



# Office of the Washington State Climatologist

July 7, 2015

## June Event Summary

June was hot and dry in WA state, to say the least. Mean June temperatures ranked as the warmest on record for nearly the entire state, as illustrated in Figure 1. Average temperatures were between 4 and 9°F above normal - not just breaking previous records, but leaping over them. Table 1 shows the rankings of average maximum temperature and total precipitation for a selection of WA stations. June ranked as the driest or second-driest for every station in the table, and was the record warmest June for most stations as well.

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June featured two extreme warm temperature events that acted like warm bookends. The first heat wave occurred on June 7-10, and while it was warmer than normal statewide, only eastern WA broke daily temperature records. A list of some of the warmest high temperatures for each day follows: June 7 saw Priest Rapids (103°F), Moses Lake (97°F), Wenatchee (99°F), and Yakima (101°F) break daily high temperatures records. More records were broken at Wenatchee (103°F), Omak (100°F), Lind (98°F), Colville (97°F), Spokane Airport (96°F), Yakima (105°F), Walla Walla (102°F), and Hanford (105°F) on June 8.

Similar temperatures were reached in eastern WA on the 9th, and temperatures cooled to “only” the upper 90s on the 10th. Meanwhile, temperatures in western WA were mostly in the mid to upper-80s during that timeframe. The early heat wave proved to just be a warm up (pun intended) for what was to occur later in the month.

Washington - Mean Temperature  
June 2015 Percentile

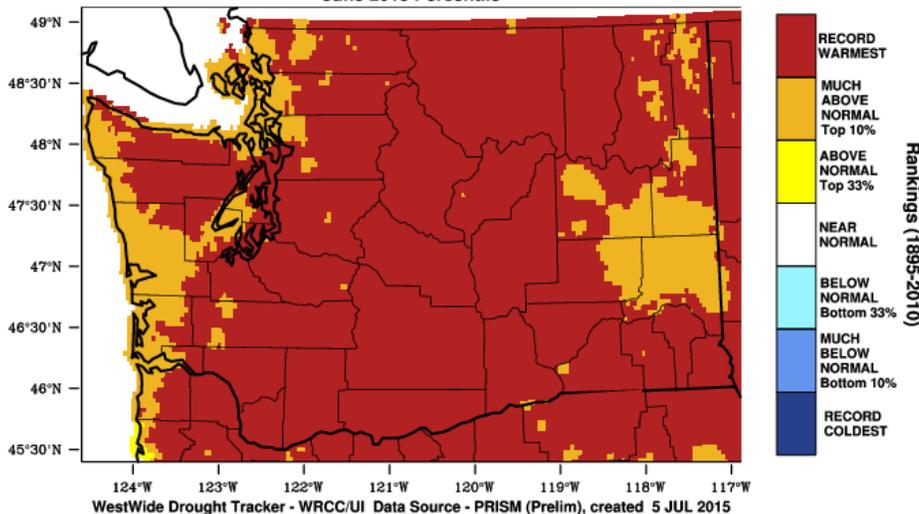


Figure 1: June average temperature percentiles for WA State (from WRCC).

Maximum temperatures soared into the 100s in eastern WA on the 26th with Chief Joseph Dam (106°F), Omak (102°F), Colville (101°F), Grand Coulee Dam (99°F), Ritzville (101°F), Goldendale (102°F), and Walla Walla (106°F) setting daily records, for example. Minimum temperatures were also high on the morning of the 27th with SeaTac (63°F) and Olympia (61°F) setting record high minimum temperature records. The warm temperatures continued into the 27th, with temperatures well into the 100s in eastern WA. Some locations, such as Pullman (99°F), Moses Lake (106°F), Ephrata (107°F), Colville (104°F), and Omak (107°F), broke their maximum high temperature record for any day in June. Finally, Walla Walla reached 113°F on the 28th, which broke a daily record for the station but is also the warmest June temperature on record anywhere in the state.

