Office of the Washington State Climatologist

May 6, 2015

April Event Summary

Mean April temperatures were near-normal for most of the state with much below normal precipitation. Some of the driest places actually came close to setting records for the driest April. Yakima, for example, recorded only a "trace" of precipitation for the month, tying with 1985, 1968, 1966, and 1956 as the driest April on record. This April ranked as the 2nd-driest at Omak (after 2007) and the 3rd-driest at Pasco (after 1946 and 1999). Though near-normal monthly mean temperatures are not usually the most exciting news to report, it is noteworthy that the near-normal temperatures are a shift from the previous 4 consecutive months that all had above normal temperatures statewide.

In this Issue

There were very few daily records broken around the state. The month began with some thunderstorm activity, but perhaps the most notable event occurred on the 6th when snow fell in the Spokane area and parts of northeastern WA. A daily maximum snowfall record was set at Spokane AP with an inch. The map from Community, Collaborative, Rain, Hail, and Snow (CoCoRaHS) network (Figure 1) shows the 24-hr snowfall total on the morning of April 7. While not snow, daily precipitation records were also set at Wenatchee (0.30") and Ephrata (0.50") on the same day from isolated showers. Other monthly highlights include a cold frontal passage on the 11th that brought a cooler pattern with showers and snow in the mountains, below freezing temperatures on the morning of the 15th in the Pasco/Yakima/Sunnyside/Ellensburg area, a high pressure building in the region on the 17th, and then another cold frontal passage on the 21st bringing subsequent showers and a little snow in the Cascades. April ended on a warm note with unseasonably warm temperatures statewide.

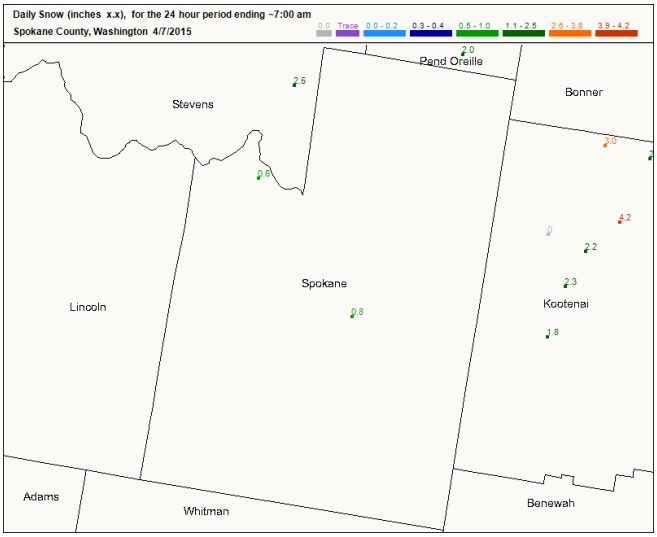


Figure 1: 24-hour snowfall total from CoCoRaHS observers on the morning of April 7 in the Spokane area and Idaho panhandle.

Snowpack, Drought Update, and New Weekly Monitoring Report

Another month has passed with bad news for WA State snowpack. While there were a few instances of snowfall in the mountains, the amount of snow was inconsequential in the larger picture. At the time of this writing, most sites have completely melted out. Figure 2 shows the basin average SWE percent of average as of 1 May 2015 from the National Resources Conservation Service. The percentage of normal has decreased compared to the 1 April numbers, with less than 35% of normal for most basins. The Upper Columbia, with 55% of normal SWE basin-wide, has one high elevation site with 87% of normal (Hart's Pass; as of 1 May) that's skewing the average a bit. Unfortunately, the other Snotel sites in the basin have very little snow left.

