Chamoli Flash Floods

February 20, 2021
Parts of Uttarakhand witnessed massive flash flooding after a chunk of the Nanda Devi glacier broke off at Joshimath in Uttarakhand's Chamoli district. GLOF is being considered to be the most likely trigger for this tragedy.

In news: Uttarakhand flash flood wreaks death, damage
Placing it in the syllabus: Disaster Management
Dimensions:

- What are flash floods?
- Reasons for the floods
- What is Glacial Lake Outburst Flood(GLOF)?
- Way forward

Content

What is a Flash Flood?

- A flash flood is a rapid flooding of low-lying areas such as washes, rivers, dry lakes and depressions.
- Flash floods are distinguished from regular floods by having a timescale of **fewer than six hours between rainfall and the onset of flooding.**

Reasons for a Flash Flood?

It may be caused by:

- heavy rain associated with a severe thunderstorm, hurricane, tropical storm, or
- meltwater from ice or snow flowing over ice sheets or snowfields
- after the collapse of a natural ice or debris dam, or
- The collapse of a human structure such as a man-made dam

Chamoli Flash Floods

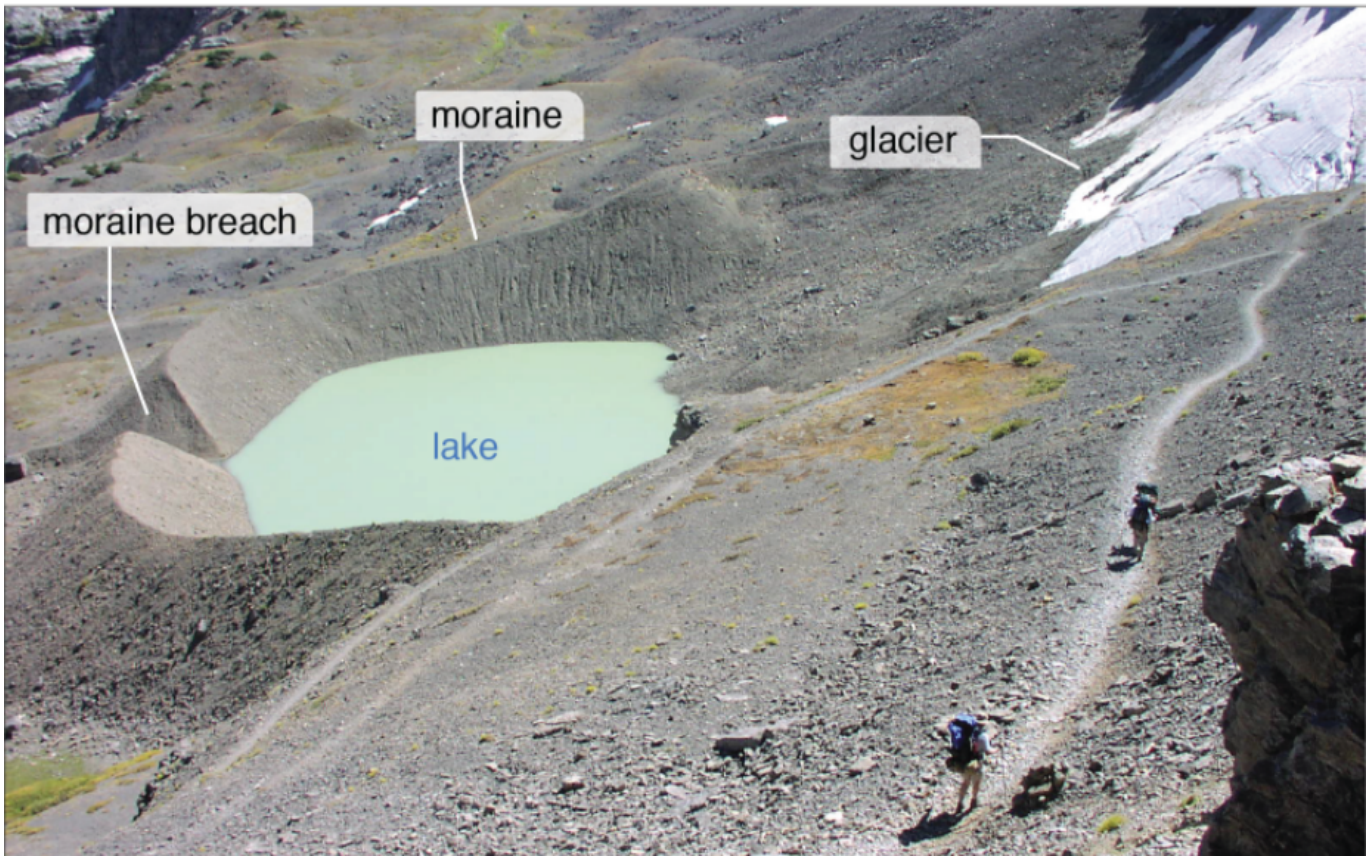
- A chunk of the Nanda Devi glacier broke off at Joshimath in the Tapovan-Reni area of Chamoli District and created massive flash floods in parts of Uttarakhand.
- The glacial break led to a massive Flash Flood in Dhauli Ganga and Alaknanda Rivers, damaging houses and the nearby Rishiganga power project.

