**Modelling of large-scale *in situ* ventilation test in clayey rock**

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The underground long-term repository of radioactive waste in low permeability media needs a good understanding of the host formation behaviour. The desaturation of the clayey rock as well as of the damaged zone located around underground galleries is an important issue considering the safety function of the clay formation. A large-scale gallery ventilation test (SDZ) is performed by the French National Radioactive Waste Management Agency (Andra) in the Callovo-Oxfordian claystone in order to highlight ventilation effects on the host rock. *In situ* measurements indicate that drainage occurs in the rock mass and that desaturation can appear close to the gallery. To reproduce theses phenomenon, a two-dimensional plane strain state hydro-mechanical modelling of a gallery excavation and ventilation is performed (Lagamine code, ULg), taking into account the damaged zone development and the rock-atmosphere interaction.

The constitutive mechanical law used to model the clayey rock is an elasto-plastic model. The material plasticity is defined by a non-associated Van Eeckelen yield surface. A flow model is used to reproduce transfers in partially saturated porous media. The different parameters used in the model are obtained from the literature and from experimental data fitting.

To properly model the hydromechanical coupling occurring in the claystone, we model the damaged zone and its permeability variation. In fact, the drilling of underground galleries induces damage propagation in the surrounding medium and creates a damaged zone in which the material properties are modified (Blümling et al. 2007). The rock-atmosphere interaction is another crucial issue that conditions the drainage kinetics in the claystone. A nonclassical hydraulic boundary condition including water and vapour exchanges is used to model the hydraulic transfers between the cavity and the rock (Gerard et al. 2008). Once the permeability evolution and the rock-atmosphere interaction are well captured, the ventilation test is modelled and the numerical results are compared to *in situ* measurements.

The numerical results indicate that it is possible to calibrate the model to obtain a satisfactory reproduction of the in-situ experimental measurements and a better understanding of the fluid transfer around the gallery during the test. Concerning the damaged zone, the hydro-mechanical model exhibits a plastic zone extension similar to the in situ measurements.

References :

Blümling P, Bernier F, Lebon P, Martin CD (2007) The excavation damaged zone in clay formations time-dependent behaviour and influence on performance assessment. Phys Chem Earth 32(8–14):588–599

Gerard P, Charlier R, Chambon R, Collin F (2008) Influence of evaporation and seepage on the convergence of a ventilated cavity. Water Resour. Res., 44: W00C02. doi: 10.1029/2007WR006500

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