Office of the Washington State Climatologist

April 2018 Report and Outlook

April 4, 2018

http://www.climate.washington.edu/

March Event Summary

Mean March temperatures were colder than normal statewide, with average temperatures mostly between 1 and 2°F below normal. Precipitation was below normal for a majority of the state, though north central WA was an exception with above normal March precipitation.

In terms of setting weather records, the month was relatively uneventful. Daily March maximum and minimum temperatures for SeaTac Airport are shown in Figure 1, along with the brown envelope that represents the normal temperature range. Of note is the warm period from March 10 to March 13, where maximum temperatures peaked at about 15-20°F above normal around the state. High maximum temperature records were set throughout western WA on the 12th with SeaTac Airport (73°F), Olympia (71°F), Quillayute (71°F), Hoquiam (71°F), and Bellingham (70°F) all setting daily records. Despite this early spring warm spell, temperatures were still colder than normal for the month as a whole around the state.

A comparatively cool and wet period occurred later in the month, from about the 22nd to the 27th. Notably, there was some measurable snow around the state on the morning of the 24th (Figure 2), though mostly a dusting west of the Cascades. SeaTac recorded a "trace" while Spokane recorded 2.7" on the 24th. OWSC received a few inquiries on whether snow in late March is unusual for WA lowlands so we decided to mention a few examples here.

The short answer, is no, snow that late in the season is not unprecedented, but it does not occur very often. For Spokane Airport, the average date of the last snow (defined as 1" or more) is March 9, but there are 34 years in the record in which the last snow of the season occurred on March 24th or later, including an inch on April 6, 2015. The latest date in the year with snow is May 11 (1967). For SeaTac Airport, we counted anything more than a "trace" since snow occurs less frequently and in

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smaller amounts than in Spokane. The average date of the last measurable snow is February 19, but there are 7 years in the record with snow March 24 or later, with the latest being 1.2" on April 17, 1972. It's a pretty good bet that chances of lowland snow are winding down as we now approach spring.

