The spectra of a general class of stochastic climate models

Richard Kleeman

Courant Institute, NYU, New York USA (kleeman@cims.nyu.edu)

Simple stochastic models of climate have played an important role historically in understanding mechanisms of low frequency variability. Such models can be derived simply from plausible physical mechanisms and are able to account qualitatively for the observed temporal spectra of a variety of phenomena such as mid-latitude SST and ENSO variability.

While undoubtedly not the last word on the complex interaction underlying such phenomena, they provide a compelling first order explanation as well as a "null hypothesis" with which to test more elaborate explanations.

In this talk we derive and analyse carefully the spectral matrix for a general multivariate Ornstein Uhlenbeck process. This class of processes covers many (but not all) influential stochastic climate models. The analysis turns out to have close connections with classical linear resonance and multivariate time series theory.

As a simple application of these ideas we derive a new mechanism to explain decadal ENSO variations.