



Office of the Washington State Climatologist

October 6, 2015

September Event Summary

Average September temperatures were cooler than normal for a majority of the state. This is a change from the warmer than normal temperatures that have been prevalent throughout the spring and summer. That being said, temperatures were not extremely cold, and for many locations, average September temperatures could be classified as near-normal. September set very few daily records for both temperature and precipitation, and in a way it could be classified as an unremarkable month from a climatological standpoint. Total September precipitation was below normal for most of the state, but some locations did receive above normal precipitation.

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The month began on a wet note, with thunderstorms on the 5th dumping scattered heavy rain in western WA. Precipitation in San Juan and King counties was especially heavy; Figure 1 shows the 24-hr precipitation total measured on the morning of the 6th by CoCoRaHS volunteer observers. Precipitation fell in eastern WA over the long Labor Day weekend as well, and the sole rainy weekend is responsible for the wetter than normal monthly stats in some parts of eastern WA. A daily precipitation record was set in Wenatchee on the 6th with 0.38". Bellingham also recorded a maximum precipitation record with 0.57" on the same day.

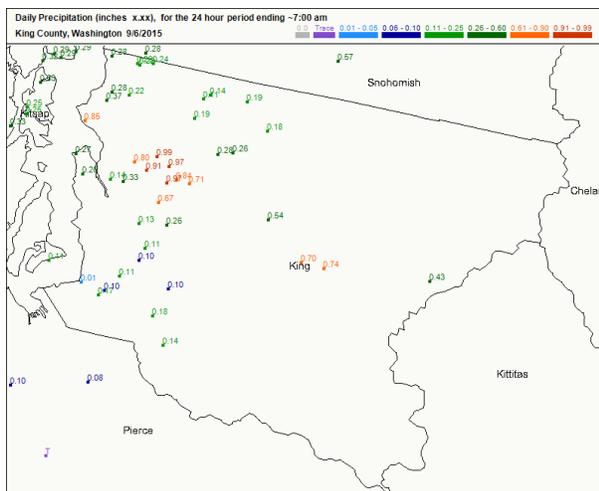


Figure 1: 24-hr precipitation measurement from King County on 9/6 from CoCoRaHS.

Warmer than normal temperatures followed, however, as a high pressure settled in for the 2nd week of September. Showers returned for western WA, largely confined to the coast and the northern Puget Sound, from the 13th through the 20th. The remainder of the month was dry with cool mornings and near-normal maximum temperatures. Fires were still burning in eastern WA throughout September, but at the time of this writing, only 1 large fire - the North Star fire north of Coulee Dam - still remains on the [Northwest Interagency Coordination Center](#) large fire map.

Community, Collaborative, Rain, Hail, and Snow Network

We're a few days into the new water year (2016), and anticipation of fall rains is high, despite the seasonal forecast from the Climate Prediction Center calling for increased chances of drier than normal conditions. Regardless of how the season turns out, we can promise that there will be many occasions to read your rain gauge as we enter the wet season! We are actively looking for more CoCoRaHS volunteers to measure precipitation in their backyards, especially on the Olympic Peninsula. OWSC has teamed up with a group of scientists at the UW that are gearing up to use all precipitation measurements available on the Peninsula (and adding their own too) to verify that the new NASA Global Precipitation Measurement (GPM) satellite is measuring precipitation accurately. On-the-ground measurements (like those that come from CoCoRaHS) are very important to "check" the satellite. The satellite will help in detecting atmospheric river events that can cause flooding in WA. The field campaign begins in November, so please sign up at www.cocorahs.org if you're interested in measuring precipitation. You can read more about the project [here](#).

Drought Update

The US Drought Monitor has indicated no changes for WA during the month of September (Figure 2). While some areas of the state have seen some precipitation - namely the Olympic Peninsula, northern Puget Sound, and parts of Lincoln and Adams counties - it hasn't been enough to make additional improvements. The more consistent precipitation in the western WA areas has helped maintain the improvements that were made there in late August with streamflows still near-normal levels. As for the precipitation in eastern WA, the above normal precipitation comes from one wet day in early September that is not enough to make an impact on the drought. Currently, the Drought Monitor depicts "extreme drought" (D3) through all of eastern WA and "severe drought" (D2) through western WA.

