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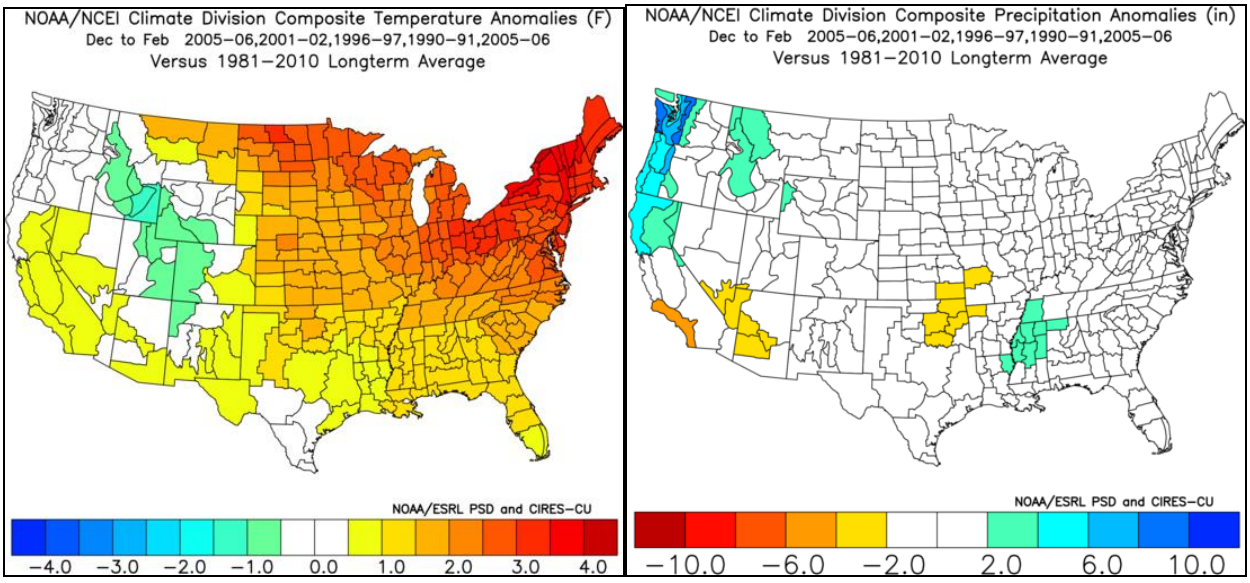
Climate Impact Company Winter 2017-18 Outlook

Issued: Tuesday, September 5, 2014

Third warmer than normal winter in a row

Executive summary: The Climate Impact Company Winter 2017-18 Outlook is issued. The forecast indicates another warmer than normal winter season as observed the 2 previous cold seasons. The warmest anomalies are in the Northeast U.S. where winter heating demand is largest. The month-to-month variability indicates the only anomalous cold weather of winter ahead is in the Northwest to Central U.S. in December. Northern U.S. snow cover to help drive cold weather does not develop and the lack of snow is a primary drive of the winter chill in the Midwest to Northeast Corridor. The forecast indicates needed rainfall and mountain snow eases new drought concerns from northern California to Washington. The outlook is based on a SSTA-based constructed analog favoring near neutral ENSO and Pacific decadal oscillation (with weak cool phase tendencies) and a warm Atlantic multi-decadal oscillation. A strong positive phase North Atlantic oscillation is expected in January causing a warm mid-winter.

Climate Impact Company Temperature and Precipitation Anomaly Forecast for DEC/JAN/FEB 2017-18



Climate discussion: The initial winter outlook for the U.S. identifies the leading indicators generating the forecast. The ENSO, PDO and AMO regimes and their forecasts are reviewed. An estimate of the NAO pattern is also addressed. A snowfall projection will be added in next month's update.

The ENSO Outlook for winter 2017-18 is very uncertain. Diagnostic trends are certainly away from El Nino and toward La Nina. Subsurface temperatures in the equatorial East Pacific have trended cooler the past 4 months signaling increased risk of La Nina (***Fig. 1***). The NCEP CFS V2 forecast model has responded to this cooling and forecasts an impressive La Nina for upcoming winter (***Fig. 2***). The Bureau of Meteorology/Australia has trended toward La Nina (***Fig. 3***). Most statistical and dynamic models (including the European model) are in neutral phase reluctant to cool the eastern equatorial Pacific due to the record warm nature of the global oceans. The Climate Impact Company constructed analog ENSO phase forecast extending to summer 2018 (***Fig. 4***) indicates neutral phase. Normally (about 80% of the time) the Pacific decadal oscillation (PDO) has a tendency to parallel the ENSO regime. Based on the Climate Impact Company PDO constructed analog forecast (***Fig. 5***) short-term cool phase is indicated followed by a return to neutral in 2018. The PDO forecast indicates ENSO may slip into La Nina before 2018 ends then shift back to neutral phase in early 2018. Also important to the SSTA-generated climate forecast is the character of the North Atlantic as measured by the Atlantic multi-decadal oscillation (AMO). During the long-term warm cycle of the AMO present the past 15-20 years the AMO has typically warmed during the summer/autumn months and cooled to near neutral later in the winter season. Of the ENSO analog years only 2004-06 occurred during the long-term warm cycle and the 2017-18 AMO regime is expected to parallel that (analog) year with the warm phase fading toward neutral during winter (***Fig. 6***). The North Atlantic SSTA pattern is very important to U.S. and Europe climate forecasts. A new sector of the North Atlantic relevant to climate winter forecasts is the sector north of Europe (Norwegian Sea) due to the decadal trend toward lack of ice in this region during the winter season. The lack of ice in the Norwegian Sea can contribute to high latitude blocking (negative North Atlantic oscillation) due to the warming influence of the open ocean on the polar atmosphere. If a persistent –NAO develops there is increased risk of cold and snow in the middle latitudes. The NMME global SSTA forecast is used by Climate Impact Company to project the northern hemisphere winter 2017-18 forecast. The NMME DEC/JAN/FEB 2017-18 global SSTA outlook agrees with the neutral ENSO and weak –PDO analog outlook issued by Climate Impact Company. The North Atlantic SSTA outlook is quite warm including the Norwegian Sea implying no ice this winter season in that region (***Fig. 7***). The very warm SSTA for DEC/JAN/FEB 2017-18 is likely cooler

by late winter. Analog years from the past 15 years when the +AMO cycle includes only the winter of 2005-06. During winter 2005-6 the NAO was weak negative on the front end, in the positive phase (and strong) in January and increasingly strong negative phase late winter to early spring. The cold/snowy influence of –NAO is more likely to occur on the back end of winter given this analog.

