Modeling and Testing Properties of Space-time Covariance Functions

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Abstract

Modeling space-time data often relies on parametric covariance models and various assumptions such as full symmetry and separability. These assumptions are important because they simplify the structure of the model and its inference, and ease the possibly extensive computational burden associated with space-time data sets. We review various space-time covariance models and propose a unified framework for testing a variety of assumptions commonly made for covariance functions of stationary spatio-temporal random fields. The methodology is based on the asymptotic normality of space-time covariance estimators. We focus on tests for full symmetry and separability, but our framework naturally covers testing for isotropy, Taylor's hypothesis, and the structure of cross-covariances. The proposed test successfully detects the asymmetric and nonseparable features in two sets of wind speed data. We perform simulation experiments to evaluate our test and conclude that our method is reliable and powerful for assessing common assumptions on space-time covariance functions.

The talk is based on joint work with Bo Li (NCAR) and Michael Sherman (TAMU).