



Contribution ID: 63

Type: Oral Presentation

Numerical simulations and experimental study of saturated/superheated steam injection into unsaturated zone of soil

Wednesday, 25 September 2024 11:30 (15 minutes)

In this research, two- and three-dimensional simulation of saturated and supersaturated steam injection process in the unsaturated zone of soil is carried out using some simplified assumptions via DuMux Simulator. The simulator is developed in the Department of Hydromechanics and Modeling of Hydrosystems (LH2), Institute for Modeling Hydraulic and Environmental Systems (IWS), Stuttgart University, for Multi-{Phase, Component, Scale, Physics, ...} flow and transport in porous media. The main objective of the study is observation and comparing the progress of the saturated temperature front and the supersaturated temperature front during the process of injecting saturated and supersaturated steam in the unsaturated zone of the soil. Moreover, some experiments are performed for supersaturated and saturated steam injection in the unsaturated zone of soil using the available sand box of Research Facility for Subsurface Remediation, VEGAS, Stuttgart University. Particular purpose of this part of study is evaluation of the heat-up efficiencies of supersaturated steam as opposed to saturated steam. Based on the experimental conditions, values of the local heat-up efficiency are calculated over time concerning the heat-up of defined points in the sandbox. The acquired values are 14.3% and 6.3% for mass based calculated local heat-up efficiency and energy based calculated local heat-up efficiency, respectively.

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Session Classification: Parallel Session 9

Track Classification: Geotechnique/Soil Mechanics