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Climate Impact Company Season 1-3 Ahead Outlook

North America

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Potential climate scenarios favor a warmer-than-normal climate

Executive Summary: The Climate Impact Company season 1-3 ahead forecast is updated. The outlook indicates a stronger-than-normal cold season polar vortex ahead most likely producing a mild climate (across U.S.) south of the cold air exposure. El Nino is forecast with below average confidence, also a mild regime contributor.

Climate discussion: There are 2 leading factors projecting the most likely climate scenario for the cold season ahead: 1. Arctic oscillation (AO) and 2. Optimum climate normal (OCN). Also considered is the El Nino southern oscillation (ENSO) outlook.

In 2018 a large area of unusually cool water gathered south and west of Greenland causing the air aloft to also cool and allow the 2017-18 wintertime polar vortex to persist over eastern Canada to Greenland. The upper trough forced hot/dry upper ridge patterns at times upstream across the U.S. and for much of summer 2018 across Europe. The eastern Canada/Greenland polar vortex has shifted north in August affecting far northern Canada toward the North Pole. The polar vortex pattern described identifies presence of persistent positive phase arctic oscillation (+AO). During the past 30 years only 1989 and 1994 have produced similarly persistent +AO regimes (***Fig. 1***). During each analog year +AO continued through the winter season.

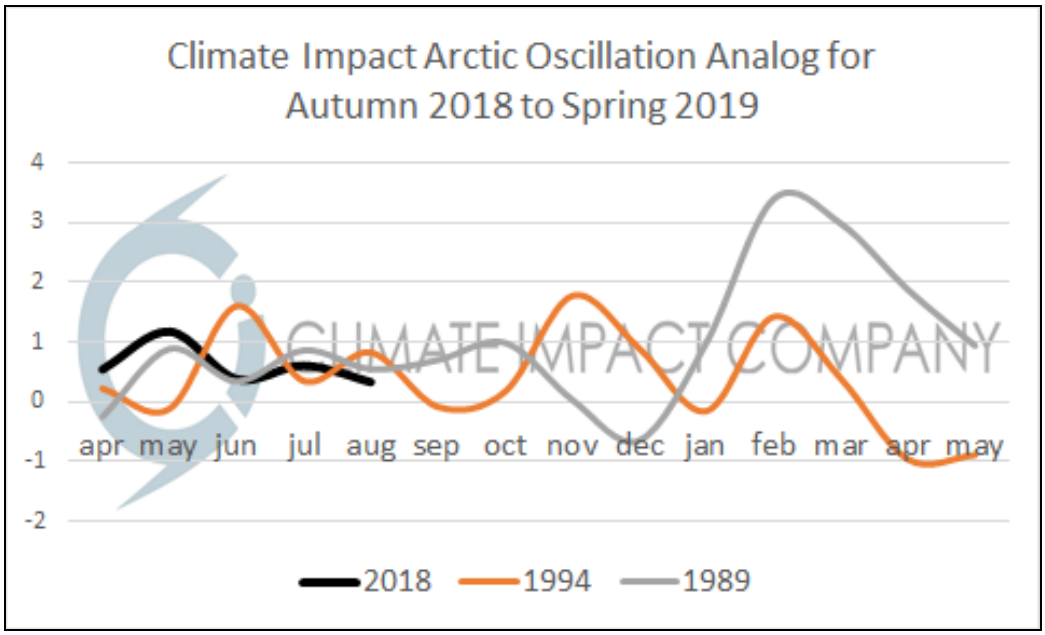

Fig. 1: *The arctic oscillation analog forecast for 2018-19 indicates a possibly strong positive phase continuing from summer 2018.*

For the upcoming 2018-19 cold season Climate Impact Company expects the polar vortex to be stronger than normal with reluctance to wonder into the middle latitudes preferring to stay near the North Pole. This projection is relatively unusual given the lack of polar ice cap in mid-to-late winter in the climate change era which can lead to warming of the atmosphere across open water north of Europe causing high latitude blocking high pressure. That relatively common wintertime pattern is unlikely this year. In fact, if the +AO projection is correct the polar vortex should be more expansive than the new normal for winter 2018-19.

