Office of the Washington State Climatologist

January 2021 Report and Outlook

January 8, 2021   http://www.climate.washington.edu/

December Event Summary

Mean December temperatures were higher than normal across the state, with greatest anomalies in central Washington. Warm anomalies transpired with the National Weather Service (NWS) reporting 13 daily high temperature records broken in December, but no instances of record cold. December precipitation was much more variable, with above normal precipitation in the Olympic Peninsula, NW Washington, and a pocket in the Kettle Range of NE Washington. On the other hand, areas lee of the Cascades received between 25 and 70% of normal precipitation, with the lowest totals in the lower Columbia Basin (more details in the "Climate Summary" section).

The state's weather began with mild conditions through the first week of December. High pressure kept most precipitation out of the area making for the 3rd driest start to December at SeaTac, which also

broke daily high temperature records on the 2nd at 60 °F and 4th at 58 °F. In fact, high pressure dominated the first half of the month as seen in the plot of surface pressure reanalysis data (Figure 1).

The weather switched back into winter around the 7th, with Olympia recording precipitation every day for the
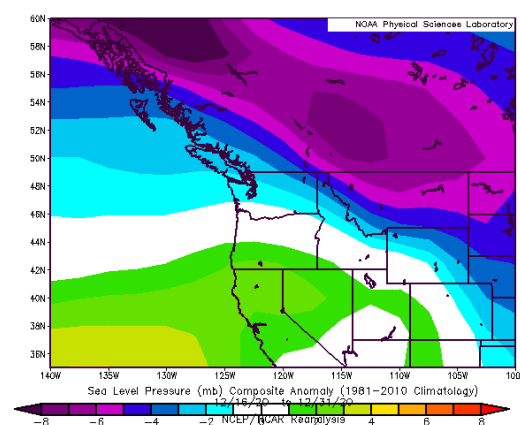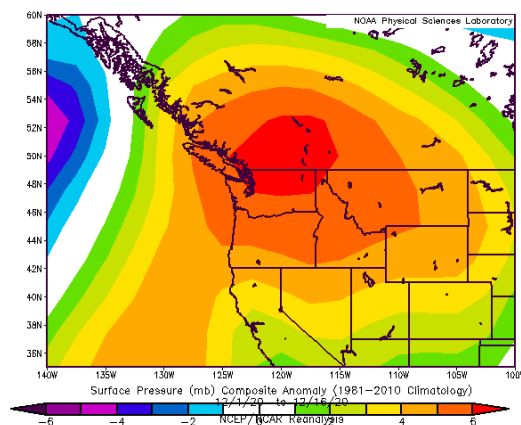

Figure 1: Model reanalysis of sea level pressure anomalies from Dec. 1 to Dec. 15 (left) and from Dec. 16 to Dec. 31 (ESRL).
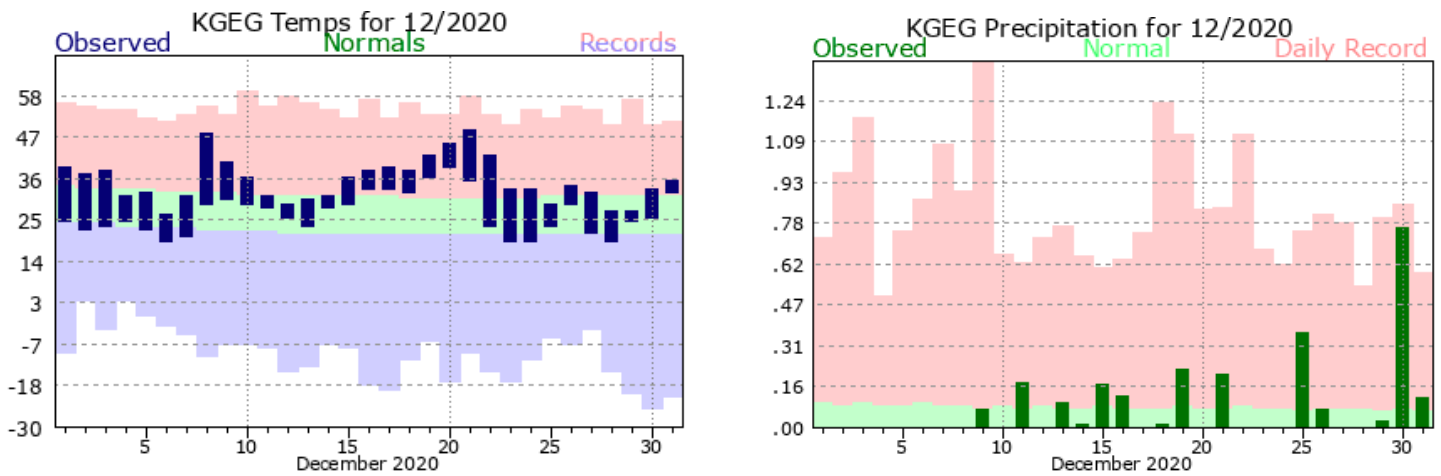
Figure 2: Daily December 2020 maximum and minimum temperatures (left) and precipitation (right) for Spokane INT'L AP compared to normal (green envelope) and historical records (red and blue envelopes) from [NWS](#).

