Office of the Washington State Climatologist

August 2022 Report and Outlook

August 9, 2022

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

July Event Summary

Mean average July temperatures were above normal statewide, a switch from the 3 consecutive months in which temperatures for a majority of the state were below normal. In short, summer finally arrived. Averaged statewide, July 2022 tied 1941 as the 9th warmest on record, 2.6°F above the 1991-2020 normal. A number of individual stations checked in with mean temperatures ranking among the top ten in their historical records (Table 1). Precipitation relative to normal was more variable throughout the state. While precipitation was below normal for western WA, central WA, and southeastern WA, there were locations in eastern WA where monthly totals were above normal. Given that the precipitation deficits were in the normally wetter portions of the state, from a state average perspective July was drier than normal.

The first 10 days of July were cooler than most of the rest of the month, as illustrated by the daily maximum and minimum temperatures for Olympia Airport in Figure 1. Most July precipitation fell during the earlier part of the month as well. Ephrata, for example, tied a daily maximum rainfall record on the 6th with 0.09". On the 7th, 0.99" was recorded at Moses Lake Grant County Airport which now ranks as the heaviest July rainfall since records began in 1949.

Conditions at the end of the month were quite different, however, as a heat wave impacted most of the state from the 25th through the 31st. The exception was the coast, where onshore flow kept temperatures much cooler than locations further inland. Quillayute, for example, had two days in the mid-80s and then much more comfortable temperatures in the mid to upper 70s for the duration of the heat wave. In contrast, SeaTac Airport recorded its longest stretch on record - 6 days! - with temperatures above 90°F from July 26-31. Despite this, SeaTac AP did not set many daily maximum temperature records because the 2022 heat wave occurred over nearly the same days as our record-breaking (at the time) 2009 heat wave.

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Plenty of daily records were set at other locations around the state, however. On the 25th, maximum daily records were set at Dallesport (108°F - tie) and Ellensburg (101°F). On the 26th, record high daily temperatures were set at Bellingham (90°F), SeaTac (94°F), Olympia (97°F), Vancouver (101°F), Ellensburg (103°F), and Dallesport (111°F - tie). On the 27th, a record high minimum temperature of 72°F was set at the Tolt South Fork Reservoir, which ranks as the warmest overnight low on any day since records began in 1962. A daily high minimum temperature record was set at Omak on the 28th with a temperature of 73°F. Record daily maximum temperatures were set that day as well: Yakima (107°F), Wenatchee (108°F), Ephrata (108°F), Ellensburg (109°F), and Pasco (109°F - tie). The 109°F at Ellensburg is now the highest temperature measured during July on record for that station. More daily records (too many to list here), were set from the 29th through the 31st, mainly in eastern WA.

Station	July Average Temperature (°F)	Rank	Records Began
Quillayute	61.5	2	1967
Pasco Tri Cities	79.0	2	1998
Vancouver Pearson AP	72.4	3	1998
Omak	76.5	4	1998
SeaTac AP	69.2	4 (tie)	1945
Bellingham AP	66.0	5	1949
Yakima AP	75.5	7	1947
Olympia	66.5	9	1941
Wenatchee Pangborn AP	77.6	10 (tie)	1960
Ephrata	78.9	10	1949
Spokane AP	74.1	14	1881

Table 1: July average temperature rankings (warmest to coldest) for selected WA locations.

We end with a note on wildfires. There was relatively little activity through the month of July but at the time of this writing (first week of August), several fires have started that are threatening a number of residences near Cheney, Lind, and Vantage.

