Rapid Hazard Assessment Report

Location: Shintaphu glacial lakes, Laya, Gasa

Country: Bhutan

Lat: 28.172762°N - Lon: 89.848022°E - Elevation: ca. 4500 m a.s.l.

Date: 29th of October 2026

Local time: 19:30 to 19:40 pm

Hazard type: glacial lake outburst flood

Imagery: (Source of imagery consulted for assessment: Sentinel-1, Sentinel-2)

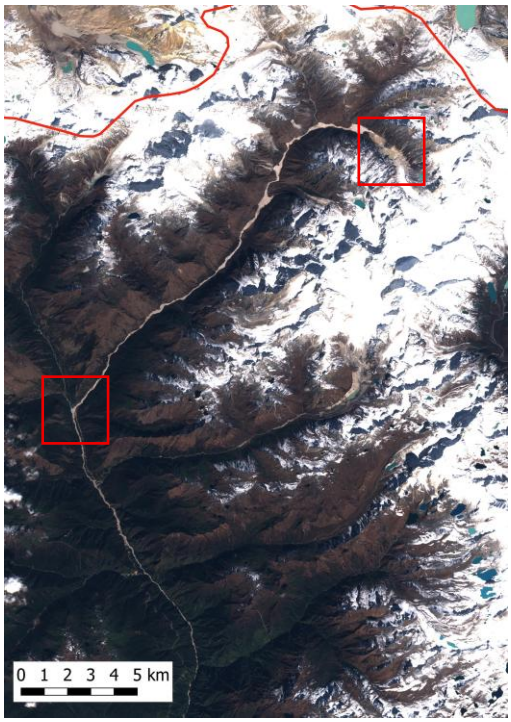


Figure 1: Overview of Laya with the Shintanphu lakes in the top red square (see Figure 2) and Taktsemakhang, where the deposits are still clearly visible and a lake has dammed (Figure 4).

