

Progress Report

Long-Term Monitoring of Gangotri Glacier, Garhwal Himalaya

(July–September 2023)

by

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Background

The Himalayan Mountain Range contains thousands of glaciers of varying properties, which are spread over 37000 km² and a stretch of 2400 km from East to West. The glacier inventory by the Geological Survey of India indicates there are 9575 glaciers in the Indian Himalayan Region (IHR). It is a well-established fact that changes in the glaciers are a key indicator of climate change; recent observation shows that snow accumulation is reducing while the ablation is increasing in the Himalayas. However, there are only a handful of ground-based studies on Himalayan glaciers. Therefore, the Department of Science and Technology (DST) has given the Wadia Institute of Himalayan Geology (WIHG), Dehra Dun the mandate to monitor Himalayan Glaciers. Presently, Uttarakhand State Disaster Management Authority (USDMA) has sponsored a project entitled “Long-term monitoring of Gangotri Glacier, Garhwal Himalaya” to WIHG (Letter no. 1765/XVIII-B-1/21-12(5)/2021 dated 21.12.2021) for which the funds were allocated in March 2022.

The approved objectives of the project are the following:

- Mapping and monitoring of the Gangotri group of glaciers.
- Mapping and monitoring of glacial lakes in the Gangotri group of glaciers.
- Monitoring of meteorological (temperature, rainfall and snowfall) and hydrological (water level/discharge and sediment transfer) parameters throughout the year and identification of extreme events.
- Risk assessment of glacial hazards (GLOF, debris flow, flash floods, etc.) using an integrated approach i.e. meteorological, hydrological, seismological, and satellite data.
- Dissemination of information to the local administration with regard to any emanating threat from the glacial hazards.

Based on the work plan submitted to USDMA, WIHG has carried out the following tasks from July to September 2023:-

1. The two (02) watch and ward, who were engaged for the period of April 2023 to April 2024, are stationed at Bhojwasa for the reporting of unusual activity in the region.
2. The Project Scientist appointed to the project has resigned in August 2023. A fresh recruitment for the vacant position will be completed through a walk-in interview soon.
3. The two (2) Automatic Weather Stations requested in the project have been purchased and successfully delivered at WIHG by the qualified firms. The installation for the same will be done at the selected sites in October-November 2023.
4. The procurement process for two (02) Broad Band Seismometers (BBS), one (01) manual meteorological observatory, and one (01) Automatic Water Level and Velocity Recorder, has been completed and the purchase orders for the same have been sent to the qualified firms for the delivery.
5. The remote sensing data will be purchased on a requirement basis.
6. A meeting was called by the Secretary, of USDMA with other officials of USDMA on 21.08.2023 to discuss the updates of the project. The progress made by WIHG regarding the purchase of instruments was also communicated in the meeting.



Figure 1. Field pictures showing the path of Bhagirathi River emerging from the snout of Gangotri Glacier (a); and the frontal part of the Gangotri Glacier (left to right view) covered with ice and debris (b); the opening of Gaumukh (snout) and broken ice blocks scattered in the river during the peak melting season.

7. Based on the physical observations by the project staff, it has been observed that the meltwater stream from Gangotri Glacier originates near the left lateral moraine, flowing across the snout of the glacier (Gaumukh) before moving downward (Figure 1). This flow across the glacier snout will enhance the melting for the frontal region.
8. Further snow cover analysis of satellite images acquired during the summer season (July-September 2023) shows the presence of seasonal snow during the melting season at higher reaches (Figure 2).