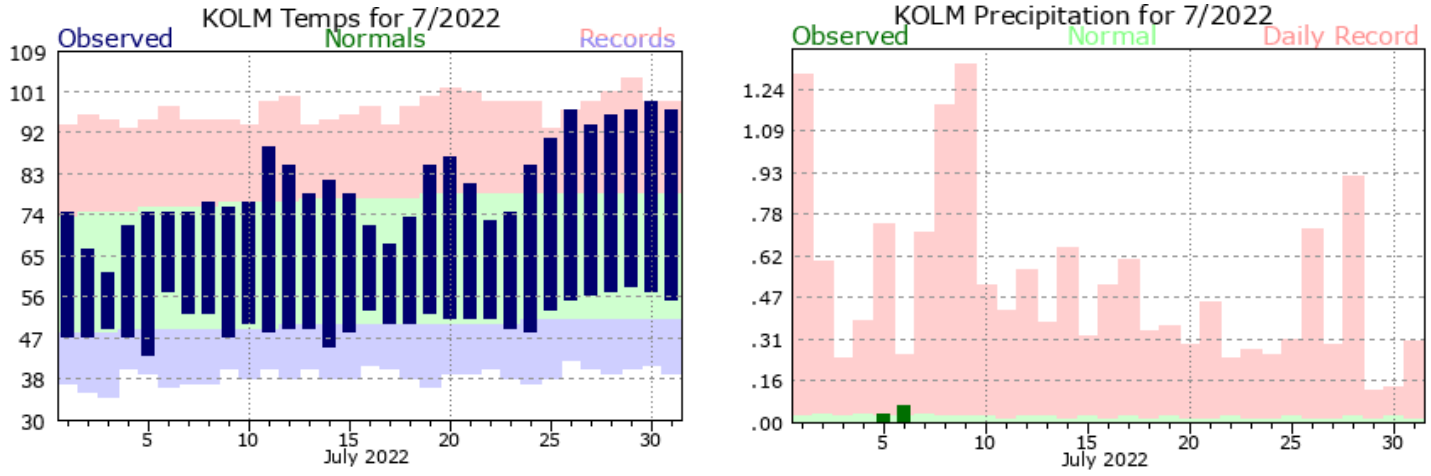


Figure 1: July 2022 daily temperatures and precipitation for Olympia Airport compared to the 1991-2020 normal (green envelope) and previous records (blue and red envelopes; NWS).

Streamflow and Drought Summary

Average July streamflow was normal to above normal throughout most of WA state (Figure 2). The few higher elevation locations that were hanging on to seasonal snowpack have now completely melted, with the late melt contributing to above normal streamflow in some locations. We note that some gauges on the Walla Walla River, Mill Creek, and South fork of the Palouse River in southeastern WA indicated record high July streamflows.

Further improvements have been made to the U.S. Drought Monitor (Figure 3) since the last edition of this newsletter. The area of moderate drought (D1) was shrunk into two smaller areas to better depict the locations with the largest long-term precipitation deficits. The area of "abnormally dry" conditions - also representing long-term dryness - was also reduced.

In mid-July, the WA Department of Ecology canceled the drought declaration that was extended for parts of eastern WA earlier in the spring. The unforeseen cool and wet conditions in spring and early summer improved water supplies enough that the declaration is no longer needed. Conditions will continued to be monitored through the remainder of summer.