Station	June Avg Max Temp (F)	Rank	June Total Precip (in)	Rank	Records Began
Quillayute	69.4	1	0.20	1	1966
Olympia	79.9	1	0.14	2	1948
Hoquiam	66.9	5	0.38	2	1953
Walla Walla	90.3	1	0.07	2	1949
Yakima	92.5	1	0.01	2	1946
Spokane	84.8	1	0.07	3	1881
Bellingham	73.6	1	0.26	3	1949
SeaTac	78.9	1	0.23	4	1945
Wenatchee	90.5	1	0.04	5	1959

**Table 1: June average maximum temperature and ranking (descending) and June total precipitation and ranking (ascending) along with the period of record for selected WA stations.**

The warm and dry month was also conducive to wildfires, with the Paradise fire in western Olympic National Park and numerous fires in eastern WA that were started on the 28th due to thunderstorms activity still burning at the time of this writing.

## The Warm Month of July 1985

### A message from the State Climatologist

This month represents the 30<sup>th</sup> anniversary of the hottest month on record for WA state – July 1985 - in the last 100 years. In recognition of the relatively warm temperatures that have prevailed in this neck of the woods during the last couple of years or so as well as the record warm June 2015 temperatures, it seems appropriate to review the weather of July 1985.

The average statewide temperature during July 1985 was 69.0°F, which represents an anomaly of 4.9°F relative to a base period of 1901-2000. This temperature was not really an outlier; there have been other months almost as hot statewide, as indicated in a list of the ten warmest

Month	Average Temperature (F)
July 1985	69.0
July 1998	68.9
July 1958	68.5
August 1967	68.5
July 2014	68.5
August 1961	68.0
August 1986	68.0
July 2007	68.0
July 1941	67.9
July 1960	67.4

**Table 2: Ten warmest months in WA during the period of 1915-2014. Note: Temperatures based on climate division data made available at [WRCC](#). The all-time record warmest month in WA appears to have been July 1906, for which a value of 69.3 F has been assigned to the statewide mean temperature.**

months (Table 2). The majority of these 10 months have been in July. Pacific Northwest heat waves occur most often in July (Bumbaco et al. 2013), and the longer nights of August generally (but by no means always) result in lower minimum temperatures, especially in eastern Washington.

The daily maximum and minimum temperatures for July 1985 at SeaTac Airport (SEA) and Spokane International Airport (GEG) are shown in Figures 2 and 3, respectively. The month of July 1985 actually lacked much in the way of extreme heat. An exception is represented by 9 July at GEG, for which the 100°F maximum temperature tied the record for the day. Instead, the month featured 4 multi-day periods of relatively high maximum temperatures, with only 6 days below normal at SEA and 2 days below normal at GEG. Minimum temperatures tended to be higher than usual, but to a lesser extent than the maximum temperatures. This is different from the summer of 2014, which included notably high minimum temperatures in association with relatively high humidity. July 1985 was also quite dry; the statewide average precipitation was 0.20" compared to the normal (1901-2000) value of 0.90". In other terms, it was tied for the 9<sup>th</sup> driest July of the 20<sup>th</sup> century.

What caused it to be so toasty in July 1985? As we are inclined to do in this corner, the regional atmospheric circulation is summarized in the form of 500 hPa geopotential height (Z) and sea level pressure (SLP) anomaly maps. Not surprisingly, the 500 hPa Z was anomalously high over WA (Fig. 4). The magnitude of this anomaly is substantial for a summer month, but there have been other Julys with higher 500 hPa Z over the state, including just last year. The SLP anomaly pattern (Fig. 5) is mostly similar to that of the 500 hPa Z, with an important difference. Specifically, the SLP was near normal over WA. The minimal SLP anomaly along with above normal heights implies high thicknesses, i.e., positive temperature anomalies in a vertically-averaged sense from the surface to the 500 hPa level. Lower SLP is also the signature of the thermally-induced low-level trough characteristic of hot weather in summertime in the western US (Brewer et al. 2012).

Some folks are wondering whether the hot weather at the end of June into early July 2015 portends blistering temperatures for the remainder of summer. The short answer is not really. While the next few months should be on the warm side for WA state in an overall sense, we cannot say just how warm, and much of anything about the prospects for additional heat waves. But then again, if we get some more of this kind of weather, you won't need *us* to tell you that it is uncomfortably hot.

