

Weather and Climate Summary and Forecast Spring 2017

Gregory V. Jones
Southern Oregon University
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Cool and relatively wet conditions continued throughout the western US in April. The general pattern in temperatures in April was cooler than normal from central California eastward to Utah and northward into nearly all of Oregon, Washington and Idaho (Figure 1). Temperatures in this area were 0.5-3.5°F below normal while southern California across the desert SW remained above normal. The cool conditions throughout the PNW and even California have slowed bud break and spring growth to average conditions compared to the past few years. Fortunately, to this point there has been little to no frost pressure, unlike the devastating events of late April throughout much of Europe. For the rest of the United States, the northern Great Plains were near normal to cooler than normal, while the rest of the south, southeast, Great Lakes, and east coast were 2-5°F warmer than normal (not shown).

Following on what seems like endless wet conditions, April did not provide a break bringing 110-150% of normal precipitation from central California, the PNW and across into the northern Rockies (Figure 1). An abrupt transition was seen moving into southern California into the desert southwest with conditions 5-25% of normal. Precipitation amounts nationwide were quite variable with drier than normal areas across the Great Plains, central Texas, the southeast, and especially Florida, while portions of the Great Lakes, the Ohio River valley and the Carolinas were much wetter than normal for the month (not shown).

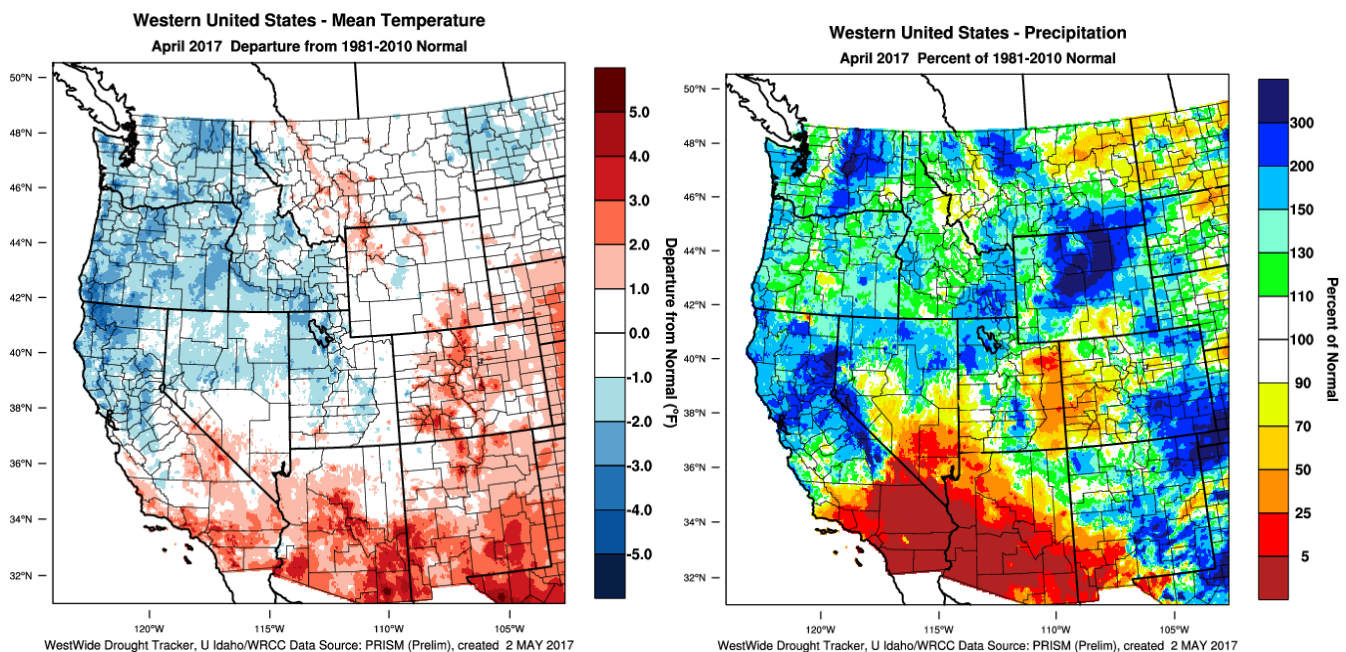


Figure 1 – Western US April 2017 temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

