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Studying slope mass instabilities above the settlement of Koroška Bela (NW Slovenia) using multidisciplinary monitoring approach

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This paper focuses on the observation of large slope mass movements that may eventually mobilize into debris flow and therefore represents a hazard for the inhabitants and the public infrastructure at the Koroška Bela settlement. Study area is located in the Karavanke Mts. (NW Slovenia), above the settlement of Koroška Bela.
Historical sources and previous investigations describe the broader area of the study territory is known to have experienced severe debris-flow events in the recent geological past. The most recent events occurred in the 18th century, and caused the partial or total destruction of more than 40 buildings and cultivated areas in a down-slope village Koroška Bela located on the vast alluvial fan. Presently, some 2,200 inhabitants live on the alluvial fan area of past debris flows. With this risk potential in mind, monitoring of the sliding masses and assessment of the displaced material volumes is even more important than the purely scientific value of any assessment efforts.
The development of the landslide monitoring system started with an engineering-geological mapping where all unstable parts of slopes were identified and mapped. Based on the results of the field-work, locations of the boreholes and geophysics profiles were determined. The established monitoring system consists of 7 boreholes equipped with inclinometers (2) and piezometers (2), periodical estimation of surface movement pattern using UAV photogrammetry and LiDAR data. In two boreholes, percolation test and discharge measurements of springs and surface streams has been carried out, accompanied by infiltration measurements by infiltrometers used to determine permeability and percolating abilities of the material, and to record and analyse groundwater level fluctuations and reactivity of the aquifer to rainfall. By using geophysical measurements we were able to define a detail geological setting, reconstruct the geometry of landslide body and estimate the thickness of sliding material. Additionally, samples were taken from the boreholes to analyse geomechanical properties of the sliding material.