Office of the Washington State Climatologist

May 2, 2014

April Event Summary

April mean temperatures were near-normal with some tendency for the monthly anomalies to come in on the warmer side. Total April precipitation across the state was variable with most of the state receiving greater than normal precipitation except for some areas on the east slopes of the Cascade Mountains and in southeastern WA.

In this Issue

Figure 1 shows the maximum and minimum temperatures for SeaTac Airport for the month of April, compared to normal. Overall, it was a rather uneventful month weather-wise. The month started out dry, but rain moved in on the 3rd and stayed for a relatively wet first weekend of the month. Temperatures were unseasonably warm on the 7th around the state (example in Fig. 1), but only offered a brief respite since cooler temperatures and light rain returned for the remainder of the week. A switch to a dry and relatively warm weekend on the 12th and 13th (especially in western WA) demonstrated the typical sea-saw weather in spring. The following week was cool and showery with some heavy rain falling on the 17th around the state. Maximum daily rainfall records were set at Quillayute (1.71”), Hoquiam (0.77”), and SeaTac Airport (0.73”) on the 17th. More heavy rain fell on the 21st and 22nd with rain especially impacting eastern WA on the latter day. The 22nd saw maximum daily rainfall records set at Omak (0.60”), Ephrata (0.32”), and Moses Lake (0.21”).

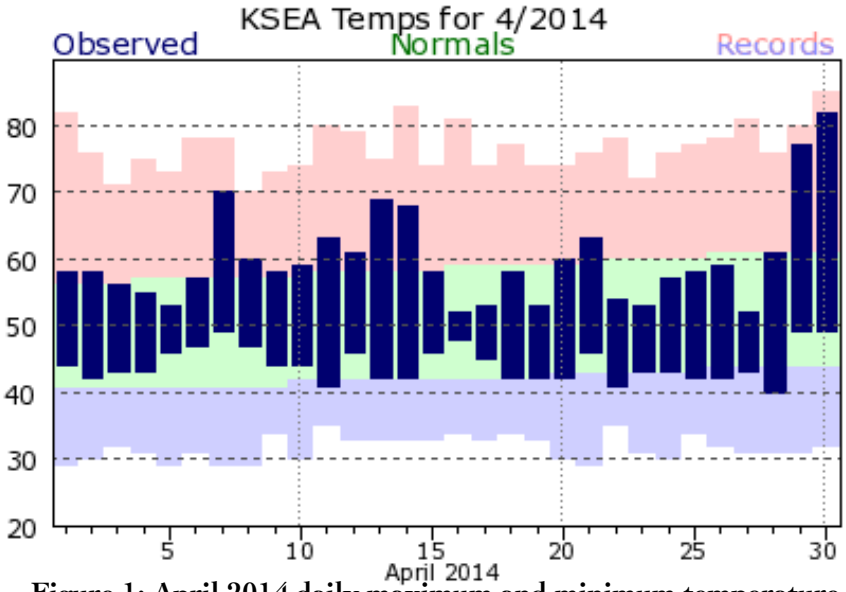


Figure 1: April 2014 daily maximum and minimum temperature (bars) for SeaTac Airport. The shading represents the normal temperature range (green), the record cold (blue), and the record warm (red) (from the National Weather Service).

The rest of the week was generally wet, particularly in the northern Puget Sound on the 24th where Bellingham set a maximum daily precipitation record of 1.15". Convective showers popped up throughout the state on the 27th, and there was even a confirmed EF0 tornado in Eatonville (Pierce County) with winds estimated at 75 mph. Fortunately, there were not any injuries. April ended on a warm note, however, with the last two days being much above normal, especially in western WA in association with easterly, offshore flow. Hoquiam and Quillayute both recorded their warmest April temperature on record on the 30th with 84°F.