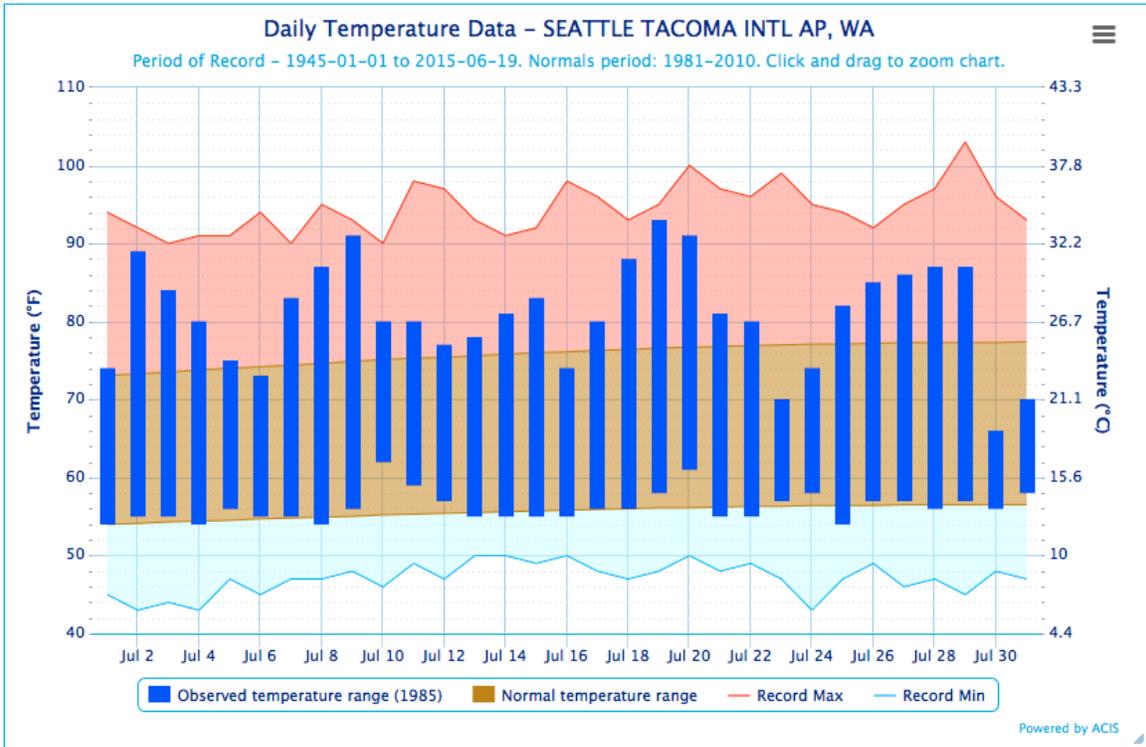


Figure 2: Daily high and low temperatures (blue bars) for SeaTac Airport in July 1985 compared to normal (brown envelope). The red envelope represents the daily record maximum temperatures and the blue envelope represents the daily record minimum temperatures.

