

Making the most of scarce data: efficient parameter estimation with geostatistical inversion

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Abstract. *Natural porous media are often strongly heterogeneous due to their formation e.g. by sedimentation processes. The optimal management of the production of oil or drinking water requires a knowledge of their hydraulic properties, particularly the permeability. Geostatistical inversion has been proposed for some years as a method for the estimation of the spatially distributed field of the permeability from measurements of hydraulic head, tracer concentrations or geoelectric currents. However, while there has been some improvement regarding the efficiency of these schemes, they usually are based on a Gauss-Newton-approach and require the assumption of a static flow field and/or have a suboptimal complexity regarding the number of measurements taken into account.*

Based on methods used in Geophysics, a new approach for parameter estimation using preconditioned Conjugate Gradient scheme has been developed, which is both faster for experiments with a static flow field, has a nearly constant complexity regarding the number of measurements and can be applied for transient problems described for example by Richards' equation. A method to efficiently assess the (linearised) uncertainty of the estimated parameter field is available as well.