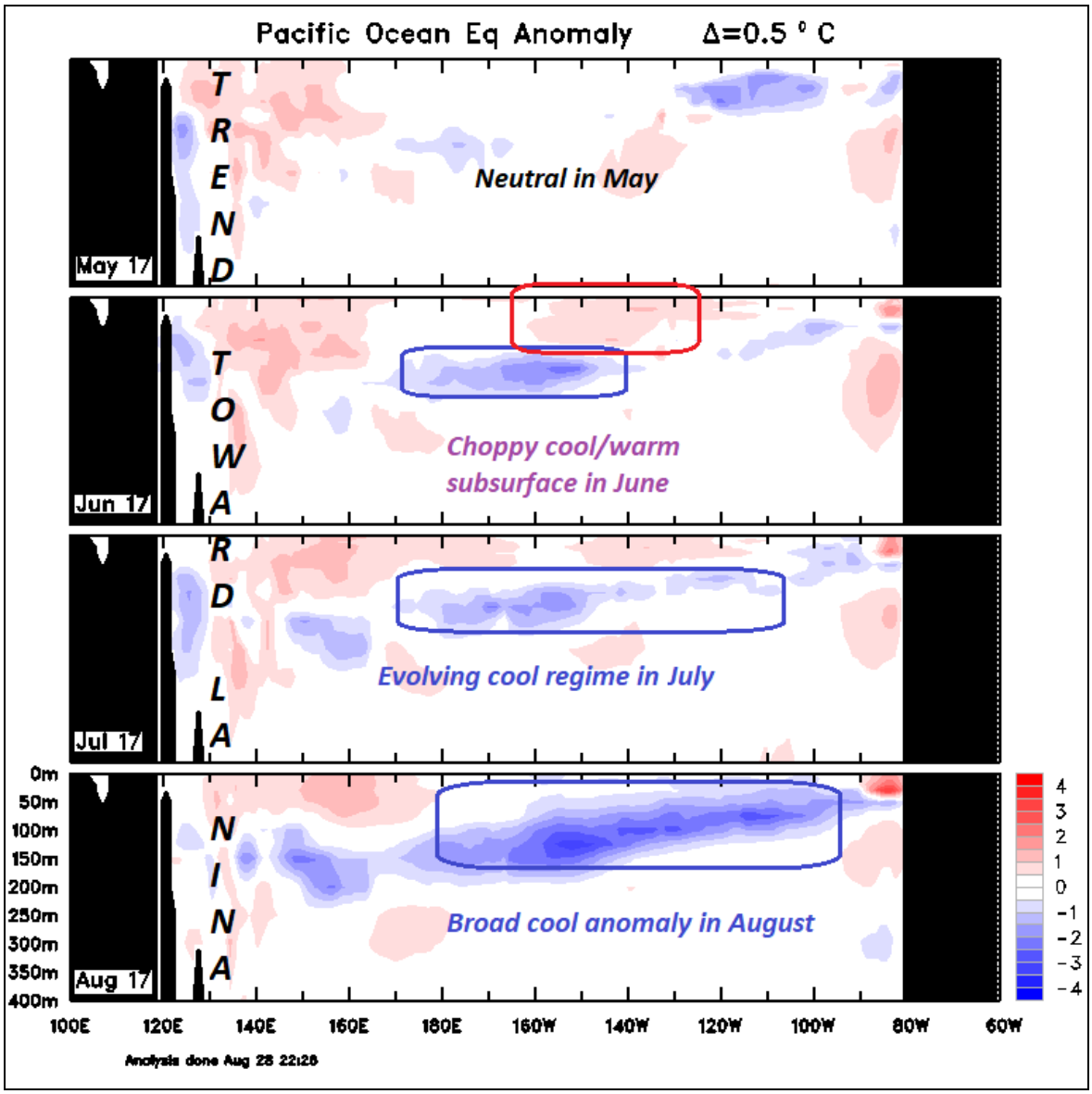


Fig. 1: *The subsurface equatorial East Pacific temperature regime oftentimes foreshadows an ENSO phase change ahead. The trend is steadily cooler in August.*

