Geophysical Research Abstracts
Vol. 15, EGU2013-6062, 2013
EGU General Assembly 2013

Recurrent ponded infiltration experiment affected by air entrapment: non-invasive visualization and three-dimensional numerical modeling

Michal Dohnal (1), Vladimira Jelinkova (1), Michal Snehota (1), Jaromir Dusek (1), and Jan Brezina (2)

(1) Czech Technical University in Prague, Prague, Czech Republic (dohnalm@mat.fsv.cvut.cz), (2) Technical University of Liberec, Liberec, Czech Republic

Recurrent ponded infiltration experiments on undisturbed soil samples have revealed a significant flow instability characterized by a decrease in the steady-state flow rate of the second infiltration run, conducted into wet soil, compared with the first infiltration run, conducted into drier soil. It has been hypothesized that this decrease was caused by air entrapment during the second run, with subsequent blocking of the preferential pathways.

This presentation focuses on (i) use of the information from CT imaging to simulate transient water flow in a three-dimensional heterogeneous porous system, (ii) comparison of the simulation results with both the infiltration experiment results and the MR imaging signal intensities, and (iii) verification of the assumption that the flow instabilities observed were caused by the air entrapped in the soil sample [1]. More specifically, we analyzed the hypothesis that MR relaxometry imaging can be used to derive information about the volume and distribution of entrapped air and that this air entrapped in well-connected preferential pathways reduces the overall flow rate more effectively than the same volume of entrapped air localized in the soil matrix.

[1] Dohnal, M., V. Jelinkova, M. Snehota, J. Dusek, J. Brezina. 2013. Three-Dimensional Numerical Analysis of Water Flow Affected by Entrapped Air: Application of Noninvasive Imaging Techniques. Vadose Zone Journal, 12 (doi:10.2136/vzj2012.0078).