

Weather and Climate Summary and Forecast November 2017 Report

Gregory V. Jones
Linfield College
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Summary:

- October was relatively cool and wet north, while warm and very dry south. Dry conditions and high winds fanned devastating fires across California.
- Growing season heat accumulation ended up near average in eastern Washington/Oregon, while 5-20% up elsewhere. Degree-day totals for 2017 ended up similar to 2013, 2014, and 2016 for most locations.
- Current conditions favor cool to cold temperatures with significant rains at lower elevations and snow at higher elevations throughout much of the western US through at least the 20th of the month. Dry conditions are likely to still prevail in central to southern California.
- The extended forecast is tilting the odds to winter being cool/wet in the PNW and cool to average and dry in California.

What a month. While October was relatively cool overall, dry conditions, heat and high winds led to the most damaging fires ever experienced in the western US, inflicting a major toll on wine regions in the North Coast. The month started off with near average temperatures and dry conditions, followed by a few frontal passages and cooler airflow, closing with a relatively warm and dry end of the month. The left map in Figure 1 shows the October temperatures over the western US with a largely cool inland PNW and Great Basin and near average western valleys of Washington and Oregon. California was mixed with coastal zones, the Sierra Nevada mountains, and southern California warmer than average while the central valley was relatively cool. What remained of harvest in the PNW was able to come in during the first twenty days of month in between systems, and was mostly completed early in the month in California. Nationwide the desert SW and the Mississippi River valley to the east coast were all much warmer than average in October while the Great Plains and Northern Rockies were near average in terms of temperatures (not shown).

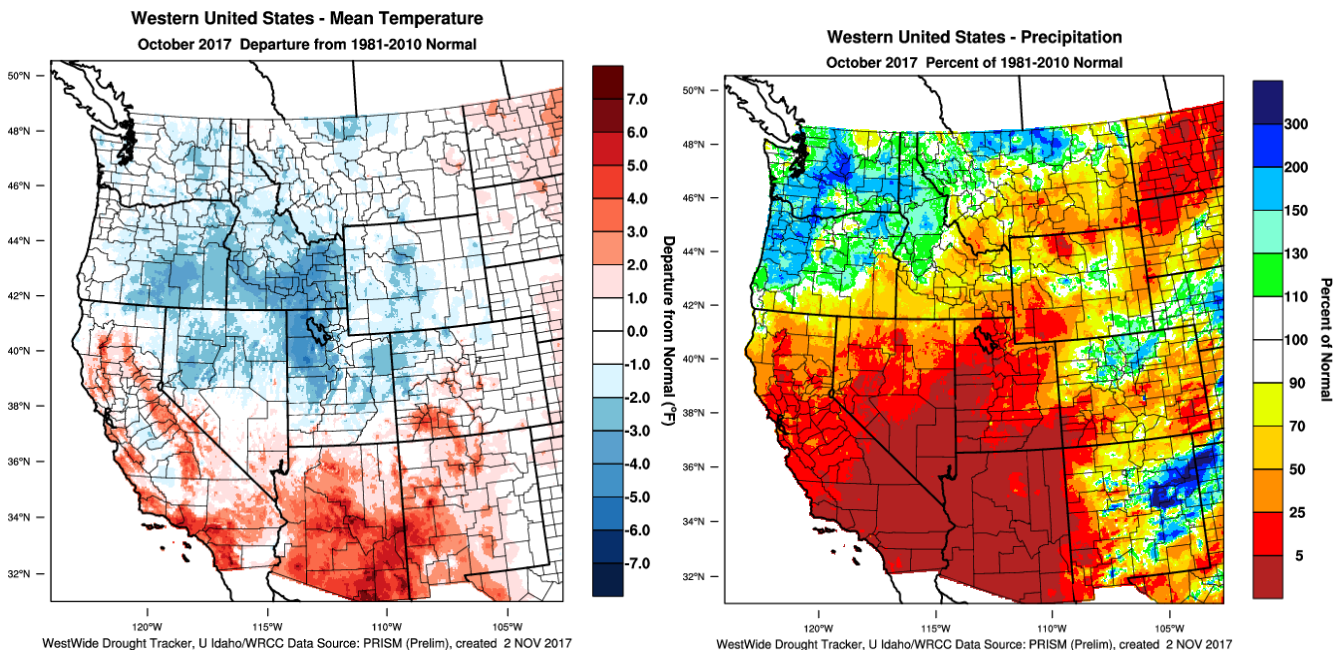


Figure 1 – Western US October 2017 temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

