Geophysical Research Abstracts
Vol. 14, EGU2012-7307, 2012
EGU General Assembly 2012

Empirical modeling of ENSO dynamics: prognosis of critical transitions in delay differential equations models of ENSO

E. Loskutov (1), D. Mukhin (1), M. Chekroun (2), and A. Feigin (1)

(1) Department of Atmospheric Research, Institute of Applied Physics RAS, Nizhny Novgorod, Russian Federation, (2) Department of Atmospheric and Oceanic Sciences, UCLA, Los Angeles, CA, United States

This work focus on prognosis of critical transitions in the DDE models of ENSO. We use a consistent Bayesian approach to modeling stochastic (random) dynamical systems by time series [1]. In this approach, the key ("robust") dynamic properties of the system evolution can be described by a few variables, while other features may be considered as a stochastic disturbance. Stochastic models of this sort are of the form of random dynamical systems; they present a necessary and important step towards reconstructing the observed systems when their adequate first-principle mathematical models are either unknown or subjected to further verification. We construct stochastic model of evolution operator of unknown system by virtue of scalar time series generated by the system. The model operator includes deterministic as well as stochastic terms; both of them supposed to be inhomogeneous in the model state space and are parameterized by artificial neuron networks. We use as a data source two DDE models of ENSO: (i) Tziperman et al. model [2] and (ii) Galanti & Tziperman model [3]. These models were complemented by both dynamical noise reflecting influences of random external forcing, and adiabatic trend of control parameter making them weakly non-autonomous. Applicability of reconstructed model for prognosis of qualitative changes (critical transitions) of system behavior is demonstrated for time interval greater than "observation" period.

1. Molkov Ya.I., Loskutov E.M., Mukhin D.N., and Feigin A.M.,Random dynamical models from time series, Phys.Rev.E, sub judice,2011.
2. Tziperman E., L. Stone, M. Cane, and H. Jarosh, El Niño chaos: Overlapping of resonances between the seasonal cycle and the Pacific ocean-atmosphere oscillator, Science,264,72–74,1994.
3. Galanti, E. and E. Tziperman, 2000. Journal of the Atmospheric Sciences. 57, 2936-2950.