Author(s): S. Rinzin, J. Steiner, A. Thapa, S. Allen, Q. Liu, I. Rashid

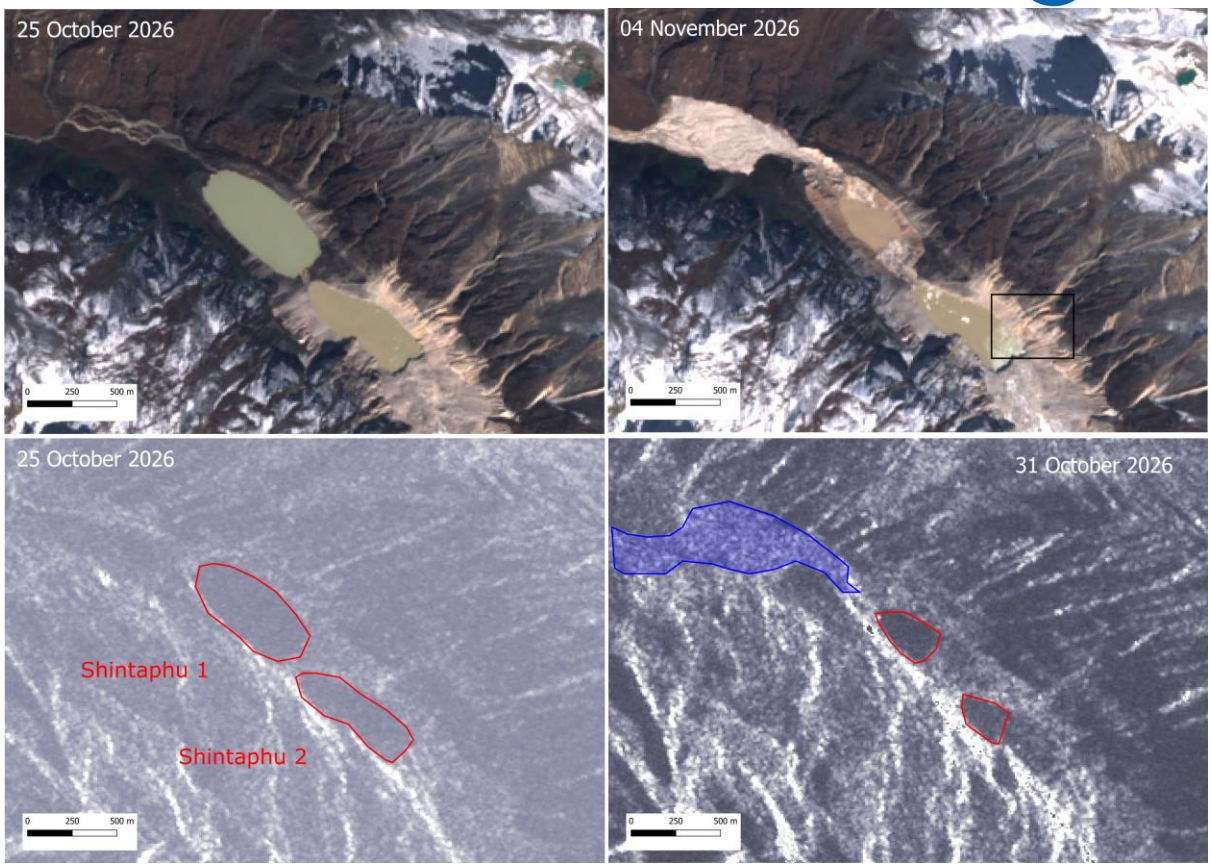


Figure 2: Top panels – optical images (Sentinel 2): Development of the Shintaphu before and after the outburst flood. The location of the minor initial moraine failure is indicated with a black rectangle, Bottom panels – radar images (Sentinel 1): Lake drainage and deposits visible just two days after the event.

Preliminary process understanding: At ca 19:30 to 19:40 PM, yak herders in the mountains above Laya started alerting local people about the flood. At 20:27 local time, a flood event was reported in Taktsemakhang, ca 20 km downstream of the Shintaphu glacial lakes located at the terminus of the Shintaphu Glacier (RGI2000-v7.0-G-15-09353). Radar imagery from one and optical imagery from two days after the event (Figure 2) suggests that the lower lake (Shintaphu-1) drained ~70% while the upper lake (Shintaphu-2) drained ~10%. Substantial debris deposits are visible just below the lower dam that was heavily eroded. While some calving in the upper lake, still connected to the lower part of the glacier, has been visible during 2026, there has been no substantial retreat or collapse of ice that could have explained an initial trigger. Precipitation data (GPM) shows no intense rainfall as a potential precursor. No failure is visible in the slopes north of the lakes prior to the event (Figure 3), and the sole direct impact is likely a moraine failure at the upper end of the Shintaphu 2 lake that reached the water surface and caused a cascade of failures. Precipitation in recent days in the upper slopes suggests a possibility of strong snow accumulation, in line with recent increase in snow depth in the area, visible snowcover, and a snowfilled avalanche gully. A temporary impoundment developed near Taktsemakhang ca 20 km downstream of the lakes that remains present until today, ca 430 m long on the 4th of November.

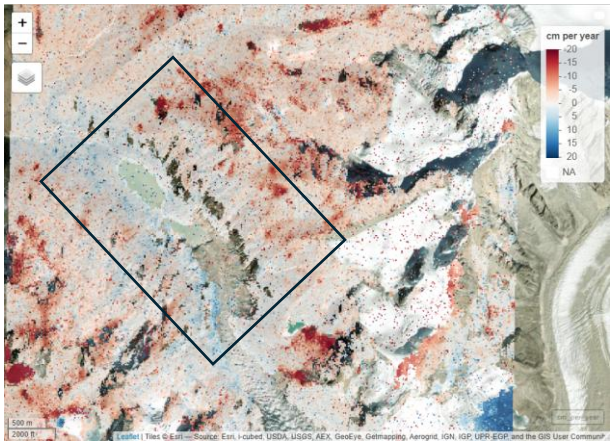


Figure 3: Displacement measured from NISAR data between June 18 and October 2026 around the lakes (black rectangle).

