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# Prediction of alpine glacier sliding instabilities: a new hope

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Mechanical and sliding instabilities are the two processes which may lead to breaking-off events of large ice masses. Mechanical instabilities mainly affect unbalanced cold hanging glaciers. In the latter case, a prediction could be achieved based on data for surface velocities and seismic activity. The case of sliding instabilities is more problematic. This phenomenon occurs on temperate glacier tongues. Such instabilities are strongly affected by the subglacial hydrology: meltwater may cause (i) a lubrication of the bed, and (ii) a decrease in the effective pressure and consequently a decrease in basal friction. Available data from Allalingletscher (Valais) indicate that the glacier tongue experienced an active phase for 2-3 weeks with enhanced basal motion in late summer in most years.

In order to scrutinize in more detail the processes governing the sliding instabilities, a numerical model developed to investigate gravitational instabilities in heterogeneous media was applied to Allalingletscher. This model made it possible to account for various geometric configurations, interaction between sliding and tension cracking and water flow at the bedrock.

We could show that both a critical geometrical configuration of the glacier tongue and the existence of a distributed drainage network were the main causes of this catastrophic break-off. Moreover, the analysis of the modeling results diagnosed the phenomenon of recoupling of the glacier to its bed as a potential new precursory sign of the final break-off. This model casts a gleam of hope for a better understanding of the ultimate rupture process which results from such glacier sliding instabilities.