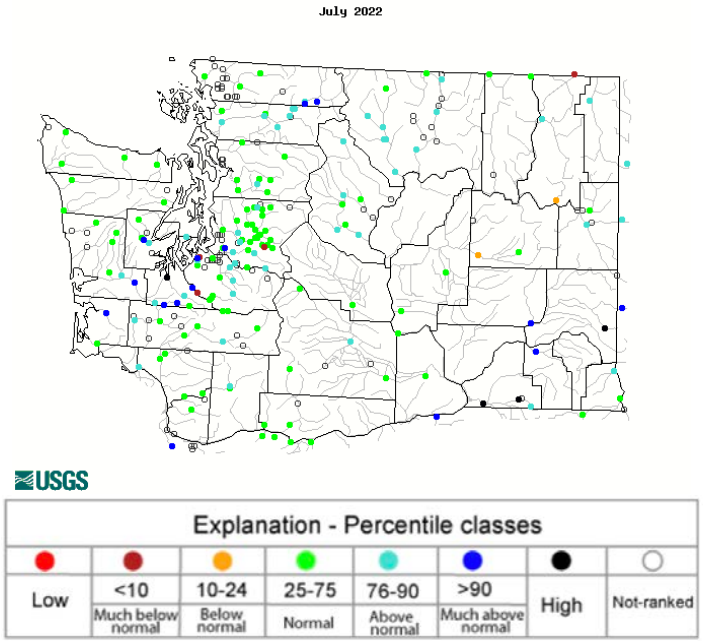


Figure 2: July 2022 average streamflow for WA (USGS).

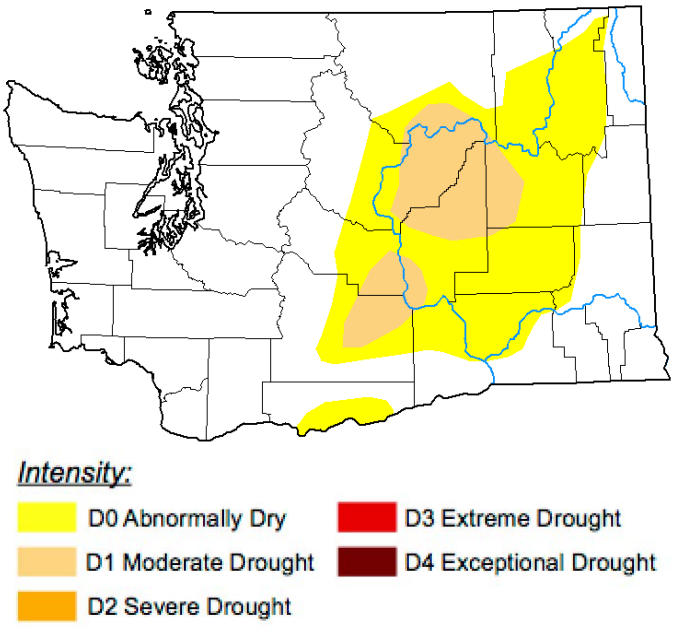


Figure 3: The August 4, 2022 edition of the U.S. Drought Monitor.

Frequency of Hot Temperatures in Summer

A Message from the State Climatologist

This month's highlight is inspired by the unusually long-lasting heat wave in WA that occurred during the last week of July 2022. We were interested in how the frequency of hot temperatures, in terms of not just maximum but also minimum values, changes over the latter part of summer. For this purpose, we have simply counted up the number of days that thresholds of specified maximum and minimum temperatures were met during the period of 1 August through 15 September during the 30-year block of 1991 through 2020, and the 30-year block of 1961 through 1990. This exercise was carried out for 5 locations: Sea-Tac (KSEA), Olympia (KOLM), Yakima (YKM), Spokane (KGEG) and Pullman (KPUW) using arbitrarily-specified thresholds for each location that represent roughly 97 to 99 percentile values for the interval of 1-15 September (the last one-third of the entire period considered). In other words, the focus is on the frequency of unusually hot, but not necessarily record-setting, days and nights, and how soon we can reasonably expect to be no longer facing the threat of more uncomfortably high temperatures.

Total counts of the hot days and nights for the first and second halves of August, and the first half of September, for the years of 1991 through 2020 at the 5 locations in WA state listed above, are itemized in Table 2. The counts for the individual days from 1 August through 15 September at KSEA and KGEG are shown in the bar charts of Figure

	Olympia		Seattle		Yakima		Pullman		Spokane	
	Min Count	Max Count	Min Count	Max Count	Min Count	Max Count	Min Count	Max Count	Min Count	Max Count
1-15 August	26	43	40	25	69	136	44	78	114	61
16-31 August	25	26	19	10	29	63	30	35	58	24
1-15 September	14	12	10	6	6	30	8	18	10	3

Table 2: The number of hot nights and hot days during 1991-2020.

