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Not My Fault: The Himalayan floods: a freak event or sign of things to come?

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People salvage their belongings from a building damaged by flash flooding in Nuwakot district of Nepal, Tuesday, Sept. 1, 2026. (AP Photo/Rajesh Kumar Singh)

The video footage is gut wrenching. It might begin with a view of an ordinary day - cars moving on streets and people walking by shops. Then the waters arrive, surging under bridges and racing by riverbank buildings. For the first few seconds it looks like everything is high enough to escape major damage. But the surge only builds, higher and higher. A bridge is broken, joining the hurtling debris mass heading downstream. The water reaches the ground floor of shoreline buildings, then the second floor and higher. Soon it's a swirling mass of chaos and suddenly the camera jumps as the videographer realizes their vantage point is no longer be safe.

Nepal, India, and the Tibet (now part of China) are no strangers to catastrophic flooding. Glacial lake outbursts in 1981 and 2016 caused floodwaters to race down the Bhote Koshi River Valley in Tibet. The 1981 floods killed 200 in Nepal. An improved alerting system prevented deaths in 2016, but financial losses were far higher. In 2008, the Kosi River breached an embankment in

Nepal, inundating 400 square miles of Nepal and northern India. At least 400 people died; some casualty estimates reach 2000.

The 1981 and 2016 floods were caused by glacial lake outbursts. Glacial lake outburst floods also called jökulhlaups, are potentially massive deluges triggered by the failure of ice dams. Relatively common in glacial areas, some like Alaska's Mendenhall Glacier near Juneau occur annually when the seasonal ice melt accumulates each summer and bursts through.

The 2008 flood was caused by monsoonal rains that caused levees to fail. Monsoons occur every year. 2008 wasn't a huge flood, but levee maintenance is costly and complicated by agreements between nations. A blame game ensued with both India and Nepal pointing fingers at one another as to whose fault the breach was. The countries have never resolved their differences over the Bihar floods, and many civil claims are still in limbo.

Nepal, China, and India all have monitoring systems for areas prone to flooding that rely on remote sensing, water level measurements, and modeling. In Nepal, the Department of Hydrology and Meteorology handles disaster monitoring and forecasting, and telecom companies provide mass SMS-based broadcasts free of charge. The system relies on a network of automated gauging stations in the major river basins. When water levels exceed a pre-programmed height, short-code SMS blast is sent to every active mobile phone pinging tower in the area believed vulnerable to flooding. The system had worked well in the past, particularly for events caused by heavy rainfall when the water levels rise relatively slowly.

The 2026 flood was not caused by either a glacial lake outburst or monsoonal rains. At the time it began, monitoring systems showed nothing unusual. A seismic event was detected at 8:37 AM local time in Nepal and reported felt lightly by some nearby. It was initially reported as a magnitude 4.4 earthquake by the USGS. That first report pegged it as a tectonic earthquake caused by fault rupture. Earthquakes are common in the region and aren't part of the real-time flood monitoring program in any of the three countries. A Chinese regional seismic network had picked up several smaller seismic events in the three hours prior to the flood onset but hadn't noted them as unusual at the time.

At about the same time as the earthquake, people in the upper parts of the basin heard a sudden roar followed only moments later by rapid rise of water. A CCTV camera captured the moment at the Gyirong border crossing between China and Nepal (see video link at https://en.wikipedia.org/wiki/Gyirong_Port). Further down the valley, the water just suddenly began to rise. No messages were received on the SMS-based alert system. Only a lucky few received any notifications that flood waters were coming and those were through informal phone calls and texts from friends and family higher up in the basin.

As I write, no one knows the true extent of loss. The current tally of lives lost is 1,318 but it will certainly rise as over 5,600 are missing. Nepal took the largest hit with over 1,200 official deaths; 31 deaths were reported in Tibet. While most are from Nepal, nearly 600 foreign nationals from 39 countries are on the list, including 83 Americans. Many of the missing will likely never be found. The Nepal government has estimated losses of nearly 400 billion U.S. $$, making it the most expensive flood of the last three decades.

It took only moments after the first flood stories to hit the news for scientists from around the world to look at what happened. Slack, a cloud-based collaboration platform, became the real-time discussion forum for the scientific community to contribute, analyze, and debunk theories of what caused the disaster. The first piece of data to be examined was the seismic signal. First pegged as an earthquake, a closer look showed it lacked the high frequency signals characteristic of earthquake P and S waves. Instead, it showed the longer period slow rumbling of a large landslide with an energy release equivalent to a M5.2 earthquake.

The seismic data gave scientists the location of a potential source but were initially thwarted by cloud cover to view satellite imagery of the area. What could be seen was the sharp edge of a glacier that had apparently snapped off at an elevation of 17,000 feet and tumbled over 4,000 feet into the valley below. Glacial collapse became the first flood-cause hypothesis. But the numbers didn't work out. The size and elevation drop of the glacial ice volume couldn't account for flood heights.

By the next day, improved satellite imagery gave scientists a clear view of the landslide site. An enormous slab of the mountainside had failed, and the glacier had slid with it. It was harder to determine the series of events from the river perspective. The near-instantaneous surge of water in the upper reaches of the watershed had destroyed the gauging stations and estimates of water height could only be made later when drones were able to examine the region.

It's still early in the quest to fully understand what happened on August 26. Scientists are calling it a cascading disaster, where one event triggers and amplifies another. A 49-acre section of the mountainside collapsed carrying rock and glacial ice into the valley below. The rock displaced the water and some of the glacier likely pulverized and liquified, but exactly how it contributed is still a question. We know that flood waters left debris 270 feet above normal river heights in the upper areas of the basin and traveled at speeds of over 100 miles per hour.

We also know that Nepal and China were unprepared for this particular rapid-onset event. The carefully crafted flood warning systems were designed for slower events, not one that ripped out monitoring sites before they could send alerts. It took nearly 40 minutes for any alerts to be sent, too late to be of use for most areas. Informal alerting worked in some cases. Rajendra Dawadi, a school principal in Nukawot, Nepal, received four phone warnings from acquaintances higher in the valley that flood waters were on the way. He quickly took action telling students and staff to leave the school and run to higher ground. He also notified school buses enroute to the school to stop and turn around. Flood water destroyed the school within ten minutes of those calls. His quick actions saved 900 people.

Much has been made in the media about signs that were ignored in the hours and days before the landslide and flood. Post event satellite examination of the region showed that the glacier had accelerated its rate of movement in the weeks before the failure and closer examination of the rock face showed cracks just days beforehand. Seismic signals recorded on the Chinese network in the region showed small signals consistent with slip events in the hours before the major collapse occurred.

What was the role of a warming planet in the Nepal event? The glacier in this story had been retreating for decades like almost all of the glaciers in Nepal. As a glacier retreats it also thins,

affecting the stability of hillslopes. A year ago, a slope collapsed into Alaska's Tracy Arm producing a large tsunamis. That failure was directly linked to the retreat of the glacier that had buttressed its toe. These aren't isolated events; a paper (Liu et al., 2021) shows the rate and size of landslides in glaciated areas of Asia are increasing.

The one thing that sticks with me in the Nepal disaster is how hard it is to prepare for and respond to an event we haven't experienced before and one with such a short trigger.

Note: How Slack helped scientists unravel the 2026 flood story is at https://www.science.org/content/article/how-scientists-unraveled-cause-devastating-flood-tibet-and-nepal.

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