Office of the Washington State Climatologist

March 5, 2012

February Event Summary

Average temperatures for February 2012 were very close to normal throughout the entire state. In fact, the weather throughout February was rather docile, with barely any temperature or precipitation daily records to note. Precipitation was variable throughout the state for the month, with most locations receiving below normal precipitation, as summarized in the "Climate Summary" below.

In this Issue

Feb Event Summary.....1
CoCoRaHS.....2
Climate Summary.....3
Snowpack Report.....5
Plant Hardiness.....6
Climate Outlook.....8

The first day of the month started out relatively wet, especially on the east side of the Cascades, but that pattern did not last long. Instead, a ridge of high pressure built into the region prompting stagnant air once again this winter for regions where the winds were light. The high pressure ensured dry conditions statewide from the 2nd through the 7th, and sunny skies prevailed. The warmer than normal temperatures at the beginning of the month at Sea-Tac is illustrated in Figure 1. A weak cold front moved in on the 8th bringing precipitation statewide, and another low pressure system moved in on the 9th and 10th bringing heavy rain. A rainy pattern continued for the next week or so, especially west of the Cascade Mountains. Heavy snow fell in the mountains on the 17th and 18th.

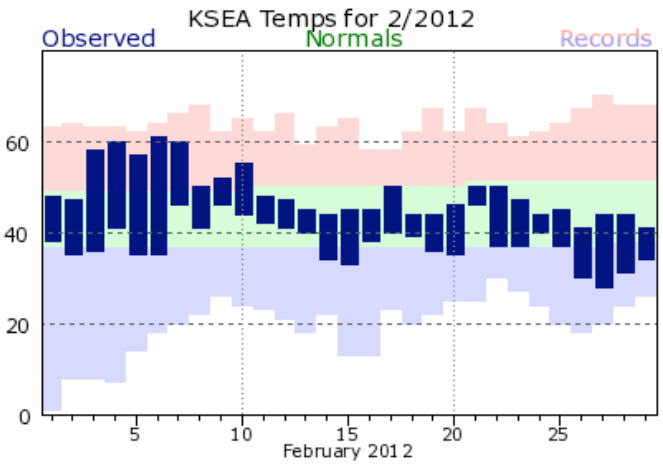


Figure 1: Daily high and low temperatures for Sea-Tac for February 2012 compared to normal (from NWS).

A more notable event occurred on the 21st, with a warm air mass raising the snow levels and heavy precipitation falling. Some flooding occurred in western WA and winds were strong statewide. Temperatures dropped on the 22nd, turning the precipitation to snow in the mountains. The final noteworthy event occurred during the last week of the month: a cold air mass produced snow showers in some western WA lowland locations and larger snow accumulations occurred east of the Cascades. The CoCoRaHS map (Figure 2) shows 24-hr snowfall in the Hood Canal area on the morning of the 29th.

It also bears noting that Governor Gregoire requested federal aid for Clallam, Grays Harbor, King, Klickitat, Lewis, Mason, Pierce, Skamania, Snohomish, Thurston, and Wahkiakum Counties for the damage to public facilities from the snow and freezing rain that occurred in mid-January. More information can be found here: http://www.governor.wa.gov/news/news-view.asp?pressRelease=1862&newsType=1.

