A model for collocation uncertainty of atmospheric profiles

Maria Franco-Villoria
University of Torino, Torino, Italy - maria.francovilloria@unito.it

Rosaria Ignaccolo
University of Torino, Torino, Italy - rosaria.ignaccolo@unito.it

Alessandro Fassò*
University of Bergamo, Bergamo, Italy - alessandro.fasso@unibg.it

Atmospheric thermodynamic data are gathered by high technology remote instruments such as radiosondes, giving rise to profiles that are usually modelled as functions depending only on height. The radiosonde balloons, however, drift away in the atmosphere resulting in not necessarily vertical but three-dimensional (3D) trajectories. To model this kind of functional data, we introduce a "point based" formulation of an heteroskedastic functional regression model that includes a trivariate smooth function and results to be an extension of a previously introduced unidimensional model. Functional coefficients of both the conditional mean and variance are estimated by reformulating the model as a standard generalized additive model and subsequently as a mixed model. This reformulation leads to a double mixed model whose parameters are fitted by using an iterative algorithm that allows to adjust for heteroskedasticity. The proposed modelling approach is applied to describe collocation mismatch when we deal with couples of balloons launched at two different locations. In particular, we model collocation error of atmospheric pressure in terms of meteorological covariates and space and time mismatch. Results show that model fitting is improved once heteroskedasticity is taken into account.

Keywords: Functional linear model; heteroskedasticity; generalized additive models; mixed models.