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Determination of landslide triggering precipitation levels based on time series analysis and numerical models - an examplary study at the the Aggenalm landslide

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Due to the feared increase in landslide activity in context of the climate change and the continuous extension of settlement areas in mountainous regions, landslide monitoring gained more importance in the last years. It became necessary to monitor more mass movements not only in order to minimize the conflict between land use and natural hazard prevention but also to better understand the underlying landslide mechanisms as basis for better prediction and prevention of catastrophic events.
A monitoring system consisting of several innovative measuring systems for the surveillance of surface and subsurface deformations has been installed at the Aggenalm landslide, situated in the Bavarian Alps in course of the alpEWAS project. To date different sensors have collected data throughout three years, allowing to perform different analysis techniques, such as time series analysis to evaluate the data, thus being able to verify and/or refine the geomechanical model of the landslide and to contribute to a better understanding of the landslide's triggers. (THURO et al. 2011)
From prior landslides at the Aggenalm and first results of the geomechanical model it is fancied that one of the major influencing factors on the movement of the slide is the precipitation. Therefore aim of the time series analysis has been to show and proof the dependency between precipitation, pore water pressure and deformation measurements. First results of the analysis support this assumption, showing a time delay between precipitation and rise in pore water pressure of 2-3 days. (SINGER et al. 2009, FESTL et al. 2011)
Based on the different datasets from the field survey and the monitoring system a numerical model using the code FLAC® (Fast Lagrangian Analysis of Continua) by Itasca has been established. The numerical analysis should help to ascertain threshold values and to simulate the deformation characteristics for extreme events, enabling a more concise early warning in the future.

References

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