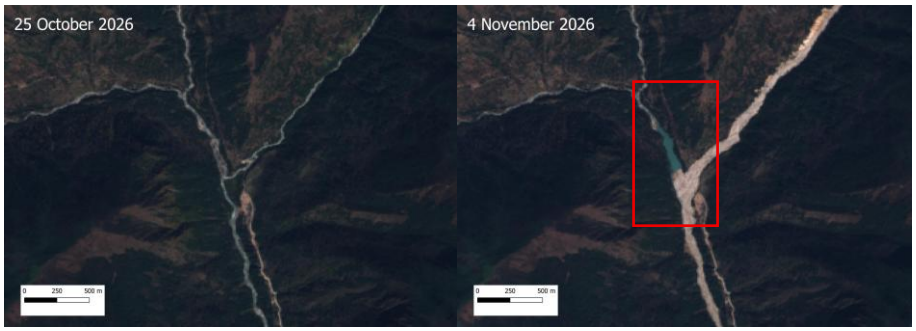


Figure 4: Damming of a lake in the downstream at Taktsemakhang, forming a lake of 430 m length and 3 ha in area. This is also the location of the EWS system at Yebisa.

Climate change context: Air temperature in the area has been comparable to recent years, the same is true for snow depth (Figure 5) and no anomalous rainfall was measured (GPM). Between 2009 and 2026, Shintaphu-1 has remained largely stable (0.23 km^2), while the upper lake has increased by 2900% over the same time period (0.005 to 0.15 km^2). As a consequence the width of the dam separating the two lakes has decreased from 100 to 75 m.

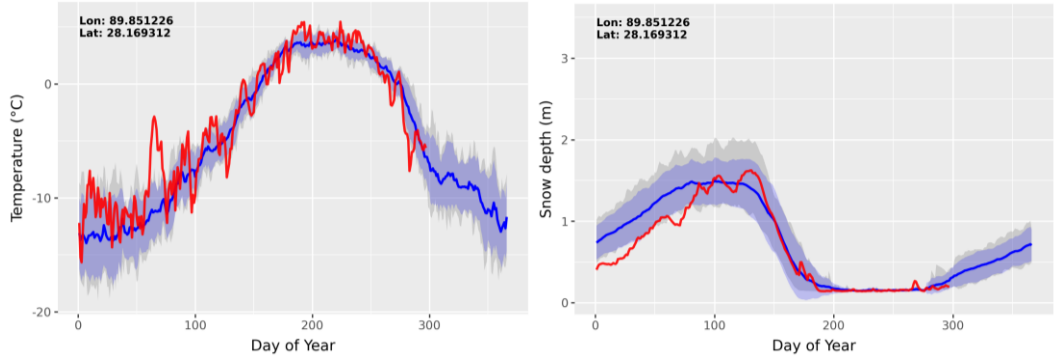


Figure 5: Air temperature and snow depth at the lakes from reanalysis data.

Socioeconomic risk context: The GLOF caused infrastructure damage along the Mo Chhu corridor, in Gasa and Punakha Dzongkhags[1]. Impacts included inundation of two residential buildings, damage to road sections and bridges, destruction of tourism infrastructure at Gasa Tshachu (hotspring), loss of eight cattle, and damage to more than two acres of paddy fields.

[1] https://thebhutanese.bt/yak-herders-first-to-alert-residents-as-flood-hits-gasa-and-punakha

Precautionary evacuations were undertaken in vulnerable settlements downstream. The lakes have previously been identified as at risk by national and independent international assessments (Figure 6, Figure 7).

