



Office of the Washington State Climatologist

June 5, 2015

May Event Summary

Mean May temperatures were warmer than normal across the state while precipitation relative to normal varied with location. Much of western WA saw very little precipitation during May. Table 1 shows a few examples of stations that received a precipitation amount ranking within the 5 driest in the historical record. Meanwhile, on the opposite end of the spectrum, some locations in the Lower Columbia Basin ranked among the top 5 wettest Mays in the historical record; May 2015 at Yakima Airport was the 4th wettest on record (since 1946) and the 2nd wettest at Pasco (since 1945), for example.

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Frequent thunderstorms over the Cascades and in eastern WA caused a majority of the rainfall events in those locations. An exception was the slow-moving low pressure system moving west to east across southern Oregon that sent wraparound precipitation throughout eastern WA on the 13th. Pullman (0.59”), Wenatchee (0.38”), Moses Lake (0.38”), and Ephrata (0.36”) all recorded daily record rainfall on that date, and 24-hour precipitation records ending at 11 am on the 13th were recorded at Whitman Mission (1.16”) and Kennewick (0.93”) as well. Thunderstorms later in the month helped to contribute to the higher than normal precipitation in the Yakima Valley. Figure 1 shows the 24-hr precipitation measurements ending in the morning of May 23, with up to about three-quarters of an inch outside of Richland.

Station	May Total Precipitation (in)	Ranking	Record (in)/Year	Previous Record (in)/Year	Records Began
Hoquiam	0.28	1		0.51/1982	1953
Quillayute	0.67	1		1.05/1972	1966
Everett	0.51	4	0.28/1924		1894
Bellingham	0.67	5	0.40/1982		1949
SeaTac	0.58	5	0.12/1992		1945

Table 1: The total May precipitation (inches), ranking (ascending), the current record and year, the record broken, and the year records began for selected western WA stations.

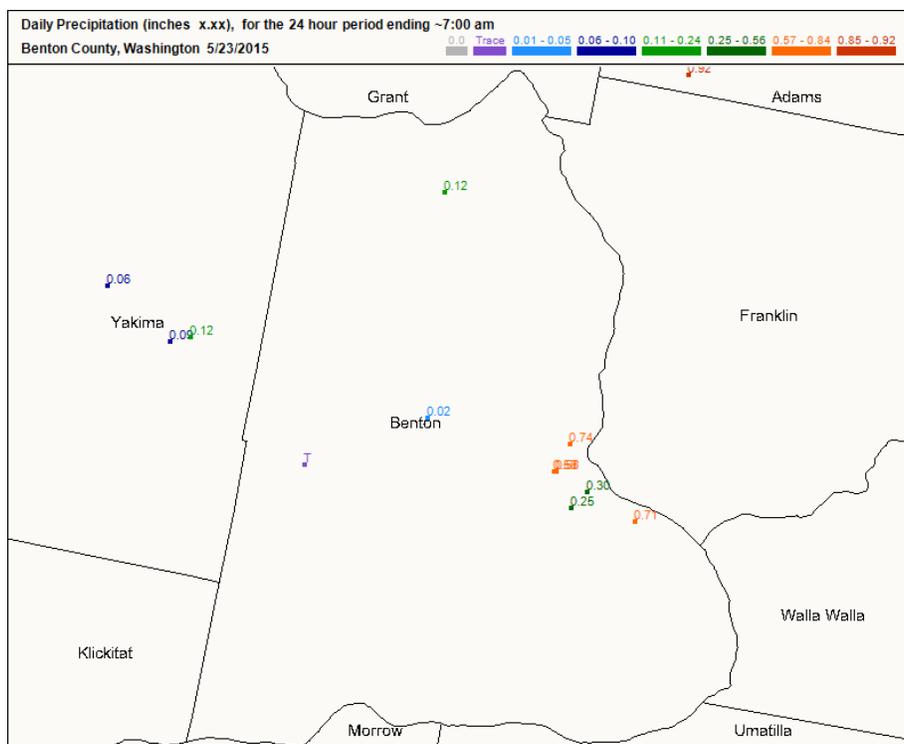


Figure 1: 24-hr precipitation ending in the morning of 23 May 2015 in the Lower Columbia Basin (from [CoCoRaHS](#) observers).

Snowpack Update and Drought Declared Statewide

The basin average snow water equivalent (SWE) percent of average from the National Resources Conservation Service (NRCS) shows that nearly all of the snowpack has melted out as of June 1 (Figure 2). The remaining basins with SWE are much below normal, ranging between 14 and 24% of normal. The poor snowpack was the primary impetus for Governor Inslee to declare a statewide drought on [May 15](#). With official declarations on the state-level, OWSC has been writing a weekly drought monitoring report that can be found here: <http://climate.washington.edu/events/2015drought/>. The report is typically released on Thursdays.

