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Remote monitoring of impending outburst floods at Kyagar Glacier, Chinese Karokoram

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The recent period of active surging at Kyagar Glacier, in the Chinese Karakoram, has led to a situation in which large glacier outburst floods occur. The rapid flow of ice to the terminus of the glacier caused more than 60m thickening of an ice dam which blocks the Keleqin River. Although the glacier is remotely located, more than 500km upstream of major settlements, outburst of the glacier dammed lake poses a threat to over 1 million inhabitants and significant infrastructure downstream. Monitoring stations on the river downstream of Kyagar Glacier can provide up to 22 hours warning once an outburst flood is on the way, but remote sensing is currently the only method of assessing the hazard potential before it occurs.

A combination of radar (Sentinel-1A) and optical (Sentinel-2, Planet) satellite products are used for assessing the volume of the lake as it forms through the season. We also create a time series of digital elevation models with single pass InSAR TanDEM-X data, to determine how the surface elevation of the ice dam and hence the maximal potential volume of the lake evolves. Glacier surface velocity is determined through offset tracking, applied to both optical and radar images, to assess the surge status of the glacier and potential for further raising or lowering of the ice dam.

The spontaneous outburst floods in 2015 and 2016, exceeding total volumes of 40, and 50 million m^3 respectively, were significantly smaller than the largest recorded outburst volume of almost 150 Mio m^3 in 1999. However an analysis of the ice-dam height evolution shows that the potential lake volume increased since 2016. In the most recent summer of 2017, the lake volume reached around 90 Mio m^3. Unexpectedly, this large lake didn't drain in one sudden event as observed in previous years, but through two less hazardous partial outbursts. In this contribution we present an analysis of the most recent outburst floods and provide an outlook for the hazard potential in the coming years.