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Effects Caused by Entrapped Air Detected During MRI Infiltration-Outflow Experiment

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During repeated ponded infiltration experiments performed on undisturbed soil sample, the changes of steady state flow rates values were persistently observed. The process of infiltration and nickel transport was investigated non-invasively by means of magnetic resonance imaging (MRI) and relaxation measurement techniques. The wetting, steady state flow and drainage phases of each experimental run were monitored together with the evaluation of validity of MRI signal of each voxel. To visualize the solute breakthrough, the nickel nitrate pulse was injected. To obtain potential preferential flow pathway structure the soil sample was scanned with computed tomography before and after MRI. The information was used to simulate transient water flow in three-dimensional heterogeneous porous system. The results of the experiment show the changes in flowing volumes and in the nickel nitrate trajectories caused mainly by the air entrapped in large pores of the sample. The results of numerical simulations are consistent with hypothetic assumption that the distribution of air bubbles is of higher impact than its volume.

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