Weather and Climate Summary and Forecast

Winter 2016-17

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What a difference from last year at this time. Temperatures in January and February 2016 were 2-6°F above normal across the west while January 2017 ushered in one of the coldest winter months in a while, especially across the PNW and northern Rockies (Figure 1). While portions of the Four Corners region had slightly above normal temperatures in January, the rest of the west was 1-8°F below normal, with areas in the PNW across into the northern Rockies experiencing average temperatures 10°F below normal or more. Largely a result of some bitterly cold air out of North America and the Arctic, the month saw nearly three weeks where daily departures were 20-35°F below average in the interior PNW and northern Rockies.

January precipitation amounts continued the wetter than average conditions in California, across the southwest and into the Rockies (Figure1) with areas seeing 110 to over 300% of normal for the month. The greatest amounts were seen throughout the Sierra Nevada mountains and into the Great Basin where some areas reported as much as 500% of average snowfall. The month also saw unexpectedly dry conditions from central Oregon north into Washington and across the Northern Rockies (Figure 1). Much of this area saw 50-70% of the normal precipitation for the month, although much of it occurred as snow and/or freezing rain.

Nationwide January ended with a complete flip flop in terms of temperatures. While much of the west was colder than normal, from the Four Corner across to Texas and north throughout the Plains and the entire rest of the eastern US, temperatures were 1-8°F above normal (not shown). Precipitation amounts nationwide were mixed with drier than normal areas in the PNW, northern Rockies, the Ozarks, and south Florida. Wetter than average areas extended from California east across the Four Corners and into the southern Plains, Texas and the southern Gulf Coast (not shown).

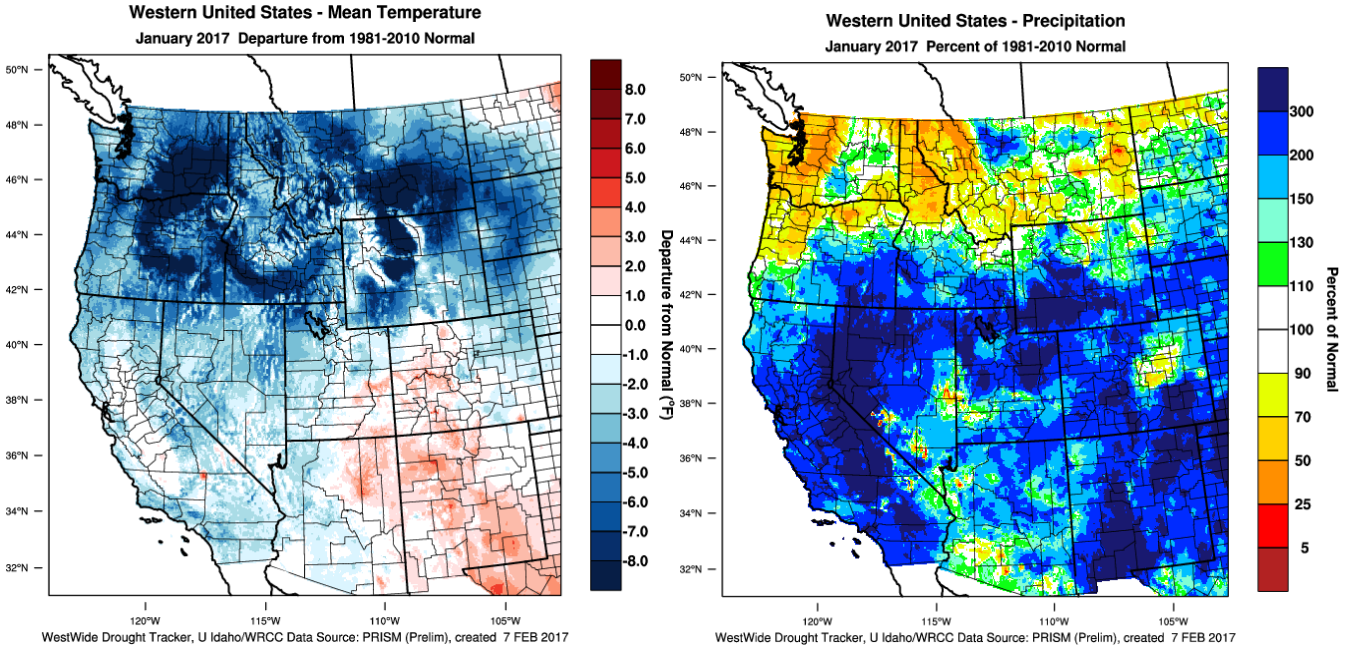

Figure 1 – Western US January 2017 temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

Drought Watch – The most recent Drought Monitor brings some dramatic changes from the past few years. While drought conditions continue in Central to Southern California, in Oklahoma, across New England and the southeast, the overall extent and intensity of the drought conditions as lessened in each area (Figure 2). For the western US the big change is the lowering and even removal of drought conditions. The west has seen nearly a 40% reduction in the area under moderate to severe drought, while California has seen a 60% reduction in the area in extreme to exceptional drought. The US seasonal drought outlook (Figure 2) forecasts that additional areas in California will likely see drought removal likely, some areas will remain in drought but improve overall. Similar changes are seen for the drought areas of the southeast and New England, while drought conditions in Oklahoma and the Ozarks are likely to persists and/or intensify.

