



Office of the Washington State Climatologist

July 2023 Report and Outlook

July 11, 2023

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

June Event Summary

Mean June temperatures were above normal for most of the state, with the largest anomalies east of the Cascade Mountains. While mean June temperatures in some parts of western WA were near-normal, averaged statewide, June tied 1982 as the 13th warmest on record, 2.6°F above the 1991-2020 normal. June precipitation was below normal for most of the state, and much below normal in parts of western and southern Washington. Table 1 shows June precipitation rankings for a handful of Washington stations. While a few areas in north central WA had near-normal June precipitation, averaged statewide, June ranked as the 18th driest on record, with 49% of normal precipitation.

Apparently not a drop of rain fell during the first week of June. This is exemplified in Figure 1, which shows the daily temperatures and precipitation totals in Olympia. The early part of the month also featured relatively warm temperatures, with breezy winds prompting the National Weather Service Seattle Weather Forecasting Office to issue a “red flag warning” for fire weather conditions on the 6th. This was the earliest such a warning had been issued for western WA since records began in 2006.

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Thankfully no major wildfires developed during this period of ideal weather for fire spread.

A fleeting switch to cooler and wetter conditions occurred on the 9th - note the mere 3°F spread in minimum and maximum temperatures at Olympia

Station	Total June Precipitation (inches)	Rank	Records Began
Walla Walla	0.04	2	1949
Hoquiam	0.38	2 (tie)	1953
Quillayute	0.66	3	1967
Bellingham AP	0.78	11	1949
Ephrata	0.06	11 (tie)	1949
Yakima	0.07	11 (tie)	1947

Table 1: June 2023 total precipitation (driest to wettest) for selected WA stations.

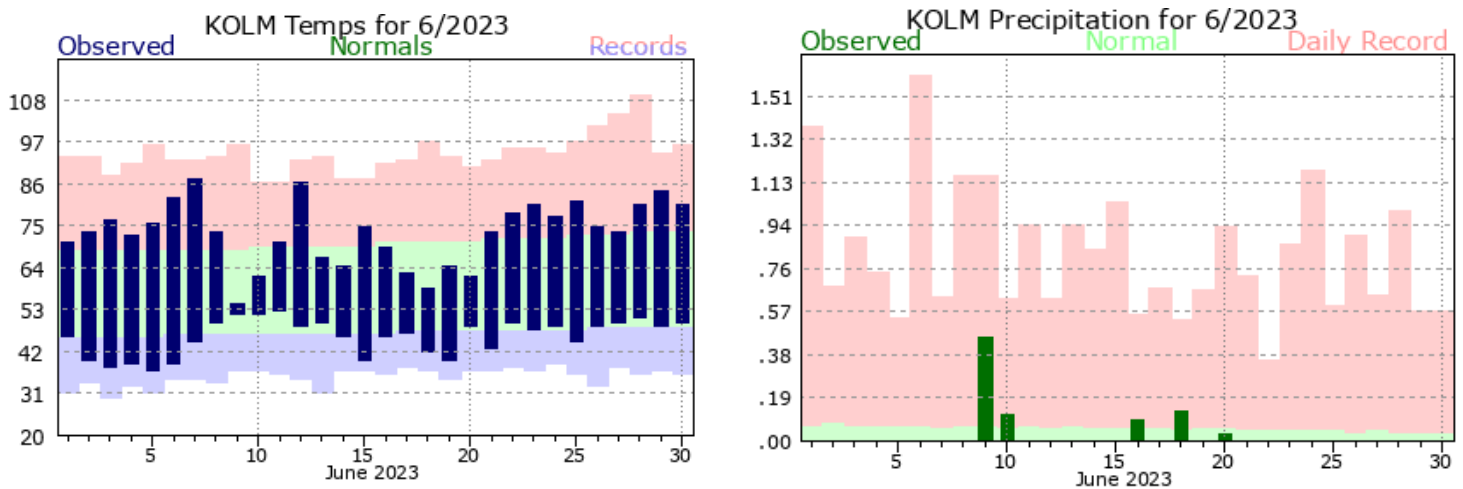


Figure 1: June 2023 daily temperatures for Olympia Airport compared to the 1991-2020 normal (green envelope) and previous records (blue and red envelopes; [NWS](#)).

