Weather and Climate Summary and Forecast
July 2023 Report

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July 3, 2023

Summary:

- Warm June northwards and much cooler than average[1] south and across the Great Basin and Rockies. Cooler ocean temperatures off California have tamped down temperatures over much of the west. Growing degree-days ahead of normal in the northwest and below average in most of California.
- Some precipitation along the south-central coast of California along with mountain and eastside thunderstorms in June brought wetter than average conditions. However, the PNW, northern California, and the southwest were substantially drier than average.
- Drought conditions continue at some of the lowest levels in many years, especially in California and the southwest. However, a dry spring pushed the PNW further into drought.
- A warm start to July will give way to more seasonal temperatures before warming up again mid-month. Some onshore flow with fog and drizzle in the usual places, along with possible precipitation in the extreme NW otherwise seasonally dry elsewhere.
- The forecast for July is pointing to the PNW likely to see above average temperatures for July, while the rest of the west is forecast to have equal chances to see slightly above to slightly below average temperatures. The July precipitation outlook is pointing to a seasonally dry month for most of the western US. The forecast for the rest of the summer has most of the US forecast to see warmer than average temperatures. The precipitation forecast through the remainder of the summer has most of the west near average, or seasonally dry.
- El Niño is now with us and projected to continue through the end of the year while the PDO remains in a strong negative phase. Right now, the PDO is helping to tamp down temperatures in California and the Basin, while El Niño is expected to push global temperatures to a top five warmest year on record.

Past Month and Year to Date:

June continued the north-south differences in temperatures over the west with the PNW much above normal while California and other southern areas were near normal or substantially below normal (Figure 1). Variations in airflow and cold coastal ocean temperatures have brought onshore flow and much cooler conditions to a large area of the west where temperatures from 2-5°F below average were experienced in June. The month saw mostly dry conditions in the PNW, northern California, and much of the southwest while coastal areas of central to southern California received upwards of 300% of normal for the month. Thunderstorm activity along the crest of the Sierra Nevada and Cascade

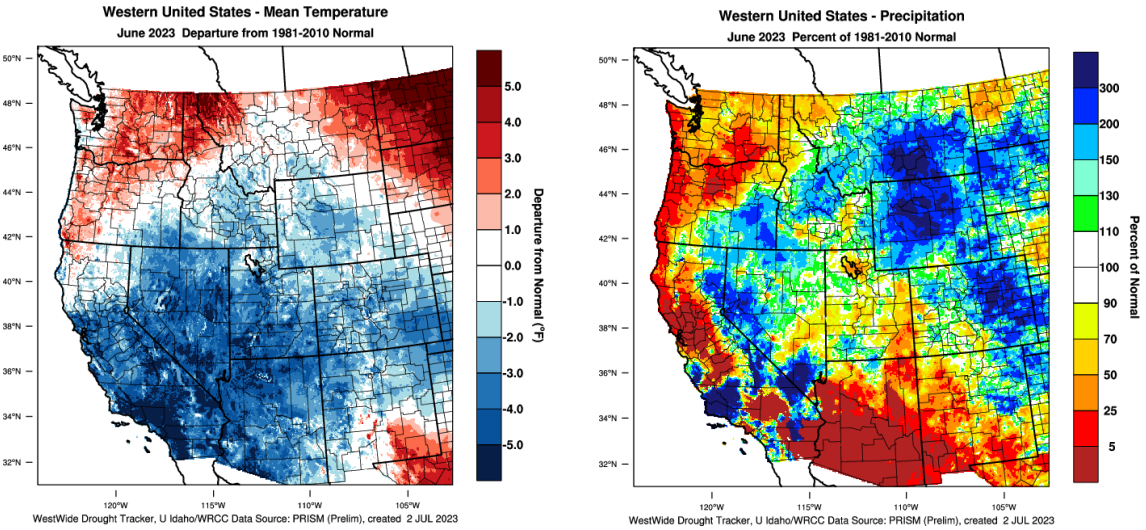

Figure 1 – Western US June 2023 temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

[1] Note that all references to normal or averages in this report are to the 1981-2010 climate normal for each weather/climate parameter unless stated otherwise. Also, note that the 1991-2020 climate normals are starting to become available across reporting agencies and will be used in this report when possible.

mountains and on the eastside of the mountains resulted in a wetter than average month in the basin (Figure 1). Temperatures across the rest of the country were dominated by cooler than average temperatures across the interior west and the eastern third of the country, while the northern Plains south to Texas saw temperatures 2-5°F above average (not shown). A wetter than average month was seen from the northern Plains and Rockies south into the central Plains, across the Gulf Coast states, and up along the eastern seaboard to New England. Texas and much of the Midwest experienced a very dry June adding to drought concerns in the grain belt of the US (see drought section).

