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Application of spatial TDR-inversion technique during a field experiment in a complex mid mountainous area

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Transient soil moisture profiles yield valuable information of near surface processes. A recently developed reconstruction algorithm based on the telegraph equation allows the inverse estimation of soil moisture profiles along coated 3-rod TDR probes. This so called Spatial TDR (STDR) technique allows the investigation of highly spatially and temporally resolved soil moisture profiles. The performance of the inversion algorithm is assessed in different laboratory experiments.
To validate the STDR technique under field conditions, an irrigation experiment was carried out at a gentle hillslope in a mid mountainous region (Eastern Ore Mountains, Saxony Germany). Complex soil layer structures formed by periglacial processes dominate the experimental site. 40 STDR were installed on an area of 12 m x 12 m. Additionally a TRIME–TDR (Time domain Reflectometry with Intelligent MicroElements) probe was used to measure soil moisture profiles with 10 cm resolution in 5 access tubes of 3 m depth. The irrigation was only accomplished for the upper half of the experimental site to observe the connectivity between the irrigated and the dry half of the experimental site. A brilliant blue dye tracer experiment in the irrigation field was realised for a better understanding of the near surface flow processes. In total 90 mm were irrigated in two experiments within two days. A physically based hillslope model, was used to evaluate the measured profiles of the irrigation experiment. The complex character of the soils leads to a heterogeneous reaction in the subsurface flow processes. We discuss the reliability of the STDR results in context to the experemental setup.