ERT monitoring at a landslide-prone hillslope in the Napf region (Switzerland) for regional landslide early warning

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In mountainous regions, rainfall-triggered landslides pose a serious risk to people and infrastructure. Regional landslide early warning systems (LEWS) have proven to be a valuable tool to warn the public about the imminent landslide danger. While regional LEWS are mostly based on empirically related rainfall exceedance thresholds, recent studies have shown that the inclusion of in-situ soil wetness information may considerably improve the forecast goodness. Most soil wetness measurements are based on sensor networks of soil moisture probes or tensiometers, which have a high temporal resolution but lack spatial coverage. In this respect, the use of electrical resistivity tomography (ERT) could add spatially distributed wetness information and potentially improve the identification critically saturated conditions.

To assess the potential of ERT monitoring for the use in a LEWS, two monitoring ERT profile lines were installed in spring 2020 at a hillslope prone for shallow landslides in the Napf region (Switzerland). The profile lines were installed both parallel to and along the slope each consisting of 48 electrodes at 25 cm spacing. Measurements were taken in Wenner-Schlumberger configuration with a remotely controlled Syscal Junior system. As a base routine, daily measurements were taken. During rainfall events, the measurements frequency was increased up to every 2 hours to better resolve infiltration processes. Finally, apparent resistivity datasets were inverted using a time-lapse inversion scheme.

Preliminary results show clear resistivity responses to the infiltration of rainwater and the subsequent progressing of the wetting front as well as the drying up due to evapotranspiration, which are in agreement with observations from collocated soil wetness sensors. Further work will include a correction for ground temperature changes, calculation of absolute volumetric water content and finally a signal comparison with in-situ sensor data during specific infiltration events to assess the information gain by ERT measurements to identify critically saturated conditions.