The Impact of Air-Sea Coupling on Tropical Intraseasonal Variability: Simulation and Predictability

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The National Center for Environmental Prediction (NCEP) Climate Forecast System (CFS) has been integrated in a freely coupled simulation for 52 years. Two experiments have also been performed with the atmosphere-only component of the model. In one experiment, the model is forced with daily SSTs from the coupled run. In the other, the model is forced with climatological SSTs from the coupled run. Additionally, a series of predictability experiments have been performed for large amplitude intraseasonal events. The impact of coupled air-sea feedbacks on the simulation and potential predictability of tropical intraseasonal variability (TISV) in the coupled and uncoupled models is investigated.

A coupled interactive ensemble technique is also applied to the CFS to determine the relative importance of internal atmospheric dynamics and coupled air-sea feedbacks in the interannual and intraseasonal variability in the CFS. A 40-year interactive ensemble simulation has been performed with the CFS. By comparing this simulation to the standard coupled simulation and the uncoupled simulation, we estimate the importance of internal atmospheric dynamics to the interannual and intraseasonal variability in the CFS.

Results indicate that air-sea coupling acts to reduce the overall intraseasonal variability of precipitation in the model. Additionally, air-sea coupling is responsible for small differences in the simulation of the TISO between the coupled and uncoupled models. From the predictability experiments, it is determined that coupled air-sea interactions can provide an additional 10-15 days of predictability in precipitation. From both the simulation experiments and a series of SST sensitivity predictability experiments, it is shown that the simulation and predictability of the TISO is very sensitive to differences in SST forcing. Specifically, climatological SSTs produce very different results than daily SSTs both in terms of simulation and predictability. Results from the interactive ensemble simulation further support the conclusion that air-sea interactions are important to the simulation of the tropical intraseasonal oscillation.