

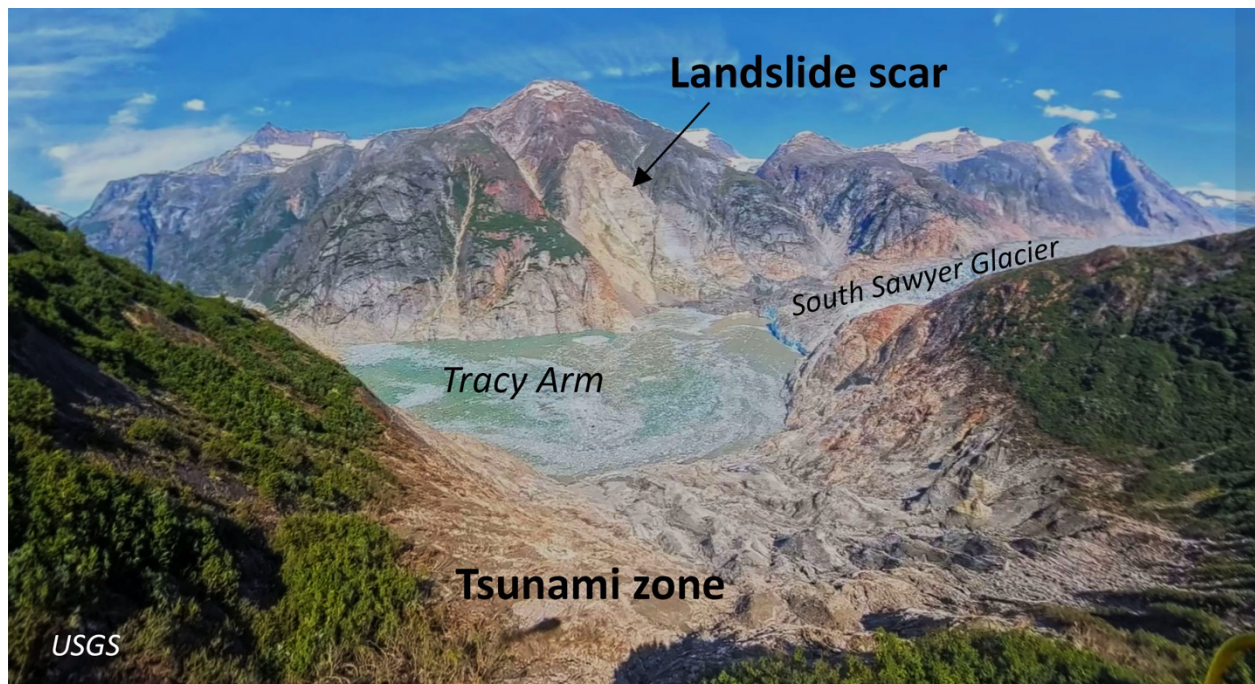
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Not My Fault: August Landslide Tsunami in Alaska ranks as the second highest of all time

Lori Dengler for the Times-Standard

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Air photo of Tracy Arm, a glacial fjord in Southeastern Alaska, showing the exposed scarp of the August 10, 2025, landslide and the barren hillside on the opposite side of the valley where the tsunami surge removed trees and other vegetation (USGS).

Last summer, a massive landslide slid into a fjord south of Juneau Alaska, producing an enormous surge of water that ran up the opposite hillside and sped down the channel, scraping off trees and soil and disturbing kayakers camped nearby. In the nearly ten months since the slide, geologists, seismologists, and tsunami scientists have been studying all aspects of the event. On May 6, a 19-member team led by Dan Shugar of the University of Calgary published the first comprehensive analysis of the landslide and ensuing tsunami in the journal *Science*.

The study examined the setting, seismic recordings of the landslide, remote imagery, post event field reconnaissance, modeled the slide and tsunami, and reveals a much larger event than was first estimated (see *Not My Fault* 8/16/26). Landslide movement wasn't instantaneous, telltale signs of the failure began days beforehand, and like the landslide tsunami generated in a Greenland fjord in 2023, the tsunami continued to oscillate within the fjord for days afterwards.

South Sawyer Glacier at the head of Tracy Arm is one of thousands of glaciers in the Juneau ice field, and one of the most accessible by cruise ships from Alaska's capital. The fjord, named

after Benjamin Tracy, a Civil War General who became Secretary of the Navy in the Harrison administration, is over 30 miles long, the upper fifth still covered in ice. The fjord was completely covered in ice as recently as the cold period known as the Little Ice Age, peaking in this area in the 1800s. Since then, rising temperatures have triggered thinning and retreat of all the glaciers in the region, changing both the hydrology and stability of valley walls.

Prior to the August landslide, concern over glacial-retreat-triggered slope destabilization had become an issue in much of Alaska, but Tracy Arm was not singled out as a region of particular concern. Several cruise ships would visit the area daily in the peak summer tourist months, and private or organized kayak tours also frequented the area. Visitors were well aware of the hazards of floating ice and glacial calving and were alerted to stay well away from the glacial front, but there was no alerting system or landslide/tsunami protocols in place at the time of last summer's slide.

The landslide occurred at 5:26 AM Alaska time seemingly without warning. There were no visible signs of the incipient failure, but a careful analysis of seismic data in the days preceding the failure showed all was not quiet. Jackie Caplan-Auerbach, a seismologist at Western Washington University and one of the co-authors of the Science study, is friends with a couple who were anchored in Endicott Arm last August, the next fjord south of Tracy Arm. They contacted Jackie after experiencing unusual swells and surges on what should have been quiet waters. Jackie looked at the seismic records from the two nearby stations and saw not only a signal characteristic of a landslide, but precursory noise as well.

