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Weather and Climate Summary and Forecast: October 2020 Report

Gregory V. Jones
Linfield University

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Summary:

- In spite of days of smoke, September was warmer than average[1] across the vast majority of the western US.
- September also continued the ongoing dry conditions throughout California and the Great Basin, although western Oregon and Washington saw initial falls rains that helped with wildfires.
- The western US drought footprint is now at 90%, with nearly 55% in severe to exceptional drought. The forecast through the first half of winter is for much of the west to remain dry, with the exception of the PNW which is forecast to see a seasonal start to fall and early winter rains.
- High pressure remains in place for the first week of October, with warmer than average temperatures giving way to seasonal temperatures by the second week. Smoke will wax and wane for many, depending on the strength and direction of the wind. No precipitation is forecast through the first 10 days of the month, however a pattern shift will bring frontal systems and seasonal rain events in the latter half of the month, but these will be mostly confined to extreme Northern California, northward into the PNW.
- The forecast for October through December is largely based on the developing La Niña and a relatively warm North Pacific. As such, the PNW is anticipated to see near average to slightly warmer and wetter first half of winter, while California is expected to be warmer than average and near average to drier than average through December. The La Niña strength will likely be the most important factor to watch as winter unfolds.

Conditions in September in the western US deserve a little more detail before we get to the averages, which clearly do not tell the whole story. In late August and the first couple of days of September, the forecast called for a heat extreme event for the coming week. However, as the very large high-pressure area responsible for the heat event grew, stretching from the desert SW to Alaska, the forecast started calling for an extreme east wind event. This was largely due to the size of the high-pressure area and that was pushing the jet stream into northern Canada and forcing the cold air southward into the Rockies and the central US. By September 7th strong winds (30-60 mph) from the east moved over numerous mountainous areas, warming, drying, and increasing in wind speed. The result was a dramatic drop in dew points (as much as 30 degrees in an hour) and lowering relative humidity (to 8-15%) to desert-like conditions even to the coast. This same event brought cold air to the Rockies with temperatures dropping 60 degrees or more in one day and significant snow to the mountains and the front range. This event was extremely rare, with only a handful of similar events in our data record.

Up and down the western US fires that had been smoldering exploded while new fires erupted around them. Unrivaled destruction spread while the winds continued to whip the fires out of control. From the fires came smoke, and a lot of it, which the east winds pushed over 1000 miles out over the Pacific. Then the circulation in the atmosphere shifted with high-pressure building in from the east, first pulling the smoke from the Pacific back over the western US, then dropping the wind speeds, which provided a modicum of advantage to firefighters. However, the declining winds, stable air, and lower solar radiation reaching the surface brought mid to high-level smoke down to the surface in many regions. The smoke lowered daytime temperatures significantly (5-25°F or more) from what would have been seen under clear skies, and over a few days, the lack of solar radiation hitting the surface caused nighttime temperatures to drop significantly (5-10°F or more). The high pressure and smoke together created a strong inversion holding smoke near the surface until westerly airflow and rain events brought some reprieve 11-13 days after the wind event started.

September 2020 will long be remembered for the east wind event, catastrophic fires, and days of suffocating smoke, but also for being a top 5 warmest Septembers on record for most of the west. I believe that it would have likely been the warmest September on record over most of the west without the smoke. However, even with up to 10 days

[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.

affected by smoke that lowered temperatures, the month was 2-6°F above average (Figure 1). Nearly all areas to the west of the Rockies saw a warm month, with isolated areas in eastern Washington, the central valley of California and portions of interior Southern California being near average. Cooler conditions played out east of the Rockies with the central portion of the country near average to below normal while the southeast and eastern seaboard were close to average (not shown). September was very dry over most of the western US, except for western Oregon and Washington and the Cascades (Figure 1). For the rest of the country, the central to northern Plains, stretching across the Great Lakes and New England were drier than average for the month, while Texas, the Gulf Coast states, southeast to mid-Atlantic experienced a wetter than average month largely due to tropical systems during the month (not shown).