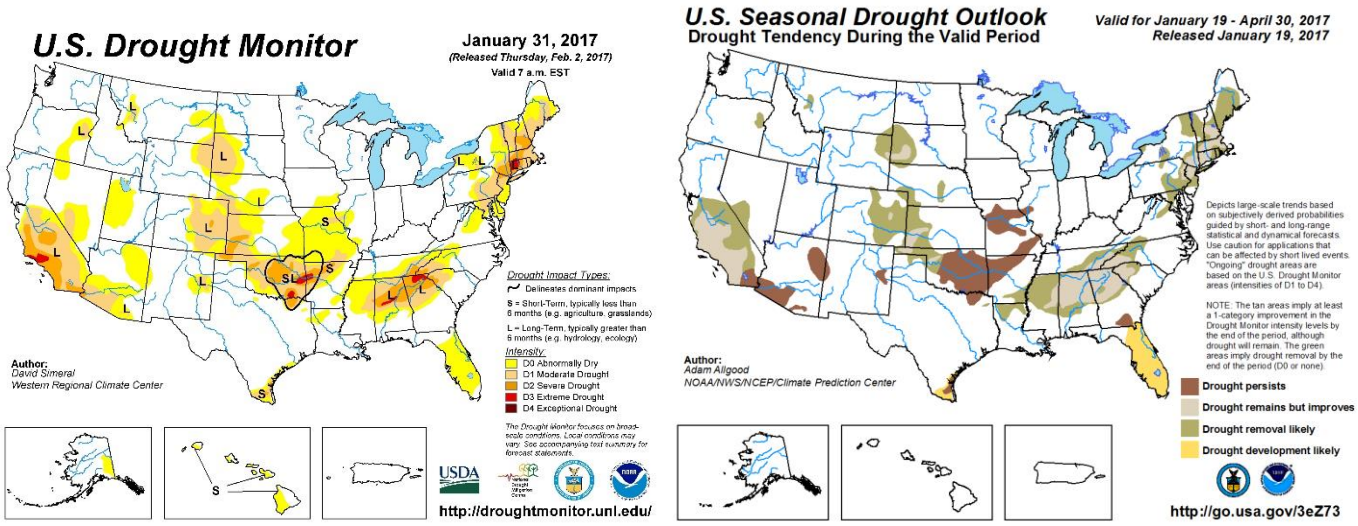

Figure 2 – Current US Drought Monitor and seasonal drought outlook.

La Niña Watch – As of this report agencies have not released an update on the conditions in the Tropical Pacific and the moderate to weak La Niña. However, the general patterns of SST temperatures in the tropics continue to favor a weak La Niña transitioning to neutral conditions in spring or early summer. The PNW continues seeing the cold and relatively wet conditions that are typical signs of a La Niña winter. The main difference from a typical La Niña winter is that more moisture continues to reach further south into California and even into the desert southwest than what is normally seen. If the forecasted La Niña to neutral conditions hold true, the statistical forecast would 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 1). However, as mentioned here previously, conditions in the North Pacific have already and will likely continue to play a more prominent role for our winter (see below).

North Pacific Watch –Considerable cooling continues in the North Pacific (Figure 3). Sea surface temperatures (SST) show cooler than normal waters extending from just off Japan all the way to the west coast of the US. This region has seen the SST cool over 5°F during the past 12 months while just south of the cooler waters is a band of warmer than normal water. Cooler waters in the North Pacific are tied to the positive phase of the Pacific Decadal Oscillation or PDO, a large-scale, long-term climate variability mechanism in the North Pacific Ocean that is closely associated with El Niño-La Niña cycles. The current conditions show a North Pacific that is slightly out of phase with the Tropical Pacific, but much cooler than anything we have seen over the last decade or so. There is little historical analog to the current conditions, but given the extent and magnitude of the cooling in the North Pacific and a weak La Niña I would continue to expect a relatively cool to cold and wet PNW into Northern California and a moderately dry and slightly warmer than normal southern California extending across the desert southwest. The cooler SST off the west coast and out into the North Pacific would point to a greater chance for a cool and late spring.