June did not alter the year-to-date temperatures across the western US very much. The coolest year-to-date temperatures continue to be found in the Rockies (2 to 6°F below average), but much of the rest of the west has also seen temperatures 1 to 4°F below average. The exception is in the PNW, where a relatively warm June moved the region closer to average or slightly above average temperatures (Figure 2). Year-to-date precipitation in 2023 continues to reflect the pattern of the wet winter that brought California largely out of drought, for now. Except for dry conditions in southeastern California, most of the state has seen 115 to over 200% of normal precipitation since the start of the year (Figure 2). The Great Basin and much of the Rockies have also had a wetter than average year-to-date helping to reduce drought conditions in those regions as well. The PNW has continued to be drier than average through June, with some areas of southeastern Oregon and Idaho getting enough moisture from thunderstorms (Figure 1) to move to just above average (Figure 2). Strong east-west temperature differences continue to hold with the eastern US running substantially above average (2 to 6°F) while the west has been cooler than average (not shown). Year-to-date precipitation amounts continue to be mixed across the eastern half of the country with moderately drier than normal conditions experienced in the Plains, much of Texas, the Midwest, Florida, and the mid-Atlantic, while the mid-south, southeast, Great Lakes, and portions of the eastern seaboard have been closer to average or slightly wetter than average (not shown).

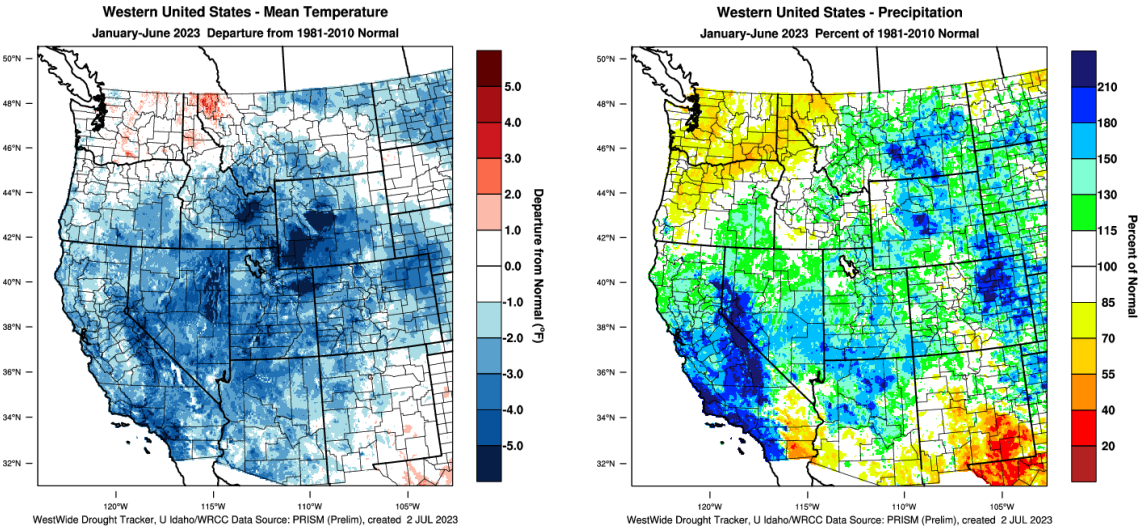

Figure 2 – Western US 2023 year to date (January 1, 2023, to June 30, 2023) temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

Heat Accumulation:

March through June 2023 growing degree-day (GDD) departures over the western US shows higher than average amounts in the PNW and northern states and lower than average amounts in California and central to southern states (Figure 3). This map is almost the exact opposite of what GDD was like at the same point in 2022. Onshore flow over cooler coastal waters from northern California southward have kept heat accumulation lower than typical for southern portions of the west coast. The departures in March through June GDD show that wine regions in the PNW are mostly above average, while from the north central valley and north coast across the south and east to the Four Corners region are mostly below average. In terms of days ahead or days behind normal, the PNW is 7-24 days ahead of normal accumulation amounts at the end of June, while inland California is near average to 7 days behind normal, and coastal California is 14-21 days behind at this point (not shown).

