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Landslide early-warning using CHASM as a web processing service

B. Thiebes (1), R. Bell (1), T. Glade (1), S. Jäger (2), H. Krummel (3), R. Holland (3), M. Anderson (4), and L. Holcombe (4)

(1) Dept. of Geography, University of Vienna, Vienna, Austria (rainer.bell@univie.ac.at), (2) geomer GmbH, Heidelberg, Germany, (3) GeoFact GmbH, Bonn, Germany, (4) School of Geographical Sciences, University of Bristol, Great Britain

This study presents the implementation of the physical-based slope stability model CHASM (Combined Hydrology and Stability Model) for a landslide early-warning system. The system is applied to a slope in the Swabian Alb, South-West Germany, which has also been subject to a preceding landslide project.
The landslide is a reactivated complex rotational landslide which causes frequently reoccurring damages to at least one building. Movement rates are generally extremely slow and are related to snow melt and heavy rainfall events. The core of the early-warning system is the near-real time calculation of slope stability within the limit-equilibrium model CHASM. This model has been successfully applied for the investigation of slope stability in many regions of the world, especially where varying slope hydrology is a key factor for the control of landslide movement initiation. CHASM includes the calculation of slope stability under varying hydrological conditions related to rainfall and infiltration. Further on, the model can be run with defined rainfall scenarios indicating a possible decrease in slope stability in advance to failure.
The general slope model including underground conditions has been created based on geophysical examination and drillings. CHASM calculations are carried out in detail to find the most suitable model calibration, followed by a validation phase.
The model CHASM has been implemented as a web-processing service and can be accessed by internet browsers to check current slope stability status. Calculation of slope stability can also be started by the user and a range of rainfall scenarios can be selected. Input data consists of monitoring data on slope hydrology from 27 tensiometers and 27 TDR sensors located on the landslide body. A meteorological station gives data on rainfall and snow conditions. All data is measured permanently, transmitted and integrated into the web-processing service.
The study described here is part of the project ILEWS (Integrative Landslide Early-Warning Systems) which aims to develop and implement landslide early-warning systems from the sensor in field to action advises for local and regional study areas.