With the end of water year 2015, the weekly drought monitoring [report](#) will no longer be produced by OWSC. This does not signify that the drought has ended, of course, and is related to the original scope of work. With a new water year, there is optimism that a much better snowpack this winter will help pull us out of drought. We will continue to monitor conditions throughout the state.

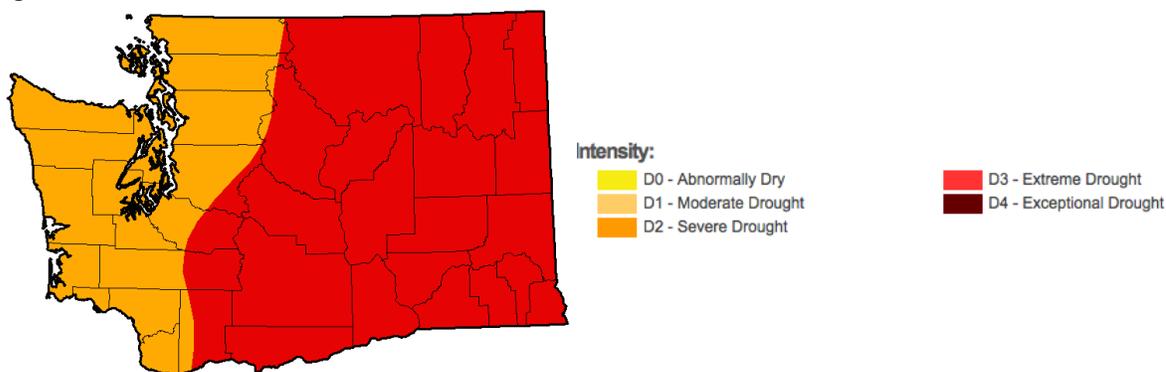


Figure 2: The 29 September 2015 edition of the US Drought Monitor (<http://droughtmonitor.unl.edu/>).

Summer in Review: Increased Number of Hot Days

A message from the State Climatologist

2015 has so far been much warmer than normal for Washington State, with January through August ranking as the warmest on record. The summer (defined as June through August) was also warm and set records as the warmest summer for the state, with temperatures 4.5°F above the 30-yr (1981-2010) normal when averaged statewide (Fig. 3). But how did the summer shape up on the daily time scale? This spotlight piece reviews the number of hot days at selected stations around the state, and how that fits in with the historical record.

June-August (JJA) average temperatures were quite remarkable for the state, as evidenced by the way 2015 stands out on Fig 3, even beating out the notorious warm summer of 1934 during the period of the Dust Bowl. It is worth noting that JJA maximum temperatures (5.2°F above normal) **and** minimum temperatures (3.6°F above normal) also ranked as the warmest on record averaged over the state. Precipitation (Fig 3), while ranking as the 9th

driest statewide with a deficit of 1.98", appears less drastic, due to the fact that it is a normally dry time of year and thus has less interannual variability. The warm temperatures are the focus here.

Figure 4 shows the number of days in June, July, and August that were 85°F or above for 7 western WA stations, with the long-term climatological average number of days for each station and month represented by the horizontal black lines. The total number of warm days varied between 6 and 36 for this set of stations, with rankings that ranged as the most on record (SeaTac Airport and Anacortes) to tied for 10th (Quillayute) and 11th (Vancouver) place (Table 1). SeaTac Airport's 26 days with temperatures of at least 85°F beat out last year, which was also warm with 22 days, and the warm summer

