Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03865, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03865
EGU General Assembly 2008

A Non-Parametric Approach for the Conditional Simulation of Large Environmental Data Sets based on Statistical Physics Models and an Application to the Walker Lake Data

M. Žukovič (1), D.T. Hristopulos (1)

(1) Department of Mineral Resources Engineering, Technical University of Crete, Chania 73100 GREECE (mzukovic@mred.tuc.gr)

Simulation is a powerful tool for the analysis of spatial processes pertaining to the environment and the health of various ecosystems. Quite often, the processes of interest follow non-Gaussian probability distributions. We present a new approach for the conditional simulation of spatial data, inspired by discrete "spin" models (Ising and Potts models) from statistical physics. The field of interest is discretized into a finite number of levels (i.e., different "spin values"). The spatial correlations are imposed by pairwise short-range interactions between the "spins". Simulation is based on minimizing a cost function that measures the distance between the normalized energy of the scattered sample (conditioning data) and the energy of the "spin" model on the simulation grid. The approach is conceptually simple, but it can integrate various data and scales. It is also computationally efficient and requires minimal input by a user. Finally, it is suitable for non-Gaussian data, since it makes no assumptions on the probability distribution. We conduct simulations on the Walker Lake data set to investigate the effects of domain size, number of discrete levels, and initial conditions on the simulation CPU time and the reproduction of the target statistics (e.g. the histogram and the variogram). Finally, we discuss potential extensions of the model.

This research project has been supported by a Marie Curie Transfer of Knowledge Fellowship of the European Community's Sixth Framework Programme under contract number MTKD-CT-2004-014135.