Geophysical Research Abstracts
Vol. 21, EGU2019-6788-1, 2019
EGU General Assembly 2019

In-situ Experiment on the Influence of Humidity on the Cyclic and Long-Term Deformation Behavior (CD-A) of the Opalinus Clay at the Mont Terri Underground Research Laboratory, Switzerland: Measurement Program and Pre-Simulations

Jobst Maßmann (1), Gesa Ziefle (1), Stephan Costabel (1), Markus Furche (1), Bastian Graupner (2), Jürgen Hesser (1), David Jaeggi (3), Franz Königer (4), Karsten Rink (5), Rainer Schuhmann (4), and Klaus Wieczorek (6)

(1) BGR - Federal Institute for Geosciences and Natural Resources, Geotechnical Safety Analyses, Hannover, Germany, (2) ENSI - Swiss Federal Nuclear Safety Inspectorate, Brugg, Switzerland, (3) Swisstopo - Federal Office of Topography, Wabern, Switzerland, (4) KIT - Karlsruhe Institute of Technology, Karlsruhe, Germany, (5) UFZ - Helmholtz Centre for Environmental Research, Leipzig, Germany, (6) GRS - Gesellschaft für Anlagen- und Reaktorsicherheit gGmbH, Braunschweig, Germany

A complex, highly coupled hydraulic-mechanical behavior characterizes claystone. The physical understanding of the related effects is of great importance concerning the stability during the construction phase as well as for the safety assessment of the integrity of a potential repository for high-level nuclear waste. The underground research laboratory (URL) Mont Terri, Switzerland, provides the unique possibility to conduct in-situ experiments in the Opalinus clay for a broad international community. The experiment on the influence of humidity on the cyclic and long-term deformation behavior (CD-A experiment) is conducted in the new part of the URL, which is currently under construction.

To compare the coupled hydraulic-mechanical effects under different conditions, the construction of two parallel oriented niches is planned in summer 2019. These niches have a length of 11 m and a diameter of 2.3 m and no shotcrete support. The first niche remains under “natural conditions”. Here, the atmospheric conditions are characterized by a seasonal change in air humidity and temperature. This will lead to a desaturation of the claystone around the niche. The second niche is locked. In this area, the air conditions imply a high humidity and the desaturation of the claystone will be avoided as much as possible.

In both niches, a geological characterization of drill cores and of rocks exposed in the niches will be carried out. Furthermore, measurements of the related parameters are planned for at least 10 years. The measuring program includes long-term measurements of the air humidity, the temperature, the deformation (extensometer), the convergence of the niches, the pore water pressure (piezometer) and the water content (Taupe). Furthermore, periodic measurements of the permeability, electrical resistivity (ERT), and nuclear magnetic resonance (NMR) on the niche walls as well as petrophysical analyses of drilled cores are planned. Seismic borehole measurements will also be carried out. The measuring program will be accompanied by the numerical simulation of the coupled hydraulic-mechanical effects in the vicinity of the niches. The comparison of the measurements with simulations considering different model approaches should support the identification of significant physical effects of the complex coupled material behavior.

This contribution will focus on the concept of the measurement program and numerical pre-simulations carried out with OpenGeoSys. Furthermore, the possibilities of an integrated visualization of numerical results in a complex geotechnical setting will be presented.