The cold winter has continued into the spring with the first four months of 2017 resulting in very cold conditions across the PNW with observations running 1-5°F below normal. The core of the coldest area continues to straddle the Columbia Valley into eastern Washington and eastern Oregon (Figure 2) while central to northern California and Nevada have experienced slightly below average to slightly above average temperatures. The desert southwest, Rockies and Four Corners region has been warmer than average and this pattern continues eastward with much of the country running substantially warmer than average (2-6°F above normal; not shown). Florida and Maine are the only other areas near normal. The first four months of 2017 has been wet throughout much of the west with the

bullseye in California and the Sierra Nevada Mountains across into the Northern Rockies and the PNW (Figure 2). Nationwide wetter than average conditions for the year have occurred in the Great Lakes through the Missouri Valley and then south into Texas, while the southeastern US and Mid-Atlantic areas were drier than average (not shown).

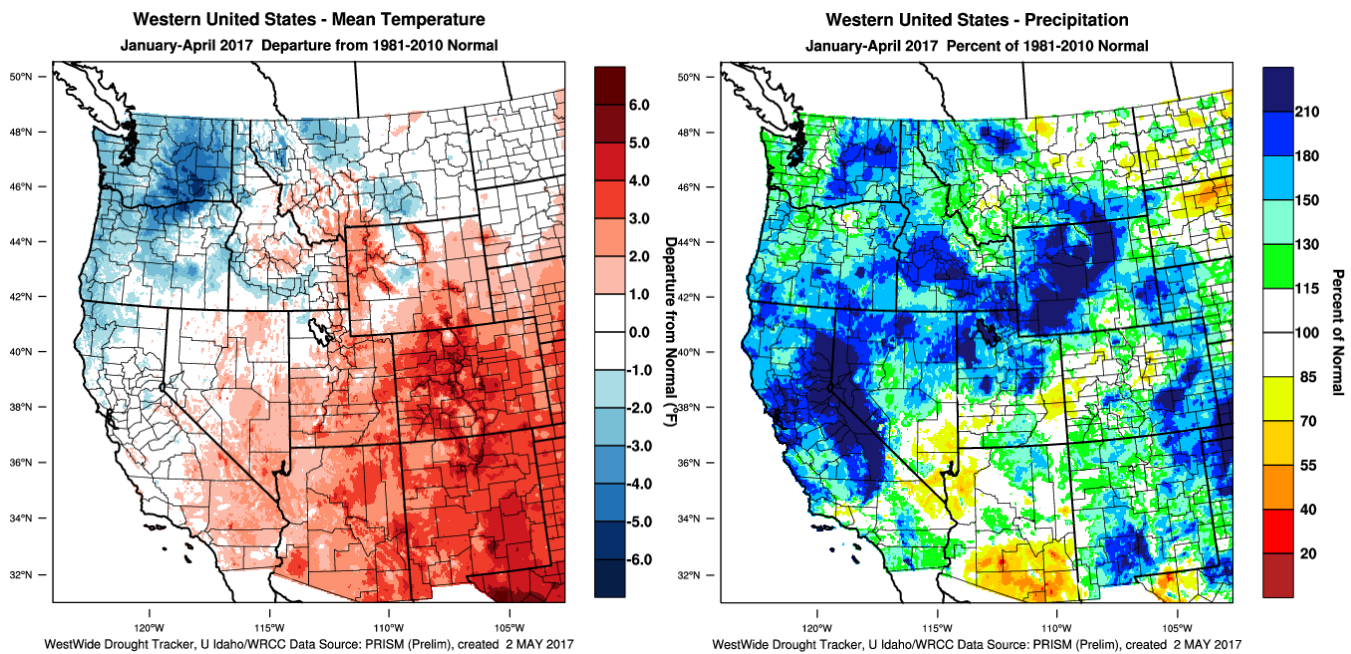


Figure 2 – Western US January-April 2017 temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

Following the general spatial temperature patterns in Figure 1 and 2, growing degree-days are near normal to below normal over most of the western portions of California, Oregon, and Washington (Figure 3; data from the CIRC). January through April accumulations are running right at the 1981-2010 normals throughout much of the western wine regions, with the exception of warmer areas in central to southern California and cooler areas in eastern Washington and Oregon. GDD accumulations for four locations in Oregon have started out right at the 1981-2010 normals for this period (see the Appendix Figure 1 for four locations in Oregon).