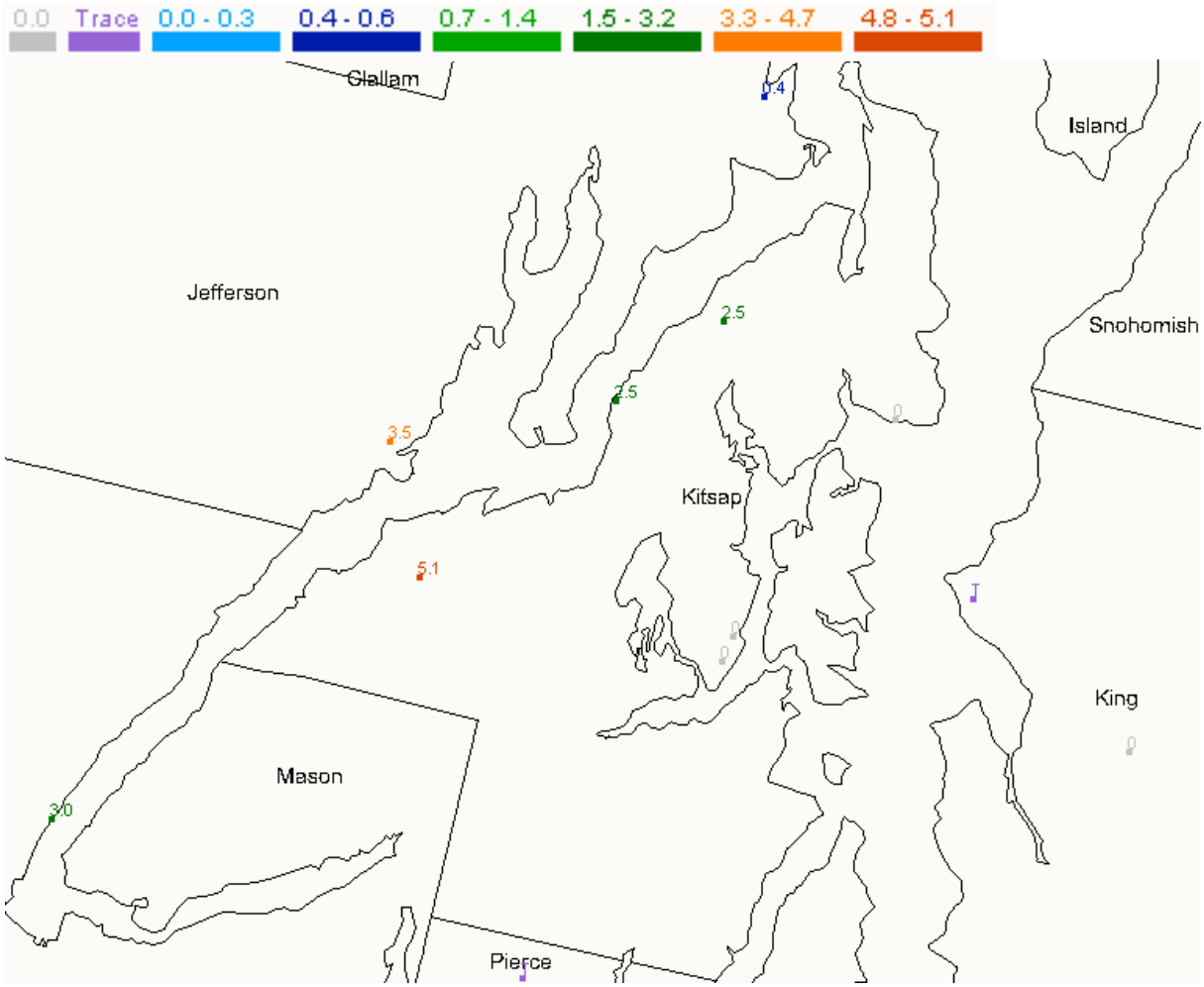


Figure 2: 24-hr snow totals from CoCoRaHS for the Hood Canal region between 7 and 9 am on February 29, 2012.

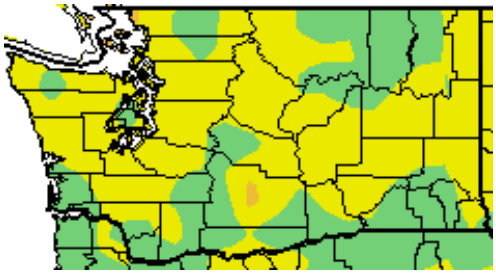
CoCoRaHS March Madness Begins

The annual friendly competition between states to see who can recruit the most new CoCoRaHS volunteers during March is underway! Do you want to know how much rain fell in your backyard? What about at your work place? Join CoCoRaHS (or help spread the word!) at www.cocorahs.org. Volunteers spend about 10 minutes a day reading their rain gauges and entering their reports online. You can track the "CoCoRaHS March Madness" competition here: http://www.cocorahs.org/Content.aspx?page=marchmadness.

