Weather and Climate Summary and Forecast

Summer 2016

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Well here we are in July and it feels and looks like April! Interesting developments both in the month of June and now in July. June 2016 was a month of three swings, very hot early, very cool in the middle of the month and then near average toward the end of the month. The cool down in the middle of June is similar to what we are seeing right now over the western US, a rare low pressure area and trough bringing unseasonably cool temperatures and relatively rare rain for this period of the year. These two summer cool downs may have a link to the cooling off of North Pacific SST (see North Pacific Watch below). However, even with the cool down in June the month still ended up warmer than normal over the majority of the western US (Figure 1). Temperatures were generally 2-6°F above normal over the west, except in the Olympics and portions of eastern Washington and Oregon (Figure 1). In terms of precipitation, most of the coastal to intermountain valleys in California, Oregon and Washington all remained dry, while parts of Northern California and much of the southern Sierra Nevada mountains and portions of the desert SW were much wetter than normal (Figure 1). For the rest of the US, Texas and much of the southeast were wetter than average in June, while much of the eastern third of the country was near normal to slightly wetter than normal (not shown). Temperatures across the rest of the US in June were largely warmer than normal, except the Great Lakes into northern New England, and in Texas which was due to greater cloud cover than normal (not shown).

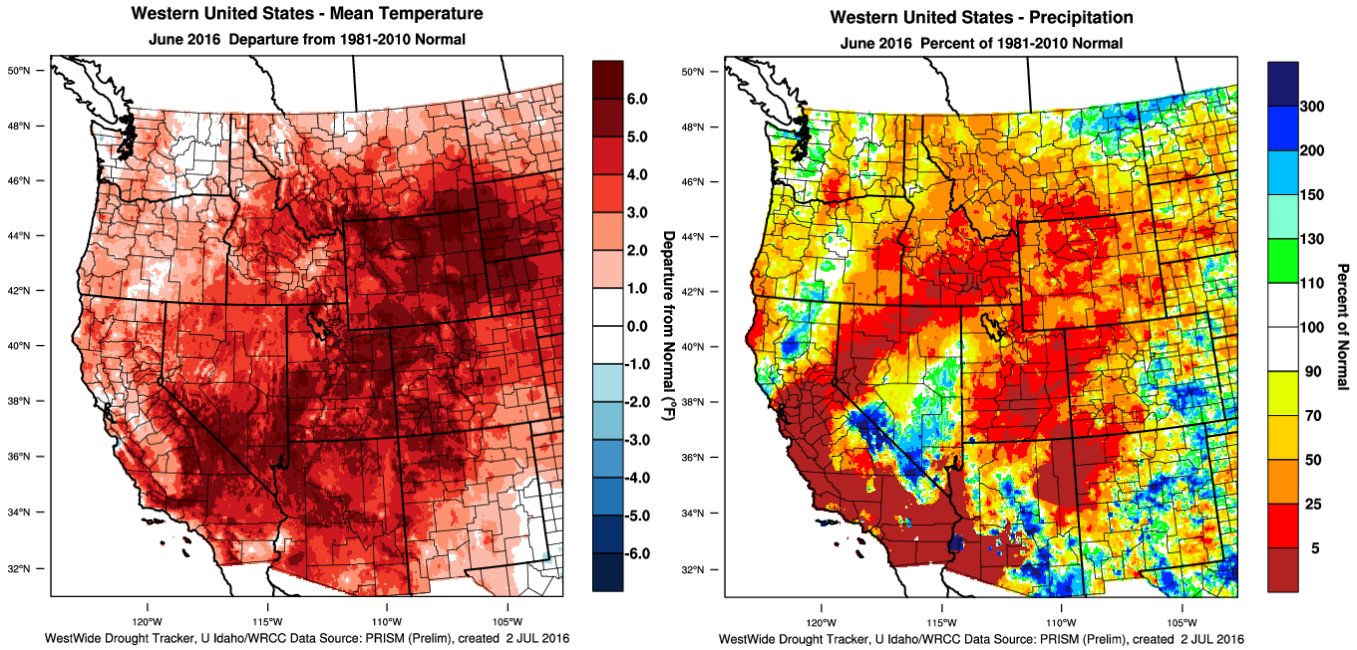

Figure 1 – Western US June 2016 temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

