Efficient posterior inference and prediction of space-time processes using dynamic process convolutions

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Abstract

Bayesian dynamic process convolution models provide an appealing approach for modeling both univariate and multivariate spatial temporal data. Their structure can be exploited to significantly reduce the dimensionality of a complex spatial temporal process. This results in efficient Markov chain Monte Carlo (MCMC) algorithms required for full Bayesian inference. In addition, the dynamic process convolution framework readily handles both missing data and misaligned multivariate space-time data without the need for imputation. We review the dynamic process convolution framework and discuss these and other computational advantages of the approach. We present an application involving the modeling of air pollutants to demonstrate how this approach can be used to effectively model a space-time process and provide predictions along with corresponding uncertainty statements.