Geophysical Research Abstracts
Vol. 14, EGU2012-6306-2, 2012
EGU General Assembly 2012

Risk Assessment of Sediment Pollution Using Geostatistical Simulations

J. Golay and M. Kanevski
University of Lausanne, Institute of Geomatics and Analysis of Risk, Switzerland (jean.golay@unil.ch)

Environmental monitoring networks (EMN) discreetly measure the intensities of continuous phenomena (e.g. pollution, temperature, etc.). Spatial prediction models, like kriging, are then used for modeling. But, they give rise to smooth representations of phenomena which leads to overestimations or underestimations of extreme values. Moreover, they do not reproduce the spatial variability of the original data and the corresponding uncertainties. When dealing with risk assessment, this is unacceptable, since extreme values must be retrieved and probabilities of exceeding given thresholds must be computed [Kanevski et al., 2009]. In order to overcome these obstacles, geostatistics provides another approach: conditional stochastic simulations. Here, the basic idea is to generate multiple estimates of variable values (e.g. pollution concentration) at every location of interest which are calculated as stochastic realizations of an unknown random function (see, for example, [Kanevski, 2008], where both theoretical concepts and real data case studies are presented in detail). Many algorithms implement this approach. The most widely used in spatial modeling are sequential Gaussian simulations/cosimulations, sequential indicator simulations/cosimulations and direct simulations.

In the present study, several algorithms of geostatistical conditional simulations were applied on real data collected from Lake Geneva. The main objectives were to compare their effectiveness in reproducing global statistics (histograms, variograms) and the way they characterize the variability and uncertainty of the contamination patterns. The dataset is composed of 200 measurements of the contamination of the lake sediments by heavy metals (i.e. Cadmium, Mercury, Zinc, Copper, Titanium and Chromium). The results obtained show some differences highlighting that risk assessment can be influenced by the algorithm it relies on. Moreover, hybrid models based on machine learning algorithms and geostatistical simulations were applied to study the phenomena of spatial nonstationarity.

References

Kanevski, M., Pozdnoukhov, A. and Timonin, V. (2009). *Machine Learning for Spatial Environmental Data: Theory, Applications and Software*. Lausanne: EPFL Press.

Kanevski, M. (Editor) (2008). *Advanced Mapping of Environmental Data: Geostatistics, Machine Learning and Bayesian Maximum Entropy*. London / Hoboken: iSTE / Wiley.