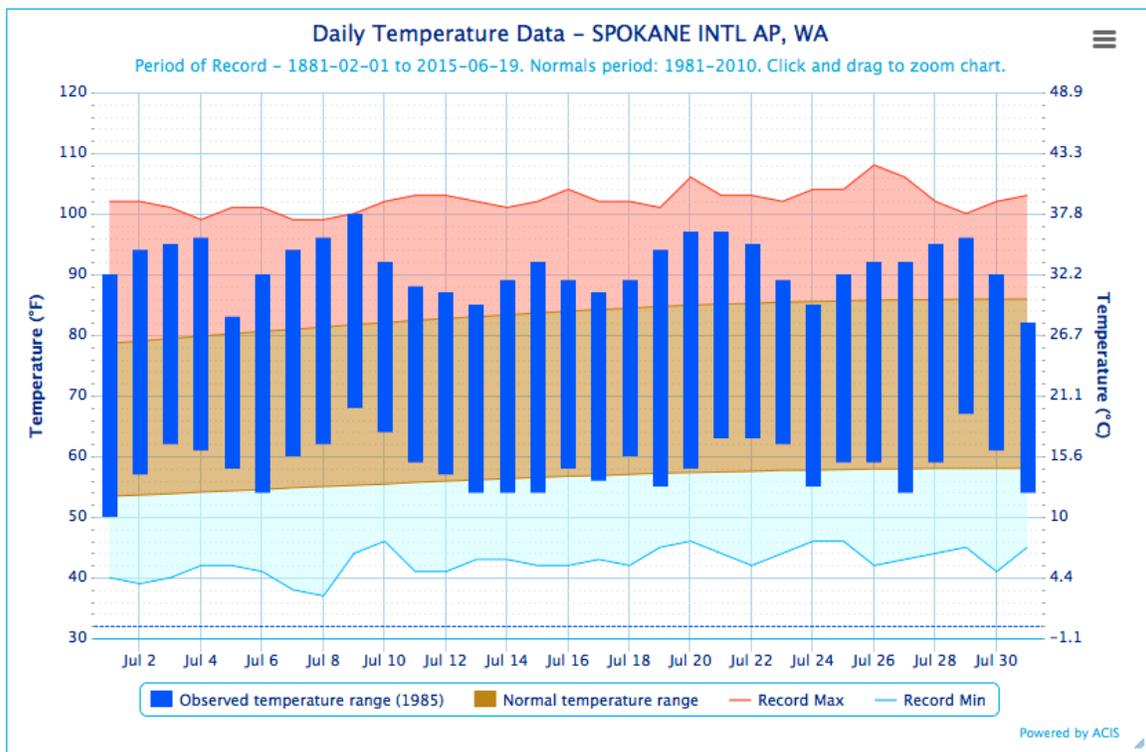


Figure 3: Same as Figure 2, except for Spokane Airport.

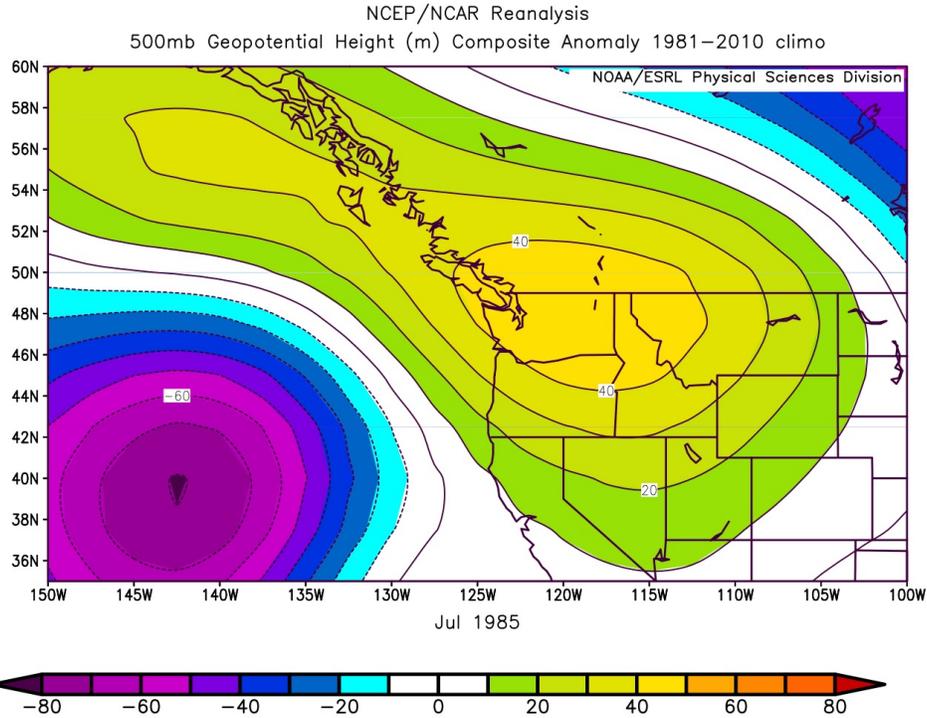


Figure 4: The 500 hPa geopotential height anomalies for July 1985 compared to the 1981-2010 normal.

