The Karakoram September 2010 massive rock avalanche and its influence on Siachen glacier mass balance

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Abstract

We use time series of digital elevation models (DEMs) derived from satellite optical stereo images (SPOT-5, -6, -7 and ASTER) to analyze the September 2010 rock avalanche that partly covered the tongue of Siachen glacier, the largest glacier in Karakoram (nearly 1100 km^2). The collapse of an entire 1000-m high rockwall (4600-5600 m a.s.l.) occurred in three days (between 9 and 12 September) through several rock avalanches. The total volume loss in the source area reached 107 millions m3. Counter-intuitively, the deposit of a thick layer of debris (_˜29 m on average) led to enhanced localized glacier thinning during the six years that followed the landslide. Surface features in high resolution imagery suggests that presence and drainage of subglacial meltwater may be responsible for this intriguing behaviour. We also estimate the contribution (roughly 6%) of this localized enhanced ablation to the total mass loss of Siachen glacier between 2010 and 2016.

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