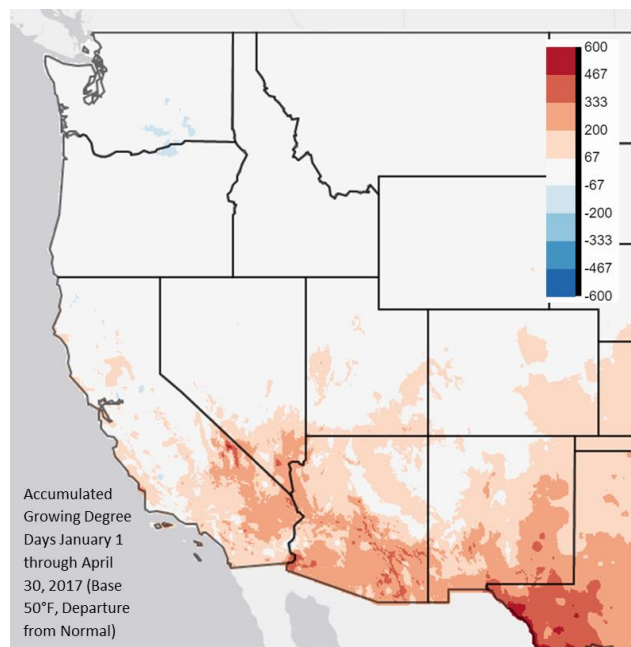


Figure 3 – Western US January through April 2017 growing degree-days departure from the 1981-2010 normals (image from Climate Impacts Research Consortium, University of Idaho).

Drought Watch – Drought conditions continue to decline in the west (Figure 4). The most recent Drought Monitor shows some remnant areas of coastal Central to Southern California still experiencing dry conditions and now considered moderate or abnormally dry. A very wet April removed almost all of the drought conditions in Oklahoma and the Ozarks, while drought conditions in the southeast and Florida have intensified (Figure 4, left panel). The US seasonal drought outlook (Figure 4, right panel) forecasts that some areas in southern California and Arizona will likely see drought persist in the mid-summer or later. Drought development and persistence is likely in the southeast, Florida, while drought conditions elsewhere in New England, Colorado, Kansas, and Oklahoma are likely to be removed.

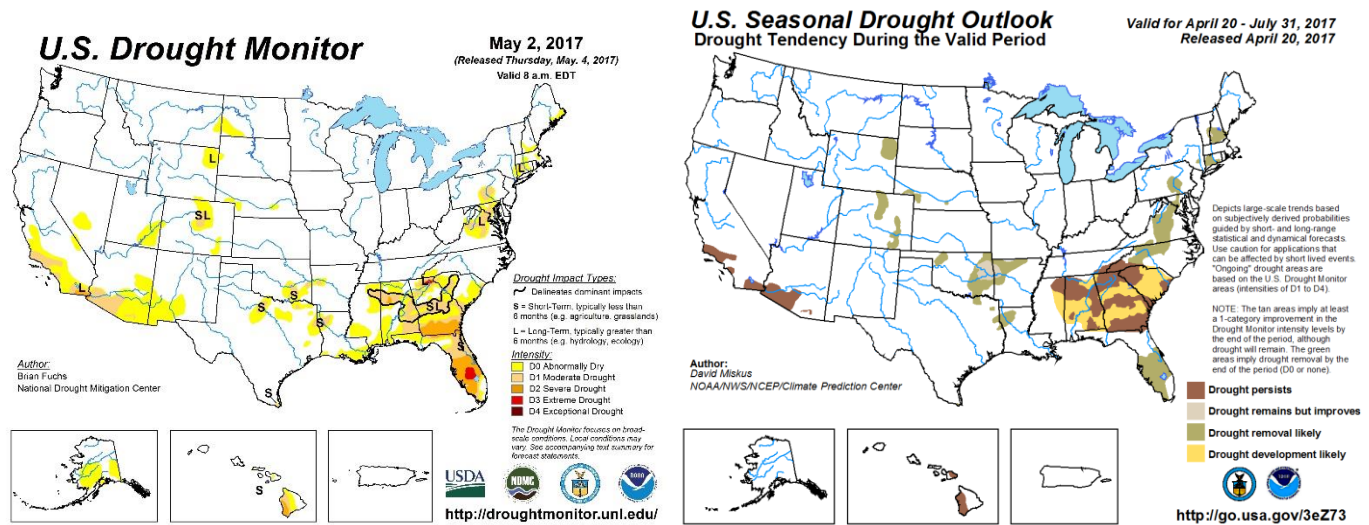


Figure 4 – Current US Drought Monitor and seasonal drought outlook.