- Local authorities have described it as a glacial burst
- Scientists say this probably means that a gigantic chunk of ice broke away from a glacier and caused the water level in the associated glacial lake to abruptly rise and possibly trigger a “moraine breach event” – the breach of a natural dam made from rock and debris that has been holding the water back.
- But it is unclear whether there was an avalanche in the

area recently or whether the lake breach was the result of construction, anthropological activities, climate change, etc.

What is Glacial Lake Outburst Flood (GLOF)?

- Glacial lake outburst flood (GLOFs) is the sudden release of water retained in a glacial lake.
- Retreating glaciers, like several in the Himalayas, usually result in the formation of lakes at their tips, called **proglacial lakes**.
- Large lakes located in front of the glacier are mainly dammed by loose **moraine** (glacial debris left behind after the ice has retreated)
- Terminal moraines act as natural dams for these glacial lakes.
- GOLF occurs when weak moraine dams crumble and the stored water in the lake burts out.
- GLOF is a release of meltwater which can be either from a moraine- or ice-dam glacial lake due to a dam failure.
- GOLF leads to massive floods and debris flows with potentially extensive damage downstream, including loss of life and infrastructure.



GLOFs have three main features:

- They involve sudden (and sometimes cyclic) releases of water.
- They tend to be rapid events, lasting hours to days.
- They result in large downstream river discharges (which often increase by an order of magnitude).

The moraine dams of a glacial lake can fail due to:

- A **buildup of water pressure** or structural weakness of the boundary due to an increase in the flow of water.
- **An earthquake (Tectonic) or cryoseism** (non-tectonic seismic event of the glacial cryosphere) can also cause GLOF. During this, the boundary of the glacial lake will collapse suddenly and release the water in the glacial lake.
- **An avalanche of rock or heavy snow:** During this, the water in the glacial lake might be displaced by the avalanche.
- **Volcanic eruptions** under the ice can also cause GLOF.

These volcanic eruptions might displace the boundary or increase the pressure on the glacial lake or both.

- **Heavy rainfall/melting of snow:** This can lead to massive displacement of water in a glacial lake.
- **Long-term dam degradation** can also induce GLOF.
- Other reasons such as the collapse of an adjacent glacial lake, etc.

Way forward:

The **National Disaster Management Authority (NDMA)** had issued detailed guidelines on how to reduce and deal with disasters caused by GLOFs:

Prevention Measures

- **Identify and Mapping Dangerous Lakes:** Potentially dangerous lakes can be identified. This identification will be based on field observations, past events, geomorphologic and geotechnical characteristics, etc.
- **Use of Technology:** It has recommended the use of Synthetic-Aperture Radar imagery. It will automatically detect changes in water bodies, including new lake formations, during the monsoon months.
- **Structural Measures:** It recommends reducing the volume of water with various methods to manage lakes structurally. Methods are pumping or siphoning out water and making a tunnel through the moraine barrier or under an ice dam.
    - **Example:** In 2014, a landslide occurred along Phuktal (a tributary to Zanskar river) in the Kargil district of Ladakh. It led to a potential flood situation. The NDMA created an Expert Task Force which along with the Army used explosives to channel water from the river. It used controlled blasting and manual excavation of debris for this purpose.
- **Land Use Planning:** Land use planning regulations need to

be developed. In downstream areas, Infrastructure development should be monitored prior to, during, and after the construction. Constructions and development in High prone areas should be prohibited. It is a very efficient means to reduce risks at no cost.

- **Trained Local Manpower:** Apart from specialized forces such as NDRF, ITBP, and the Army, there is a need for trained local manpower. These teams will assist in planning and setting up emergency shelters, distributing relief packages, identifying missing people, and addressing the needs for food, healthcare, water supply, etc.
- **Early Warning System:** A robust early warning system in vulnerable zones should be put in place.

Disaster Response Measures

- **Building disaster response procedures:** Response strategies need to consider a multi-hazard perspective, considering that access and evacuation routes, and relief camps could be damaged not only by GLOFs but also another mountain hazard
- **Trained Local communities as first responders:** Training the local communities in search and rescue operations and emergency relief measures, including logistics for medical treatment. . Such training and preparation should be undertaken at the local level through a suitably devised Incident Response System (IRS) coordinated by the local administration through the Emergency Operations Centers (EOCs).
- **Emergency medical response team:** Quick Reaction Medical Teams, mobile field hospitals, Accident Relief Medical Vans, and heli-ambulances should be set up in areas inaccessible by roads.

Rehabilitation Measures

Psychological Counselling: The guidelines also call for

psychological counseling of victims.

Mould your thought: What is Glacial Lake Outburst Flood (GLOF)? Discuss measures to prevent tragedies created by GLOF.

Approach to the answer:

- Introduction
- Define GLOF
- Discuss the causes and effects of GLOF briefly
- Mention the NDMA guidelines
- Conclusion