



Field-scale prediction of soil moisture patterns by means of a fuzzy c-means clustering algorithm, digital elevation data, and sparse TDR measurements

Ingmar Schröter, Hendik Paasche, Peter Dietrich, and Ute Wollschläger

Department Monitoring and Exploration Technologies, UFZ - Helmholtz Centre for Environmental Research GmbH, Permoserstraße 15, 04318 Leipzig, Germany

Soil moisture is a key variable of the hydrological cycle. For example, it controls partitioning of rainfall into a runoff and an infiltration component and modulating physical, chemical and biological processes within the soil. For a better understanding of these processes, knowledge about the spatio-temporal distribution of soil moisture is indispensable. For the field to the small catchment scale with survey areas up to a few square kilometres, there are numerous new and innovative ground-based and remote sensing technologies available which have great potential to provide temporal information about soil moisture patterns.

The aim of this work is to design an optimal soil moisture monitoring program for a low-mountain catchment in central Germany. In a first step, the fuzzy c-means clustering technique (Paasche et al., 2006) was used to identify structure-relevant patterns in a set of different terrain attributes derived from a DEM. Based on these patterns optimal measurement locations were identified to conduct in-situ soil moisture measurements. To consider different wetting and drying states in the catchment, several TDR measurement campaigns were conducted from April to October 2013. The TDR measurements have been integrated with the structure-relevant patterns obtained by the fuzzy cluster analysis to regionally predict soil moisture. In this study, we outline the conceptual framework of this integrative approach and present first results from field measurements.

The results of the project are expected to improve the monitoring and understanding of small catchment-scale hydrological processes and to contribute to a better representation of soil moisture dynamics in physically-based, hydrological models operating at the field to the small catchment scale.

Reference:

Paasche, H., J. Tronicke, K. Holliger, A.G. Green, and H. Maurer (2006): Integration of diverse physical-property models: Subsurface zonation and petrophysical parameter estimation based on fuzzy c-means cluster analyses. *Geophysics* 71(3), H33–H44, doi:10.1190/1.2192927.