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Regionalisation of stream temperatures in Austria by external drift Top-kriging

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The knowledge about annual and seasonal characteristics of stream temperature is a basic requirement for a number of problems of water resources management, in the context of water quality and ecohydrology. For sites where no stream temperature data have been monitored, stochastic regionalisation techniques can be used to infer characteristic temperatures from neighbouring, undisturbed catchments where stream temperature data have been collected. Such techniques are usually based on some kind of correlation of the variable of interest, either on the spatial correlation of the variable itself (geostatistical model), or on its correlation with auxiliary variables that are available at both observed and unobserved sites (regression model).

In this paper, we present external drift Top-kriging as a geostatistical method for estimating stream temperatures at unobserved sites. The method combines the geostatistical Top-kriging model with a linear regression model. In a first step, a linear regression model between stream temperature and air temperature is fitted, in order to exploit the information given by an auxiliary variable. In the second step, Top-kriging, or topological kriging, is applied to the residuals of the regression model. Top-kriging exploits the spatial correlation of temperatures for estimating low flows at unobserved sites. In Top-kriging, the spatial correlation of measured data with different support (catchment area) is described by the regularised variogram. Hence, Top-kriging takes the area and nested nature of catchments into account. The approach is tested on an Austrian data set consisting of 230 streamflow temperature stations. Results indicate that the model presented here is well suited for estimating stream temperatures at unobserved river

sites in Austria. It is shown how the model performs in stream temperature mapping for any river cross-section in Austria.