next two weeks. South westerly flow brought steady warm moisture into the region shrinking the diurnal temperature range to 5 °F or less for many areas such as the Seattle WFO, Olympia, Wenatchee, and Spokane all on the 16th (Fig. 2). The stretch of active weather culminated with an atmospheric river ahead of a stout cold front on the Solstice. The incoming tropical moisture set daily warm temperature records at Walla Walla, Vancouver, and SeaTac, which also broke a daily precipitation record with 1.64". As the strong cold front passed over SeaTac, temperatures quickly fell 20 degrees to 34 °F between 4pm and 7pm, and the rain briefly turned to snow (Figure 3).

Compared to the previous two weeks, cooler and less active weather rounded out the rest of 2020. Fairly consistent showers struggled to reach eastern Washington after Christmas, except for the 30th when enough moisture found freezing temperatures in Spokane to produce snowfall that totaled 8.1"- a new daily snow record and the 9th snowiest day in December for the city. A warming trend made the snowfall short-lived as rain returned late in the day.
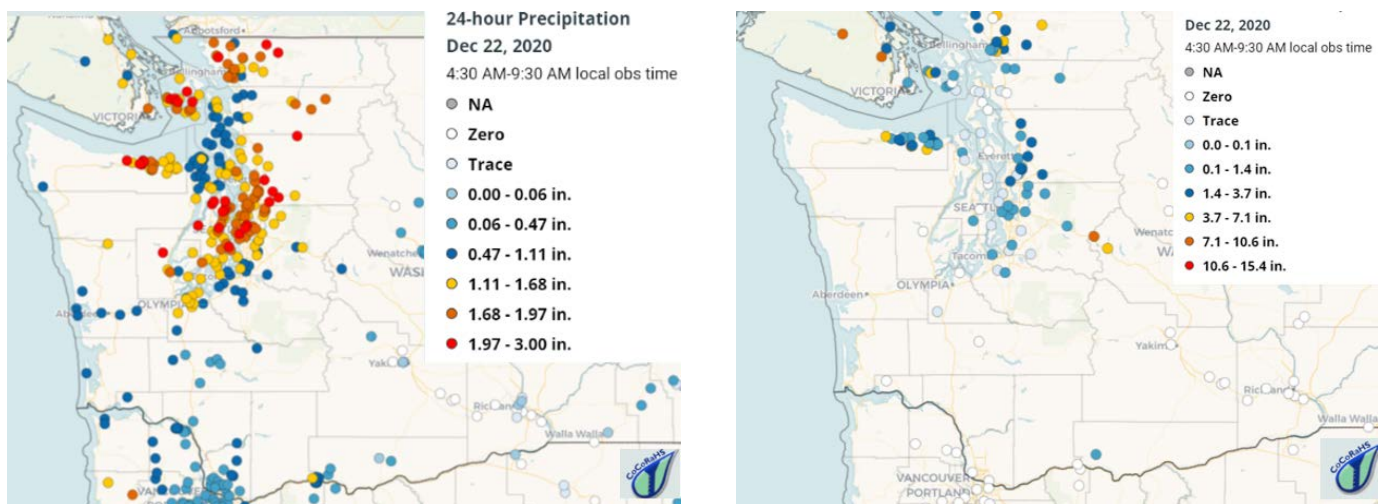

Figure 3: CoCoRaHS precipitation observations taken on the morning of Dec 22 for the preceding 24 hours capturing the heavy precipitation (left) on Dec 22 in Western Washington turning to snow (right) in the evening ([CoCoRaHS](#)).

