



# Office of the Washington State Climatologist

## February 2019 Report and Outlook

February 6, 2019

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

### January Event Summary

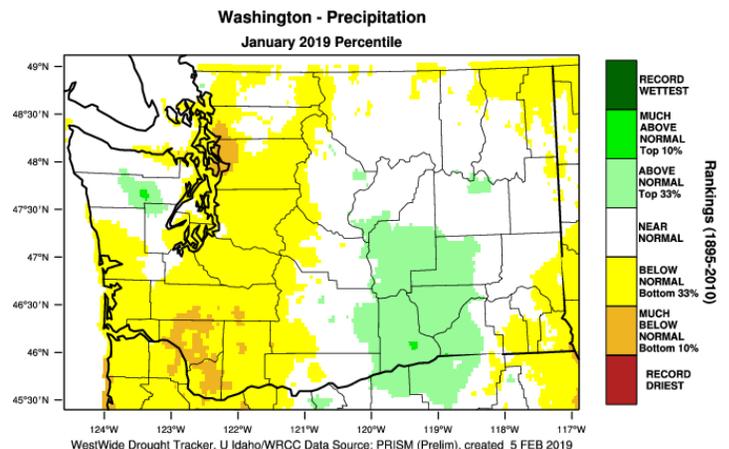
Mean January temperatures were warmer than normal for most of the state, especially in central and eastern WA where anomalies were between 2 and 4°F above normal. Precipitation amounts were variable across the state, but generally less than normal, especially west of the Cascade Mountains. On the other hand, the Lower Columbia basin and Spokane area received normal to above normal precipitation for the month. Neither of these precipitation anomalies were particularly record-breaking, with neither the dry (west) or wet (east) anomalies among the top 10% in the historical record (Figure 1).

January began with fairly active weather. An atmospheric river brought copious precipitation on the 3rd, which was particularly heavy on the Olympic Peninsula. Figure 2 shows the daily temperatures and precipitation for SeaTac Airport for the month, illustrating that the precipitation on the 3rd was the second highest daily total of the relatively dry month. Another low pressure system impacted the state on the 5th and 6th, bringing some strong winds in western WA. Both SeaTac Airport and Hoquiam recorded wind gusts of 60 mph, for example.

### In this Issue

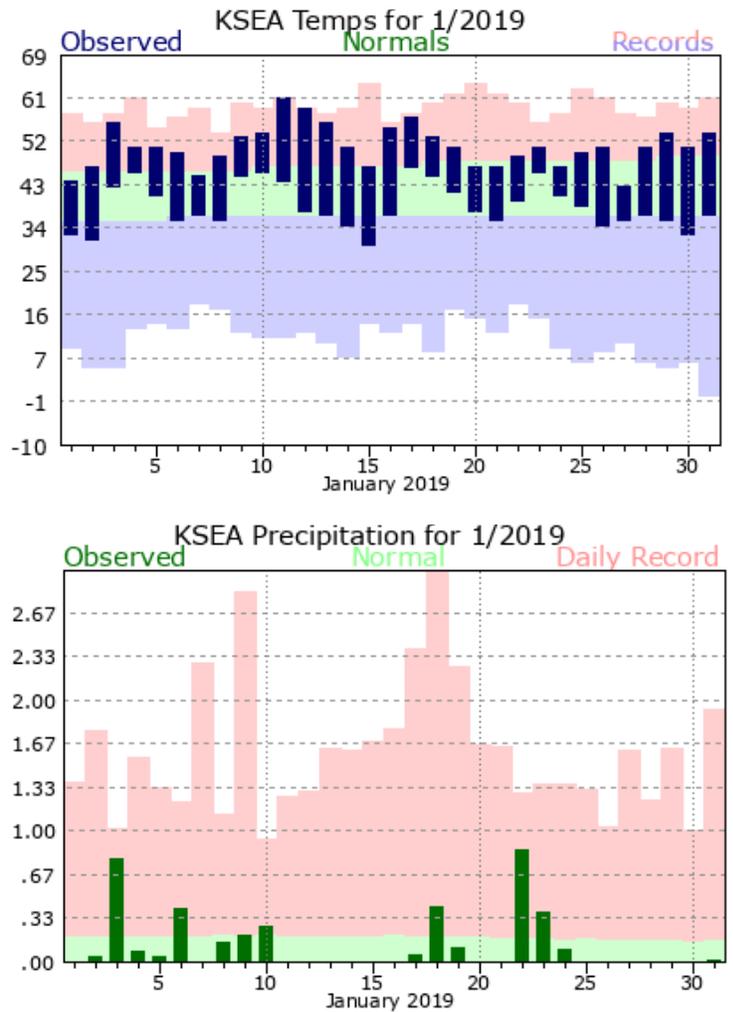
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A notable warm and dry period began late in the second week of the month, during which a daily record high temperature of 61°F was set at SeaTac (Figure 2). Hoquiam set a daily record high temperature of its own of 57°F on the 13th. The