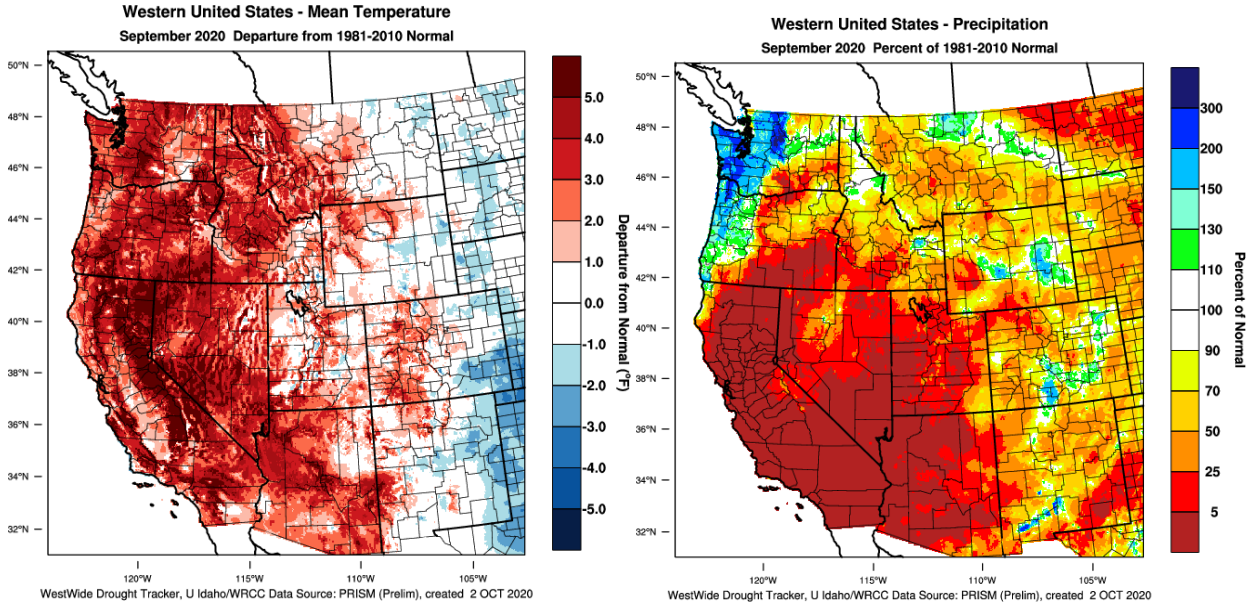


Figure 1 – Western US September 2020 temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

Year to date for 2020 finds temperatures in the western US are running largely near average to above-average (Figure 2). Portions of western Washington and Oregon, eastern Washington, and Idaho continue to run cooler than average or average for the year. The northern Rockies, the northern Cascades in Washington, and northern to central Plains are the only areas of the country running colder than average (1-2°F below normal) while Texas, the Gulf Coast states, and the eastern third of the US have been seeing temperatures 1-3°F above normal (not shown). Precipitation amounts during 2020 have also been mixed across the western US with most of California, the eastside of the Cascades, and the bulk of the Great Basin and Four Corners region continues to run 20-70% of average rainfall (Figure 2). Portions of western Oregon are closer to average year to date, while western and eastern Washington, the Blue Mountains of Oregon, much of Idaho, and the California-Arizona border have seen 105-220% of average rainfall. The relatively dry year to date for 2020 continues to add to longer-term drought concerns for much of this area (see Drought section below). On the other hand, the majority of the eastern third of the country has seen wetter than average conditions since the first of the year, while dry conditions have been seen from the Panhandle region into the Plains and in northern New England (not shown).