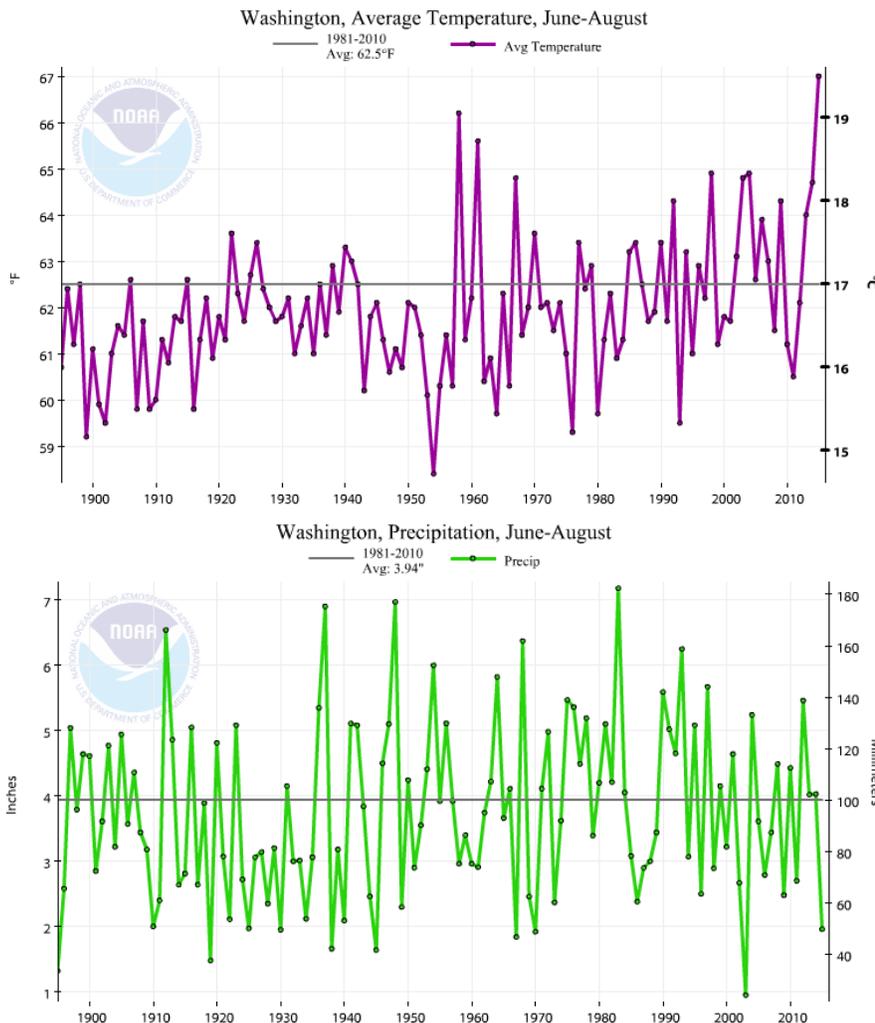


Figure 3: Statewide average temperature (top) and total precipitation (bottom) for June through August from 1895 to 2015 (NCEI).

Station	Total Number of Days	Ranking
Olympia	36	3
Vancouver	34	11 (tie)
SeaTac Airport	26	1
Yakima	24	1
Ephrata	20	1
Wenatchee	18	1
Walla Walla	17	1 (tie)
Colville	13	3
Everett	10	4
Mazama	9	1
Bellingham	9	2
Anacortes	9	1 (tie)
Quillayute	6	10 (tie)
Spokane Airport	4	4 (tie)

Table 1: Total number of days at or exceeding 85°F for western WA stations and at/exceeding 100°F for eastern WA locations with the ranking.

with the long-term climatological average illustrated by the black lines. The total number of days ranged from 4 to 24, with Yakima and Ephrata having the most with 24 and 20 days, respectively (Table 1). Five of these stations had the highest number of days at 100°F or above on record (Yakima, Walla Walla, Wenatchee, Ephrata, and Mazama) or tied for the summer. Spokane Airport typically has 1 100°F day per summer, but tied for 4th place this year with 4 days. A larger deviation from normal can be seen with Colville; this summer saw 13 days (3rd place) with 100°F or above. That kind of heat occurs on only about 3 days in a typical summer.

