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ANALYSIS OF ANISOTROPIC VARIOGRAM MODELS FOR PREDICTION OF THE CURONIAN LAGOON DATA

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The first step in a geostatistical analysis is to determine the shape of a so-called (semi)variogram, which is a function of local data variability with distance between observations. The semivariogram is a function that relates variance to spatial separation and provides a concise description of the scale and pattern of spatial variability. It defines the distance over which autocorrelation exists.

Suppose (see [2] p. 52) that $\{z(s) : s \in D\}$ is realization of a random process $\{Z(s) : s \in D\}$, where D is a fixed subset of R^d with positive d-dimensional volume. Let us consider a particular realization $z(s)$ of intrinsic random function $Z(s)$. For locations s_k and s_l and associated random variables $Z(s_k)$ and $Z(s_l)$ the variogram is

$$2\gamma(s_k - s_l) = Var[(Z(s_k) - Z(s_l))], \quad \text{for all } s_k, s_l \in D. \tag{1}$$

If the semivariogram depends only on distance between locations the process is called isotropic. The sample estimator of the isotropic semivariogram based on the method-of-moments is

$$\hat{\gamma}(h) = \frac{1}{2N(|h|)} \sum_{(s_k, s_l) \in N(|h|)} [Z(s_k) - Z(s_l)]^2, \tag{2}$$

where $N(|h|)$ denotes all pairs (s_k, s_l) for which $|s_k - s_l| = |h|$.

When the process Z is anisotropic [i.e. dependence between $Z(s)$ and $Z(s+h)$ is a function of both the magnitude and the direction of h], the semivariogram (of the intrinsicall stationary process) is no longer purely a function of distance between two spatial locations ([2], p. 62) Anisotropic models of semivariogram may be geometric (the sills are the same and the ranges are different), zonal (the sills are different or if the shapes are different) and others.

In this research the estimation of anisotropic variogram models and prediction of the Curonian Lagoon data are described and analysed. All computations are made by using gstat package of R system. Prediction results are compared with results of early research which are described in [3] and [4].

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