(Figure 1). Fire danger remained high east of the Cascades for several days beginning on the 13th, however, and a few daily high temperature records were set at Yakima (95°F) and Ellensburg (93°F - tie) on the 12th and Ephrata (95°F) on the 13th. Wildfire smoke from the Donnie Creek Fire in British Columbia impacted eastern WA on the 14th and 15th, but it was relatively short-lived due to a weather pattern shift.

cooler air did not stick around long as the temperatures warmed to above normal to close out the month. Despite the warm/dry conditions and thunderstorm activity on the 22nd through 24th, Washington was mostly spared from major wildfires. As of early July, only two major fires (Tunnel Five west of White Salmon and McEwan northeast of Shelton) were burning, both of which ignited in early July.

The shift occurred from a low pressure system that arrived just in time to usher in cooler and wetter weather that lasted through Father's Day, Juneteenth, and the summer solstice. On the 19th, daily record minimum temperatures were set at Yakima (35°F) and Walla Walla (44°F - tie). But the

Still, the last two months have been anomalously warm and dry for a majority of WA state. Figure 2 shows the May-June temperature and precipitation percentiles when compared to other May-June periods going back to 1895. Nearly the entire state has been in the warmest 10% of the

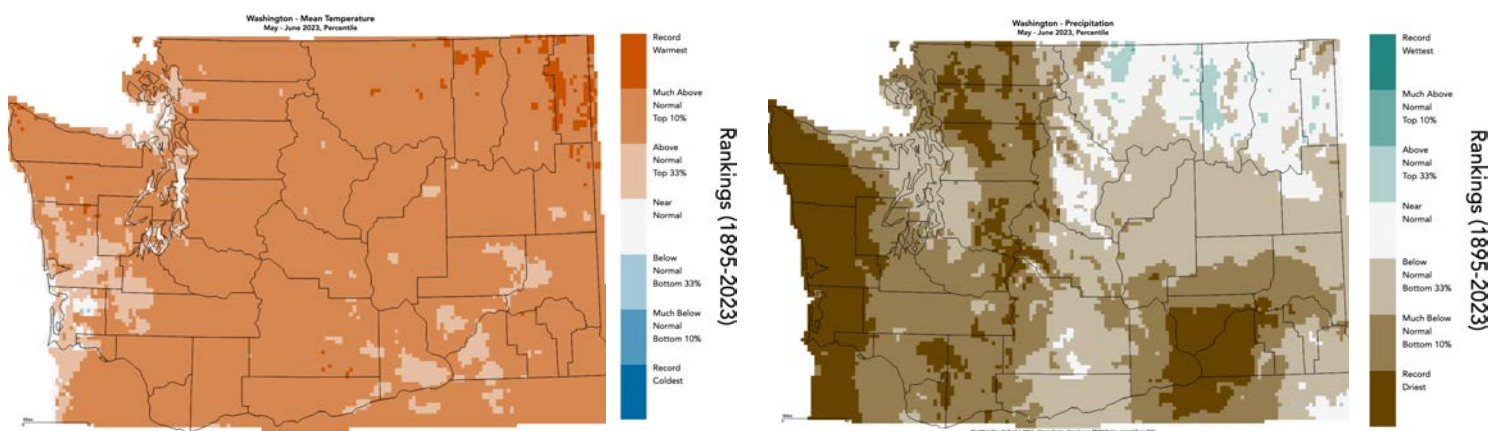


Figure 2: Mean May-June temperature (left) and precipitation (right) percentiles compared to 1895-2023 ([WRCC](#)).

historical record. Precipitation has been even more anomalous, with May-June ranking as the record driest along the coast and in parts of southeastern WA. An even wider area has been in the driest 10%.

Streamflow and Drought Summary

The snowpack’s May disappearing act and the continuation of warm and dry conditions has resulted in much below normal June streamflow for rivers throughout western WA and north central WA. Statewide, a majority of the stream gauges rank either among the lowest 10th percentile or between the 10th and 24th percentile for June (Figure 3), a marked contrast to the above normal streamflows in May from rapid snowmelt. Accordingly, the U.S. Drought Monitor (Figure 4) depicts a larger area of the state in both “abnormally dry” and “moderate drought” conditions compared to the last edition of our newsletter.

