Groundwater flow in the fractured system surrounding a nuclear waste repository

Alvaro Sáinz-García, Diego Sampietro, Elena Abarca, Jorge Molinero: *Amphos 21 Consulting S.L., Barcelona, Spain*
Patrik Vidstrand, Henrik von Schenck, Ola Wessely: *Swedish Nuclear Fuel and Waste Management Company, Stockholm, Sweden*

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For a deep geological repository situated in granite, the interface between the fractured rock and the waste vaults is very important. The interface can control the retention as well as the distribution of any released radionuclides and must therefore be properly described and understood.

To connect the discrete fractures in the rock with the continuous materials of the engineered barriers in the vault provides a challenge when it comes to modelling groundwater flow as well as coupled mass transport. In this work, different conceptual and numerical approaches have been used to represent such systems.

Geological data has been used to represent the granitic rock and its fracture zones (Figure 1). Two different conceptual and numerical approaches have been used to represent the fractured system: 1) an Equivalent Continuous Porous Media (ECPM) modelled with DarcyTools [1] and 2) a Discrete Fracture Network (DFN) modelled with COMSOL Multiphysics [2]. The DarcyTools capabilities to upscale DFNs are used to create a set of ECPM fields with increasing resolution., i.e., reducing the cell size near the fractures. The results of groundwater flow simulations in these ECPM fields are compared to the flow results with the DFN model in Comsol. Focus is placed in obtaining consistent results for the flow reaching leaving and the waste vaults.

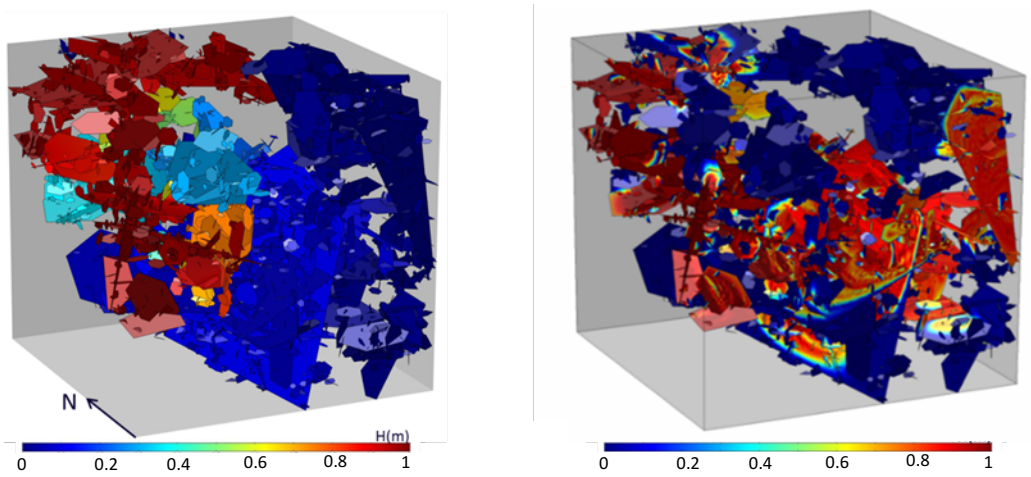

Figure 1: Hydraulic head (left) and tracer concentration (right) in a model with 3000 fractures.

References

[1] U. Svensson and M. Ferry, *DarcyTools: A computer Code for Hydrogeological Analysis of Nuclear Waste Repositories in Fractured Rock*, Journal of applied Mathematics and Physics, 2, 365-383, (2014).
[2] COMSOL Multiphysics v5.3, COMSOL AB, Stockholm, Sweden.