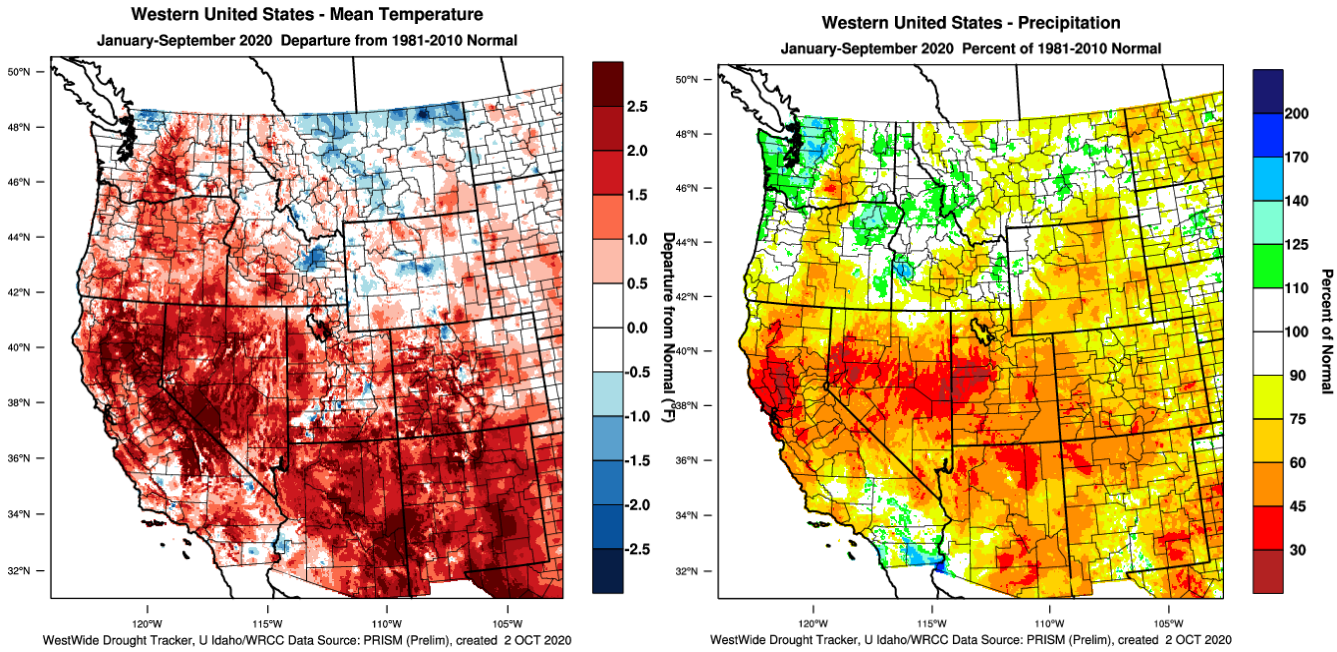


Figure 2 – Western US year to date (January-September) temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

Even with the lower temperatures due to smoke for many regions, heat accumulation (GDD) for the western US was above average for the month. GDD from March through September shows the vintage close to near normal to above normal (Figure 3). GDD amounts over most of California, Oregon, and Washington are currently 5-15% above normal or two weeks or more ahead of average for this time of the season. Some areas, however, are slightly behind in heat accumulation albeit much less than in previous months. Portions of eastern Washington, eastern Oregon, and Idaho are 5-10% down or about one week to 10 days behind. In California, the vast majority of the state shows above-average heat accumulation while isolated inland areas of Southern California remain below average.

Growing degree-day amounts for four locations in Oregon's main wine regions reflect the broader regional patterns seen in Figure 3. All four locations are running above the 1981-2010 normals for the months' March through September (3 to 21%), with eastern Oregon (Milton-Freewater and the Walla Walla region) continuing to be closer to the long-term average (see Appendix Figure 1). Similarly, compared to the average of the last 15 years for the sites, Medford is 7% up, Rosburg is 10% up, and McMinnville is 2% above average, while Milton-Freewater is 6% down. Compared to 2019, Medford is 6% higher, Roseburg is 4% higher, McMinnville is roughly the same, and Milton-Freewater is 5% below (see Appendix Figure 1 for four locations in Oregon).

