Geophysical Research Abstracts
Vol. 20, EGU2018-10745, 2018
EGU General Assembly 2018

The Role of Stochastic Forcing in Generating ENSO Diversity

Erin Thomas (1), Daniel Vimont (1), Matthew Newman (2,3), and Cecile Penland (3)

(1) Atmospheric and Oceanic Sciences Department, University of Wisconsin - Madison, (2) University of Colorado, CIRES, Boulder, United States, (3) NOAA/ESRL/PSD, Boulder, United States

El Niño-Southern Oscillation (ENSO) variability is influenced by numerous oceanic and atmospheric phenomena, which complicate our ability to predict and analyze the mechanisms responsible for generating ENSO diversity. The predictability of ENSO events depends on the characteristics of both the forecast initial conditions as well as the stochastic forcing that occurs after a forecast is initialized. In this talk, we use a linear inverse model (LIM) to diagnose how stochastic forcing impacts different ENSO events. In a previous study, it was shown that despite extensive model development, the tropical SST forecast skill of the operational North American Multi-Model Ensemble (NMME) of eight coupled atmosphere-ocean models remains close both regionally and temporally to that of a vastly simpler LIM derived from observed covariances of SST, sea surface height, and wind fields. The LIM clearly captured the essence of the predictable SST dynamics. The NMME and LIM skills also closely tracked and were only slightly lower than the potential skill estimated using the LIM's forecast signal-to-noise ratios. This suggests that the much simpler LIM may be used not only to diagnose the predictable ENSO signal but also how noise impacts ENSO development and potential prediction skill.

In the LIM framework, stochastic forcing is capable of improving the predictability of the ENSO event if it excites optimal initial conditions that maximize deterministic ENSO growth. However, it can also be detrimental to the predictability of the event if it excites unpredictable growth or interference after the forecast is initialized. This study uses LIM to identify specific spatial and temporal characteristics within stochastic forcing that contribute to the development of ENSO diversity, specifically Central Pacific (CP) or Eastern Pacific (EP) ENSO characteristics. The technique is then used to analyze the role of initial conditions and noise forcing throughout the evolution of several past ENSO events. Overall, the results confirm that ENSO events are influenced by a rich variety of phenomena that can influence the event throughout its entire evolution.