The onset of fall rains was largely a north-south issue during October with much of Oregon, Washington and northern Idaho being wetter than average, while from the California border south and east to the Four Corners region saw little to no rain and were considered extremely dry (Figure 1). Dry conditions during the month were also seen across the northern Great Plains, much of Texas, the lower Mississippi River valley, and the southeastern coast (not shown). Wet conditions were seen across the upper Mississippi River valley, Great Lakes, Gulf Coast, Florida and New England.

For the first ten months of 2017 temperatures continue to trend above average globally and for the US as a whole, with the US currently on track to have its 3rd warmest year on record. The only cooler than average zones in the contiguous US states are in eastern Washington and Oregon and portions of southern Idaho, eastern Montana and central Wyoming which are running up to 2°F below average. California year to date is +2.7°F warmer than average, Oregon is +1.9°F, and Idaho is +2.0°F. The remainder of the western US continues to be on the pace to end up 1-3°F above average. Cumulative precipitation patterns for the first ten months of 2017 continues to show overall wetter than average conditions in the western US, driven largely by late winter and spring rains (Figure 2). Some isolated regions are showing drier than normal conditions year to date, including southern Nevada, southeastern California, Arizona and the Four Corners region, and eastern Montana. The continued dry conditions in the northern Great Plains remains one of the driest areas in the US, while the bulk of the rest of the eastern US has experienced average to wetter than average conditions year to date, especially along the Gulf states (not shown).

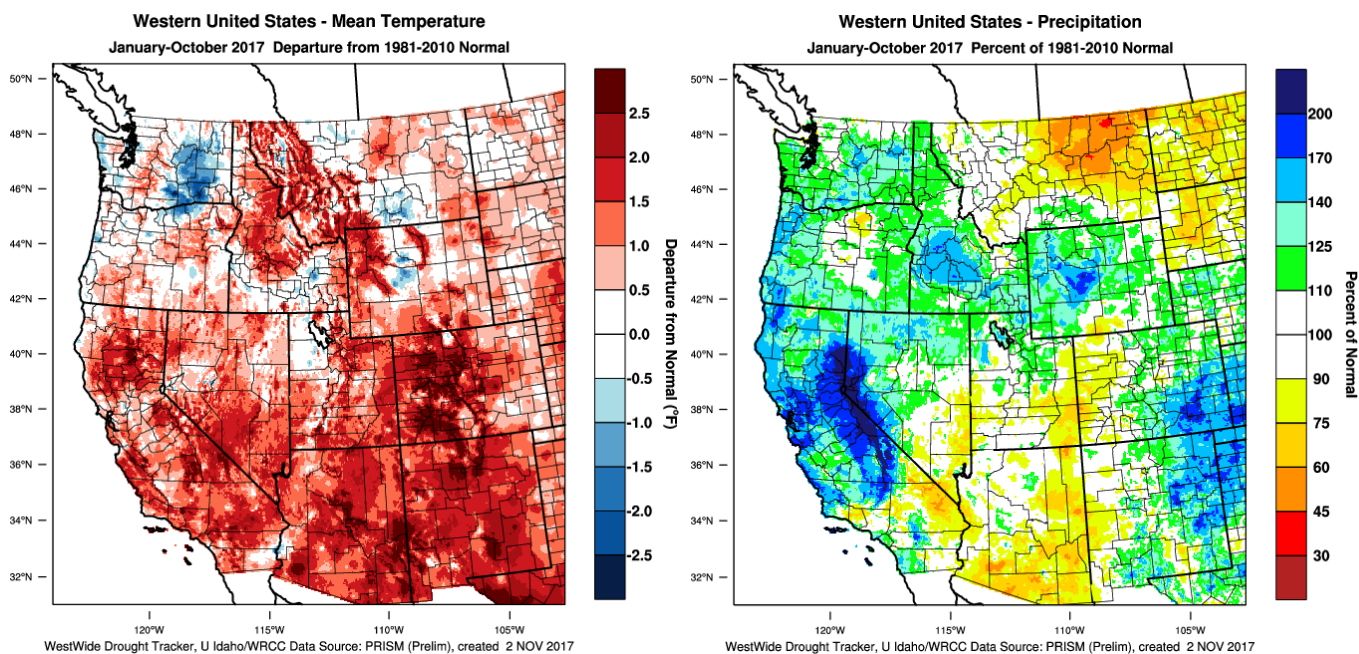


Figure 2 – Western US January-October 2017 temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

