The Evolution of the Lead-Lag ENSO-Indian Monsoon Relationship in GCM Experiments

Emilia K. JIN[1]
(kjin@cola.iges.org)
James L. KINTER III[2]

[1]George Mason University, Fairfax, VA, USA
[2]Center for Ocean-Land-Atmosphere Studies, Calverton, MD, USA

The relationship between ENSO (El Niño and the Southern Oscillation) and Indian monsoon rainfall has been studied using a suite of 55-yr experiments with a 62-wavenumber, 64-level atmospheric general circulation model (GCM) taken from the NCEP Climate Forecast System (CFS). The "pacemaker" experiment, in which tropical Pacific SST is prescribed from observations but coupled air-sea feedbacks are maintained in the other ocean basins, was conducted for the 1950–2004 period. The "control" run with climatological SST values instead of coupling with the slab ocean model was also conducted. Four independent integrations were made for each of these two forcing scenarios. A 52-year run with the CFS coupled GCM is also compared as the "coupled" experiment.

The evolution of the lead-lag relationship between ENSO and the Indian monsoon is not only a good example of air-sea coupled co-variability, but also an interesting subject for this model, because, in the coupled experiment, the model cannot mimic this relationship, producing an insignificant covariability in contrast with the observed. In the control run without a coupled ocean, the relationship is also less well simulated. Surprisingly, the simulated relationship in the pacemaker experiment is reasonably close to observed. This shows that simple systems with only local air-sea feedback are capable of greater realism than sophisticated coupled models, since the coupled GCM has significant errors in the ocean dynamics and the atmospheric Walker circulation related to ENSO. Focusing on the tropical western Pacific, the excessive westward penetration of SST anomalies associated with ENSO in the coupled experiment is mainly related to the failure to reproduce the ENSO-monsoon relationship.