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.

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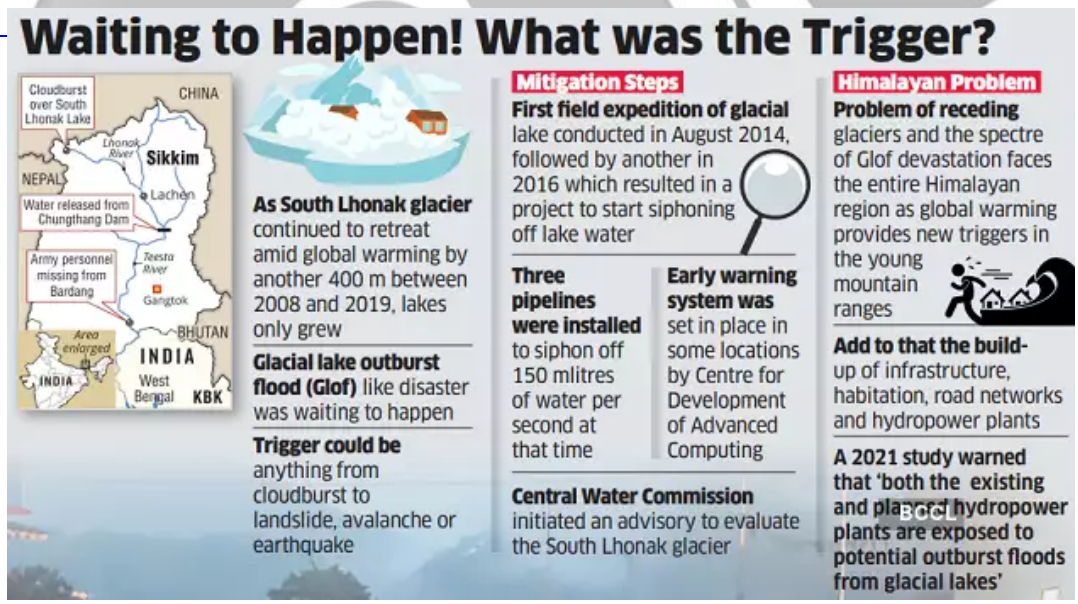

What is Glacial Lake Outburst Flood?

- **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**, Uttrakhand 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.