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Confined aquifer characteristics and deformation of a hillslope in the Vorarlberg Alps, Austria

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To assess the development and the complex dynamics of mass movements on large hillslopes, it is essential (1) to identify critical slope areas and their behaviour within the framework of geological and climatological conditions, and (2) to understand the mechanisms, especially the interaction of surface and subsurface hydrological, hydrogeological and mechanical processes across spatial and temporal scales.
Data from hydrological and geotechnical monitoring at an Alpine slope system, which shows creep movement on a translational shear zone with about 10 cm per year (Heumoes Slope, ca. 1 km2, 915 - 1375 m a.s.l., Vorarlberg, Austria), indicate that the movement is event driven and not of a continuous type.
The investigated slope has been recently equipped with additional inclinometer and pressure piezometer devices which proof an earlier hypothesis of a fast connection between precipitation events via the unsaturated zone of adjacent hillslopes to the saturated zone of the mass movement. Macropores and shrinkage cracks induce fast preferential infiltration in behalf of a particular soil moisture state into adjacent hillslopes, feeding small groundwater bodies. These are represented by a debris spring at the border to the central body of the mass movement. The signal of the debris spring corresponds astonishing well with observed piezometer time series in 300 m distance (height difference: 51 m). This lateral pressure propagation from the adjacent hillslopes (debris spring) to the piezometer again corresponds to deformation events, observed by a continuously measuring inclinometer chain. Besides maximum deformation rates during snow melt, precipitation event related high deformation rates are observed in fall.
With this presentation we want to give new insights into the complex three dimensional pressure system of the Heumoes Slope landslide. We will discuss the process chain from fast hydrological processes via the groundwater system to the observed deformation in the hillslope body, stressing the necessity of process and pattern identification in landslide research, especially with the focus on hydrological processes.