

Introduction to Geostatistical Estimation and Simulation

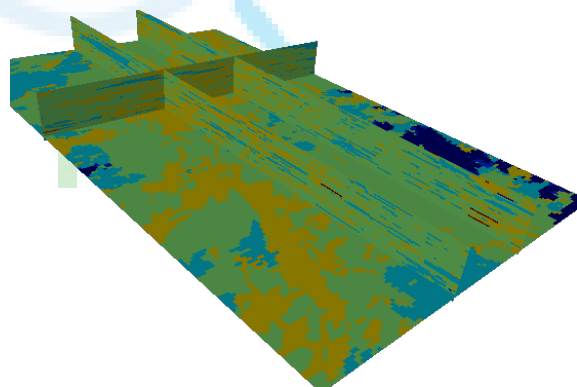
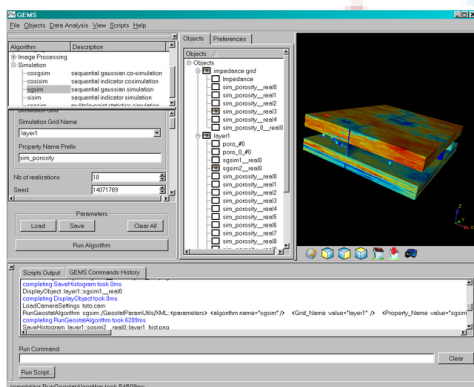
Instructor: Alexandre Boucher, PhD

Date : 11-12 September 2010

Location: Ghent, Belgium

Web : www.geoenv.ugent.be

This two-day short course aims at providing an introduction to geostatistical estimation and simulation. The class covers variogram modeling, kriging, cokriging as well as stochastic simulations with variograms and training images. The focus is on an intuitive understanding of the underlying concepts with the help of computer-based exercises. The strengths and limitations of the techniques are highlighted to provide a critical perspective and insight on when a method is appropriate for a given study. The difference between estimation map (kriging) and simulated realizations will be given particular attention. The exercises will be performed with the open-source software SGeMS (www.sgems.sourceforge.net) based on remote sensing imagery and hydrogeological data.



About the instructor :

Alexandre Boucher received a Ph.D. from Stanford University, CA, USA. He currently teaches geostatistics in the department of Environmental Earth System Science at Stanford University. He has taught short courses on the subject in the US, Switzerland and Japan. He is a contributor and developer to the open source SGeMS geostatistical software and coauthor of the book Applied Geostatistics with SGeMS: A User's Guide.



Syllabus

Day 1

Introduction to probability:

- Probabilistic versus deterministic modeling.
- Concept of random variable and random function.

Exploratory data analysis:

- Interpreting histogram, scattergram and QQ-Plot

Spatial Continuity:

- Describing texture with variogram and covariance
- Exercise:* Computing and modeling variograms

Spatial estimation with kriging:

- Unbiasedness and Estimation variance
- Deriving the kriging system of equations
- Exercise:* simple, ordinary and universal kriging.

Day 2

Factorial Kriging and Cokriging:

- Extending the kriging system of equations to filter spatial structures and integrate secondary attributes.
- Exercise:* Filter a remote sensing image with factorial kriging

Geostatistical simulations:

- Kriging-based simulation algorithms:
 - sequential Gaussian simulation
 - sequential indicator simulation
 - direct sequential simulation
- Training image based simulation algorithm
- Exercise:* Simulation of lithologies with training image followed by simulation of porosity with sequential Gaussian simulation.

Uncertainty modeling and risk analysis:

- Using geostatistical estimation and simulation for decision making.
- Exercise:* Distribution of shortest paths based on a set of simulated and estimated maps