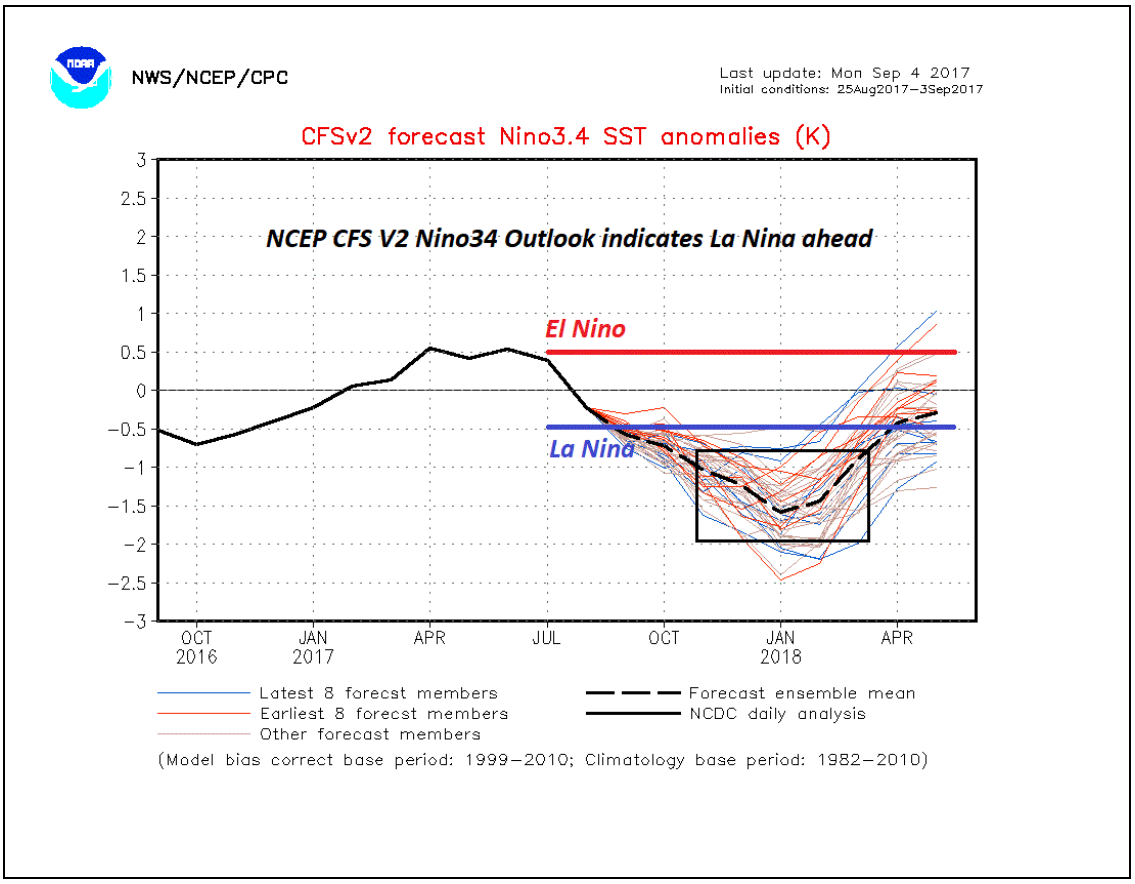


Fig. 2: *The NCEP CFS V2 ENSO forecast indicates a strong La Nina for winter 2017-18.*

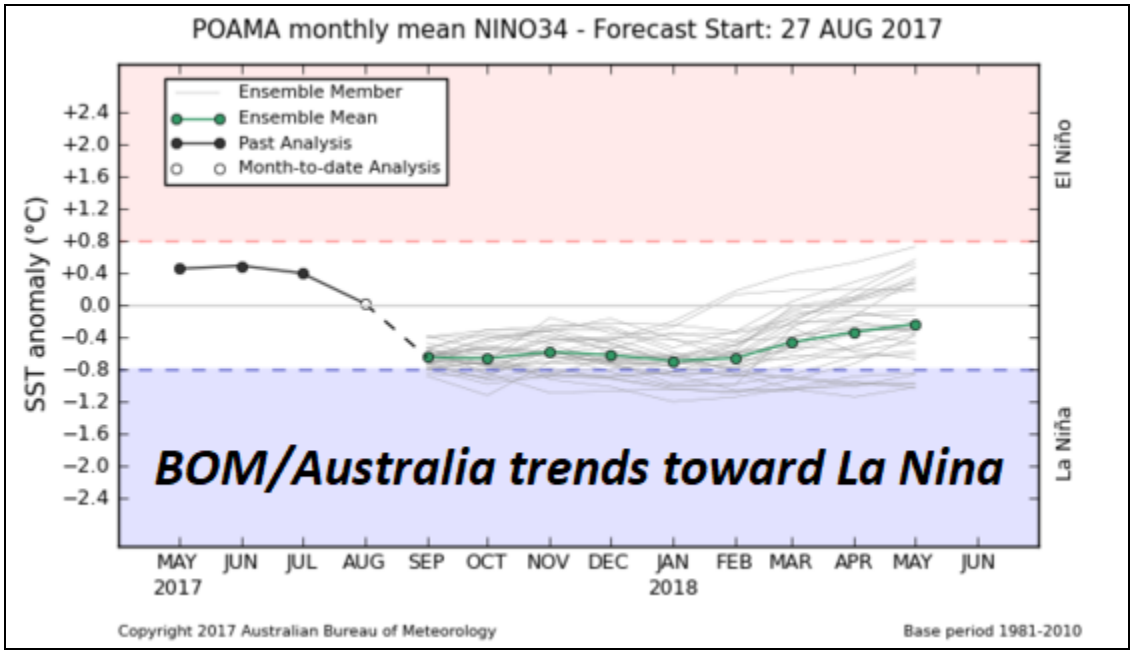


Fig. 3: *The Bureau of Meteorology/Australia ENSO forecast trends toward La Nina.*