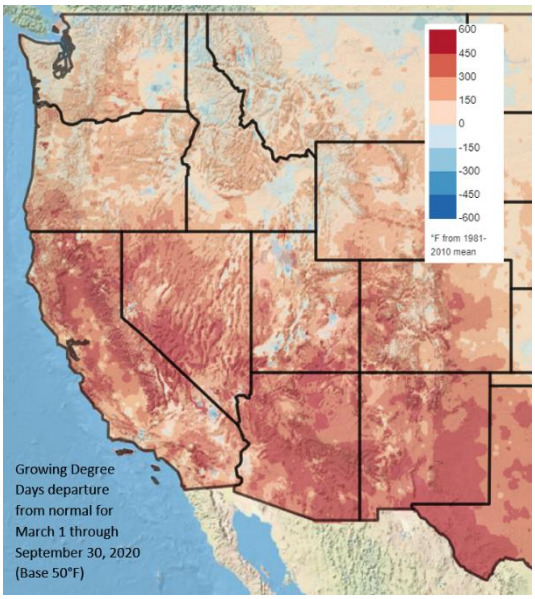


Figure 3 – Western US March through September 2020 growing degree-days (image from Climate Impacts Research Consortium, University of Idaho).

Drought Watch – Dry conditions continued during the month of September over the western US (Figure 1) with drought intensifying across much of the region (Figure 4). These conditions continue to influence an active fire season. Currently, over 90% of the western US is in some category of drought with nearly 55% in severe to exceptional drought conditions. The only areas not exhibiting drought are western Washington, coastal Southern California, and scattered small areas in the northern Rockies. During September, drought concerns further developed in many areas of the west and into the Great Lakes and New England. The longer-term outlook for the US through December continues to show the forecasted dry conditions for much of the west with further development expected in Southern California, the southern Plains, and Texas. The PNW is expected to see some improvement in drought conditions with fall rains as detailed in the forecast below. The Four Corners region continues to be the bullseye for the western drought, with additional areas in the Rockies, Plains, and the panhandle region likely to see drought conditions develop further (Figure 4, right panel).

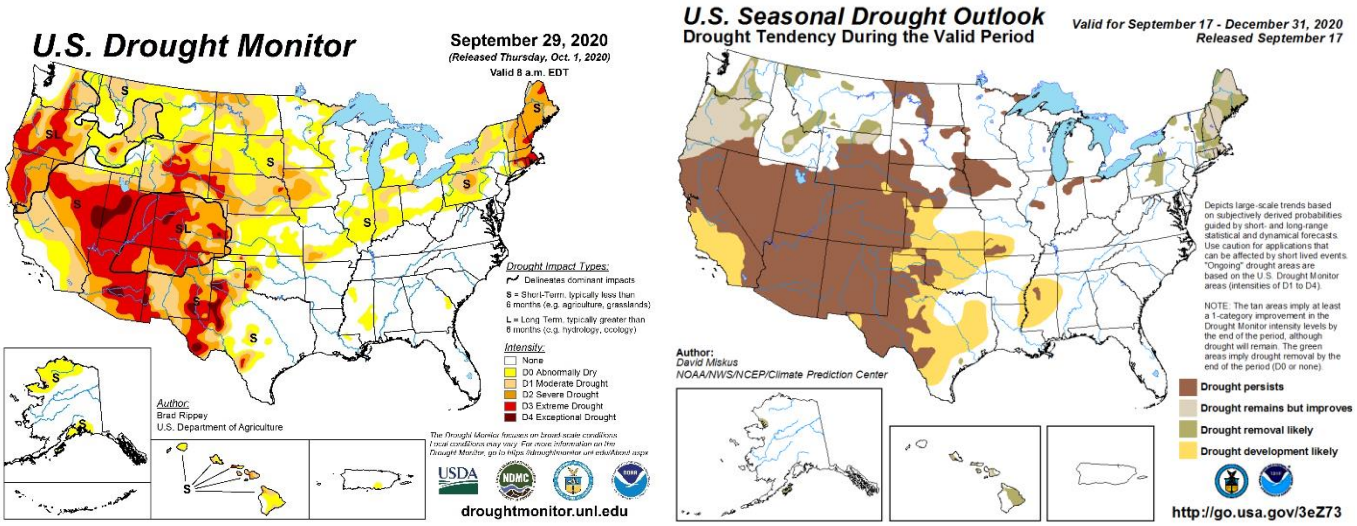


Figure 4 – Current US Drought Monitor and seasonal drought outlook.