The US Drought Monitor depiction (Figure 3) has worsened in several areas around the state over the last few weeks. D0 - abnormally dry - conditions were introduced into western WA to represent the drier than normal conditions that have persisted for the last 2-3 months. D2 - severe drought - was introduced in northeastern WA to represent the very low streamflows and impacts that forest and fish managers have reported. Unfortunately, the higher than usual precipitation that has fallen in the Yakima region is still not enough to make up for the deficits the region has seen in snowmelt, and no changes have been made to the Drought Monitor in that area.

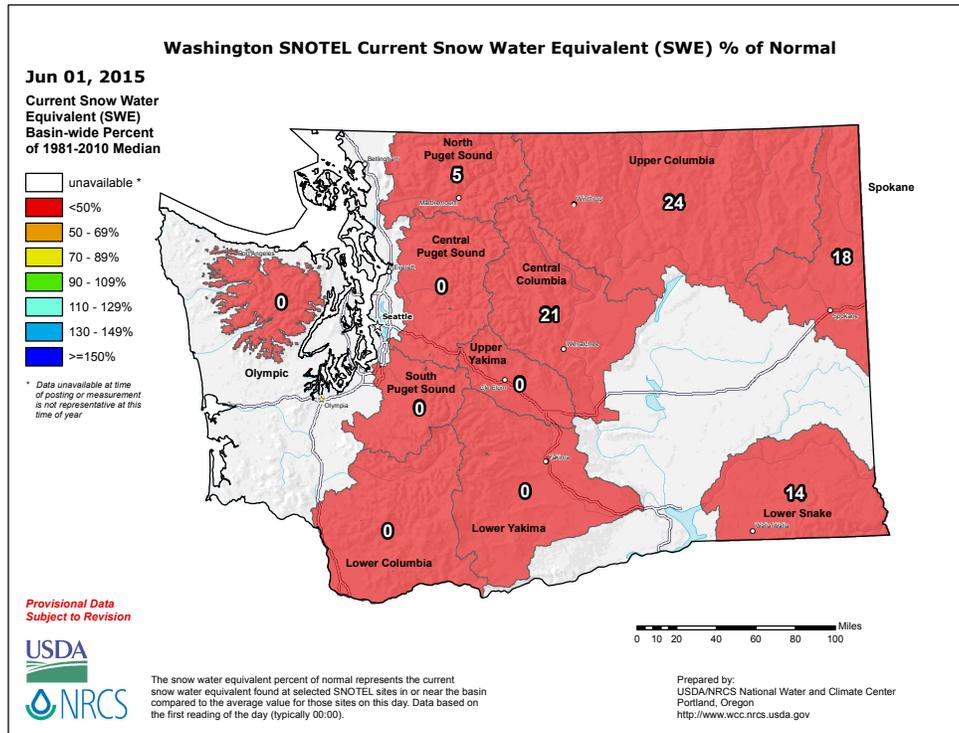


Figure 2: Snowpack (in terms of snow water equivalent) percent of normal for Washington as of 1 June 2015 (from the National Resources Conservation Service).

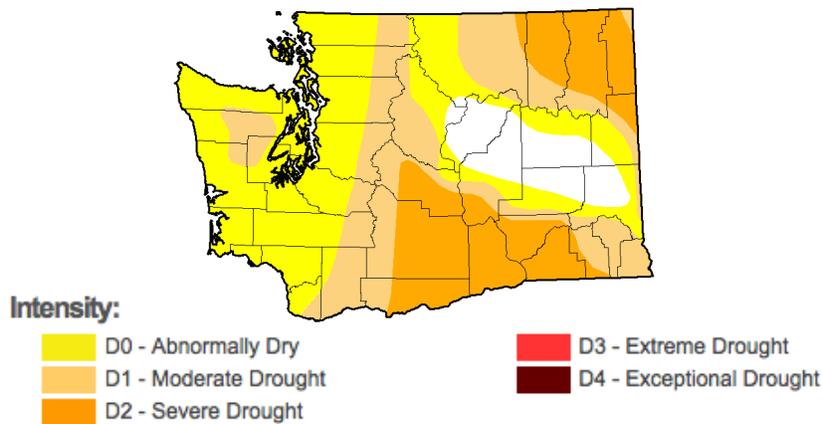


Figure 3: The 2 June 2015 edition of the US Drought Monitor (<http://droughtmonitor.unl.edu/>).