ENSO Watch – Updates on ENSO from governmental agencies have not been released as of this report, but the tropical Pacific remains close to neutral conditions where the equatorial sea surface temperatures (SSTs) are near average to slightly above average across the central and east-central Pacific. However, the main core of the ENSO monitoring region in the eastern Pacific Ocean (near Central and South America) has continued to warm (Figure 5) likely leading to El Niño development in the summer and fall. Neutral conditions tend to mean that there is little tropical influence in mid-latitude weather. Statistically, neutral conditions in the tropics would slightly favor the next few months to be warm and dry across the southern half of the US; wet and cool to cold in the north (see forecast periods below and Appendix Figure 2). If the models and forecast agencies are correct in their call for El Niño conditions (warmer than average tropical SSTs) to develop by summer or early fall, we will likely see some transition to overall warmer and moister conditions in the Tropical Pacific sector. These conditions can warm the western US slightly but need to be considered along with the North Pacific conditions (see below). I will continue to watch these models over the next month or two to get a read on potential influences to ripening periods across the west.

North Pacific Watch – Cooler than average ocean temperatures in the Gulf of Alaska and eastern North Pacific continue, although the magnitude and spatial extent has declined from recent months (Figure 5). Sea surface temperatures (SST) in this area are at 3-4°F cooler than average and 5-8°F cooler than last year at this time (note figure is in °C). Surface waters in the central North Pacific have warmed, as have surface waters across the 20-40°N latitude band. While the north-south pattern of cold and warm surface waters is likely adding to the energy of the atmospheric circulation over the North Pacific, the warming points to a potential shift over the next few months. I continue to feel confident enough that the current PDO-ENSO conditions would continue to favor a relatively cool PNW into Northern California and a moderately dry and slightly warmer than normal southern California extending across the desert southwest. These conditions are evident in the forecast periods below. Also of note that our winter/spring flow of the mid-latitude westerlies has produced a pattern of troughing in the west (cool/wet) and ridging in the east (warm/dry), but also the conditions that ushered in early vine growth in Europe followed by devastating frosts in many wine regions. Climate scientists are pointing to enhanced warming in the Arctic leading to

a weaker temperature gradient between the tropics and the poles, resulting in more occurrences of a wavy, amplified jet stream capable of producing more extreme weather in the mid-latitudes.