**Figure 1: Precipitation percentiles for January 2019 (from WWDT).**

high pressure system that dominated during this period also brought morning fog on some occasions, but the afternoon sun was uncharacteristic for January. Unsettled weather began again on the 17th, however, and this was the start of the period in which the locations in eastern WA with normal to above normal monthly precipitation received their rain/snow. It was relatively short-lived though, as another high pressure dominated during the last week of the month, bringing dry conditions statewide.



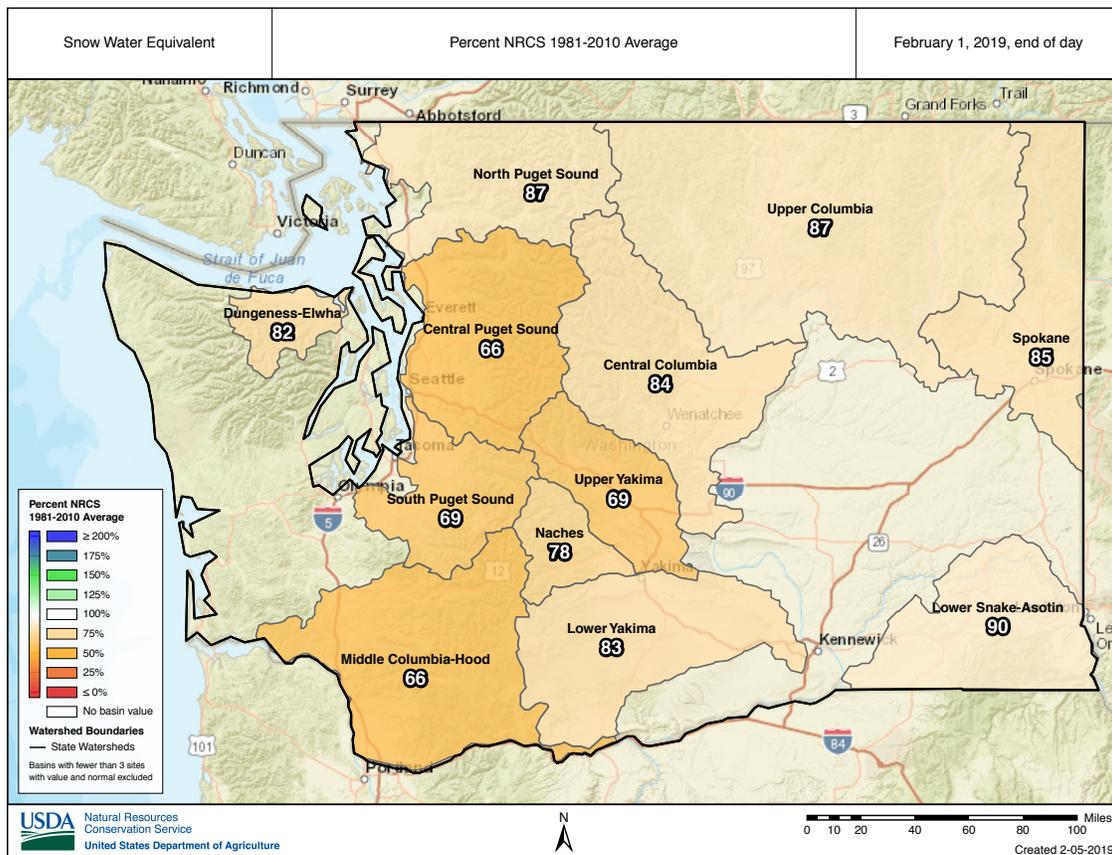
**Figure 2: Daily January 2019 a) temperatures (dark blue bars) and b) precipitation for SeaTac Airport and historical records. [NWS](#)**