Many of the stations, both west and east of the Cascades, had their highest number of hot days in July, which isn't too much of a surprise since that's the climatological peak over the period of record as well. Relative to normal, June is actually the more impressive month in terms of days getting hotter than usual. For stations across the entire state, the number of hot days was higher than usual for the whole summer and the mean summer temperature was

of 1967. On average, SeaTac Airport usually has 9 days of temperatures 85°F or above. Bellingham usually sees about 2 days reaching this threshold, but had 9 in 2015, only shy of the record of 14 days in the summer of 1958.

The number of days with temperatures 90°F or above this past summer in western WA is also record-breaking for some stations (not shown). SeaTac Airport, for example, had a record with 12 days of temperatures 90°F or above. The previous record was 9 days in 1958. At Quillayute, 2015 tied for 3rd place with 3 days 90°F or above; it typically only sees 1 day each summer with such warm temperatures. Olympia Airport had an impressive 17 days 90°F or above, which was a close 2nd to the 18 days in 1967. Other locations, such as Bellingham, Anacortes, and Everett only had 1 day above 90°F (July 5, July 20, and July 20, respectively), and thus didn't set any records. Though the mercury didn't creep up to 90°F often in Anacortes this summer, the number of days 85°F or above did tie for first place with 9 days, evidence of the nearby water moderating the temperatures to a certain extent.

The temperatures and the rankings of warm summer days was much more impressive for stations east of the Cascades. Figure 5 shows the number of days with maximum temperatures at or exceeding 100°F for 7 eastern WA stations

higher than normal as well. This unusually hot weather exacerbated the drought in WA, with substantial impacts on agriculture and wildfires, among other effects.