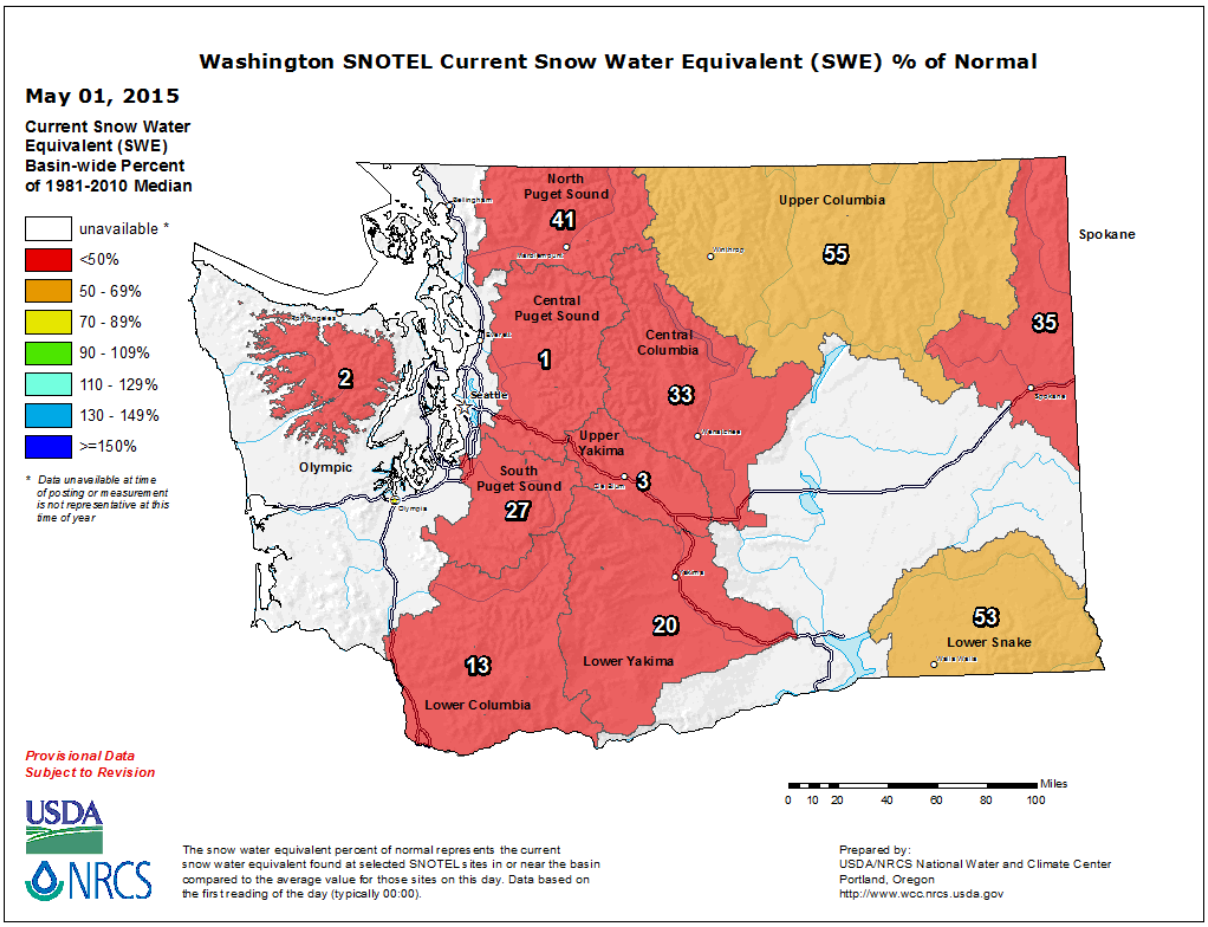


Figure 2: Snowpack (in terms of snow water equivalent) percent of normal for Washington as of 1 May 2015 (from the National Resources Conservation Service).

The poor snowpack is represented in the US Drought Monitor depiction (Figure 3) with moderate drought ("D1") throughout the mountains. Severe drought ("D2") has also been introduced to the Lower Columbia Basin because of the recent dry conditions that have contributed to the Yakima Bureau of Reclamation needing to tap into their reservoir storage almost two months earlier than usual. This area was also the one region of the state with warmer than normal April temperatures.

