Upscaling coupled thermo-hydro-mechanical processes for Performance Assessment – DECOVALEX

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A methodology for addressing the DECOVALEX III Bench Mark Test 2 is presented. Hydro-mechanical (HM) modelling has been conducted on fracture networks generated from fracture length and density statistics, which have been described by a power law. For each rock formation in the test, effective hydraulic conductivity tensors have been derived for a range of mechanical parameters and depths below ground level. The upscaled hydraulic conductivities have been used in a site scale continuum model of groundwater flow and transport to assess performance indicators, including time of travel from repository to ground surface. Preliminary results indicate that interpretation of the fracture length and density data can have a significant effect on upscaling calculations, including the determination of a suitable hydraulic representative elementary volume. HM modelling shows that there is a non-linear decrease in the change of fracture aperture with depth, and that although large aperture fractures remain at depth, the majority of fractures tighten to almost the residual aperture at about 750m below ground level. Consequently, anisotropy of the effective hydraulic conductivity also changes with depth. Flow and transport modelling at the field scale indicates that, of the controls investigated, mechanical properties of the rock have the greatest influence on solute travel times.

PowerPoint presentation:

Numerical upscaling of the hydraulic properties of fractured rock using hydro-mechanical property data

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Publications


