Geophysical Research Abstracts
Vol. 17, EGU2015-15124, 2015
EGU General Assembly 2015

Insights about fracture shape and aperture from push-pull thermal tracer tests achieved at different scales

Maria V. Klepikova (1), Tanguy Le Borgne (2), Olivier Bour (2), Rebecca Hochreutener (2), and Nicolas Lavenant (2)

(1) Engineering Geology, ETH Zurich, Zurich, Switzerland, (2) Geosciences Rennes, OSUR, UMR CNRS 6118, University of Rennes 1, Rennes, France

The prediction of transport patterns in fractured media is a challenging task. Different transport mechanisms are generally contributing: dispersion at fracture scale related to aperture variability, dispersion at network scale due to transport in different flowpaths and matrix diffusion. It is however difficult to know which mechanism is dominant.

In this study we test the interest of heat tracer tests for providing new constraints on transport in fractured media by interpreting three push-pull tests of different duration. A series of heat and solute push-pull tracer test with Dirac-type injection was conducted in fractured aquifer of Ploemeur, France. The comparison of solute and heat breakthrough curves shows that due to thermal loss to the rock matrix temperature recovery peak arrives earlier than concentration peak. Moreover, the peak is significantly smaller for temperature recovery while it exhibits a longest tailing. Finally, we found that the recovered peak temperature decreases with scale and has a power law slope of -1 on a log-log plot.

By means of flow and heat numerical model, we investigate the relevance of different conceptual models: single 'plate', 'tube' and 'ellipse' homogeneous fracture models at different scales. For all tested fracture geometries temperature breakthrough curves were found to be sensitive to fracture aperture. An 'elliptical tube' fracture model was found to provide the best fit to the data and based on this model, we were able to estimate the aperture of the fracture in the present case. Moreover, the comparison of experimental breakthrough curves and modelling results also suggests that the effective fracture aperture may increase with scale. This work emphasizes that multiple-scale push-pull thermal tests can provide valuable insights on fracture geometry and fracture aperture.