



Geophysical monitoring of dike water content

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A monitoring method is being developed to obtain the spatial distribution of water content changes inside a flood-protection dike. At an initial stage, the water content is being quantified by combining geophysical methods.

To measure the water content, a combination of geophysical methods has been used on a full-scale dike model located at the Federal Waterways and Research Institute in Karlsruhe. The model is built on a waterproof sealing of plastic and placed in a large basin to allow artificial flooding. The experiments comprised several rainfall scenarios and a flooding experiment. The dike is equipped with vertically installed STDR flat-band cables. The spatial time-domain reflectometry (STDR) method allows for spatially resolving the water content distribution along the cable sensor. The water content distributions retrieved by the in-situ STDR method are used as ground truth for the indirect geophysical measurements.

Indirect geophysical measurements included electrical resistivity tomography (ERT) and ground-penetrating radar (GPR) surveys. ERT was applied along an 8 m long survey line down the land-side slope of the dike. GPR measurements were taken using vertically installed PVC tubes to lower a metallic reflector into the dike body. Consecutive ERT measurements are combined with an initial GPR measurement to quantify the water content.

Presented are results from the various rainfall and flooding scenarios and an analysis of the performance of the ERT/GPR approach by quantitative comparison with the STDR measurements. By using forward modelling, the influence of the inversion on measurements with strong resistivity changes in only one region is discussed. Sensitivity studies concerning the influence of the parameters in Archie's Law will be shown.