The WA State Department of Ecology issued a statewide “Drought Advisory” on July 5, warning of possible drought development from our recent weather conditions. Advisories are not drought *declarations*, and thus no emergency water permitting is authorized or emergency funding available as of now. There does seem to be some drought impacts that are already emerging. For example, the U.S. Bureau of Reclamation’s Yakima Basin revised July 6 forecast decreased the junior water rights water supply to 72% of their entitlements from June 1-September 30, down from the 77% projections in early June. There are also some concerns of earlier curtailments than usual for irrigation districts on Skagit River.

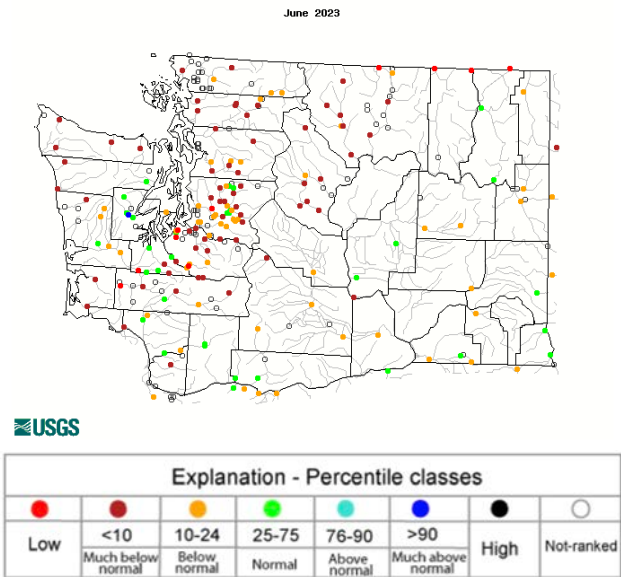


Figure 3: June 2023 average streamflow (USGS).

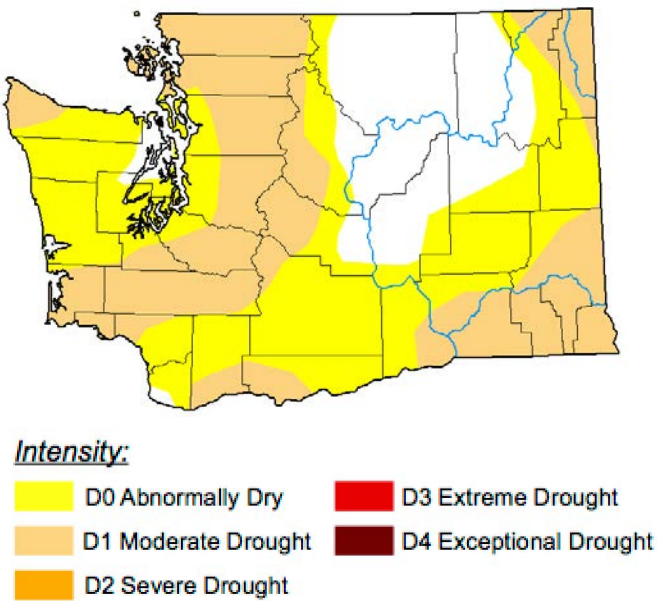


Figure 4: The July 6, 2023 edition of the U.S. Drought Monitor.

Additionally, the Clallam County PUD issued stage 2 (encouraging water conservation) and stage 3 (restricting outdoor watering on certain days) water alerts for some small communities in the western part of the county. Yes, even the Olympic coast can face water shortages.

 **Report Your Drought Impacts**

Are you experiencing a drought impact? Your on-the-ground observations are critical in helping us understand the broad picture of drought in the state. The National Drought Mitigation Center and partners have developed Condition Monitoring Observer Reports on Drought ([CMOR-drought](#)), a short survey that allows the public to enter their observations regarding crops, water supply, fire, etc. We would greatly appreciate your input, and these reports help experts assess drought impacts for both the U.S. Drought Monitor depiction and on the state level.