# Snowpack Update

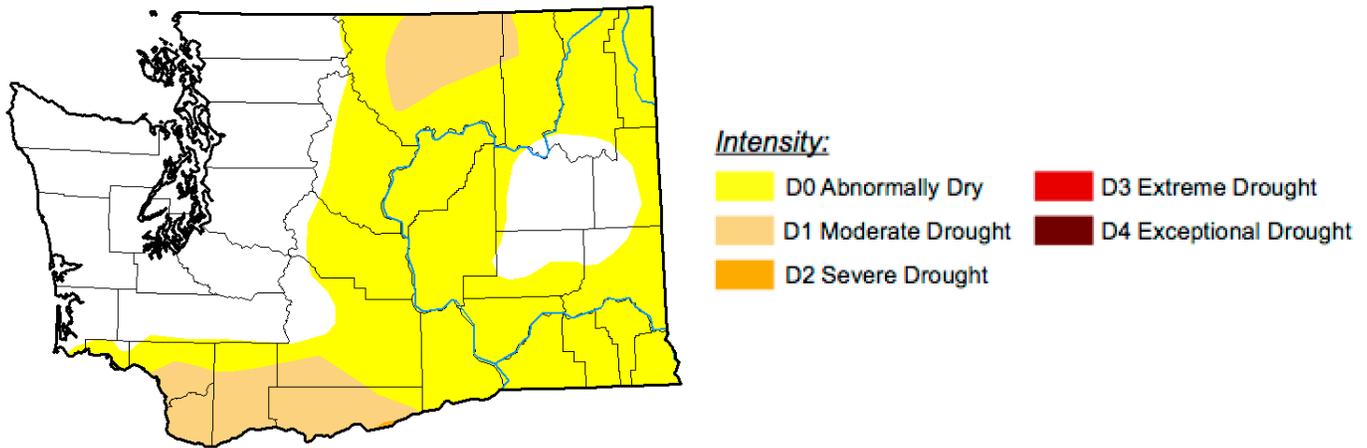
January snowpack continued to build throughout the state, but not at the normal pace. The February 1 basin-average snow water equivalent (SWE) is thus less than it was on January 1, with all of the basins below normal. The February 1 basin average SWE percent of normal from the Natural Resources Conservation Service is shown in Figure 3. The Lower Snake-Asotin, Spokane, Upper Columbia, and North Puget Sound basins are faring the best, with between 85 and 90% of normal SWE. The Olympics (Dungeness-Elwha basin), Lower Yakima, Central Columbia, and Naches basins are worse off with basin averages between 78 and 84% of normal. The basins on the

rest of the western slopes of the Cascades (Central Puget Sound, South Puget Sound, and Middle Columbia-Hood) and the Upper Yakima are even further below normal, with averages between 66 and 69% of normal. These regions were driest relative to normal for January.

The U.S. Drought Monitor map (Figure 4) has shown continued improvements in WA, particularly in the eastern WA locations where January precipitation was above normal and the longer term precipitation percentages of normal have improved.



**Figure 3: Snowpack (in terms of snow water equivalent) percent of normal for WA as of 1 February 2019 (NRCS).**



**Figure 4: The 31 January edition of the [US Drought Monitor](#).**

## What a Blast: The Arctic-Air Outbreak of February 1989

A message from the State Climatologist

This edition of the OWSC newsletter more or less coincides with the 30<sup>th</sup> anniversary of the severe cold snap of early February 1989. Last month we reviewed the record warm anomalies that occurred in January 1953; perhaps it makes some sense to take a look at the other side of the coin. Moreover, the record cold experienced in the Midwestern US during the last week of January made those of us that are fond of cold weather reminisce about colder than normal weather in our neck of the woods.

