Geophysical Research Abstracts
Vol. 14, EGU2012-1955, 2012
EGU General Assembly 2012

Role of nonlinearities associated with air-sea coupling processes in El Nino's phase-locking

R. Zhang (1,2), W.S. Duan (1), and Y.S. Yu (3)

(1) Institute of Atmospheric Physics, China (ruimzz@hotmail.com), (2) Graduate University of the Chinese Academy of Science, China, (3) Institute of Ocean, Chinese Academy of Sciences, China

We use the approach of conditional nonlinear optimal perturbation (CNOP) to investigate the optimal precursory disturbances in the Zebiak-Cane El Niño-Southern Oscillation (ENSO) model. By exploring the dynamical behaviors of the El Niño events caused by these CNOP-type precursors, we find that the CNOP-El Nino events, as expected, tend to phase-lock to annual cycle in the Zebiak-Cane model, with the SSTA peak at the end of the year. However, for the linearized CNOP-El Nino events, i.e. the El Nino events with the CNOPs as initial anomalies but in the linearized Zebiak-Cane model, they are inclined to phase-lock to be earlier than the CNOP-El Nino events despite there exists annual cycle in the model. It is obvious that nonlinearities play an important role in El Nino's phase-locking. In particular, the nonlinear temperature advection increases the zonal SST difference and the anomalous westerly, which weakens the anomalous upwelling and acts on the increasing anomalous vertical temperature difference, finally enhancing the El Nino and then delaying the time that the SSTA attains peak. The nonlinear temperature advection, together with the effect of the annual cycle, makes the El Nino events attain the peak at the end of the year.