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Inverse reconstruction of transient soil moisture profiles - evaluation of the Spatial-TDR

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The so called Spatial-TDR system allows a monitoring of transient soil moisture profiles. Using a fast inversion algorithm it is possible to reconstruct the electrical properties along a probe in homogenous materials. To evaluate the applicability of the Spatial-TDR under field conditions different laboratory experiments were carried out in this study. The measurements were made with 60 cm long three-rod probes. A changing water table has been simulated in soil columns filled with homogeneous and layered silt and sand. Besides the impact of the soil heterogeneity the effect of a changed probe geometry and an air gap along the probe were investigated.

For straight probes with good soil contact the reconstructed soil moisture values were very reliable for the homogeneous and layered soil profile. However, the reconstruction algorithm does not cope with discrete changes of impedance along the probe resulting in an oscillation in the reconstructed moisture profiles. The failure is due to the rather flat edge of the TDR input signal and can not be detected by the optimization approach yet. Altogether, the Spatial-TDR measurement system may be very useful to capture temporal and spatial soil moisture dynamics in high temporal resolution down to 50 cm depth. However, it requires further development if one wants to capture accurate absolute soil moisture values.