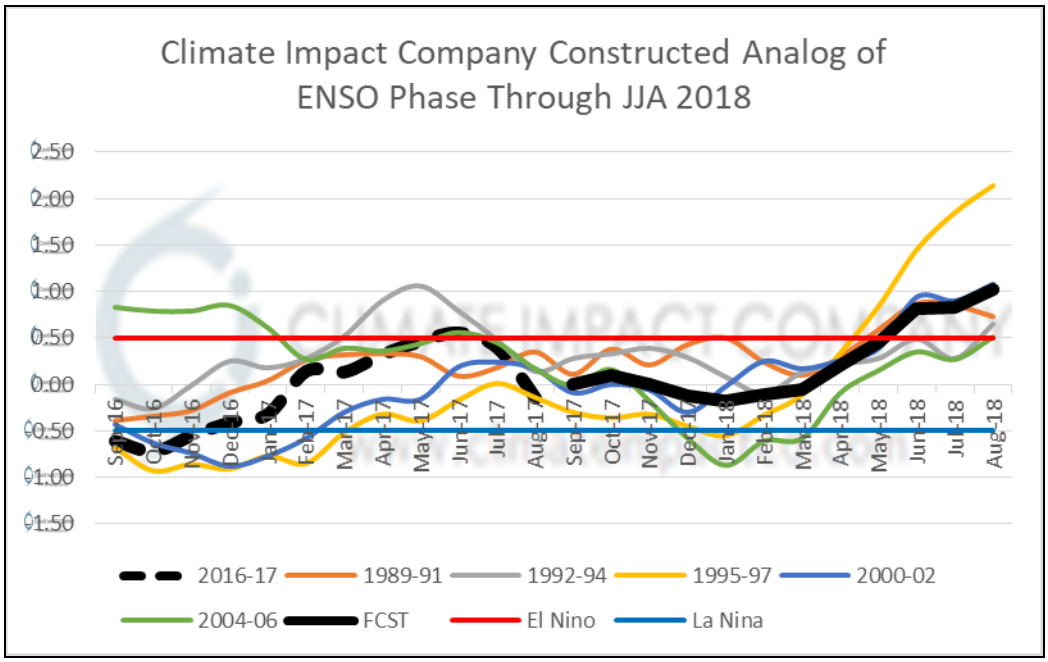


Fig. 4: *The Climate Impact Company ENSO forecast favors neutral phase ahead.*

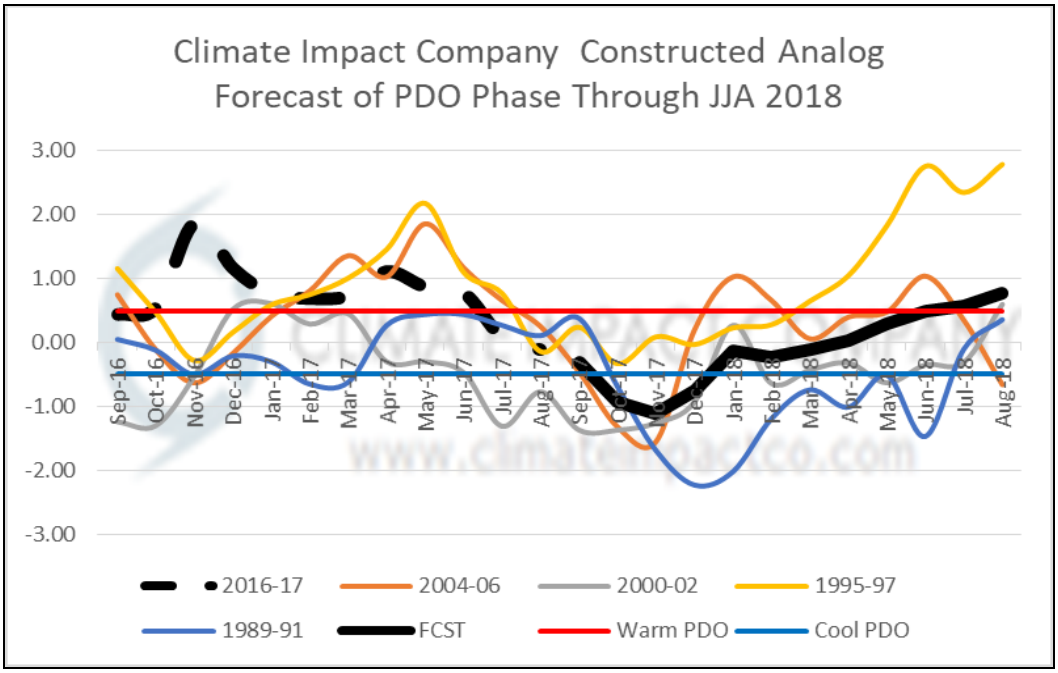


Fig. 5: *The Climate Impact Company PDO forecast indicates short-term cool phase returning to neutral phase in 2018.*

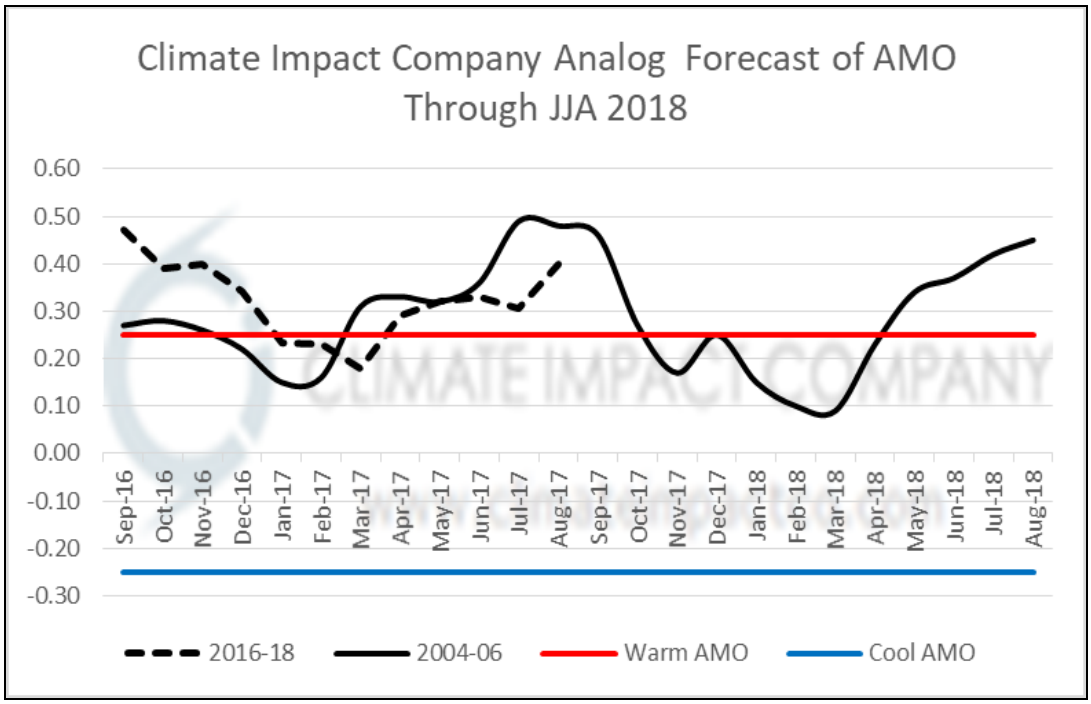


Fig. 6: *The Climate Impact Company AMO forecast indicates the warm phase eases to neutral during northern hemisphere winter followed by a return to warm phase later in 2018.*

