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Geostatistical Applications of Spartan Spatial Random Fields in Environmental Mapping.

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Spartan Spatial Random Fields (SSRF's) are a recently proposed geostatistical model (Hristopulos, 2003) with applications in environmental risk assessment and natural resources estimation. SSRF's provide spatial dependence models that are computationally fast, do not requires the estimation of the experimental variogram, and allow incorporating constraints based on physical laws in the probability density function. SSRF's at the first stage provide new, differentiable covariance functions. These can be used with the Kriging estimators, or with a new class of spatial estimators that become possible in the SSRF framework. This presentation focuses on methodological issues such as the inference of the SSRF model parameters from samples distributed on an irregular network, and the determination of an optimal correlation neighborhood for the SSRF estimator. Applications of the method to real data sets are considered, extending previous investigations (Varouchakis and Hristopulos, 2004). The issue of spatial estimation (interpolation) at unknown locations is investigated using novel spatial estimators (Hristopulos, 2005). The estimation error of the method is discussed, and the estimates are compared with the standard Ordinary Kriging estimator applied in connection with "classical" covariance models.

1. D. T. Hristopulos, "Spartan Gibbs Random Field Models for Geostatistical Applications," *SIAM Journal on Scientific Computing*, **24**(6), 2125-2162 (2003)

2. D. T. Hristopulos, "Spartan Spatial Random Field Models Inspired from Statistical Physics with Applications in the Geosciences," *Next III Conference*, 13-18 August 2005, Kolymbari, Chania. http://xxx.lanl.gov/abs/physics/0510035

3. M. Varouchakis and D. T. Hristopulos, "An Application of Spatial Spartan Ran-

dom Fields in Geostatistical Mapping of Environmental Pollutants," in *Proceedings of the International Conference of Computational Methods in Sciences and Engineering* 2004 (eds. T. E. Simos and G. Maroulis), pp. 741-744, VSP International, The Netherlands.