Three Flavors of Drought in the PNW

A message from the State Climatologist

With the topic of drought the focus of numerous local and national news stories of late – whether it’s the current Pacific Northwest (PNW) drought, the devastating multiyear California drought, or the torrential, drought-ending rains in Oklahoma and Texas – it is a good time to review a paper published in 2010 by current and former OWSC staff on different “flavors” of drought in the PNW. Bumbaco and Mote (2010) describe three of the many

ways drought can develop in the PNW using 3 recent case studies, and describe the various impacts on sectors that the droughts had in the past. This highlight will review some of the general findings of that paper, and compare the WA drought this year with that of 2005.

Bumbaco and Mote (2010) used the water years (Oct through Sept) of 2001, 2003, and 2005 to illustrate 3 flavors of drought in WA State. The first, in 2001, resulted in low winter snowpack caused by low winter precipitation, and had most of its impacts in the spring and summer. In addition to the generally low streamflow in the winter (Dec-Feb), the snowmelt dominated streams in the state (mostly in eastern WA) had streamflows during summer (June-September) that ranked among the 5 lowest in 55 years. Loss of revenue from hydropower was approximately \$3.5 billion in WA State alone, and caused increases in electricity rates of 10-58%. The second flavor of drought – the dry summer drought – occurred in WA in the summer of 2003 as result of the second warmest and second driest (at the time of journal publication) Jul-Aug for WA and OR combined. Even though summers are typically dry in the region, there were additional consequences including record or near-record low flows during the Jun-Sept period for streams that are not snowmelt dominated. The fire season was also particularly bad in OR and British Columbia, but WA was mostly spared. The last flavor of drought – and the one that is particularly relevant to the drought occurring currently – was in 2005. Warm winter temperatures decreased the snowpack, leading to both winter and summer drought. WA Cascade precipitation was between 70 and 80% of normal during the winter, but snowpack was only 20% of normal for much of the winter. Early season storms were accompanied by such warm temperatures that snow water content declines were observed even at the highest locations monitored.

The 2005 “flavor” of drought is the most similar to what has occurred this season, and the last statewide drought declaration before this year occurred in early March 2005. But there are also some differences. Figures 4 and 5 show the monthly statewide average temperature and total precipitation for the 2005 and 2015 water year along with the 20th century average.

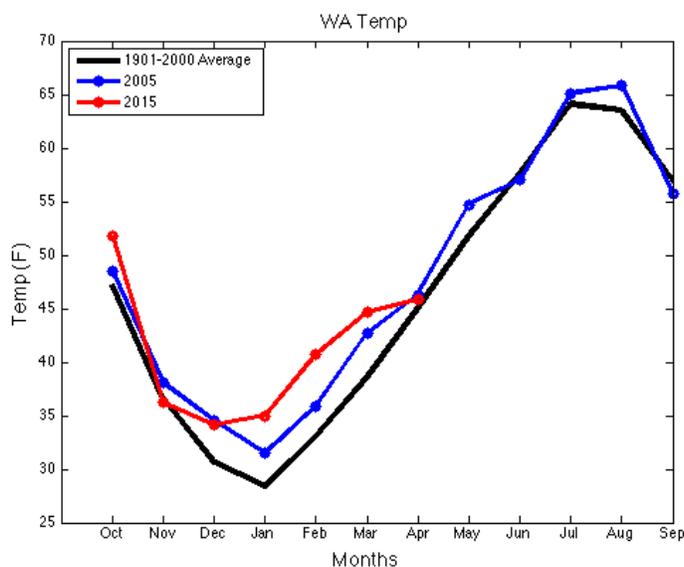


Figure 4: Statewide average temperature for the 2005 and 2015 water years (October through September) compared to the 20th century average (1901-2000).

Temperatures in Jan through March for the 2015 water year were much warmer than those in 2005 (Fig 4). February, for example, was 4.8°F warmer than in 2005. Also note that 2005 precipitation was lower than normal, while Oct through Mar precipitation in 2015 was much closer to normal (Fig 5). In 2005, a few intervals of warm, wet weather associated with atmospheric rivers were interspersed with periods of lesser precipitation and near normal temperatures. On the other hand, 2015 featured more consistently above normal temperatures, causing most of the precipitation in

