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Alterations of hydraulic soil properties influenced by land-use changes and agricultural management systems

Thomas Weninger (1), Janis Kreiselmeier (2), Parvathy Chandrasekhar (2), Stefan Jülich (3), Kai Schwärzel (2), and Andreas Schwen (1)

(1) Institute of Hydraulics and Rural Water Management, University of Natural Resources and Life Sciences Vienna (BOKU), Austria (thomas.weninger@boku.ac.at), (2) Institute for Integrated Management of Material Fluxes and of Resources, United Nations University (UNU-FLORES), Dresden, Germany, (3) Technical University of Dresden, Institute of Soil Science and Site Ecology, Dresden, Germany

Estimation and modeling of soil water movement and the hydrologic balance of soils requires sound knowledge about hydraulic soil properties (HSP). The soil water characteristics, the hydraulic conductivity function and the pore size distribution (PSD) are commonly used instruments for the mathematical representation of HSP. Recent research highlighted the temporal variability of these functions caused by meteorological or land-use influences. State of the art modeling software for the continuous simulation of soil water movement uses a stationary approach for the HSP which means that their time dependent alterations and the subsequent effects on soil water balance is not considered. Mathematical approaches to describe the evolution of PSD are nevertheless known, but there is a lack of sound data basis for parameter estimation. Based on extensive field and laboratory measurements at 5 locations along a climatic gradient across Austria and Germany, this study will quantify short-term changes in HSP, detect driving forces and introduce a method to predict the effects of soil and land management actions on the soil water balance.
Amongst several soil properties, field-saturated and unsaturated hydraulic conductivities will be determined using a hood infiltration experiments in the field as well as by evaporation and dewpoint potentiometer method in the lab. All measurements will be carried out multiple times over a span of 2 years which will allow a detailed monitoring of changes in HSP. Experimental sites where we expect significant inter-seasonal changes will be equipped with sensors for soil moisture and matric potential. The choice of experimental field sites follows the intention to involve especially the effects of tillage operations, different cultivation strategies, microclimatically effective structures and land-use changes. The international project enables the coverage of a broad range of soil types as well as climate conditions and hence will have broad applicability of the implemented model modifications.