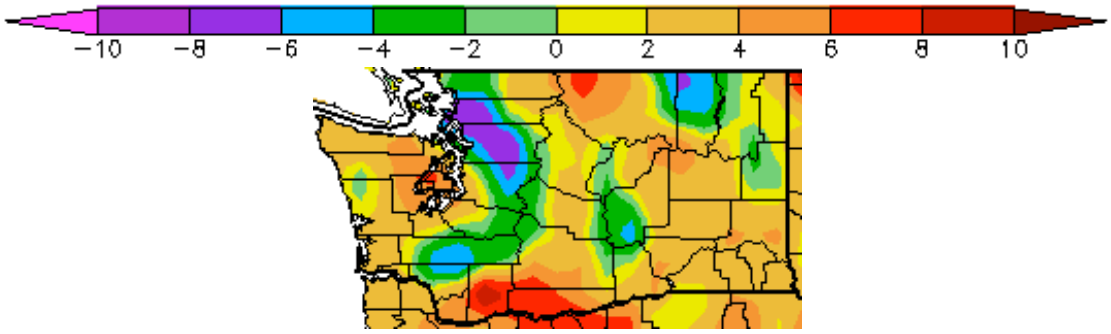
Climate Summary

February temperatures were near climatological means, with the temperature departure from normal (1971-2000) map from the High Plains Regional Climate Center below showing all of WA within 2°F of normal. Many of the WA towns and cities were so close to normal that there is actually a discrepancy between the information shown in the map and in Table 1. For example, the map indicates that SeaTac was slightly warmer than normal in February, when Table 1 shows that SeaTac was -0.2°F below normal. This difference is due to comparing the temperatures to different normal periods. The map still uses the old normals (1971-2000) while the values listed in Table 1 are the updated normals (1981-2010). Either way, the message is that February temperatures were typical for most of the state.

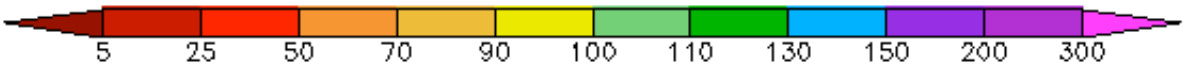
February precipitation was below normal for most of the state, with a majority of the state receiving between 70 and 90% of normal precipitation (e.g., Vancouver, Wenatchee, Omak). Olympia and Seattle had closer to normal precipitation. As shown in the February precipitation percent of normal map below, a few areas of the state received above normal precipitation: the northern Puget Sound locations south to Lewis County, Grant County east of the Cascades, the Spokane area, and most of Ferry County in northeastern WA.



Temperature (°F)



Precipitation (%)



February temperature (°F) departure from normal (top) and February precipitation % of normal (bottom). Source: High Plains Regional Climate Center (http://www.hprcc.unl.edu).

	Mean Temperature (°F)			Precipitation (inches)			Snowfall (inches)		
	Avg	Norm	Departure from Normal	Total	Norm	% of Norm	Total	Norm	% of Norm
Western Washington									
Olympia	40.9	41.0	-0.1	5.01	5.27	95	0	4.7	0
Seattle WFO	43.9	43.4	0.5	3.21	3.31	97	T	0.6	0
Sea-Tac	43.2	43.4	-0.2	3.63	3.50	104	T	1.7	0
Quillayute	43.5	42.1	1.4	11.40	10.35	110	0	2.6	0
Vancouver	43.6	43.5	0.1	2.92	4.03	72	M	M	-
Eastern Washington									
Spokane AP	32.7	33.0	-0.3	1.68	1.33	126	9.4	6.8	138
Wenatchee	34.8	34.8	0	0.70	0.81	86	M	4.4	-
Omak	31.2	31.8	-0.6	1.11	1.30	85	M	M	-
Pullman AP	34.5	34.9	-0.4	1.39	1.52	91	M	M	-
Ephrata	36.2	34.1	2.1	0.67	0.74	91	M	3.1	-
Pasco AP	39.1	38.9	0.2	0.65	0.86	76	1	M	-
Yakima AP	37.8	36.1	1.7	0.78	0.78	100	5.1	2.6	196

Table 1 - February 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.

Snowpack

Snowpack has improved since this time last month, as shown in Figure 3, displaying the snow water equivalent (SWE) percent of normal as of 1 March from the National Resources Conservation Service (NRCS). Despite the drier than normal conditions throughout much of WA, the mountains were able to pick up several feet of snow on multiple occasions in February. The North Puget Sound, Central Puget Sound, and Lower Yakima Basins all have above normal snowpack with SWE between 111 and 126% of normal. The rest of the WA basins are at about normal snowpack (93-107% of normal), except for the Upper Columbia Basin which is slightly below normal with 88% of normal.

