Abstract Eucop 2014:

On the performance of digital elevation models in a high mountain environment

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Rockglaciers as a visually detectable feature of mountain permafrost have received a lot of attention concerning their kinematics and thermal characteristics. Despite the extensive kinematic and thermal monitoring of these creeping permafrost features, few attempts to understand and model their dynamics have been undertaken so far. In order to improve the understanding of the dynamics of rockglacier creep, there is a need to analyze kinematic data in a rheological context, considering ground surface temperatures (GST), borehole temperatures at different depths and subsurface material properties using a modeling approach. This study presents a comprehensive review of existing modeling approaches focusing on different aspects in order to assess rockglacier dynamics. Current models use numerous simplifications such as continuous temperature variations and the assumption of homogenous sub-surface material or concentrate on one component only. Improved modeling approaches will have to incorporate realistic sub-surface characteristics, water infiltration and latent heat fluxes. These process model simulations will allow for an assessment of how changes of climatic parameters can lead to changes in subsurface characteristics and finally to a rheological response.

The main objectives of this study are: a) a critical literature review on existing modeling approaches on rockglacier dynamics by listing strengths and limitations and b) giving resulting recommendations for a modeling approach focusing on the rheological response to changing forcing factors. The key issue - represented by real data – is the change of landform geometry, that reflects mass changes and/or fluxes. This is based on a comprehensive long-term kinematic dataset derived from remote sensing and terrestrial surveying to simulated surface velocities, their temporal variability, discrepancies can be assessed and attributed to advective processes, such as percolating water within the permafrost body.