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A potentially catastrophic rockslide: the case of the Kilchenstock, Glarus (Switzerland)

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The Kilchenstock peak is located in the Swiss Alps about 15 km south of the city Glarus. Many rockfalls from the Kilchenstock have been reported since the 19th century. The first study of this rock slope instability is done by Albert Heim in the 30s. The area is mainly composed of folded flysch with a stratigraphy predominantly dipping towards SSE. Heim reveals a sliding mass near the top of the mountain, where the stratigraphy locally dips 35° towards NW. This represents an unstable volume of 2.5 million cubic meters. At the foot of this area blocks break off and fall towards the town of Linthal 1000m below. Heim measured velocities of the sliding mass from 1927 to 1932. On two occasions the displacement's velocity has accelerated (up to 40mm per day) suggesting an imminent large rock-collapse. No catastrophic failure has occurred so far, however such an event remains possible and its characterization consists of the main objectives of the present study.
A detailed structural study is performed based on digital elevation model (DEM) as well as field investigations. These investigations are carried out at different scales in order to obtain complete geological cross-sections across the mountain. 2D finite element modelling simulation will be performed in order to assess the stability of the different rock compartments of the mountain and in particular focused on Heim's unstable area.
The first results suggest that the failure mechanism of the main instability is primarily controlled by a stepped-like sliding along the bedding with different velocities varying from one bedding layer to the others. In addition, the ongoing field work show that the activity isn't confined to the area described by Heim, but rather extends to the whole slope, suggesting a larger and deeper potential rock slope deformation at the Kilchenstock. This is supported by different signs of activity and geomorphic gravitation features such as rockfalls, scarps, double ridge, cracks. The existence of several contiguous or imbricated landslides seems therefore likely, which would constitute a complex instability.
The model shows the geometrical arrangement of the failure surfaces and allows linking the deep instability with shallower ones in order to better constrain and understand the unstable areas and assess a potential evolution of the whole slope.