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Investigating talus slope geomorphology as impacted by permafrost thaw (Valais, Switzerland): stipulating a research framework

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Climate change is altering temperature regimes and precipitation patterns worldwide. In the European Alps, atmospheric temperatures have risen twice as fast as the global average since 1900, while precipitation regimes are changing as well. Snow cover duration and extent has significantly decreased in the Swiss Alps, mainly due to earlier spring melt and rise in winter temperatures. Moreover, future projections predict a continuation of these trends. Spatial distribution and thermal properties of permafrost are highly influenced by ground surface conditions (snow and vegetation) and air temperature. Climate induced permafrost degradation is, therefore, expected. While alpine permafrost research has mainly focused on rock glaciers, less attention has been given to talus slopes. The latter are subjected to different kinds of slope processes such as debris flows, solifluction, permafrost creep, avalanches and rock fall. These processes are especially effective under a changing periglacial climate. Therefore, it is important to study permafrost distribution in these talus slopes, since it is believed to have large influence on slope stability. In this study, permafrost distribution will be mapped on several talus slope segments (10 – 40 ha) using geomorphological evidence, temperature data and measuring electrical resistivity tomography (ERT) profiles in addition to already existing data. The current dynamics of the study area will be studied by constructing detailed 3D models, using ground based and aerial photography (Unmanned Aerial Vehicles, UAV) and the Structure-from-Motion method (SfM). The resulting Digital Elevation Models (DEM) will be used to quantify and understand the current geomorphological processes acting on these talus slopes. Historical aerial and terrestrial photographs will be used to give an idea about the magnitude and frequency of past geomorphic processes (e.g. debris flows). Historical and current dynamics can then be compared and contrasted with permafrost occurrence. By doing so, this study will answer following question: “To which extent will climate-induced permafrost degradation impact geomorphological processes on talus slopes?”.