There is a strong tendency for warming influence on winter-time regimes due to the historically warm ocean surface of the past decade. The warm influence on climate by the oceans has occurred somewhat independent of ENSO. The second-most important contribution to the 2018-19 cold season climate forecast is addition of OCN for the past 10 years (***Fig. 2***).

ENSO is always a major contribution to a climate forecast. Right now ENSO is neutral. Subsurface warming of the equatorial East Pacific occurred over the early-to-middle summer period but the atmosphere failed to respond and El Nino onset did not occur. The warm water supply in the East Pacific has faded but a new Kelvin Wave emerged near the Dateline in August (***Fig. 3***).

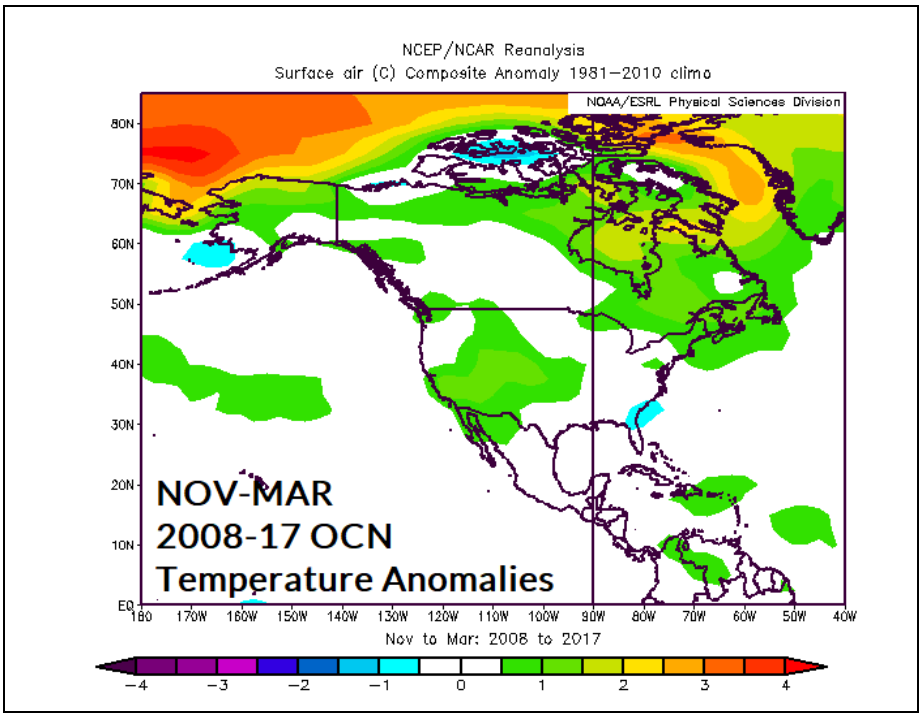

Fig. 2: *The 10-year climatology or optimum climate normal is applied to the season 1-3 ahead forecast most focused on the cold season.*

