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LiDAR-based detection and evaluation of mass-movements at the eastern fringe of the Alps

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Although most large mass-movements are found in central areas of orogens with high topography and steep slopes, in recent years more and more slope instabilities have been found in areas with moderate relief (e.g. Leopold et al. 2013). While their size and volume commonly is not very high, they nonetheless impose relatively high risk on infrastructure and property. Our study area is located in the eastern fringe of the Alps, at the boundary to the Pannonian Basin. Geologically the area is dominated by Miocene to Quaternary mainly clastic sediments (Zorn 2000), deposited above a metamorphic nappe pile of Penninic, Lower and Upper Austroalpine tectonic units (Schuster et al. 2001). Neogene deformation is characterized by strike-slip and normal faults, which accommodate the complex structural situation at the transition between Eastern Alps, Carpathians and Pannonian Basin. The main deformation occurred in the early Miocene and there are geomorphological and seismic indications for still ongoing tectonic activity.
Our study combines airborne as well as terrestrial light detection and ranging (LiDAR) measurements with a variety of visualisation methods, complemented by fieldwork and engineering geological measurements. Although some slope instabilities occur in regolith above metamorphic rocks, the majority of current mass movements are located in fine-grained Pannonian (Miocene) sediments with creep and – especially associated with stronger precipitation events – slide as main deformation processes. Instable slopes commonly show small gradients, in several cases as low as 8 degrees. LiDAR measurements have proven to be the method of choice in this relatively low relief and partly forested area, where mass-movement landforms and processes are quite difficult to analyse otherwise. High-resolution digital terrain models from LiDAR data provide insight into many details of the extent, shape and structures of mass-movement, which are hardly visible in the field.

References

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