In geothermal reservoir engineering reliable permeability estimates are important. At the European EGS test site at Soultz-sous-Forêts three wells had been drilled into the granitic bedrock down to about 5 km and then hydraulically stimulated for enhancing the hydraulic connectivity. In July 2005, to study the change in hydraulic properties, a chemical tracer was injected into well GPK3 for 19 hours at a rate of 0.015 m$^3$ s$^{-1}$. Tracer concentration was monitored in the production wells GPK2 and GPK4 during the following 5 months.

We simulate the Soultz geothermal reservoir with the numerical simulator shemat-suite and applied an Ensemble-Kalman-Filter (EnKF) to estimate the cell-by-cell variation of permeability. EnKF uses a forward propagation of an ensemble of realizations to obtain Gaussian error statistics. At successive points in time, different kinds of observations, such as tracer concentration and bottom-hole pressure are combined in one data vector and used to update the system variables. This improves the data fit successively. We studied the performance and spatial resolution of the EnKF technique on a 2D test model and applied it to a 3D model of the Soultz reservoir.

With the EnKF approach, a permeability field and its standard deviation is obtained which explains the tracer concentrations at both GPK2 and GPK4 simultaneously. The permeability in most of the reservoir is about $10^{-15}$ m$^2$; GPK2 and GPK3 are well connected with a mean permeability of about $10^{-13}$ m$^2$, while a flow barrier exists between GPK2 and GPK4.