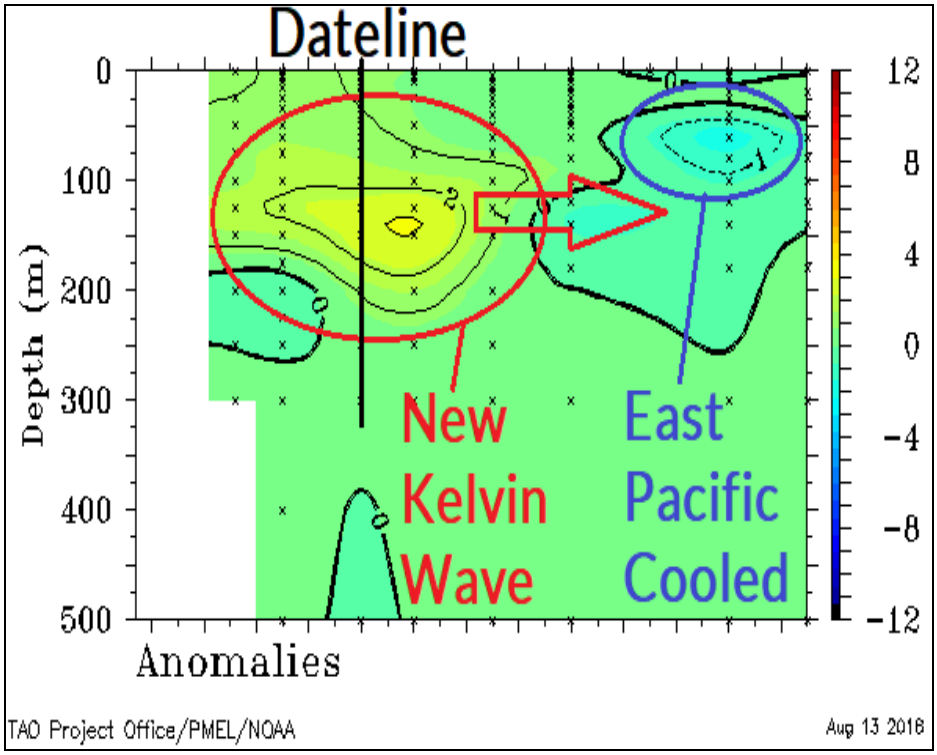

Fig. 3: *Subsurface equatorial Pacific Ocean temperatures indicate sudden cooling in the East Pacific while a Kelvin Wave emerges near the Dateline.*

The ENSO outlook is made with below average forecast confidence. Previously, El Nino Modoki was forecast by Climate Impact Company. In fact, the ENSO regime has acquired an El Nino Modoki look in recent weeks as surface warming has favored the equatorial Pacific near the Dateline compared to the relatively cooler eastern equatorial Pacific (***Fig. 4***). The El Nino Modoki possibility remains valid.

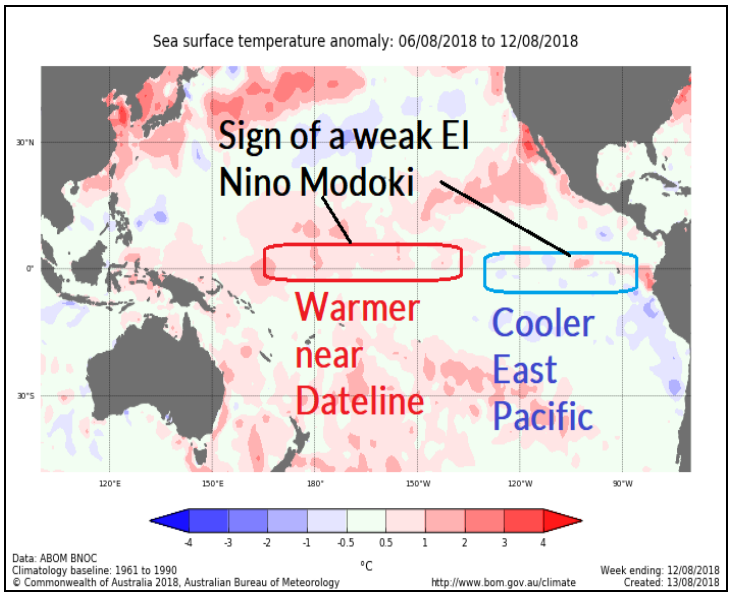

Fig. 4: *Pacific Ocean SSTA analysis indicates an El Nino Modoki look with equatorial Pacific warming near the Dateline.*