The stage was set for our event in Alaska during late January 1989. Bitterly cold air masses are no stranger in the interior of the 49<sup>th</sup> state, but this one was a doozy. For example, every single day during the last two weeks of the month included temperatures at least 40 degrees below normal in Tanana, AK with the temperature bottoming out at -76°F on 27 January. The all-time maximum sea level pressure record for North America of 1078.6 hPa was set at Northway, AK on 31 January due to

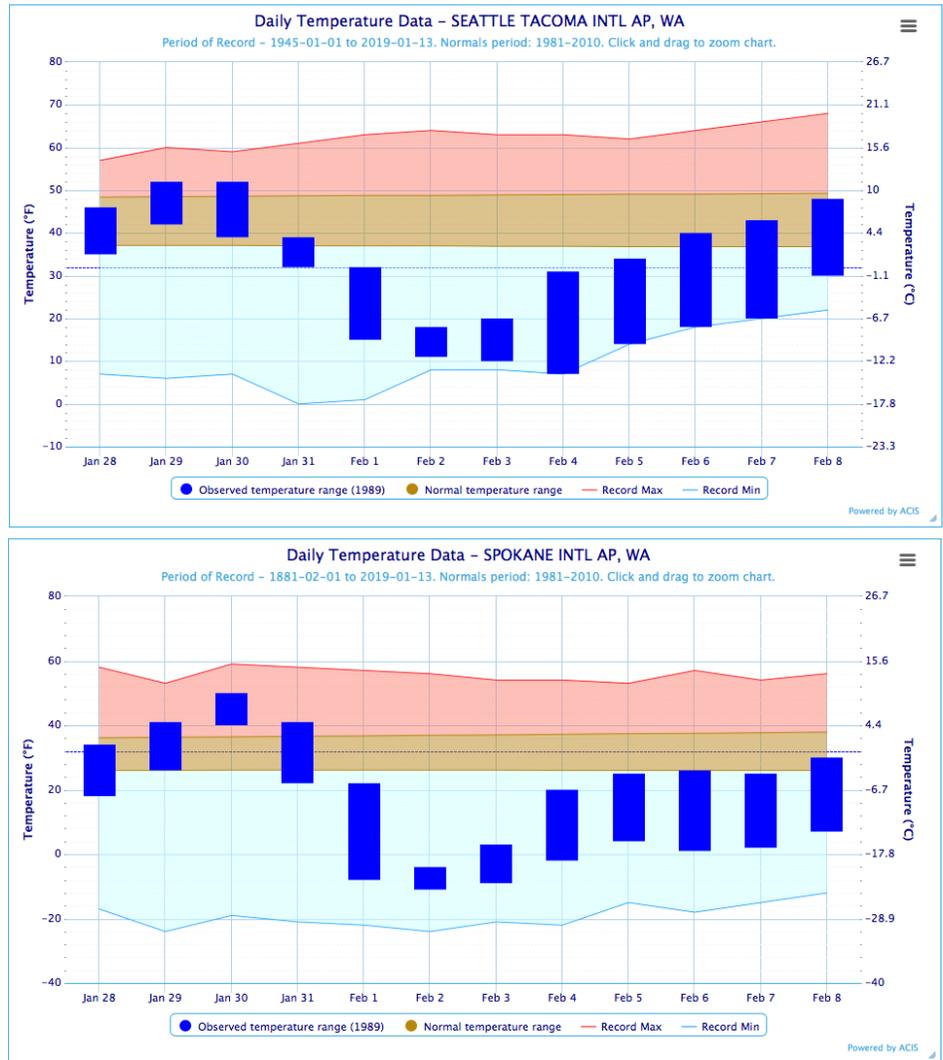
the massive Arctic high associated with the frigid air. A major change in the hemispheric atmospheric circulation pattern near the beginning of February brought relief for Alaska (it actually became unusually warm by the second week of the month) and some big changes for the lower 48, including Washington.

The cooling is summarized here in terms of the maximum and minimum temperatures recorded at Sea-Tac (KSEA) and Spokane International (KGEG) Airports from 28 January through 8 February 1989, as plotted in Figure 5. The coldest temperature at Sea-Tac was 7°F on 4 February, with daily minimum temperature records set during 4 days in a row. The average temperatures on 2 and 3 February were about 28°F below normal. But Spokane did even better in some ways. It was especially cold on 2 February; the combination of a maximum temperature of -4°F and a minimum temperature of -11°F represented an average temperature about 39°F below normal.

Remarkably, that night included winds of 15-17 knots (17-20 mph) at KEGEG that mixed the lower atmosphere and likely disrupted the formation of a surface-based inversion. Without this wind, it is likely that the temperatures would have plummeted into the record territory of the -20s.

