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Climate Impact Company Research *Why La Nina Won't Develop/Winter Implications*

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Current State of ENSO: The Nino34 SSTA region cooled to -0.6C the past 2 weeks which is slightly below the La Nina threshold of -0.5C (***Fig. 1***). NOAA indicates 3 consecutive months of these cool anomalies are required to qualify as an onset of La Nina. Assuming the Nino34 SSTA continues to exceed the La Nina threshold the onset of La Nina is delayed until early October. The slower and weaker cooling trend has been caused by lack of trade winds in the equatorial East Pacific to up-well strong anomalous cool waters in the subsurface equatorial Pacific. The subsurface cool anomalies intensity peak was in early June (***Fig. 2)***. However, the lack of trade winds has slowed the up-welling process while the subsurface cool anomaly has lost about 50% of its amplitude (***Fig. 3***).

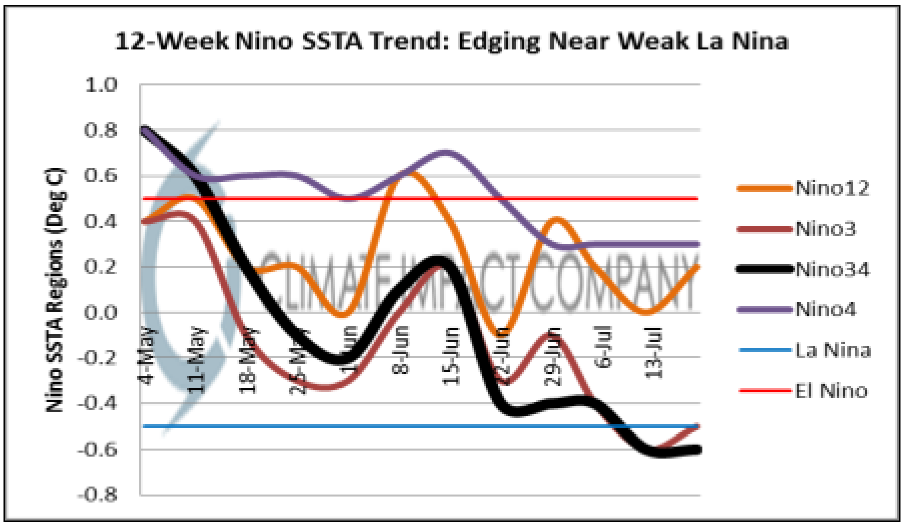

Fig. 1: *The 12-week Nino SSTA region observations indicate a trend toward weak La Nina.*

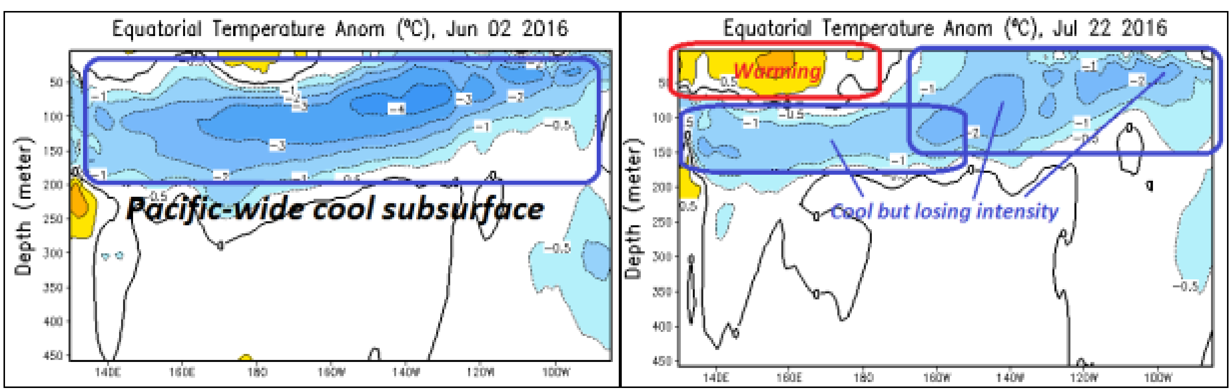

Fig. 2-3: *Equatorial subsurface Pacific Ocean cool anomalies have weakened sharply since early June.*

Inhibiting La Nina Development: Based on multivariate ENSO index (MEI) the global climate remain in an El Nino pattern (***Fig. 4***). The El Nino climate signature is still present despite the cooling in the eastern equatorial Pacific due to the influence on global climate of a record warm global ocean surface (***Fig. 5***). Seasonal SSTA forecasts vary but generally agree on the globally warm SSTA pattern persisting late into 2016 and preventing La Nina from developing (***Fig. 6***).