Cumulative conditions since the first of the year continue to show a largely warmer than normal western US with precipitation amounts mixed (Figure 2). Average temperatures for the period have run 1-5°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 up to 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 Texas and the middle Atlantic states (not shown). For 2016 precipitation amounts have been 90 to 150% of normal from Northern California across to Nevada and into much of the Washington and the 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 Gulf Coast states, while portions of the eastern US have been drier than average so far this year (not shown).

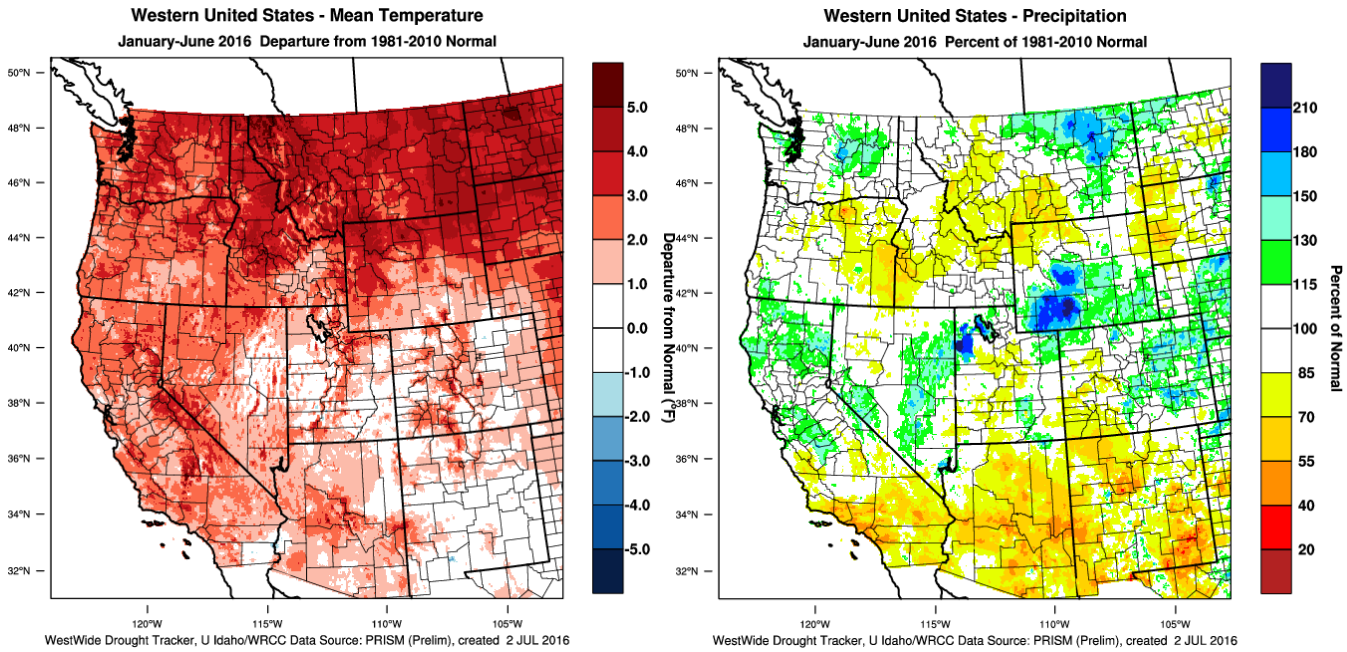

Figure 2 – Western US year to date (January through June 2016) temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

Following the general spatial temperature patterns in Figure 1 and 2, growing degree-days are higher than normal over most of the western portions of California, Oregon, and Washington (Figure 3; new data from the CIRC). January through June accumulations are running 100-500 units higher than the 1981-2010 normals throughout much of the western wine regions, with the exception of a portion of the North in California. While GDD accumulations are still running roughly 15-25 days ahead of the long term average, the cool down through the middle of June brought 2016 down to similar values seen the last two warm years (2014 and 2015) (see the Appendix Figure 1 for four locations in Oregon).

