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Not My Fault: What a month for tsunamis

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Sawyer Island looking towards the southeast. Landslide is around the corner at the top of the image about three miles away. Before the tsunami, much of the island was covered with trees and vegetation. Tsunami height is estimated from the trim lines and surviving vegetation. USGS reconnaissance photo taken three days after the tsunami.

Move over earthquakes, tsunamis have taken center stage. I will acknowledge the largest magnitude earthquake since 2011, but the Kamchatka M8.8 did little shaking damage and the tsunami was the bigger story. There have been three other tsunami events since July 16th, and the most recent produced surges of over 100-foot high. Earthquakes are certainly part of the story and triggered three of them. But gravity alone was the culprit for number four.

I've written about the Alaska and Kamchatka earthquake-caused tsunamis so let me introduce you to the intriguing number four. On Sunday August 10 at 5:26 AM ADT, seismographs operated by the Alaska Earthquake Center picked up unusual signals in SE Alaksa. The network was able to pinpoint their origin to Tracy Arm, a popular vacation fjord about 50 miles southeast of Juneau. The amplitude of the signals suggested energy equivalent to a M5.4 earthquake, but signals looked nothing like a typical seismic source – they started slowly, built up in size, and the high-frequency signal lasted nearly 2.5 minutes, much longer than that of 5.4 earthquake.

Seismologists at the Alaska Earthquake Center had seen similar traces before and immediately interpreted the signal as that of a large landslide in Tracy Arm, a narrow glacial fjord carved by the South Sawyer Glacier. Landslides trigger vibrations as the mass of material breaks away and rumbles down slope. If the slide is large enough, seismographs can record them.

Twenty minutes later, a group of kayakers camping at Harbor Island about 50 miles downstream of the landslide site was suddenly awakened by the roar of water even though they were camped in the woods far from the water. Much of their gear was swept into the water, one kayak had disappeared, and another was in a tree. They sent a distress signal via marine radio and were picked up by a nearby charter yacht. They estimated the water was 20 feet above the normal level.

The tsunami was recorded on one tide gauge. The Juneau instrument, 55 miles away as the crow flies but nearly 80 miles via the waterways, recorded a signal arriving at 6:21 AM and lasting nearly four hours. The peak amplitude was 14 inches above the expected tidal variation. Tsunamis always lose energy with distance from the source, but the twists and turns of the complex channels will further reduce the size.

Since these early reports, scientists have zeroed in on Tracy Arm, examining satellite imagery, aerial reconnaissance, water way observations, and sending a few intrepid climbers to the site. Tracy Arm is part of a labyrinth of fjords in Southeastern Alaska carved by glaciers and is one of the more accessible. It is part of the Tracy Arm-Fords Terror Wilderness, a popular day excursion from Juneau. I have friends who visited there several years ago and raved about the wildlife and glacial formations.

The National Park Service has jurisdiction in the area and sent observers that day. Their saw vegetation stripped from nearby slopes up to 100-ft elevation. Sawyer Island, only a few miles downstream of the landslide location had been stripped nearly bare by the water force, only a few trees at the top surviving. The slopes of Tracy Arm exhibited a neat trimline well above the normal high tide level.

Aerial reconnaissance the Coast Guard and USGS scientists over the next few days revealed more details of what had happened. Several thousand feet of the north wall of Tracy Arm adjacent to the terminus of South Sawyer Glacier had collapsed into the water. From the size of the failure and analysis of the seismic signal, the Alaska Earthquake Center estimated a volume of at least 100 million cubic meters. If you have a hard time visualizing, imagine a block of rock over a quarter mile on each side tumbling into the fjord. The debris completely blocked the channel in front of the glacier.

We were fortunate last Sunday. Had the slide occurred midday, a number of excursion boats would have been in Tracy Arm. The rapid water rise, turbulence, and debris from the tsunami would have made navigation very difficult. For smaller craft like kayaks, the result would likely be deadly. There is no warning system for landslides in this part of Alaska, and most boaters would not have heard or felt the landslide. Their first indication of something amiss would have been the roar of water followed almost immediately by the torrential flow.

It's still early days and the full story of what happened at Tracy Arm won't be known for weeks or months as onsite investigations and more detailed data analysis is completed. It's possible that peak tsunami elevations will end up higher, some unconfirmed reports already suggesting numbers in the hundreds of feet. The most reliable source for updates is the Alaska Earthquake Center https://earthquake.alaska.edu/event/025a7d7cil/detail.

What triggered the slide? Jackie Caplan-Auerbach a seismologist at Western Washington University noticed hundreds of small seismic events in the 18 hours prior to the main landslide. They are tiny – in the magnitude 1 to 2 range – but atypical of normal background levels and increased in number up to an hour before the slide. It's not unusual for landslides to begin creaking before they fail in masse, but I don't have the full story yet. I am looking forward to learning more.

The Tracy Arm event is not the first large landslide to occur in Alaska in recent years. In 2015, a massive slope failure in Taan Fjord near Yakutat, about 330 miles NW of Tracy Arm triggered a tsunami that reached a height of over 600 feet above the fjord, the fourth-highest tsunami ever recorded. Alaska holds the record for the three higher tsunamis – all related to landslides in fjords. Atop the leader board is 1958 when an earthquake-triggered landslide tumbled into Lituya Bay. The ensuing tsunami surges stripped old growth spruce trees over 1700 feet above the water level.

The warming climate and glacial retreat have created hundreds of similar exposed slopes in Alaska. At the height of the most recent glacial advance roughly 20,000 years ago, ice covered almost all of southern and southeastern Alaska, gouging channels on their advance to the sea. As temperatures increased, glacial ice melted, first disappearing from upper slopes and then slowly retreating up valley. That retreat has accelerated in the last fifty years. South Sawyer Glacier abutted the landslide slope forty years ago, providing a buttressing force against slide movement.

The USGS, Alaska Earthquake Center, and other agencies have established a landslide monitoring system in several areas of Alaska. In April 2024 I took a field trip to the Barry Arm monitoring site in Prince William Sound (see Not My Fault 5/4/24). The situation at Barry Arm is very similar to Tracy Arm where the Barry Glacier has only recently exposed the fjord walls. Slope failure in this area could have significant impact on the heavily used Prince William Sound region and to communities like Whittier on its shores. Seismographs and slope measuring instruments now dot the site hoping to provide alerts to boaters and populated areas before tsunami surges arrive.

The Tracy Arm failure will provide a wealth on information about landslide-generated tsunamis and is likely to expand landslide monitoring to Tracy Arm and other areas frequented by recreational and tourist boast traffic. But these systems are costly to install and maintain and, in a time of budget cutbacks, will be difficult to establish.

Learn more about the Tracy Arm and other recent tsunamis and earthquakes at the 2025 edition of the Redwood Coast Tsunami Work Group Earthquake – Tsunami booth on the west end of Hindley hall near the model train exhibit. Open this weekend from noon to 9 and resuming August 20 – 24.

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