As the growing season comes to an end, heat accumulation departures from normal (Figure 3) show that the majority of the west ended up above normal (Figure 3). Portions of eastern Washington and Oregon ended up slightly above to slightly below normal due to a cool start to the season. The rest of Oregon ended up 15-20% above average, while California ended up 5-25% above average and Idaho 10-15% above average. Heat accumulation (GDD) amounts for four locations in Oregon ended the season 15-21% above the 1981-2010 normals with Medford experiencing the greatest deviation from average. Each location ended up below the GDD values seen in 2015, the warmest on record for each location (see the Appendix Figure 1 for four locations in Oregon). The 2017 heat accumulation totals in the western US wine regions ended up being very close to the values seen in 2013, 2014, and 2016.

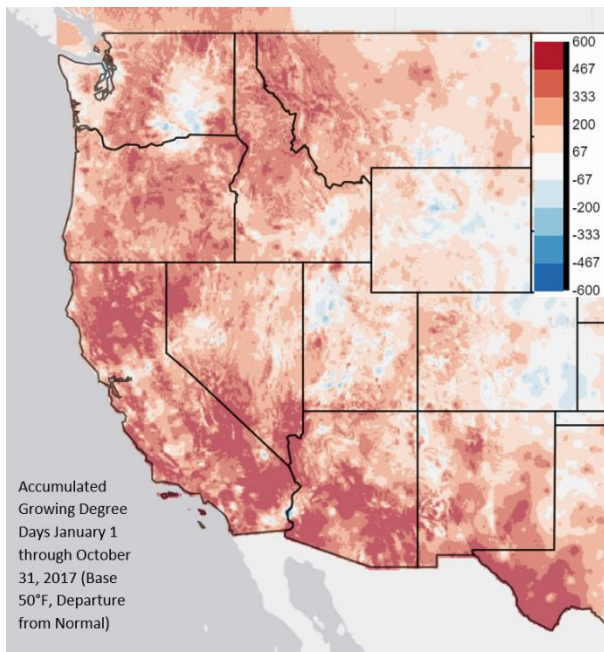


Figure 3 – Western US January through October 2017 growing degree-days departure from the 1981-2010 normals (image from Climate Impacts Research Consortium, University of Idaho).

Drought Watch – The same general drought pattern continues from the last few months (Figure 4; left panel). The inland PNW, Montana and the northern Great Plains continue to show some of the most moderate to severe drought conditions nationwide. Coastal Central to Southern California across into Southern Arizona also continue to exhibit long-term moderate drought. Scattered short-term drought exists across many areas of the rest of the country (areas in yellow in Figure 4, left panel). The seasonal drought outlook for the United States through January (Figure 4, right panel) predicts drought to persist and/or develop in the two main regions of Montana/Northern Great Plains and California/Arizona. Additional drought development and persistence is likely in scattered regions across the US with portions of the Mississippi River valley seeing the most development. Onset of winter rains are expected to continue to ease the minor seasonal drought in the PNW (see forecast periods).