At specific stations in Oregon, four locations in the main wine regions in the state that I have monitored for many years are substantially above both the 1981-2010 (+22-62%) and 1991-2020 (6-44%) climate normal for the March to June

period. These locations are also 12-17% over the average of the last 15 years and 45-74% over what they accumulated in the same period in the 2022 vintage.

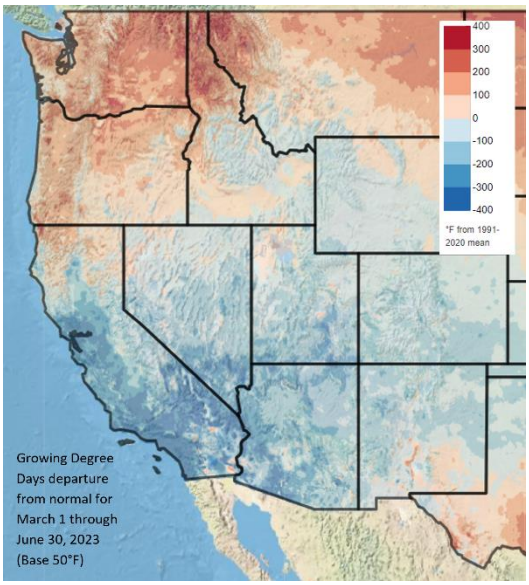

Figure 3 – Western US March through June 2023 growing degree-days (image from Climate Impacts Research Consortium, University of Idaho).