	Olympia		Seattle		Yakima		Pullman		Spokane	
	Min Count	Max Count	Min Count	Max Count	Min Count	Max Count	Min Count	Max Count	Min Count	Max Count
1-15 August	23	52	23	28	56	113	47	56	87	56
16-31 August	22	24	5	9	16	43	17	28	27	24
1-15 September	10	13	5	7	0	8	13	6	2	4

Table 3: The number of hot nights and hot days during 1961-1990.

4. During the years of 1991 through 2020, there was a steep drop-off after about 20 August in the number/frequency of the hot days and to a lesser extent the hot nights. This timing is consistent with the heat wave study of Bumbaco et al. (2013), which identified intense events west of the Cascades of 3-days and longer duration of which there none of the hot day variety after 13 Aug (JD 225) and none of the hot night variety after 18 August (JD 230). For east of the Cascades, there is even a greater decrease in heat events with time over late summer. Considering the 3 east side stations together (Table 2), hot nights (days) are about 10 (5) less likely during the first 15 days of September compared to the first 15 days of August. These numbers depend on the thresholds chosen to define hot days and nights at each location, of course, but we expect the proportions of 1-day events during the different times of year are not highly sensitive to the thresholds. And at the very least, we trust that most will agree that a day that reaches 90°F on the west side, and 95°F on the east side of the Cascades, constitutes a hot day.

We will now go further back in time and consider the 30-year period of 1961-1990. The counts for the individual days of the year at KSEA and KGEG are shown in Figure 5; the total counts for the half month intervals from the start of August until mid-September at the 5 WA locations are itemized in Table 3. Given the overall increases since 1895 in summer (June-August) of about 1°F in the maximum temperature and 3°F in the minimum temperatures for WA state as a whole, it is not surprising that most of the counts for the 30-year period of 1961-1990 are lower than their counterparts for 1991-2020. As shown here, this is especially the case for the hot night counts during the latter part of August and first part of September. We note that the western stations of KOLM and KSEA had some hot days during the middle of September in the years of 1961 through 1990, illustrating that it was possible to get some heat quite late in the summer in the past as well as now, though it was less likely.

Increases in the probability of hot temperatures in late summer are liable to have implications for natural and human systems in the Pacific Northwest. There are a variety of ecological studies that show that climate change is liable to have important impacts on the phenology of natural systems, i.e., through disruptions in the timing of processes in these systems. That being said, we close with the good news from a human perspective, namely despite the upward creep in our summer temperatures over the years, we should draw comfort that the odds of hot weather will greatly diminish in a few weeks.