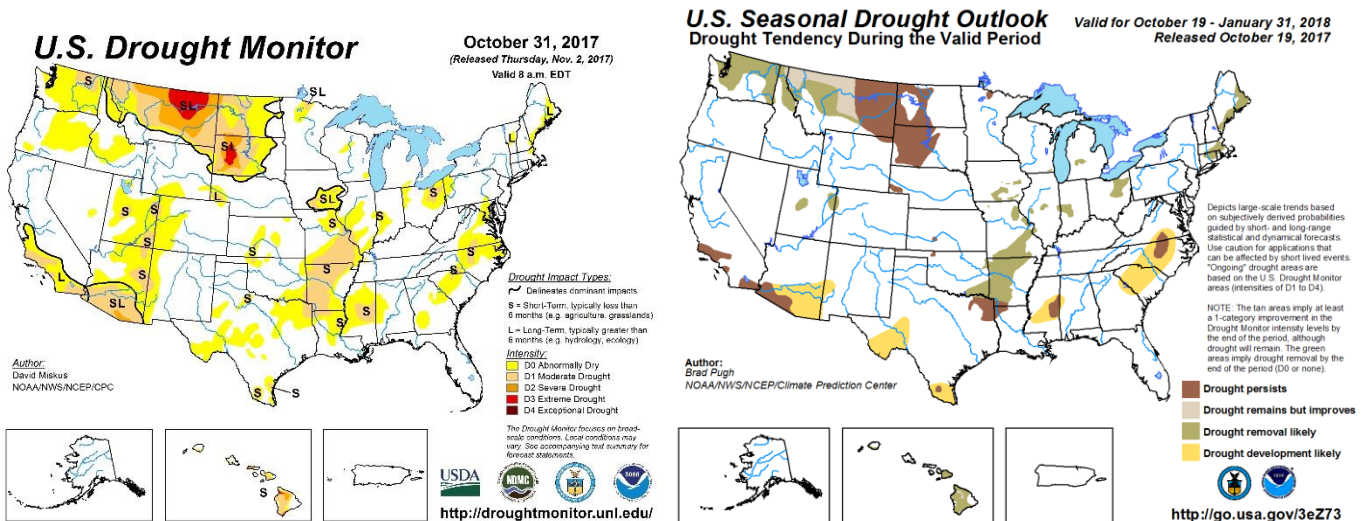


Figure 4 – Current US Drought Monitor and seasonal drought outlook.

ENSO Watch – Continued mixed signals coming out of the tropics, although the media is picking up more and more on La Niña, so it must be happening! In mid-October 2017, the tropical Pacific remained in an ENSO-neutral state but near the borderline of weak La Niña, as SSTs in the east-central tropical Pacific have cooled to the threshold for La Niña and the atmosphere has also shown patterns suggestive of near-La Niña conditions. The collection of latest

ENSO prediction models indicates weak La Niña as a likely scenario during Northern Hemisphere fall and winter (CPC/IRI). Multiple governmental and research agencies are also currently indicating that the outlook slightly favors La Niña development, and carries a La Niña watch. In general, neutral conditions tend to mean that there is little tropical influence in mid-latitude weather and statistically tilts the odds to favoring the next few months to be warm and dry across the southern half of the US; wet and cool the further north one goes into Canada (see forecast periods below). A weak La Niña would statistically favor a wetter and cooler winter in the PNW and a cool, but dry California.

North Pacific Watch – Some cooling across the North Pacific Ocean due to a relatively cold air mass over Siberia and into the western portion of the ocean basin. Some areas continue to display warmer than average SSTs but conditions are more mixed this month compared to last month (Figure 5). Surface waters are running -2°F below to $+3^{\circ}\text{F}$ above average from the Gulf of Alaska down along the west coast with some of the coldest waters developing off California (note figure is in $^{\circ}\text{C}$). The latest November-December-January (NDJ) ensemble forecast for SST continues calls for either maintaining the current conditions or a slight cool down along the west coast of North America while the rest of Northern Pacific is forecast to stay warmer than average. The conditions in the North Pacific are slightly favoring a warmer than average western US during NDJ (see 90-day forecast below), however the current cooling in the ocean basin and continued La Niña development would favor a cooler and wetter winter in the PNW, while California would tend to be cooler and drier through the 90-day forecast window (below and in Appendix Figure 2).

