

Weather and Climate Summary and Forecast Summer into Harvest 2016

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With school and football season starting a hint of fall is right on time and the transition has started (see forecast periods). But first let's look back at August ... the month lived up to the forecast in some ways but differed in others. Temperatures were mixed with inland California, western Nevada, Oregon and Washington all seeing above normal conditions (2-4°F) which was spot on with the forecast (Figure 1) while eastern Washington and Oregon along with much of Idaho experienced near normal temperatures during the month. On the other hand, central coastal California experienced a fairly strong marine layer and fog, resulting in temperatures 1-2°F below normal, while much of the Great Basin and Rockies were cooler than normal due to monsoon cloud cover during the month (missed in the forecast). In terms of precipitation, the bulk of the western US was much drier than normal during August (Figure 1), however remember it does not take much to be drier than normal during this month. Nationwide, the dry conditions in the west gave way to much wetter than average conditions from Texas and the Gulf Coast up the Mississippi and Ohio river valleys and into the upper Midwest and Great Lakes while the eastern seaboard was close to normal rainfall (not shown). The nationwide temperature pattern in August was a west, central, east pattern with a generally warm west coast, cool Rockies to the plains and then a very warm eastern third of the country from the Mississippi River to the southeast and into New England (not shown).

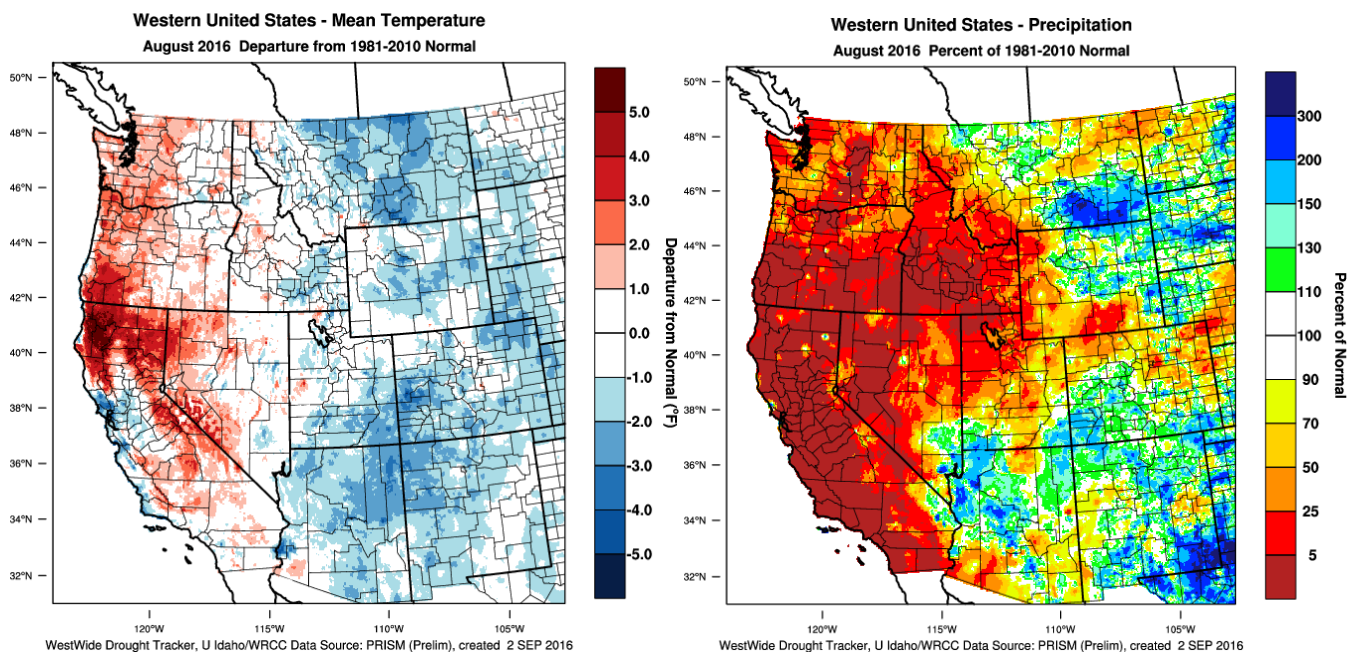


Figure 1 – Western US August 2016 temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