Snowpack and Drought Monitor Summary

Despite the dry period early in the month, snowpack built in the mountains from a series of storms in the second half of the month. The basin average snow water equivalent (SWE) percent of normal from the Natural Resources Conservation Service (NRCS) as of January 1 is shown in Figure 4. Snowpack is normal to above normal throughout the Olympic and Cascade Mountains, ranging from 97 to 119% of normal. Basins in eastern WA - the Lower Pend Oreille, Spokane, and Lower Snake-Walla Walla - were below normal on January 1 (85-90% of normal) but have already jumped back up to the normal range in just the first week of January (not shown).
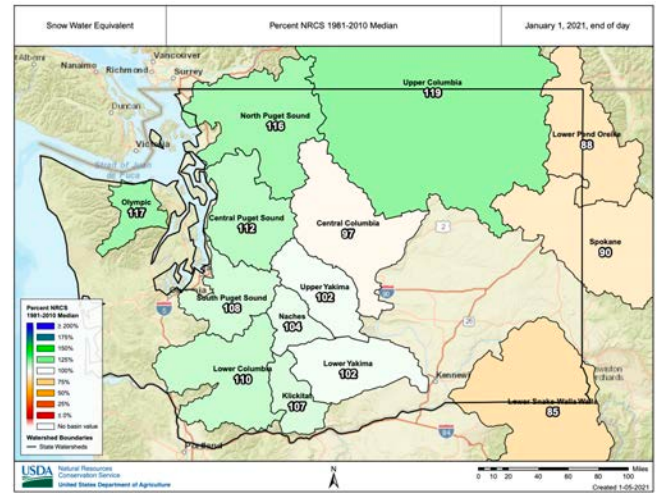
The healthy snowpack has spurred some improvement in the U.S. Drought Monitor (Figure 5) despite total December precipitation being below normal for a majority of eastern WA locations. Areas of "extreme drought" (D3), "severe drought" (D2), and "moderate drought" (D1) have all been reduced in response to improving short term drought metrics. "Abnormally dry" (D0) conditions were removed completely from Spokane and Pend Oreille counties and reduced in other eastern WA locations in response to the heavy precipitation during the last week of December and the first week of January.

Figure 4: Snowpack (in terms of snow water equivalent) percent of normal for Washington as of January 1, 2021 (from NRCS).

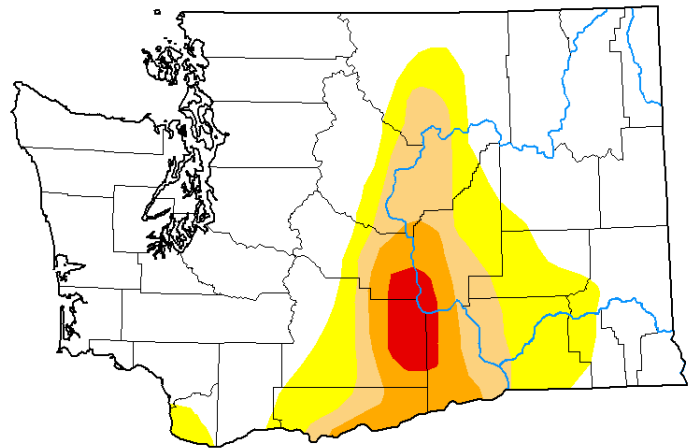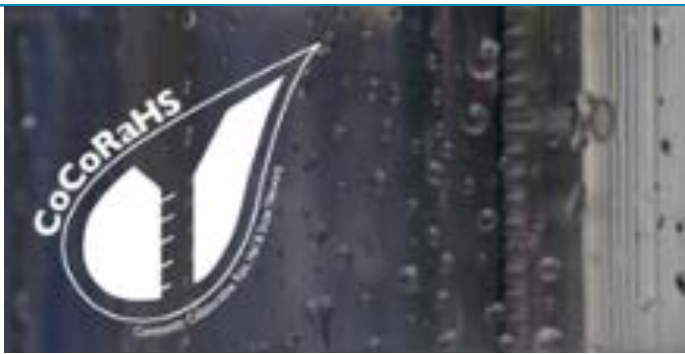**Figure 5: The January 7, 2021 edition of the U.S. Drought Monitor.**