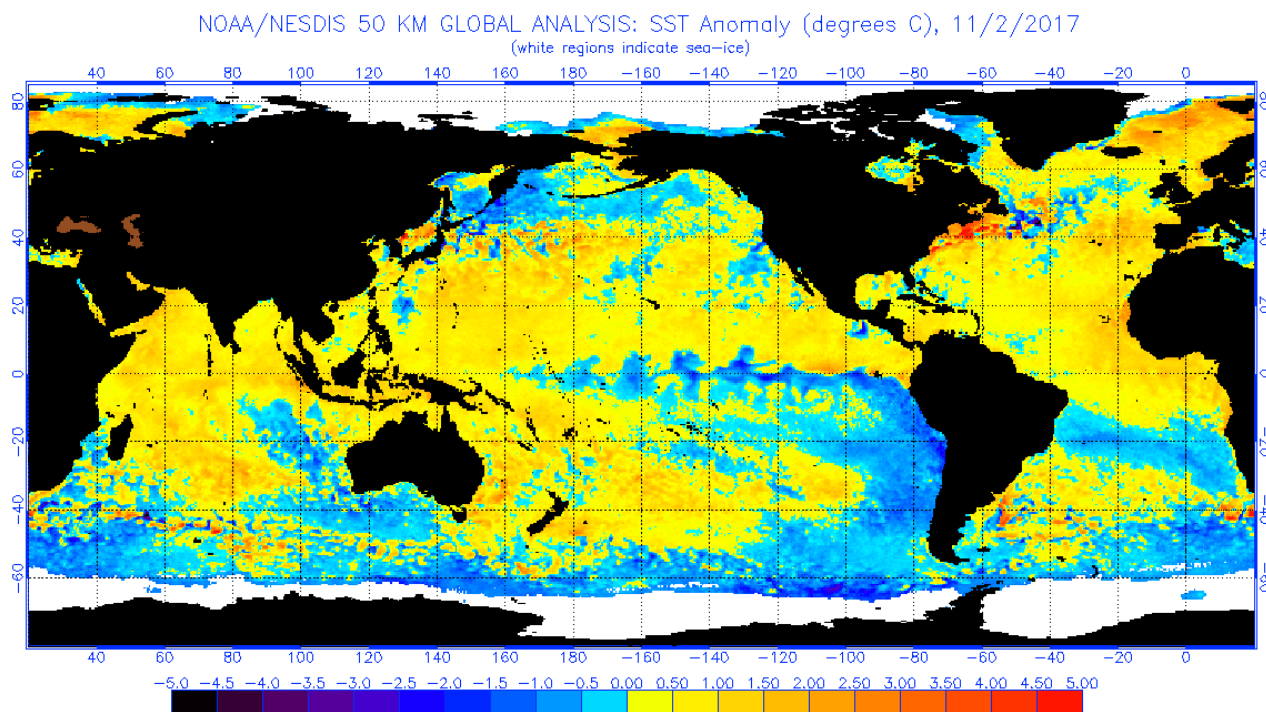


Figure 5 – Global sea surface temperatures ($^{\circ}\text{C}$) for the period ending November 2, 2017 (image from NOAA/NESDIS).

Forecast Periods:

6-10 Day (valid November 13-17): Plenty of cold, wind and moisture on tap for this forecast period. Multiple frontal passages bringing strong wind fields and plenty of rain at lower elevations and snow at higher elevations. Western Washington, Oregon, and Northern California likely to see below normal temperatures with the inland PNW being closer to seasonal temperatures. From Southern California to the Great Lakes and across the southeast temperatures will likely be above normal. Precipitation appears to be largely focused on the PNW although rainfall will likely make its way to the Bay Area, otherwise the rest of the west into the heartland is forecast to be relatively dry and New England to be wetter than average.

