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The inner structure of landslides and landslide-prone slopes in south German cuesta landscapes assessed by geophysical, geomorphological and sedimentological approaches

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Investigations on landslide activity in the cuesta landscape of Germany, usually characterized by an interbedding of morphologically hard (e.g. sand-/limestones) and soft (clay) sedimentary rocks are relatively sparse. However, spring 2013 has once again revealed a high susceptibility of the slopes in the Franconian and Swabian Alb to mass movements, when enduring rainfalls initiated numerous landslides causing considerable damage to settlements and infrastructure. Many aspects like the spatial distribution of landslides, triggering factors, and process dynamics - especially with view on the reactivation of landslides - require intensive investigations to allow for assessment of the landslide vulnerability and the development of reliable early-warning systems.
Aim of the study is to achieve a deeper insight into the triggering factors and the process dynamics of landslides in the cuesta landscape with special regard on landslide proneness of slopes and the potential reactivation of old landslides. A multi-methodological approach was conducted based on geophysical investigations (seismic refraction tomography – SRT, electrical resistivity tomography – ERT), geomorphological mapping, morphometric GIS-based analysis, core soundings and substrate mapping.
Study sites are located in the Swabian Alb (southwestern Germany) in the Jurassic escarpment where where Oxfordian marls and limestones superimpose Callovian clays, as well as in the northeastern Franconian Alb, within the escarpment of the so called Rhätolias with with red claystones of the late Norian (Feuerletten formation) below interbedding layers of sand- and claystones of the Rhaetian (Upper Triassic) and Hettangian (Lower Jurassic). The investigated landslides strongly differ with respect to their age, from young landslides originated in spring 2013 to ancient landslides.
Investigations reveal a distinct diversity of landslide types composed of a complex combination of processes. The applied methods allow for a sophisticated characterization of the landslides and the deduction of process complexes with phases of reactivations. The combination of ERT and SRT enables the delineation of the inner structure of the slide masses including rupture surfaces, landslide blocks and material inhomogeneities.