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A morphometric approach to reveal the effects of ground-ice thaw on rapid mass movements in northern Iceland

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Permafrost degradation is one of the main controlling factors of slope instabilities in glacial and periglacial environments (e.g., Gruber and Haeberli, 2007). In permafrost terrains, ground ice can occur in pores, cavities, voids in soils or rocks, and its thaw can cause slope failures. A plethora of studies exists on the destabilisation of bedrock slopes due to permafrost degradation (e.g., Harris et al., 2001; Magnin et al., 2015). However, the role of thawing ground ice in conditioning and controlling the dynamics of rapid mass movements involving loose deposits is not well constrained, and has been rarely explored through geomorphometric analysis.
In this research, we investigate two landslides induced by ground-ice thaw in Iceland, whose source materials comprised ice-cemented talus deposits. We apply quantitative terrain analysis using high-resolution DEMs to describe and quantify the morphometric characteristics of these landslides. Our morphometric approach allows us to show that different dynamic processes were involved during both failures due to the presence of ground ice. This caused the movement to evolve during the failure event, changing the mobility and trajectories of the landslides. Improving our knowledge on this type of landslides through morphometric analysis is important, as it can aid in assessing their hazard and in predicting similar rapid mass movements in comparable settings.

References:
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