ENSO Watch – Now that October is here, the window on our first half of winter ENSO forecast is becoming clearer. The tropical Pacific continues to show signs of developing La Niña (cold event) conditions (Figure 5). In mid-September, the Climate Prediction Center (CPC) report indicated that SSTs in the east-central Pacific are below average, indicating La Niña conditions. In addition, patterns in atmospheric variables are consistent with La Niña conditions. Most model forecasts point to the Tropics exceeding the threshold of La Niña SST conditions for fall and winter and implying about an 80% chance for La Niña for fall, 70% for winter. The official CPC/IRI outlook and other agencies outlooks are consistent with these model forecasts, calling for a 75% chance of La Niña for fall and winter. From this, a La Niña advisory is posted. Seeing more clarity in La Niña conditions and forecasts leads me to believe that we will likely head into a pattern that is shown in the October and three-month forecasts in Appendix Figure 2 where the PNW has a greater chance of being wetter than average, while California and the southwest remain dry. Contrary to average La Niña conditions, which are typically cooler than average over the west, the current forecast is calling for warmer than average conditions, which could reflect more influence from the North Pacific (see below).

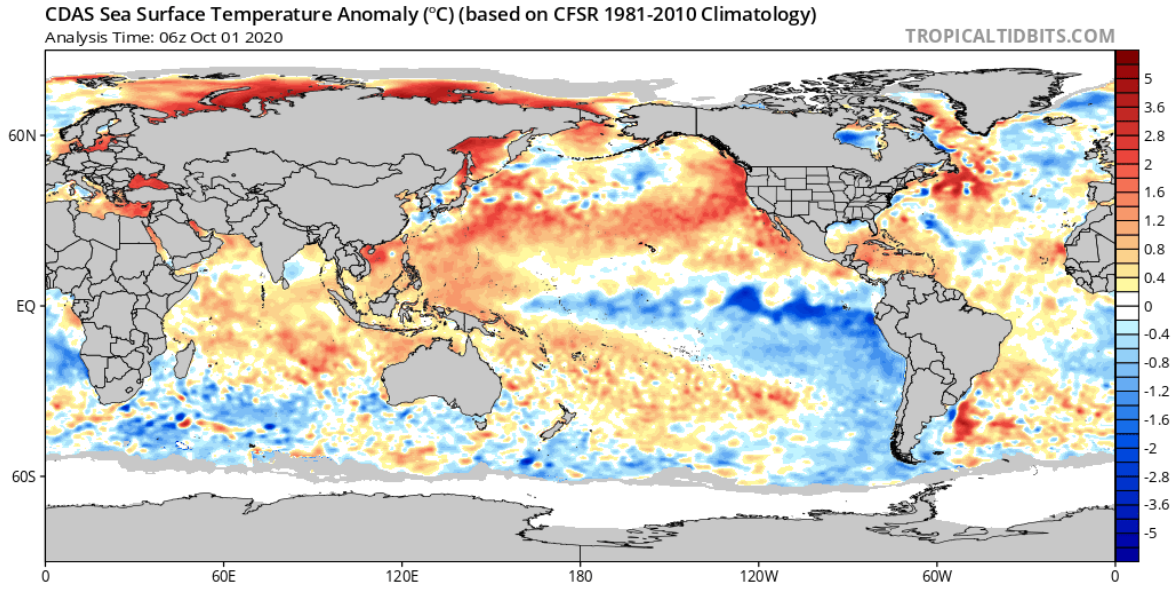


Figure 5 – Global sea surface temperatures (°C) for the period ending October 1, 2020 (image from Tropicaltibits.com).

