Uncertainty Assessment in Geostatistical Modeling of Functional Data[1]

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Abstract. The increasing interest in spatially correlated functional data has recently led to the development of appropriate geostatistical techniques. Prediction of a curve at an unmonitored location can be obtained using a functional kriging with external drift model that takes into account the effect of exogenous variables (either scalar or functional). The spatial correlation is accounted for when estimating the drift by means of an iterative algorithm. Nevertheless, while much effort has been put in prediction, uncertainty evaluation for functional spatial prediction remains an open issue. We propose a semi-parametric bootstrap for spatially correlated functional data that allows to evaluate the uncertainty of a predicted curve. Prediction bands are obtained by ordering the bootstrapped predicted curves in two different ways according to band depth and L^2 distance. The performance of the proposed methodology is assessed via a simulation study. Moreover, the approach is illustrated on a well known data set of Canadian temperature and on a real data set of PM_{10} concentration in the Piemonte region, Italy. Based on the results it can be concluded that the method is computationally feasible and suitable for quantifying the uncertainty around a predicted curve.

Keywords. B-splines, band depth, functional data modelling, generalized additive models, geostatistics, trace-variogram.

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