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Spatially averaged approach to heterogeneous flow in sand boxes assessed with neutron radiography

I. Hincapié (1), P. Germann (1), P. Vontobel (2)

(1) Soil Science Section, Department of Geography, University of Bern, Hallerstrasse 12, CH-3012 Bern, Switzerland (hincapie@giub.unibe.ch / Phone: +41 (0) 31 631 4055

(2) Neutronradiography Division ASQ, Paul Scherrer Institute, CH-5232, Villigen, Switzerland

Infiltration experiments were carried out in sand boxes to analyze flow in unsaturated media. Sand of three different grain size ($>$0.2 mm, $>$0.5 mm and $>$1.0 mm) was packed in aluminium sample holders (40 x 20 x 0.5-1.0 cm).

We used Neutron Radiography (NR) as a tool to monitor the infiltration-drainage process in air dried samples. Dynamic records of volumetric water content, $\theta(x, z, t)$ were acquired through a series of image analysis procedures (the monitored image area was 20 x 25 cm). Water-content waves, WCW from selected and averaged $\theta(\Delta z, t)$ were obtained.

Flow is approached with advancing WCW, that are built by rivulets, which are tiny water streaks, gravity driven and are considered the basic units of preferential infiltration.

We report soil moisture variations during and after infiltration, wetting front variability and velocity of wetting fronts. Rivulet approach was found to apply successfully also to finger flow in the spatial range of cm.