Re-activation of landslide in sub-Arctic areas due to extreme rainfall and discharge events (the mouth of the Great Whale River, Nunavik, Canada).

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Author: Piotr Owczarek
Magdalena Opala-Owczarek
Stéphane Boudreau
Patrick Lajeunesse
Lukasz Stachnik

Author Affiliation: Institute of Geography and Regional Development, University of Wroclaw, Pl. Uniwersytecki 1, 50-138 Wroclaw, Poland. Electronic address: piotr.owczarek@uwr.edu.pl.

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Abstract: Climate change is impacting surficial geomorphic processes, especially in sensitive areas such as the sub-Arctic. One of the most common examples involves landslides, which often develop in glacio-isostatically raised marine clays in northeastern Canada. One of these sites, an expansive area of complex landslide terrain located at the mouth of the Great Whale River in Nunavik, has already been studied due to its age and morphology. We present new data, based on the multidisciplinary research including geomorphic, dendrochronological, and hydroclimatological analyses, allowing us to determine how contemporary climate change has affected landslide reactivation during the last 80 years. Our research included collecting 60 cores from Picea glauca trees, growing on the marginal zone of a landslide deposit, as well as from a reference site. The tilted trees formed eccentric growth-ring patterns, which provided us with reliable dates on the landslide events. In addition to these dendrochronological data, we studied these landslides using repeated aerial photography, which showed changes in river channel constrictions in the period 1969-2019. Based on the eccentricity index of the tree ring data, we recognized disturbance events due to landslides. We compared these data with the hydroclimatological conditions and found clearly visible correlations between heavy rainfall and discharge (>95th percentile) of the Great Whale River. The increased landslide activity over the past several years can be linked to an increase in extreme summertime rainfall events. Increased landslide activity poses a real threat, through its input of large amounts of fine-grained sediment to the river, causing it to narrow.

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