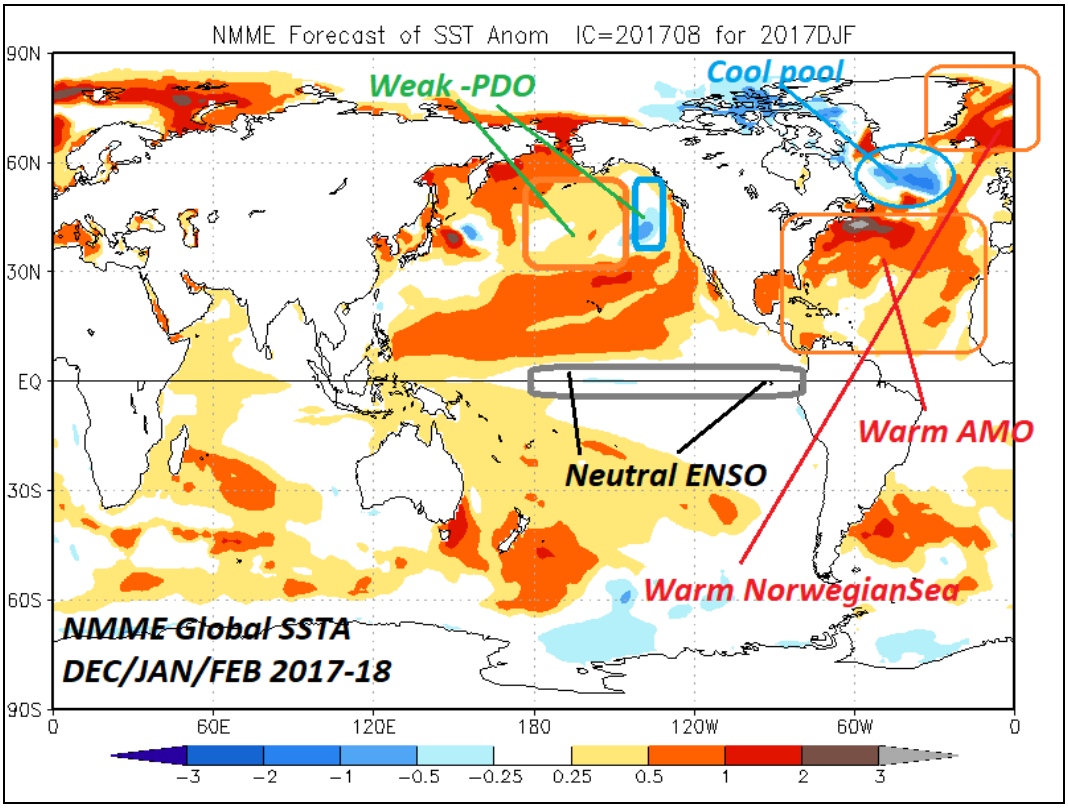


Fig. 7: *The NMME global SSTA forecast is in general agreement on regional SSTA patterns with the CIC analog forecast used to generate the winter 2017-18 outlook.*

Climate summary: The winter 2017-18 outlook is (mostly) biased by a projected warmer-than-normal North Atlantic coupled with near neutral ENSO and PDO (with a weak cool phase bias). Given the globally warm SSTA pattern lingering through wintertime difficult is the case to somehow generate cold temperatures this winter season.

Forecast summary: The winter 2017-18 outlook is based on a constructed analog. A constructed analog means identifying past contributors to climate similar in 2017 to past years and regressed 6-12 months. The regression includes ENSO, PDO and AMO regimes. The analog years are more sensitive to selecting years in the current long-term climate cycle as identified by ENSO/PDO and AMO which began 15-20 years ago. Analog year 2005 is quite similar to 2017 and given considerably more weight generating the forecast. The monthly outlooks begin with November 2017 and end with March 2018.

November 2017: The onset of the cold season is much warmer than normal. Pacific influence dominates leaving beneficial wet weather into the West Coast and a drier than normal pattern downstream across the East-central U.S., Southeast States and East Coast. Occasional polar air masses dip south into the Midwest/Great Lakes region bring wetter than normal start to the cold season however I the absence of the Canadian air masses temperatures are quite mild.