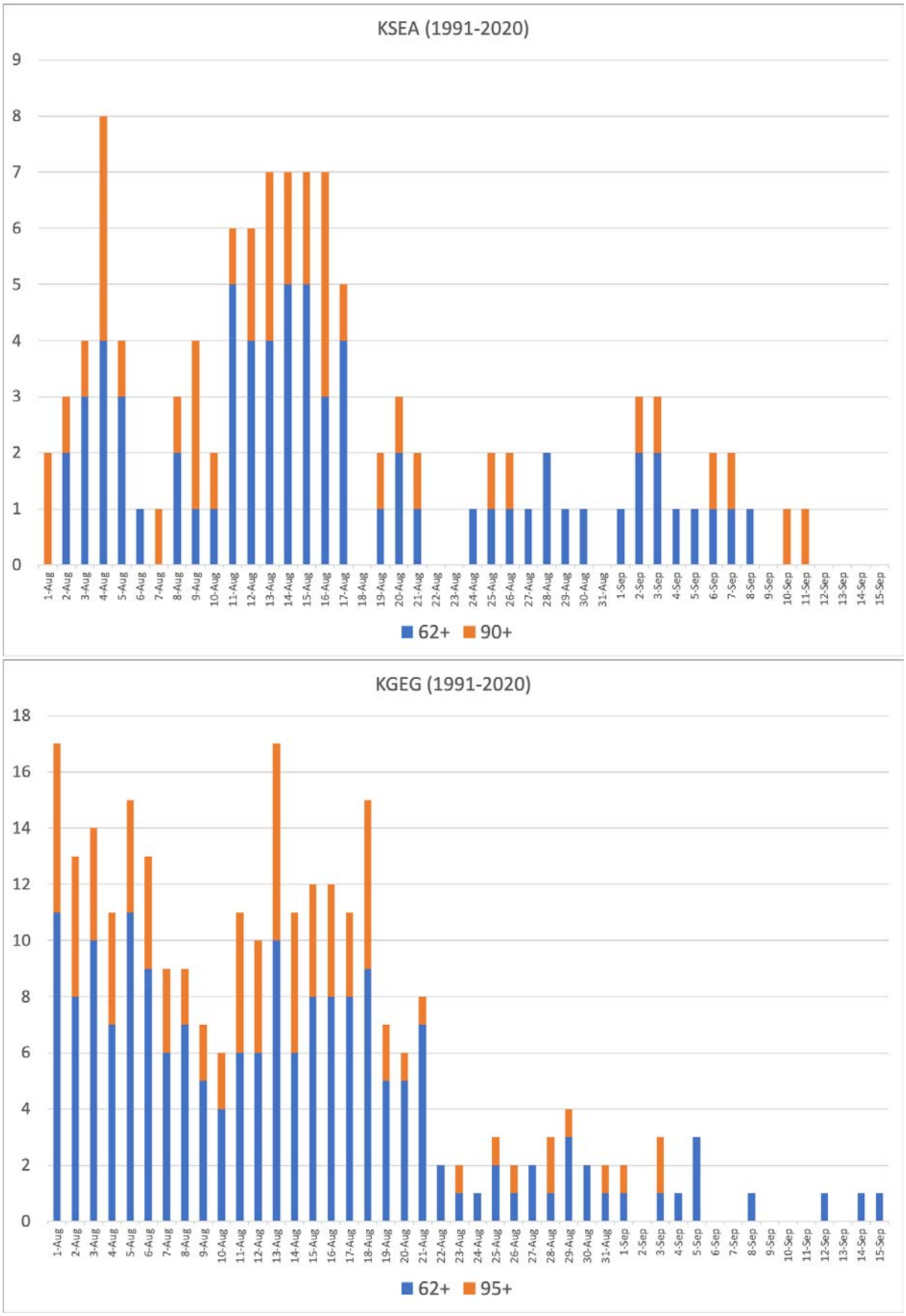


Figure 4: The number of warm days and nights at SeaTac Airport (top) and Spokane (bottom) in the 1991-2020 period. Warm days were classified as those 90 or above for Seattle and 95 or above for Spokane. Warm nights were defined as 62 or above for both.