Snowpack Summary

Figure 2 shows the snow water equivalent (SWE) percent of normal as of May 1 from the National Resources Conservation Service (NRCS). High elevation mountain locations received some additional snow during April, helping the percent of normal numbers to remain high. The Spokane and Lower Snake basins have much above normal SWE at this time (134% and 145% of normal, respectively). SWE in the Upper Columbia, North Puget Sound, Central Puget Sound, South Puget Sound, Central Columbia, and Lower Yakima basins is above normal, with values ranging between 110 and 122% of normal. The Upper Yakima and Lower Columbia has near-normal SWE at 104 and 94% of normal, respectively. The only basin that is still below normal is the Olympic basin with 88% of normal. Recent precipitation has led to improvements in the US Drought Monitor (Figure 3) in the northern section of eastern WA.

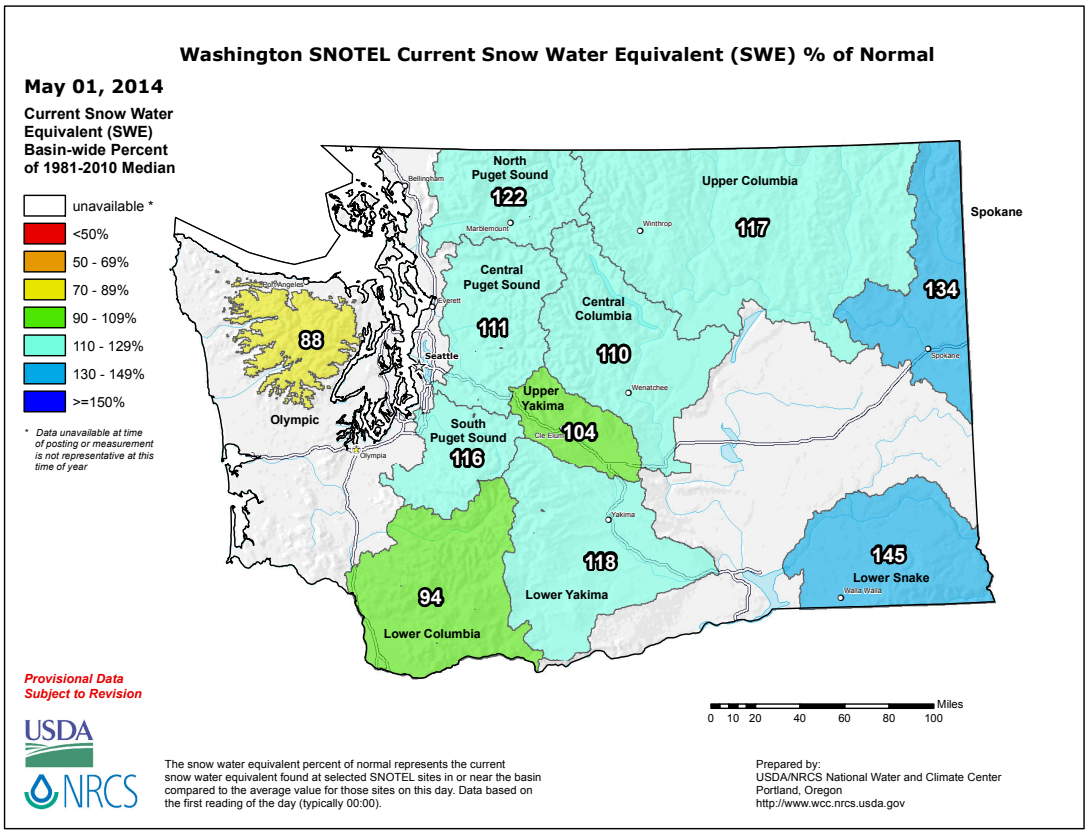


Figure 2: Snowpack (in terms of snow water equivalent) percent of normal for Washington as of May 1, 2014. Image is from the National Resources Conservation Service (NRCS).