The CoCoRaHS Corner

December lived up to the expectations of precipitation observers providing measurable precipitation everyday of the month. Consistent rain prompted 500 more precipitation reports than November with the December tally reaching 11,114. Per usual, December carried wide variations in precipitation, and our network captured this phenomenon quite well. Quinault NE 2.2 received 19.77" over the month with 3.02" coming solely on 17th while Sunnyside 1.2 W recorded a measly 0.18" in only five bouts. While Yacolt 9.0 N recorded the most single day precipitation on the 20th with 3.64", the 22nd was the wettest day around the state with an average report of 1.07" for 371 stations, which was twice as wet as the second wettest day on the 20th.

Over 2020, a total of 84 new observers joined the network. Bringing in new observers is critical not only to expanding the spatial coverage of precipitation observations, but also replacing stations that are no longer active. Reasons for observers joining and quitting the network can vary, but not so curiously, many have joined recently as the wetter period of the year picked up. Figure 6 shows the monthly total of new CoCoRaHS observers in 2020 with the climatological precipitation averaged for Washington State to see how closely tied new sign-ups are with precipitation totals. A wave of new observers joined in April 2020 when COVID-19 measures brought more time around the house for many in the state. Then as summer arrived, only a few new observers were enticed by mostly empty rain gauges. Ahead of the climatologically rainy period, September saw a spike of new observers, which could possibly coincide with the new school year taking place at home. From October to December, a healthy number of new observers joined the network, prompting our numbers to exceed attrition. New sign ups are slowly decreasing, so we encourage you to include family members, friends, or neighbors to join our network and keep CoCoRaHS growing.
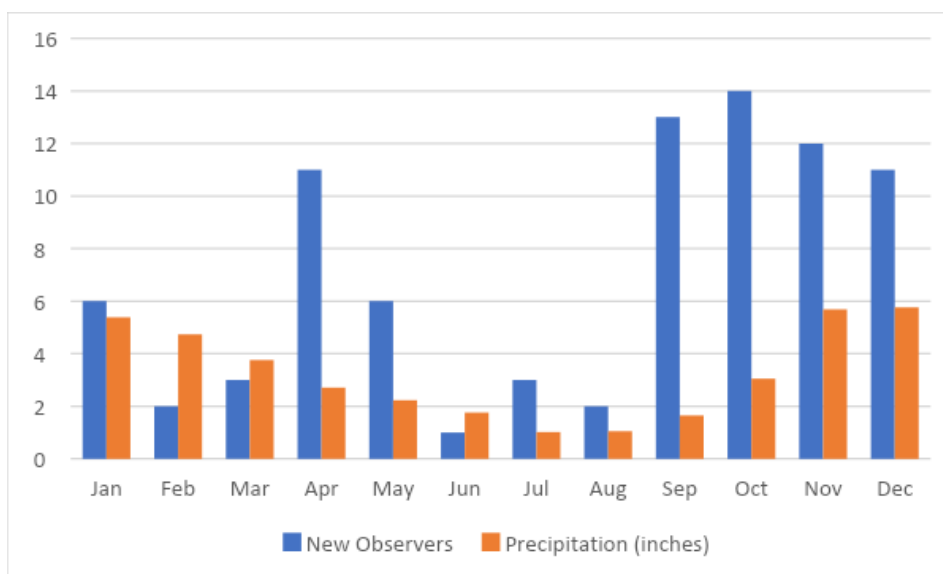

Figure 6: Amount of new CoCoRaHS observers who signed up each month of 2020 (blue) and climatological precipitation average across Washington State (orange).

What is the Ideal Climate?
A message from the State Climatologist

The Camelot Climate Index (https://ggweather.com/camelot.htm), created by Jan Null (Certified Consulting Meteorologist, Golden Gate Weather Services) to score U.S. locations based on an "ideal" climate, was recently discussed on the American Association of State Climatologists (AASC) listserv. The index bases "ideal" on a sunny and mild climate with relatively few extremes. The ideal climate used in the Camelot Index is of course extremely subjective. One person's perfect 85F summer day is too hot for another. Her dream of a major snowstorm is his nightmare. You get the picture.

