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Determination of soil moisture patterns with electric Resistivity Tomography and spatial TDR technique on a sandy soil

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The determination of soil moisture patterns with high spatial and temporal resolution is a well-known challenge in experimental hydrology and related applied science. Our study focuses on the observation of transient soil moisture profiles with two different geophysical methods: electric resistivity tomography (ERT) and spatial TDR (STDR), as these methods are likely to complement each other. The resulting dataset will be used later for the implementation of a physically based hydrological model. The field investigations concentrate on grassland with heterogeneous sandy soil. The observation period was in the summer months and the different patterns were investigated in time and space.

The STDR technique used a reconstruction algorithm based on the telegraph equation to invert soil moisture profiles along coated three rod TDR probes. That allows the exploration of the near surface processes with a highly spatial and temporal resolution of the soil moisture profiles. The adequate quality of the inversion results was verified by different laboratory experiments. ERT method measures the apparent electrical resistivity and gives qualitative information about structures, water content and substrate changes for a given spatial extent. We used a transect with a Wenner array setup and a spacing of 15 cm between the electrodes over a total length of 11 m. Six STDR probes with rods of 60 cm length were distributed within the experimental site. The two techniques thus compliment each other well, combining high temporal resolution soil moisture profiles with larger extent information on subsurface structures and water content changes.