Geophysical Research Abstracts
Vol. 16, EGU2014-14626, 2014
EGU General Assembly 2014

Capability of EnKF to assimilate tracer test data at the lower detection limit

Johanna Bruckmann, Christian Vogt, and Christoph Clauser

Institute for Applied Geophysics and Geothermal Energy, E.ON Energy Research Center, RWTH Aachen University, Germany (jbruckmann@eonerc.rwth-aachen.de)

We model water flow and estimate permeability distribution to improve regional groundwater management for a tectonically limited hard-rock aquifer. Management of groundwater resources for drinking water supply requires understanding and quantifying of the regional groundwater flow and groundwater budget which depends largely on the petrophysical transport properties (e. g., porosity and permeability) of the underground. We study a structurally complex and thus highly heterogeneous area on a regional scale: the Hastenrather Graben 15 km northeast of Aachen, Germany. Here, groundwater is produced from a carbonate aquifer for drinking water supply. However, direct data on the geometry and petrophysical properties of the underground are sparse and most data are only one-dimensional. For overcoming this limitation and coping with the heterogeneity of the underground we use the Ensemble Kalman Filter (EnKF) for stochastic parameter estimation and statistical ensemble analysis.
Assimilating time-dependent tracer test data will help estimating permeability. The fact that the aquifer is used for drinking water supply prevents using of any artificial tracer such as radioactive or fluorescent tracer. Instead, drinking water with a lower salinity compared to the groundwater (e.g., dam water) will be used. The detection limit will be relatively low due to the low salinity contrast between reservoir water and tracer. It might even be in the range of measuring error.
For studying the sensitivity of EnKF at the limit of detection we set up a synthetic scenario based on the conditions in our study area. Performing EnKF assimilation runs based on perturbed observations characterized by different measurement error levels yields information on the acceptable signal-to-noise-ratio required by EnKF for successful estimates of the given synthetic permeability distribution. This, in turn, provides information on the limits of the real-world's tracer test at low salinity contrast.