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Mass movement processes in unconsolidated Pleistocene sediments - a case study of channel-hillslope coupling in Upper Bavaria

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Areas with unconsolidated Pleistocene sediments and slopes within the Flysch zone are particularly vulnerable to mass movement processes. Due to an increase in extreme precipitation events which is assumed for the Bavarian Alps, a rising number of gravitational slope processes has to be expected in future. The aim of the studies presented was the investigation and quantification of the "Hochgraben" landslide in unconsolidated glacigenic sediments by use of a combination of mapping, surveying, core percussion drilling and geophysical subsurface examination (ERT). The detailed topographic survey of the landslide was achieved by measuring more than 2,000 singular points from a ring polygon with a medium point distance of about 3 m. Extensive 2D-geoelectric measurements were carried out using a GeoTom device equipped with 50 electrodes. The landslide is situated near the Jenbach creek at the northern border of the German Alps which has been well known as a dangerous, steep mountain creek. The alpine foreland glaciation led to the formation of Pleistocene valley fills in ice dammed sedimentary basins. These slope sediments move into the talweg by fluvial erosion and landslide processes and are thus, responsible for the high sediment load of the Jenbach. The investigated Hochgraben slide is a complex landslide. The upper part is characterized by antithetically rotated sliding blocks separated by terrain steps which stand out as having similar movement rates and directions. The second division of the landslide begins at a distinct terrain step; here, the block slide changes into a more mudflow like movement process. In the lowermost part, fluvial erosion prevails. This part of the landslide has been stabilized artificially by wooden torrent dams and by a stony dam at the foot of the slope. Geoelectrics proved to be a particularly efficient tool for subsurface investigation in this study area. Slip surface

was clearly detected; the 2D-sections illustrate the structure of the slide. The thickness is 7 - 10 m corresponding to the results of the drillings. Below the lowest sliding block, a terrace like subsurface structure was detected at a constant elevation which consists of a layer of early, ice-compacted valley fill deposits. The kinematics of the slide appears to be closely connected to the glaciation history and is a good example of complex channel-hillslope coupling. The basic landslide disposition is caused by the clayey, weakly consolidated sediments on the one hand and the strong downward erosion of the Jenbach on the other hand which is steepening and destabilizing the adjacent slopes. Observed erosion around small water outlets at the very foot of the slope is not the primary reason for the slope movement. The crucial factor is gully erosion at the central terrain step which gradually removes the support of the upper slope parts leading to the observed rotational movement of he upper slope. This movement presses out soaked, pulpy sediments which provide an easily erodable sediment source.