



The University of Chicago  
Department of Statistics

Ph.D. Seminar

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**Characteristics of a Model Error in an Air Quality  
Model and Fixed-Domain Asymptotic Properties  
of Spatial Cross-Periodograms**

**MONDAY, July 16, 2007 at 1:00 PM  
110 Eckhart Hall, 5734 S. University Avenue**

**ABSTRACT**

The first part explores the characteristics of a model error in an Air Quality Model. The difficulty in assessing errors in numerical models is a major obstacle to improving the ability to predict air quality. There are many different sources of errors in the numerical air quality models. With simulation outputs at different resolutions, using the CMAQ, a numerical air quality model used by the US Environmental Protection Agency(EPA), characteristics of the errors due to different resolutions are investigated. The availability of fine scale simulated outputs for several air pollutants leads to considering spatial cross-periodogram and its asymptotic properties, which is presented in the second part.

The second part shows fixed-domain asymptotic properties of spatial cross-periodograms. Cross-periodograms can be used to study a multivariate spatial process observed on a lattice. For spatial data, it is often appropriate to study asymptotic properties of statistical procedures under fixed-domain asymptotics in which the number of observations increases in a fixed region while shrinking distances between neighboring observations. Using fixed-domain asymptotics, we prove relative asymptotic unbiasedness and relative consistency of a smoothed cross-periodogram after appropriate filtering of the data. In addition, we show smoothed cross-periodograms are asymptotically normal when the process is stationary multivariate Gaussian with appropriate assumptions on high frequency behavior of the spectral density.

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Information about building access for persons with disabilities may be obtained in advance by calling Karen Gonzalez (Department Administrator and Assistant to Chair) at 773.702.8335 or by email ([karen@galton.uchicago.edu](mailto:karen@galton.uchicago.edu)).