North Pacific Watch – In contrast to the cooler surface waters in the Tropics, the North Pacific continues to show a large area of anomalously warm water running 2-5°F above average (Figure 5). Over the last few weeks, near-shore temperatures have warmed slightly from the Gulf of Alaska, Oregon, and California while some slight cooling was seen out over the central Pacific. This confounds what appeared to be a strengthening of upwelling or a longer-term move to the cold phase of the Pacific Decadal Oscillation (PDO) in prior months. With a PDO in the cold phase, coupled with a strengthening La Niña (see above), the PNW could be in for a relatively cold and wet winter while California would likely be cool and dry. However, the current warmth in the North Pacific might mute the La Niña effect, making the magnitude of the impact lowers (closer to average temperatures and precipitation in the PNW). Hopefully, some of this will become clearer as we move further into October which gets us over the forecasting wall for early winter.

Forecast Periods:

Next 5 Days: High pressure, stable air, warmer than average temperatures, and dry conditions continue from the end of September. Smoke will wax and wane with wind direction and strength. As the high pressure breaks down some from north to south toward the end of this period, more seasonal temperatures but continued dry conditions will prevail.

6-10 Day (valid October 7-11): The high pressure from the first of the month gives way to a more typical October pattern with the flow off the Pacific bringing seasonal temperatures along the coast while inland areas are likely to stay much warmer than average. During this period, the majority of the country will likely see above average-temperatures, except the mid-Atlantic to New England where average to slightly cooler than average temperatures are likely. Zonal flow will usher in a rain event or two during this period likely bringing rainfall above normal in the PNW to near average heading south, then not much, if any rain, from the Bay Area south along the coast. The rest of the country is forecast to drier than average, with the exception of Florida and northern New England likely being the slightly wetter than average.

