Experimental and Numerical Analysis of Air Trapping in a Porous Medium with Coarse Textured Inclusions

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A b s t r a c t

The paper presents a 2D upward infiltration experiment performed on a model porous medium consisting of fine sand background with two inclusions made of coarser sands. The purpose of the experiment was to investigate the effects of structural air trapping, which occurs during in-filtration as a result of heterogeneous material structure. The experiment shows that a significant amount of air becomes trapped in each of the in-clusions. Numerical simulations were carried out using the two-phase water-air flow model and the Richards equation. The experimental re-sults can be reproduced with good accuracy only using a two-phase flow model, which accounts for both structural and pore-scale trapping. On the other hand, the Richards equation was not able to represent the struc-tural trapping caused by material heterogeneity.

Key words: vadose zone, Richards equation, heterogeneous soils, air trapping.