Geophysical Research Abstracts
Vol. 19, EGU2017-16617, 2017
EGU General Assembly 2017

Current challenges in quantifying preferential flow through the vadose zone

John Koestel, Mats Larsbo, and Nick Jarvis
Swedish University of Agricultural Sciences, Soil and Environment, Uppsala, Sweden (john.koestel@slu.se)

In this presentation, we give an overview of current challenges in quantifying preferential flow through the vadose zone. A review of the literature suggests that current generation models do not fully reflect the present state of process understanding and empirical knowledge of preferential flow. We believe that the development of improved models will be stimulated by the increasingly widespread application of novel imaging technologies as well as future advances in computational power and numerical techniques. One of the main challenges in this respect is to bridge the large gap between the scales at which preferential flow occurs (pore to Darcy scales) and the scale of interest for management (fields, catchments, regions). Studies at the pore scale are being supported by the development of 3-D non-invasive imaging and numerical simulation techniques. These studies are leading to a better understanding of how macropore network topology and initial/boundary conditions control key state variables like matric potential and thus the strength of preferential flow. Extrapolation of this knowledge to larger scales would require support from theoretical frameworks such as key concepts from percolation and network theory, since we lack measurement technologies to quantify macropore networks at these large scales. Linked hydro-geophysical measurement techniques that produce highly spatially and temporally resolved data enable investigation of the larger-scale heterogeneities that can generate preferential flow patterns at pedon, hillslope and field scales. At larger regional and global scales, improved methods of data-mining and analyses of large datasets (machine learning) may help in parameterizing models as well as lead to new insights into the relationships between soil susceptibility to preferential flow and site attributes (climate, land uses, soil types).