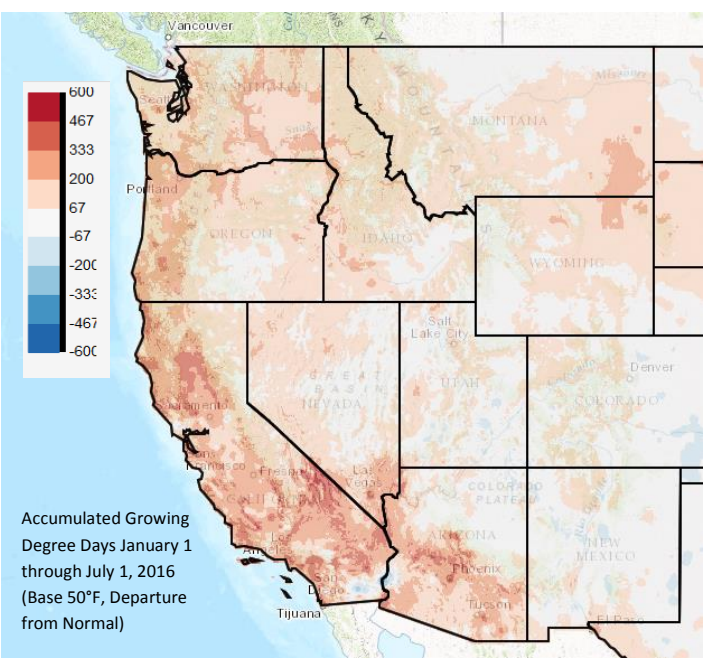

Figure 3 – Western US January through June 2016 growing degree-days departure from the 1981-2010 normals (image from Climate Impacts Research Consortium, University of Idaho).

Drought Watch – 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 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 Arizona, California and Nevada will likely persist through the end of August and beyond, while drought development is likely into the Pacific Northwest.

