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Hispar Glacier on the run

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The Karakoram Mountain Range is well known for its numerous surge-type and recently or currently surging glaciers. Latest analysis of time-series from satellite data has revealed several new insights in the related variability of glacier extents, flow velocities and elevation changes. As surge-type glaciers have their own dynamic playbook and show a very limited direct response to climatic forcing, it is important to correctly identify them when glacier changes are interpreted in climatic terms. One of the glaciers known to be influenced by surges from tributary glaciers but not surging itself is the 50 km long, debris-covered and comparably flat Hispar Glacier in the Hunza catchment (Pakistan). Its terminus is at the same location for more than 120 years and no signs of unusual activity were reported before.

However, in late autumn of 2014 the entire middle section of the glacier started to increase its flow velocity from about 40 to 4000 m/yr by May 2015. The surge continued until spring 2016 with flow velocities around 1500-2000 m/yr and a sudden drop back to pre-surge levels in summer 2016. Thereby, a well-defined surge front advanced by about 3 km from May to July 2015 and a further 3 km afterwards. Animated time-series from archived Landsat images (OLI and ETM+) clearly show the mass wave traveling down-glacier over this period. The temporal variability of flow velocities has been captured with Sentinel 1 data acquired every 11 to 22 days starting from February 2015 and previous image pairs from Radarsat-2, ALOS PALSAR and Landsat 8. Results suggest that changes of the hydrologic regime are responsible for the observed seasonal variability.

A further analysis of historic Corona reconissance satellite imagery from 1965 and 1969 revealed that the 2015/16 surge of Hispar Glacier seems not to be unprecedented, but should have occured in a similar way around 1960 and maybe several times before as numerous elongated surge marks indicate. They might have been created by surge-type events of its middle northern tributary (Jatmaru) and later fast-flow events of the main glacier. Jatmaru surged in 2015/16 at the same time as Hispar Glacier and it is not yet fully clear who of them was first or how a synchronous surge was initiated.