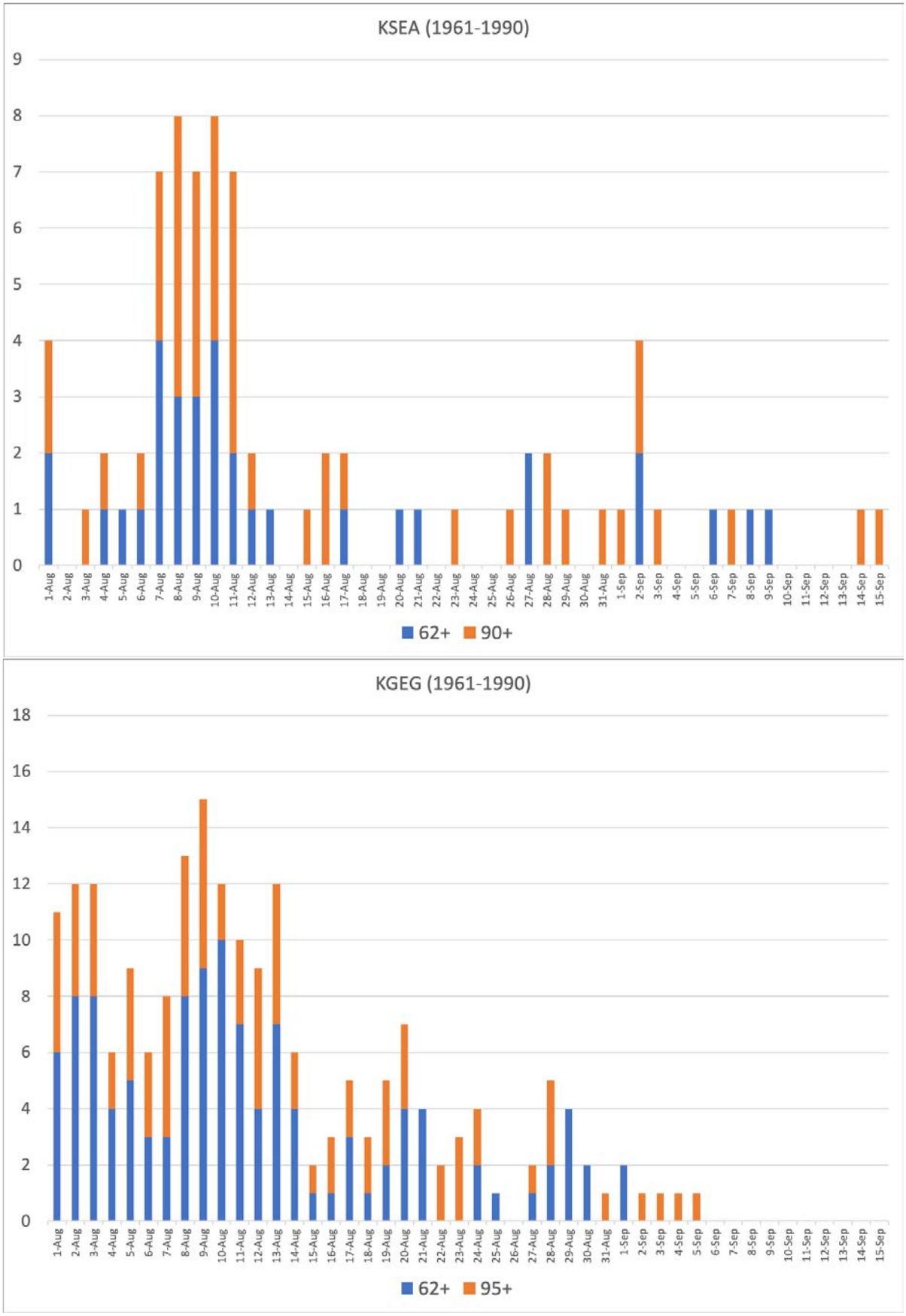
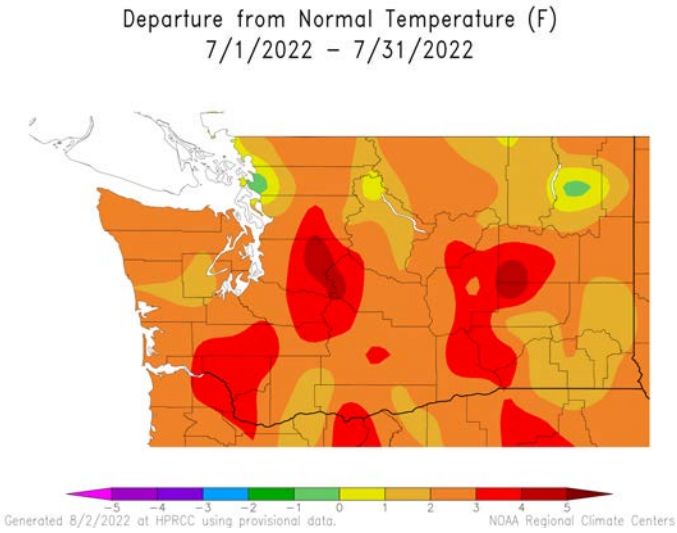


Figure 5: As in Figure 4, except for the 1961-1990 period.

