



## Glacial Lake Outburst Flood in Sikkim

**For Prelims:** [Glacial Lake Outburst Flood](#), [Teesta River](#), [Indian Himalayan Region](#), [Climate change](#), [National Disaster Management Authority](#), [Avalanche](#)

**For Mains:** Factors Responsible for GOF and Measures to Mitigate the Risk, Important Geophysical Phenomena.

**Source:** IE

### Why in News?

Sikkim recently experienced a [Glacial Lake Outburst Flood \(GLOF\)](#). The **South Lhonak Lake**, a **glacial lake** located at an altitude of 17,000 feet in the state's northwest, experienced a **rupture as a result of continuous rainfall**.

- Consequently, water was discharged into the downstream regions, causing flooding in the [Teesta River](#) and impacting four districts of Sikkim: Mangan, Gangtok, Pakyong, and Namchi, as reported by the Sikkim State Disaster Management Authority (SSDMA).
- This flooding also caused the **Chungthang Hydro-Dam in Sikkim (on Teesta river) to breach**, worsening the overall situation.

### // **Waiting to Happen! What was the Trigger?**

The infographic is divided into several sections:

- Map:** Shows the location of South Lhonak Lake in Sikkim, India, near the border with China and Nepal. It also marks the Chungthang Dam and the Teesta River.
- Text:** "As South Lhonak glacier continued to retreat amid global warming by another 400 m between 2008 and 2019, lakes only grew".
- Text:** "Glacial lake outburst flood (Glof) like disaster was waiting to happen".
- Text:** "Trigger could be anything from cloudburst to landslide, avalanche or earthquake".
- Mitigation Steps:**
  - "First field expedition of glacial lake conducted in August 2014, followed by another in 2016 which resulted in a project to start siphoning off lake water".
  - "Three pipelines were installed to siphon off 150 mlitres of water per second at that time".
  - "Early warning system was set in place in some locations by Centre for Development of Advanced Computing".
  - "Central Water Commission initiated an advisory to evaluate the South Lhonak glacier".
- Himalayan Problem:**
  - "Problem of receding glaciers and the spectre of Glof devastation faces the entire Himalayan region as global warming provides new triggers in the young mountain ranges".
  - "Add to that the build-up of infrastructure, habitation, road networks and hydropower plants".
  - "A 2021 study warned that 'both the existing and planned hydropower plants are exposed to potential outburst floods from glacial lakes'".

### What is Glacial Lake Outburst Flood?

- About:**

- A **GLOF (Glacial Lake Outburst Flood)** is a sudden and potentially catastrophic flood that occurs when water stored behind a glacier or a moraine (a natural accumulation of ice, sand, pebbles, and debris) is released rapidly.
  - These floods happen when glacial lakes formed by melting ice accumulate water behind weak moraine dams.
  - Unlike sturdy earthen dams, these moraine dams can fail abruptly, releasing large volumes of water in minutes to days, leading to devastating downstream flooding.
- The **Himalayan terrain**, with its **steep mountains**, is particularly vulnerable to GLOFs.
  - **Climate change**, accompanied by **rising global temperatures**, has expedited the process of glacier melting in the **Sikkim Himalayas**.
    - The region now boasts more than 300 glacial lakes, with ten identified as susceptible to outburst floods.
- GLOF can be triggered by several reasons, including **earthquakes, extremely heavy rains and ice avalanches**.
- **Impact:**
  - GLOFs can result in catastrophic **downstream flooding**. They have the potential to release millions of cubic meters of water in a short period of time.
    - Peak flows during GLOFs have been recorded as high as **15,000 cubic meters per second** (as per [National Disaster Management Authority](#)).

### How Susceptible is South Lhonak Lake to GLOFs?

- The **South Lhonak lake** in northern Sikkim is situated about 5,200 meters above sea level.
  - Scientists have previously warned that the **lake had been expanding over years**, possibly from the melting of the ice at its head.
  - Notably, seismic activities, including a **2011 magnitude 6.9 earthquake**, escalated the GLOF risk in the area.
- In 2016, the **Sikkim State Disaster Management Authority** and other stakeholders launched a critical plan to drain excess water from South Lhonak Lake.
  - Visionary innovator **Sonam Wangchuk** led the effort, employing **High Density Polyethylene (HDPE) pipes** to siphon off water from the lake.
  - This initiative successfully reduced the lake's water volume by approximately 50%, mitigating the risk to some extent.
- However, the recent tragedy is believed to be caused by an **avalanche originating from the ice-capped feature surrounding the lake**.

### What are the Other Recent GLOF Incidents in India?

- In **June 2013**, Uttarakhand had received an **unusual amount of rainfall leading to the melting of the Chorabari glacier** and the eruption of the **Mandakini river**.
- In **August 2014**, a glacial lake outburst flood hit the village of Gya in Ladakh
- In February 2021, Chamoli district in Uttarakhand witnessed flash floods which are suspected to have been caused by GLOFs.

### What Actions be Taken to Reduce the Risk of GLOFs?

- **Glacial Lake Monitoring:** Establishing a comprehensive monitoring system to track the growth and stability of glacial lakes in vulnerable regions.
  - Satellite imagery, remote sensing technology, and **field surveys through drones** can be used to **regularly assess changes in glacial lakes and their associated moraine dams**.
- **Early Warning Systems:** and early warning systems that can provide timely alerts to downstream communities in the **event of a GLOF**.
  - Also, there is a need to complement it with **flood protection measures**, such as **constructing protective barriers, levees, or diversion channels** to redirect floodwaters away from populated areas.

- **Public Awareness and Education:** There is a need to **raise public awareness about the risks of GLOFs and educate communities** living downstream about evacuation procedures and safety measures, as per NDMA's guidelines related to GLOF.
  - Conduct drills and training programs to ensure that residents know how to respond in case of a GLOF.
- **International Cooperation: India can collaborate with neighboring countries in the Himalayan region**, as GLOFs can have transboundary impacts.
  - Sharing information and best practices for GLOF risk reduction and management with neighboring countries can help to mitigate the risk.

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