So what do the readers of this newsletter think the ideal climate is? We have created a short survey – just 14 questions – for our readers to anonymously answer with their preferences for their ideal climate. The idea is to make our own, more detailed map of WA State, defining the ideal climate based on our reader's responses. Our index will weigh the different parameters based on your preferences as well. For example, perhaps you're very adamant about not liking cold temperatures, but the total annual precipitation doesn't matter as much to you; you would rank your choice of total annual precipitation low (i.e., it would be weighted less in the final calculation) in the survey.

The map from the Camelot Climate Index is shown in Figure 1. Not surprisingly, San Diego, often noted for its "perfect" (albeit boring) weather ranked the highest using sunny and mild conditions as the ideal. The Camelot Index was only computed for 3 WA locations – Quillayute, Seattle, and Spokane. Seattle ranked the highest of the three, likely for its mild temperatures in both winter and summer. Our working hypothesis is that the residents of WA, or at least the readers of this newsletter, are made of sterner stuff and embrace conditions that make weather wimps cower.

We will compute the index based on the respondent's choices of the ideal values for each parameter, considering their medians and ranges. In general, we will use observed data for the period of 1981-2010 in determining the normalized extent to which each

parameter for each location deviates from the ideal. The ranking of the importance of each category will then be used to determine a score for the various locations across WA. We very much hope you will participate...if nothing else we expect you might find it interesting to see how your ideal weather conditions compare with those associated with our readers as a group, and which location in the state will end up taking top honors.

To summarize this hard-hitting piece, we're interested in computing our own subjective index for WA state based on what our readers consider the ideal climate. The survey can be found here; remember there's no wrong answers! Please fill it out before the end of January 2021. One entry per person: potential voter fraud will be litigated by an elite unit that has already been assembled, and they should have some time on their hands. The results related to our yet-to-be-named index will be included in a subsequent newsletter edition sometime in 2021, of course only after approval by WA state authorities.
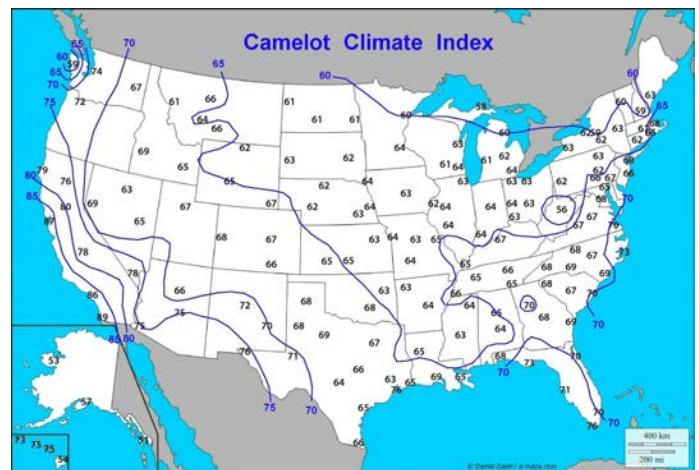

Figure 7: Map of the Camelot Climate Index created by Jan Null. Higher scores equate to more pleasant climates. The index does not view favorably the climate of NW Washington.

Climate Summary

Mean December temperatures were above normal across the state with the warmest spots lee of the Cascades in central-eastern Washington. The greatest positive departure from normal was focused along the Okanogan Valley. Omak and Ephrata saw average temperatures 5.4 and 5.1 °F above normal, respectively (Table 1). Most areas of the state experienced average temperatures 2 to 4 °F above normal such as Seattle WFO (3.8 °F), Quillayute (3.3 °F), Wenatchee (3.2 °F), and Pullman AP (3.8 °F). The only areas that received near normal temperatures were in western Skagit County and in Lewis County. La Niña winters tend to provide cooler weather for Washington State, but generally these cooler temperatures are realized after December. At the beginning of the month, the Climate Prediction Center (CPC) forecasted equal chances of above, below, and near to normal temperatures for December, and below normal temperatures for December through February picking up on a delayed La Niña influence.