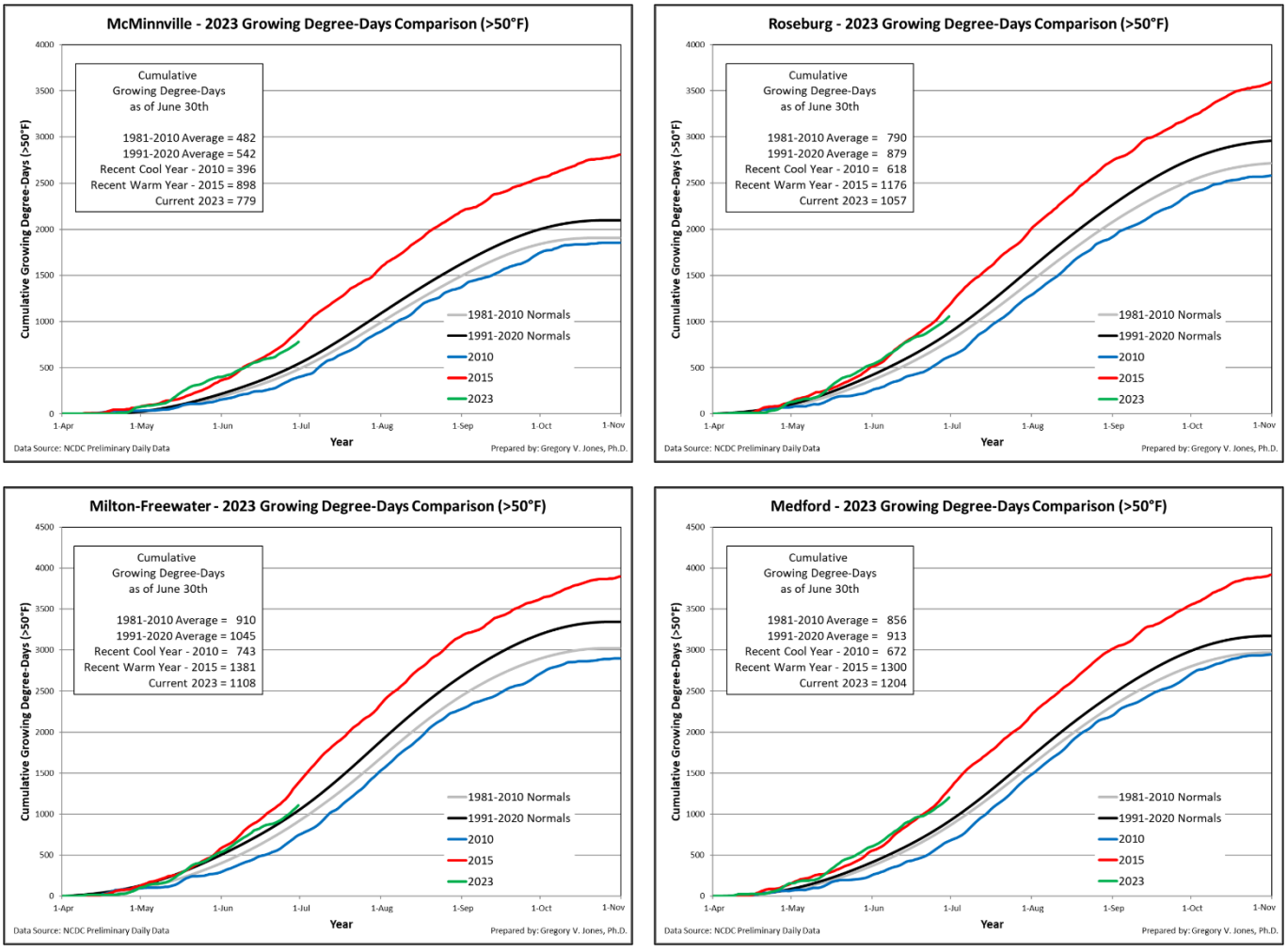

Figure 4 – Cumulative growing degree-days (base 50°F, no upper cut-off) for McMinnville, Roseburg, Milton-Freewater, and Medford, Oregon. Comparisons between the current year (2023) and a recent cool year (2010), a recent warm year (2015), and both the 1981-2010 and 1991-2020 climate normals are shown (NCDC preliminary daily data).

Drought Watch – The greatest change in overall drought conditions in the US came from the central Plains and upper Midwest to Texas where hot and dry conditions have been entrenched over the last 30 days or so. Dry conditions also extend toward New England and the mid-Atlantic as of now (Figure 5). In the Pacific Northwest, most of the region saw continued dry weather, increasing seasonal evaporative demand, and lowering streamflows all leading to worsening drought conditions. Relatively cool conditions and scattered precipitation kept most of California and a significant portion of the southwest and Great Basin out of drought declarations. Drought conditions have bumped up to 55% nationally. Across the west, large variations in drought coverage can be seen with Washington moving to nearly 70% of the state in the lowest levels of drought but no areas in the more extreme categories. Oregon saw some improvement in drought conditions on the eastside but little precipitation on the westside moved it further into drought. Over each of the drought categories, Oregon is just under 83% now, although the area of extreme drought categories (severe, extreme, and exceptional) has dropped to close to 7%. Idaho has continued to see drought coverage drop from 70% in April to just under 40% today with no areas in the more extreme categories. The cool spring and scattered precipitation in June have held California to just less than 29% in some level of drought with the more extreme drought categories not on the map (Figure 5).

Over the remainder of the summer, the seasonal drought outlook shows some improvement, some development, and conditions keeping recently dry locations off the map for now (Figure 5, right panel). Portions of the PNW, southern California, southern Nevada, and central Utah are expected to remain in drought or develop further as we move into summer. But much of California, the Great Basin, Rockies, and Four Corners region is forecast to stay out of drought for now. Most of Texas, portions of New Mexico, and the Great Lakes are forecast to see drought persist or develop further, while the Midwest is forecast to see some improvement or removal (Figure 5).