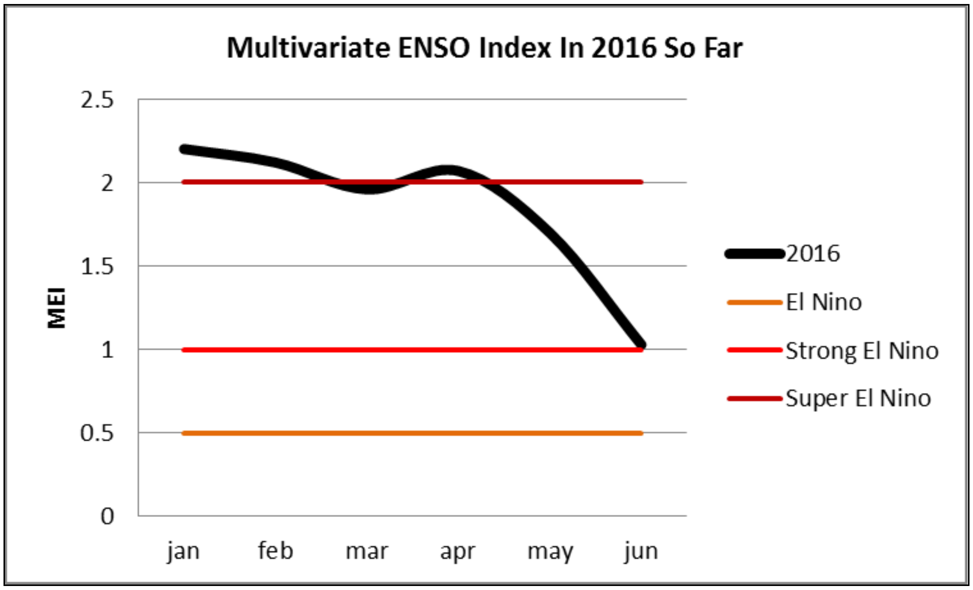

Fig. 4: *Multivariate ENSO index in 2016 (so far) indicates the El Nino climate remains.*

