GEOS-5 Seasonal Forecast System: ENSO Prediction Skill and Bias
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Model, data, experiment
The GEOS-5 AOGCM known as S2S-1.0 has been in service from June 2012 through January 2018 (Borovikov et al. 2017). The atmospheric component of S2S-1.0 is Fortuna-2.5, the same that was used for the Modern-Era Retrospective Analysis for Research and Applications (MERRA), but with adjusted parameterization of moist processes and turbulence. The ocean component is the Modular Ocean Model version 4 (MOM4). The sea ice component is the Community Ice Code, version 4 (CICE). The land surface model is a catchment-based hydrological model coupled to the multi-layer snow model. The AGCM uses a Cartesian grid with a 1° × 1.25° horizontal resolution and 72 hybrid vertical levels with the uppermost level at 0.01 hPa. OGCM nominal resolution of the tripolar grid is 1/4°, with a meridional equatorial refinement to 1/4°. The coupled model initialization, selected atmospheric variables are constrained with MERRA. The Goddard Earth Observing System integrated Ocean Data Assimilation System (GEOS-iODAS) is used for both ocean state and sea ice initialization. SST, T and S profiles and sea ice concentration were assimilated.

For 35 years, every 5 days, a 9-month coupled seasonal hindcast has been initialized. In this study we included 4 mid-month hindcasts, concurrent with the hindcasts for the new forecast system S2S-2.1 (in production mode since December 2017).

Tropical Pacific Ocean SST S2S-1.0 forecasts in 1982-1998 and 1999-2016

Seasonal cycle bias for Equatorial Pacific Ocean SST indices

ACC, MSSS, predictability skills

Fig. 1. Reynolds SST used as ODAS observations for the initialization of the seasonal hindcasts/forecasts, and as SST validation. Shown here are the mean SST values over 1982-1998 and 1999-2016 periods for 4 seasons (Boreal winter, spring, summer and autumn), and the difference between these two fields.

Fig. 3. Monthly mean SST forecast drift with respect to Reynolds. Solid lines show the 1982-1998 period, dashed lines correspond to the 1999-2016 period.

Fig. 4. The paper by Xue et al. (2013) was an inspiration for this study. Similar characteristics of ACC still exist for the CFSv2 and S2S-1.0 SST forecasts.

Fig. 5. Top row: SST ACC and MSSS for the Niño 3.4 index. The Pearson correlation coefficient was used in all calculations. The dashed line in the ACC panel shows potential predictability P and the difference with the ACC. Bottom row: potential predictability P and the difference with the ACC. Forecast start months are along the y-axis and lead months are along the x-axis. Please flip the pages to see skills for other SST indices.

References

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