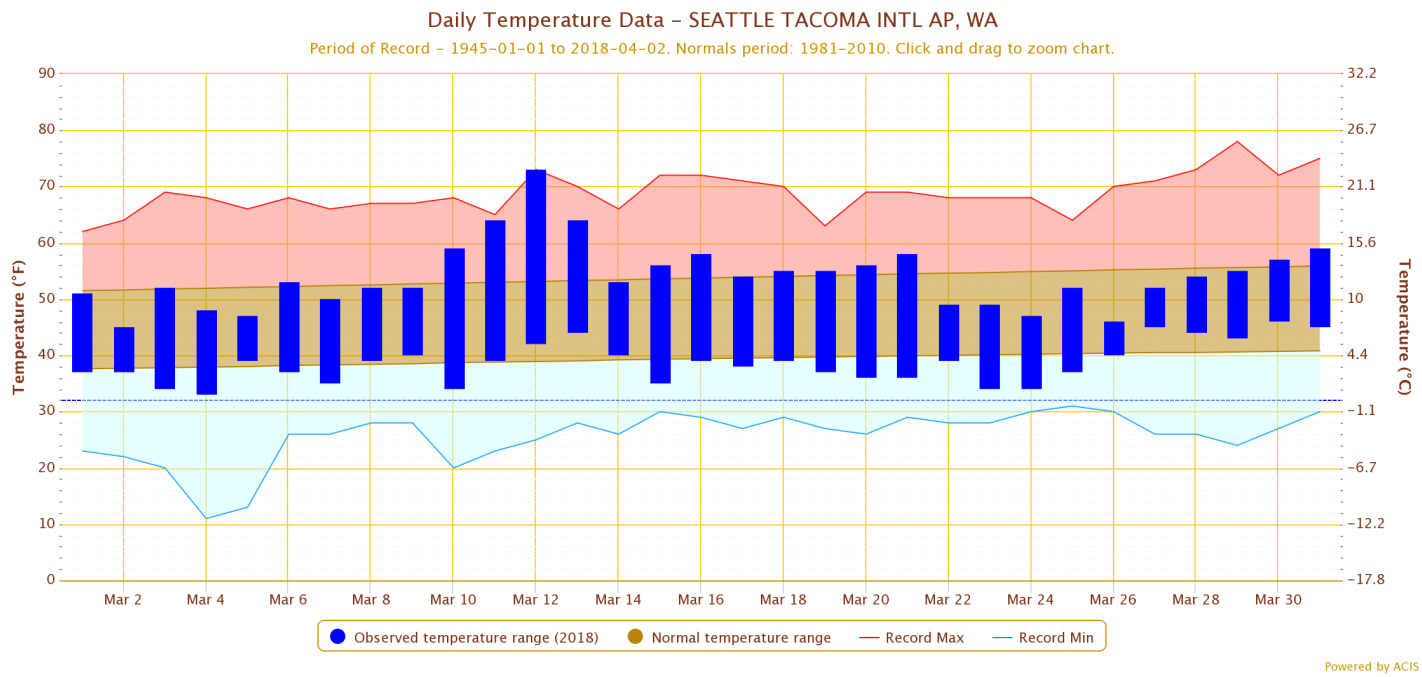


Figure 1: Daily March 2018 temperatures (dark blue bars) for SeaTac Airport with the normal range of temperatures (brown envelope) and historical records (red and blue envelopes).

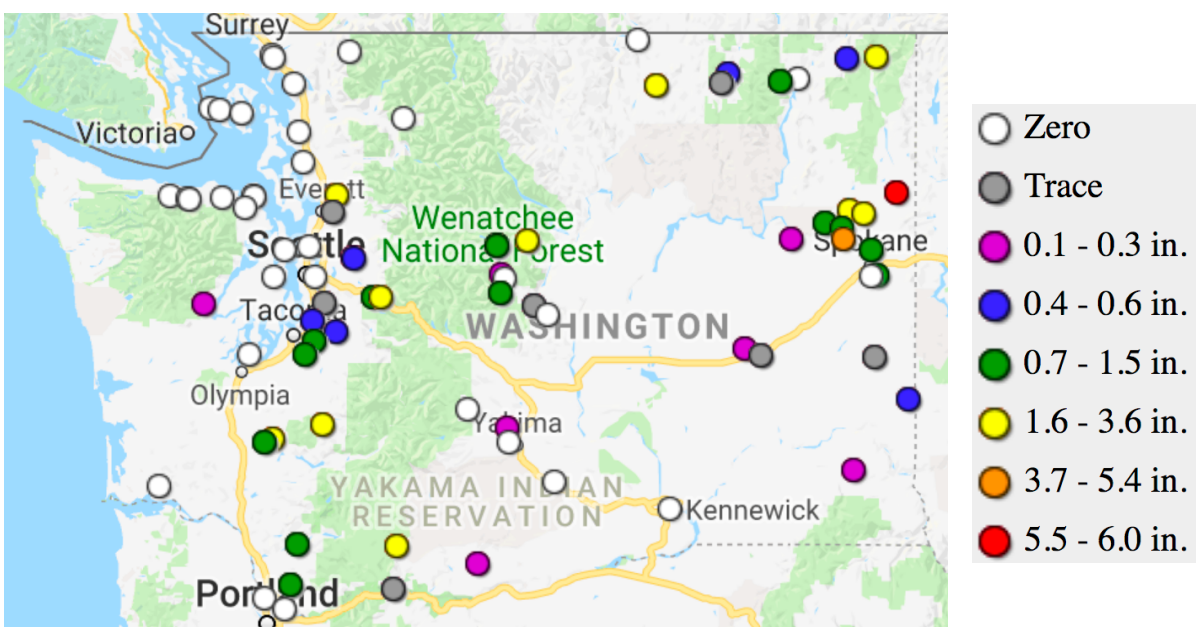


Figure 2: 24-hr snowfall observations ending between 7 and 9 am on March 24, 2018 from [CoCoRaHS] observers.

Snowpack Update

The below normal March temperatures were accompanied by several snow storms to continue to build snow in our mountains. Early April snowpack - the typical seasonal peak - is in good shape around the state. The basin average snow water equivalent (SWE) percent of normal from the National Resources Conservation Service is shown in Figure 3. As of April 2nd, basin-average SWE ranges between 98 and 136% of normal throughout the state. The North Puget Sound and Upper Columbia basins have the highest SWE relative to normal, with 124 and 136% of normal, respectively.

The U.S. Drought Monitor has removed the abnormally dry conditions ("D0" category) from south central WA since last month's newsletter. While portions of this area have been drier than normal on short time scales, other indicators (such as the normal snowpack) have led to the removal of abnormally dry conditions.

