Geostatistical Tools for Deriving Block-Averaged Values of Environmental Attributes

Pierre Goovaerts

Department of Civil and Environmental Engineering,
The University of Michigan,
Ann Arbor, MI 48109-2125, USA.

Abstract

This paper reviews four different approaches for estimating the block-averaged value of an environmental attribute from point data: 1) the sample arithmetic average, 2) the declustered mean, 3) block kriging, and 4) stochastic simulation. The first approach is straightforward and well suited for estimation over large blocks that contain many randomly located observations. Declustering techniques can be used to correct for preferential sampling of specific subareas of such large blocks. The last two techniques, kriging and simulation, account for the pattern of spatial dependence of observations and allow one to compensate for the shortage of data inside small blocks by incorporating observations outside the block. The major advantage of stochastic simulation is that it provides a non-parametric measure of the uncertainty attached to the prediction of a single block or multiple spatially dependent blocks.Stochastic simulation can also be used to upscale properties like permeability that do not average linearly in space, whereas the first 3 techniques are only valid for linear averaging parameters. The different techniques are illustrated using a soil data set related to heavy metal contamination over a 14.5km^2 area in the Swiss Jura.