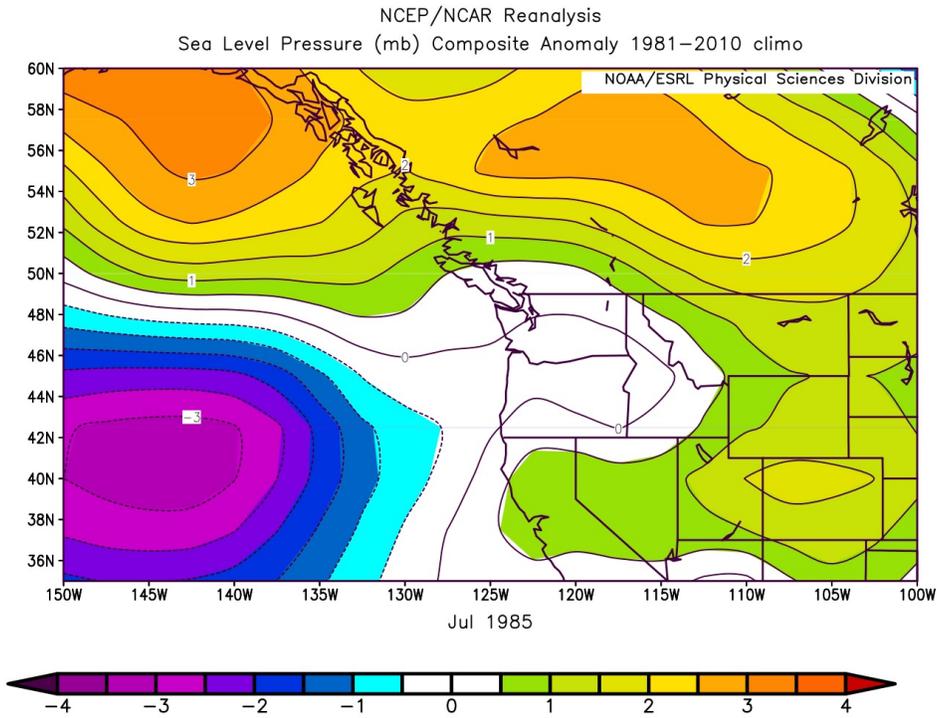


Figure 5: The sea level pressure anomalies for July 1985 compared to the 1981-2010 normal.

## References

Brewer, M., C. Mass, and B. Potter, 2012: The West Coast thermal trough: Climatology and synoptic evolution. *Mon. Wea. Rev.*, **140**, 3820-3843.

Bumbaco, K.A., K. Dello, and N.A. Bond, 2013: History of Pacific Northwest heat waves: Synoptic pattern and trends, *J. Appl. Met. Clim.*, **52**, 1618-1631.

## Drought Update

The dry conditions during the spring into early summer for most of WA state have not eased any drought concerns throughout WA State. The Governor declared a statewide drought emergency on [May 15](#), which is still in effect. The federal US Drought Monitor - which uses different criteria than the state to define drought - has also worsened the depiction of drought in WA State over the last several weeks (Figure 6). Moderate drought - "D1" - exists throughout all of western WA as a response to the recent dry conditions. Severe drought - "D2" - is present in the Peninsula due to the low snowpack and recent dry conditions. Both moderate drought and severe drought have been expanded in eastern WA to coincide with dry conditions there as well. Record low streamflows have been recorded throughout the state, and the forecasts for streamflow for the remainder of the water year are much below normal.

For more frequent drought updates, a weekly drought monitoring [report](#) is available from OWSC.