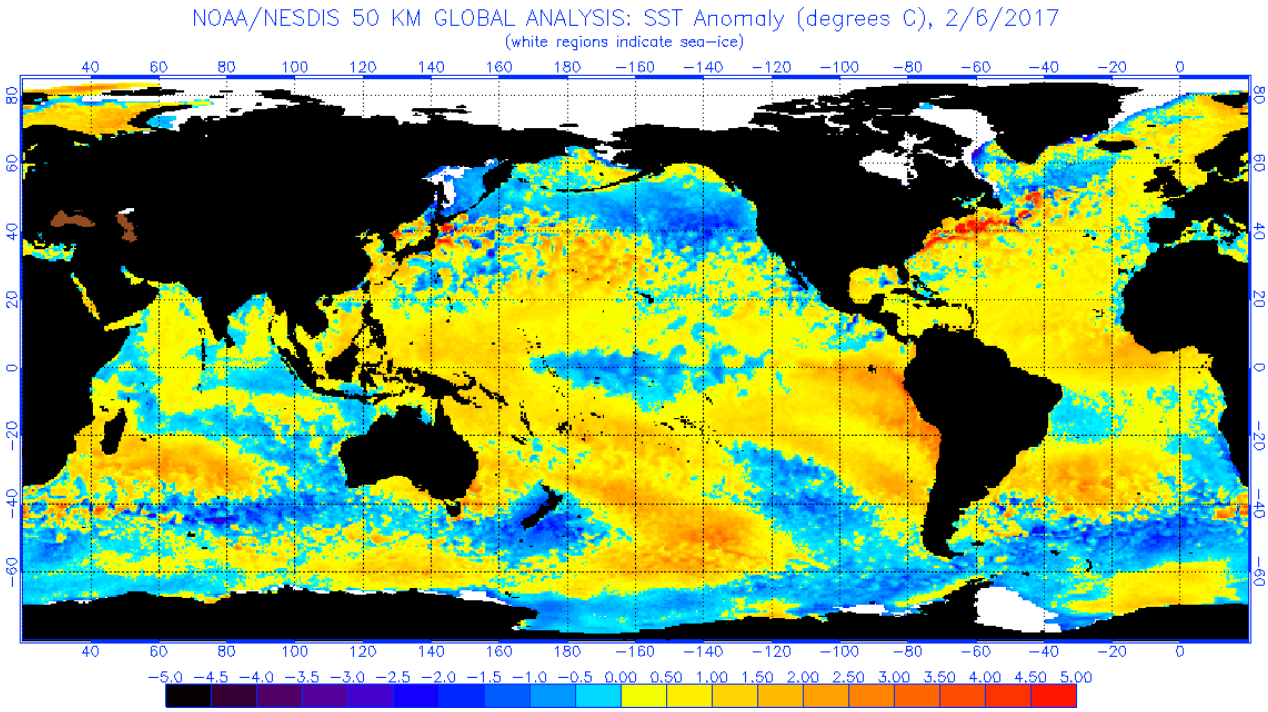

Figure 3 – Global sea surface temperatures (°C) for the period ending February 6, 2017 (image from NOAA/NESDIS).

Forecast Periods:

6-10 Day (valid Feb 12-16): A February thaw is forecast over the 6-10 day period with the majority of the country likely to experience warmer than normal conditions. The exception in the interior PNW where temperatures are forecast to be normal to slightly below normal. For precipitation, the forecast through the middle of the month is calling for a drier period throughout much of the western US and across the Rockies and into the Plains states. The extreme northwest of Washington and into British Columbia are forecast to be wetter than average as is the Gulf Coast and up into New England.

8-14 Day (valid Feb 14-20): Temperature forecast carries forward from the 6-10 day period with the bulk of the country with a greater likelihood of being warmer than normal. The interior PNW forecast remains on the normal to cool side and New England will likely shift to much cooler than average. The 8-14 precipitation forecast calls for the west to shift from dry in the 6-10 day to wet with California likely seeing the main core of the precipitation. For the rest of the US the Great Lakes into New England are forecast dry during this period while the Gulf Coast is forecast to be wetter than average.

30 Day (valid Feb 1-28): For the majority of the US the 30 day forecast for the month of February points to a warmer than average period. The desert SW and into the Four Corners has the greatest chance of being warmer than average while the northern tier of states has a slightly lower chance of being warmer than average (see Appendix Figure 1). The precipitation forecast for February calls for the PNW to end up wetter than average. The pattern for a wetter month extends across the northern Rockies and into the Great Lakes. A portion of the desert SW and into Texas are forecast to be drier than average for the month, while central to southern California across the central Rockies, through the Mississippi River valley and into the southeast and into New England have an equal chance of being slightly above to slightly below (see Appendix Figure 1).

