Geophysical Research Abstracts
Vol. 20, EGU2018-13527, 2018
EGU General Assembly 2018

Deriving complete 3-D water retention curves using X-ray difference-imaging

John Koestel

Swedish University of Agricultural Sciences, Soil and Environment, Uppsala, Sweden (john.koestel@slu.se)

Knowledge on the soil hydraulic properties is fundamental in many geoscientific applications, such as pesticide leaching risk assessment or improved weather and climate forecasts. Often, the soil hydraulic properties are needed at the landscape and regional scale, which are considerably larger than the scale at which they are typically measured, namely at a scale of a few centimeters. The development of respective upscaling approaches is hampered by nature of this scale gap itself: it is known that connectivity properties are central to the up-scaling of hydraulic properties, yet measurement data for mutually adjacent, connected support volumes are yet absent. Instead the available data on soil hydraulic properties rather resembles an ensemble of grab samples that are sparsely distributed within the domain of interest. Non-invasive imaging techniques based X-rays, neutron-rays or nuclear magnetic resonance have proved to be able to image soil water contents with 3-D spatial resolution. Albeit these methods are constrained to the decimeter scales or smaller, respective 3-D data may provide new insight into the general relationship between topology, connectivity and scale of soil structures and hydraulic properties that are also valid at larger scales.
In this pilot study, I am investigating the potential and limitations of X-ray derived 3-D water retention curves in 8 individual, undisturbed soil columns (6 cm in height, 6.7 cm inner diameter) that were sampled from four different arable field sites with contrasting soil texture. Sub-resolution water contents were inferred by difference imaging of gray-scale calibrated images. The resulting 3-D water retention data is used to evaluate the applicability of Warrick-scaling for the investigated soils.