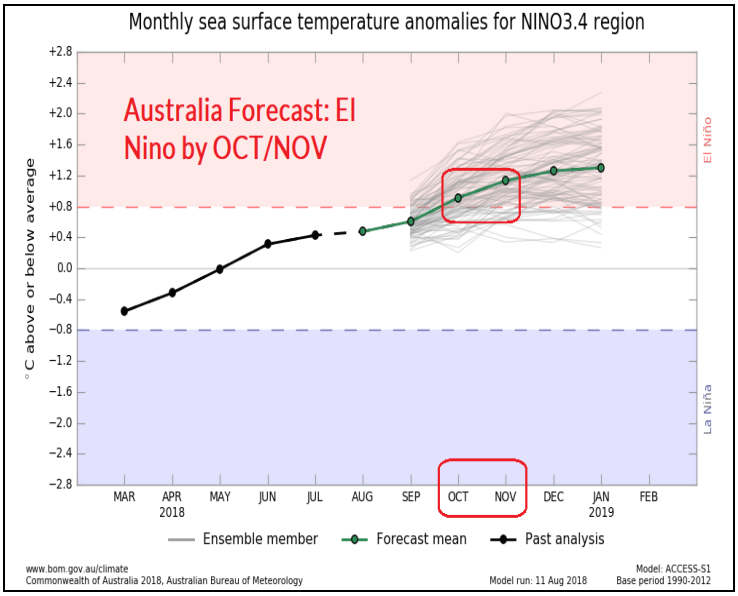

Fig. 5: *The Bureau of Meteorology/Australia ENSO forecast using Nino34 SSTA indicates El Nino onset during OCT/NOV.*

However, if the Kelvin Wave near the Dateline shifts east and reaches the northwest coast of South America during the autumn season a more conventional El Nino would occur. Many forecast models are expecting this scenario (*Fig. 5*).

Given the unexpected weakening of the warm waters in the eastern equatorial Pacific Ocean the past few weeks there is a possibility that the next warming event could also weaken and El Nino fails to develop leaving neutral ENSO for winter 2008-19.

In summary, ENSO has 3 possibilities for 2018-19: The previously forecast El Nino Modoki or a conventional El Nino or neutral ENSO (*Fig. 6*). Each scenario was considered making the climate forecast and fine-tuning of this aspect of the outlook will be refined as forecast confidence increases during autumn.

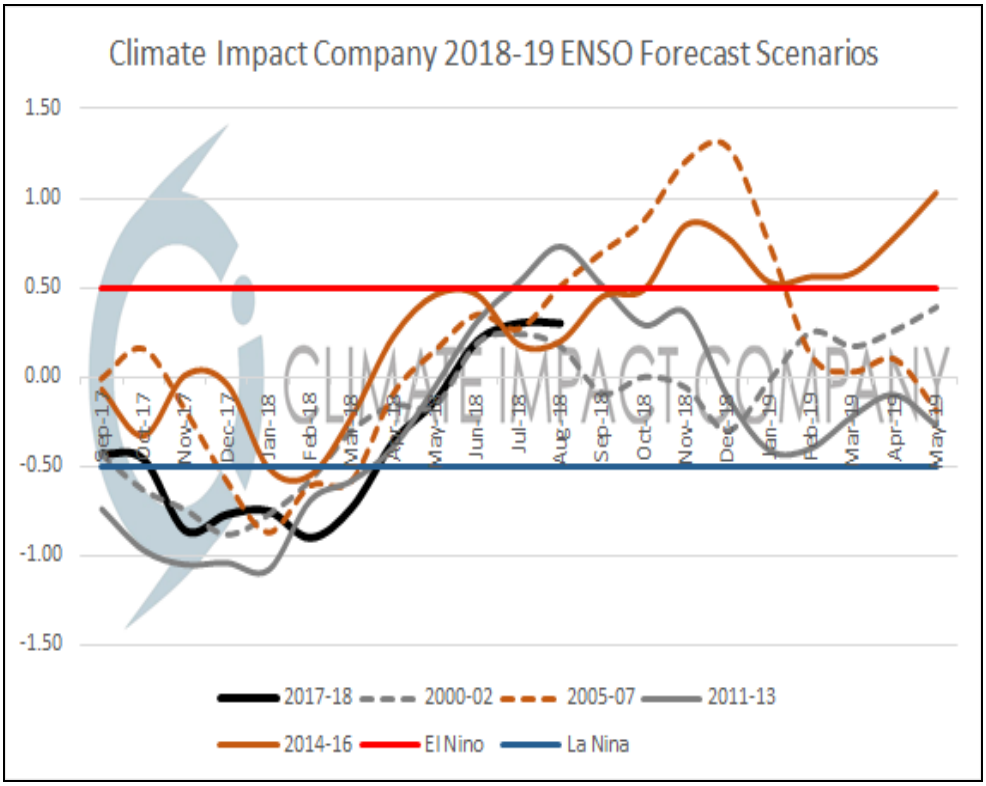

Fig. 6: The updated Climate Impact Company ENSO analog years indicates 4 scenarios of which 2 are El Nino and 2 are neutral ENSO ahead.

