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An El Nino-Southern Oscillation forecast system formulated by an intermediate coupled model and its nonlinear forcing singular vector

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Previous studies have indicated the role of model errors in the short-term climate prediction [e.g., El Nino-Southern Oscillation (ENSO) prediction] in addition to the initial errors. Particularly, an ENSO related-intermediate coupled model (ICM) usually ignores some physical processes and their interactions, such that it cannot exactly depict the ENSO evolution, then inducing prediction uncertainties. In the present study, a nonlinear forcing singular vector-tendency error (NFSV) model is established by identifying the statistical relationship between observations and hindcasts generated by the ICM forecast system developed by Zhang et al. (2003). The NFSV-tendency error model is used to offset the model errors induced by the missing processes in the ICM. Then the ICM, coupled with the NFSV-tendency error model, formulates a new ENSO forecast system.
Eighteen-month hindcasts are made for the SST anomaly during the period 1982-2014 starting from each calendar month. As compared with the original ICM-based ENSO forecast system, the new ENSO forecast system significantly reduced the systematic errors of 0.4 °C for SST anomalies. The prediction skills of SST anomalies are therefore significantly improved. Especially, the new ENSO forecast system present much higher skill in predicting the SST anomalies over the central tropical than doing it in other regions, indicating a potential of distinguishing the central Pacific El Niño event in predictions. Cross-validation experiments further confirm the usefulness in the new ENSO forecast system. It is expected that the new ENSO forecast system is applied to real-time prediction of the tropical SST anomaly associated with the ENSO events