

Time-lapse ERT measurements to monitor rainfall triggered landslides at the laboratory scale

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To study landslide activities and monitor the conditions of the slope body, different parameters should be measured and evaluated over time.

Rainfall is considered as one of the main landslide triggering factors for a majority of landslides in Europe. Considering the importance of groundwater in the mechanisms that govern the stability of slopes, monitoring of the hydrological conditions of hazardous slopes is very critical. In a research initiated at the 'Applied Geology and Geophysics Lab' of Politecnico di Milano, Lecco campus, a landslide simulator was designed and used to reproduce small scale slopes. Integration of different geoenvironmental techniques (geology, photogrammetry, topography surveying, geophysics) was possible to monitor a variety of parameters. Considering the simulations for rainfall triggered landslides, we adapted laboratory scale cables and electrodes for performing time-lapse ERT measurements to monitor the water saturation of the soil. Four experiments were carried out in May and June 2017. Resistivity measurements were tried to be optimized after the first experiment (e.g., reducing the time of measurements, changing the azimuth of the profile). 48 electrodes were buried at the depth of 1cm along the slope dip direction, in the middle of the slope. The Wenner array with the spacing of 3cm was used for measurements. After failure of the downdip parts of the soil and losing the contact of the first electrodes with the soil body, resistivity measurements continued with half of the

profile (24 electrodes) until the whole profile experienced failure. As expected, inverted resistivity sections revealed the time changes in the water saturation of the soil body. Using the limited time-lapse TDR data, we calibrated Archie's law with our resistivity data to construct water saturation maps. Moreover, failures were detectable in resistivity sections, being compatible in time and space with the results of photogrammetry and topography surveying.

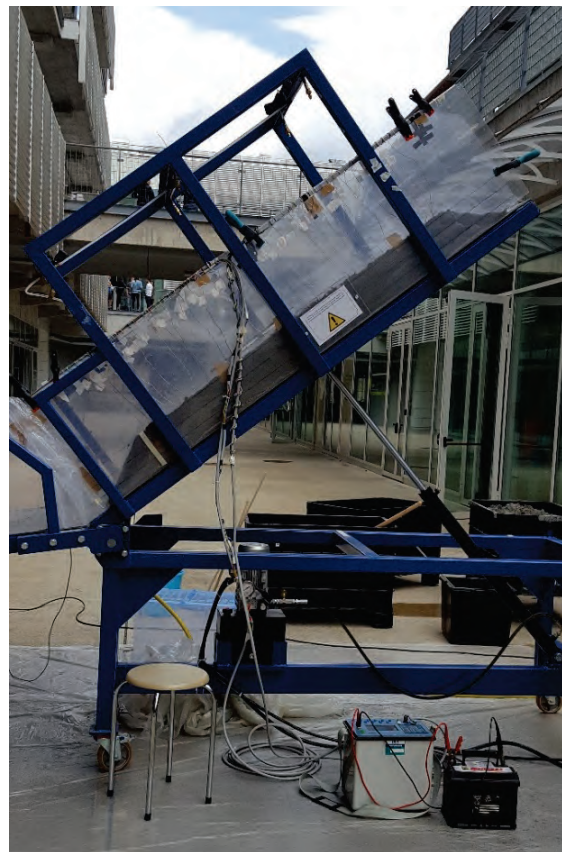


Figure: Landslide simulator and resistivity equipment for time-lapse ERT monitoring of the slope body.

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