Indo-Pacific ENSO modes in a double-basin Zebiak-Cane model

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We study Indo-Pacific interactions on ENSO timescales in a double-basin version of the Zebiak-Cane ENSO model, employing both time integrations and bifurcation analysis (continuation methods).

The model contains two oceans (the Indian and Pacific Ocean) separated by a meridional wall. Interaction between the basins is possible via the atmosphere overlaying both basins. We focus on the effect of the Indian Ocean (both its mean state and its variability) on ENSO stability. In addition, inspired by analysis of observational data (Wieners et al, Coherent tropical Indo-Pacific interannual climate variability, in review), we investigate the effect of state-dependent atmospheric noise.

Preliminary results include the following: 1) The background state of the Indian Ocean stabilises the Pacific ENSO (i.e. the Hopf bifurcation is shifted to higher values of the SST-atmosphere coupling), 2) the West Pacific cooling (warming) co-occurring with El Niño (La Niña) is essential to simulate the phase relations between Pacific and Indian SST anomalies, 3) a non-linear atmosphere is needed to simulate the effect of the Indian Ocean variability onto the Pacific ENSO that is suggested by observations.