO3.4 index for the 3-month period of December-February for the years of 1948-2020 (NCEP Reanalysis).

similarity between the pattern of the SLP signal over the North Pacific in Figures 6 and 7. Considering that ENSO models are forecasting a NINO3.4 value of -1 to -1.5 for the winter ahead, the regression on past data yields an expectation of a positive SLP anomaly of about 4 mb, which is close to the value predicted by the models. Further support for this La Niña playing a major role in our weather is provided by previous work by CICOES researcher Andrew Chiodi, who found that La Niña events that included a prominent suppression of deep cumulus convection in the western tropical Pacific were accompanied by an atmospheric response in the North Pacific that was 3-4 times stronger than those winters that were labeled as La Niña based on the overall SST anomaly distribution in the tropical Pacific, but for whatever reason(s) lacked much of an expression in terms of central and western Pacific convection. Based on the observed convection with the present La Niña, it is on track to qualify as the type of event that is accompanied by enhanced precipitation in WA (A. Chiodi, personal communication).

OK, fine, La Niña is liable – but of course not guaranteed – to bring joy to winter sports enthusiasts and other interests depending on mountain snowpack, but what about that warm water off our coast? Is there the potential for the disaster of 2014-15, which is famous for both the extremely warm water off the coast and the record high winter temperatures and low snowpack? The short answer is almost certainly no. To begin with, while the SSTs off our coast are elevated, the depth of the warm water appears to be considerably less than at the same time of year in 2014 (not shown). More specifically, the temperature at the 50 meter deep level were more than 1°C higher in the September of 2014 than 2020. In other words, there is not nearly as large a reservoir of extra heat in the upper ocean, which means it can cool off relatively rapidly depending on the atmospheric forcing. And the atmosphere may well cooperate, given La Niña. As illustrated by the model projections and historical averages associated with La Niña, it is expected that wind anomalies out of the northwest will prevail for the winter season as a whole. This sense of flow results in coastal upwelling, bringing up cooler water from depth that can rapidly decrease surface temperatures. That process is important for a narrow strip near the coast, but northwest flow also tends to cool off the upper ocean farther

offshore. In that region of deeper waters, northwesterly flow is accompanied by relatively cool air masses leading to enhanced fluxes of heat from the upper ocean to the atmosphere. It also forces equatorward upper ocean currents (Ekman transports) and hence the advection of colder water from the north. These effects do not occur day in and day out, but if in fact, there are northwesterly wind anomalies for the winter as a whole, the present warm SSTs along the coast probably will not plague us, nor the juvenile salmon that enter the marine environment next spring. This scenario is consistent with the climate model projections for March 2021 (Fig. 8), which indicate SSTs along the coast that are actually on the cool side. As an aside, the models have the upper ocean remaining warm well off the coast; the high SLP that is forecast in the central North Pacific means less storminess, and the weaker winds mean reduced surface heat fluxes out of the ocean and less stirring up of cooler water from below.

The bottom line is that if the winter plays out as expected, we should have at least a decent snowpack going into spring. This happens to be a La Niña for which the models are forecasting a more robust signal for precipitation rather than temperature, and so the prospects for especially cold temperatures are not all that high. On the other hand, we also need to take what we can get since most of our winters in recent years (with 2016-17 being an exception) have been on the warm side.

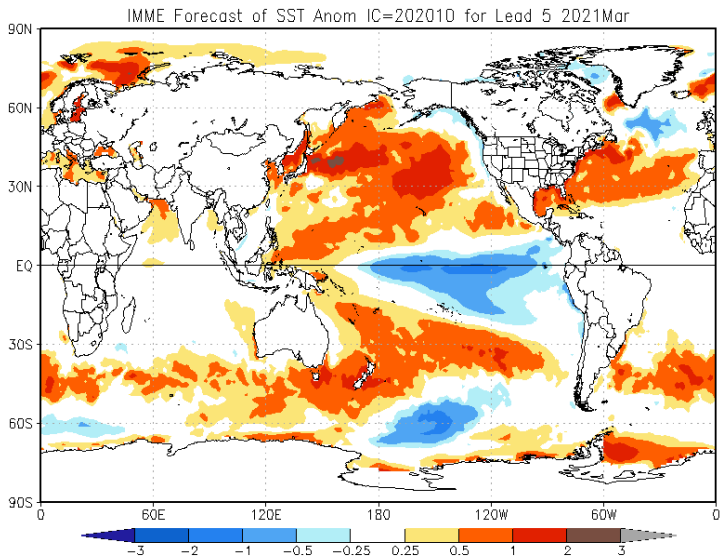

Figure 8: International multi-model ensemble (IMME) forecasts of SST for March 2021.