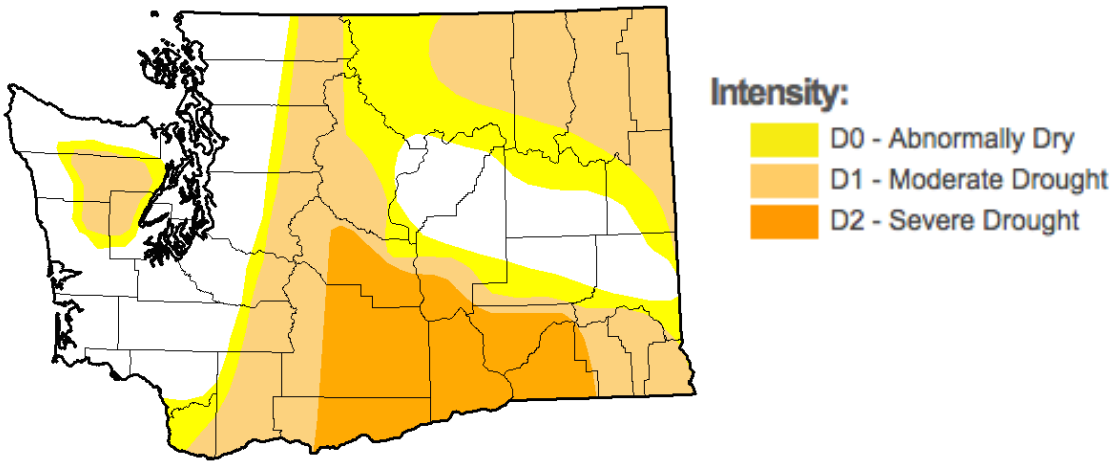


Figure 3: The 28 April 2015 edition of the US Drought Monitor (http://droughtmonitor.unl.edu/).

On the state level, Governor Inslee made more drought declarations on April 17, as shown on this map. As part of our collaboration with the state on drought monitoring and response, OWSC is now writing a weekly drought monitoring report that focuses on conditions in the areas in declared drought. These reports can be found archived on our website, and are released on Thursdays.

OWSC's Trend Analysis Updated

One of OWSC's most popular web tools - a temperature, precipitation, and snow water equivalent (SWE) trend analysis tool that allows the user to select different time periods of analysis - has been updated with station data through 2014. The temperature and precipitation data are from the USHCN version 2.5 dataset from the National Centers for Environmental Information (formerly known as the National Climatic Data Center). The USHCN temperature data has been objectively corrected for biases in the data using neighboring stations, and is considered a high quality dataset suitable for trend analysis. More caution should be used interpreting the trends in precipitation and SWE data as that has not been corrected for potential inhomogeneities. The updated tool can be found: www.climate.washington.edu/trendanalysis.

Extreme Precipitation Events in Washington State during the month of May

A message from the State Climatologist

One year ago (May 2014), this newsletter included a piece on the historical record of extreme short-term precipitation events in Washington state, with a focus on whether there were any noticeable trends in the frequency and intensity of these event. The previous piece considered the top ten 1-day precipitation events at a variety of stations west and east of the Cascade

Mountains for a cool season defined as October through April, and for a warm season defined as May through September. The two seasons were considered separately since the weather patterns promoting heavy precipitation events tend to be quite different during the different times of year. But in some ways this division is arbitrary. In particular, the month of May can include both winter-like and summer-like weather. So we thought it might be interesting to delve into the largest 1-day precipitation events during just the month of May. The objectives here are to see if the record indicates any meaningful trends, and to document the typical synoptic weather situations associated with heavy May rains on the west and east sides of Washington state.

The results shown here are based on daily values of precipitation from station data; 6 stations each in western WA and eastern WA representing different parts of the state. The stations have relatively complete records of daily precipitation data back to 1945 and were picked for their geographic coverage. Mountain foothills stations were included in both the western group (Baring) and the eastern group (Leavenworth and Winthrop). Table 1 itemizes the amounts and dates of the record 1-day precipitation at the twelve stations for the month of May. We were struck by how much it can rain in a day in eastern Washington.