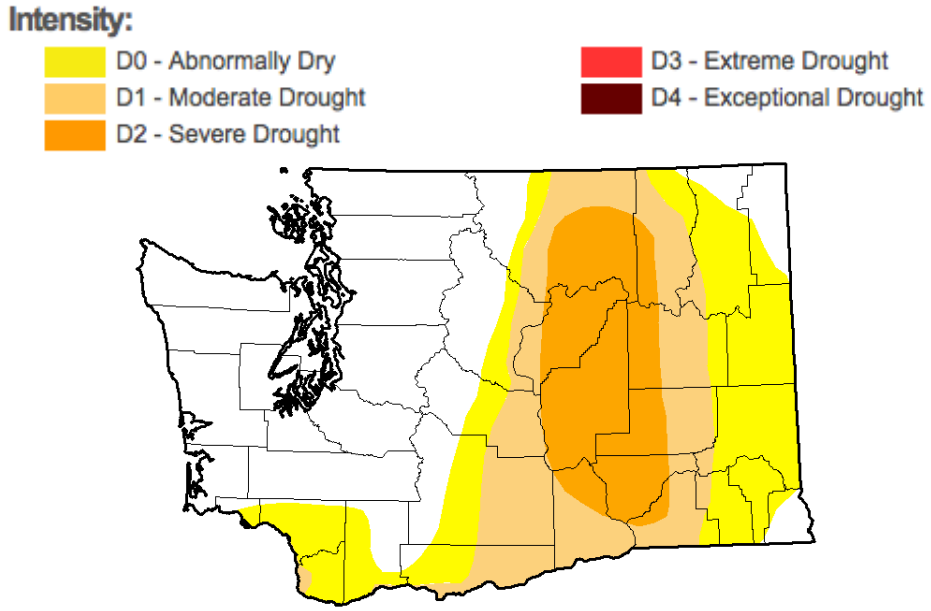


Figure 3: The April 29, 2014 edition of the US Drought Monitor (from the National Drought Mitigation Center).

Extreme Precipitation Events in Washington State

A message from the State Climatologist

There has been a slight upward trend in mean precipitation for Washington state over the last century or so, but this change is marginal from the standpoint of statistical significance. Readers are encouraged to explore this for themselves using an application on the OWSC website: www.climate.washington.edu/trendanalysis. Mean values of precipitation on monthly and longer time scales are important for many applications, of course, but that is not the whole story. A separate issue concerns whether extreme short-term precipitation events are getting more frequent or intense. A recent publication of the National Climate Assessment (ncadc.globalchange.gov) suggests that extreme precipitation events are on the rise for most of the US but to a lesser extent for the Pacific NW. OWSC decided to take a quick look on its own at this issue. For this purpose we have considered cool season (October-April) and warm season (May-September) separately, since the weather patterns promoting heavy precipitation events tend to be quite different in the two seasons.

The results shown here are based on daily values of precipitation from station data; 5 stations each in western WA and eastern WA representing different parts of the state. The stations selected have relatively complete records of daily precipitation data back to 1950 and provide more-or-less complete geographic coverage. Towards that end, a mountain station was included in both the western group (Mt. Rainier) and the eastern group (Stehekin). Shown below are the intensity (in relative terms for each location) and year of occurrence of the top ten events at each of the 5 western stations and 5 eastern stations for the cool season and for the warm season.
The stations chosen are far enough apart so that extreme 1-day precipitation events tend to occur at individual rather than multiple stations. Only about 15% of the events in western

Washington occurred at multiple stations; less than 10% did so east of the Cascades. In terms of the correspondence between west and east, about 10% of the winter events were included in the top ten lists of both a western and an eastern station. In summer only 5 or about 5% were of this type. Moreover, two of these occurred during the last week of September and so while included in the warm season set may well have been winter-like storms. This aspect of the results was no great surprise given the localized nature of heavy rains, but still, we did not expect almost a complete lack of overlap. This is not so much the case for heat waves, for example, which tend to be manifested on broader spatial scales across the Pacific Northwest.

Our primary interest in examining the daily precipitation records is to determine how the extreme events have been distributed over the years from 1950 to the present. For the western Washington cases in the cool season (Figure 4), there is a noticeable preponderance of events in the latter half of the record. Nothing of this sort is evident for the western stations as a group for the heaviest rainfalls in the warm season (Figure 5). Meaningful trends in the intensity of the most extreme events are lacking in both seasons. While not evident from the data as plotted, there is also an increased probability of cool season events occurring at multiple stations in western Washington during recent decades (none occurred before 1977 among the 5 stations used here).

