Geophysical Research Abstracts, Vol. 7, 06642, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06642

Geostatistical indicators of pollutant concentrations in rivers

C. Bernard-Michel, C. de Fouquet

Centre de Géostatistique, Ecole des Mines de Paris, Fontainebleau, France
(caroline.bernard-michel@ensmp.fr / Phone : +33 1 64694777)

In order to assess river quality, different parameters such as nutrients concentrations are measured in different monitoring stations.

The information contained in these measurements must be summarized in a few synthetic statistical indicators (annual mean or quantile) making it possible to compare in a realistic manner the quality of water in different stations, and its evolution year after year.

They are currently used in the context of the water framework directive, which aims at achieving good water status for all waters by 2015.

In France, the indicator recommended to characterize nitrate concentrations is the 90% quantile of yearly concentrations in each monitoring station. It is estimated using the classical statistical inference (empirical quantile) based on a hypothesis proved to be incorrect: time correlations are ignored. That can have important consequences, particularly in the case of irregular monitoring: for example nitrate concentrations are higher in winter, and then if sampling is increased in winter out of precaution, the quantile is falsely increased.

Moreover, the empirical quantile presents a bias even in case of independent data, and this bias depends on the sample size which is particularly embarrassing when comparing monitoring stations with different sampling strategies.

It is therefore necessary to develop methods taking into account time correlation and reducing the bias of the 90% quantile indicator. This can be done by a linear interpolation of the empirical quantile and with geostatistics, by assigning kriging weights of the annual mean to measurements.

Moreover, to estimate the annual mean of concentrations for a stream segment and not only at a site, it is also necessary to take into account spatial correlation. It presents theoretical difficulties because of changing the support of the random process from R^n to specific support such as a hydrographic network. On such supports, most of usual spatial covariance models are not valid anymore. It is then necessary to develop new spatial models on networks supports. Different elementary models are presented and compared according to their different properties. Real measurements on the French basin of Rhin Meuse are used in order to evaluate the pertinence of the models.

References:

[1] J-P. Chilès and P. Delfiner. *Geostatistics, modeling spatial uncertainty*. Wiley, 1999.

[2] P. Monestiez, J-S. Bailly, P. Lagacherie, and M. Voltz. Geostatistical modeling of spatial processes on directed trees : Application to Fluvisol extent. Submitted and accepted for publication in *Geoderma*.

[3] J.M. Ver Hoef, E. Peterson, and D. Theobald. Spatial statistical models that use flow and stream distance. Submitted and accepted for publication in *Environmental and Ecological Statistics.*