Modelling the kurtosis of spatiotemporal processes

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The goal of this work is to propose a novel class of robust models for phenomena that vary continuously in space and time, in which the variance of the process may depend on spatial covariates. Thus, it is expected that the covariates help to explain spatial heterogeneity. The resulting model is non-stationary as the covariance function depends on spatial locations. In geostatistical data, it is usually assumed Gaussianity for the spatial process of interest. However, in practice, this might not be appropriate when the real data present outliers or heterogeneity. The non-Gaussian process presented by Fonseca and Steel (2011) models the variance of the phenomenon as a spatial process. Our proposal is to allow this variance process to depend on spatial covariates. The idea is to improve the explanation of variability of the process by allowing the kurtosis to vary with spatial location. The inference procedure is performed under the Bayesian framework. We present an illustrative example in the modeling of the maximum temperatures in the Spanish Basque country. The resultant posterior predictive interval for unobserved locations of the proposed model is narrower than the ones obtained under the usual Gaussian process or the process presented by Fonseca and Steel (2011). Further, the parameters associated with the kurtosis process have interesting interpretation.

Keywords: Bayesian inference; Heavy-tailed; Non-stationarity; Non-Gaussian process.