Western Stations	Max 1-day Amount (in)	Date
Aberdeen	2.72	5 May 2009
Forks	3.05	23 May 1973
Olympia Airport	1.54	5 May 1948
SeaTac Airport	1.83	29 May 1969
Bellingham Airport	1.52	16 May 1988
Baring (on US 2)	3.10	3 May 2010
Eastern Stations	**Max 1-day Amount (in)**	**Date**
Wapato (near Yakima)	1.51	14 May 2011
Leavenworth	1.68	18 May 1991
Winthrop	1.17	14 May 2011
Kennewick	1.18	16 May 1994
Pullman	1.35	8 May 1956
Spokane Airport	2.19	21 May 2004

Table 1: Highest 1-day precipitation total in during May for 12 weather stations in WA State.

But does that mean that the circulation patterns associated with the heaviest rains in May are similar on the two sides of the Cascade Mountains? The regional distributions of 500 hPa geopotential height (Z) and sea level pressure were examined for each of the days in Table 1, and it became apparent that much different set-ups occur during the rainiest days in western versus eastern Washington state. A composite 500 hPa Z map for the 6 western cases (Fig. 4) shows a winter storm pattern with moderate-strong westerly flow. Relatively minor differences were found among the individual cases. The composite 500 hPa Z map for 6 eastern cases is shown in Figure 5. This composite includes 27 May 1998, during which Winthrop received its second highest total of 1.10", to the 5 days listed in Table 1 because the event of 14 May 2011 constituted record amounts at both Wapato and Winthrop. The 500 hPa Z distribution for the

eastern cases is very different. These cases are typically associated with an upper-level low near the coast and weak southeasterly flow over eastern Washington. One of the cases in this composite was kind of an oddball; 2.19" rain fell in Spokane on 21 May 2004 with weak northwesterly flow at 500 hPa. Thunder was reported during this event, and in general, the pattern for the eastern cases is much more akin to that associated with summer thunderstorms than the winter-type disturbances that cause the heaviest May rains on the west side.

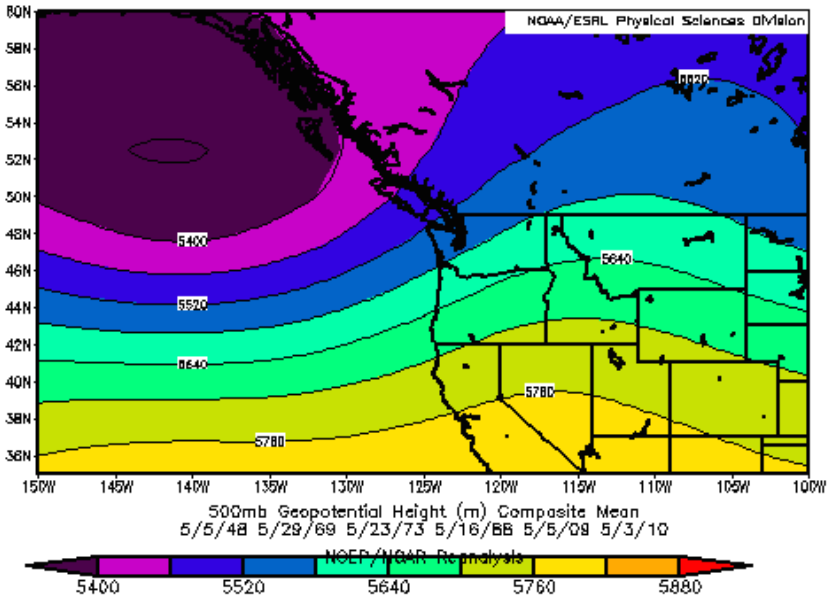


Fig 4: Composite 500 hPa geopotential heights assocaited with the top 1-day May precipitation events at the six western Washington stations in Table 1.