Cumulative conditions since the first of the year continue to show a largely warmer than normal 2016 throughout the western US with precipitation amounts mixed (Figure 2). Average temperatures for the period have run 1-4°F or more above the 1981-2010 climate normals for much of California, Oregon, Idaho and Washington. While portions of Montana and the Dakotas have been 5-6°F above normal, areas in eastern Nevada and the Four Corners have been closer to normal for the year to date. This pattern continues across the entire US, with temperatures running 1-3°F above normal in most regions but 5°F or more above normal in the northern Rockies and Plains states and closer to normal in southern Texas and the Four Corners area of the southwest (not shown). For 2016 precipitation amounts have been 90 to 150% of normal from Northern California into southern Oregon, central Washington and portions of the northern Rockies (Figure 2). Dry conditions have been seen across eastern Oregon into Idaho and eastern

Montana along with Southern California and across the southwest. The wetter than average conditions extends out of the northern Rockies and into the Great Plains then south into the Mississippi and Ohio river valleys, while portions of the eastern US have been drier than average so far this year (not shown).

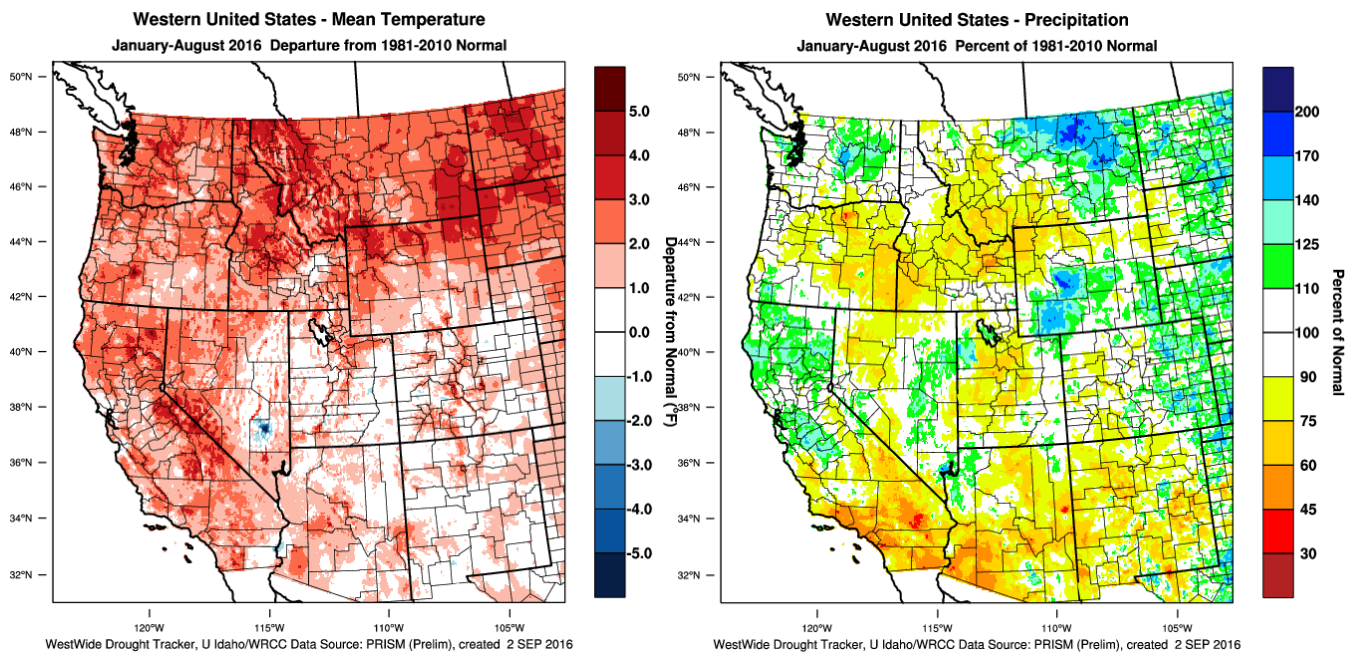


Figure 2 – Western US year to date (January through August 2016) temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

