

Monitoring rock avalanche hazard from the Svínafellsheiði mountainside in SE Iceland

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ABSTRACT

During the last five decades, three large rock slope failures have taken place onto outlet glaciers in Iceland, in 1967 on the Steinsholtsjökull outlet glacier in the northern part of the Eyjafjallajökull ice cap, in 1972 on the Jökulsárgilsjökull outlet glacier in the southern part of Mýrdalsjökull ice cap and in 2007 on the Morsárjökull outlet glacier in southern part of the Vatnajökull ice cap. The volume of two of these landslides has been estimated. The rockslide, which fell on Steinsholtsjökull, was about 15 million m³ and part of it fell into a proglacial lake, causing a large glacier lake outburst flood (GLOF). The rock avalanche, which fell on Morsárjökull, was around 4.5 million m³. The causes of these three rock slope failures can be related to undercutting of mountain slopes and fast retreat and thinning of the glaciers.

Today, the retreat and thinning of outlet glaciers in Iceland is fast and in front of most of the outlet glaciers proglacial lakes have formed and many of them are growing year-by-year. The consequence of this retreat is often unstable mountain slopes, which increases the risk of slope failures and mass movements onto the glaciers and possibly into their proglacial lakes.

In 2014, a 115 m long and up to 30 cm wide fracture was detected at 850 m height on the Svínafellsheiði mountain, above the Svínafellsjökull outlet glacier in SE Iceland. The fracture was mapped in 2016 and survey points were installed in bedrock on both sides of the fracture. In the spring of 2018, another fracture was discovered, on recent aerial photographs, in the lower part of the Svínafellsheiði mountainside. Field surveys showed that these two fractures are connected and form up to 1.7 km long fracture system, which can be traced from 850 m height down to the surface of the Svínafellsjökull glacier at around 300 m a.s.l. It is assumed that around 1 km² of the mountain slope is unstable, which might mobilize around 60 million m³ of bedrock, but the depth to the sliding surface within the bedrock is not known at this point.

From 2016 to 2018, the total widening of the upper fracture is around 2.6 cm and similar rate of movement was detected by satellite radar interferometry (InSAR) in the upper slope between 2016 and 2017. Interestingly, the same data reveal 4–5-cm displacement on the lower fracture during the same time interval.

Data that have been obtained since 2016 indicate that an area of ca. 1 km² in the Svínafellsheiði mountainside is potentially unstable and if it would collapse as single rock slide it would be one of the largest rock slope failures during the Holocene in Iceland.