The trends in the intensities of the heaviest May rains were assessed in the following manner. We again considered 1-day precipitation amounts during May for the same sets of 6 western and 6 eastern stations. The top values during each May from 1945 through 2014 was determined for each station and used to form 6-station averages, yielding representative measures of the greatest 1-day rain of the month for the two sides of Washington state. The time series of these averages for the western and eastern stations are shown in Figure 6. Our interpretation of these time series is that there is no discernible trend in the intensity of May rains in western Washington. There may be a slight tendency for heavier May rains in eastern Washington; the frequency of years with relatively high values has been greater since roughly 1990. We recognize that our analysis is far from comprehensive. Nevertheless, both the results shown here, and monthly precipitation records (as can be explored with the featured application on the OWSC web page: http://www.climate.washington.edu/trendanalysis/) indicate that year-to-year variations are dominating secular changes in the precipitation in Washington state.

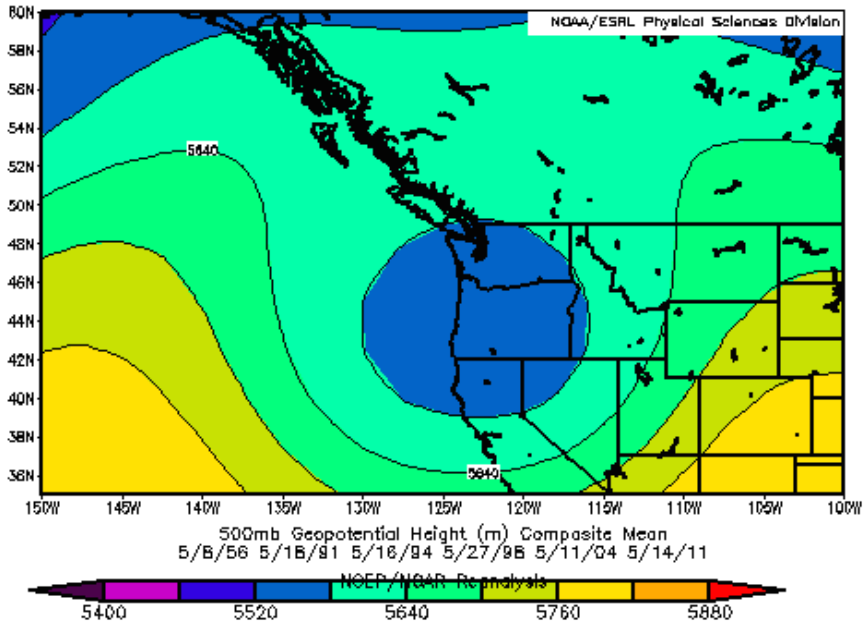


Fig 5: As in Fig. 4, except for the five eastern Washington events in Table 1 plus 27 May 1998 to account for the duplicate day.

