Measuring of uncertainty in geostatistics: estimation or simulation?

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This paper presents a comparative study between estimation and simulation both concerned to uncertainty measurements. It has been proved that depending on the simulation algorithm used, the E-type estimates from a set of simulated realizations is equivalent to the OK estimates. Ordinary kriging estimation provides an uncertainty measurement, which is traditionally based on the kriging variance. Recently an alternative approach based on interpolation variance has been proposed. Conditional stochastic simulation has been preferred in relation to OK estimation because a field of uncertainty at unsampled points can be derived. The GSLIB's cluster.dat was chosen as a test data set. For this data set both ordinary kriging and E-type estimates, derived from different simulation algorithms, are very similar. While the kriging variance does not present any correlation with OK estimate, the interpolation variance as well as the conditional variances around E-type estimates derived from 50 conditional stochastic simulation realizations do present good correlations. Moreover, the interpolation variance does not show a linear relationship with the kriging variance as should be expected, due to its homoscedastic characteristic. On the other hand, the interpolation variance and conditional variances computed from different conditional simulation algorithms present reasonable correlations. It proves that the interpolation variance and conditional variances are equivalent and dependent on local hard data. Finally, the resulting OK estimate and E-type estimates are well correlated, but OK image is smoothed while E-type images are more sensitive to local variations. Therefore, the conditional stochastic simulation is a good choice for both prediction and uncertainty measurement.