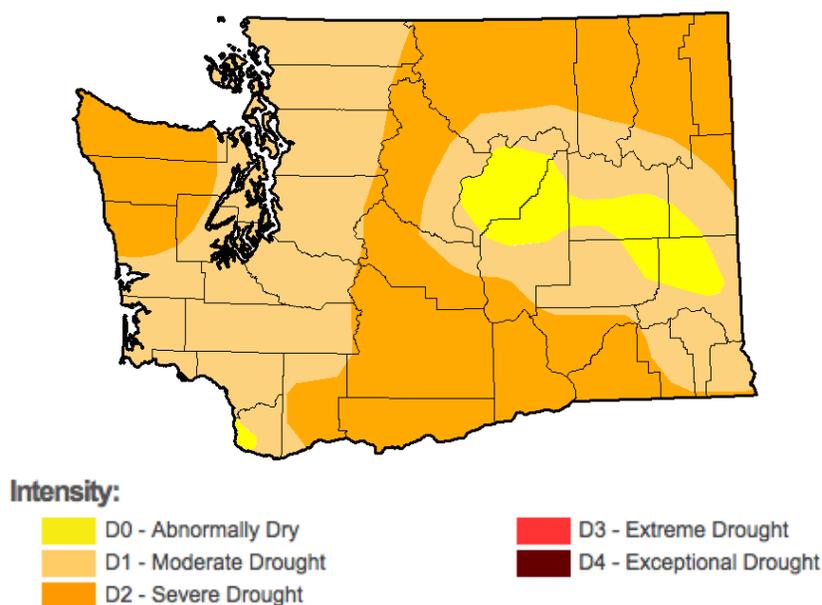
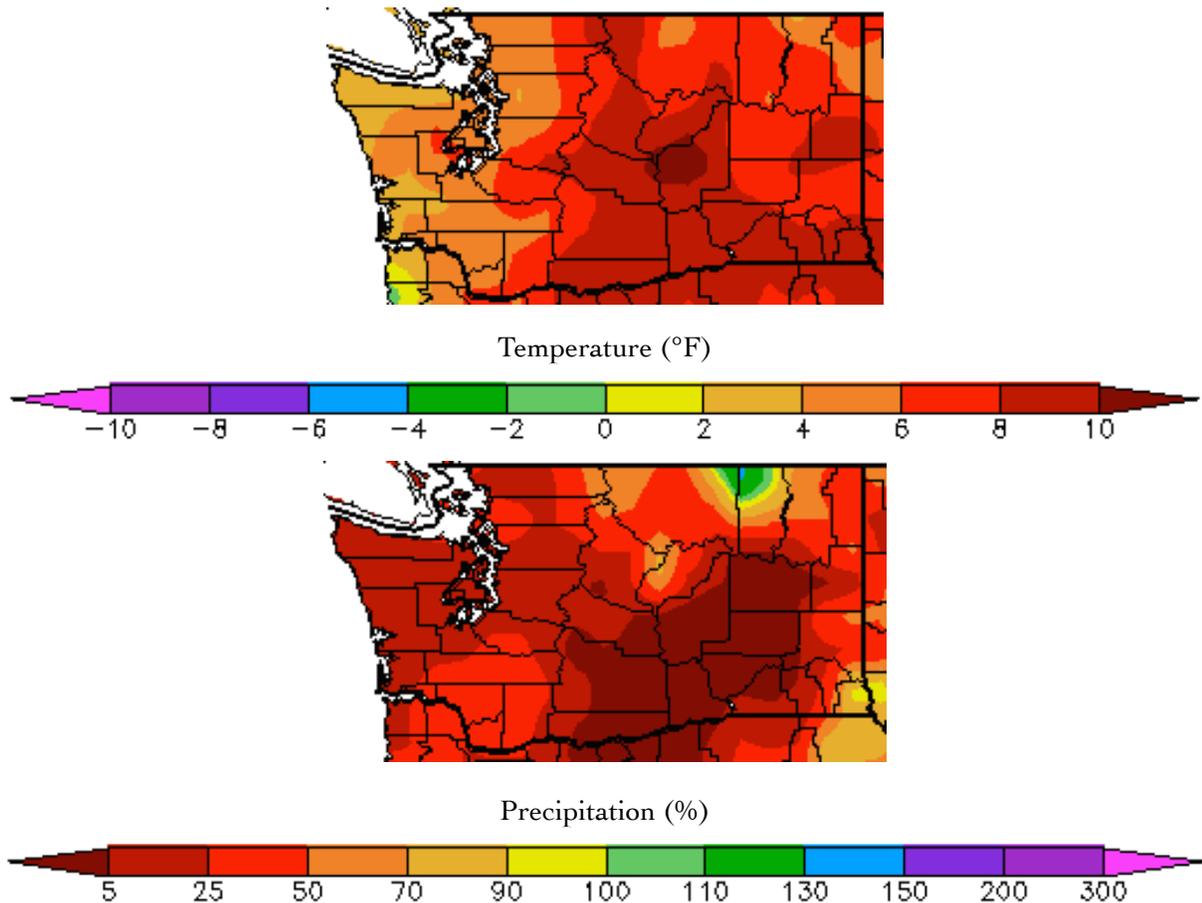