Early warning: The first warning of the GLOF originated from yak herders near Laya, who sensed unusual ground vibrations and heard the sound of rushing water. They immediately alerted nearby communities through telephone calls and the Laya Gewog messaging group. The Gasa Dzongkhag Administration received its first notification at 7:47 PM, prompting local authorities to disseminate warnings to downstream communities. The flood subsequently reached Taktsemakhang at 8:27 PM, and warning sirens were also activated along the Mo Chhu and downstream Punatsangchhu. Three river-level monitoring stations, forming part of the existing GLOF Early Warning System (EWS) in the Punatsangchhu basin, are located along the Mo Chhu[2]. Although none of the glacial lakes in this sub-basin are directly monitored at the source, the Yebisa monitoring station (Figure 6) is situated downstream of Shintaphu Lake.

Regional context and earlier studies: Previously only one GLOF (Simdong Goi Tsho, before 1966) has been reported for this catchment (Shrestha et al., 2023). Shintaphu-1 has been identified as potentially dangerous by the government[3] (Figure 6), and has received extensive monitoring with respect to volumes in 2016 (referred to as Mo_gl 234 in records). Since these assessments the upper lake has developed into a permanent feature and now likely poses the graver risk of setting off a cascade as has happened in this case. A subsequent assessment by Rinzin et al. (2021) classified Shintaphu-1 as moderately susceptible and Shintaphu-2 as highly susceptible to generating a GLOF. In contrast, a GLOF hazard assessment incorporating downstream flood propagation and impacts (Rinzin et al., 2026) classified Shintaphu-1 and Shintaphu-2 as moderate and low hazard lakes. A regional assessment has placed both lakes among the most hazardous in the region, and when including exposure in the downstream, as especially risky compared to the many other lakes in the area (Zheng et al., 2021) (Figure 7).

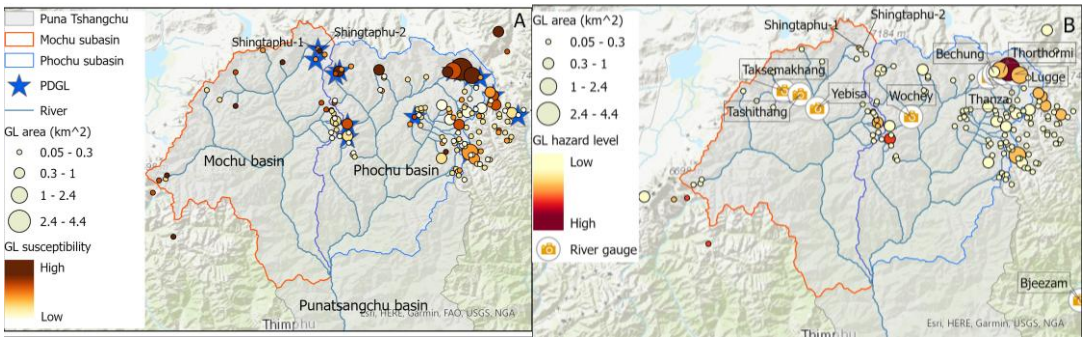


Figure 6: (A) Shows potentially dangerous glacial (NCHM, 2019) and GLOF-susceptible (Rinzin et al., 2021) lakes in the Punatsangchu basin. (B) is the distribution of hazardous glacial lakes based on the modelled hazard map and downstream impact (Rinzin et al., 2026).

