Monitoring infiltration and subsurface stormflow in layered slope deposits with 3D ERT and hydrometric measurements

Rico Hübner[1], Thomas Günther[2], Katja Heller[1], Ursula Noell[3], Arno Kleber[1]

(1) *Institute of Geography, Dresden University of Technology, Helmholtzstr.10, 01069 Dresden, Germany*
(2) *Leibniz Institute for Applied Geophysics (LIAG), Stilleweg 2, 30655 Hannover, Germany*
(3) *Federal Institute for Geosciences and Natural Resources (BGR), Stilleweg 2, 30655 Hannover, Germany*

Understanding the nature and dynamics of water infiltration into slope deposits is essential to understand the processes of hillslope catchments and thus for prediction of floods. Our monitoring test site is located in the Eastern Ore Mountains and of consists of three periglacial sediment layers. Classic hydrometric data (i.e. matric potential) provide important temporally dense information, but they cannot be obtained in sufficient spatial density to understand water flow. We used 3D ERT for monitoring controlled artificial infiltration of water being taken from the nearby spring, once in a dry and once in a wet precondition. About 300 electrodes were installed in 10cm grids. In order to reduce measuring speed with regard to the fast processes, we optimized a combined dipole-dipole and gradient setup with almost 3000 data every 35 minutes. The computed 3D models are clearly able to image water transport through the individual layers. Comparison with hydrometric point data proves the applicability of the approach and the necessary resolution reached.

Infiltration through the uppermost layer is dominated by vertical preferential flow, whereas water movement in deeper layers is mainly downslope matrix flow. Subsurface stormflow occurs in form of organic layer interflow and at the interface to the first basal layer. Main driving factor for it is a capillary barrier effect at the interface to the second basal layer, preventing water from entering the deepest layer under unsaturated conditions. However, as saturation increases, the barrier breaks down and water reaches the hydraulically conductive base layer where additional stormflow may occur. As a result, ERT is able to provide important insight for understanding water movement in slope deposits.