For eastern Washington, cool season extreme events were relatively frequent in the 1990s, but an overall trend is lacking (Figure 6). There does seem to be a modest increase in the number of extreme events in eastern Washington during the warm season (Figure 7), but it is unlikely that this increase is robust from a statistical significance perspective. Similar to western Washington, it does not appear that the 1-day rainfall events have changed in intensity east of the Cascades.

The results turned up here are mostly consistent with recent research, such as the Mass et al. (2011) extreme precipitation study that focused on the coastal zone and the Janssen et al. (2014) study that examined extreme precipitation in the Pacific Northwest as a whole. We find the uptick in cool season events in western Washington intriguing, but caution that not too much should be made of them. More stations need to be included to put this highly tentative finding on a firmer foundation. If indeed a real change has occurred, it would be interesting to delve into whether it was more attributable to an increase in humidity, or more due to the dynamics (regional circulation patterns favoring heavy precipitation).

References

Janssen, E., D.J. Wuebbles, K.E. Kunkel, S.C. Olsen, and A. Goodman, 2014: Observational- and model-based trends and projections of extreme precipitation over the contiguous United States, *Earth's Future*, 99-113.

Mass, C., A. Skalenakis and M. Warner, 2011: Extreme precipitation over the west coast of North America: Is there a trend? *J. Hydromet.*, **12**, 310-318.

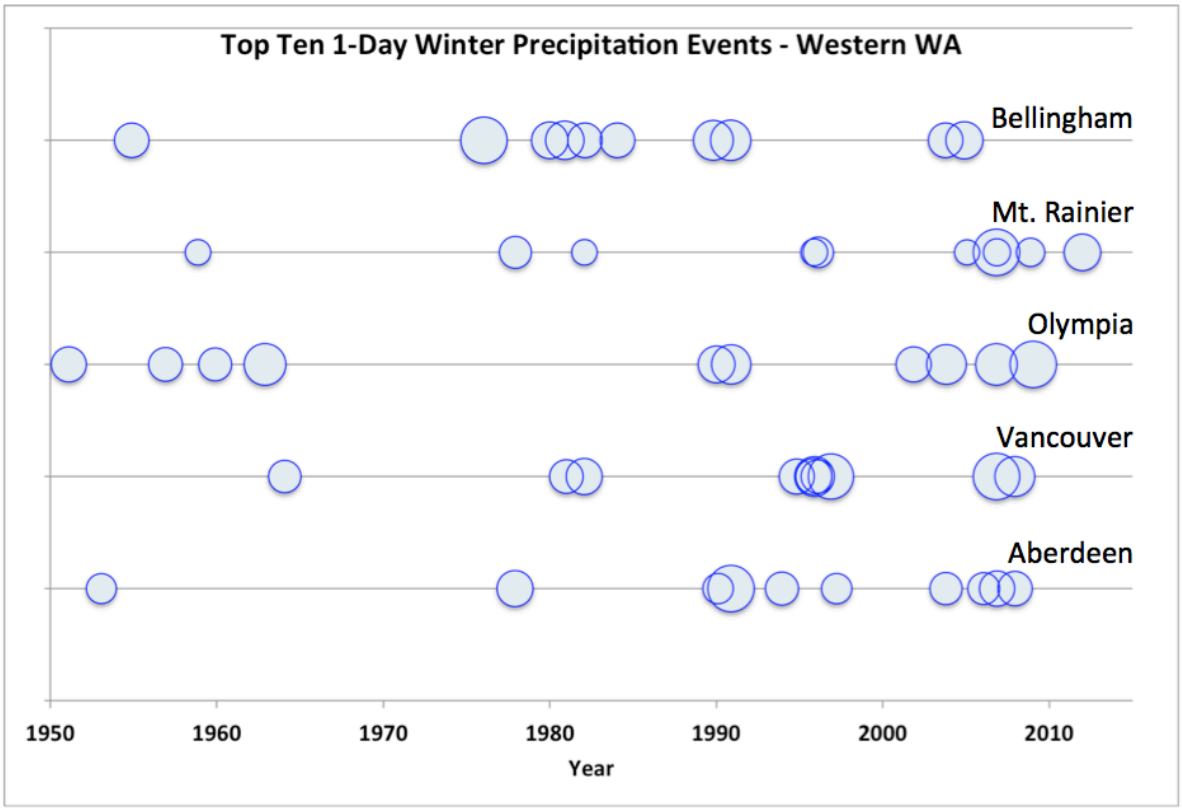


Figure 4: The top ten winter (October-April) daily precipitation events since 1950 for 5 stations in western WA. The size of the circle is proportional to the magnitude of the event for each station record, separately.

