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Spatio-temporal dynamics of a slow-moving landslide in the Vorarlberg Alps, Austria

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To assess the development and the dynamics of mass movements on large hillslopes, it is important to enhance the understanding the complex interactions of surface and subsurface hydrology and mechanical processes. Especially investigations in intact slope systems provide a means to develope perceptional models and test simulation tools. The Heumös slope at Ebnit, Vorarlberg/Austria is an example for a slow-moving, deep seated landslide in cohesive sediments prior to a catastrophic failure, where movement rates are observed with geotechnical and geodetic methods.

Inclinometer measurements in different boreholes situated in the central slope area indicated movement rates of 1 cm and 8 cm per year along a shear zone at 8 m and 11 m depth, respectively. Geodetic survey using GPS and terrestrial techniques measured surface movement rates between 0 and 25 cm per year in different areas of the slope, with faster movement at the upper and lower parts of the central slope body. The data suggest a seasonal periodicity of the movement with maxima occurring in fall and minima in winter. However, temporal resolution is coarse, with time intervals of 2 month or longer. This restricts more detailed inferences on temporal variability of the movement and discrimination of influencing factors. Therefore, one borehole was equipped with an automatic inclinometer system measuring at hourly intervals. This high-resolution time series gives detailed insight into the temporal variability of the movement. For example, during the first six month of the series movement rates at one depth showed variations between 1 and 20 cm per year. Furthermore, relations of hydrological processes to slope movement can be established with the data from continuous monitoring.