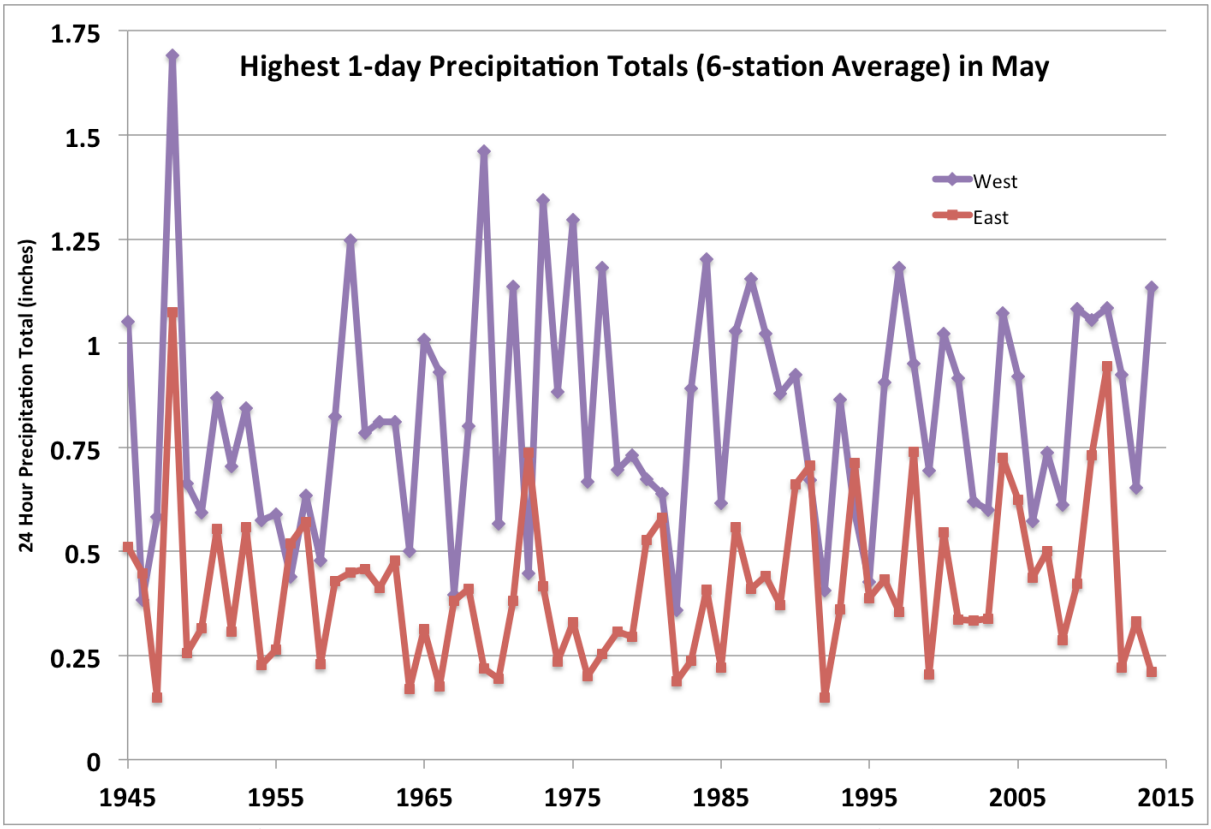
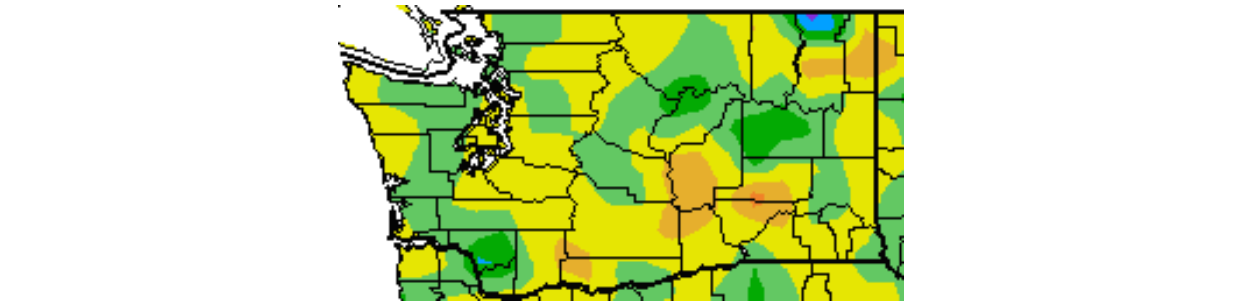


Fig. 6: Time series of top 1-day May precipitation amounts averaged for the six western stations (purple) and six eastern stations (red) listed in Table 1.

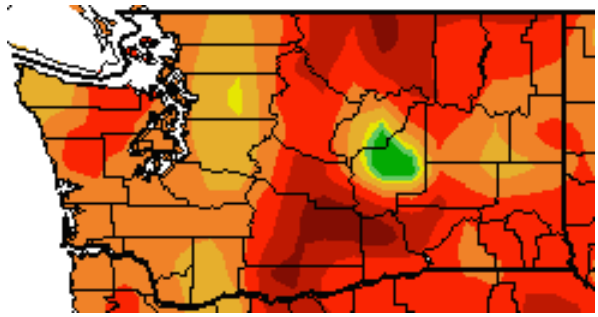
Climate Summary

For the first time in several months, mean monthly temperatures for April were near-normal for a majority of the state, with most locations within 1°F of normal. A few areas near the Lower Columbia Basin were warmer than normal, with temperatures between 1 and 2°F, according to the map below from the High Plains Regional Climate Center.

