

Hydro and hydro-mechanical modelling of ventilation test in clayey rocks

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Long-term repository of radioactive waste in deep argillaceous geological media needs a good understanding of the host formation behaviour. Underground research laboratories (URL) and in situ experiments have been developed to study the feasibility of a safe repository in low permeability media. Considering the safety function of the formation and the need of low permeability, the behaviour of the excavation damaged zone (EDZ) is a major issue. Because drainage may modify the structure and the size of this zone, a ventilation test (SDZ) is realised by the French national radioactive waste management agency (ANDRA) in an experimental gallery of the Meuse/Haute-Marne URL located in Callovo-Oxfordian claystone (Cruchaudet et al. 2010). The aim is to characterise the effect of the desaturation and possible resaturation of the damaged zone due to controlled ventilation. Several in situ experimental measurements have been realised during the test and exhibit hydro-mechanical behaviour of the rock around the gallery.

Hydro and hydro-mechanical numerical modellings are performed with the finite element code Lagamine to reproduce the ventilation test. At first, a two dimensional plane strain state, then an axisymmetric state, then a three dimensional state modelling is realized. A biphasic flow model in unsaturated soil (Collin et al. 2002) and an elasto-plastic constitutive law are used for the host formation. A nonclassical boundary condition has been developed in order to model the exchanges between the cavity and the rock (Gerard et al. 2008). Numerical results show that it is possible to calibrate the models to obtain a satisfactory reproduction of the in situ experimental measurements (fig. 1) and a better understanding of the fluid transfer around the gallery during the ventilation test.

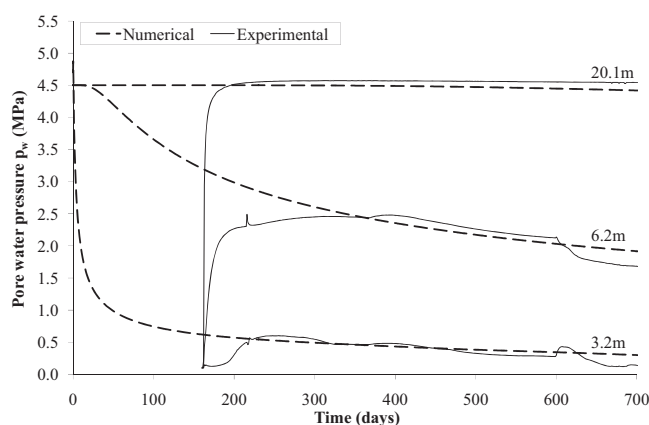


Fig. 1. Matching between numerical results and experimental measurements after model calibration at different distances from the gallery wall (three dimensional state model with only fluid transfer).

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