Earthquakes are easy to recognize on a seismogram with the sharp onsets of P and S-waves followed by the longer period surface waves. Landslides look different, often longer duration and spindle shaped as the slide builds up speeds and then slows down. Landslides are sometimes preceded by precursors, a sort of stutter as the mass begins to creak. Jackie noticed a strong precursory signal in the hours before the final failure and over the next months, she and colleagues would pour over the records, filtering and processing for finer detail. Unfortunately, the seismometers were over 60 miles from the landslide source, and the vibrations were faint but still enough to tell an interesting story. In the 36 hours prior to the slide, the precursory signal steadily builds, becoming almost a continuous tremor in the hour before failure. Ongoing examination suggests the precursors began as much as a week beforehand.

The slide itself was enormous. A volume of 64 million cubic meters of material, equivalent to 25 great Giza pyramids, took less than two minutes to collapse into the fjord below. Seismic stations more than 600 miles away recorded the vibrations generated by the landslide. It was also detected on an array of infrasound detectors, some over 200 miles distant. The response of the displaced water was quick, accelerating up onto the opposite side and removing soil and vegetation to a height of 1,578 feet above the water level. This tsunami now ranks as the second highest credible tsunami ever recorded, surpassed only by the 1958 Lituya Bay tsunami at 1,721 feet.

Four groups of people camped near Tracy Arm witnessed the tsunami. Closest were a group of kayakers who awoke to water carrying away a boat and much of their gear, although as a precaution they had stored it well above the water level. Pat Lynett at USC, another member of the Science publication team, used their accounts, water level recordings, and remote sensing

data to model the Tracy Arm tsunami. The area near the source would have been dominated by “a cross-channel-directed, intensely turbulent, white-water surge” moving at speeds of 150 mph. It took only minutes for the surge to reach several common Tracy Arm cruise viewing locations, which were fortunately unoccupied due to the early morning hour. Farther down the fjord, channel geometry produced localized amplification as water accelerated around curves and embankments.

Once exiting Tracy Arm, the tsunami wave energy quickly dissipated as the water spread into the larger Endicott Arm and Stephens Passage, but the complex channel shape produced significant irregularity in the water heights with some areas experiencing only a few feet of flooding and other exceeding 20 feet. All tsunamis exhibit some variation in height due to coastal shape, but fjords exacerbate the differences.

This transition from the deep narrow channel of Tracy Arm to the wider channels of Endicott Arm also affected the period of the tsunami. We usually talk about the very long periods of tsunamis compared to normal ocean waves. Earthquake-triggered tsunamis typically have periods of many minutes to over an hour. In the confines of Tracy Arm, modeling shows tsunami periods were only about a minute, but once reaching the wider channels, were about 20 minutes.

A noticeable feature of the Tracy Arm tsunami was its duration. We call the long duration sloshing in a confined channel a seiche and because of the relatively low friction on the channel walls, seiches in fjords can last a long time. The 2023 landslide-triggered tsunami seiche in Greenland lasted 9 days with amplitudes of 20 to 30 feet. The Tracy Arm seiche was not as large, with a dominant period of just over an hour that lasted a day and a half.

The Tracy Arm landslide and tsunami caused no significant damage or injuries to people or property. The gear lost by the kayak group was the only cost. It was fortuitous timing that minimized the loss. Had it occurred later in the day when several cruise ships were in the fjord within a few miles of the landslide source, the outcome would have been different. The question arises, is there any way to warn or reduce the hazard to tourists in the future?

With thousands of glaciers retreating in Alaska, it is not possible to instrumentally monitor all of them to identify potential precursors to major slides. The State of Alaska has a landslide monitoring group, and the August event has increased interest in assessing hazards and identifying those of most concern to human activity. Barry Arm in the Prince William Sound area has been the subject of much concern for over a decade and a warning system with State and the National Tsunami Warning Center has been developed for that specific area. But elsewhere, landslides are not part of tsunami warning protocol.

Our tsunami warning system is focused on earthquake-triggered tsunamis. They are the most common and have the greatest potential to impact people. We have a good understanding of the relationship between earthquakes and tsunamis and can analyze the earthquake signal to project the tsunami threat in a timely manner. Landslides are far trickier, and although the Tracy Arm study showed precursors, they aren't easily adaptable for warnings or applicable elsewhere.

In the near term, the approach has been to limit exposure in Tracy Arm. Most cruise operators have cancelled Tracy Arm from their 2026 itineraries, choosing to focus on nearby Endicott Arm instead. There is no way to prohibit private groups from visiting the area, but it is being strongly discouraged. But Tracy Arm is not the only place in Southeastern Alaska where landslides in fjords are a threat. The Dawes glacier at the head of Endicott Arm is also retreating and the same factors that triggered the Tracy Arm slide are present there as well.

What is the relevance of the Tracy Arm tsunami to the North Coast? The extraordinary water heights seen in Tracy Arm and Lituya Bay are not possible here. But landslides falling into water bodies are something to be aware of. Whether a slide into a river, or along the coast, it's always a good precaution to move away from the water's edge when you feel an earthquake.

Note: The full Science article is at <https://www.science.org/doi/10.1126/science.aec3187>, including an animation of tsunami.

Lori Dengler is an emeritus professor of geology at Cal Poly Humboldt, and an expert in tsunami and earthquake hazards. The opinions expressed are hers and not the Times--Standard's. All Not My Fault columns are archived online at <https://kamome.humboldt.edu/taxonomy/term/5> and may be reused for educational purposes. Leave a message at (707) 826-6019 or email Kamome@humboldt.edu for questions and comments about this column or to request copies of the preparedness magazine "Living on Shaky Ground."