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Soil moisture monitoring in landslide investigation using 2D-resistivity

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Detailed investigations of landslides are essential to understand fundamental landslide mechanisms. Since numerous landslides are triggered by rainfall or rapid snowmelt, soil moisture and pore water pressure are very important parameters in landslide hazard assessments. Traditional techniques in landslide investigation include drillings, piezometers or nowadays TDR measurements in order to get information on the subsurface conditions and the changes of water regimes within the landslide mass. However, these techniques are quite expensive and provide point information only. In contrast, geophysical methods are comparably cheap, fast to carry out and the analysis results give a 2D or 3D image of the subsurface. For monitoring purposes repeated measurements can even provide 4D information.

This study present the preliminary results of a geophysical investigation of a landslide complex in the Swabian Alb using 2D-resistivity. It is shown that 2D-resistivity is able to detect the subsurface structure of the landslide and - maybe even more important - to monitor the changing soil moisture conditions within the landslide. Two measurements on exactly the same profile, one after heavy snowmelt and the other two month later, resulted in enormous variations ($>$ 1000 Ùm) in the respective resistivity values, giving a totally different image of the subsurface. Thus, it is important to consider the environmental conditions and plan carefully the timing of the field campaign, if only single geophysical measurements are to be used for the determination of subsurface structures. The advantage of the sensitivity of 2D-resistivity towards soil moisture is, that it can be used for the monitoring of soil moisture conditions in a landslide which might give information on critical water contents within the slope which might cause the landslide to move slowly or even to accalerate the movement until catastrophic

failure. Furthermore, it might be possible to detect the water percolation paths within the landslide. This knowledge can improve necessary drainage measures to increase landslide stability. Concluding, 2D-resistivity is a very powerful tool for investigating landslides. However, the results should always be carefully validated using traditional techniques. This study contributes to the project Integrative landslide risk analysis and risk evaluation in the Swabian Alb, Germany (InterRISK).