Precipitation on longer time scales has been below normal for most of the state, however. Since the beginning of the water year (October 1, 2011), parts of the Columbia plateau east of the Cascades have only had between 50 and 70% of normal precipitation (Figure 4). On this basis, the United States Drought Monitor has the majority of this region in "moderate drought": http://droughtmonitor.unl.edu/DM_state.htm?WA,W.

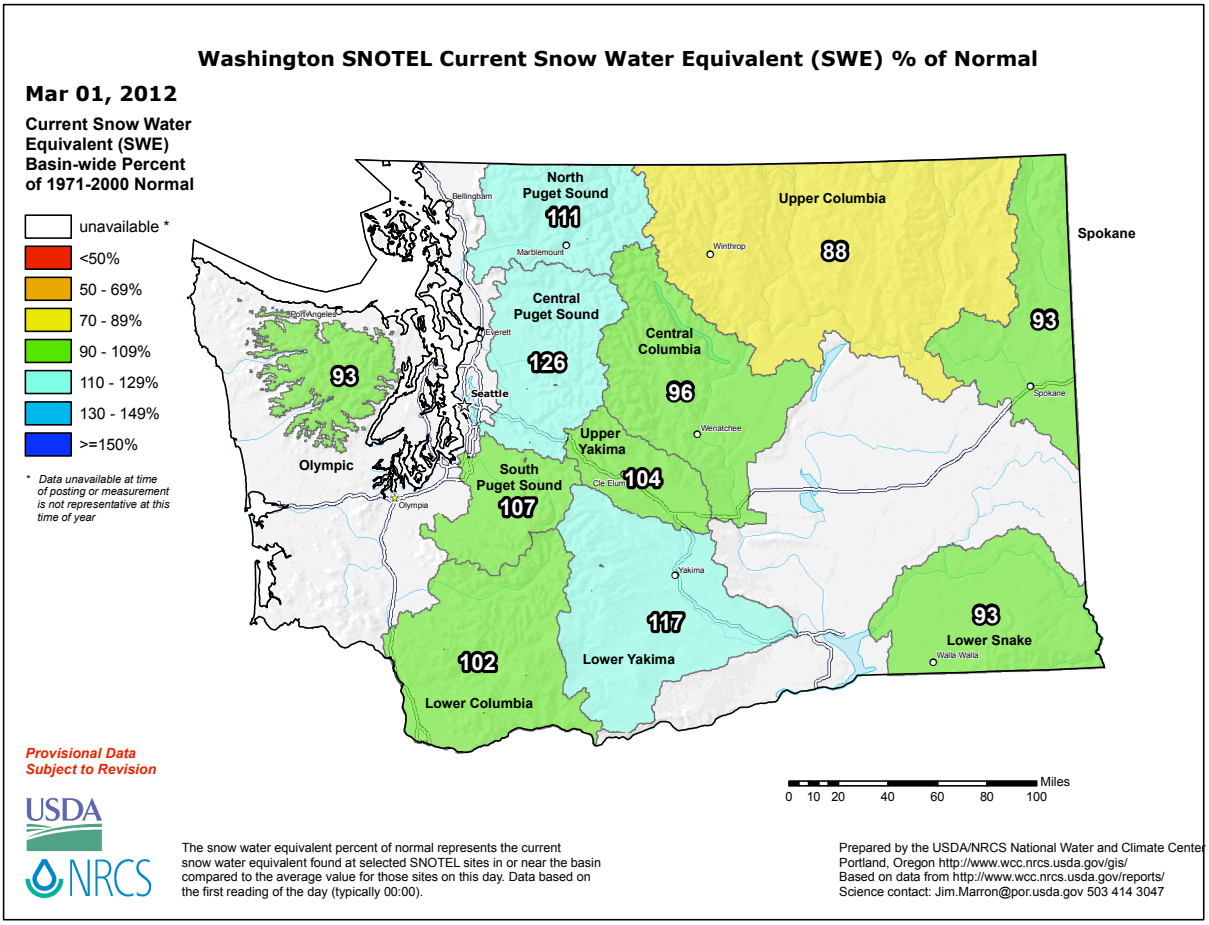


Figure 3: Snowpack (in terms of snow water equivalent) percent of normal for Washington as of March 1, 2012. Image is from the National Resources Conservation Service.

