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Ensemble-mean dynamics of the ENSO recharge oscillator under state-dependent stochastic forcing

Fei-Fei Jin (1), L. Lin (2), A. Timmermann (3), J. Zhao(1)

(1) Department of Meteorology, SOEST, University of Hawaii at Manoa, Honolulu, USA, (2) Department of Meteorology, Florida State University, Tallahassee, USA, (3) International Pacific Research Center, SOEST, University of Hawaii at Manoa, USA (jff@soest.hawaii.edu / Fax 808-9672877)

In this paper, the conceptual recharge oscillator model for the El Niño-Southern Oscillation phenomenon (ENSO) is utilized to study the influence of fast variability such as that associated with westerly wind bursts (WWB) on dynamics of ENSO and predictability. The ENSO-WWB interaction is simply represented by stochastic forcing modulated by ENSO-related sea surface temperature (SST) anomalies. An analytical framework is developed to describe the ensemble-mean dynamics of ENSO under the stochastic forcing. Numerical ensemble simulations verify the main results derived from the analytical ensemble-mean theory: the state-dependent stochastic forcing enhances the instability of ENSO and its ensemble spread, generates asymmetry in the predictability of the onsets of cold and warm phases of ENSO, and leads to an ensemble-mean bias that may eventually contribute to a climate mean state bias.