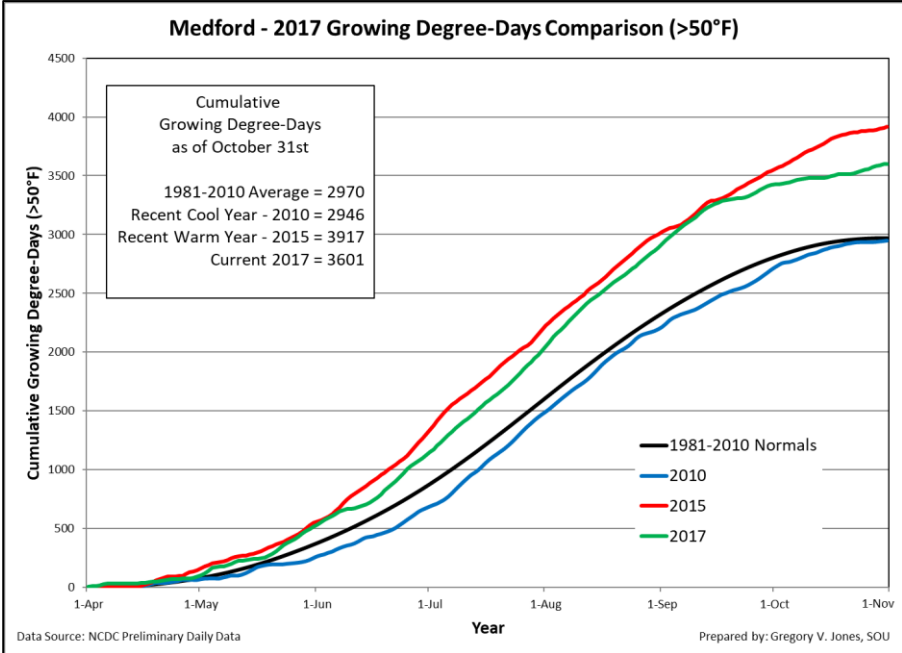
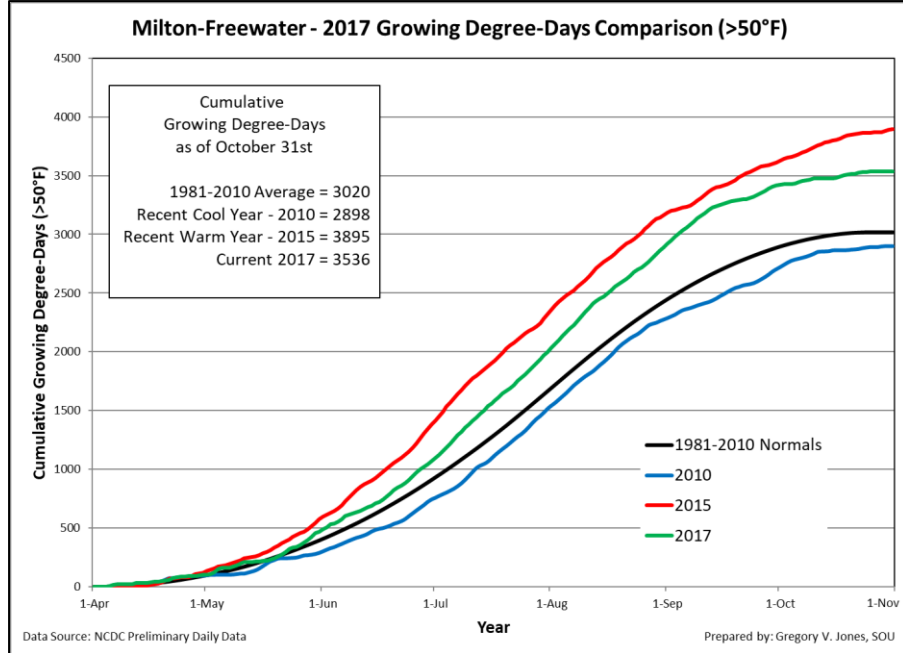
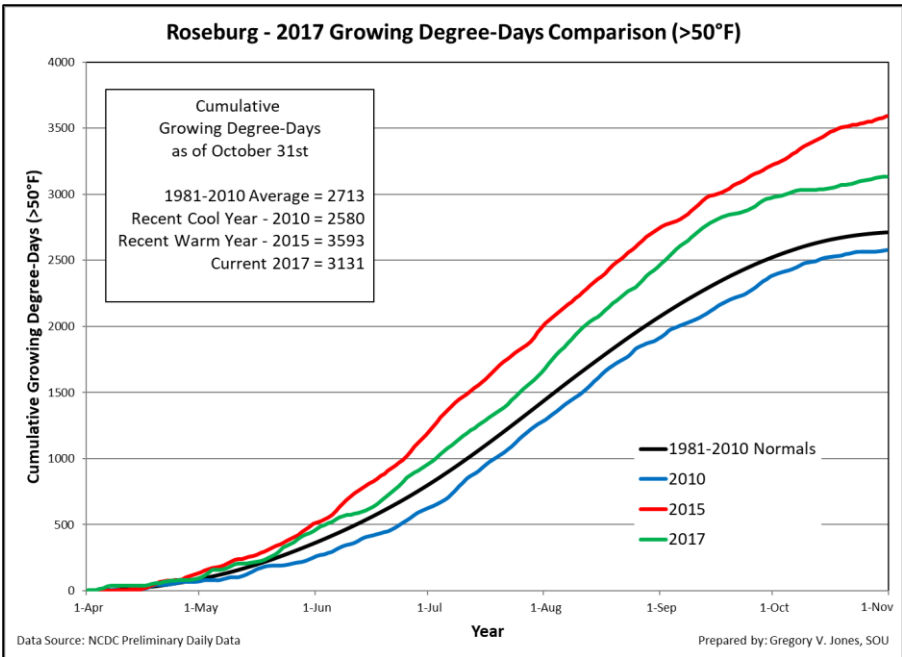
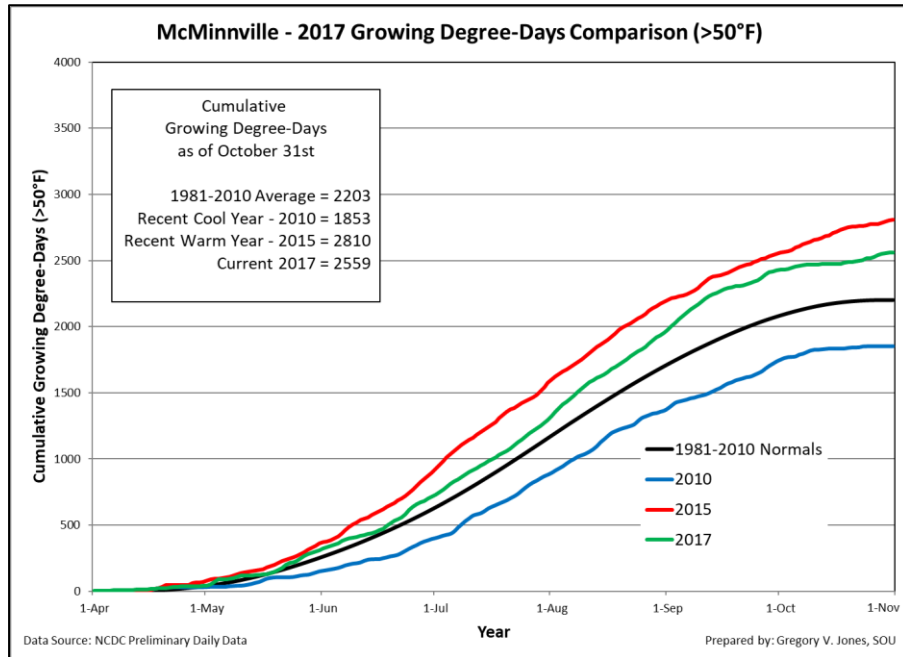
8-14 Day (valid November 15-21): General pattern of cooler than average and wetter than average holds through at least the 21st of the month for the PNW and Northern California. Forecast also continues to show a high likelihood of warmer than average conditions from Southern California nearly all the way across the country. Wet conditions are forecast to continue in the PNW and across the northern tier of states and the Great Lakes, while the rest of the country is forecast to be below average in terms of precipitation.