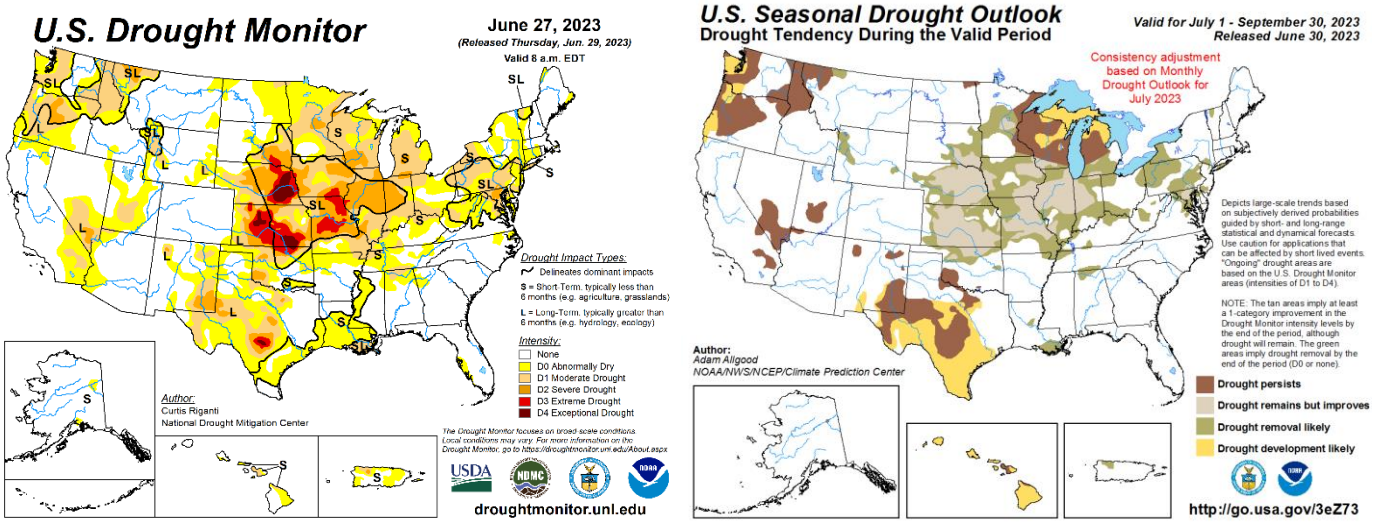

Figure 5 – Current US Drought Monitor and seasonal drought outlook.

ENSO Watch – By mid-June, sea surface temperatures (SSTs) anomalies in the central-eastern equatorial Pacific have moved warm to El Niño conditions and are expected to gradually strengthen into the Northern Hemisphere winter 2023-24 (Figure 6). The eastern and central Pacific regions exhibit warm SST anomalies now over much of the Tropical Pacific and many of the ocean and atmosphere variables across the tropics are now consistent with a full-fledged onset of El Niño conditions. The Climate Prediction Center issued an El Niño advisory in June 2023, signaling the onset of the warm phase of the ENSO. The vast majority of the models in the ENSO prediction plume forecast an El Niño event continuing during the North Hemisphere summer and highly likely into the fall and winter.

North Pacific Watch – While North Pacific sea surface temperatures continue to show strongly negative Pacific Decadal Oscillation conditions (Figure 6), a split pattern has developed further over the last 30 days. The immediate area in the Gulf of Alaska is exhibiting moderately cold conditions, while the warm plume in the central North Pacific now extends to southern Alaska and southward along the Canadian coast. From southern Oregon to Baja the SSTs flip back to colder than average. The result of this pattern is a warmer than average PNW while California has been cooler than average due to the influence of the colder coastal waters and onshore air flow. Time will tell if this pattern continues, but for now, the feedback between the atmosphere and ocean along the west coast, especially south into California, continues

to bring relatively cool onshore conditions. Like last month, these conditions add to the observations (Figure 1) and forecast (Figure 7) for warmer than average temperatures north and cooler than average temperatures south. As is normal during the summer, the connection between the warming in the Tropical Pacific (El Niño) and the SSTs in the North Pacific is not as strong in the summer months but tends to strengthen into fall.

