Spatio-temporal models with space-time interaction and their applications to air pollution data

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Abstract

It is of utmost importance to have a clear understanding of the status of air pollution and to provide forecasts and insights about the air quality to the general public and the environmentalists. Previous studies of spatio-temporal models already showed that even short-term exposure to high concentrations of fine atmospheric particulate matters can be hazardous to the health of common people. In this study, we develop a spatio-temporal model with space-time interaction for air pollution data ($PM_{2.5}$). The proposed model uses a parametric space-time interaction component along with the spatial and temporal components in the mean structure, and introduces a random-effects component specified in the form of zero-mean spatio-temporal processes. The implementation of the model is done using a fully Bayesian set-up. In particular, MCMC methods are used to estimate the coefficients, to test for the presence of space-time interaction and for model comparison. For application, we analyze the hourly air pollution data ($PM_{2.5}$) from Beijing, Chengdu, and Shanghai − three major cities in China.