A study of the impact of initialization on ENSO predictability based on ensemble coupled data assimilation

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El Niño-Southern Oscillation (ENSO) is the most prominent short-term climate oscillation on the earth but its forecast skill is still highly uncertain. In recent years, much research effort in climate prediction has been devoted to model initialization and data assimilation issues.

In this work, an ensemble coupled data assimilation system is established based on the Zebiak-Cane model to study the impact of initialization on ENSO predictability. The Kaplan Sea Surface Temperature Anomalies (SSTA) which order Jan 1856 to Dec 2016 and FSU wind stress anomalies (WSA) which order Jan 1961 to Feb 2002 are assimilated into the new system for model initialization. Retrospective forecasts of ENSO for the period 1856 to 2016 are carried out. In the assimilation experiments, we try several assimilation strategies, such as localization, inflation.

Results show that the mean absolute errors in SSTA are reduced remarkably, compared with the values before assimilation. So do the values in WSA. More than that, the new system enhances the ENSO forecast skill by about 10%, compared with the previous system based on nudging scheme. The model successfully predicts all prominent El Niño events at lead times of up to two years, including the event in 2016/17, and ameliorates the spring predictability barrier.

Key words: model initialization, ENSO predictability, ensemble coupled data assimilation, Zebiak-Cane model