Geophysical Research Abstracts
Vol. 13, EGU2011-11522-1, 2011
EGU General Assembly 2011

Geostatistics on river networks - a review

Gregor Laaha (1) and Günter Blöschl (2)

(1) BOKU Vienna, Institute of Applied Statistics and Computing, Vienna, Austria (gregor.laaha@boku.ac.at), (2) Vienna University of Technology, Institute for Hydraulic and Water Resources Engineering

Geostatistical methods have become popular in various fields of hydrology, and typical applications include the prediction of precipitation events, the simulation of aquifer properties and the estimation of groundwater levels and quality. Surprisingly little effort has been undertaken to apply geostatistics to stream flow variables. This is most likely because of the tree-like structure of river networks, which poses specific challenges for geostatistical regionalisation. Notably, the shape of catchments (irregular block support), the nestedness of catchments along the river network (overlapping support), and the definition of a relevant distance measure between catchments pose specific challenges. This paper attempts an annotated survey of models proposed in the literature, stating contributions and pinpointing merits and shortcomings. Two conceptual viewpoints are distinguished, (1) one-dimensional models which use covariances along a stream network based on river distance, and (2) two-dimensional models where stream flow is conceptualised as the integral of the spatially continuous local runoff process over the catchment area. Both geostatistical concepts are evaluated relative to geostatistical standard methods based on Euclidean distances, either in geographic space, or in physiographic space of catchment characteristics. It is shown how the methods perform in various examples including spatial prediction of low flows [1], floods [2], stream temperatures [3] and nitrate loads [4]. It is further discussed how the methods can be extended to perform space-time analysis of stream flow variables.

References:
[1] Laaha G, Skøien J, Blöschl G (2010) Spatial prediction on a river network: Comparison of Top-kriging with regional regression. Environmetrics (under review).
[2] Skøien J, Merz R, Blöschl G (2006) Top-kriging – geostatistics on stream networks. Hydrology and Earth System Sciences 10: 277–287.
[3] Laaha G, Skøien J, Blöschl G (2010) Spatial prediction of stream temperatures using Top-kriging with an external drift. Biometrics (under review).
[4] Laaha G, Skøien J, Blöschl G, Schilling C, Haberl R (2010) Spatial prediction of nitrate loads on a river network (in preparation).