# Statistical characters of realizations derived from sequential indicator simulation

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***Abstract***

The issue of statistical characters of the stochastic realization has received much less attention than simulation algorithms and their roles in expressing spatial uncertainty. In fact, two of the three types of space of uncertainty introduced by Goovaerts can be characterized by probability distributions derived from the realizations. In this paper the local and the regional spaces of uncertainty are analyzed in the case of well-averaged porosity of a deep water turbidity reservoir. The background simulation algorithm is a sequential indicator one, because it allows for spatial correlation pattern of very large and very small values. In this way, wider range of uncertainty may be captured. One-hundred realizations were generated for each of the six grid systems defined by different resolutions ranging from 10x10 m to 35x35 m of sizes. For each of *L* realizations (*L=1,2,…,100*) of a particular resolution two types of arithmetic averages were calculated. The first one was the average of the grid values of this realization (RA), and the next one was the average of the grid values of the first *n* realizations (GA). Beside of these, for each *L* the variance of the grid values of the first *L* realizations was also derived. According to the rule of variance decomposition, for *L>3*, this variance can be subdivided into within-grid-points (WGP) and between-grid-points (BGP) parts. The first one (WGP) reflects the local stability or uncertainty of the estimation, while the next one (BGP) may express the lateral variability of the porosity. From the one-hundred averages and the corresponding two variances three sequences can be formed. In these the $n^{th}$ term is the average or WGP or BGP of the grid-point values of the first *n* realizations. According to the week low of large numbers these sequences show stochastic convergences. After their stochastic approximation the appropriate limit values can be calculated. The speeds of the convergences, the limits, as well as the shapes of the sequences depend on the grid resolution that is the amount of geological details captured by the simulation. In case of variances, WGP > BGP means that the simulation result is determined by the space of local uncertainty while WGP < BGP reflects that the result is affected by the space of lateral uncertainty. The local uncertainty may be originated from unstable estimation, while the regional one may be the realization of geological heterogeneity.