EGU2020-21854
https://doi.org/10.5194/egusphere-egu2020-21854
EGU General Assembly 2020

Dispersion in small-scale discrete fracture networks with internal fracture roughness: Challenges for site-scale modelling

Andrew Frampton and Liangchao Zou
Stockholm University, Dept of Physical Geography, Stockholm, Sweden (andrew.frampton@natgeo.su.se)

There is a need for improved understanding of the mechanisms controlling solute transport in fractured crystalline rocks in order to address long-term safety analysis of repositories for spent nuclear fuel. In this contribution, flow and transport in three-dimensional discrete fracture networks with internal heterogeneity in aperture and permeability is investigated using a numerical DFN model. The fracture networks are obtained using field data of sparsely fractured crystalline rock from the Swedish candidate repository site for spent nuclear fuel. Then, heterogeneity textures with different correlation length and variance are created and mapped to each individual fracture of the network to represent internal fracture roughness. We demonstrate how the structure and variability of textures on the scale of individual fractures leads to different transport and dispersion behaviour at the scale of the network. Key thresholds for cases where flow dispersion is controlled by single-fracture heterogeneity versus network-scale heterogeneity are identified. Furthermore, we highlight enhanced flow channelling for cases where small-scale structure continues across intersections in a network, and highlight challenges for extension to large scale and site-specific modelling.