Following the general spatial temperature patterns in Figure 1 and 2, growing degree-days continue higher than normal over most of the western portions of California, Oregon, and Washington (Figure 3). January through August accumulations are running near normal up to 500 units higher than the 1981-2010 normals throughout much of the western wine regions. GDD accumulation in August was higher than average in most regions, with the exception of eastern Washington/Oregon and portions of the North and Central Coast of California. The growing season continues to run roughly 10-20 days ahead of the long term average across the majority of the western, but is now almost guaranteed to end up lower than 2015 (see the Appendix Figure 1 for four locations in Oregon).

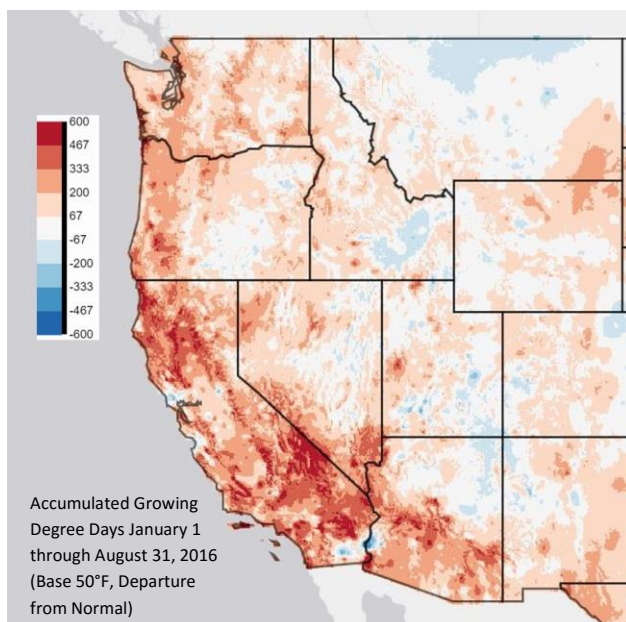


Figure 3 – Western US January through August 2016 growing degree-days departure from the 1981-2010 normals (image from Climate Impacts Research Consortium, University of Idaho).

Drought Watch – Again not much change from last month with western US drought conditions lessened in some areas but expanding in others. Conditions since the first of the year have also not changed much with central and southern California and into the southwest and Great Basin continuing to be very dry (Figure 4). The US seasonal drought outlook forecasts that the driest regions in California, Nevada and eastern Oregon will likely persist through the end of November and beyond. Some drought removal is likely along coastal Oregon and in Arizona as the monsoon season is expected to pick up over this time period.

