Geostatistical model of water discharge on the Moselle basin

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In order to model water discharge at any point of a hydrographic network, different hydrological models ([3]) have been developed by water agencies using statistical regressions between measurements and various watershed characteristics (http://www.eau-rhin-meuse.fr/). We propose to estimate specific discharges using these relations but also considering space correlations. This is a particular application of geostatistics because on tree supports, usual covariances are not valid anymore ([4]) then appropriate models have to be developed.

Various models have been proposed in [2] and one of them is applied here for the estimation of water discharges on the Moselle basin. This basin is located in the east of France and represents a hydrographic network with about 100 important confluences and 100 monitoring stations.

First, we present an experimental analyze of data: correlations between annual means of discharges and drainage basin surfaces, importance of the distance to be considered in the calculation of the variograms (Euclidean or stream distance) ([1]), evidence of non stationarity, dependence/independence of connected/non connected points. . .

Then we construct a model for specific discharge considering the one-dimension random functions Y_I defined on each path linking one source to the outlet. When different paths join at a node, the resulting random function Z downstream is a linear combination of the corresponding using specific weights. Fits to measurements are presented.

Bibliography:

[1] Bernard-Michel C., de Fouquet C., 2005. Geostatistical Indicators of Nutrients

Concentrations in Streams. Proceedings of IAMG'05: GIS and Spatial Analysis, Vol 2, 716-721. Edited by Quiming Cheng, Graeme Bonham Carter

[2] de Fouquet C., Bernard-Michel C., 2006: Modèles géostatistiques de concentrations ou de débits le long des cours d'eau. Accepted for publication in Comptes rendus de l'Académie des sciences.

[3] Sauquet E., 2000: Une cartographie des écoulements annuels et mensuels d'un grand basin versant structurée par la topologie du réseau hydrographique. Doctorat Mécanique des milieux géophysiques et environnement, Institut national polytechnique de Grenoble.

[4] Ver Hoef J.M., Peterson E., Theobald D., 2004: Spatial statistical models that use flow and stream distance. Accepted for publication in Environmental and Ecological statistics