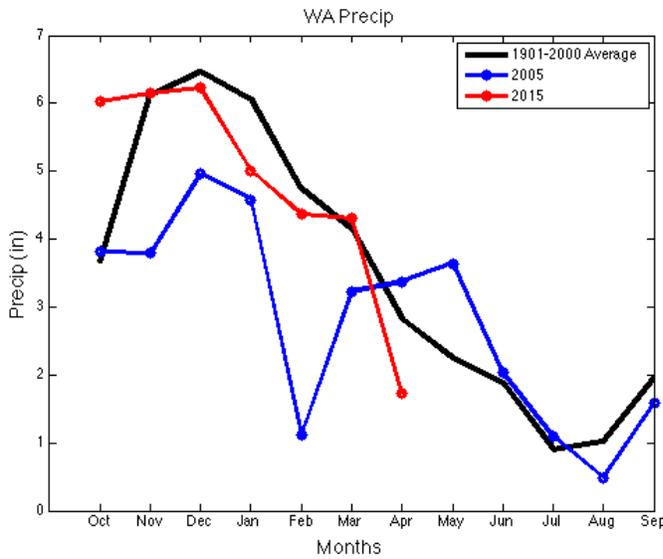


Figure 5: As in Fig. 4, except for total statewide average precipitation.

the mountains to fall as rain rather than snow. Another significant difference is 2005’s wet spring – including big snows in the mountains in late March – that actually mitigated some feared impacts. In contrast, spring has been drier than normal this year. The May data point isn’t available yet, but will very likely be drier than normal averaged statewide.

The combination of low streamflows from snowmelt-dominated rivers and the recent drier than normal conditions impacting streams has resulted in 26% of WA stream gauges with record low flow as of May 31. Table

2 shows the snapshot of the percentage of stream gauges in each category on May 31 compared to the same date in 2005 and 2001. WA State is worse off with respect to streamflow now than in those two previous drought years; 84% of the stream gauges are below normal currently as opposed to 58 and 57% in 2005 and 2001, respectively.

Year	Lowest Ever at Stream Gauge	<10th %tile	10-24th %tile	25-75th %tile	76-90th %tile	>90th %tile	# of Stream Gauges
2001	0	11	46	41	1	1	109
2005	7	32	19	31	8	3	117
2015	26	32	26	15	1	1	136

Table 2: Percentage of WA State stream gauges in each percentile (%tile) category on May 31 in 2001, 2005, and 2015.

The consequences of this unique drought year are already being felt, with more expected as summer approaches. There has already been some intervention for fish in the several watersheds, WA State Department of Ecology is buying water rights from willing farmers, and recreation industries (skiing and whitewater rafting) have been forced to adapt. More information on the conditions in WA State and actions being taken can be found in OWSC’s weekly drought monitoring report that is released on Thursdays (<http://www.climate.washington.edu/events/2015drought/>) and on the WA State Department of Ecology drought website (<http://www.ecy.wa.gov/drought/index.html>).

