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Analysis of the relation between unconsolidated sediment depth and surface morphometry on an Alpine slope

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The study investigates the relation between regolith depth and surface morphology on (sub-)hillslope scale at a test site in the Schmirn Valley (Tyrol, Austria). Information on the depth of unconsolidated sediments (regolith) is needed as input for shallow landslide modelling. Both surface morphology and regolith depth depend on processes of erosion and deposition as well as on the underlying bedrock relief. Identification of connections between these parameters could enable rough estimates of regolith depth by a morphometric analysis of remotely sensed digital terrain models (DTMs). Scenarios on hillslope development as well as associated implications regarding a regolith depth to surface morphology relation are discussed. This provides a conceptual framework for the data analysis. Terrestrial laser scanning produces high resolution DTMs with accuracies in the order of a decimetre. Morphometric parameters at multiple scales are extracted from these DTMs. Penetrometer tests provide regolith depth information. A correlation analysis is conducted to identify possible relationships between these variables. However, this analysis does not consistently confirm the proposed relationship between surface morphology and regolith depth. A considerable influence on regolith depth variability is attributed to the rugged bedrock morphology. Generally, the data preparation and analysis workflow proved to be useful for a three-dimensional characterisation of the regolith and for geomorphologic studies of hillslope evolution. Limitations mainly concern the choice of the test site and the density of point (depth) data. It is concluded that field data from a larger site with a similarly high spatial resolution is necessary to investigate the suggested relationship between regolith depth and surface morphology.