Geophysical Research Abstracts
Vol. 20, EGU2018-8571-1, 2018
EGU General Assembly 2018

Optimal spatial coverage sampling to support estimation of covariance parameters and minimization of prediction error for soil mapping

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Planning a geostatistical survey for soil requires rational choices regarding the sampling strategy. Prior knowledge on the soil property spatial variation can be used to optimize the sampling configuration. It involves explicit formulation of an objective function to minimize, and time-consuming spatial optimization procedure. The practical use of those techniques is limited when more than one soil variable need to be jointly estimated or when we are ignorant about the spatial structure of the soil property. For those reasons, spatial coverage sampling is often preferred, as it relies on the simple dispersion of samples as uniformly as possible. Spatial coverage sampling design are adequate to estimate the soil property spatial mean, but often fail at estimating robustly the model covariance parameters.

In this paper, we use an expression of the expected total sampling error which accounts for both covariance prediction uncertainty and prediction error. We address two practical questions. First, how many samples taken with a spatial coverage sampling design are needed to reach the same precision as an optimized sample scheme? Second, how many samples taken with a spatial coverage sampling design with 10% close pair samples are needed to reach the same accuracy as an optimized sample scheme?

Our experiments suggest that about 20% additional samples need to be collected when a spatial coverage sampling strategy is adopted. When 10% of the samples are taken as close pairs, the number of additional samples needed is about 12%.