30 Day (valid November 1-30): Overall pattern for November shows a high likelihood of the west coast, inland PNW and the northern Rockies being colder than average (NOAA's Climate Prediction Center, see Appendix Figure 1). The rest of the US is forecast to remain near average to warmer than average for the month. A similar pattern is being forecast for greater than average precipitation across the western US, northern Rockies and Great Lakes with the southern Plains, Gulf Coast, and into the mid-Atlantic forecast to remain drier than average.

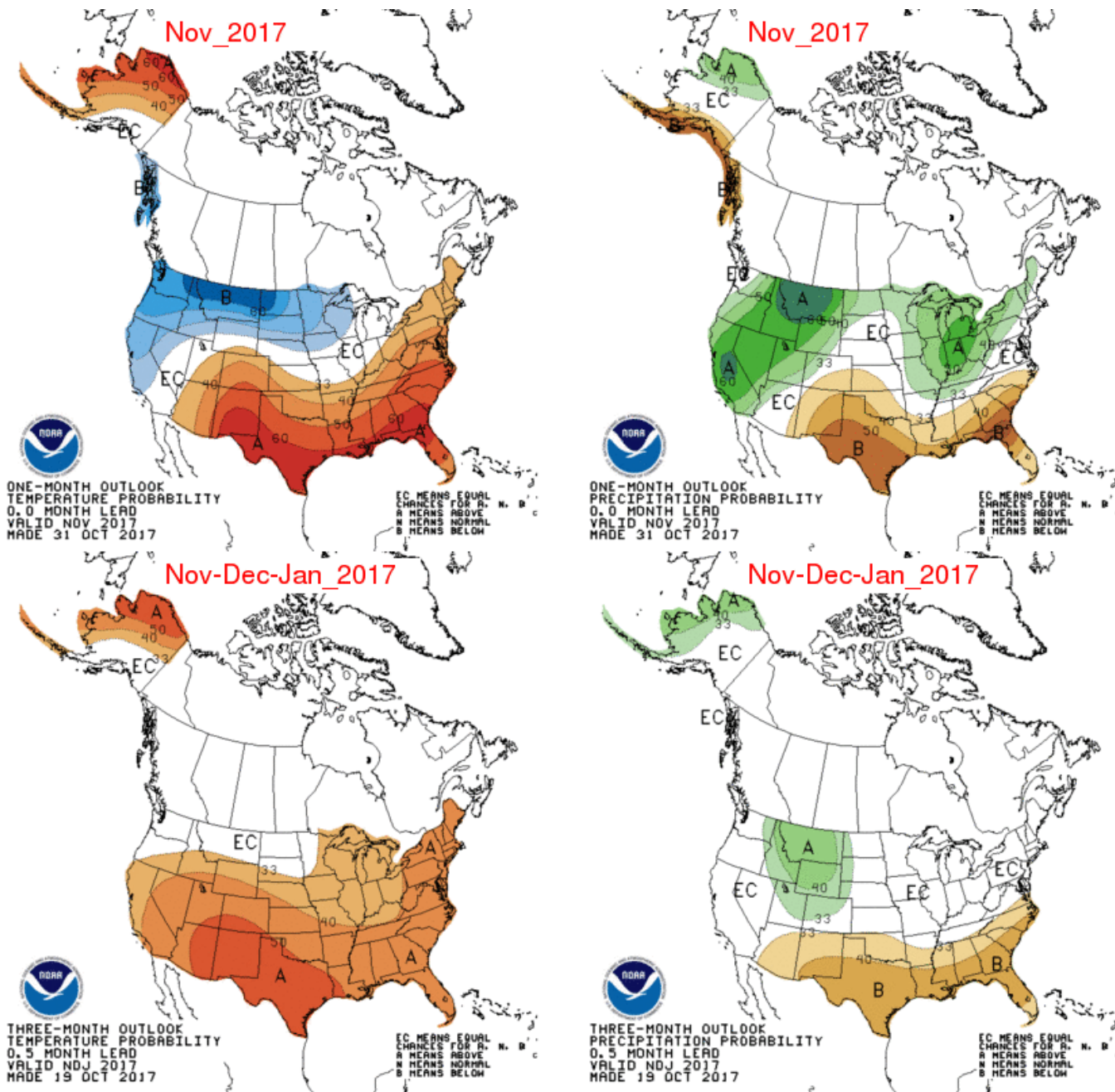
90 Day (valid November-December-January): Updates for the winter forecast for NDJ is still pointing toward continued warmer than normal conditions likely across the US. The Texas and the Four Corners region has the highest likelihood of being warmer than normal during the three-month period (NOAA's Climate Prediction Center, see Appendix Figure 2). The PNW across the Northern Rockies and into the northern Great Plains have an equal chance of being slightly above or below average. While this forecast is partially due to the warming of the North Pacific, continued La Niña development (see above) could still change the dynamics at play. The precipitation forecast over the NDJ period is less clear nationwide with the northern Rockies forecast to see wetter than average conditions, while Texas, the Gulf Coast and southeast are forecast to be drier than average and everything else in between, including the west coast, near average (see Appendix Figure 2). For the western US, I am still leaning to a transition to a cooler NDJ than this forecast shows, especially if the La Niña continues to develop. This would also point to a wetter (snowier) winter in the western US, especially in the PNW, but a drier than average central to southern California.

Gregory V. Jones, PhD
Director of the Center for Wine Education
Linfield College
900 SE Baker Street
McMinnville, OR 97128-6894
503-883-2218
gjones@linfield.edu





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 (2017) 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 November (top panel) and November, December, and January (bottom panel) (Climate Prediction Center, climate.gov).