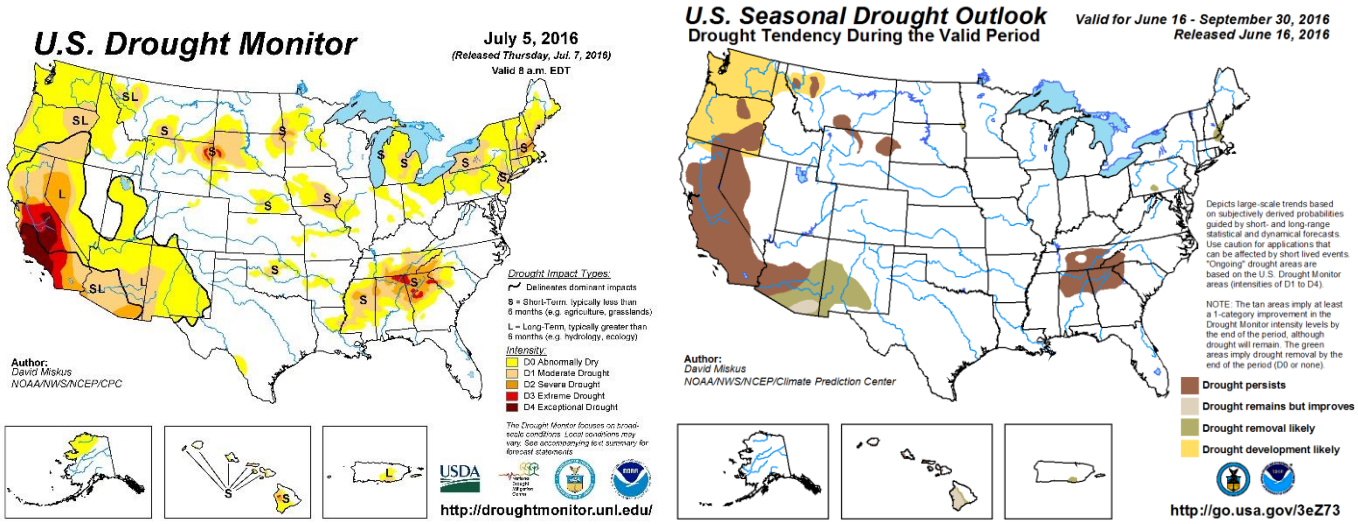

Figure 4 – Current US Drought Monitor and seasonal drought outlook.

La Niña Watch – Yes, you read correctly … 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. 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), but 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 warmer coastal waters along the west coast should help bolster a warmer than average growing season, especially higher minimum temperatures, but the cooler pool of water might be indicative of a slowing of this effect. My hunch is that the interesting June and now July trough conditions and slightly cooler air flow are a result of this shifting SST and the resulting circulation adjustments over the North Pacific. Long range forecasts are typically driven by conditions in the North Pacific and the state of El Niño 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. As such I will monitor how it evolves over the next few months.

