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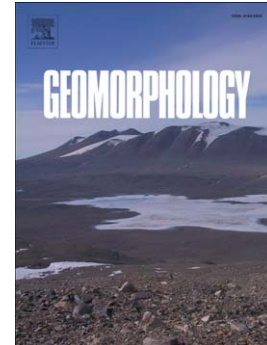
Increasing risks related to landslides from degrading permafrost into new lakes in de-glaciating mountain ranges

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***Increasing risks related to landslides from degrading  
permafrost into new lakes in de-glaciating mountain  
ranges***

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**Abstract**

While glacier volumes in most cold mountain ranges rapidly decrease due to continued global warming, degradation of permafrost at altitudes above and below glaciers is much slower. As a consequence, many still existing glacier and permafrost landscapes probably transform within decades into new landscapes of bare bedrock, loose debris, sparse vegetation, numerous new lakes and steep slopes with slowly degrading permafrost. These new landscapes are likely to persist for centuries if not millennia to come.

During variable but mostly extended future time periods, such new landscapes will be characterized by pronounced disequilibria within their geo- and ecosystems. This especially involves long-term stability reduction of steep/icy mountain slopes as a slow and delayed reaction to stress redistribution following de-buttressing by vanishing glaciers and to changes in mechanical strength and hydraulic permeability caused by permafrost degradation. Thereby, the probability of far-reaching flood waves from large mass movements into lakes systematically increases with the formation of many new lakes and systems of lakes in close neighborhood to, or even directly at the foot of, so-affected slopes. Results of recent studies in the Swiss Alps are reviewed and complemented with examples from the Cordillera Blanca in Peru and the Mount Everest region in Nepal.

Hot spots of future hazards from potential flood waves caused by large rock falls into new lakes can already now be recognized. To this end, integrated spatial information

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