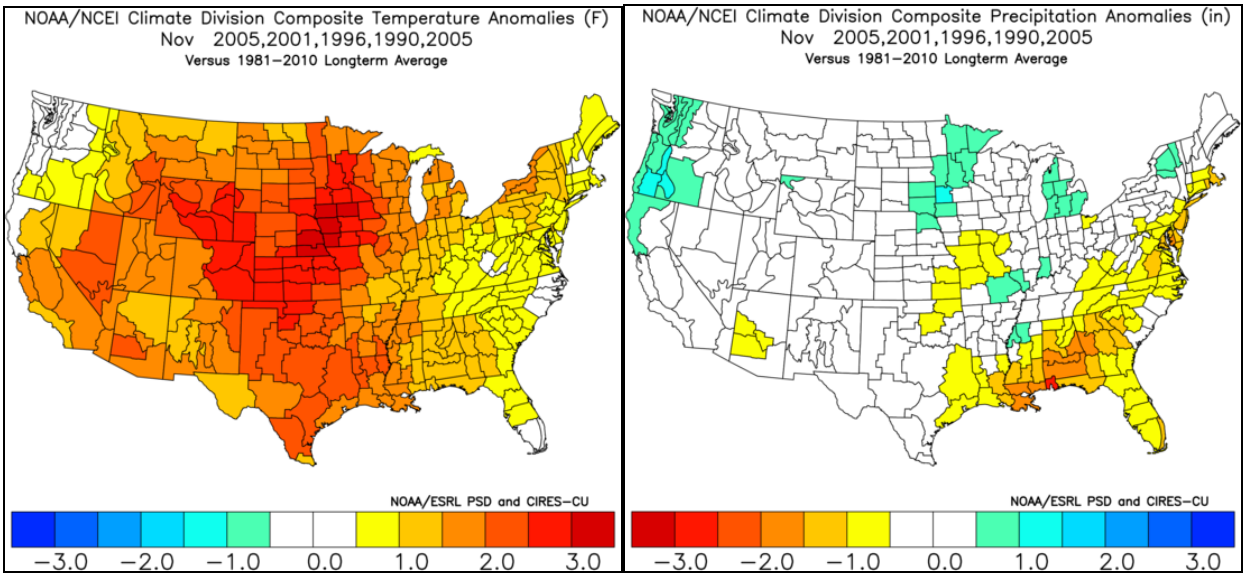


Fig. 8-9: *The CIC temperature and precipitation analog forecast for November 2017 is indicated.*

December 2017: Meteorological winter begins with a cold and snowy regime in the Northwest to North-Central U.S. Anomalous cold settles into the Intermountain Region, the northern and central Rockies and the northern half of the Great Plains. Heavy precipitation rolls off the Pacific into northern California. In the East a much different regime is expected featuring a warmer than normal pattern in the South and East with dry climate in Texas and the southeast Great Plains.

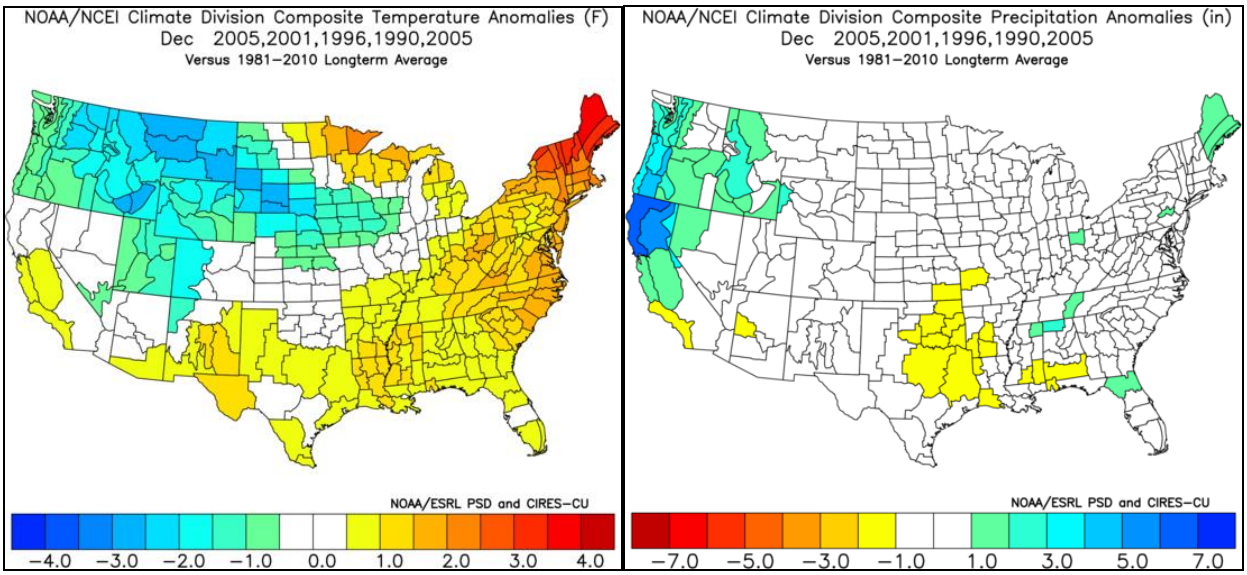


Fig. 10-11: *The CIC temperature and precipitation analog forecast for December 2017 is indicated.*

January 2018: A mid-winter thaw is likely in the Central and East U.S. strongest in the Midwest to Northeast U.S. Once again a strong zonal Pacific influence leads to the warm pattern. The Northwest is stormy while parts of the Southeast are also wetter than normal. There are no significant dry anomalies during mid-winter. The lack of northern snow cover hurts cold risk in the Great Plains, Midwest and Northeast U.S. during mid-winter.

