

Book Review

Title: *Geostatistics for Environmental Scientists*, 2nd Edition

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There are many theories that are seemingly worth linking the environment and statistical methods through a space or space-time sampling framework. A prominent theory of spatial random processes is fully explored in *Geostatistics for Environmental Scientists*, a book that was first published in 2001, and later revised in a second edition in 2007. The book grasps the definition of ‘Geostatistics’ from a farmer’s imaginary story, to connect it to a soil/environment survey. The soil survey is very important for the authors’ methodology. It is characterized by sampled locations to determine how much is known and how soil/environmental surveys can apply Geostatistics methods to generate estimates and predict values for unknown locations through variogram and covariance.

The authors’ methodology approached it in two ways: (1) started by describing basic statistics, estimation, prediction, and mapping as for classical surveys, perhaps by considering choice and measurements of environmental variables and random process; and then (2) extended classical estimation to include spatial classifications in estimating covariance and variograms, a ‘model-based’ approach, to increase precisions. Based on the theory of Matheron, a primary author of Geostatistics methods under the ‘regionalized variable theory’, the authors express environmental structure, estimation of variations from one point to another, and its use in the predictions of soil characteristics in un-sampled locations using mathematical functions.

The book consists of twelve chapters: including introduction, basic statistics, prediction and interpolation, characterizing spatial processes, reliability of experimental variogram and nested sampling, spectral analysis, local estimation or prediction, kriging in the presence of trend and factorial kriging, cross-correlation and disjunctive kriging and stochastic simulation. The tone of regionalization variable theory and its background in environmental surveys was not robust though the mathematical functions are clearly explained and extensively shown through practical examples. Against the view of the regionalized theory, the authors state that “... sampling design is less important for geostatistic

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prediction than it is in classical estimation.” The topic of great importance to me to avoid biased estimates, improve coverage, and provision of sufficient sample points. Matheron discussed this argument, by applying random function to a specific point. This puzzle is still questioning the authors’ prediction power of the kriging at a prediction grid, once compared to a sampling grid.

Moreover, the confusion is unclear since the book has patched different sampling strategies in three chapters. In Chapter Two, the authors proposed stratified and systematic designs as better to simple random sampling for areal study; in chapter Four, they preferred the replicated sampling for classified groups; and in Chapter Six, a multi-stage (multi-level) or nested strategies (equal vs unequal scheme) was emphasized to estimate the variance at each level. All these were implicitly explained and practically exemplified. In my opinion, and given the practical examples, the sampling design is necessary and should be considered from the survey design to a prediction grid.

Compared with geostatistical methodology, this book has value to environmental scientists, but the structure is not well organized as expected. Though the authors were interested in illustrating the spatial random process to handle environmental studies, the relationship between the ‘theory of regionalized variables’ and the ‘theory of random process’ was partially illustrated to reason the theories and applicability. Better still, is in the added aide-memoire, which summarizes analytical steps to handle both environmental surveys, and the remote sensing data and simulation chapter (Chapter Twelve), which illustrate variations of different function to judge the probability that kriging results exceed a certain threshold. Although there are a considerable collection of commands presented in Appendix B that may assist the reader, however, the authors would have to include these commands in an appropriate chapter.