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SEASONAL RAPID ADVANCEMENT OF SURGING GLACIERS IN KARAKORAM RANGE: A POTENTIAL NATURAL HAZARD

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Ministry of Science & Technology

Seasonal rapid advancement of surging glaciers in Karakoram Range: A potential natural hazard

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Scientists from Wadia Institute of Himalayan Geology(WIHG), Dehradun an autonomous institute under the Department of Science & Technology have found a seasonal advancement in 220 surge-type glaciers in the Karakoram Range of Ladakh through detailed assessment of some major surging glaciers of the Karakoram range using satellite images and thermal data. ‘Surging’ or ‘Surge-type’ glaciers are a certain type of glaciers that have shown advancement in volume and length over a period of time.

The behaviour of these glaciers, which represent 40% of the total glaciated area of the Karakoram goes against the normal trend of considerable reduction in volume and length of most glaciers in the Himalaya in recent decades.

Surging of glaciers is potentially catastrophic as it can lead to the destruction of villages, roads and bridges. It can also advance across a river valley and form ice-dammed lake. These lakes can form catastrophic outburst floods. Therefore, monitoring of glacier surges, ice-dammed lake formation, and drainage is of paramount importance.

Assessment and regular monitoring of surge-type glaciers of Karakoram has been a daunting task. Because in the conventional method, it required a ground-level assessment of subglacial flows. Keeping these challenges in mind, a team of Scientists from WIHG led by Dr Rakesh Bhambri, carried out a detailed assessment of some major surging glaciers of the Karakoram range using of multi-temporal and multi-sensor satellite images (Landsat 8 OLI, ASTER and Sentinel-2), Digital Elevation Models (DEM) and thermal data.

The scientists focused on the Shispare and Muchuhar glaciers, former tributaries of the once larger Hasanabad Glacier situated in Hunza Valley, Gilgit-Baltistan, Pakistan. In the 20th century, ground surveys and maps suggested that the two tributaries Shispare and Muchuhar retreated and had separated into distinct glaciers by 1954. In 2017–2019, a surge of Shispare Glacier, a former tributary of the once larger Hasanabad Glacier (Hunza region), dammed the proglacial river of Muchuhar Glacier, which formed an ice-dammed lake and generated a small

Glacial Lake Outburst Flood (GLOF).

The team detected three major surges from 1973 to 2019 using satellite images. Surge movement produced the highest recorded Karakoram glacier surface flow rate and resulted in a glacier frontal advance of around 1500 m. According to the study, the recent active phase of the Shispare surge began in April 2018, showed two surface flow maxima in June 2018 and May 2019, and terminated following a GLOF on 22–23 June 2019. The team inferred that surge during winter is more hydrological controlled due to staggered subglacial flow and low amount of meltwater. The surging terminates in summer due to channelized flow of meltwater and considerable heterogeneity in movement is also observed during summer and springtimes.

The Surge-type glaciers oscillate between brief (months to years) rapid flow and lengthy (tens to hundreds of years) slow flow or stagnation, which are called the ‘active’ (or ‘surge’) and ‘quiescent’ phases, respectively. This unsteady glacier flow makes it difficult to accurately assess individual glacier mass balances using *in-situ* observations because of the uncertain outcomes. Subglacial processes and conditions like amount of debris, distribution of stored water, and temperature gradient are crucial to understand the diversity of surge-types and surge-like behavioural spectrum. However, such information has been rare or unknown in the Karakoram, because ground-based observations are difficult to acquire.

The study published in the journal Nature, Scientific Reports will help to understand the diversity of glacial behaviour and help make accurate assessments of individual glacier mass balances for disaster planning and management.

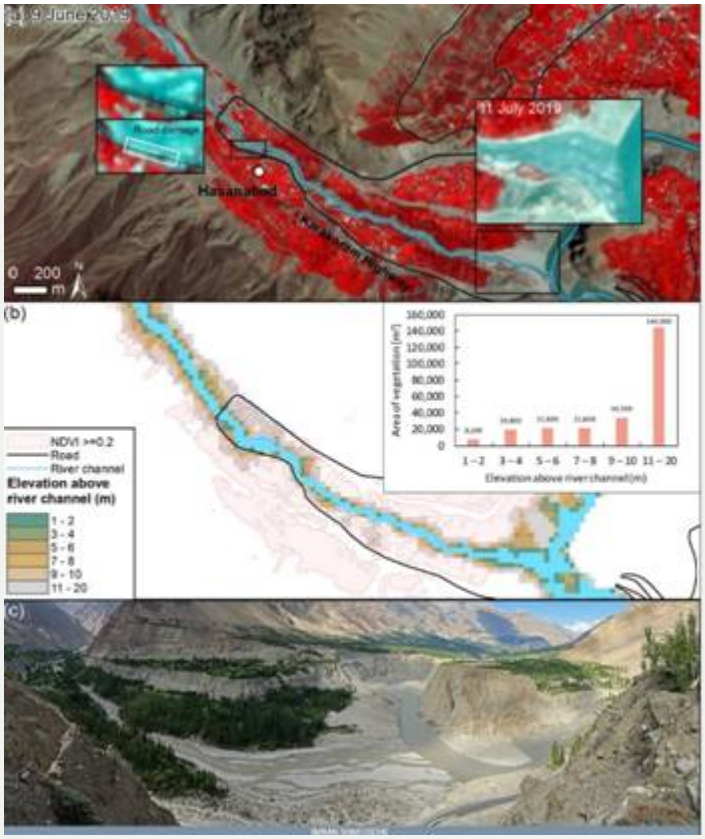

*Fig: (**a**) PlanetScope image (09 June 2019) of the river channel and adjacent vegetated land (agricultural fields, tree plantations and orchards) before lake drainage, with post-lake drainage insets (11 July 2019). (**b**)Elevation above the river channel and the area of vegetated land (09 June 2019) within each elevation band. (**c**)Panoramic view in 2014 of the confluence with the Hunza River, overlooking the inset in panel (**a**) (Photograph by Imran Shah. 2014. License: CC BY-SA 2.0).*

[Links:

Bhambri, R. et al. (2020)The hazardous 2017–2019 surge and river damming by Shispare Glacier, Karakoram. Scientific Reports https://doi.org/10.1038/s41598-020-61277-8]

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