Geophysical Research Abstracts
Vol. 16, EGU2014-4133-1, 2014
EGU General Assembly 2014

3D dye patterns and physical soil properties under two contrasting land uses: Anisotropic variance structures and its influence on solute leaching

Andreas Schwen (1), Jason Backus (2), Riley J. Walton (3), and Ole Wendroth (3)

(1) Institute of Hydraulics and Rural Water Management, University of Natural Resources and Life Sciences (BOKU), Vienna, Austria (andreas.schwen@boku.ac.at), (2) Kentucky Geological Survey, University of Kentucky, Lexington/KY, USA, (3) Department of Plant and Soil Sciences, University of Kentucky, Lexington/KY, USA

Leaching of solutes below the root zone has been identified as a main source of potential groundwater pollution. In structured soils, preferential flow paths can have a significant influence on rapid leaching of solutes. Dye tracer experiments have been frequently used to map the spatial distribution of macropore structures. However, the relative influence of the macropore network on solute leaching under field conditions and its correlation with physical properties of the matric soil (texture, density, mechanical strength) and land use effects have not been analyzed yet and require innovative sampling techniques. The objectives of the present study were to map the macropore network and analyze the leaching behaviour of a conservative tracer under two contrasting land uses. Ponded infiltration experiments with Potassiumbromide (KBr) and Brilliant Blue (BB) were conducted on a silt loam soil in Lexington, KY. Two land use systems, grassland and cropland (wheat), were tested. At soil water content close to field capacity, a total of 30 mm multi-tracer solution was infiltrated on an area of 1.2×0.7 m with a ponding head of 20 mm. The concentrations of KBr and BB were 10 and 5 g/L, respectively. After 24 hours, 10 profile sections (width: 100 cm, depth: 70 cm) were excavated in steps of 5 cm and sampled. Dye stained areas were mapped based on digital image analysis. The relative dye coverage was calculated as a function of depth. Vane shear resistance was measured as a proxy for soil mechanical strength. At every other profile section, the soil was sampled for soil water content at regular intervals along a 10×10 cm raster. X-ray fluorescence analysis was used to derive concentrations of Br, SiO_2 and $Al2O_3$, the latter two being used as proxy for soil particle size distribution. Anisotropic variance and covariance analysis was applied to derive direction-dependent correlations between physical, mechanical, and hydrological observations and to identify the relative influence of the macropore network and land use regime on solute leaching.