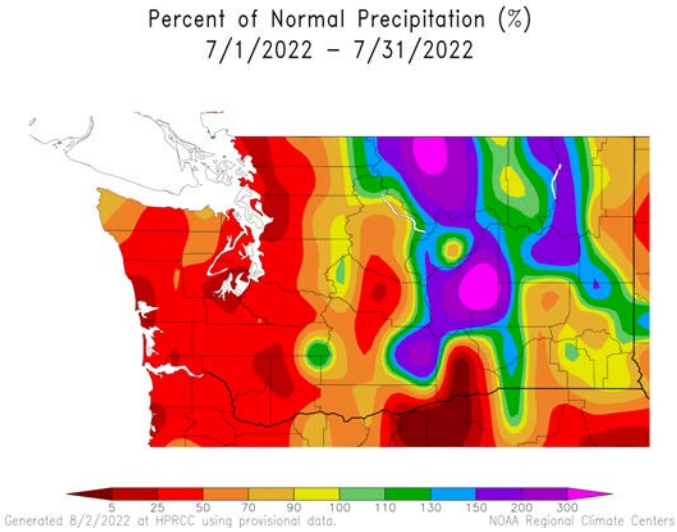
Climate Summary

Average July temperatures were above normal statewide, as shown in the plot from the High Plains Regional Climate Center. Most locations in WA had average temperatures 2-3˚F above normal for the month. Olympia, Hoquiam, and Omak, for example, were 2.3, 2.6, and 2.8˚F above normal (Table 4). There were a few exceptions. Ephrata and Pasco were warmer relative to their normal, with temperatures 3.6 and 4.3˚F above normal (Table 4).

Total July precipitation was variable, with western WA receiving less than normal precipitation and more variability east of the Cascade crest. Okanogan, Ferry, Stevens, Douglas, Grant, and eastern Yakima counties largely received above normal precipitation due to rain that fell early in the month. July is typically very dry throughout WA so above normal precipitation is still not much. Approximately 1" fell in Omak, for example, which amounts to about 200% of normal precipitation (Table 4). Pasco received exactly normal precipitation for the month - 0.15" - which gives this climatologist a certain satisfaction. Total July precipitation in western WA ranged from as little as 5 to 70% of normal. Of the stations itemized in Table 4, Olympia and Hoquiam recorded the least relative to their normals, measuring just 17 and 18% of average, respectively.



July temperature (˚F) departure from normal relative to the 1991-2020 normal (HPRCC).



July total precipitation percent of 1991-2020 normal (HPRCC).

Station	Mean Temperature (°F)			Precipitation (inches)		
	Average	Normal	Departure from Normal	Total	Normal	Percent of Normal
Western Washington						
Olympia	66.5	64.2	2.3	0.09	0.53	17
Seattle WFO	69.2	66.5	2.7	0.19	0.78	24
SeaTac AP	69.2*	67.1	2.1	0.18	0.60	30
Quillayute	61.5	59.3	2.2	1.17	1.58	74
Hoquiam	62.9	60.3	2.6	0.15	0.85	18
Bellingham AP	66.0	63.9	2.1	0.31	0.88	35
Vancouver AP	72.4	69.0	3.4	0.24	0.42	57
Eastern Washington						
Spokane AP	74.1	71.0	3.1	0.34	0.42	81
Wenatchee	77.6	74.7	2.9	0.54	0.24	225
Omak	76.5	73.7	2.8	1.08	0.52	208
Pullman AP	68.7	67.0	1.7	0.45	0.39	115
Ephrata	78.9	75.3	3.6	0.37	0.30	123
Pasco AP	79.0	74.7	4.3	0.15	0.15	100
Hanford	81.7	78.2	3.5	0.33	0.20	165

Table 4: July 2022 climate summaries for locations around Washington with a climate normal baseline of 1991-2020. *2 days are missing from this monthly average.