Aridity Index - Columbia Basin Time Series

A Message from the State Climatologist

Readers of this newsletter know that the Columbia Basin of Washington state is a dry region due to the shadowing of precipitation by the Cascade Mountains. Perhaps less appreciated is that this effect is actually a bit more pronounced in summer than in winter. For example, the “Central Basin” climate division (WA #8) averages a little less than 20% of the precipitation that occurs in the “Puget Sound Lowlands” climate division (WA #3) in mid to late summer (July-August-September; JAS) versus about 24% in winter (December-January-February). An illustration of the spatial pattern in mean precipitation for the months of July-September is shown in Figure 5. A few spots in the

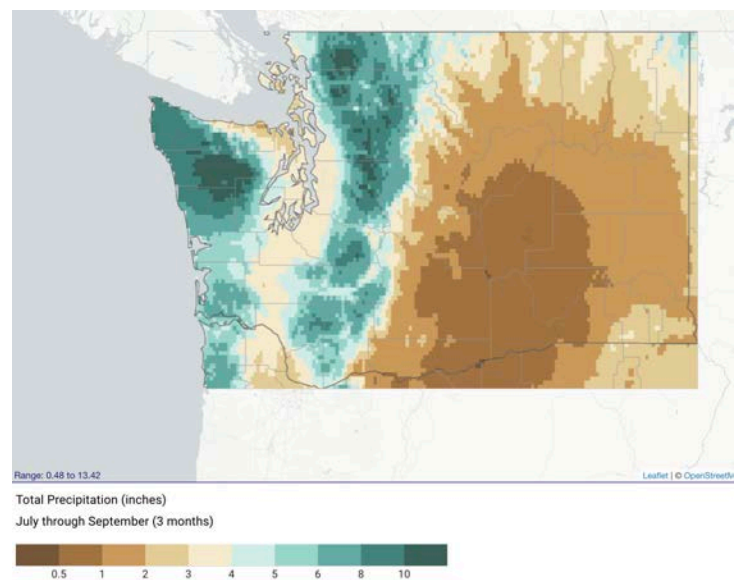


Figure 5: The 1991-2020 average of total July-September precipitation, using gridded NCEI data ([NCEI](#)).

Columbia Basin check in with totals dipping down to about 0.50” for the three-month season. It is no surprise that it is dry in that part of Washington state but how might that be changing over time? The present piece addresses that question in a follow-up to last month’s edition on the trend in potential evapotranspiration (pET) through consideration of a climate metric known as the aridity index.

The climate community has used different formulations for the aridity index (AI). An early version proposed by Thornwaite was based on the water deficiency – the pET minus the precipitation – normalized by the pET. This index reflects the percentage of water that would have to be supplied to maintain vegetation not stressed by lack of water. In more common use in modern times is a form from the United Nations Environment Programme (UNEP) defined as $AI = \text{Precipitation}/pET$ where both variables are long-term (often annual) means. Locations with an AI between 0.05 and 0.20 are classified as “arid”, with an AI of less than 0.05 classified as “hyperarid”. Here we examine time series of AI for the season of July through September, again as in last month’s piece using data from the AgriMet stations of Odessa, LeGrow and Lind, WA. Which of these categories do you expect applies to these stations?

You can see for yourself in the seasonal mean time series of AI for the years of 1987 through 2022 plotted in Figure 6. Over that interval, an overall decrease in AI has occurred for all three stations. During the early 1990s the AI reached the arid category, but since roughly the turn of the century during most years all three stations were in the hyperarid category, with only a few exceptions. Particularly dry years occurred in 2018 and 2020 when the AI was 0.01 and lower. The variability in

the AI is largely driven by the precipitation term; seasonal totals range from less than 0.1 to greater than 2 inches at the three locations. By way of comparison, the ratio of the lowest to highest seasonal mean pETs are 0.55, 0.76 and 0.64 at Odessa, LeGrow and Lind, respectively. The higher ratio – and lower year-to-year variability in general – at LeGrow probably reflects the impacts of local irrigation through its tendency to increase the relative humidity. Certainly LeGrow has both a lower mean value of pET, and a lack of especially high pET years, compared to the other two locations. The standard deviation in seasonal total precipitation at LeGrow is similar to that at Odessa and Lind during the years of 1987 through 2022. Overall, the JAS AI at each of the 3 stations varies closely together from year-to-year.