Climate Summary

Mean October temperatures were near to and above normal across much of the state aside for a pocket of below normal temperatures in the NE corner. Temperatures were above normal statewide early in the month, but a bout of well below normal temperatures late in October tempered the warm anomalies . Greatest warm temperature anomalies existed in the area surrounding Tri-Cities with Pasco recording average temperatures 2.2 °F above normal (Table 1). The populated lowlands adjacent to Puget Sound featured temperatures 1 - 2 °F above normal. On average, SeaTac was 1.5 °F above normal and further north in Bellingham temperatures were 1.7 °F above normal. While Spokane featured record breaking snowfall and cold, monthly temperatures were still 0.4 °F above normal for month as a whole.

October precipitation totals were largely a mixed bag with well above normal values for the Cascades and northeastern Washington, but below normal values in western Washington and the Lower Columbia Basin. Wenatchee and Spokane recorded 211 and 140 % of normal precipitation, respectively, which was the first month in those locations of above normal precipitation since May ended. Pasco was embedded in a region of below normal precipitation in the Lower Columbia Basin, observing 0.26" of precipitation or 40 % of normal, continuing its run of below normal monthly precipitation, which began in June as well. Western Washington experienced below normal precipitation with SeaTac recording 74 % of normal precipitation. The main climatology story came with the wintery storm passing over Washington in late October, which brought October snowfall records to a multitude of stations in eastern Washington - capped by Spokane recording 7.5" of snowfall when it normally receives only 0.1" in October (not shown in Table 1).

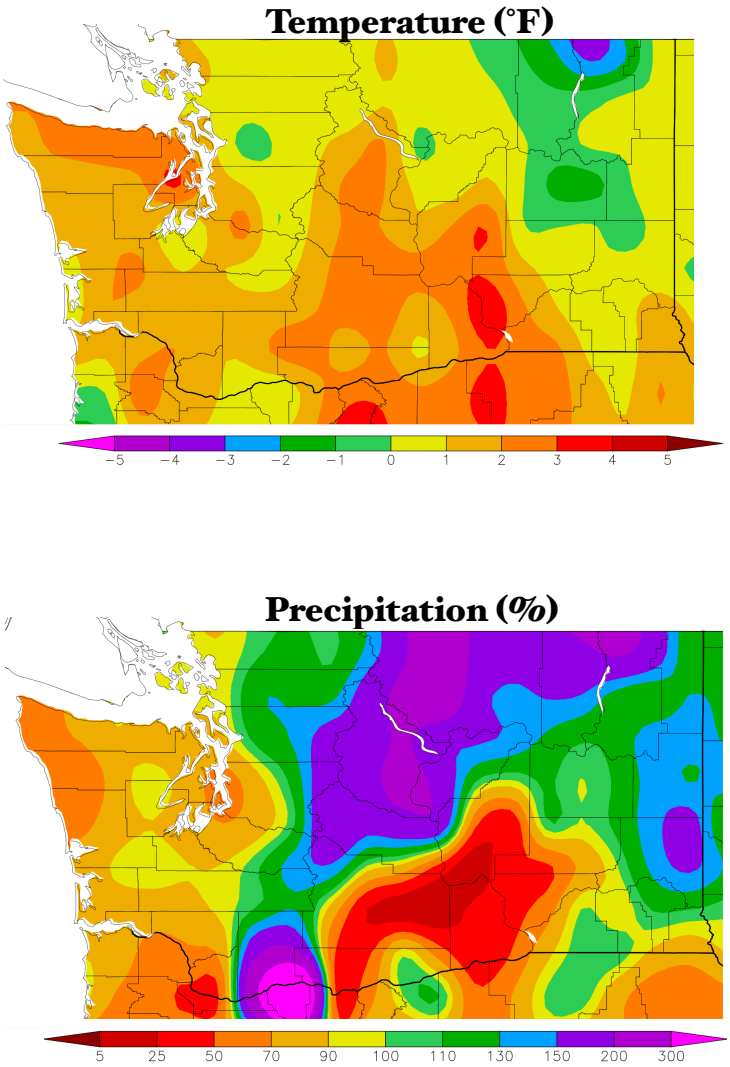

Figure 9: October temperature (°F) departure from normal (top) and precipitation percent of normal (bottom).

