MICHIGAN STATE UNIVERSITY
Department of Statistics and Probability

COLLOQUIUM

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Spatio-Temporal Modelling using Integro-Difference Equations

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Abstract

Integro-difference equations are a particular parametrization of a hierarchical dynamic model for spatio-temporal analysis. The dynamics of the process defined by an integro-difference equation is dependent upon the kernel choice. The traditional kernel used in this setting is Gaussian, and it has been shown that the advection and diffusion of the resulting process is controlled by the mean and the variance of the kernel. By using approximations to stochastic partial differential equations, it is shown that, or non-Gaussian kernels, higher order moments and tail behavior of the kernel affect how an IDE process evolves over time. Thus, kernels with more flexible shapes and tail behavior generally result in more flexible models. Moreover, by making the kernel dependent on location, it is possible to obtain non-stationarity. We focus on kernels from the bivariate stable family. Such kernels can take on a variety of shapes, including varying tail behavior, orientations, and skewness. The bivariate stable density is defined by a random measure, which controls the shape. We model the random measure using Bernstein polynomials with a geometric weights base. We extend the model to be spatially-varying by making the measure dependent on location. The method is illustrated by modelling sea surface temperature in the Tropical Pacific. Our results indicate that the model has good predictive skill for future El Niño events.

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