Figure 6: The 30 June 2015 edition of the US Drought Monitor (<http://droughtmonitor.unl.edu/>).

## Climate Summary

Mean monthly June temperatures were much warmer than normal statewide, according to the map below from the High Plains Regional Climate Center. Some areas in eastern WA exceeded an impressive 8°F above normal; Spokane Airport, Hanford, Ephrata, and Wenatchee were 9.3, 9.4, 10.5, and 10.9°F above normal, respectively (Table 3). Average June temperatures west of the Cascades were mostly between 4 and 6°F above normal, with Olympia an even 6.0°F above normal, for example.

Total June precipitation was minimal: most of the state received less than 25% of normal. A few locations, such as Pasco and Ephrata did not receive any measurable precipitation during the month, and others have nearly as dismal monthly precipitation numbers (Table 3). For example, both Spokane and Quillayute, on opposite sides of the state, received just 6% of normal precipitation. Pullman was a “wet” spot, receiving 42% of normal precipitation - most of which fell from thunderstorms on June 1.



*June temperature (°F) departure from normal (top) and June 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)		
	Average	Normal	Departure from Normal	Total	Normal	Percent of Normal
Western Washington						
Olympia	65.1	59.1	6.0	0.14	1.76	8
Seattle WFO	67.1	61.0	6.1	0.15	1.63	9
SeaTac AP	67.7	60.9	6.8	0.23	1.57	15
Quillayute	58.8	55.3	3.5	0.20	3.50	6
Hoquiam	59.5	56.8	2.7	0.38	2.24	17
Bellingham AP	64.0	58.5	5.5	0.26	1.86	14
Vancouver AP	69.3	63.3	6.0	0.39	1.79	22
Eastern Washington						
Spokane AP	71.4	62.1	9.3	0.07	1.25	6
Wenatchee	77.6	66.7	10.9	0.04	0.60	7
Omak	73.1	65.5	7.6	0.45	1.23	37
Pullman AP	65.3	58.6	6.7	0.45	1.08	42
Ephrata	77.1	66.6	10.5	T	0.61	0
Pasco AP	75.3	67.5	7.8	T	0.68	0
Hanford	79.0	69.6	9.4	0.13	0.51	25

**Table 3: June 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 is present, and sea surface temperature anomalies in the eastern equatorial Pacific have strengthened, according to the Climate Prediction Center ([CPC](#)). Averaged over the last four weeks, sea surface temperatures (SSTs) were above normal throughout the entire equatorial Pacific. The strongest equatorial SST anomalies are currently off the South American coast, and exceed 3°C. The “El Niño Advisory” released on 5 March is still in effect. There is over a 90% chance that El Niño conditions will continue through the summer of 2015, and a greater than 85% chance it will last through next winter (2015-16).

The CPC seasonal outlook for July is calling for increased chances of above normal temperatures statewide, with relatively high odds - above 60% using the three-tier system - in central WA. July precipitation is expected to be below normal, especially in the western half of WA.

The July-August-September (JAS) CPC outlook is calling for higher than normal temperatures statewide, with the highest odds in the western half of the state. For precipitation, there are equal chances (“EC”) of below, equal to, or above normal precipitation statewide.

Remember that these outlook percentages are based on a tercile system, and therefore the chances of below, equal to, or above normal temperatures or precipitation are split into equal probabilities of 33%. When there is a greater than a 33% chance of an occurrence, it should be looked at as a slight tilting of the odds in favor of that outcome.



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



*July-August-September outlook for temperature (left) and precipitation (right) from the CPC.*