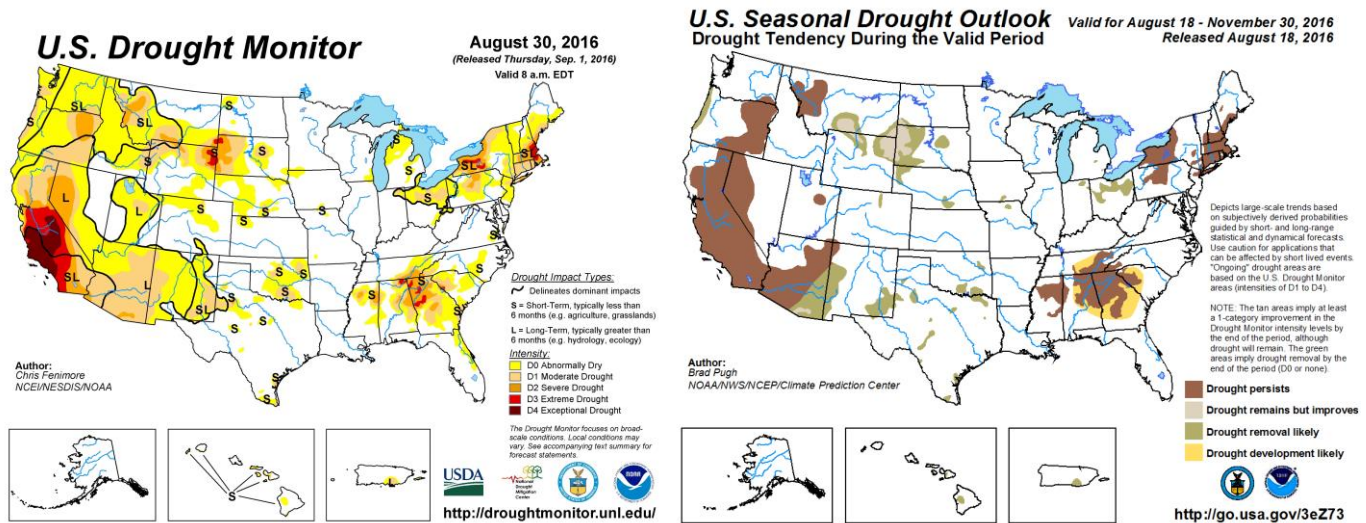


Figure 4 – Current US Drought Monitor and seasonal drought outlook.

La Niña Watch – Not much change from last month ... But would like to remind everyone this space has shifted from focusing on El Niño to paying more attention to potential La Niña developments. The shift to cooler surface waters in the tropical Pacific across the equator toward the central Pacific reflects the continued waning of El Niño and the developing La Niña conditions. Prediction models are in agreement that La Niña development is extremely likely by fall. If the transition into La Niña conditions by fall materializes, the western US would likely experience a colder and snowier winter. However, many forecasters are hedging their bets lower with moderate to minor La Niña development. But all forecasters are saying that we should not expect this La Niña to follow 'normal' conditions from the western to eastern US due to Arctic warmth. I will monitor this over coming months as there is some lead time forecasting that can come from knowing the combined conditions in the tropics and north Pacific (see below).

North Pacific Watch – Again some changes here, but not dramatic or straightforward. Warmer than average sea surface temperatures (SST) along the west coast in the North Pacific continue (Figure 4). While the warm pool has expanded from June/July to today, the magnitude and spatial extent of the warm waters has declined from the conditions seen during 2012-2015. The cooler than average conditions out over the central North Pacific also extends further east and covers a greater area than the last few years. The expansion of the warm pool in the North Pacific in August should support a warmer than average ending to the growing season, but there is some indication of early shifts in circulation coming off of Siberia that might bring earlier than anticipated fall troughing and low pressure systems across the North Pacific and into the PNW. We have seen some early evidence of this effect with some flip-flopping in the position of the North Pacific high pressure area. Long range forecasts are typically driven by conditions in the North Pacific and the state of ENSO in the tropics. If we continue to see a shift to cooler waters in the North Pacific AND the tropics continue to transition to La Niña, the western US will likely shift into a cooler regime, especially into the fall and winter.

How conditions in the tropical and north Pacific set up in the next 15-45 days will be the key in better understanding how the end of the season and winter will play out. As such I will monitor how it evolves over the next few months.