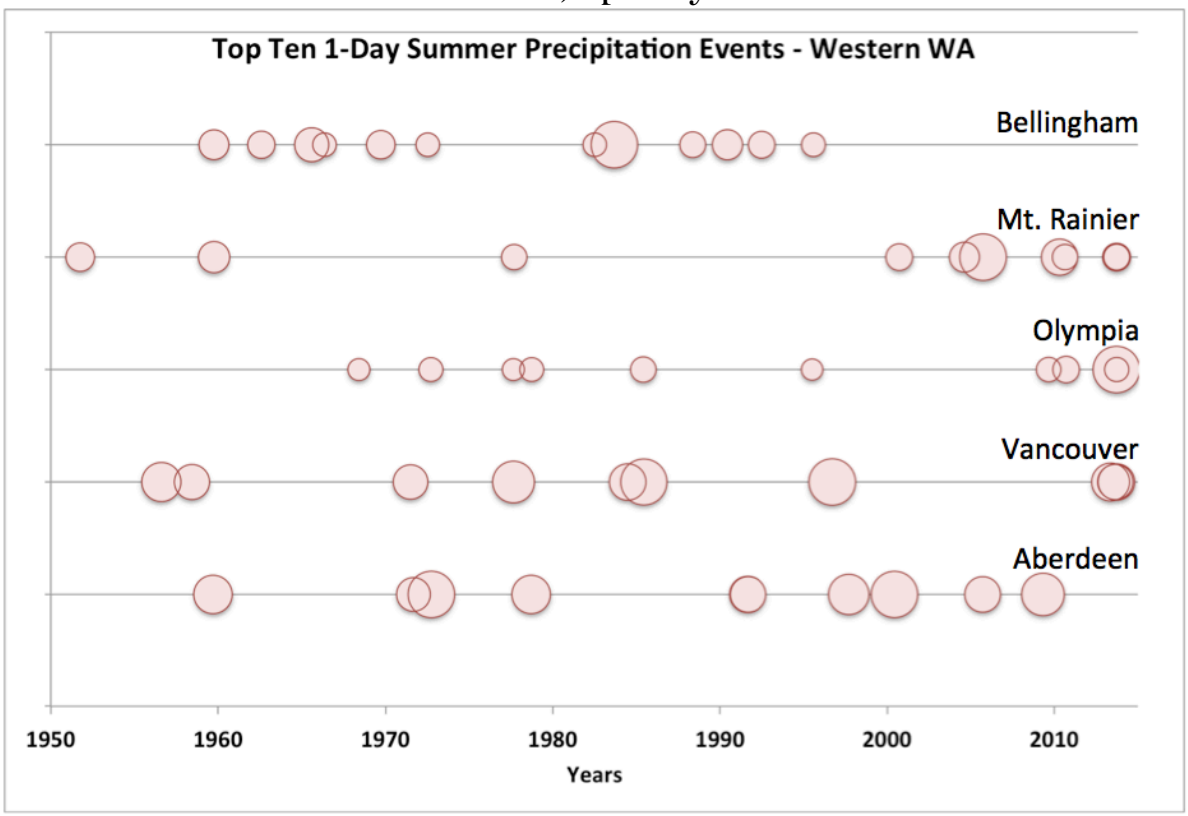


Figure 5: As in Fig. 4, except for summer precipitation (May-September).