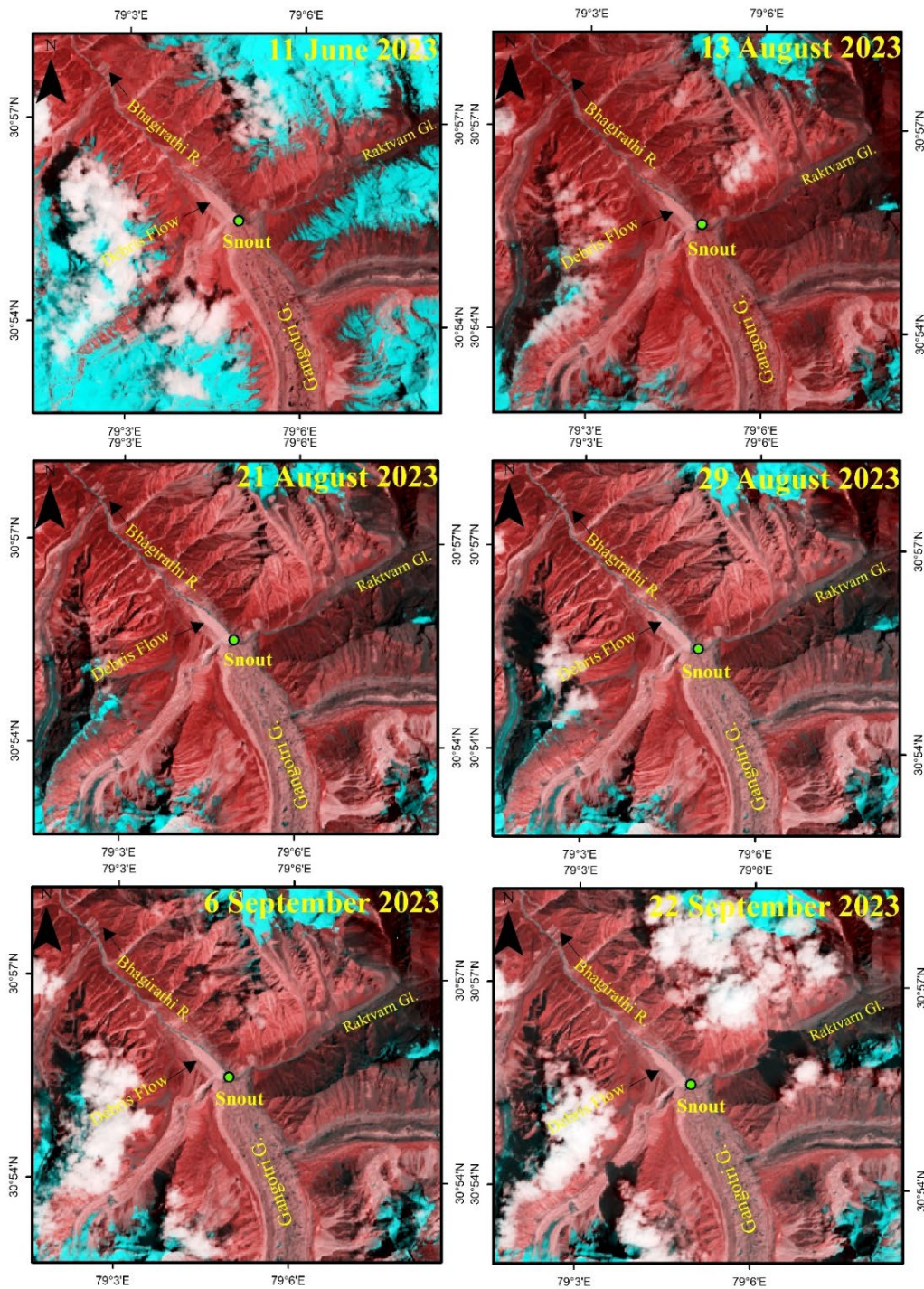


Figure 2. Satellite images indicate the presence of debris, no damming or lake, and the uninterrupted natural flow of the Bhagirathi River in the frontal region of Gangotri Glacier during the melting season (July-September 2023).

Further, based on the field survey and satellite images, no development of a major lake has been observed in the Meru Bamak, Raktvarn Glacier, and Gaumukh region to date. The Bhagirathi River is flowing uninterrupted without any natural or artificial damming from the debris in the proglacial region of Gangotri Glacier.