Kolloquium:

In situ recovery of Uranium, a reactive transport modeling approach

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In situ recovery is a well-established technique for uranium exploitation, representing over 50% of worldwide production, with some key advantages: low production costs and reduced environmental footprint. The economic potential and technical challenges to predict and optimize production have led to intensive research. The presentation focuses on the use of reactive transport modeling to improve the understanding of processes and their coupling: this offers in itself some opportunities to guide optimizations, improve production forecasting, and more generally help in planning.

A geochemical model is built, based on ore characterization and extensive thermodynamic and kinetic databases. The model is further constrained by the geometry of the system: distribution of hydraulic properties and mineral content using geostatistical realizations of the block-model. Finally, exploitation conditions are simulated: geometry of the well field, injection fluid composition and flow-rates in injection and production wells. Most parameters of the model are constrained by field data or operational choices, with minimal adjustment, which increases the robustness of the approach. After calibration, some applications of the model are presented: optimization, estimation of production for short-term or long-term planning.

A similar model can also be used to investigate post-mining evolution, including e.g. natural attenuation.