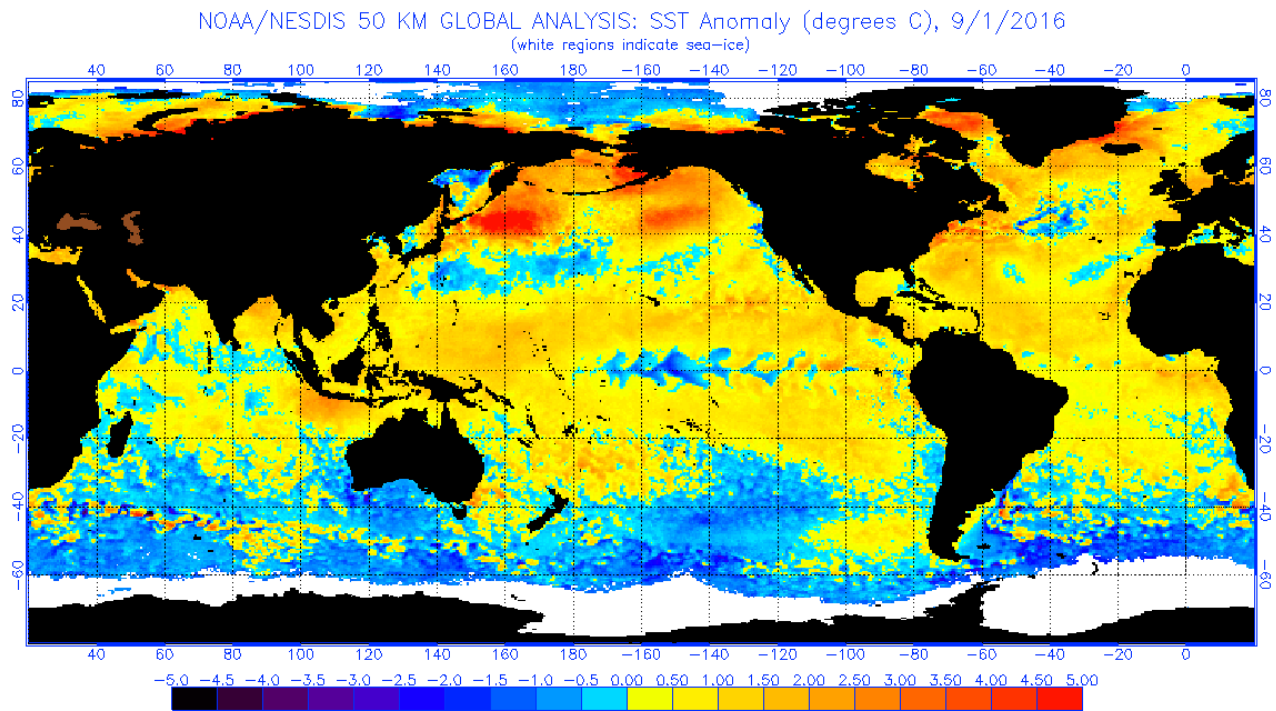


Figure 4 – Global sea surface temperatures (°C) for the period ending September 1, 2016 (image from NOAA/NESDIS).

Forecast Periods:

6-10 Day: Our Labor Day weekend and into next week is dominated by a shortwave trough that will spun off systems into the PNW and west. The conditions will result in relatively cool temperatures for this time of year, but is not likely to produce much in the way of precipitation (very isolated and likely confined to more northerly areas of Oregon, Washington and British Columbia). The 6-10 day outlook from the CPC reflects this pattern with a high likelihood for a warmer than normal period from southern Oregon into southern California and the western Great Basin. Western Washington in the inland PNW and the northern Rockies have a greater chance of being cooler than normal. The 6-10 precipitation outlook shows the northerly track of these early low pressure systems with higher than average rainfall likely in the far north of the PNW, with either more normal or slightly drier conditions south into Oregon and California.

