



Instabilities of wetting fronts during infiltration into dry porous media

F.Rezanezhad(1), G.Spina(2), H.-J.Vogel(1), K.Roth(1)

(1) Institute of Environmental Physics, University of Heidelberg, Germany

(2) Faculty of Physics, University of Turin, Italy

Fereidoun.Rezanezhad@iup.uni-heidelberg.de

Unstable flow during infiltration through initially dry porous media has been studied for different flow rates in a Hele-Shaw cell. The vertical redistribution and dynamics of water movement in the $160 \times 60 \times 0.3$ cm cell was determined experimentally to study fingered flow with Light Transmission Method (LTM). This method is a fast and simple tool to measure the dynamics of water content with a high temporal and spatial resolution. Calibration of LTM with X-ray absorption were developed and demonstrated for imaging transient saturation field in porous media system and evaluation of these techniques accomplished by direct comparison of X-ray and LTM, which showed very close agreement between the two techniques. Images were recorded with a digital camera and the resulting time series of images was analyzed. In addition, 12 mini-tensiometers were distributed over the cell to measure the water potential. From the experimental results, we corroborated that the Longitudinal saturation profile of gravity driven fingers shows saturated tips and much less saturated tails. We further measured the transverse saturation profile with high spatial resolution. To improve the understanding of the related processes, we used a dye tracer to visualize the velocity field and separation of a mobile and an immobile component of water within flow fingers with implications for solute transport, and measured the dynamics of water content and water potential in the vicinity of the flow fingers.