90 Day (valid Feb-Mar-Apr): The long lead forecast for February-March-April (FMA) from the CPC continues the general conditions from the previous 90 day forecast. Namely a cooler than average northern PNW across the northern Rockies and into the northern Plains and western Great Lakes (NOAA's Climate Prediction Center, see Appendix Figure 1). Northern California and Oregon across the central Rockies, Plains, and into the Great Lakes are

forecast to have an equal chance of being slightly warmer to slightly cooler than average, while the southern tier of the country and up into New England is forecast to be warmer than normal. The FMA precipitation forecast is holding to a likely higher than average rain/snow amounts across the northern states and into the Great Lakes. The southern tier of states is forecasted to remain drier than average while areas in between are forecasted to have an equal chance to be slightly above average, normal, or slightly below average precipitation.

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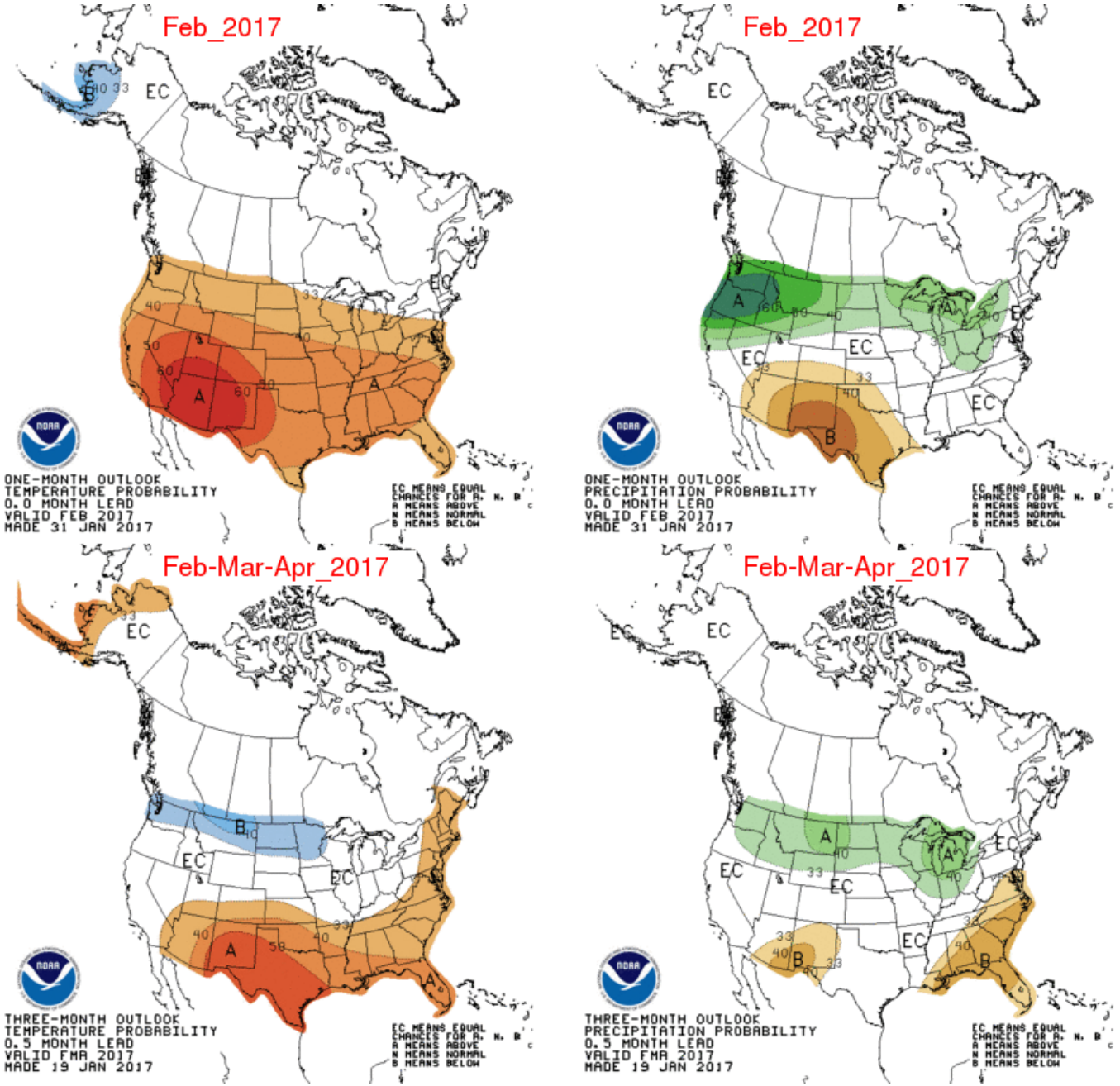

Appendix Figure 1 – Temperature (left panel) and precipitation (right panel) outlooks for the month of February (top panel) and February, March, and April (bottom panel) (Climate Prediction Center, climate.gov).