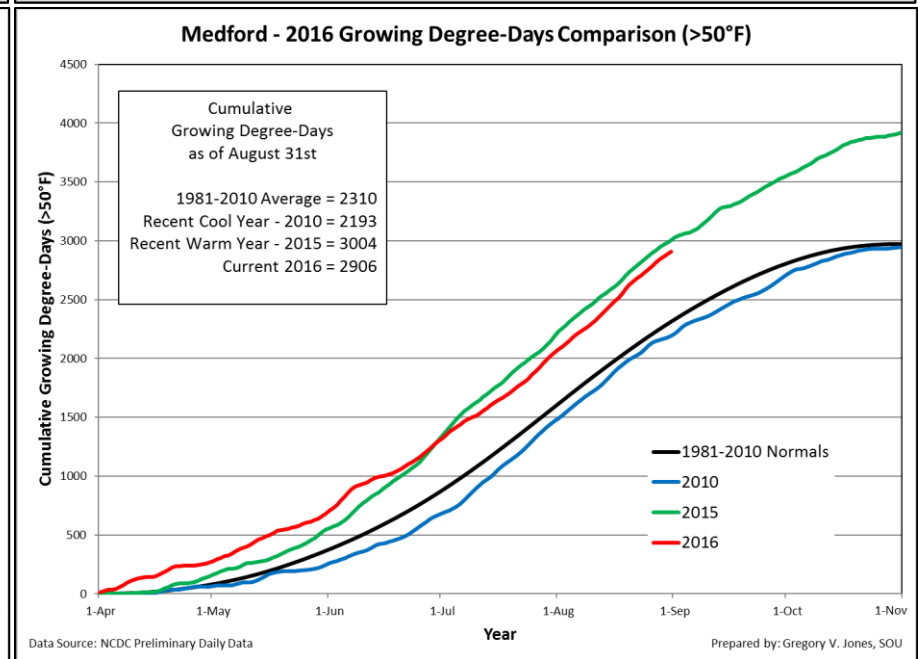
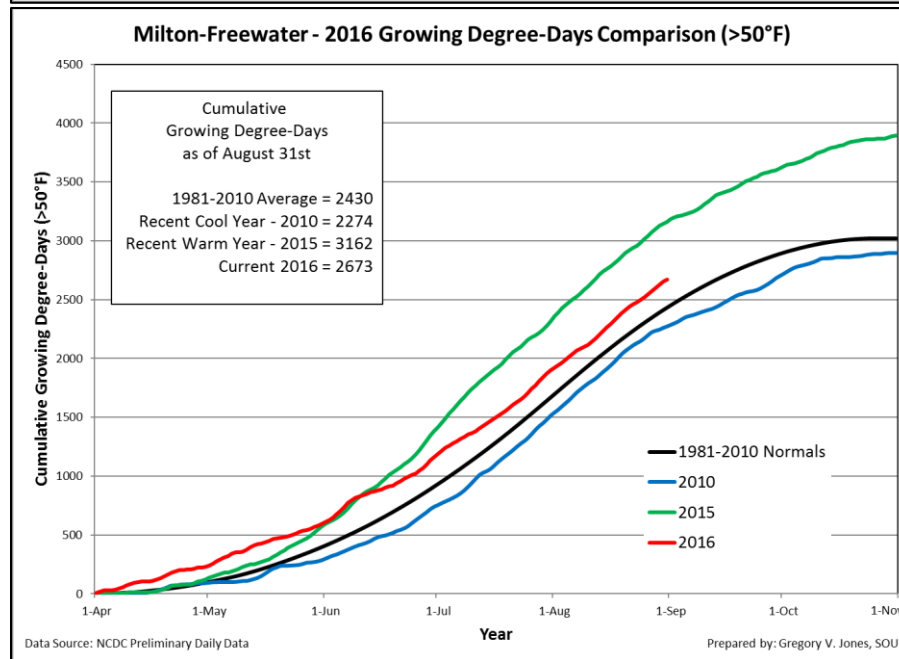
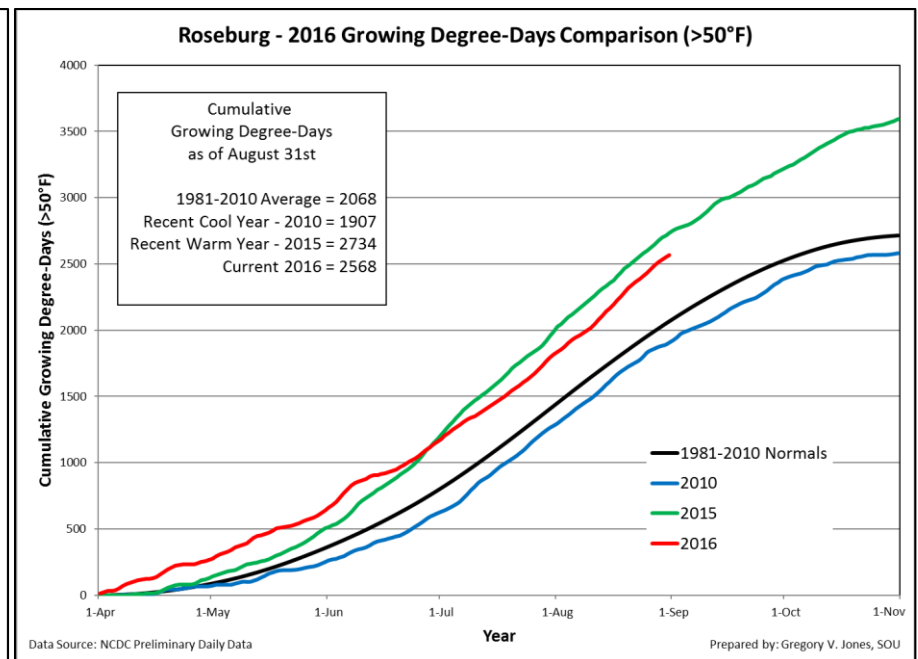
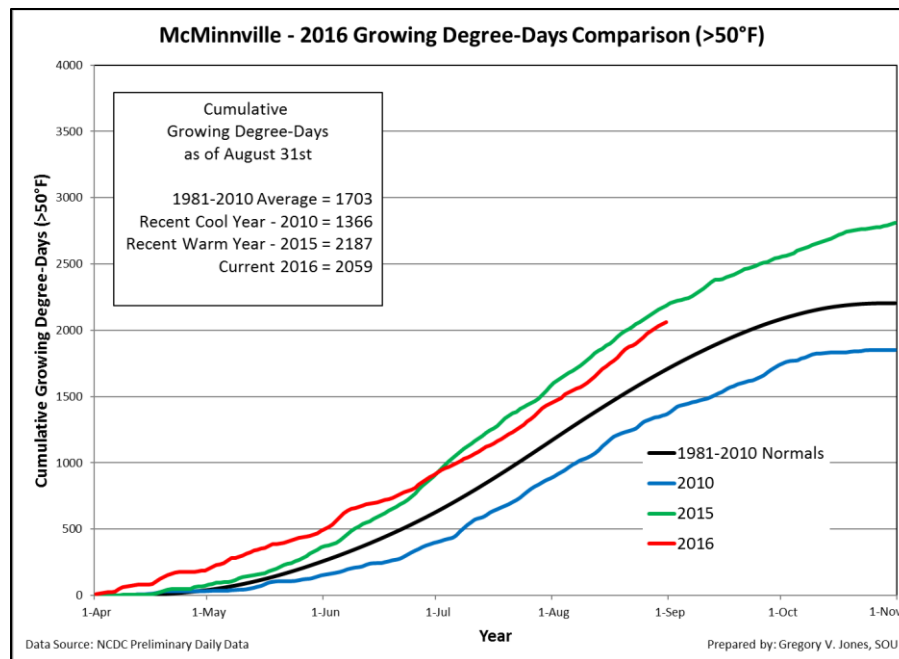
8-14 Day: Main shift from the 6-10 period is a warm up over most of the west that will bring conditions above normal into the middle of the month. The CPC outlook expands the likelihood of warmer than normal conditions from southern California into western Washington, and shifts the cooler than normal outlook into the Rockies. The precipitation forecast during this period shifts the entire PNW to having a higher likelihood of drier than average conditions while California and the southwest are likely to be closer to normal.