Another way of looking at the data is from a water deficiency perspective. Over the past 36 years, the linear best-fit trends to pET-P time series for July through September indicate declines of about 8 to 9 inches at Odessa and Lind and a decline of about one-third that at LeGrow. We are not experts on what that means for agriculture, and the terrestrial ecosystems of the Columbia Basin, but we expect it’s something.

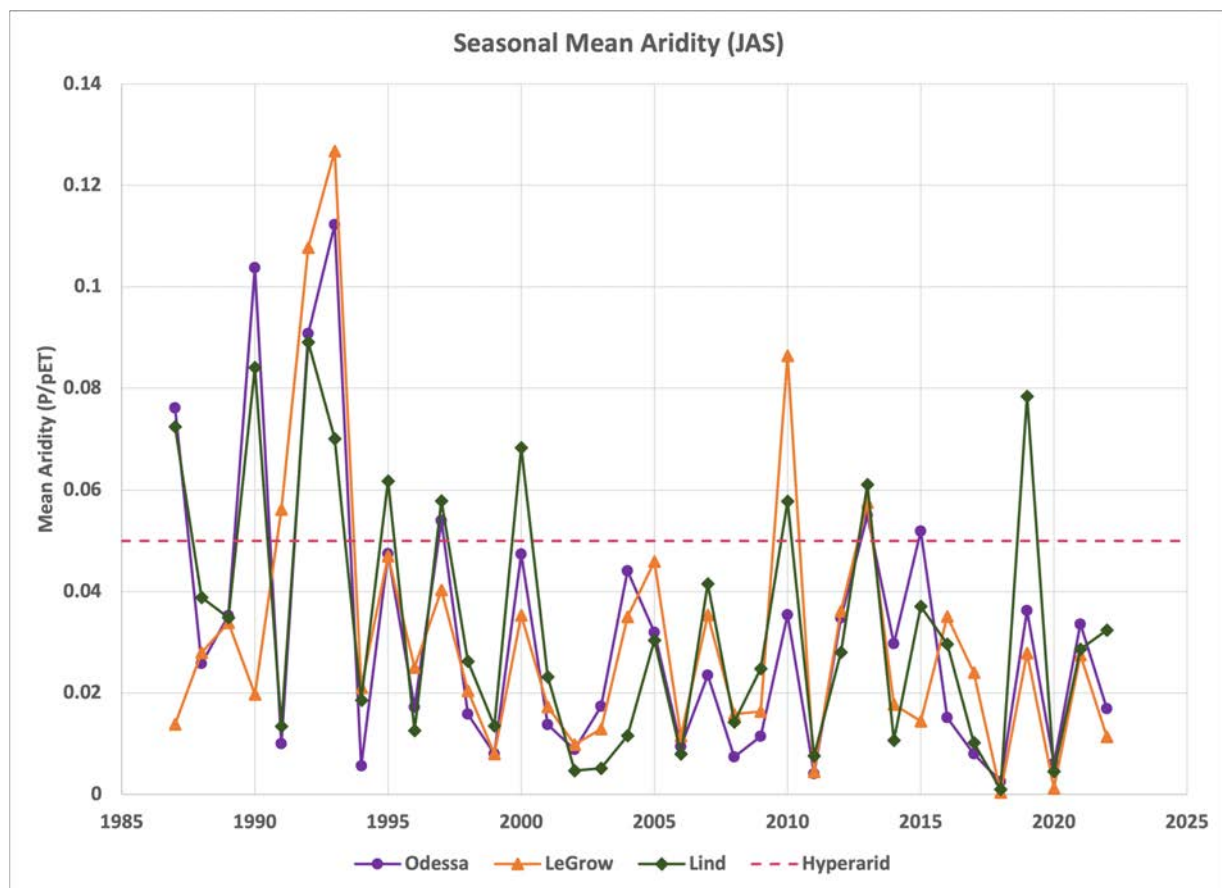
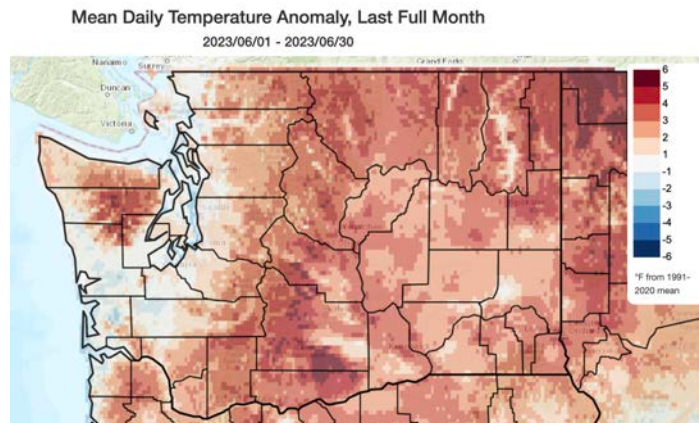