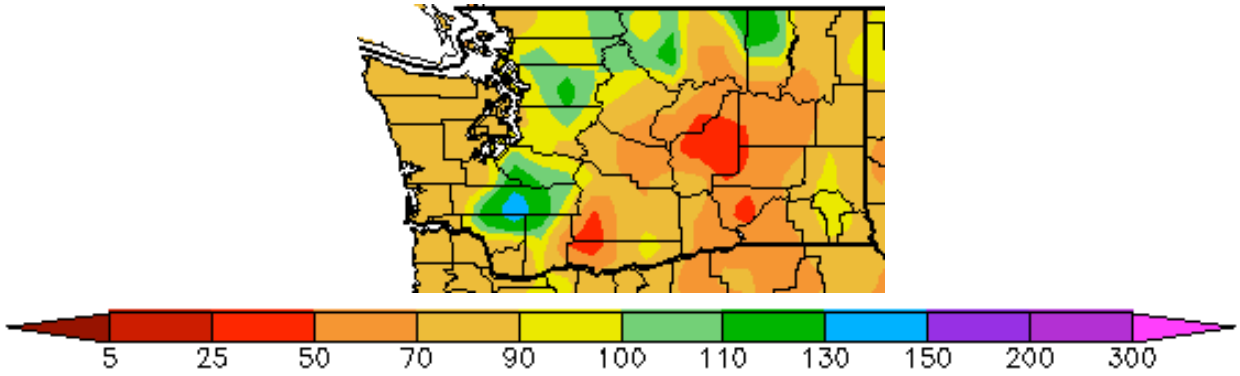


Figure 4: Percent of normal precipitation for the current water year (October 1, 2011 through February 29, 2012). Image is from the High Plains Regional Climate Center.

Plant Hardiness Zones for WA State

A message from the State Climatologist

The US Department of Agriculture has recently posted new plant hardiness information; a map for WA state is reproduced here (Fig. 5) and can be found at the following website: http://planthardiness.ars.usda.gov/PHZMWeb/. This map indicates the average annual minimum temperatures that can be expected based on the historical record extending from 1976 through 2005, providing guidance as to what types of plants can survive and thrive in a region. The effects of the state's terrain are evident in a general sense, with much colder extreme temperatures east of the Cascades and at higher elevations. The analysis upon which this map was based was broad-scale in its nature relative to the scales characteristic of the microclimates in various regions of the state. In other words, the utility of this map may be enhanced through account of local effects on minimum temperatures.

The lowest temperatures in WA generally occur during clear, calm weather during arctic-air outbreaks, especially after recent snowfall. These conditions promote nighttime cooling of a shallow layer of air near the surface. This air is relatively dense, and if the winds are light, will tend to flow downhill to collect in low-lying locations. This results in hilltops and slopes often being warmer than valleys in the late-night and early morning hours. The spatial scales of these effects range from less than a kilometer to tens of kilometers and can be impacted by the steepness of the slope. This general rule certainly has some exceptions. In particular, urban areas and locations near bodies of water are not as prone to nighttime cooling, and therefore experience locally warmer minimum temperatures. The type of land use in the surrounding area (e.g., heavily vegetated) can also account for variations in minimum temperature over relatively short distances.

The differences in extreme minimum temperatures might be larger than would otherwise be expected. Table 2 includes a pair of comparisons, between Sea-Tac (SEA) and Olympia (OLM) for western WA, and between Spokane International Airport (GEG) and Felts Field (SFF) for eastern Washington, of minimum temperatures recorded during the last decade (2002-2011). OLM and GEG are about 2-4°F colder on average in winter than their nearby

