Evaluating the performance of numerical ENSO forecasts for the June-August time period relative to a statistical/analog approach

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Abstract

The development of an El Niño event was forecasted by a suite of numerical models during the Northern Hemisphere summer when the lead time was greater than one month. However, as the season approached, most of the same models flipped the forecast trajectory into one that included a neutral ENSO state through August and eventual La Niña conditions by early 2018. This study examines the skill of the numerical ENSO forecasts that were made during March-May for the June-August time period as compared to the skill demonstrated by other methods, including statistical and analog approaches. Any systematic/seasonal bias that may exist amongst these methods is also illuminated in order to help improve the skill of forecasts in future seasons.

Objectives, Data, and Methods

Objectives: Identify top-performing method for the 2017 summer ENSO forecast among the NMME, a statistical model, and analogs during the preceding March; quantify any NMME bias for this lead-time; demonstrate potential US impacts from the performance.

Data: ERA-Interim and NCEP/NCAR monthly reanalysis data

Methods: A statistical model was built using lead-time indicators (monthly teleconnection values), identified by creating a time series for June-August ENSO variability from EOF analysis. JMP was then used to compare this time series to a large suite of monthly March teleconnection values in a two-step process that involved response screening (linear regression) followed by the implementation of a fit model and cross-validation techniques.

Results

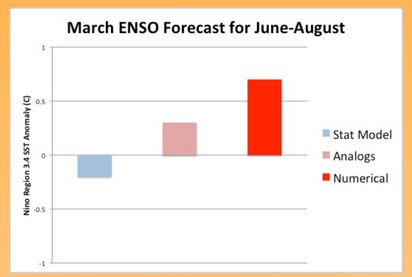

Figure 1. June-August ENSO forecasts made in March from a statistical model, analog mean, and numerical model consensus.

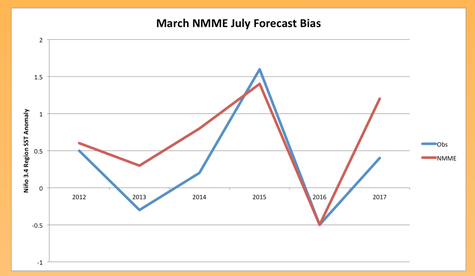

Figure 2. Comparison of NMME ENSO forecasts for July made during March to the observed ENSO state via the Niño 3.4 Region SST anomalies.

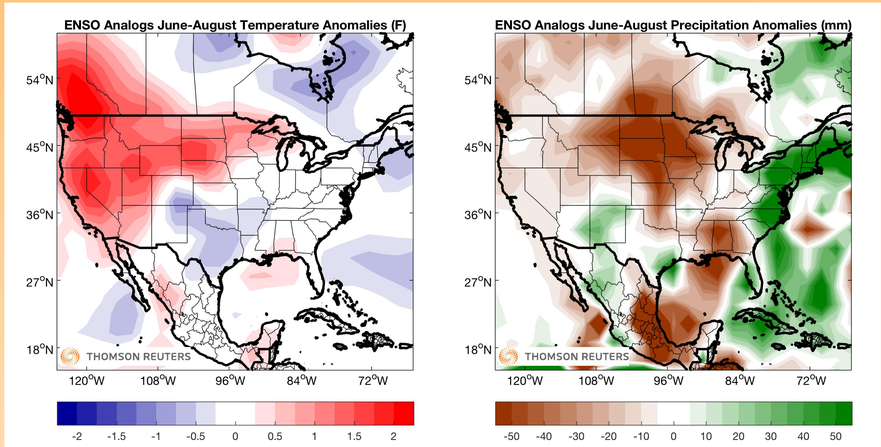

Figure 3. Composite temperature (F) and precipitation (mm) anomalies for June-August from the same ENSO analogs that outperformed a statistical model and NNME forecast for the summertime ENSO state.

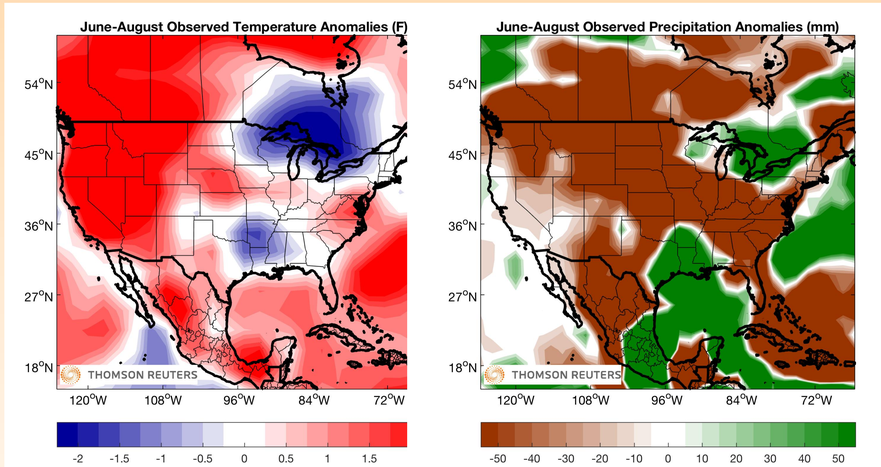

Figure 4. Observed temperature (F) and precipitation (mm) anomalies for June-August, 2017.

Conclusions

- An analog approach outperformed both a statistical model and numerical models (including the NMME) for the test case of the 2017 ENSO state with a 4-month forecast lead time (Figure 1).
- Over the past 6 years, the NMME shows a 0.3°C **warm bias** for the forecasted July ENSO state based on the March forecast (Figure 2), showing a potential area of improvement for NMME performance.
- Impacts from correctly anticipating the June-August ENSO state can be far reaching into many applications, as evidenced by the accuracy of the analog forecast made from the ENSO analogs in March over North America (Figures 3 and 4).

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