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Geoelectrical Monitoring of infiltration processes at two embankment dams during the 100-year flood in Austria

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In June 2013, a "hundred-year-flood" threatened large parts of Austria and caused enormous loss of properties. After the last "hundred-year-flood" in 2002, several communities, especially along the Danube river, had built mobile flood walls or embankment dams, which had to stand the test for the first time. In Lower Austria, the flood started on 1st of June and had its maximum on the 5th with discharge rates of 11000 m³/s instead of usually around 2000 m³/s at Kienstock (Wachau, Lower Austria).

On 5th of June, two geoelectrical monitoring profiles were installed at the embankment dam in Krems (Lower Austria). One profile with 45 electrodes at a spacing of 0.6 m was installed perpendicular to the dam; a second profile with 45 electrodes at a spacing of 1 m was installed parallel to the dam at approximately 30 cm lateral distance to the water level at its maximum. 6 measurements per day were measured until June 11th, when the water level reached almost its normal level. As the measurement of the first geoelectrical section didn't show any significant indication of infiltration of river water into the dam body, the main focus of the embankment dam monitoring in Krems was on the 3D effect caused by decreasing water level. The 3-D effect leads to an increase of apparent resistivity at a certain depth which corresponds to the area of influence where the water level change took place. Comparison of the results with the 4D-Inversion of theoretical data of a 3D-Model of the dam showed that the magnitude of the 3D-effect is much higher than the expected changes of subsurface resistivity due to infiltration or drying.

Another monitoring site was found at an embankment near Korneuburg (Lower Austria) on June 6th, where a weakness zone had to be investigated. At this time, water level had already started to decrease. 61 electrodes were positioned at a spacing of 0.5 m, whereas the detected weakness zone was located in the middle of the profile. Due to the lack of equipment, only one further measurement (after the flood) could be performed on June 11th. A 4D inversion of the two datasets showed a resistivity decrease at the surface due to infiltration of rain water. At the assumed weakness zone, a strong resistivity increase due to drying of the embankment could be observed.