Total December precipitation was much more heterogeneous than that of the average temperatures with widespread variability. Northern regions featured the most precipitation when compared to normal. The central and northern Cascades received slightly above normal precipitation, while the northern end of the Olympics through the San Juans was well above normal in the 150 to 200% range. The 6.82" that fell in Bellingham accounted for 161% of normal December precipitation (Table 1). The rest of western Washington was closer to normal precipitation with 80 and 95% of normal in Vancouver and Seattle WFO, respectively. Eastern Washington fared on the drier side of normal with the driest pocket in south-central Washington, as seen in Hanford where 0.52" of precipitation was recorded or 43% of normal. Not all of eastern Washington experienced below normal precipitation with a particularly wet spot of 150-200% of normal precipitation centered in the Kettle Range. Pullman also departed from the drier conditions in eastern Washington with 140% of normal precipitation.
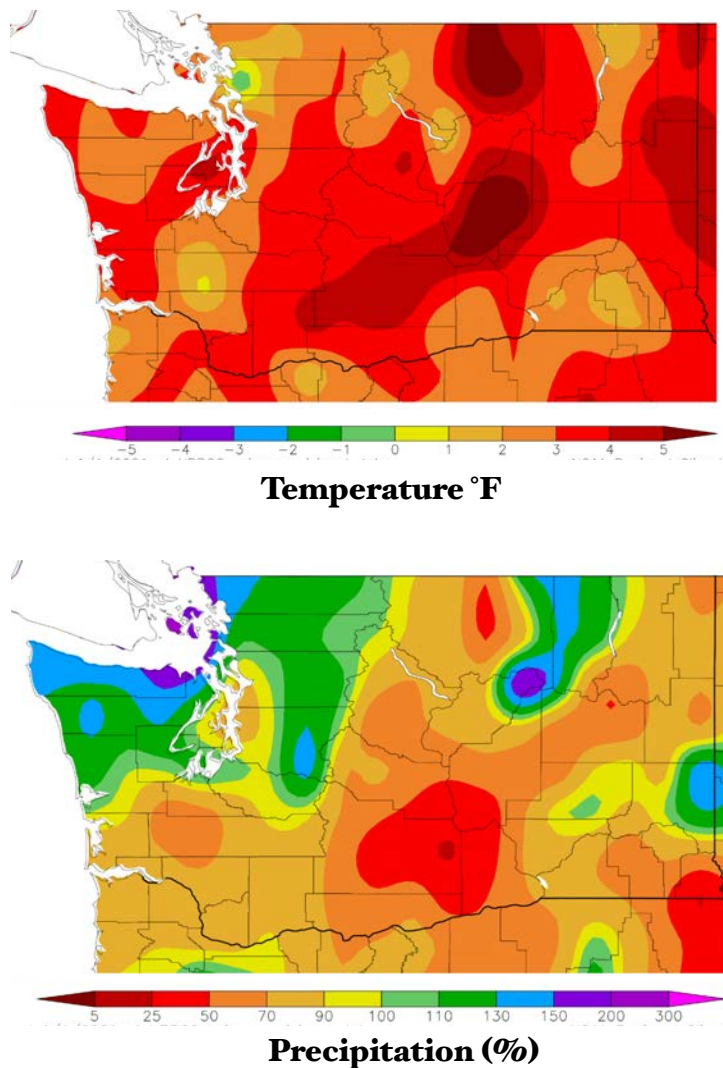

Temperature °F

Precipitation (%)

Figure 8: November 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)			Snowfall (inches)		
	Avg	Norm	Departure from Normal	Total	Norm	% of Normal	Total	Norm	% of Normal
Western Washington									
Olympia	41.6	38.4	3.2	7.32	7.46	98	0.0	2.6	0
Seattle WFO	44.4	41.1	3.3	5.17	5.43	95	0.2	2.3	9
SeaTac AP	44.4	40.6	3.8	6.65	5.35	124	0.5	1.7	29
Quillayute	43.7	40.4	3.3	17.64	12.99	136	0.0	2.1	0
Hoquiam	44.5	41.6	2.9	10.42	9.96	105	0.0	0.4	0
Bellingham AP	42.0	38.1	3.9	6.82	4.22	162	0.0	2.9	0
Vancouver AP	43.0	40.6	2.4	5.41	6.77	80	M	M	-
Eastern Washington									
Spokane AP	31.8	27.4	4.4	2.37	2.30	103	17.8	14.6	122
Wenatchee	31.3	27.9	3.2	0.86	1.40	61	M	12.9	-
Omak	31.1	25.7	5.4	1.25	2.20	57	M	M	-
Pullman AP	33.9	30.1	3.8	2.20	1.57	140	M	M	-
Ephrata	32.5	27.4	5.1	0.88	1.24	71	M	7.6	-
Pasco AP	36.1	33.1	3.0	0.63	1.21	52	M	M	-
Hanford	34.9	31.1	3.8	0.52	1.20	43	3.1	5.9	53