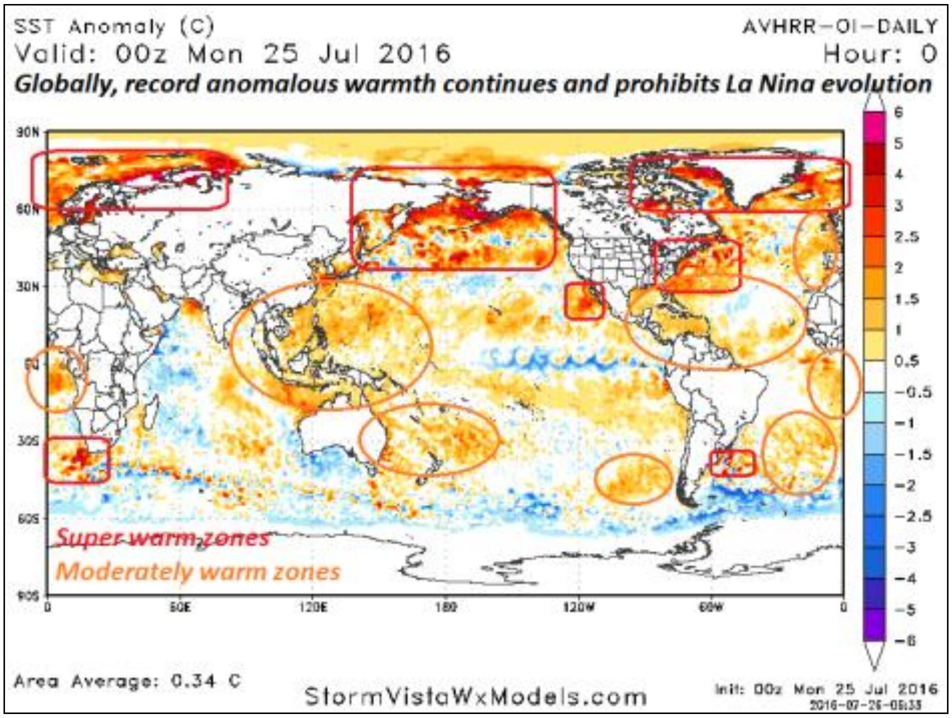

Fig. 5: *Daily global SSTA analysis reveals the plethora of moderate to strong anomalous warm ocean regions. The record warm global SSTA is helping to prevent La Nina from forming.*

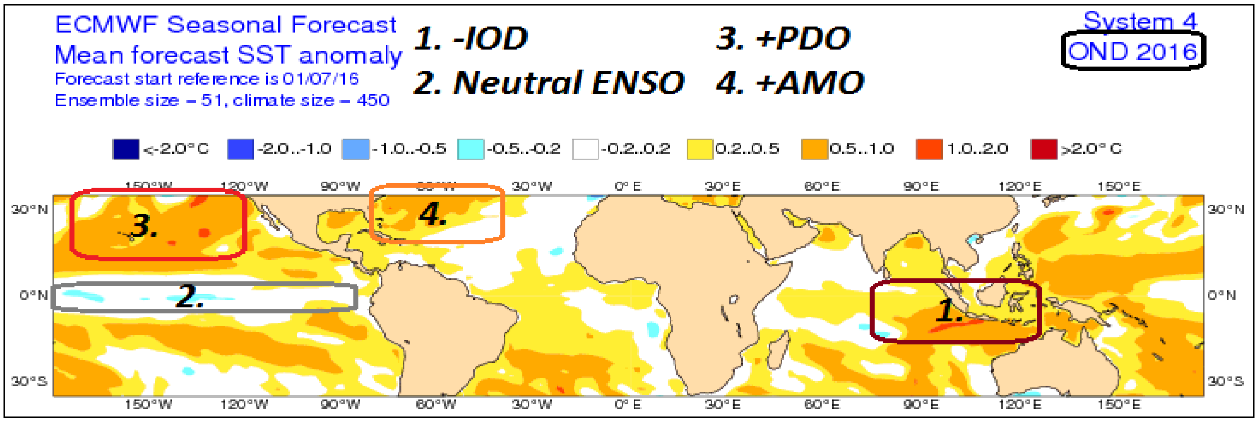

***Fig. 6:** ECMWF seasonal SSTA forecast valid for OCT/NOV/DEC 2016 indicates dominant anomalous warmth and no La Nina.*

Neutral ENSO and winter 2016-17: Given the likely strength of globally warm SSTA projected for late this year and the June MEI which indicated a strong La Nina climate was still present reasonable is a projection of a less positive MEI but still marginally favoring an El Nino climate given the warm oceans and no La Nina. To make an early estimate on what winter 2016-17 may look like across the U.S. analog years using MEI in the neutral to weak positive phase are averaged. The neutral ENSO to weak warm ENSO MEI phase analog years occurring during the winter season (DEC/JAN/FEB) from the past 20 years (when the long-term cool cycle of ENSO and warm cycle of AMO has been present) are 2003-04, 2004-05 and 2014-15.