Outlooks: Indicated is a simple analog forecast considering +AO regimes, OCN and the 3 ENSO possibilities indicated. The outlooks are annotated for high impact weather/climate. Forecasts are compared to previously indicated outlook.

SEP/OCT/NOV 2018: Meteorological autumn 2018 for North America is warmer-than-normal with caveats. The far northern latitudes, the polar region and across northern Canada are likely trending colder than indicated. However, the warm forecast indicated for central continent is made with above normal forecast confidence. The Southeast and eventually the West Coast cool to near normal. The precipitation forecast is made with below average forecast confidence. A wetter scenario occurs if El Nino develops. The Southwest U.S. is likely wetter than indicated. Otherwise the East-Central to Northeast autumn outlook is drier-than-normal.

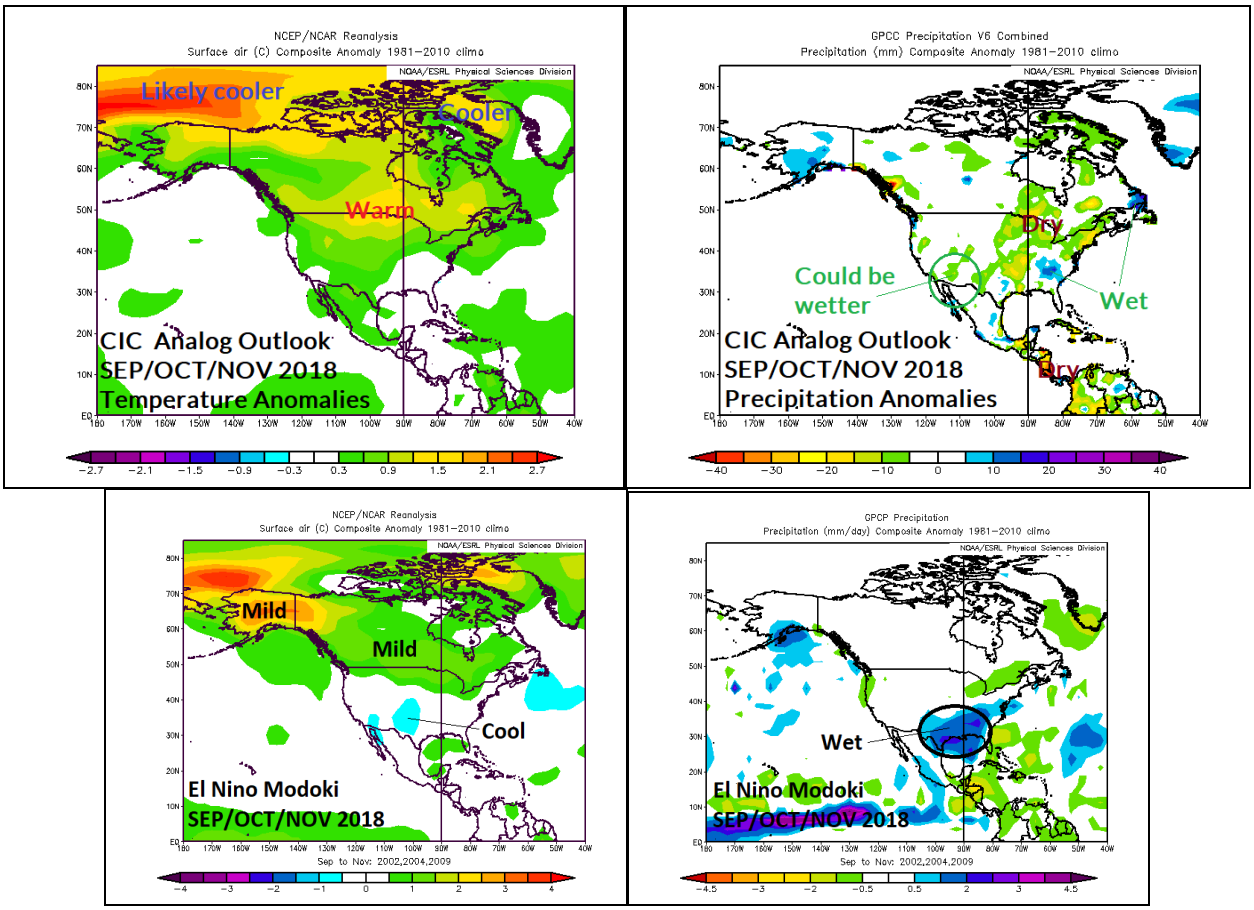

Fig. 7-10: The Climate Impact Company SEP/OCT/NOV 2018 temperature and precipitation anomaly forecast for North America is indicated. The previous forecast is below.

DEC/JAN/FEB 2018-19: Meteorological winter 2018-19 is overwhelmed by mild influences including OCN and a potential El Nino episode. The expected +AO regime implies the northern latitudes will be much colder than indicated. Cold (arctic) air masses may be prevalent in the northern latitudes and if released south can cause U.S. arctic outbreaks. However, in the absence of that scenario a very warm pattern is likely. The forecast is adjusted warmer from previous. The precipitation outlook is made with less confidence. The wet pattern in the Southeast U.S. is confidently forecast however the drier pattern indicated in the Southwest U.S. including California is made in anticipation of a weak El Nino (or neutral ENSO) and susceptible to reversing wet again. At the moment, much needed rainfall in California during winter 2018-19 is in-doubt. The northern U.S. is likely to observe below normal snow cover although Canada may be snowier than normal and if so colder than indicated.