Speaking of winds, the aforementioned Arctic high brought very strong outflows through the Fraser River gap into the Bellingham area. Bellingham Airport (KBLI) observed sustained winds from the northeast as great as 48 mph with gusts to 73 mph (with temperatures in the single digits). These winds persisted considerably longer than typical with regional arctic-air outbreaks. The winds remained above either 35 mph sustained and/or 46 mph in terms of gust speeds during the 3-day period from 8 PM PST on 31 January through 8 PM on 3 February. This was also one of those rare situations for which it was evident that it was going to be plenty cold enough for snow, even in the lowlands of western WA. In this regards, the west side did relatively well with Sea-Tac receiving about 6" while Spokane checked in with only 1". In other words this event was much more noteworthy in terms of temperatures rather than snowfall for most of the state.

Some previous research carried out by the OWSC backs up that contention. This research involved



**Figure 5: Maximum and minimum temperatures for Seattle (KSEA) and Spokane (KEGEG) during 28 January through 8 February 1989.**

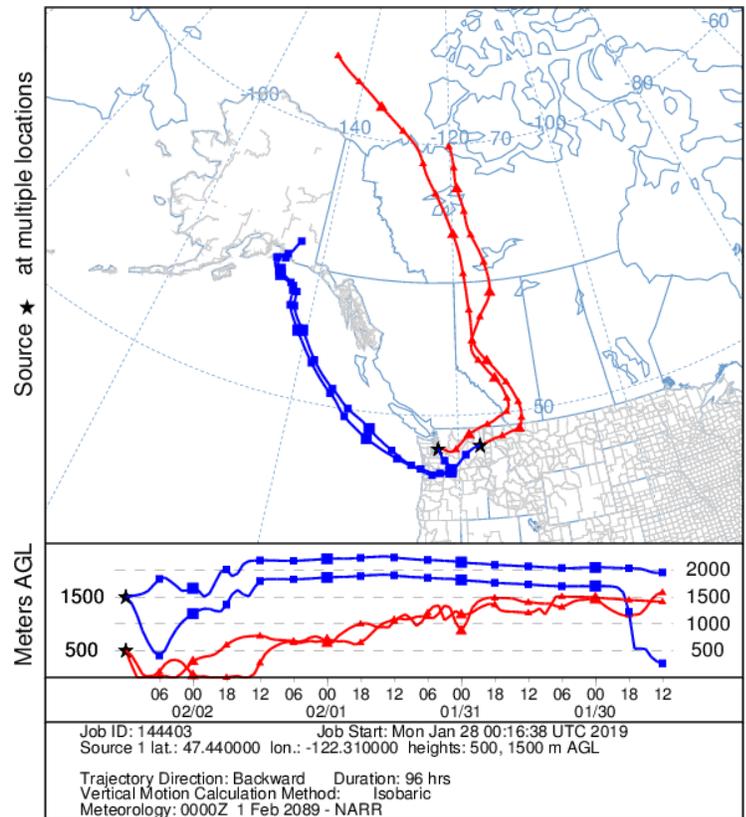
examining the relationship between the Madden-Julian Oscillation (MJO) and cold-air outbreaks in the Pacific NW. As part of this work, the intensity of cold-air outbreaks based on 5-day averages of 850 hPa air temperatures averaged over the Pacific Northwest, along with the strength of the 500 hPa winds from the north, were compiled to compare with indices for the state of the MJO. This exercise revealed that the 850 hPa temperatures during the early February 1989 event were the coldest of the entire analysis period of 1978 through 2014. The twice-daily weather balloon soundings from Quillayute, WA near the

northwest corner of the state indicate an observed 850 hPa temperature as low as  $-18.1^{\circ}\text{C}$  from the 1200 UTC sounding on 3 February 1989. This cold snap did not happen to coincide with a phase of the MJO that tends to be accompanied by chilly temperatures. On the other hand, the winter season of 1988-89 featured a strong La Niña and winter temperatures are usually colder than normal, especially after the first of the calendar year.