Figure 6: The July-September Aridity Index calculated from 1987 through 2022 for three stations in the AgriMet Network: Odessa (orange), LeGrow (purple), and Lind (green). The “hyperarid” threshold of 0.05 is marked by the dashed, pink line.

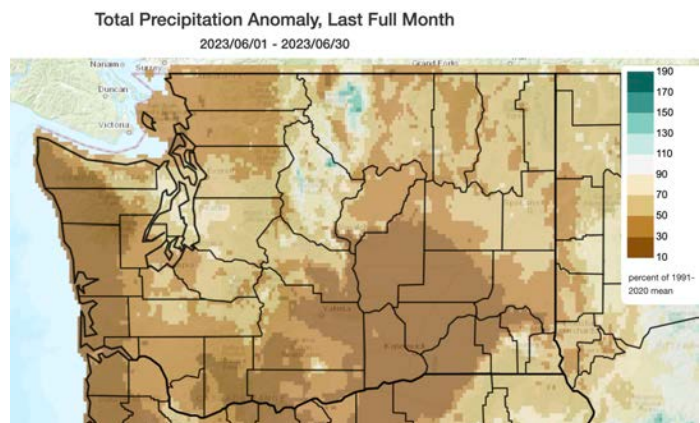
Climate Summary

Mean June temperatures were above normal for a majority of the state. The Olympic Mountains, east slopes of the Cascades, and northeastern WA were especially warm relative to normal, with temperatures between 4 and 6°F above normal. Temperature anomalies east of the Cascades were generally between 2 and 4°F above normal. Hanford, Wenatchee, and Spokane were 3.1, 3.5, and 4.2°F above normal, respectively (Table 2). Average June temperatures were near-normal in the Puget Sound Lowlands, with the June 2023 temperature at SeaTac Airport exactly equal to the 1991-2020 normal temperature. A few locations on the coast and along the Puget Sound were slightly cooler than normal for June (map), but the sparser station data shown in Table 2 does not capture those pockets.

June precipitation was below normal throughout the vast majority of the state. The coast and the Lower Columbia Basin were the driest locations relative to their normal, receiving less than 30% of normal. Quillayute, Hoquiam, Hanford, and Ephrata received only 20, 19, 11, and 9% of normal precipitation (Table 2). Pasco received only a “trace” of precipitation on several days in June. Other locations received some precipitation for the month, totaling between 70 and 90% of normal precipitation. For example, SeaTac AP and Spokane AP measured 84 and 76% of normal precipitation, respectively. A few areas in western Okanogan county and Chelan county received normal to above normal June precipitation.



June temperature (°F) departure from normal relative to the 1991-2020 normal ([Climate Toolbox](#)).



June total precipitation percent of 1991-2020 normal ([Climate Toolbox](#)).

Station	Mean Temperature (°F)			Precipitation (inches)		
	Average	Normal	Departure from Normal	Total	Normal	Percent of Normal
Western Washington						
Olympia	59.9	59.1	0.8	0.81	1.46	55
Seattle WFO	61.9	61.4	0.5	1.33	1.57	85
SeaTac AP	62.0	62.0	0.0	1.22	1.45	84
Quillayute	57.4	55.5	1.9	0.66	3.30	20
Hoquiam	58.3	57.1	1.2	0.38	2.01	19
Bellingham AP	59.3	59.8	-0.2	0.78	1.61	48
Vancouver AP	64.9	63.3	1.6	0.78	1.61	48
Eastern Washington						
Spokane AP	66.5	62.3	4.2	0.86	1.17	76
Wenatchee	70.0	66.5	3.5	0.27	0.50	54
Omak	69.0	65.1	3.9	0.38	0.98	39
Pullman AP	62.7	59.8	2.9	0.36	1.17	31
Ephrata	70.6	67.2	3.4	0.06	0.65	9
Pasco AP	70.8	67.8	3.0	T	0.61	0
Hanford	73.0	69.9	3.1	0.06	0.57	11

Table 2: June 2023 climate summaries for locations around Washington with a climate normal baseline of 1991-2020.