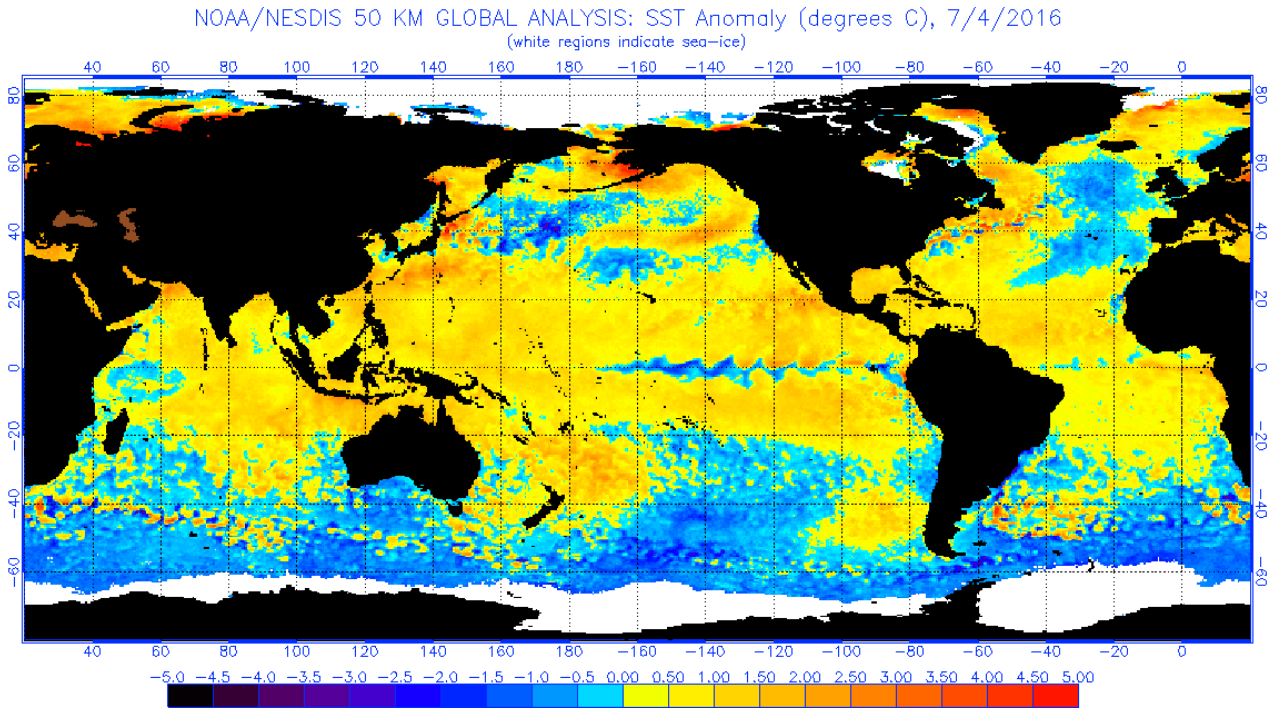

Figure 4 – Global sea surface temperatures (°C) for the period ending July 4, 2016 (image from NOAA/NESDIS).

Forecast Periods:

6-10 Day: The short term forecast is being driven by a rare break from heat in the month of July. A trough of low pressure that looks more like an April or May event will allow on shore flow and one or two frontal passages out of the Gulf of Alaska. The result is that temperatures during this period are forecast to be cooler than normal across the PNW, the Great Basin, northern Rockies and into much of California. Even with the low pressure area and moderate chances for rain across the PNW and California, the precipitation forecast for this period remains low overall. California and into the southwest is forecast to see normal to drier than normal conditions during this period.

8-14 Day: Similar to the 6-10 day forecast with the overall pattern driven by the lingering cool down in the western US and much warmer than average conditions throughout the vast majority of the rest of the country. Again this is very unusual temperature pattern for July. Precipitation forecasts into the middle of July have no clear indication, with likely normal conditions across the west.

30 Day: Once the unusual short term cool down ends mid-month (see above), the forecast through the rest of the month of July calls for warmer than average conditions through the western US with central to southern California having the greatest chance of much warmer than average conditions. Precipitation during July is forecasted to have an equal chance to be slightly above average, normal, or slightly below average for much of the west (in other words no evidence for the dynamics needed to drive summer precipitation at this point).

90 Day: The July-August-September (JAS) forecast continues the 30 day July forecast as given above. The majority of the continental United States has elevated chances of well above average summer 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 July outlook, with the west forecasted to have an equal chance to be slightly above average, normal, or slightly below average, while portions of the inland PNW are forecasted to be drier than normal. Precipitation

occurrence and accumulation over the next three months will be driven by increasing chances of warm season thunderstorms which are typically quite spotty, so amounts received will vary tremendously.