Past reviews of noteworthy events in our newsletter have often included 500 hPa geopotential height anomaly maps to summarize the overall atmospheric circulation. This time we thought of taking a different tack, with the goal of specifying the source(s) of the cold air that visited WA in early February 1989. This can be done through estimation of back trajectories using the HYSPLIT application maintained by NOAA's Air Resources Laboratory. What we show here in Figure 6 are the estimated trajectories using the isobaric option, which essentially ignores vertical motions (which are prone to substantial errors). These results indicate continental origins for the air in both locations at the height of 500 meters (red lines), and southeast mainland Alaska as the source for the air at 1500 meters (blue lines). The latter's journey over the ocean would have allowed it to pick up some moisture.

We close with musings about the prospects for a future arctic blast of comparable ferocity. It is definitely possible, but perhaps it would be a stretch to call it probable. As reviewed in this space in the monthly newsletter for January 2018, the incidence of monthly circulation patterns favoring extremely cold temperatures in WA has really dropped off in recent decades. In fact, February 1989 represents the last occurrence of

NOAA HYSPLIT MODEL  
Backward trajectories ending at 1200 UTC 02 Feb 89  
NARR Meteorological Data



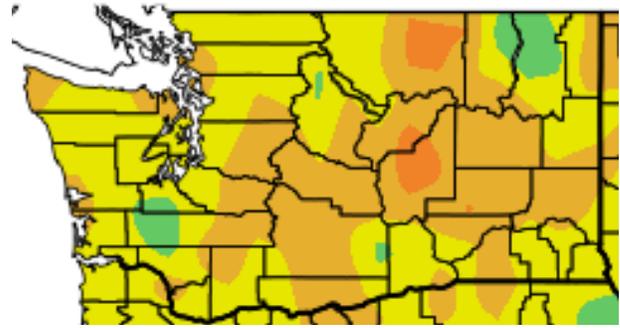
**Figure 6: 96-hr back trajectories for air parcels ending up at the 500 and 1500 meters above ground level at Seattle (KSEA) and Spokane (KGE) on 2 February 1989 at 1200 UTC using data from the North American Regional Reanalysis (NARR).**

either of the two coldest circulation patterns found in analysis of the period of 1948 through 2017. A repeat of the weather we enjoyed 30 years ago would require both the precursor build-up of exceptionally cold air, followed by evolution in the flow over western North America to deliver it to our backyards. With that said, I don't think any of us at OWSC would have guessed a year ago that the Midwest would experience a record cold event of the magnitude of the one that just occurred, so we're not discounting surprises in our own backyards. From a more local perspective, not that long ago there was little indication that there would be snow in the Puget Sound lowlands, with more apparently on the way!

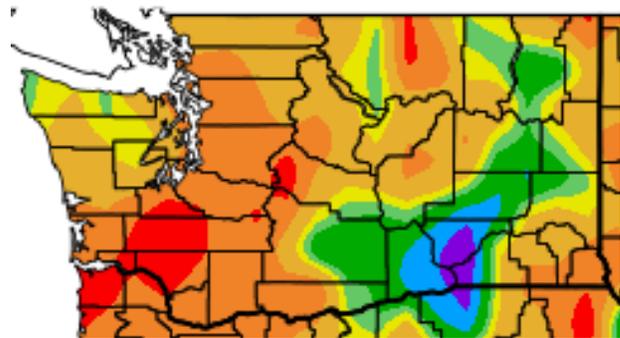
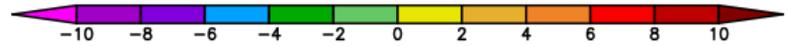
# Climate Summary

Mean January temperatures were above normal throughout the state. Most of the state had temperature anomalies between 2 and 4°F above normal, as shown in the map on the right from the High Plains Regional Climate Center. Parts of eastern WA were even warmer, however, like Omak and Ephrata, which had anomalies of 4.1 and 5.2°F above normal, respectively (Table 1). On the other hand, there were a few regions that were on the warm side, but still considered near-normal for the month. For example, Olympia was only 0.7°F above normal, and other southern Puget Sound locations were near-normal as well.

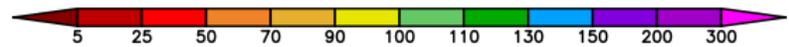
Total January precipitation was below normal for most of the state, with a few notable exceptions. Western WA was drier than usual, with a large area only receiving between 50 and 70% of normal precipitation. Vancouver, for example, only measured 51% of normal for the month (Table 1). The Seattle area did somewhat better, with between 60 and 70% of normal precipitation. Parts of eastern WA were dry as well (examples: Omak and Wenatchee) but there was a substantial region with normal to above normal January precipitation, including Spokane, Pullman, and Pasco.