Climate Outlook

According to the Climate Prediction Center (CPC), El Niño is present and an “El Niño Advisory” is in effect as of early June. Over the last month, above normal sea surface temperatures (SSTs) have persisted throughout the eastern and east-central equatorial Pacific Ocean. The SSTs off the coast of Peru have remained particularly warm. There is a strong consensus among [ENSO models](#) that El Niño will persist through the fall and winter; chances of El Niño next winter (Dec 2023-Feb 2024) are 96%.

The CPC July temperature outlook (Figure 7) has increased odds of above normal temperatures for the entire state. The chances of above normal temperatures are slight, only tilting the odds between 33 and 40% on the three-tiered scale. July precipitation is uncertain for the state with equal chances of below, near-normal, or above normal precipitation (i.e., a 33.3% chance of each of the three outcomes occurring).

The three-month July-August-September (JAS) temperature outlook (Figure 8) is calling for higher chances of above normal temperatures statewide. The odds are relatively high for a majority of the state, specifically between 50 and 60% on the three-tiered scale. The northeastern corner of the state has slightly lower odds, but is still likely to experience above normal JAS temperatures. The precipitation outlook indicates slightly elevated chances of below normal precipitation for western and parts of north central Washington. The remainder of the state has equal chances of below, near-normal, or above normal precipitation.

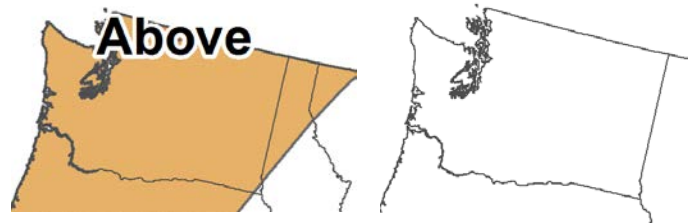


Figure 7: July outlook for temperature (left) and precipitation (right).

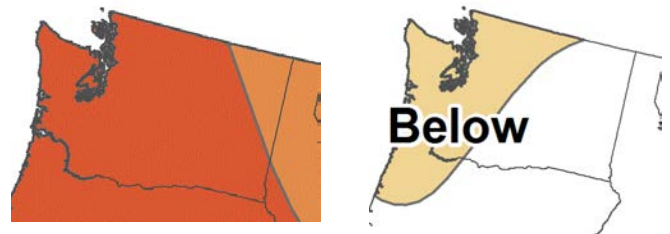
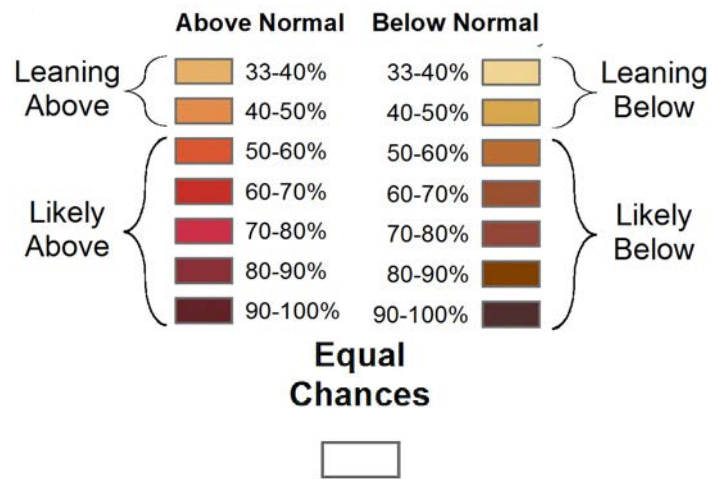


Figure 8: July-August-September outlook for temperature (left) and precipitation (right) (Climate Prediction Center).