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Multi-parameter monitoring of a slow moving landslide in Gresten (Austria)

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Landslides pose a major threat around the world, to both human life and infrastructure. This may be an even bigger issue in the near future, as an increased landslide activity is commonly listed as an expected impact of human-induced climate change, together with an increasing population growth and the further demand of living space. This requires sound and appropriate means of monitoring slopes prone to landsliding.

Monitoring systems for investigating kinematic aspects of landslides aid in analyzing, interpreting, and ultimately understanding its spatio-temporal movement behavior. Landslides around the world greatly differ in terms of typology, movement patterns and geometry, thus, making it difficult to establish a one-fits-all monitoring solution. The linkage between multiple systems with automated instrumentation has often demonstrated the benefits of continuous surveillance in terms of predicting and early warning forthcoming landslide movements.

Within this presentation, we introduce a recently established long-term monitoring site on the active Salcher landslide that makes use of an innovative multi-parameter system. The investigated landslide is situated in the municipality of Gresten (Austria) and extends over approx. 8000 m^2. This slow moving, deep-seated landslide is geologically located in the Gresten Klippenbelt (Helvetic Zone). The characteristic lithofacies are the Gresten Beds of Early Jurassic age that is covered by a sequence of marly and silty beds with intercalated sandy limestones. Together with the adjacent Flyschzone, this area exhibits one of the highest landslide susceptibility within Austria.

The monitoring setup consists both of surface and subsurface systems. Surface measurements on multiple locations are performed with highly sensitive sensor networks that measure surface inclination and acceleration. These are wirelessly connected with each other, highly flexible and constructed with a high longevity, yet still at a high measurement rate (currently every five minutes). A permanently installed terrestrial laser scanner (TLS) performs a scan of the landslide surface once a day. The subsurface part of the monitoring system consists of manual and automatic inclinometers, piezometers for monitoring ground water level changes, TDR probes and a fully automatic geoelectrical monitoring profile for analyzing the spatially distributed changes of electrical resistivity over the entire length of the landslide. The monitoring site was established to last for at least a decade and all continuous data is automatically transferred via internet to an external server. Additionally, a weather station has been installed on the landslide. The collected data is used within further analyses (such as data correlation, threshold analysis, and spatio-temporal slope stability analysis).

The presentation will focus on the first results of the monitoring system and will highlight ongoing and future work tasks including data processing, analysis and visualization within a web-based platform. The overall goal of the described system is to enable authorized users and decision makers to utilize the near real-time data and analysis results to issue alarms if potentially hazardous changes are recorded.