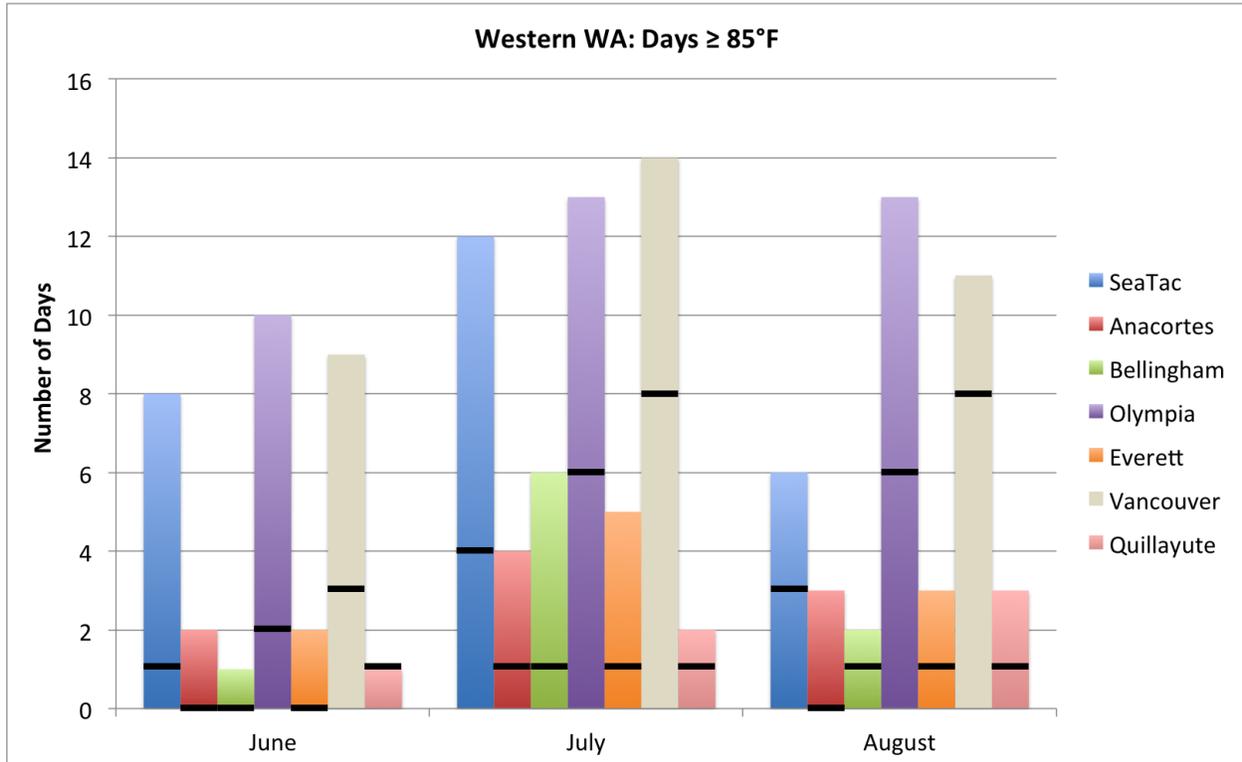


Figure 4: The total number of days with maximum temperatures 85°F or above in June, July, and August for 7 western WA locations. The solid black line represents the period of record climatology for the typical number of days in each month.

