FSU Meteorology Seminar Series, Fall 2019

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Non-Gaussian climate variability within a stochastic framework

Abstract

Earth's atmosphere-ocean system is distinguished by its variability over a wide range of time scales. The non-linear multi-scale interactions between these time scales are complex and are further complicated by the large number of subsystems and modes in the atmosphere-ocean system. In recent years, stochastic methods have been developed to approximate the variability associated with weather (fast) and climate (slow) time scale interactions. This weather-climate time scale separation may be represented as a stochastic process, where weather is modeled as a rapidly decorrelating process and climate as a slowly decorrelating process. Here, we explore a stochastic model developed by Sardeshmukh and Sura which uses correlated additive and multiplicative (CAM) noise and relies on a state-dependent (multiplicative) noise forcing to represent the weather-climate time scale interface.

An important problem in climate variability is the statistical representation of extreme weather and climate events. While a description of the tails of a probability density function (pdf) is essential for modeling extreme events, an understanding of the full pdf is required to capture the full dynamics of the atmosphere-ocean system. On daily scales, the statistics of the large-scale atmospheric circulation are non-Gaussian. The CAM noise model, though only a linear stochastic approximation to the full system dynamics, is typically able to generate a realistic evolution of climate anomalies that follow a non-Gaussian probability distribution. We examine the non-Gaussianity of a few atmospheric variables from reanalysis data and investigate the spatiotemporal properties of the statistics. A non-Gaussian pdf obtained from the CAM noise model will also be discussed and compared to observations.

Time: Thursday, Nov. 21 @ 3:30 PM
Location: LOV 353