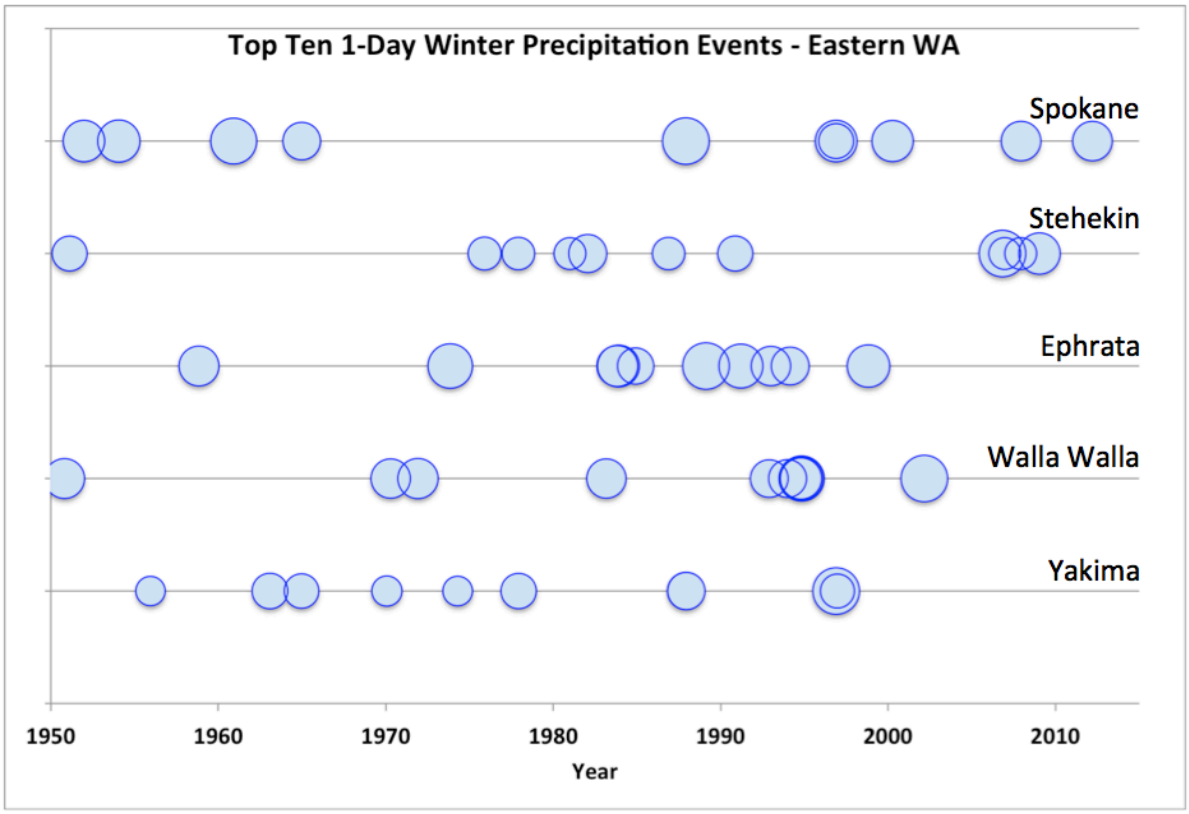


Figure 6: As in Fig. 4, except for eastern WA.