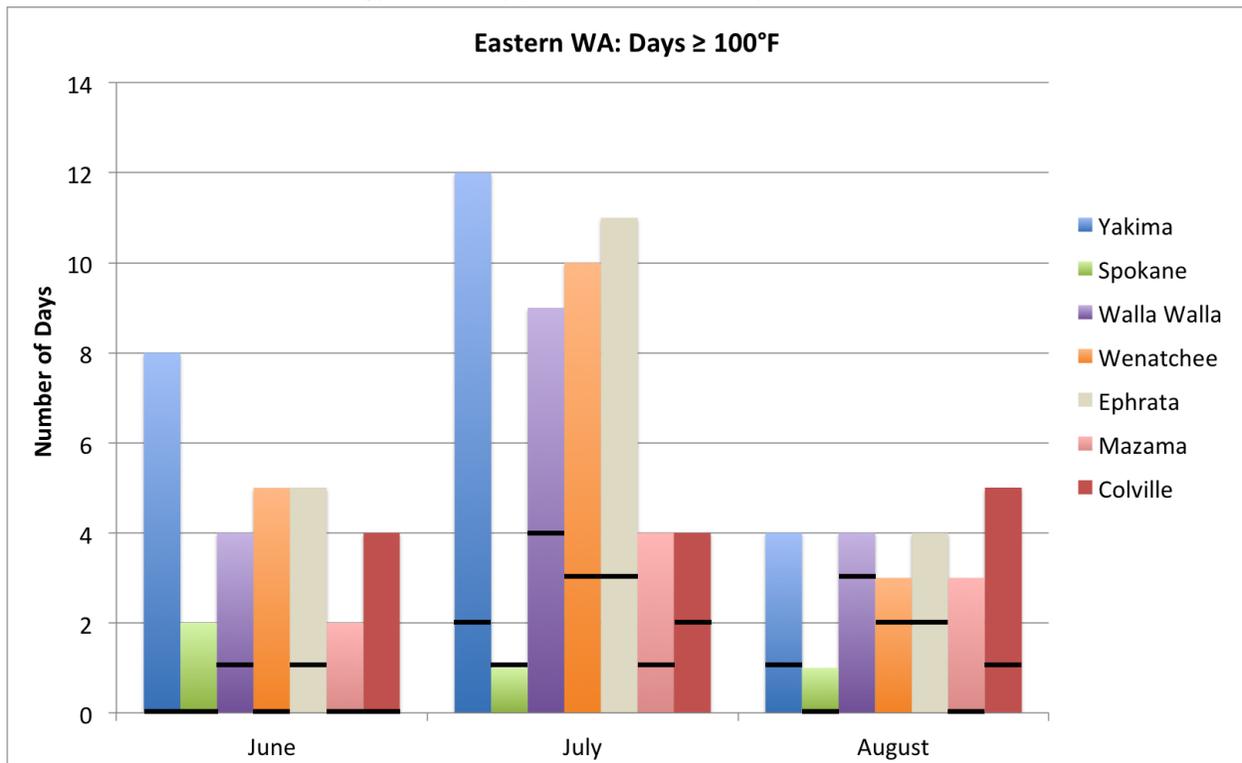
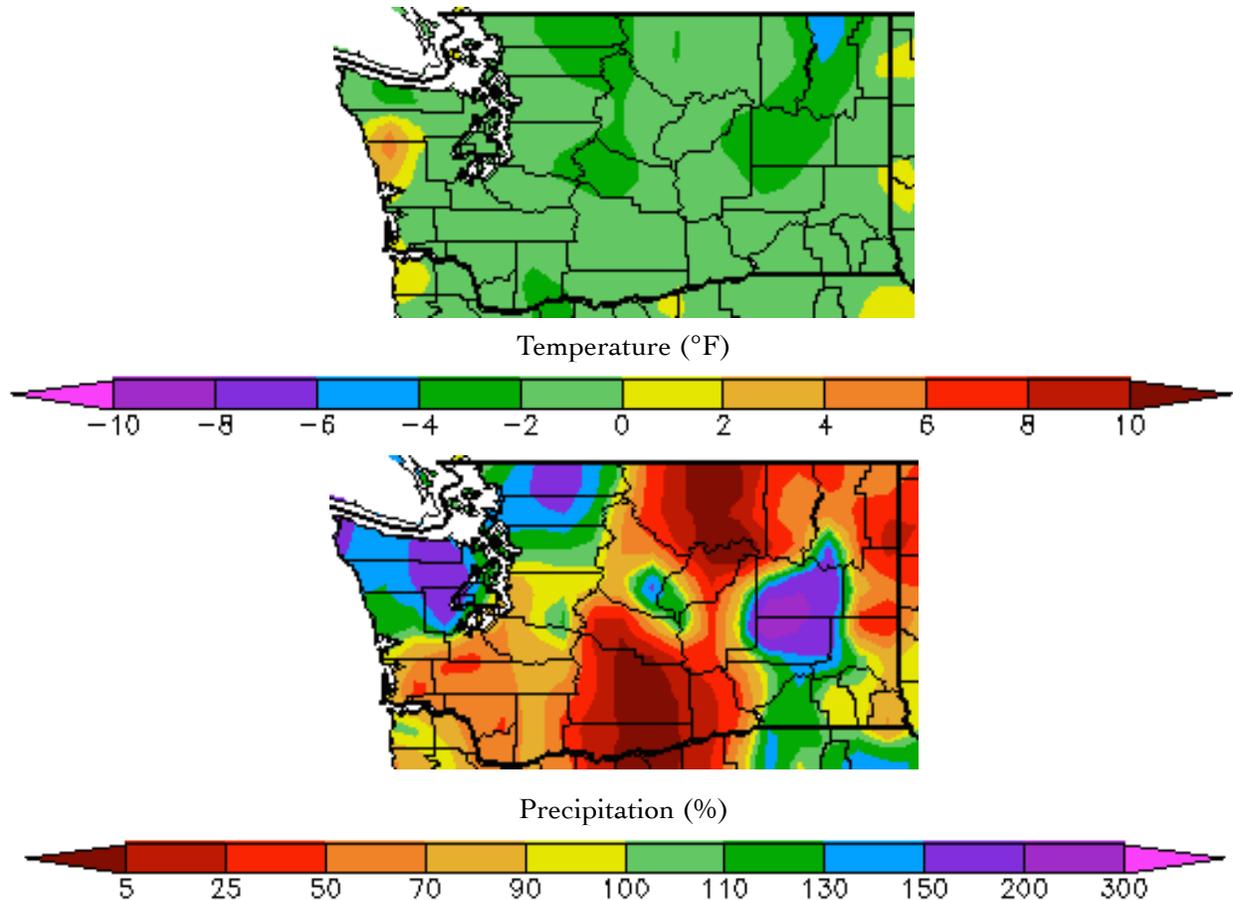


Figure 5: As in Fig. 4, except for 7 eastern WA locations and days above 100°F.