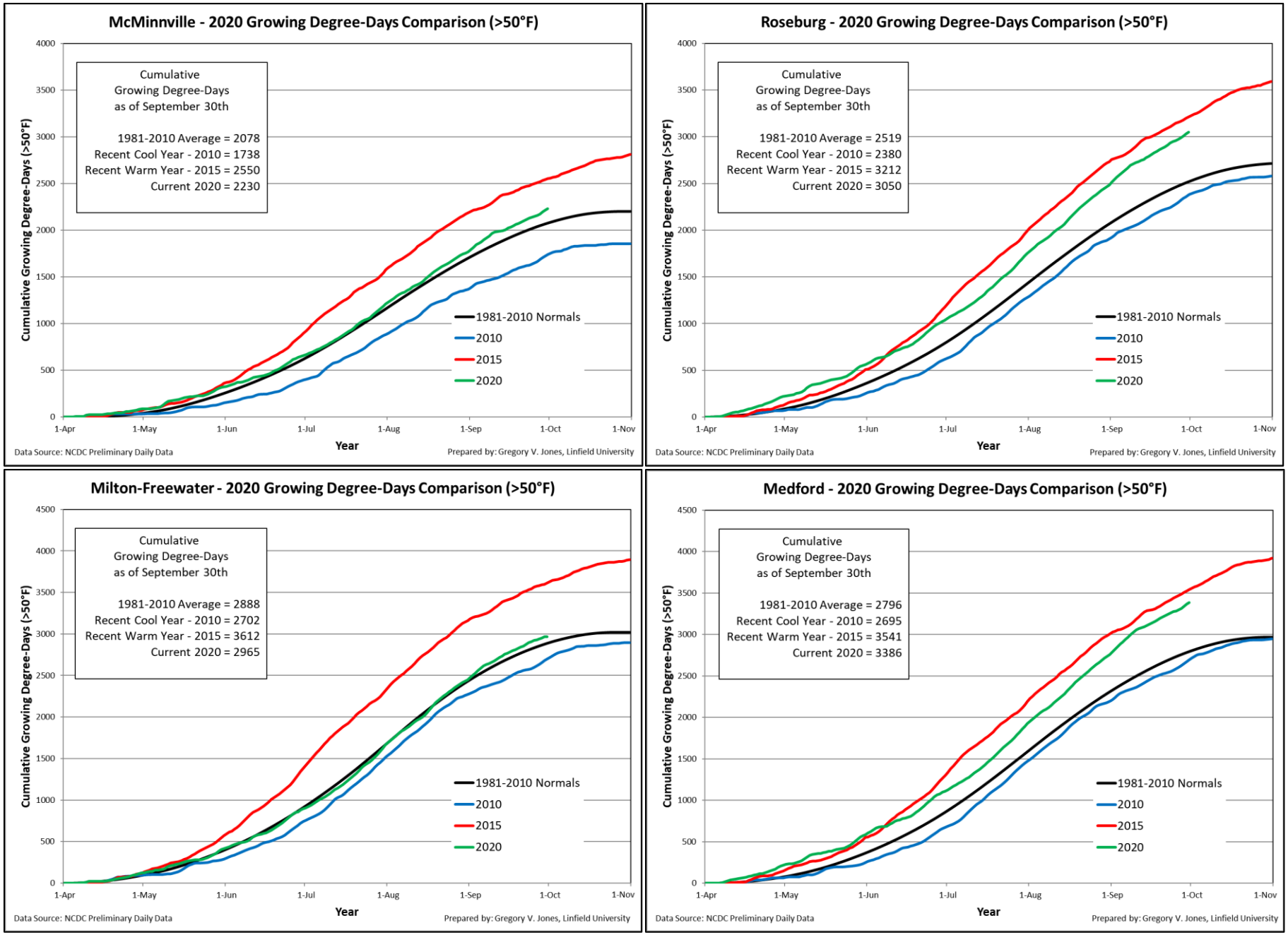
8-14 Day (valid October 9-15): Overall patterns do not change much from the last forecast period to this one. The main difference in temperatures is that the overall warmer than average conditions spreads over the entire country. The main difference in precipitation is the expanded likelihood of a dry period over the bulk of the US, except far south Florida, while the PNW to Northern California is likely to continue to see typical October frontal passages and near average to above-average rainfall.

30 Day (valid October 1-31): The initial forecast for the month of October is pointing the country experiencing a generally warmer than average month. The one area of the country expected to be closer to average is the PNW, while the warmest areas will likely be the desert southwest and New England (see Appendix Figure 2). Precipitation for October is forecast to be above average for the PNW, near average in California and much of the west, and below-average over the majority of the central US. Florida is the only other area outside of the PNW that will likely have a wetter than average October.