Temperature (°F)



Precipitation (%)



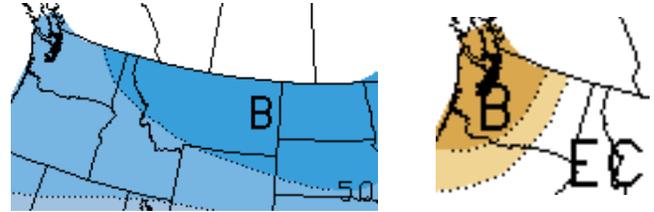
**January temperature (°F) departure from normal (top) and precipitation percent of normal (bottom). (High Plains Regional Climate Center; relative to the 1981-2010 normal).**

	Mean Temperature (°F)			Precipitation (inches)			Snowfall (inches)		
	Avg	Norm	Departure from Normal	Total	Norm	% of Norm	Total	Norm	% of Norm
Western Washington									
Olympia	40.5	39.8	0.7	4.88	7.84	62	0	1.9	0
Seattle WFO	44.0	42.1	1.9	2.87	4.81	60	0	0.4	0
Sea Tac AP	45.0	42.0	3.0	3.83	5.57	69	0	1.4	0
Quillayute	43.6	41.6	2.0	15.03	14.61	103	0	2.0	0
Hoquiam	45.5	42.6	2.9	7.22	10.33	70	0	1.3	0
Bellingham AP	41.5	39.2	2.3	3.79	4.67	81	0	3.4	0
Vancouver AP	41.5	41.6	-0.1	2.83	5.50	51	M	M	-
Eastern Washington									
Spokane AP	30.9	29.5	1.4	1.75	1.79	98	5.2	11.4	46
Wenatchee	31.4	29.5	1.9	0.83	1.06	78	M	M	-
Omak	30.9	26.8	4.1	0.96	1.89	51	M	M	-
Pullman AP	34.1	31.6	2.5	1.91	1.82	105	M	M	-
Ephrata	34.0	28.8	5.2	0.63	0.91	69	M	M	-
Pasco AP	36.2	34.9	1.3	1.59	1.22	130	T	M	-
Hanford	35.1	33.4	1.7	1.17	0.94	124	0.2	4.6	4

**Table 1: January 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.**

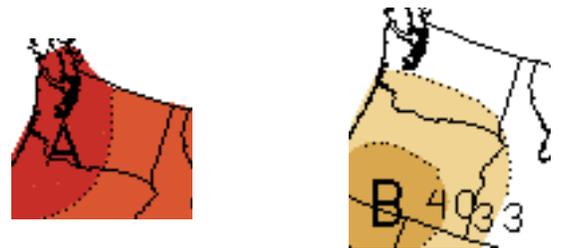
# Climate Outlook

ENSO-neutral conditions are still present in the tropical Pacific Ocean, and the likelihood that an El Niño will develop this winter has decreased. As mentioned in last month's newsletter, the atmospheric component of El Niño did not manifest itself and the sea-surface temperature anomalies have weakened in the tropical Pacific. Still, the Climate Prediction Center (CPC) has an "El Niño Watch" in effect, with about an 80% chance that El Niño will develop during the January through March period.



**February outlook for temperature (left) and precipitation (right)**

The CPC February outlook calls for increased chances of below normal temperatures for all of WA state, with slightly higher chances of colder than normal temperatures in northeastern WA. This deviates from the warmer seasonal outlooks that CPC has been issuing all winter due to the colder than normal temperatures expected for the first couple weeks of February. February precipitation is expected to be below normal for a majority of the state. The exception is the easternmost area of eastern WA, where there are equal chances of below, equal to, or above normal precipitation for the month.



**February-March-April outlook for temperature (left) and precipitation (right)**

**(Climate Prediction Center)**

The CPC February through April seasonal temperature outlook calls for warmer than normal temperatures statewide averaged over the season, consistent with the longer range forecast models and recent trends. The likelihood of warmer than normal temperatures is higher for western WA. For precipitation, just the southern tier of WA has a signal, with the CPC expecting below normal precipitation for February through April. The rest of the state has equal chances of below, equal to, or above normal precipitation.