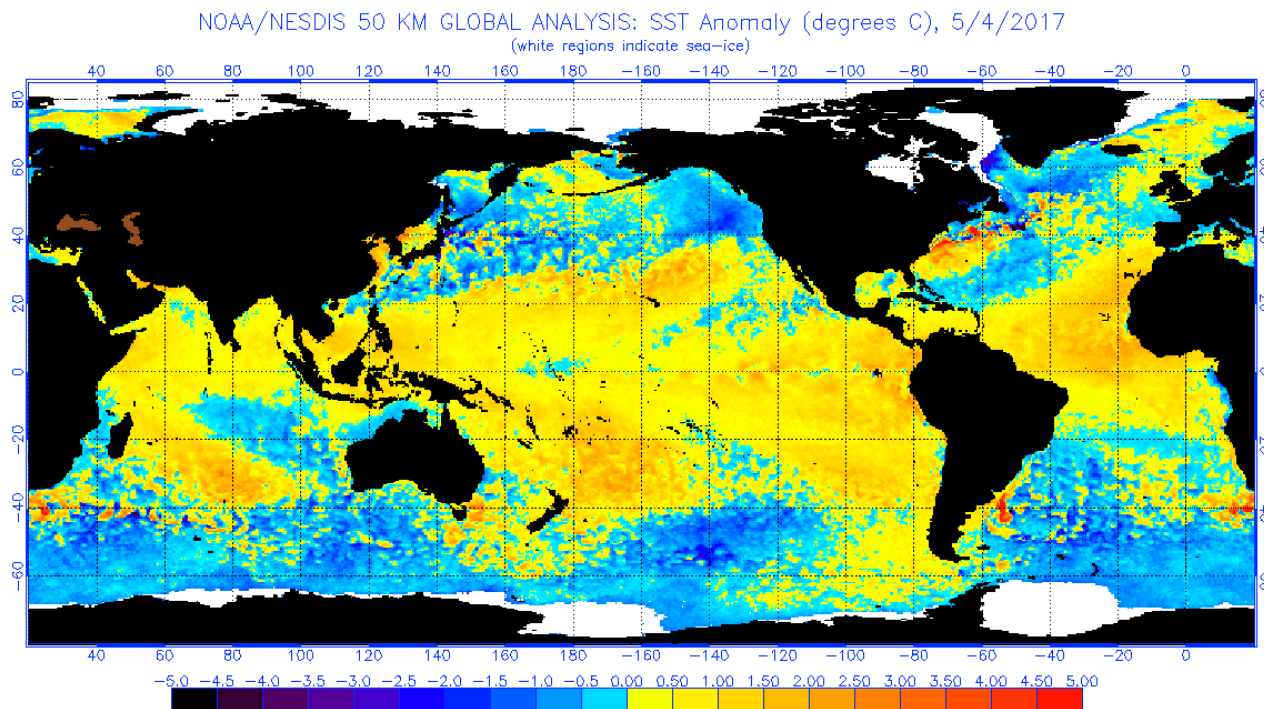


Figure 5 – Global sea surface temperatures (°C) for the period ending May 4, 2017 (image from NOAA/NESDIS).

Forecast Periods:

6-10 Day (valid May 15-19): The current warm period will give way to temperatures that drop rapidly to below normal conditions through the forecast period. Cool and occasionally wet weather will continue into next week as upper level troughing of the atmosphere will control west coast weather. The entire western US to the Rockies is forecast to have a greater than average chance for cool conditions, with frost potential not expected unless there are clearing skies after one of the troughs passes. The rest of the US has a high likelihood of warmer than average conditions over this same period. In term of precipitation, the PNW and northern Rockies are likely to see wetter than normal conditions through mid-month while central to southern California and the desert southwest are likely to be drier than normal. Areas east from the Gulf Coast to the Great Lakes are likely to be drier than average during this period.

8-14 Day (valid May 17-23): Broad cool pattern in the forecast shifts slightly eastward but does not change much from the 6-10 day period. The core of the cooler than average conditions will center over the Rockies with conditions cold enough for frost. West coast wine regions will likely stay cooler than average, but frost is hit or miss depending on the transitions from troughs to ridges and clearing skies. From the Rockies eastward the bulk of the rest of the country will likely see much warmer than average conditions. Conditions also continue to be favorable for a wetter than average period for the PNW, Rockies and into the heartland while the east coast remains relatively dry.