30 Day: Combining current conditions and the short outlooks above, the 30 day forecast for the month of September points to the month having a greater chance of warmer than normal conditions through the west (see Appendix Figure 2). The cooler pattern into the inland PNW and northern Rockies is forecast to likely continue throughout the month. Precipitation during the remainder of September is forecasted to below normal in Oregon, with the rest of the western US having an equal chance to be slightly above average, normal, or slightly below average (in other words there is nothing indicating anything other than normal September rainfall amounts).

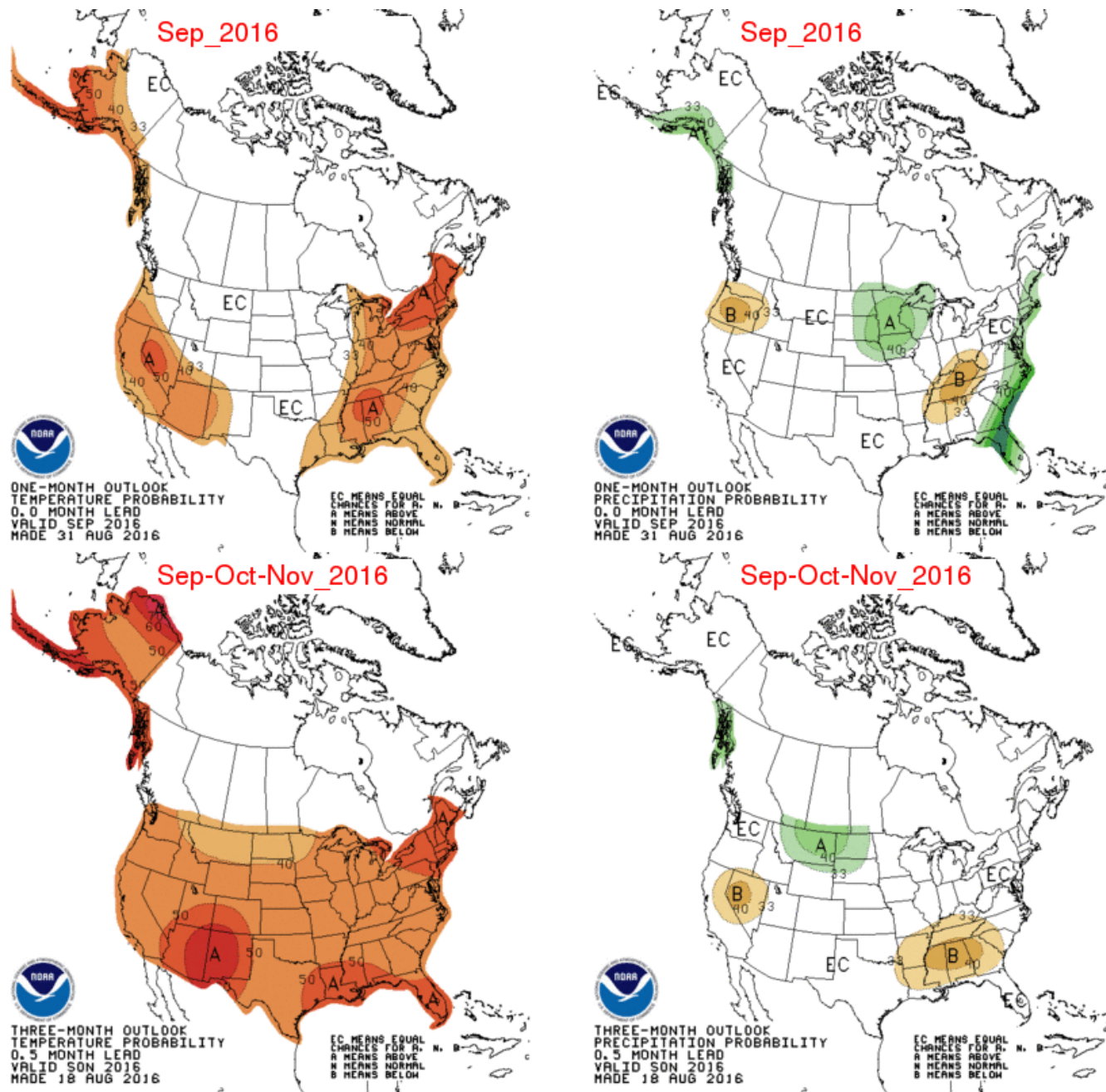
90 Day: The broken record continues from the majority of the forecast community with the September-October-November (SON) forecast pointing to the majority of the continental United States having elevated chances of well above average fall temperatures, according to the latest outlook from NOAA's Climate Prediction Center (see Appendix Figure 2). There are no substantial changes to the pattern in the western US with everywhere in California, Oregon, Washington and Idaho expected to see higher than normal temperatures. Like the temperature forecast, the precipitation forecast for the west does not change much from the September outlook, with much of the west forecasted to have an equal chance to be slightly above average, normal, or slightly below average, while portions of the Great Basin are forecasted to be drier than normal. However, it should be noted that some forecasters are calling for an early and stormy winter for the west that is forecast to start in mid to late October. As mentioned previously in the La Niña and North Pacific Watch sections, the SST and circulation developments over the next 15-45 days will be the key in better understanding how the fall and winter will play out.

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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 (2015) 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 September (top panel) and September, October, and November (bottom panel) (Climate Prediction Center, climate.gov).