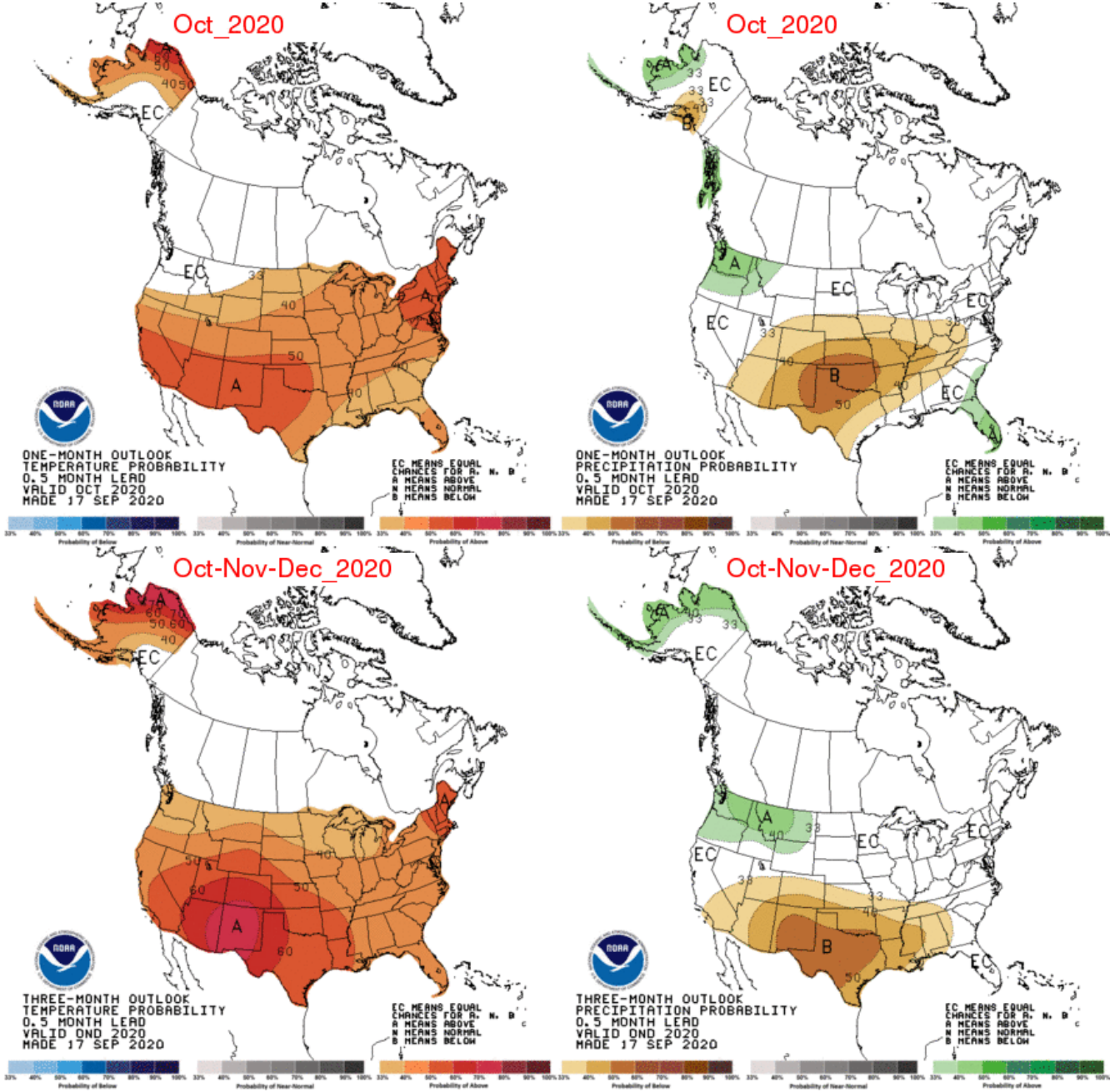
90 Day (valid October-November-December): From fall and into the first half of winter the entire US is expected to see above-average temperatures (see Appendix Figure 2). The Four Corners region and portions of the West continue to be forecast to have the greatest likelihood of a warmer three-month period. The 90-day outlook for precipitation continues the broad pattern for dry conditions from September and October, with the driest conditions mostly across the southwest, Texas, southern Plains, and western Gulf Coast states. The PNW is forecast to see a slightly wetter than average three-month period, while California and the rest of the country have an equal chance of being slightly above to slightly below average.

Gregory V. Jones, Director
Evenstad Center for Wine Education
Evenstad Chair in Wine Studies
Linfield University
900 SE Baker Street
McMinnville, OR 97128-6894
503-883-2218
gjones@linfield.edu

Linfield University



Appendix Figure 1 – Cumulative growing degree-days (base 50°F, no upper cut-off) for McMinnville, Roseburg, Milton-Freewater, and Medford, Oregon. Comparisons between the current year (2020) and a recent cool year (2010), a recent warm year (2015) and the 1981-2010 climate normals are shown (NCDC preliminary daily data).



Appendix Figure 2 – Temperature (left panel) and precipitation (right panel) outlooks for the month of October (top panel) and October, November, and December (bottom panel) (Climate Prediction Center, climate.gov).