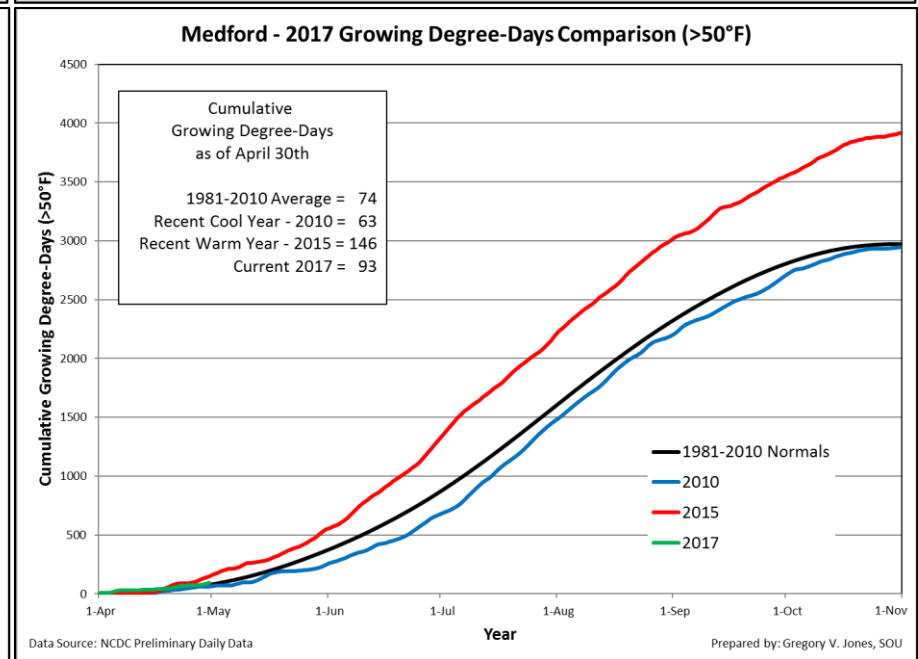
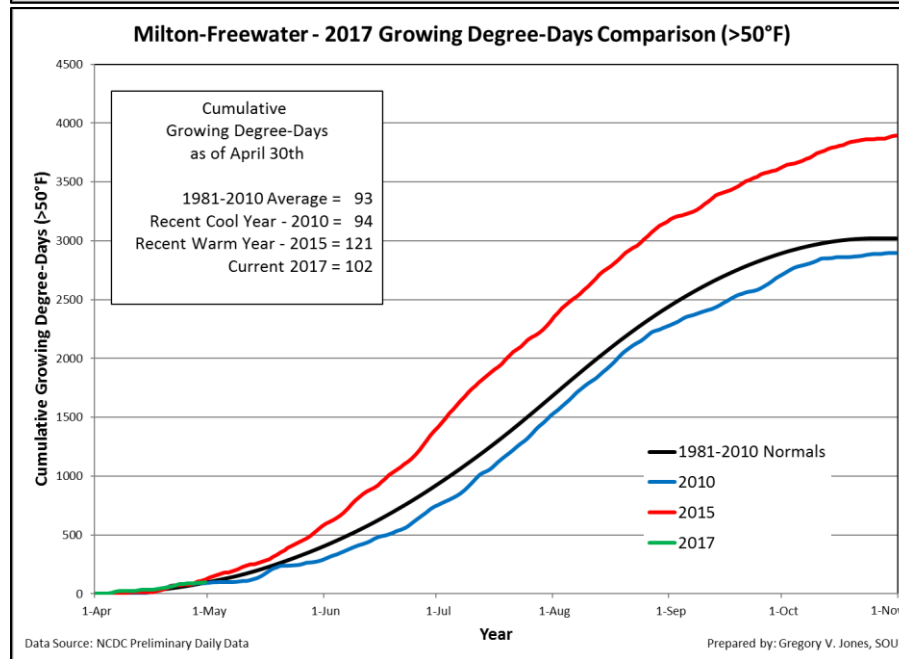
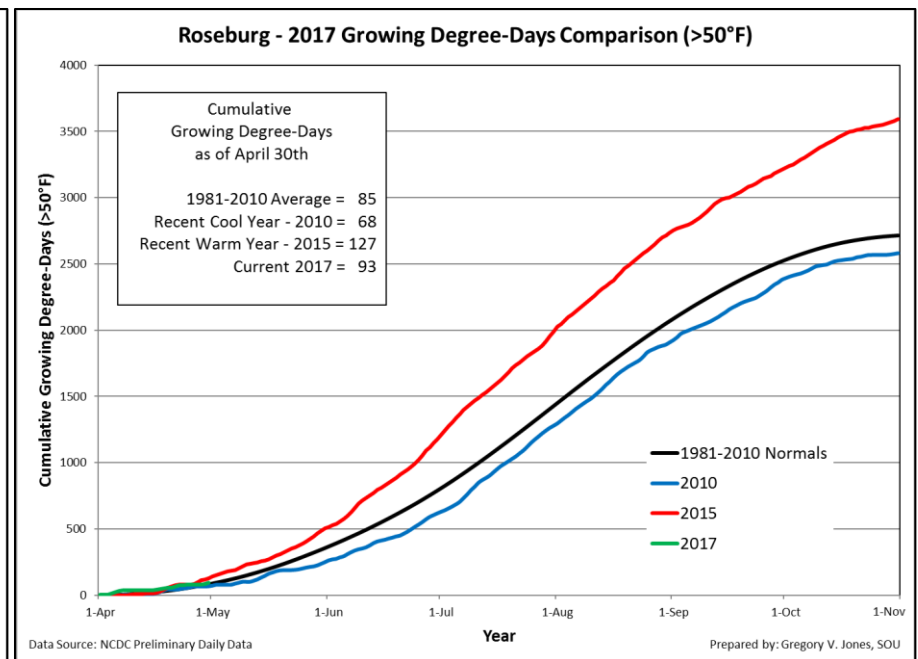
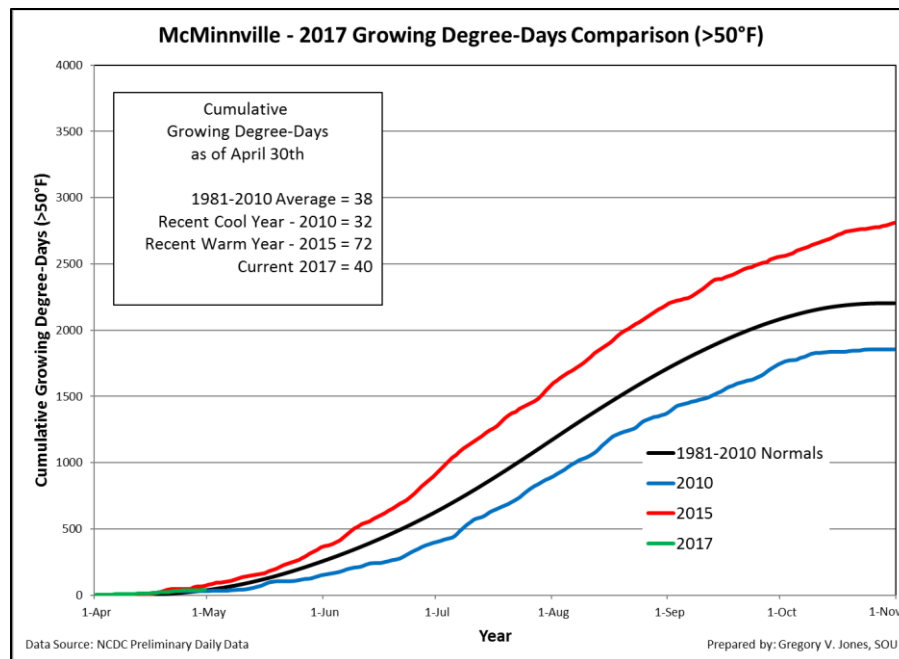
30 Day (valid May 1-31): The forecast for the month May (see Appendix Figure 2) for central California and the PNW is for an equal chance of being slightly above to slightly below normal temperatures by the time the month is over. Warmer conditions are likely to build in the desert southwest and southern Rockies. Warmer than normal conditions are forecasted along the Gulf Coast and into Florida while the Ohio River valley and the Great Lakes will likely be cooler than average. The precipitation forecast for May is very mixed across the US with most of the west forecasted to be near normal, with the exception of coastal northern California and Oregon with greater odds of being drier than normal. The Rockies will likely see above average May precipitation while the Great Plains is forecasted to be below