(High Plains Regional Climate Center; relative to the 1981-2010 normal).

	Mean Temperature (°F)			Precipitation (inches)		
	Average	Normal	Departure from Normal	Total	Normal	Percent of Normal
Western Washington						
Olympia	51.6	50.3	1.3	4.04	4.60	88
Seattle WFO	54.1	53.3	0.8	2.98	3.41	87
SeaTac AP	54.3	52.8	1.5	2.58	3.48	74
Quillayute	51.7	50.0	1.7	7.13	10.49	68
Hoquiam	52.8	52.2	0.6	4.83	6.53	74
Bellingham AP	51.5	49.8	1.7	3.50	3.68	95
Vancouver AP	55.2	53.8	1.4	1.81	3.07	59
Eastern Washington						
Spokane AP	48.0	47.6	0.4	1.66	1.18	141
Wenatchee	52.0	50.9	1.1	0.93	0.44	211
Omak	49.6	48.9	0.7	1.82	1.08	1.69
Pullman AP	48.5	47.5	1.0	2.30	1.34	172
Ephrata	51.5	50.5	1.0	0.39	0.53	74
Pasco AP	54.1	51.9	2.2	0.26	0.65	40

Table 1: October 2020 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), La Niña conditions are present in the equatorial Pacific Ocean and are expected to remain in place through the winter and spring of 2021. Sea surface temperature (SST) anomalies in the western equatorial Pacific have slightly increased to values between 1 and 1.5 °C, and below normal SSTs have halted their westerly progression at 160 E. All Niño indexes are negative with the principal index Niño 3.4 having dropped to -1.7 °C, which is below the ENSO model forecasts a few months ago. These forecast models indicate an 80% probability of La Nina persisting through the end of winter (JFM of 2021) with roughly equal odds of La Nina or neutral conditions for the following March through May period.

The CPC November temperature outlook (Figure 10) has favored above normal temperatures in the southwest half of the state. In the northeast half of the state, there are equal chances of above below, and near to normal temperatures. The precipitation outlook gives increased chances of above normal precipitation virtually to the entire state in the 40-50% range.

The three-month (November-December-January) CPC temperature outlook (Figure 11) has slightly increased chances of below normal temperatures in the northwest corner of the state. The rest of the state has equal chances of above, below, or near to normal temperatures. The seasonal precipitation outlook has increased odds of above normal precipitation across the state with slightly higher chances in the eastern half of the state. La Niña tends to favor above normal precipitation with cooler temperatures for Washington State.

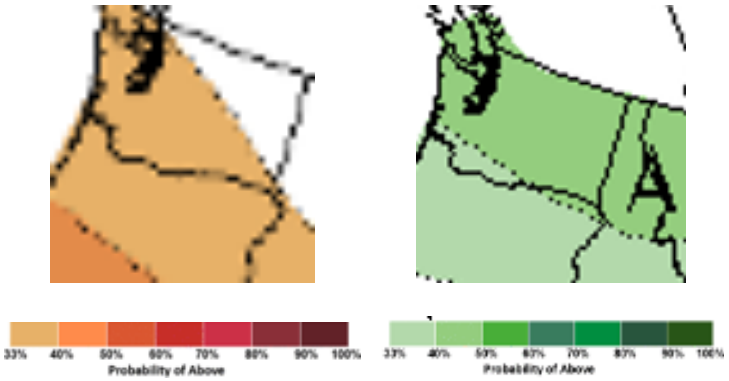

Figure 10: October outlook for temperature (left) and precipitation (right)

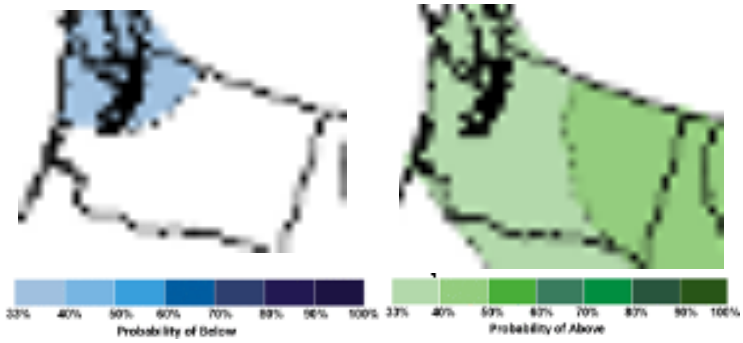

Figure 11: October-November-December outlook for temperature (left) and precipitation (right)

(Climate Prediction Center)