Gregoire Mariethoz, Sanjeev Kumar Jha, Matthew F. McCabe, Jason P. Evans

1 The University of New South Wales, School of Civil and Environmental Engineering, Sydney, Australia.
2 Climate Change Research Center, University of New South Wales, Sydney, Australia.

Background

Multiple-point geostatistics (MPS) is a family of stochastic spatial analysis methods aimed, in a broad sense, at interpolating values at unknown locations and assessing the uncertainty of the interpolation. A characteristic of MPS is the use of a training image (TI) to convey prior information on the spatial structure of the unknown variable to interpolate.

Novel applications

Recent advances in MPS offer new possibilities in remote sensing, surface hydrology and climate modeling. MPS is an ensemble of tools for the characterization of spatial phenomena. Its most prominent characteristic is the use of training images for defining what type of spatial patterns are deemed to result from the processes under study. In the last decade, MPS have been increasingly used to characterize 3D subsurface structures consisting of geological facies, with application primarily to reservoir engineering, hydrogeology and mining. Although the methods show good results, a consistent difficulty relates to finding appropriate training images to describe largely unknown geological formations.

Despite this issue, the growing interest in MPS triggered a series of different methodological advances, leading to improved computational performance and increased flexibility. With these recent improvements, the scientific community now has unprecedented numerical tools that allow dealing with a wide range of problems outside the realm of subsurface applications. These include the simulation of continuous variables as well as complex non-linear ensembles of multivariate properties. It is found that these new tools are ideal to address a number of issues in scientific fields related to surface modeling of environmental systems and geophysical data. Shifting focus and investigating the application of MPS to surface hydrology results in a wealth of training images that are readily available, thanks to global networks of remote sensing measurements.

This poster illustrates recent results in this direction, including MPS applications to the stochastic downscaling of climate models, the completion of partially informed remote sensing images and the prediction of the evolution of river bathymetry. A major advantage is the use of satellite images taken at regular intervals, which can be used to inform both the spatial and temporal variability of hydrological processes.

References