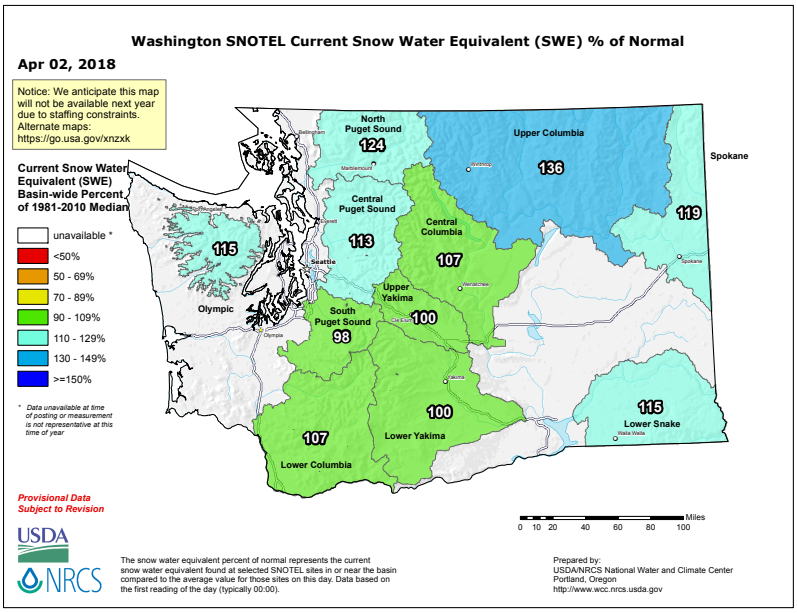


Figure 3: Snowpack (in terms of snow water equivalent) percent of normal for WA as of 2 April 2018 (NRCS).

photo by Henry Reges, CoCoRaHS

Community, Collaborative Rain, Hail, and Snow (CoCoRaHS) Network

Thank you, CoCoRaHS observers, for continuing to record your rain and snow observations!

Have you ever wondered about the history of rain measurements? A recent "Message of the Day" on the CoCoRaHS site reminded us that there's a short history available on the CoCoRaHS webpage. It can be assessed here: https://www.cocorahs.org/Content.aspx?page=Rainfall_Part1.

If you think your friends and relatives may be interested in reporting for CoCoRaHS, then please help spread the word! New observers can sign up at www.cocorahs.org.

What Climate Change means to our crucial Snowpack

Originally published in The Seattle Times on March 23, 2018

By: Nick Bond and Karin Bumbaco

"Low mountain snowpack raises water-supply fears in Washington" was a Seattle Times headline on January 6, 2015. Just one year later, another headline proclaimed, "Snow pack in good shape, likely well into spring". Given this conflicting information, what can we say about changes in our state's snow?

Snowpack is arguably the most crucial climate-related variable for the Pacific Northwest. It makes large contributions to spring and summer water supplies for agriculture and fish, and impacts hydropower production, forest and ecosystem health, and recreation. Our snowpack is a key feature of our mountains, and the state would be a much different place without it.

With the end of the snow-building season on the horizon, our current snowpack is in good shape, with near-normal to above-normal snow totals throughout most of Washington state. The Bureau of Reclamation's March 2018 forecast shows adequate water supply for the state's key agricultural area in the Yakima Basin, and there isn't current concern for drought development anywhere in the state.

As is often the case, the present snowpack varies substantially across the western U.S. While northern Idaho, Montana, and Wyoming are also enjoying a good snow year, Oregon, southern Idaho, and the southwestern US are lacking snow, with concerns about summer water supplies. These regions have been hit by the one-two punch of a winter that's been both drier and warmer than normal.

In Washington state, we have certainly seen how warm winter temperatures can lead to drought. Three years ago was a recent, extreme example. Precipitation was relatively normal during the winter of 2014-15, but with a much higher proportion of rain instead of snow in the mountains. The result was a record low snowpack, with some major impacts on water supplies the following summer. On the other hand, the state saw plenty of snow the following year, and the snowpack was mostly above normal again last winter.

These sorts of fluctuations make it tough to assess local trends in snowpack. Some of this variability is due to El Niño/La Niña – key features of the tropical Pacific atmosphere-ocean system that influence weather patterns far from the equator. The current and expected state of the tropical Pacific is useful for seasonal weather predictions, and plays a role in the swings in the amount of snowpack that we can see from year-to-year. These seasonal predictions are inherently less accurate than weather forecasts for the next few days, with the potential for major surprises. Ultimately, Mother Nature holds the cards and has some tricks up her sleeve.