Table 1: December 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

La Niña conditions are present in the equatorial Pacific. According to the Climate Prediction Center (CPC), La Niña is expected to remain present until the spring when neutral conditions are favored. In May of 2020, below normal sea surface temperatures (SST) emerged in the eastern equatorial tropical Pacific and spread across the international dateline to 160 °E by October. Ever since, the structure of SST has remained largely constant. While the central equatorial Pacific still hosts below normal SST, this region has undergone 1 °C of warming over the past month. As a result, the NINO 3.4 index has climbed above -1 for the first time since the La Niña advisory was issued by the CPC in September. ENSO forecast models favor La Niña until March-April-May when it becomes a tossup between La Niña and neutral conditions. By the late spring, neutral conditions are most likely at a 66% chance. Nearly all models predict La Niña to slowly decrease in intensity through the winter.

The CPC one-month temperature outlook for January has increased chances of above normal temperatures statewide. Chances of above normal temperatures are only slightly enhanced in western Washington, but are in the 40-50% range for eastern Washington. This is a departure from the temperature outlook issued in mid-December, which predicted decreased chances of above normal temperatures. The precipitation outlook favors above normal precipitation across the state with the greatest chances coming in western Washington.

Opposed to the one-month outlook, the three-month CPC outlook for January through March has increased chances of below normal temperatures for the entire state. As for precipitation, the outlook gives increased chances of above normal precipitation statewide with only slightly increased chances in the SW corner of the state.
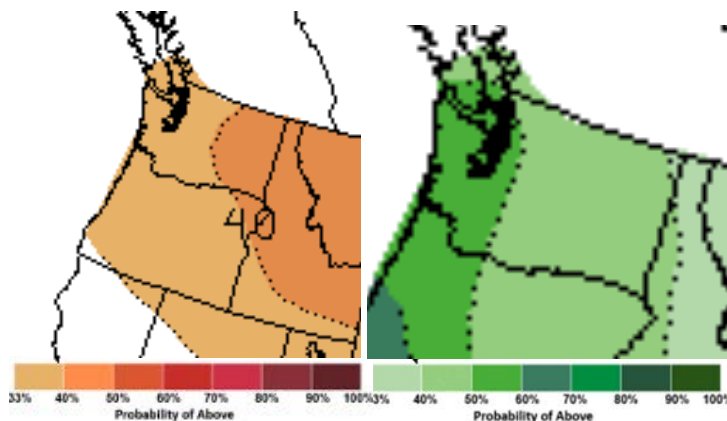

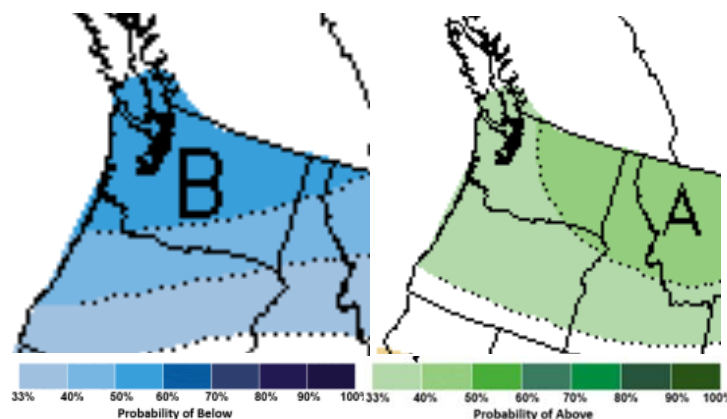**Figure 9: January outlook for temperature (left) and precipitation (right).**

Figure 10: January-February-March outlook for temperature (left) and precipitation (right) ([Climate Prediction Center]).