Geophysical Research Abstracts
Vol. 19, EGU2017-7696, 2017
EGU General Assembly 2017

Image analysis method for the measurement of water saturation in a two-dimensional experimental flow tank

Benjamin Belfort, Sylvain Weill, and François Lehmann
LHyGeS UMR 7517, Université de Strasbourg, CNRS, ENGEES, F-67000 Strasbourg, France (belfort@unistra.fr)

A novel, non-invasive imaging technique that determines 2D maps of water content in unsaturated porous media is presented. This method directly relates digitally measured intensities to the water content of the porous medium. This method requires the classical image analysis steps, i.e. normalization, filtering, background subtraction, scaling and calibration. The main advantages of this approach are that no calibration experiment is needed and that no tracer or dye is injected into the flow tank. The procedure enables effective processing of a large number of photographs and thus produces 2D water content maps at high temporal resolution. A drainage / imbibition experiment in a 2D flow tank with inner dimensions of 40 cm x 14 cm x 6 cm (L x W x D) is carried out to validate the methodology. The accuracy of the proposed approach is assessed using numerical simulations with a state-of-the-art computational code that solves the Richards. Comparison of the cumulative mass leaving and entering the flow tank and water content maps produced by the photographic measurement technique and the numerical simulations demonstrate the efficiency and high accuracy of the proposed method for investigating vadose zone flow processes. Application examples to a larger flow tank with various boundary conditions are finally presented to illustrate the potential of the methodology.