Along with substantial year-to-year variability, we've seen declines in snowpack for Washington state as a whole, particularly when you look back many decades (Mote at al. 2018; Stoelinga et al.

2010). The 2018 study by Philip W. Mote, director of the Oregon Climate Change Research Institute, found that "over 90% of snow monitoring sites with long records across the western U.S. show declines, of which 33% are significant vs. 5% expected by chance".

It also depends a lot on where and when you look. Average winter temperatures in our mountains have warmed about 2°F over the last 100 years, but total precipitation shows little consistent change. This means that locations well above the usual rain-snow line, such as Harts Pass (~6,500') in the north Cascades, have negligible trends in April 1 snowpack from the mid-1980s through 2016. It's a different story for other locations, such as Hurricane Ridge (~4,500') in the Olympic Mountains, which has a statistically significant declining trend of about 3.5 inches of snow per decade in April 1 snowpack since 1950.

The bottom line is that year-to-year variability will continue to be the dominant effect on our snowpack over at least the next decade or two. At some point, however, these variations will be overwhelmed by a warming of the Pacific Northwest. Years such as 2015, specifically its warm winter temperatures, will become more the rule rather than the exception by about the 2050s.

Such a future promises more winter floods and more summer droughts as precipitation falls more as rain rather than snow. It will still get cold and dark in winter, of course, and the higher elevations will still get snow. The problem is that the area of our mountain watersheds reliably receiving snow — the places that hold fresh water until the summer dry season — will decrease as freezing levels ratchet upwards.

What can be done? A first step is to recognize that changes are happening, even though we cannot be certain how fast. Developing resilience to present day climate fluctuations — such as the conditions we saw in 2015 — through management practices that adjust for changes in supplies and demands, will have substantial payoffs.

References:

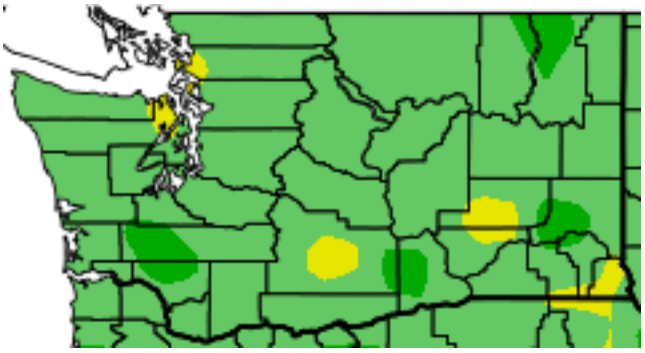
Mote, P.W., S. Li, D.P. Lettenmaier, M. Xiao, and R. Engel (2018): Dramatic declines in snowpack in the western US, *npj Climate and Atmospheric Science*, doi:10.1038/s41612-018-0012-1

Stoelinga, M.T., M.D. Albright, and C.F. Mass (2010): A new look at snowpack trends in the Cascade Mountains, *J. Climate*, doi: 10.1175/2009JCLI2911.1

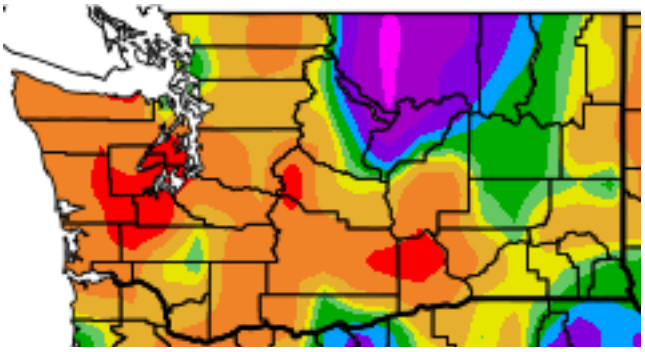
Climate Summary

Mean March temperatures were on the cooler side of normal for the entire state, with temperatures in the "0-3°F below normal" category on the map from the High Plains Regional Climate Center on the right. According to Table 1, Olympia, Wenatchee, and Pasco had the coldest March temperatures relative to normal, with anomalies 1.9, 1.9, and 2.0°F below normal. Ephrata had exactly normal temperatures, and several other sites (SeaTac Airport, Pullman, and Hanford, for example) were within half a degree Fahrenheit of normal.

