Geophysical Research Abstracts
Vol. 13, EGU2011-3229, 2011
EGU General Assembly 2011

Analytical solutions for diffusive transport with heterogeneous reactions and porosity changes

Mohamed Hayek, Georg Kosakowski, and Sergey Churakov
Paul Scherrer Institut, Laboratory for Waste Management, CH-5232 Villigen PSI, Switzerland (mohamed.hayek@psi.ch)

The strong coupling of transport and chemical processes via precipitation-dissolution reactions and subsequent changes of porosity and transport parameters is of interest in many geoscientific fields (e.g. evolution of material interfaces, CO2 sequestration, nuclear waste management, hydrothermal systems).
We present analytical solutions for diffusive transport coupled with heterogeneous chemical reactions and causing porosity changes in porous media. The novel solutions describe the spatial and temporal evolution of solute and solid concentrations, and porosity for a set of initial and boundary conditions. The form of the solutions and the choice of admissible boundary conditions might limit the applicability to natural systems. However, we believe that the proposed solutions are extremely useful for benchmarking and testing numerical codes. As an example, we present a comparison between analytical solutions and numerical ones obtained by using a global implicit finite volume scheme. A good agreement is obtained between the analytical and the numerical solutions.