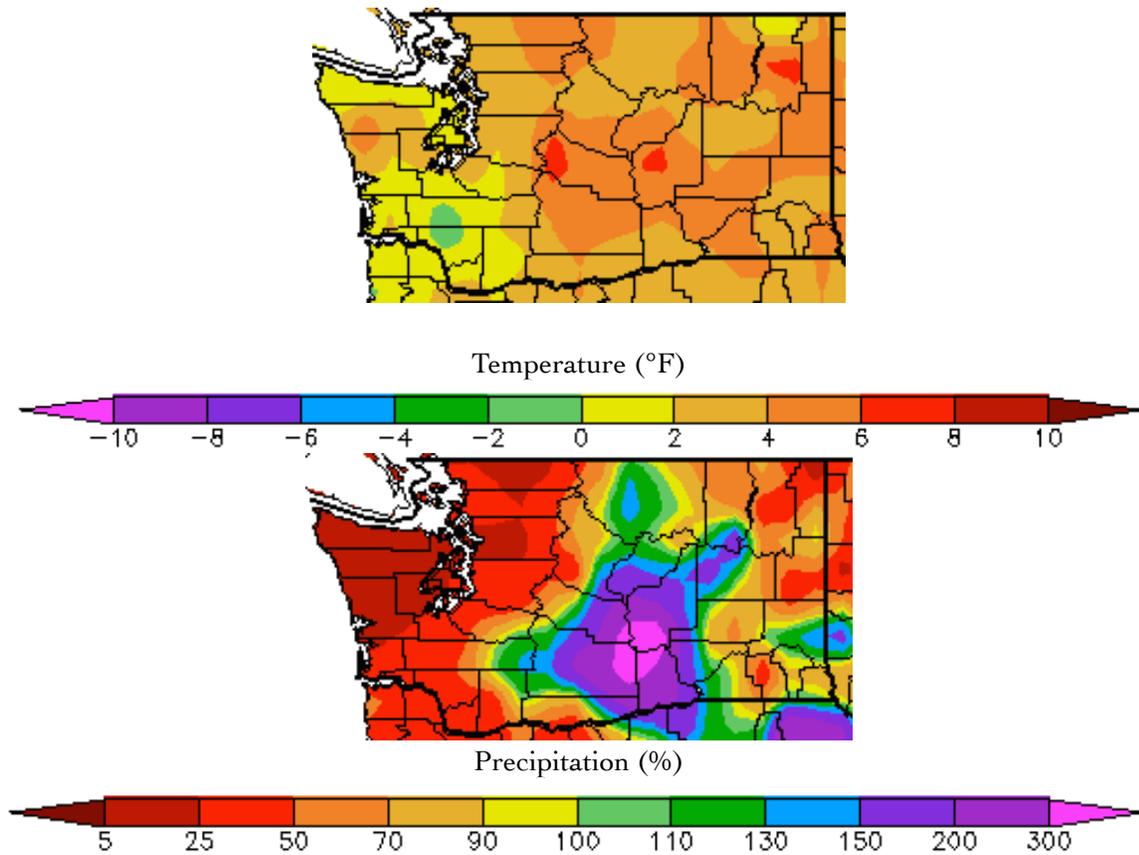
Reference

Bumbaco, K.A. and P.W. Mote, 2010: Three Recent Flavors of Drought in the Pacific Northwest, *J. Appl. Met. Clim.*, **49**, 2058-2068.

Climate Summary

Mean monthly May temperatures were warmer than normal statewide. According to the map below from the High Plains Regional Climate Center, most of the state was at least 2°F above normal. Eastern WA had warmer temperatures relative to normal with a large area between 4 and 6°F warmer than normal for the month. Spokane, Ephrata, and Wenatchee were particularly warm with positive temperature anomalies of 5.6, 5.8, and 5.8°F, respectively (Table 3). May temperatures were warmer than normal west of the Cascade Mountains as well with most locations between 2 and 4°F warmer than normal. Seattle and Bellingham were 3.1 and 3.6°F warmer than normal, respectively.

Total May precipitation was much below normal in western and northeastern WA, and above normal throughout most of the Lower Columbia Basin. The Olympic Peninsula only received between 5 and 25% of normal precip while the rest of western WA did not fare much better with between 25 and 50% of normal. For example, Hoquiam, Quillayute, and Bellingham received 9, 13, and 27% of normal, respectively. Northeastern WA and parts of southeastern WA were also drier than normal, with Spokane only receiving 52% of normal. The Lower Columbia Basin and north through Omak were wetter than normal, however, from frequent thunderstorm activity. Wenatchee and Ephrata received 178 and 182% of normal, respectively, while Hanford received nearly 300% of normal with 1.49" (Table 3).



May temperature (°F) departure from normal (top) and May 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	56.6	54.2	2.4	0.67	2.33	29
Seattle WFO	59.1	56.0	3.1	0.91	2.16	42
SeaTac AP	59.1	56.0	3.1	0.58	1.94	30
Quillayute	53.2	51.3	1.9	0.67	5.11	13
Hoquiam	54.3	53.0	1.3	0.28	3.29	9
Bellingham AP	57.4	53.8	3.6	0.67	2.48	27
Vancouver AP	60.1	58.1	2.0	0.68	2.47	28
Eastern Washington						
Spokane AP	60.7	55.1	5.6	0.85	1.62	52
Wenatchee	65.6	59.8	5.8	1.21	0.68	178
Omak	62.0	58.1	3.9	1.42	1.31	108
Pullman AP	56.4	53.2	3.2	1.96	1.56	126
Ephrata	65.1	59.3	5.8	1.18	0.65	182
Pasco AP	64.0	60.7	3.3	1.28	0.73	175
Hanford	66.5	62.1	4.4	1.49	0.51	292

Table 3: May 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 have strengthened 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 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 an approximately 90% chance that El Niño conditions will continue through the summer of 2015, and a greater than 80% chance it will last through the end of the calendar year.

The Climate Prediction Center seasonal outlook for June is calling for increased chances of above normal temperatures statewide, with the highest chances of warmer than normal temperatures west of the Cascade Mountains. The June precipitation outlook is calling for higher chances of below normal precipitation for the western WA, and equal chances of above, equal to, or below normal precipitation in eastern WA.

The summer (June-July-August; JJA) CPC outlook is very similar to the June outlook. There are higher chances of above normal temperatures for all of WA state with the highest chances for locations west of the Cascade Mountains. For precipitation, there are equal chances of below, equal to, or above normal precipitation in eastern WA but increased chances of below normal precipitation in western WA.



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



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