average and the Gulf Coast up into New England has a higher likelihood for a wetter than average month (see Appendix Figure 1).

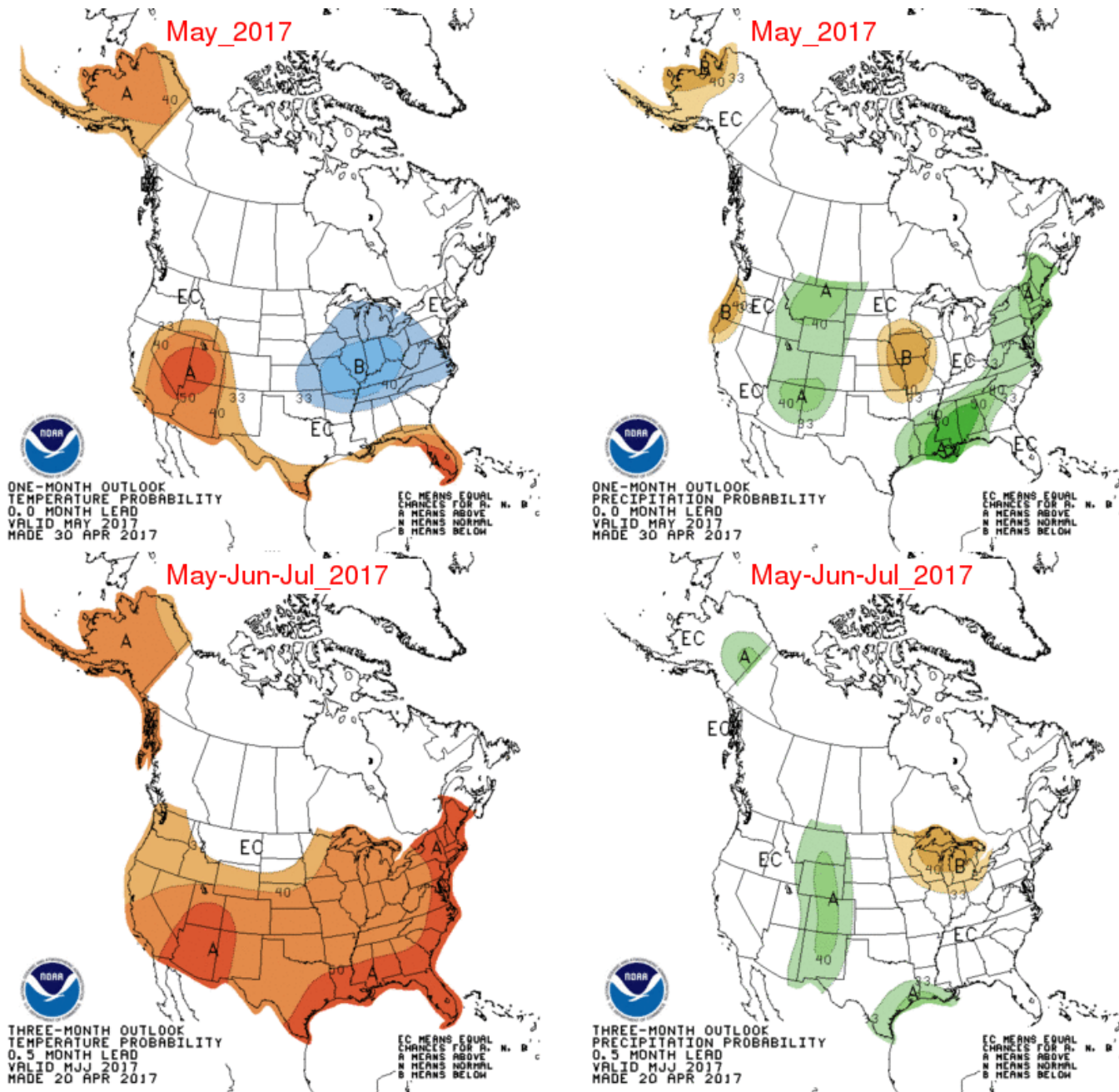
90 Day (valid May-June-July): The forecast for May-June-July (MJJ) from the CPC continues to point to a warm up into the summer. The bulk of the country has an above average chance of being warmer than normal with the desert southwest, Gulf Coast and east coast likely seeing the warmest conditions. The PNW and northern Rockies are forecast to have a lower chance of being warmer than normal and even pointing to an equal chance of seeing slightly above to slightly below average temperatures (NOAA's Climate Prediction Center, see Appendix Figure 2). In other words, this region will likely see close to normal spring into summer temperatures. The MJJ precipitation forecast for the west coast is holding to average conditions, or in other words seasonally dry. The Rockies have a small chance of being wetter than average, while the Great Lakes are forecasted to be drier than average and the rest of the eastern US has no clear signal and is forecast for an equal chance to be slightly above average, normal, or slightly below average precipitation (see Appendix Figure 2).

Gregory V. Jones, PhD
Environmental Science and Policy
Southern Oregon University
1250 Siskiyou Blvd
Ashland, OR 97520
541-552-6758
gjones@sou.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 May (top panel) and May, June, and July (bottom panel) (Climate Prediction Center, climate.gov).