Quantifying Uncertainty

One of the objectives in optimization is to understand and manage the uncertainties throughout the remedial efforts in order to achieve the remedial goals with sufficient confidence. The general topic of Attainment of Closure Goals is related to Quantifying Uncertainty (see General Topics, Table 2). More complex and advanced geospatial analyses can help quantify uncertainty. Analyzing the estimated uncertainties may help inform decisions regarding future sampling locations, areas requiring remediation, or attainment of closure goals. The analyses provide maps of uncertainty in the estimated/interpolated values.

Understanding the Results: ▼*Read more*

Kriging, with cross-validation: After transforming or detrending the data, or both if necessary, fit the empirical variogram using several models. Select several neighborhoods. Perform cross-validation in order to evaluate the accuracy of the alternative models and neighborhoods. Then use the cross-validation to compare the accuracy of each model (and neighborhood) in order to choose the most suitable one. Through the analysis of the error terms, the most suitable model (the most accurate) and neighborhood are chosen for further estimates. The more accurate the model, the more likely it is that the kriging results are representative of the variable of interest.

Contour kriging variance: The precision of the predictions generated from kriging can be measured using the prediction standard error or variance. By creating a map of the standard error or variance, the areas that may require additional sampling can be identified. To use this approach to evaluate potential additional sampling locations, first place a hypothetical sample in a zone of concern (high variance), assign it a random value of the variable of interest (for example, concentration), and then recalculate the map of variance from this new sample point to help determine whether the decrease in variance is significant.

Conditional simulation: Perform a Gaussian (normal distribution) transformation of the raw distribution. Fit a theoretical variogram, select a grid of prediction locations, and perform several simulations of concentrations (>100 for instance). Prepare maps of the probability of exceeding the remediation cleanup target concentrations. Estimate volumes of contamination for each simulation. The probability maps correspond to the risk of occurrence of contamination. Focus on blocks showing 30% to 60% probability of exceeding the threshold. In these blocks, the occurrence of contamination is not accurately estimated and represents the areas of uncertainty. The volume associated with these blocks can be estimated. Further investigations may be needed in these areas in order to improve the estimate of the risk of contamination and to minimize the uncertainty of the volume estimate.