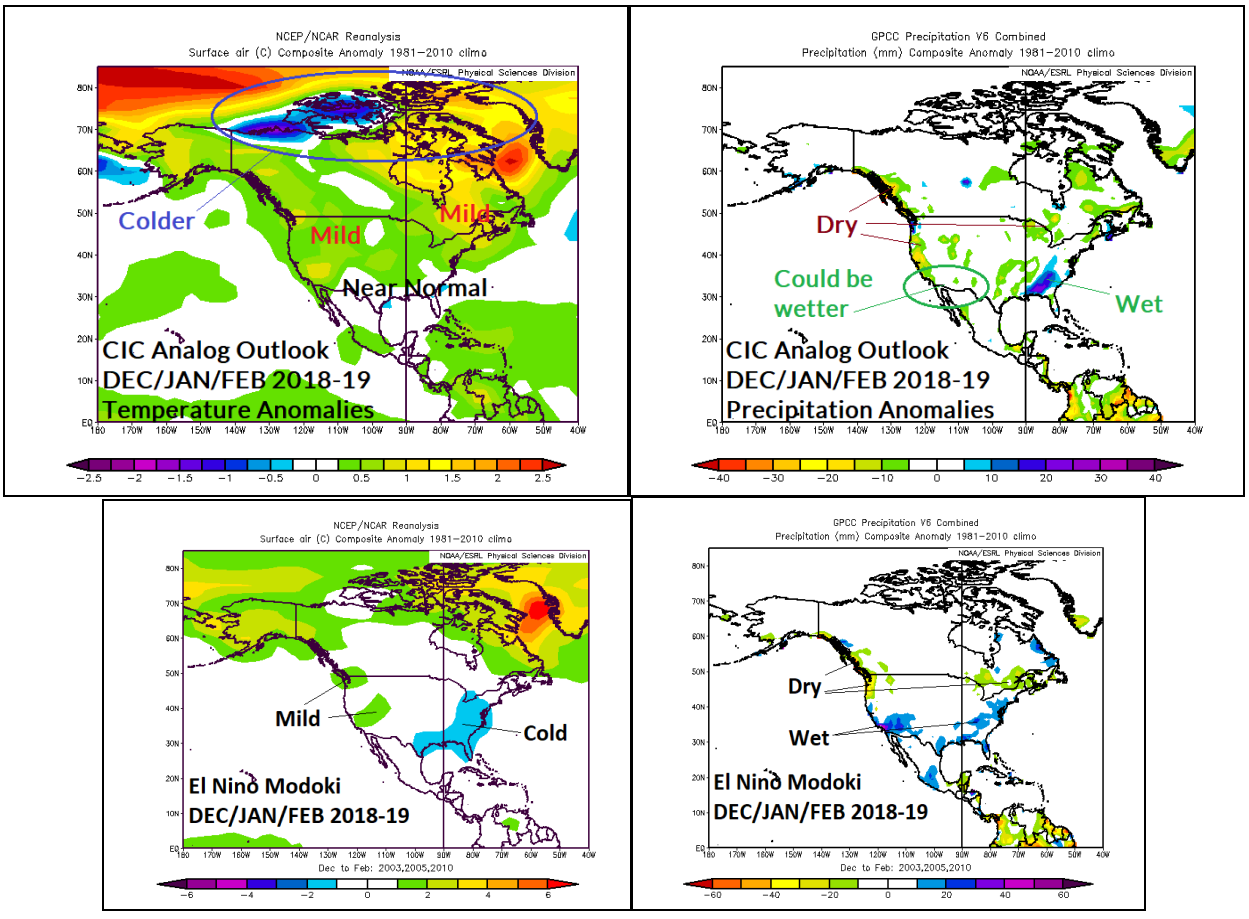

Fig. 11-14: *The Climate Impact Company DEC/JAN/FEB 2018-19 temperature and precipitation anomaly forecast for North America is indicated. The previous forecast is below.*

MAR/APR/MAY 2019: Meteorological spring 2019 is forecast quite wet across Texas and the Great Plains. The East