



THE UNIVERSITY OF CHICAGO

Department of Statistics

DISSERTATION PROPOSAL

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Data-Driven Simulations of Future Transient Temperatures with Changing Covariance

Thursday, October 02, 2014, at 3:00 PM
Eckhart 135, 5734 S. University Avenue

ABSTRACT

Impacts assessments for future climate change depend on changes in temporal variability in addition to changes in mean climate. General circulation models (GCMs) do predict changes in variability, but do not reproduce the means or variability of observed climate. The proposed research addresses the ensuing need for estimation of changes in variability predicted by GCMs, and for climate simulations that combine observational data with GCM projections of changes in both mean and variability. Leeds et al. (2014) introduced a methodology for modifying existing temperature observations based on GCM projections of changes in means and covariances between two equilibrated (stationary) climates under different CO₂ concentrations. Here, we extend that methodology to account for GCM projections of transient (nonstationary) climates. No other methods that we are aware of account for changes in temporal dependence, and therefore in different changes in variability at distinct timescales. Our approach characterizes changes in time-varying spectra in terms of the GCM input(s) forcing the transient realization, using approximate likelihood methods for nonstationary processes. As a secondary goal, we can combine our methodology with climate model emulation to study changes due to forcing scenarios for which no GCM realizations exist.

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