EGW 2018 - Abstract Submission

Joan Delort Ylla[a], Allan M.M. Leal[a] and M.O. Saar[a]

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Towards a porosity-independent permeability update model for large-scale reactive transport simulations

We present a new permeability update model when mineral dissolution and precipitation reactions are considered in continuum reactive transport simulations in porous media. The model is independent of porosity and formulated such that permeability changes occur across the faces of the discretized cell elements, rather than on their center nodes as is usual in the literature. Each face in the mesh is assumed to have a connecting channel along which the fluid flows from one cell to the other and reacts with the surrounding minerals. Initial aperture values for these channels are assigned in a way that consistently reproduces the desired initial permeability field. As the fluid flows and reacts along these channels, these apertures change and so does their intrinsic permeability. The proposed permeability update method has been tested in a 1D reactive transport problem in which CO_2-saturated brine flows through a column of porous rock composed of 90% quartz and 10% calcite (volume composition). As expected, calcite is dissolved at the entrance and re-precipitates in the middle of the core, where a temperature step is empirically imposed. Our novel permeability update model behaves in a similar fashion to Kozeny-Carman-like models when permeability decrease is caused by mineral precipitation. This result shows the difficulty of implementing a permeability update model truly independent from the size of the discretized cell elements. We found however promising ideas that might be worth investigating in the future.

[a]Geothermal Energy and Geofluids Group, Department of Earth Sciences, ETH Zurich, Switzerland.