



An analytical approach for Bayesian area-to-point kriging: a case study with crop yields

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Area-to-point kriging (ATPK) is a geostatistical method to create raster maps of high resolution using data of the variable of interest of much lower and possibly differing resolutions. As with point kriging, the method can be posed in the framework of a linear mixed model, in which a spatial trend based on some covariates (for which high resolution maps are available) gives the fixed effects and spatially-correlated residuals give the random effects. Then, the regression coefficients and variogram parameters at high resolution support can be estimated by restricted maximum likelihood. With conventional ATPK methods, uncertainty in the variogram model parameters is not accounted for. In this talk we present a Bayesian version of ATPK (BATPK) in which prior distributions of regression coefficients and variogram parameters are updated with the available data. Commonly, posterior distributions of model parameters and posterior predictive distributions are approximated by Markov chain Monte Carlo (MCMC) sampling from the posterior. Even with advanced sampling algorithms such as Differential Evolution MCMC, this can be computationally expensive. We therefore considered a partly analytical approach of BATPK, in which the fixed-effect and variance parameters are integrated from the posterior distribution analytically and the integral over the remaining correlation parameter is approximated via a discrete sum. We tested this approach with simulated one-dimensional data as well as in real-world case studies on aggregated crop yields in Burkina Faso and China.