



PoPEX - An adaptative importance sampler for the categorical inverse problem

Philippe Renard, Christoph Jäggi, Yasin Dagasan, Przemyslaw Juda, and Julien Straubhaar
University of Neuchâtel, Centre for Hydrogeology and Geothermics, Switzerland (philippe.renard@unine.ch)

One challenge in stochastic hydrogeological modeling is to solve the inverse problem when the parameter fields take a discrete set of values. This typically occurs when considering different rock types having a large contrast in parameter values. Situations of this kind are particularly hard because the usual techniques based on derivatives (sensitivity coefficients) or covariances are inefficient. In this presentation, we will present the Posterior Population Expansion (PoPEX) method. It is an ensemble based technique designed to identify categorical parameter fields in a Bayesian perspective. The method generates iteratively an ensemble of categorical fields using any geostatistical technique and evaluates their likelihood values. To illustrate the method, we will employ a multiple-points statistic technique, but the approach is general. During the inversion process, the relation between observed state variables and parameter values is derived from the ensemble and used to constrain the generation of the next categorical fields. The method is shown to be more efficient than more classical Markov chain Monte Carlo approaches and to provide accurate uncertainty estimates on a set of examples. As the algorithm still requires to compute the likelihood for a significant number of fields, we also explore how Generative Adversarial Networks could be used to accelerate PoPEX by predicting rapidly the misfit.