is marginally mild and drier than normal. The western U.S. outlook is temperate and possibly wetter-than-normal in northern California.

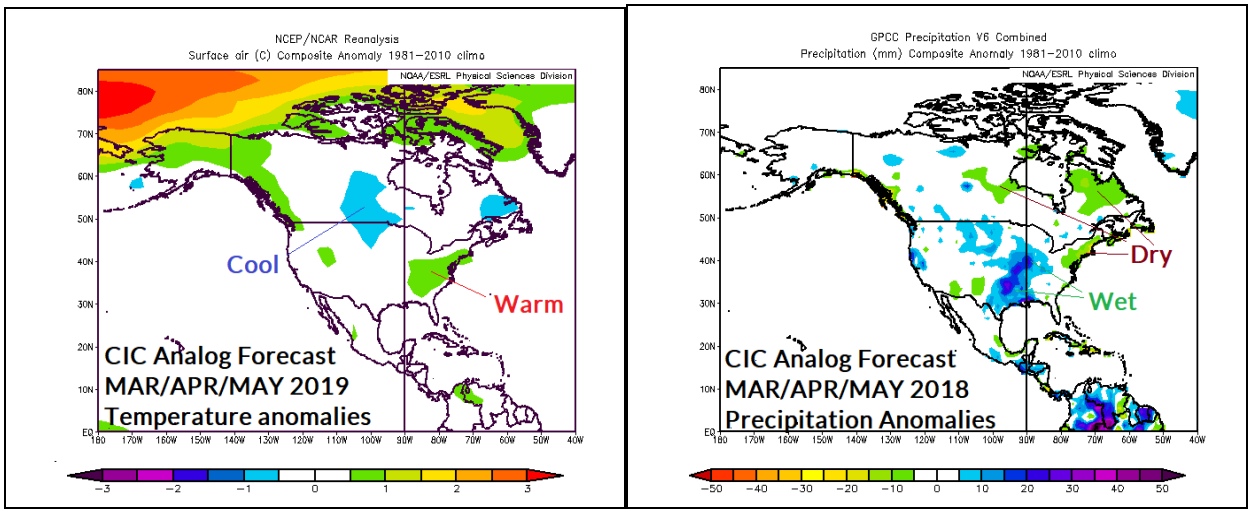

Fig. 15-16: *The preliminary Climate Impact Company MAR/APR/MAY 2019 temperature and precipitation anomaly forecast for North America is indicated.*