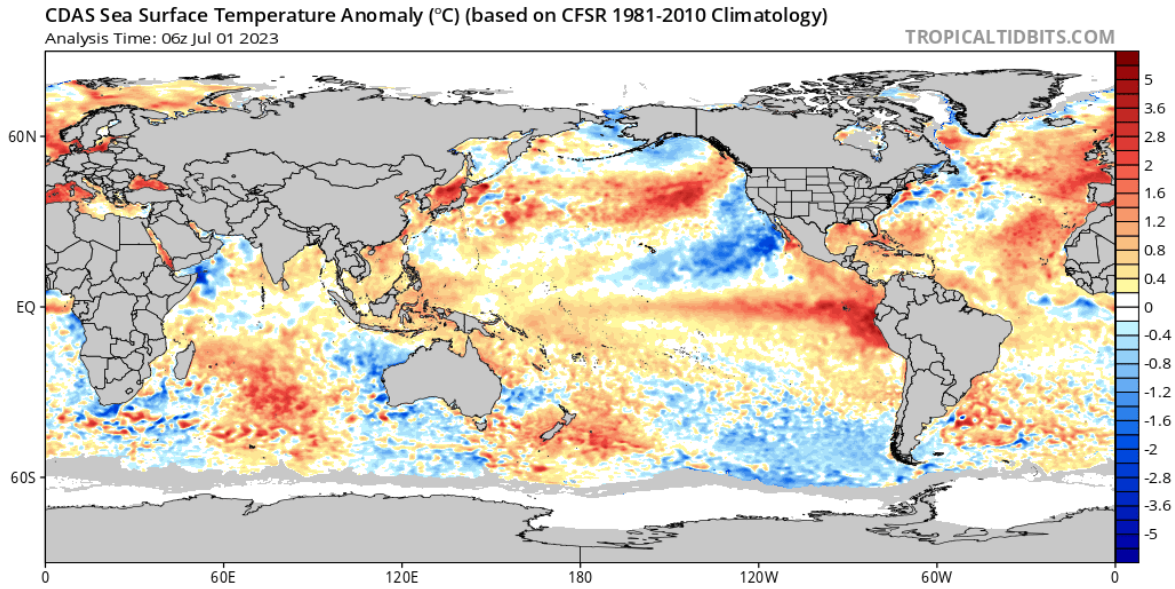

Figure 6 – Global sea surface temperatures (°C) for the period ending July 1, 2023 (image from Tropicaltibits.com).

Forecast Periods:

Next 5 Days: Summertime warm to hot pattern with high pressure dominating over the short term. Expect conditions to be the warmest over the next few days, then tamp down a little due to onshore flow, then warm up again. The PNW will likely see the greatest departures from average with coastal zones staying cool from Canada to Baja. Inland areas in California will warm from cooler conditions of late. No rain on the forecast, except maybe some fog drizzle in the usual places.

6-10 Day (valid July 8-12): High pressure continues to be in control over the western US with above average temperatures forecast for the PNW and Great Basin. California will likely see close to normal temperatures for this time of year, except along the coast where onshore flow enhanced by the cool coastal waters (Figure 6) will keep temperatures slightly below average. Temperatures are forecast to remain high across the south with the Four Corners region to Texas to Florida likely to continue to see sweltering conditions. Below average temperatures are forecast from the Plains across the Great Lakes to the Mid-Atlantic. Dry conditions are forecast over most of the west with the possibility of some moisture flowing out of Canada into the inland PNW and northern Rockies. Wet conditions are forecast for most of the eastern US with New England likely seeing the wettest conditions.

8-14 Day (valid July 10-16): The forecast holds with high pressure continuing to dominate over the western US. Temperatures are likely to be close to average along the California coast to warmer than average everywhere else across the west. The warmest conditions are likely to remain from the Four Corners, across from Texas and the south to Florida. Cooler temperatures are forecast across the Great Lakes and along the eastern seaboard. Possible precipitation across the northernmost reaches of the PNW while everywhere else in the western US is forecast to be seasonally dry. The eastern US is forecast to see close to normal to above normal precipitation through mid-month.

30 Day (valid July 1-31): The monthly outlook has the PNW likely to see above average temperatures for July, while the rest of the west is forecast to have equal chances to see slightly above to slightly below average temperatures (Figure 7). The heat dome over Texas and southern states will likely push that region to a significantly warmer than average July with the east coast likely to see a warm month as well. The July precipitation outlook is pointing to a seasonally dry month for most of the western US, except for portions of the southwest where a drier than average month is forecast

(Figure 7). The middle of the country from the Plains across the mid-south and into New England is forecast to see above average rainfall for the month.

90 Day (valid July-August-September): The seasonal outlook from July through September has most of the US likely to see warmer than average temperatures, with portions of the southwest having the greatest chance of warmer than average conditions (Figure 7). The only region not following this pattern is the northern Plains, which is forecast for equal chances of slightly above to slightly below temperatures. The desert southwest is the bullseye with the greatest likelihood of seeing above average temperatures. The precipitation forecast through the remainder of the summer has most of the west near average, or seasonally dry, except extreme northwest of Oregon and Washington along with most of the Four Corners region which is forecast to be drier than average (Figure 7). For the rest of the country, the northern Rockies, and central Plains, along with southern Florida, are forecast for above average precipitation while portions of the Great Lakes are more likely to see dry conditions through the rest of the summer.