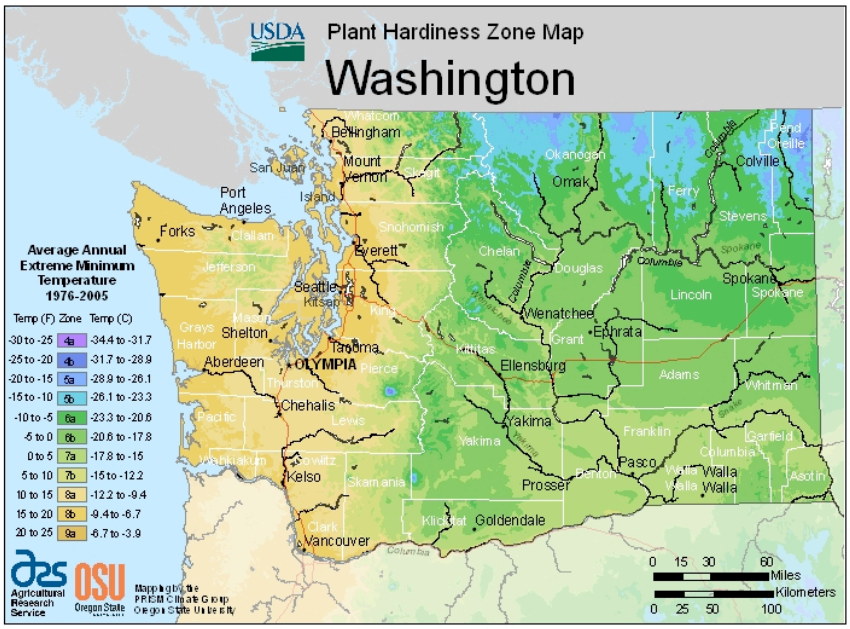


Figure 5: Plant hardiness map for WA State from the USDA. A larger image can be seen here: http://planthardiness.ars.usda.gov/PHZMWeb/.

counterparts of SEA and SFF, and usually about 10°F colder during extreme events, but probably for different reasons. SEA tends to be warmer than OLM because it is situated on a small bluff. The former location will tend to experience both drainage of the near-surface air that cools most rapidly at night, and greater wind speeds, which serves to mix down warmer air from above the surface layer. The same sort of contrast often occurs in the Everett area; the minimum temperatures recorded at Paine Field (PAE) at 184 m are typically 10-15°F warmer than those at Arlington (AWO) at 42 m during cold snaps. On the other hand, GEG is both cooler, and at a higher elevation, than SFF and so the same mechanism does not seem to be operating there. A detailed investigation would be required to confirm this, but we suspect the relative warmth of SFF can be attributed to a combination of it being in a more urban environment and near the Spokane River. These effects are not as prominent at GEG, which is located on an elevated plain well southwest of the city center. No matter the cause, this example for the Spokane area illustrates that elevation is not the only determinant of our state's microclimates.

Station	Range of annual Min T (°F)	Average January Min T (°F)	Station Elevation (m)
SeaTac (SEA)	14 to 25	37.2	130
Olympia AP (OLM)	5 to 17	33.8	62
Spokane AP (GEG)	-22 to 7	24.0	723
Felts Field (SFF)	-10 to 10	26.1	595

Table 2: Annual range of daily minimum temperatures for SEA, OLM, GEG, and SFF and the average January minimum temperature from 2002 to 2011 (in Fahrenheit). The station elevation (meters) is also shown.

So how can someone determine if they live in a cold or warm spot? It is easy enough to measure temperatures on one's own property; a cheap garden ther-

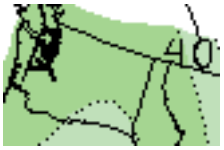
mometer (sometimes even available at dollar stores!) is accurate enough for this purpose. The keys here are to site the thermometer properly, that is with good exposure, and to compare temperatures with those from nearby official weather stations near daybreak during calm, clear and cold weather when local effects can be particularly evident. For readers of this newsletter, we expect that these comparisons will not just be valuable in making the best use of the USDA map towards selection of plants for the yard, but interesting in their own right.

Climate Outlook

The weak-to-moderate La Niña is weakening across the equatorial Pacific Ocean according to the CPC (http://www.cpc.noaa.gov/products/precip/CWlink/MJO/enso.shtml). Warming in the east-central and eastern Pacific Ocean has become evident in the last four weeks while sea-surface temperatures in the central Pacific remain at least 0.5°C below normal. ENSO forecast models are indicating a transition to near-neutral conditions during the March-April-May period. Nevertheless, the effects of La Niña often linger into spring, as reflected in the forecasts from the CPC.

The March CPC temperature outlook has higher chances of below normal temperatures statewide. Precipitation is expected to be above normal for March for the whole state, with chances exceeding 40% for a majority of the state.

The CPC 3-month seasonal outlook for spring (March-April-May; MAM) follows the same pattern. Below normal temperatures are expected for the western two-thirds of WA, with higher chances of below normal temperatures in western WA. The western half of WA has increased chances of above normal precipitation for MAM, while areas east of the Cascades have equal chances of above, equal to, or below normal precipitation.



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

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