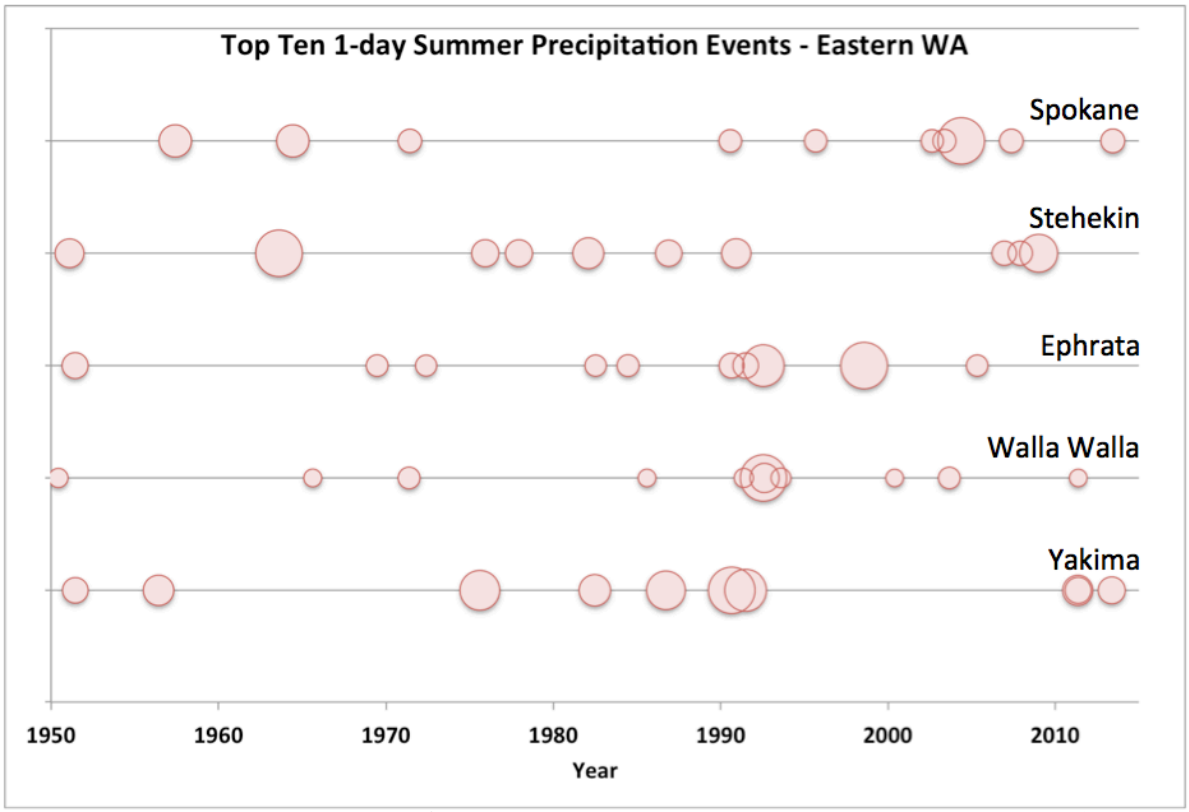
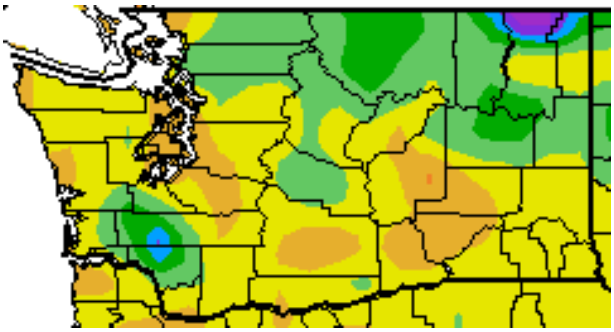


Figure 7: As in Fig. 4, except for eastern WA summer precipitation (May-September).

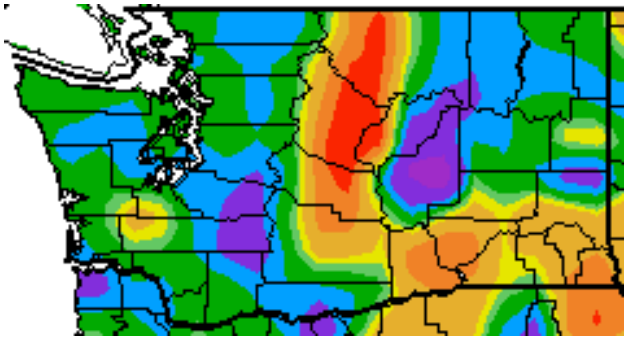
Climate Summary

Mean April temperatures were near-normal with most of the state on the warmer side, as shown in the map from the High Plains Regional Climate Center below. The Olympic Peninsula, central and southern Puget Sound, and the southern portions of central and eastern WA were up to 2°F above normal for the month. The exception is southwest WA where mean April temperatures were as much as 3°F cooler than normal. The northern portion of the state also had below normal temperatures.