Total March precipitation was below normal for most of the state, with some areas such as the eastern Olympic Peninsula and portions of the Lower Columbia Basin only receiving between 25 and 50% of normal precipitation. The coastal sites of Hoquiam and Quillayute were also low, receiving only 54 and 57% of normal precipitation, respectively (Table 1). On the other hand, north central WA received above normal precipitation for the month. Omak, for example, had more than double their usual March precipitation, with 225% of normal (Table 1). The somewhat unusual monthly precipitation pattern, with above normal precipitation only in north central WA, is thanks in part to weak southeasterly flow anomalies aloft favoring precipitation in that location.



Temperature (°F)



Precipitation (%)

March temperature (°F) departure from normal (top) and precipitation percent of normal (bottom). (High Plains Regional Climate Center; 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	42.6	44.6	-1.9	2.59	5.29	49	M	0.7	-
Seattle WFO	46.2	46.6	-0.4	2.49	3.51	71	T	0	0
SeaTac AP	46.3	46.5	-0.2	2.44	3.72	66	T	0.8	0
Quillayute	42.3	44.1	-1.8	6.15	10.83	57	M	0.7	-
Hoquiam	45.1	46.0	-0.9	3.80	6.99	54	M	0	-
Bellingham AP	43.4	44.2	-0.8	3.26	3.22	101	M	0.7	-
Vancouver AP	46.2	48.0	-1.8	2.93	3.57	82	M	M	-
Eastern Washington									
Spokane AP	39.5	40.2	-0.7	1.30	1.61	81	4.9	3.5	140
Wenatchee	42.2	44.1	-1.9	0.72	0.64	113	M	M	-
Omak	40.8	41.5	-0.7	2.68	1.19	225	M	M	-
Pullman AP	40.2	40.6	-0.4	1.44	2.05	70	M	M	-
Ephrata	43.0	43.0	0.0	0.46	0.68	68	M	M	-
Pasco AP	44.3	46.3	-2.0	0.49	0.79	62	M	M	-
Hanford	46.1	46.5	-0.4	0.35	0.57	61	0	0.4	0

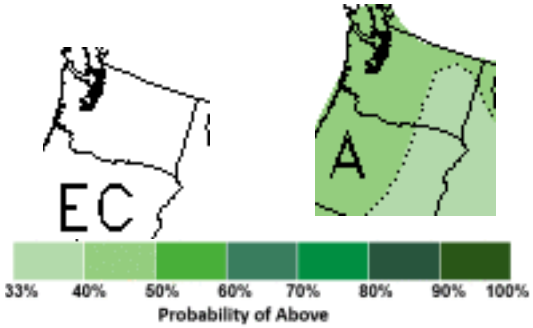
Table 1: March 2018 climate summaries for locations around Washington with a climate normal baseline of 1981-2010. Note that the Vancouver Pearson Airport and Seattle WFO 1981-2010 normals involved using surrounding stations in estimating the normal, as records for these station began in 1998 and 1986, respectively.

Climate Outlook

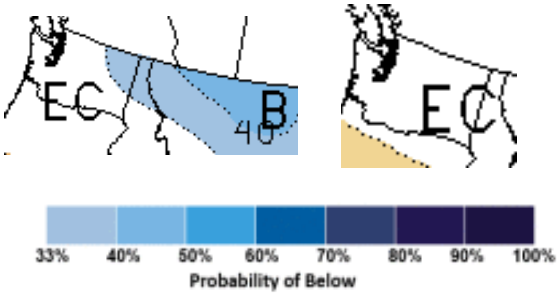
La Niña conditions weakened considerably in February and into March, with the temperatures just below the surface in the equatorial Pacific Ocean approaching normal. Other aspects of the La Niña - such as enhanced areas of thunderstorms in the western equatorial Pacific - have also weakened. Most ENSO models show the current La Niña continuing to decay with a transition into ENSO neutral conditions this spring (March-May). The effect of ENSO on our seasonal weather is weakening, and the increased precipitation expected in April is largely based on global climate model output.

The April temperature outlook from the CPC has little indication for how the temperatures will play out. There are equal chances of below, equal to, or above normal temperatures across Washington. On the other hand, for precipitation, there are higher chances of above normal precipitation statewide.

The three-month CPC seasonal outlook (April–May–June) calls for an equal chance for above, near normal, or below normal temperatures across most of the state. The exception to this is northeastern Washington, where we can expect a higher chance of below normal temperatures. Washington can also expect an equal chance of either above, equal to, or below normal precipitation across the state for April-June.



April outlook for temperature (left) and precipitation (right)



April-May-June outlook for temperature (left) and precipitation (right)

(Climate Prediction Center)