Climate Summary

Mean monthly September temperatures were near-normal to below normal for most of WA State, which is a big change from the persistently warmer than normal temperatures over the last several months. In fact, this is the first time since November 2014 that a majority of the state has been on the cooler side of normal. The temperature anomalies weren't extreme: according to the map from the High Plains Regional Climate Center below, most of the state is colored within 2°F of normal, and all of the stations itemized in Table 2 were within 1.5°F of normal. Spokane, Seattle, Vancouver and Ephrata were locations with the largest cooler than normal anomalies, with temperatures all about 1.2°F below normal.

Total September precipitation relative to normal varied across the state, with the Olympic Peninsula, northern Puget Sound, and Lincoln and Adams counties receiving above normal precipitation, ranging between 130 and 200% of normal for the month. Bellingham, for example, received 139% of normal (Table 2). Other locations were extremely dry, such as Omak that only received a trace of precipitation and the Yakima-area, which received between 5 and 50% of normal precipitation. Other locations - such as the southern and central Puget Sound, received more precipitation, but were still drier than normal for the month (example: Olympia and Vancouver received 53 and 79% of normal precipitation, respectively).



*September temperature (°F) departure from normal (top) and precipitation % 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	57.9	58.9	-1.0	0.90	1.71	53
Seattle WFO	60.4	61.6	-1.2	1.11	1.52	73
SeaTac AP	60.5	61.3	-0.8	0.83	1.50	55
Quillayute	56.8	56.6	0.2	6.22	3.82	163
Hoquiam	59.0	58.7	0.3	2.76	2.28	121
Bellingham AP	56.8	57.2	-0.4	2.48	1.78	139
Vancouver AP	62.4	63.6	-1.2	1.23	1.56	79
Eastern Washington						
Spokane AP	58.9	60.2	-1.3	0.52	0.67	78
Wenatchee	64.0	64.4	-0.4	0.40	0.34	118
Omak	62.0	62.6	-0.6	T	0.58	0
Pullman AP	57.2	58.2	-1.0	0.69	0.78	88
Ephrata	62.7	63.8	-1.1	0.16	0.36	44
Pasco AP	62.8	63.4	-0.6	0.12	0.40	30
Hanford	65.2	66.4	-1.2	0.06	0.31	19

Table 2: September 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

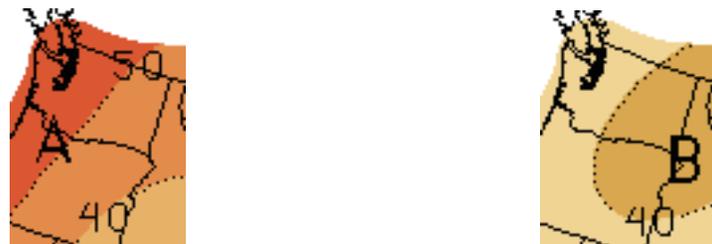
El Niño conditions are present in the tropical Pacific Ocean. The sea surface temperature (SST) anomalies are much warmer than normal and have strengthened since the last edition of the newsletter, according to the Climate Prediction Center ([CPC](#)). Averaged over the last month, SST anomalies exceed 2.5°C in the central and eastern equatorial Pacific. The “El Niño Advisory” released by the CPC on 5 March is still in effect, and the ENSO forecast [models](#) are nearly unanimous in a strong El Niño lasting through the winter of 2015-16. There is about a 95% chance that the conditions will persist through the winter, with chances dropping to about 75% in the spring.

The CPC seasonal outlook for October is calling for increased chances of above normal temperatures statewide, with higher chances of warmer than normal temperatures for the western two-thirds of the state. October precipitation is more uncertain: there are equal chances that there will be below, equal to, or above normal precipitation for most of the state. In other words, each outcome is assigned a 33% chance of occurring.

The autumn (October-November-December; OND) CPC outlook is calling for higher than normal temperatures statewide, with the odds of warmer temperatures exceeding 50% for the western half of the state. For precipitation, there are increased chances of below normal precipitation for the entire state, with odds of below normal precipitation higher for eastern WA.



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



October-November-December outlook for temperature (left) and precipitation (right) from the CPC.