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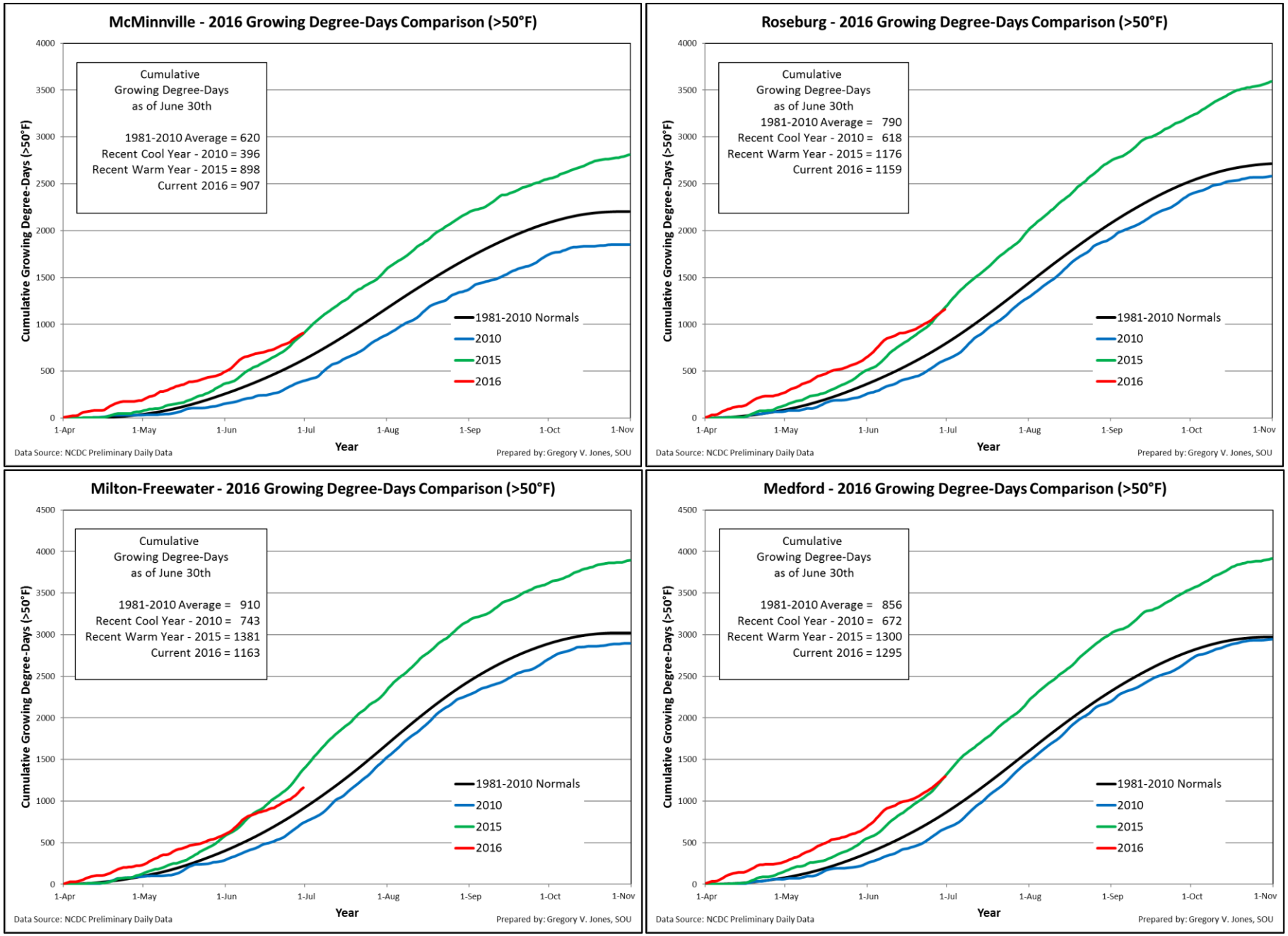
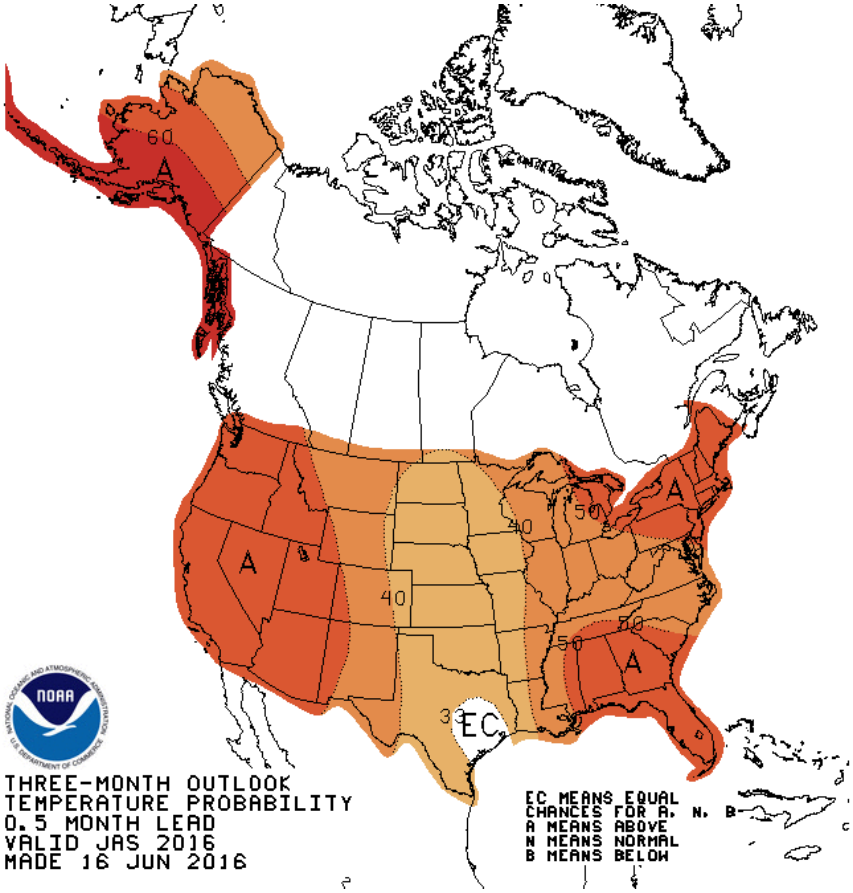
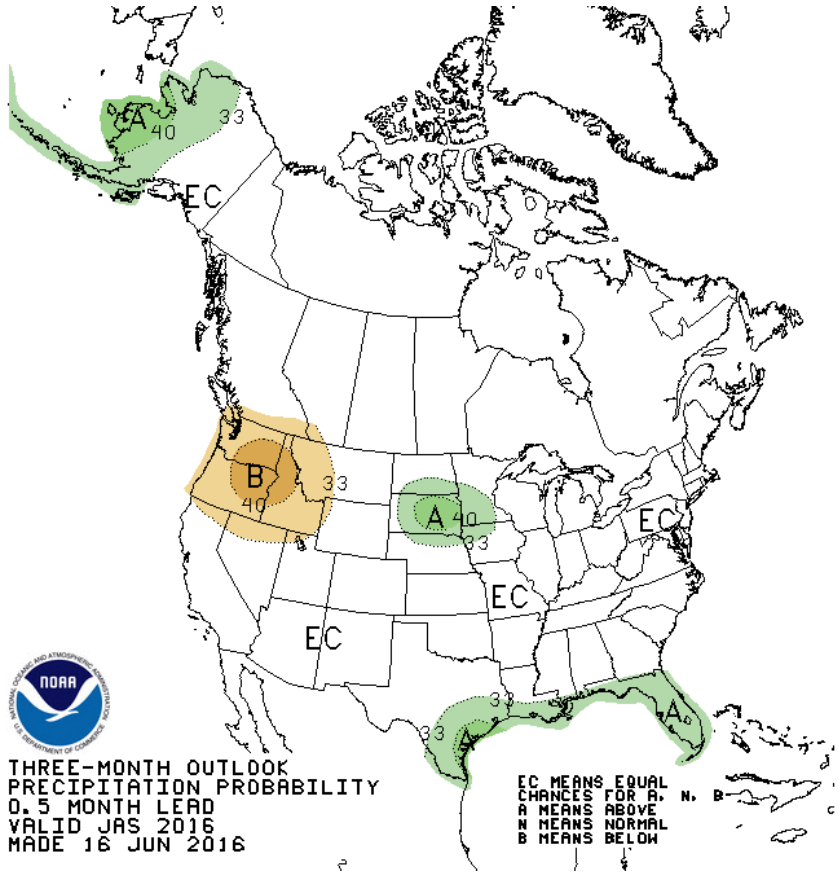


Appendix Figure 1 – Cumulative growing degree-days (base 50°F, no upper cut-off) for McMinnville, Roseburg, Milton-Freewater, and Medford, Oregon. Comparisons between the current year (2015) and a recent cool year (2010), a recent warm year (2015) and the 1981-2010 climate normals are shown (NCDC preliminary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





Appendix Figure 2 – Temperature (left panel) and precipitation (right panel) outlooks for July, August, and September (Climate Prediction Center, climate.gov).