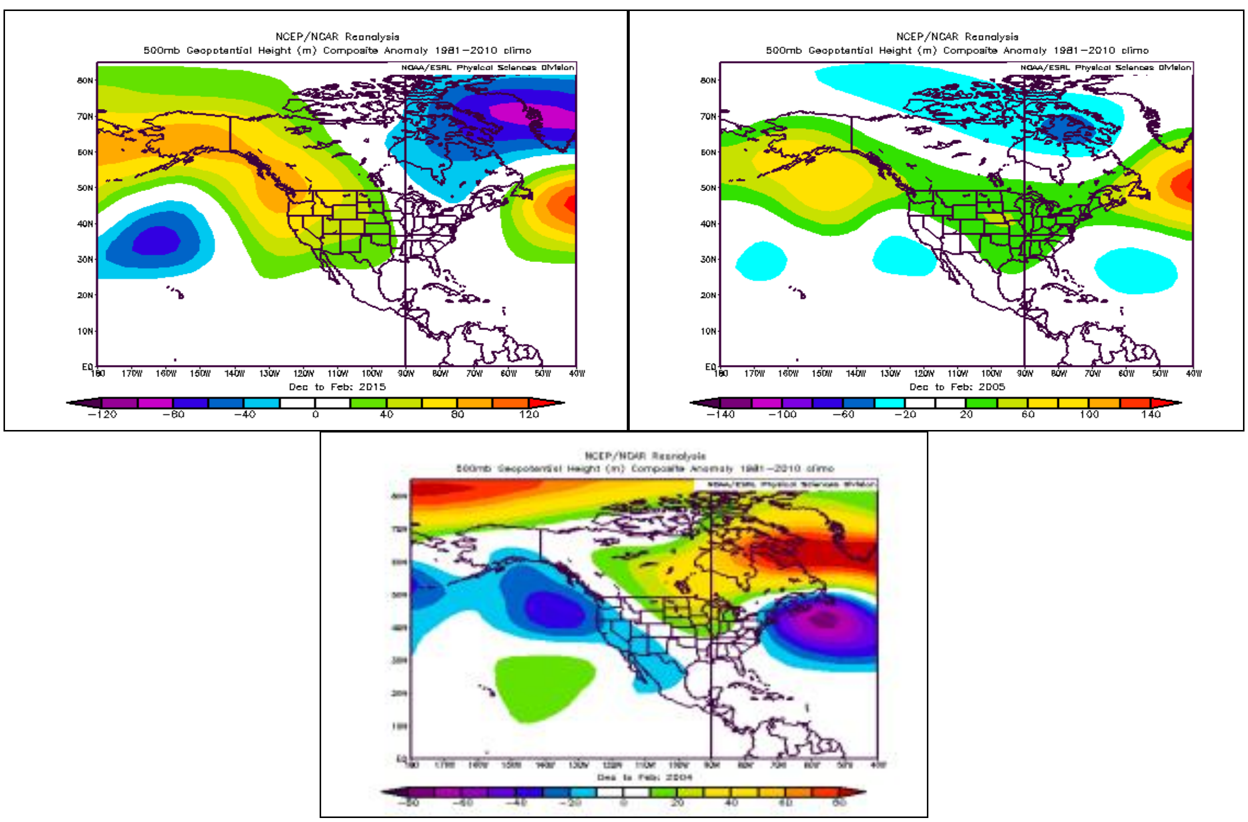

***Fig. 7-9:** 500 MB anomalies for meteorological winter (DEC/JAN/FEB) 2014-15 (top left), 2004-05 (top right) and 2003-04 (bottom).*

The 500 MB anomaly pattern governing the sensible weather for each of the 2014-15, 2004-05 and 2003-04 winter seasons vary WIDELY. Winter of 2014-15 featured a strong polar vortex extending from Greenland toward the Northeast U.S. while an amplified ridge affected western North America (***Fig. 7***). This pattern was likely shaped by a strong warm phase of the Pacific decadal oscillation (+PDO). The polar vortex was weaker and displaced farther north in northeast Canada during the 2004-05 winter season allowing a mild upper ridge pattern to dominate the Central U.S. (***Fig. 8***). During winter 2003-04 500 MB trough(s) persisted off the Northwest and Northeast coastlines (***Fig. 9***). The catalyst to the Northeast coastal upper trough was likely peaking anomalous warmth of the combination of both the Atlantic multi-decadal oscillation (AMO) and tropical North Atlantic (TNA) index. A weak +PDO and +AMO are expected during upcoming winter implying a combination of 2014-15 and 2003-04 winter 500 MB anomaly patterns are favored (***Fig. 10***).

