Modelling landslide early warning on the internet

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This contribution presents the implementation of a prototypical early warning system on a landslide in the Swabian Alb, south-west Germany. This region is frequently affected by landslides of different types and magnitudes. The complex rotational landslide under investigation threatens a settlement area and causes annually reoccurring damages to structures located on the landslide in particular following snowmelt and strong rainfalls.

Within the ILEWS project (Integrative Landslide Early-Warning Systems) landslide early-warning system concepts, for both local and regional scale were developed and implemented. The warning concepts cover the full warning chain from the sensor in field, data transmission and storage, early warning modelling to action advises to various end-users. Project partners include specialists in sensor technology, geoinformation, geomorphology, geodesy, history, social geography and spatial planning.

The basis of the local technical early warning system is a multi-sensor monitoring system for slope movement (automated and mobile inclinometers, geodetic measurements), slope hydrology (geoelectric profiles, TDR sensors, tensiometers) and climate (weather station). Data is transmitted in real-time to the WebGIS database and utilized for consequent early warning modelling.

The presentation focuses on the early warning model applying the physical-based slope stability program CHASM (Combined Hydrology and Stability Model) which regards slope hydrology as one of the key factors for landslide initiation. CHASM is implemented as a web-processing service so actual calculation of slope stability takes place on a server. The model can be accessed by standard internet browsers to check current slope stability based on monitored hydrological data, and expected slope stability based on weather forecasts.
Moreover, registered users can select individual profiles by clicking on a map, choose scenarios for rainfall and slope moisture, and initiate a CHASM calculation. The factor of safety and further program results are displayed at the end of the simulation.

Besides the technical design of the implemented early warning model, the benefits and limitations as well as the applicability to other study areas and landslide processes will be discussed in the presentation.