



Ice motion and seismic activity on a steep temperate glacier tongue

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Ice motion and seismic activity on a steep temperate glacier (Triftgletscher, Bernese Alps, Switzerland)

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In the last 15 years Triftgletscher (Bernese Alps, Switzerland) has substantially retreated (several hundreds of meters) from the riegel and a proglacial lake containing 6.10^6 m³ water has been formed in the glacier forefield.

Because of the glacier retreat, especially the thinning of the lower flat tongue, the stability of the steep section behind it is affected. The consequence is that the likelihood of large ice avalanches starting from the steep section will increase. The recent intensive glacier thinning in the lower tongue area of 6-10 m.a⁻¹

has even worsened the situation because the runout path of the ice avalanches has become steeper. Ice avalanches with several millions of m³ triggering impulse waves by plunging into the lake can be the consequence.

The aim of our study is to improve the understanding of the mechanisms leading to such instabilities and to develop a predictive method based on both seismic and photogrammetric surveys.

The seismic recording is performed with help of 3 geophones installed on the rock on both sides of the serac fall allowing a continuous record. We are able to highlight seismic events by applying an automatic detection procedure, to locate their sources and also to evaluate the released energy of each detected icequake. The most part of these events are due to crack openings and falls of ice chunks, but we could also isolate specific events corresponding to stick-slip motions. The latter seem to play a significant role in the destabilization of the ice mass and represent valuable precursors to break-off episodes.

The 2D picture analysis is achieved by analysing photographs taken every day at the same time by an automatic camera installed in the glacier vicinity. Surface motions are derived from grey scale comparisons between consecutive pictures, carried out with the commercial software Veddac. Stick-slip events detected from the seismic survey appears to be associated with phases of rapid surface motions.

We present first the spatial and temporal distribution of the seismic activity recorded during the summer 2008 and describe the seismic events associated to stick-slip motions. Then different results from pictures analysis are shown in order to interpret seismic results. We finally discuss the influence of the water on the detection method and propose processes explaining the observed relationship between the seismic activity and the glacier dynamics in the case of temperate glaciers.