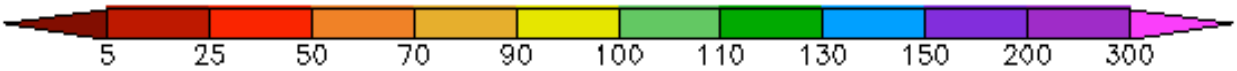
Total April precipitation was above normal for western WA and northeastern WA, ranging between 110 and 200% of normal in those locations. For the western WA locations listed in Table 1, the April percent of normal precipitation was around 125% of normal for most of them. The eastern slopes of the Cascade Mountains did not fare as well, with April precipitation totaling between 25 and 70% of normal. Southeastern WA was also on the drier side, with most of the area receiving between 70 and 90% of normal.



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)		
	Average	Normal	Departure from Normal	Total	Normal	Percent of Normal
Western Washington						
Olympia	49.6	48.3	1.3	4.26	3.54	120
Seattle WFO	52.5	50.5	2.0	3.45	2.77	125
SeaTac AP	52.0	50.3	1.7	4.18	2.71	154
Quillayute	48.2	46.7	1.5	9.90	7.85	126
Hoquiam	50.0	48.7	1.3	6.35	5.10	125
Bellingham AP	50.6	48.4	2.2	3.42	2.69	127
Vancouver AP	52.6	52.1	0.5	3.14	3.01	104
Eastern Washington						
Spokane AP	46.9	47.0	-0.1	1.14	1.28	89
Wenatchee	53.8	51.6	2.2	0.24	0.46	52
Omak	49.3	50.0	-0.7	1.18	1.05	112
Pullman AP	46.1	46.1	0.0	1.45	1.56	93
Ephrata	52.1	50.4	1.7	0.95	0.48	198
Pasco AP	53.9	52.9	1.0	0.35	0.65	54
Hanford	55.3	53.4	1.9	0.38	0.55	69

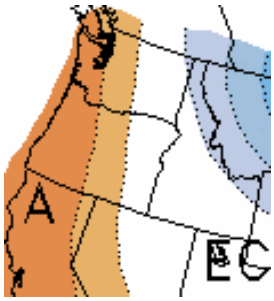
Table 1: April climate summaries for locations around Washington with a climate normal baseline of 1981-2010. Note that the Vancouver Pearson Airport and Seattle WFO 1981-2010 normals involved using surrounding stations in NCDC's new normal release, as records for these station began in 1998 and 1986, respectively.

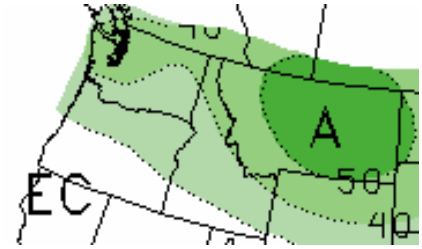
Climate Outlook

The conditions in the equatorial Pacific Ocean are ENSO-neutral, according to the Climate Prediction Center (CPC): http://www.cpc.ncep.noaa.gov/. Averaged over the last month, sea-surface temperatures (SSTs) are above normal throughout most of the equatorial Pacific Ocean, except in the far eastern equatorial Pacific Ocean where they are below normal. There is a consensus among the model predictions that near-neutral ENSO conditions will persist through the spring 2014, and increasing chances that an El Niño could develop as early as this summer. The "El Niño Watch" that was initially released by the CPC in early March is still in effect, and indicates that when the El Niño will develop and how strong it will become are still very uncertain. Better predictions for next fall and winter will be available this summer.

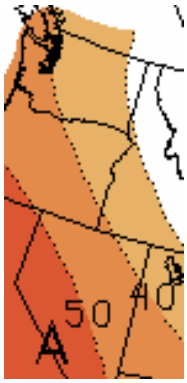
The Climate Prediction Center seasonal outlook for May has increased chances of warmer than normal temperatures for the western half of WA State and equal chances of below, equal to, or above normal temperatures for the eastern half. For precipitation, there are increased chances of above normal precipitation throughout the entire state for May.

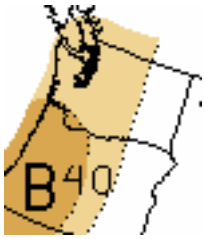
The three-month May-June-July (MJJ) temperature outlook has a higher chance of above normal temperatures for WA State. The precipitation outlook is calling for below normal precipitation for the western two-thirds of the state. The eastern one-third has equal chances ("EC") of below, equal to, or above normal precipitation.





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





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