[2] https://www.nchm.gov.bt/attachment/ckfinder/userfiles/files/Final%20SOP.pdf
[3] https://www.nchm.gov.bt/attachment/ckfinder/userfiles/files/Re-assessment%20of%20Potentailly%20Dangerous%20Glacial%20Lakes.pdf

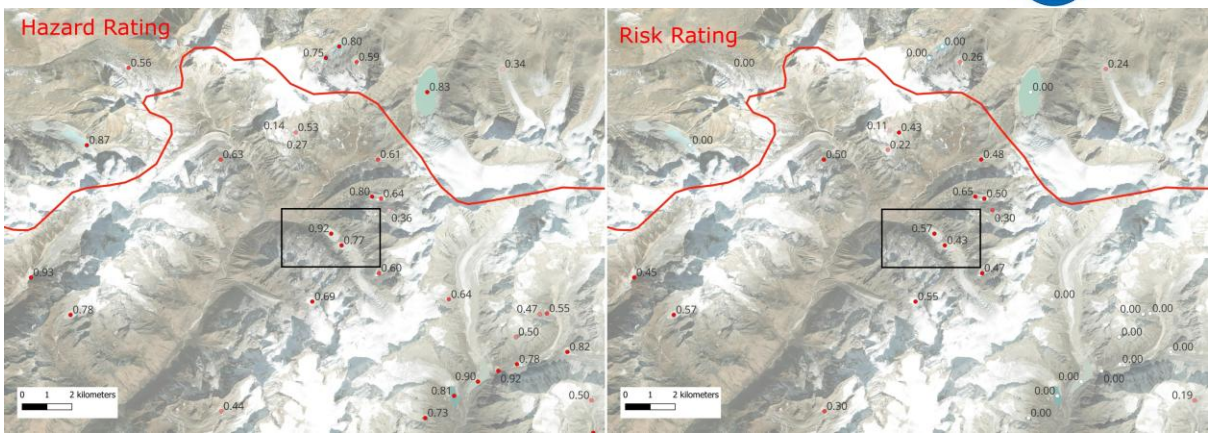


Figure 7: Regional hazard (left) and risk classification (right) from (Zheng et al., 2021)

Literature:

National Center for Hydrology and Meteorology (NCHM). (2021). Standard operating procedure (SOP) for GLOF early warning system: Punakha-Wangdue Valley (Version 3.00). Royal Government of Bhutan. https://www.nchm.gov.bt/attachment/ckfinder/userfiles/files/Final%20SOP.pdf

National Center for Hydrology and Meteorology (NCHM). (2019). Reassessment of potentially dangerous glacial lakes in Bhutan. Royal Government of Bhutan. https://www.nchm.gov.bt/attachment/ckfinder/userfiles/files/Re-assessment%20of%20Potentailly%20Dangerous%20Glacial%20Lakes.pdf

Rinzin, S., Dunning, S., Carr, R. J., Allen, S., Wangchuk, S., & Sattar, A. (2026). Advancing glacial lake hazard and risk assessment in Bhutan through hydrodynamic flood mapping and exposure analysis. *Natural Hazards and Earth System Sciences*, *26*(2), 1015–1037. https://doi.org/10.5194/nhess-26-1015-2026

Rinzin, S., Zhang, G., & Wangchuk, S. (2021). Glacial lake area change and potential outburst flood hazard assessment in the Bhutan Himalaya. Frontiers in Earth Science, 9, Article 775195. https://doi.org/10.3389/feart.2021.775195

Shrestha, F., Steiner, J. F., Shrestha, R., Dhungel, Y., Joshi, S. P., Inglis, S., Ashraf, A., Wali, S., Walizada, K. M., & Zhang, T. (2023). A comprehensive and version-controlled database of glacial lake outburst floods in High Mountain Asia. *Earth System Science Data*, *15*(9), 3941–3961. https://doi.org/10.5194/essd-15-3941-2023

Zheng, G., Allen, S. K., Bao, A., Ballesteros-Cánovas, J. A., Huss, M., Zhang, G., Li, J., Yuan, Y., Jiang, L., Yu, T., Chen, W., & Stoffel, M. (2021). Increasing risk of glacial lake outburst floods from future Third Pole deglaciation. *Nature Climate Change*, *11*(5), 411–417. https://doi.org/10.1038/s41558-021-01028-3