Climate Outlook

La Niña conditions are present in the Pacific Ocean and a "La Niña Advisory" remains in effect, according to the Climate Prediction Center (CPC). Over the last 4 weeks, sea surface temperature (SST) anomalies have warmed in the eastern and central equatorial Pacific Ocean. La Niña may continue to weaken through the summer, but is expected to strengthen again in the fall. According to ENSO models, there is a 66% chance of La Niña for the October through December period compared to 32% for neutral conditions and 2% for El Niño.

The CPC outlook for August (Figure 6) shows increased chances of above normal temperatures statewide. August precipitation is expected to be below normal for the Olympic Peninsula, Puget Sound region, and north central WA. The remainder of the state has equal chances of below, equal to, or above normal precipitation, which on the three-tiered scale used for these forecasts means that there's a 33.3% chance of either three outcomes. In other words, August precipitation is uncertain for some portions of the state.

The three-month outlook for Aug-Sept-Oct (ASO) shown in Figure 7 indicates that the odds of above normal temperatures are higher than usual statewide. ASO precipitation is uncertain, with equal chances of below, equal to, or above normal precipitation statewide.

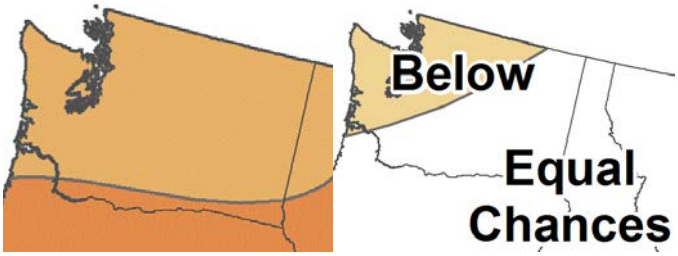


Figure 6: August outlook for temperature (left) and precipitation (right).

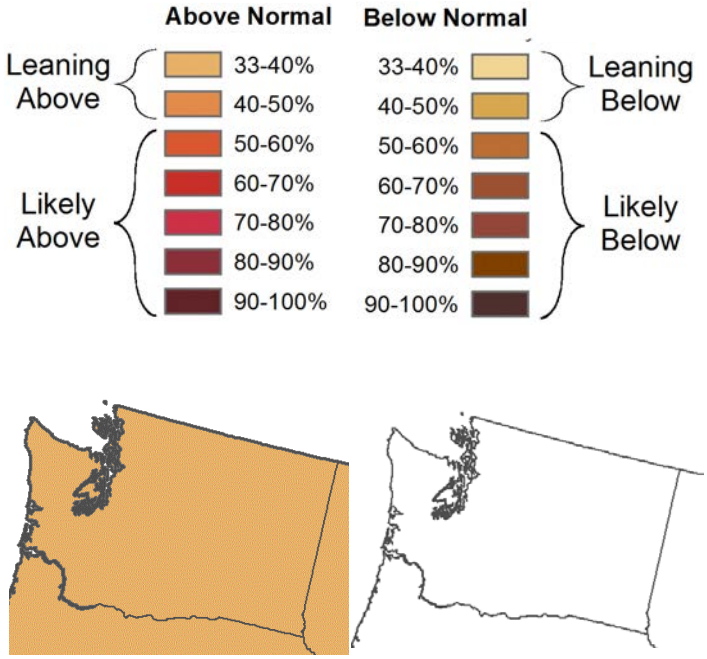


Figure 7: August-September-October outlook for temperature (left) and precipitation (right) (Climate Prediction Center).