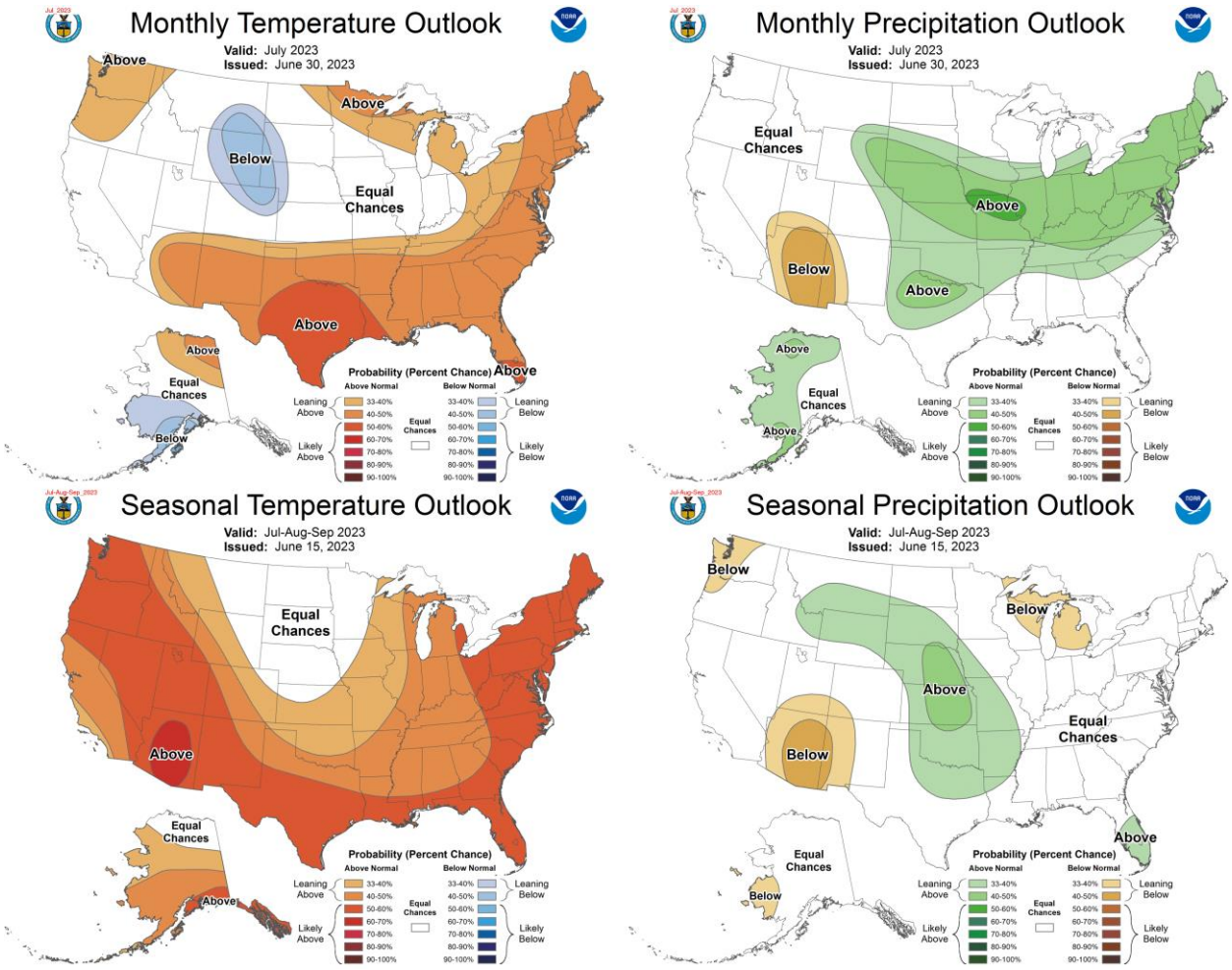

Figure 7 – Temperature (left panel) and precipitation (right panel) outlooks for the month of July (top panel) and July, August, and September (bottom panel) (Climate Prediction Center, climate.gov).

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