COMPARING TIME DOMAIN REFLECTOMETRY AND RESISTIVITY TOMOGRAPHY MEASUREMENTS FOR ESTIMATING THE DISTRIBUTION OF SOIL WATER

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Three different methods to determine the spatial distribution of soil water were tested and compared on a full-scale dike model. Field data were obtained during a controlled simulation of an extreme rainfall event in the context of dike infiltration due to precipitation and simulated flood events. Two different temporally high-resolution time domain reflectometry (TDR) measurement systems were compared, both using a new inversion algorithm for extraction of dielectric profiles along the probes: 1.vertically embedded cables, 2. conventional, surface near vertically oriented twin rod probes. The results were converted to the dielectric coefficients respectively volumetric water content using a calibration function for the dike material. Furthermore, time-lapse direct-current (DC) resistivity tomography measurements were carried out along the same cross-section. The resulting temporal resistivity changes can be related to changes in the soil water content, yielding the spatial distribution of water infiltration into the dike. A comparison of the three methods showed similar results, except for differences in resolution. The embedded TDR cable, having a very high resolution in the vicinity of the cable, yields high-resolution water content data, but requires the direct installation of the sensor cable in the ground. The vertically oriented TDR probes are in a limited length easier to install and have high vertical resolution, but are horizontally limited by number and spacing of the probes. The resistivity tomography measurements yields only relative values of changes in water content, but have reasonable horizontal and vertical resolution and can be conducted at low costs.