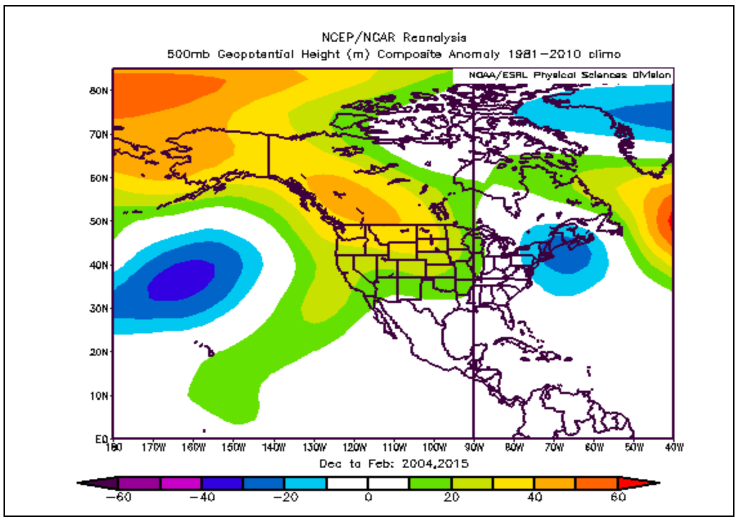

Fig. 10: *500 MB anomalies for meteorological winter (DEC/JAN/FEB) combining 2014-15 and 2003-04 analog years.*

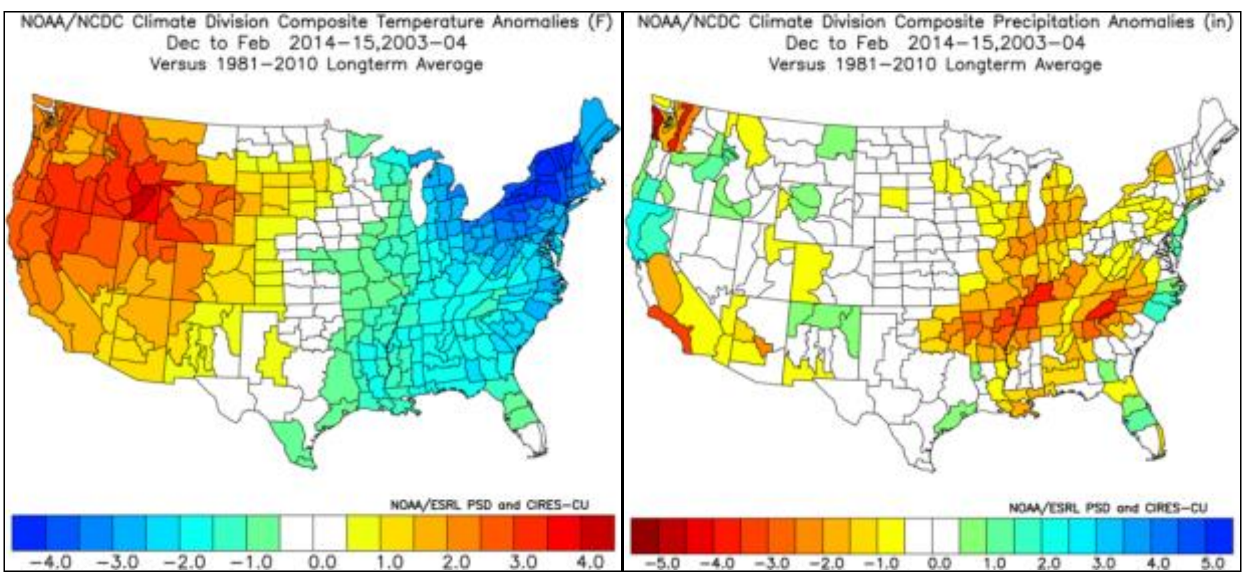

Fig. 11-12: *Sensible climate anomalies across the U.S. for DEC/JAN/FEB 2016-17 implied by 2014-15 and 2003-04 analog years.*

Conclusions: La Nina is not likely in 2016. Any weak La Nina that could occur during autumn dissipates by winter. Onset of a weak La Nina if it occurs is mid-October and lasting for no more than 1-2 months. Although neutral ENSO is projected for winter 2016-17 the anomalous warm global oceans will lend support to a borderline weak El Nino climate pattern leftover from 2015-16. The combination of this projected pattern with other leading modes of climate variability such as PDO and AMO are very important determining the winter 2016-17 climate. Combining recent analog years from the current long-term climate cycle implies winter 2016-17 is cold in the East while the West is warm (***Fig. 11***) and Interior East is dry (***Fig. 12***).