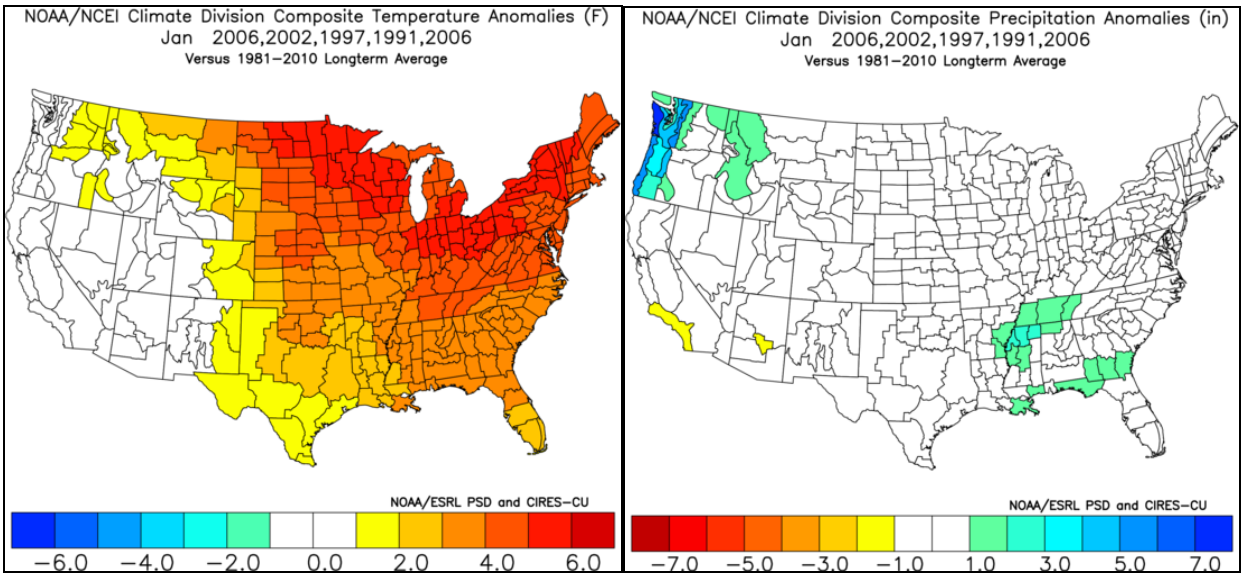


Fig. 12-13: *The CIC temperature and precipitation analog forecast for January 2018 is indicated.*

February 2018: Late winter maintains the lack of snow cover across the northern U.S. Therefore late meteorological winter s also warmer than normal especially the northwest Great Plains and Northeast States. Much of the nation is drier than normal particularly California where beneficial rains and mountain snow started the winter season. The only wet weather is in the northwest and north Gulf of Mexico region plus the central Rockies.

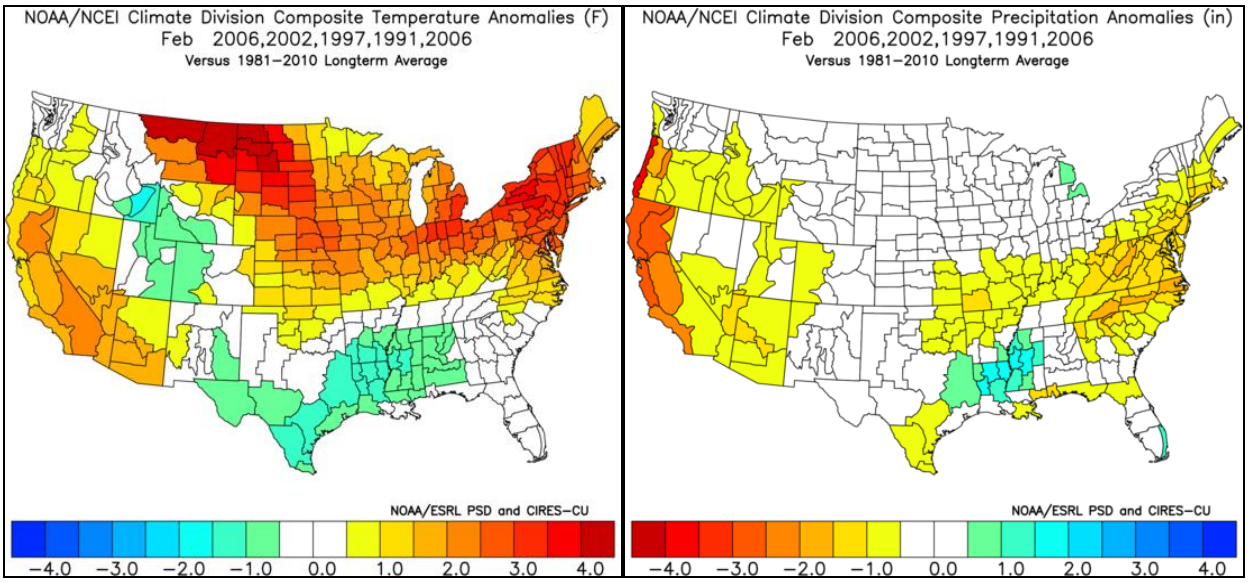


Fig. 14-15: *The CIC temperature and precipitation analog forecast for February 2018 is indicated.*

March 2018: The South and East U.S. are still warmer than normal. However calendar winter ends cold and snowy across much of the West and North-Central U.S. Precipitation returns to somewhat greater than normal for the West Coast. Additionally, a potent storm track is forecast for the East-Central U.S. A dry pattern persists in the Southeast and East Coast.

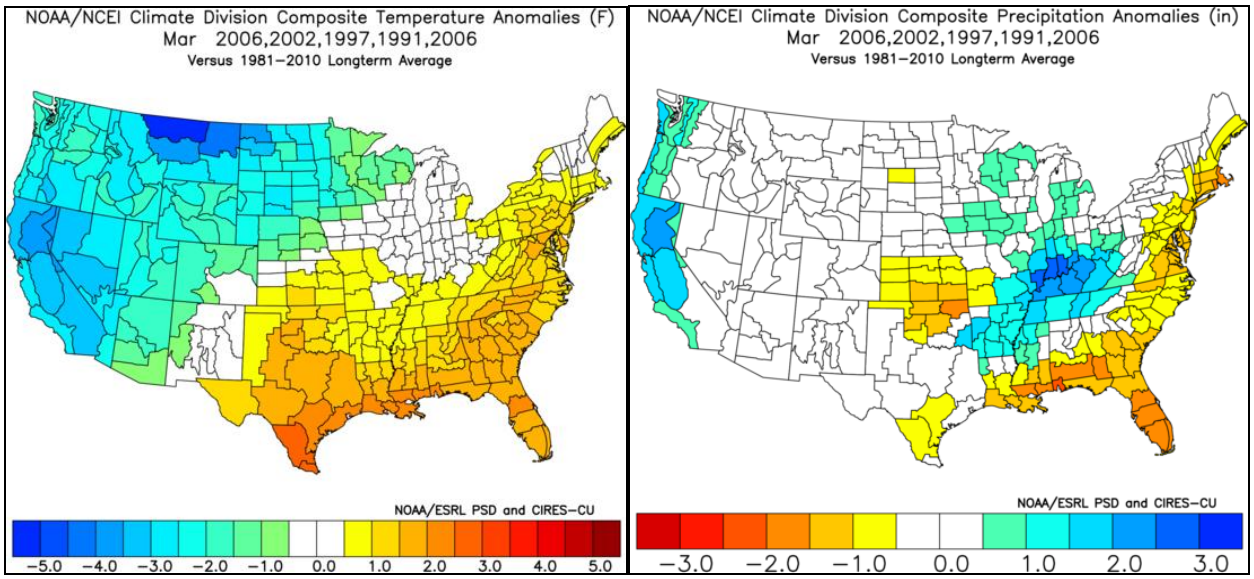


Fig. 16-17: *The CIC temperature and precipitation analog forecast for March 2018 is indicated.*