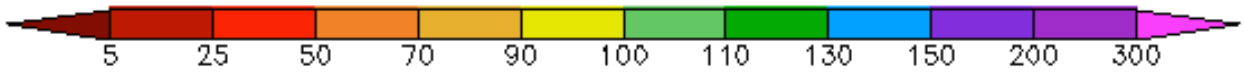
Total April precipitation was much below normal, with most of eastern WA receiving less than 50% of normal precipitation. Spokane, Pasco, and Omak received 41, 31, and 10% of normal precipitation, respectively (Table 2). Some parts of western WA fared a little better, with between 50 and 90% of normal precipitation for April. A wet day on April 6 at Ephrata caused the station to reach normal precipitation for the month, and is represented by the one green area on the percent of normal precipitation map.



Temperature (°F)



Precipitation (%)



April temperature (°F) departure from normal (top) and April precipitation % of normal (bottom).
(High Plains Regional Climate Center (http://www.hprcc.unl.edu); 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	48.5	48.3	0.2	1.92	3.54	54	0	0	-
Seattle WFO	51.9	50.5	1.4	1.52	2.77	55	0	0	-
SeaTac AP	51.4	50.3	1.1	2.03	2.71	75	0	0	-
Quillayute	47.5	46.7	0.8	6.19	7.85	79	0	0.1	0
Hoquiam	49.0	48.7	0.3	3.22	5.10	63	0	0	-
Bellingham AP	49.1	48.4	0.7	1.23	2.69	46	0	0	-
Vancouver AP	51.3	52.1	-0.8	1.79	3.01	59	0	M	-
Eastern Washington									
Spokane AP	47.5	47.0	0.5	0.53	1.28	41	1.0	1.0	100
Wenatchee	52.8	51.6	1.2	0.30	0.46	65	M	0	-
Omak	49.5	50.0	-0.5	0.10	1.05	10	M	M	-
Pullman AP	45.7	46.1	-0.4	0.58	1.56	37	M	M	-
Ephrata	51.2	50.4	0.8	0.57	0.48	119	M	0	-
Pasco AP	52.1	52.9	-0.8	0.20	0.65	31	M	M	-
Hanford	54.6	53.4	1.2	0.09	0.55	16	0	T	0

Table 2: April 2015 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 NCDC's new normal release, as records for these station began in 1998 and 1986, respectively. M denotes missing data.

Climate Outlook

El Niño conditions are still present in the equatorial Pacific Ocean. Averaged over the last four weeks, sea surface temperatures (SSTs) were above normal throughout the equatorial Pacific as well as most of the eastern Pacific Ocean, according to the Climate Prediction Center (CPC): http://www.cpc.ncep.noaa.gov. The "El Niño Advisory" released on 5 March is still in effect. Models are predicting that the El Niño conditions will persist through the end of the calendar year, with chances between 60 and 70%. The likelihood of the El Niño persisting decreases with time, and better forecasts for next winter will be available later this summer.

The Climate Prediction Center seasonal outlook for May is calling for increased chances of above normal temperatures for WA State. West of the Cascade Mountains has the highest odds for warmer than normal temperatures in the state but eastern WA has at least a 50% chance of warmer than normal temperatures with the three class system. The May precipitation outlook is calling for increased chances of below normal precipitation for the western two-thirds of WA State. The eastern third has equal chances of above, equal to, or below normal May precipitation.

The May-June-July (MJJ) CPC outlook is very similar to the May outlook for temperatures: there are increased chances, especially west of the Cascades for warmer than normal temperatures for the three month period. For precipitation, there are equal chances of below, equal to, or above normal precipitation statewide.

May outlook for temperature (left) and precipitation (right) from the CPC.

May-June-July outlook for temperature (left) and precipitation (right) from the CPC.