Population weight HDD forecasts for NOV-17 to MAR-18: The U.S. gas home heating population weight HDD forecast indicates the 2017-18 season is substantially warmer than normal and similarly warm to the last 3 winter seasons early-to-middle winter compared to the 30-year normal (***Fig. 18***). The 2014-15 mid-to-late winter was vigorously cold and that risk is not expected this year. The 2017-18 forecast is somewhere in-between the warmth of the past two winter seasons when using the 10-year normal (***Fig. 19***).

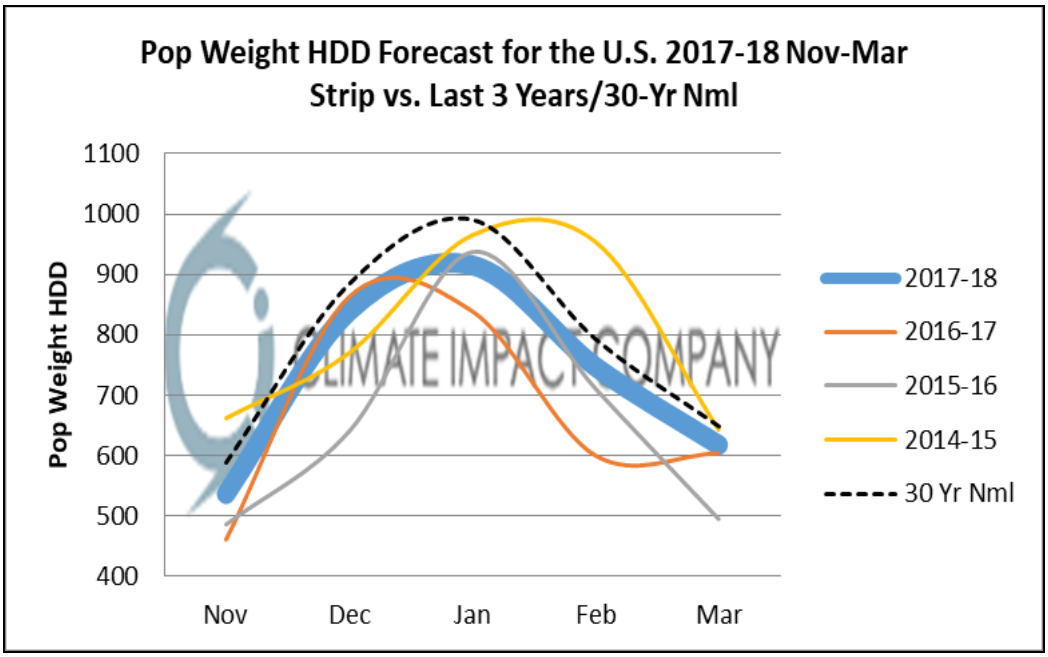


Fig. 18: *The CIC gas population weight HDD forecast for the U.S. for November 2017 to March 2018 versus the 30-year normal and past 3 winter seasons.*

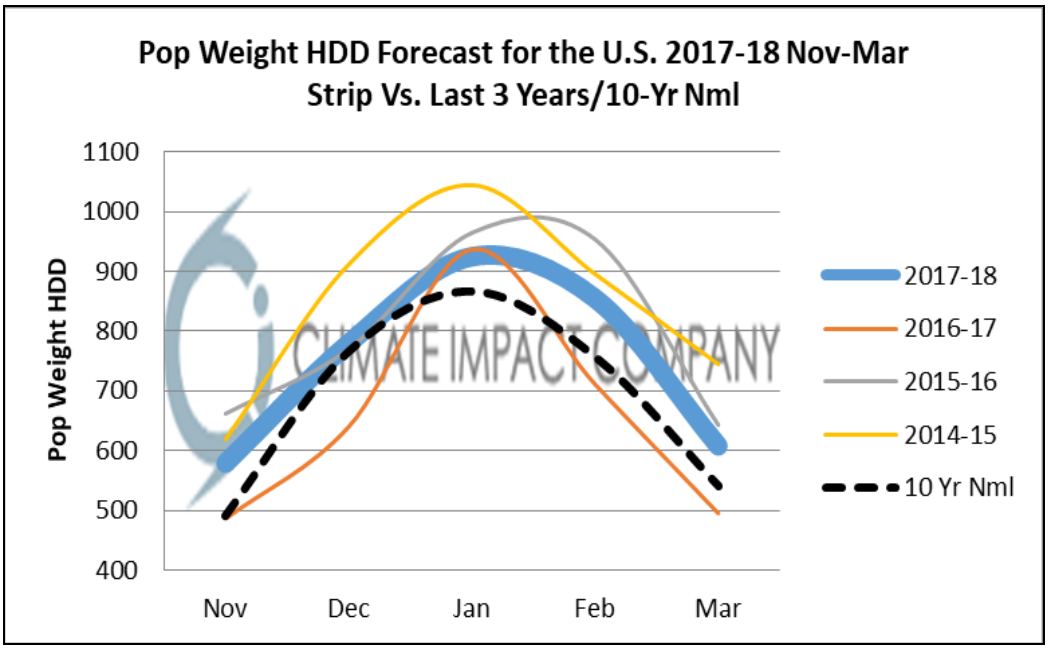


Fig. 19: *The CIC gas population weight HDD forecast for the U.S. for November 2017 to March 2018 versus the 10-year normal and past 3 winter seasons.*