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Not My Fault: Remembering the Indian Ocean tsunami twenty years later

Lori Dengler for the Times-Standard

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The Indian Ocean tsunami stripped vegetation along the northern Sumatra coast. This shows Lhoknga near Banda Aceh where peak water heights exceeded 100 feet (photo Jose Borrero).

I gave two papers at the fall meeting of the American Geophysical Union in December 2004. One was about tsunami hazards of San Francisco Bay and the other a poster on a new method of tsunami hazard mapping. There were roughly thirty people in the oral session, pretty typical for tsunami meetings at the time, most of them friends as well as colleagues.

The tsunami science world was small and mostly under the radar of mainstream media. There was plenty of interesting work being done including ground-breaking modeling techniques, revisiting older tsunami events, and new warning techniques, but the highest tsunami death toll of the previous five years was 54 and interest from the larger earth science community was tepid.

Few people came by to look at our poster, so I spent my time talking to Paula Dunbar whose poster was near ours. Paula was developing NOAA's Global Historical Tsunami Database and had worked for decades sorting through journals and reports of past tsunami events, assessing their validity, and displaying impacts in a way that anyone could access. She remarked how discouraging it was that there was so little interest. I said – just wait, as soon as there is a major tsunami somewhere in the world, people will drive you crazy clamoring for information.

Little did I know that major tsunami would occur less than two weeks later, on Boxing Day December 26th, and it would strike an ocean we usually didn't think much about when it comes to tsunami risk. Paula would revise the numbers she entered into her database numerous times over several years, ending up with a death toll of 227,899, making it the deadliest tsunami of all times, surpassing number two on the list by more than 120,000 souls.

I can recall exactly where I was and what I was doing when I learned of the Sumatra – Andaman Islands earthquake and the unfolding tsunami saga. For those of us east of the International Date Line, it was still Christmas Day, and I had avoided checking my computer most of the day. I snuck a peek just after 5 PM and saw the preliminary USGS magnitude posting of a magnitude 8 off the northwest coast of Sumatra, Indonesia.

Those of us who follow earthquakes are always nervous when a M8 pops up on the screen. It is much more difficult to accurately assess the true size of great earthquakes because of the very long duration of rupture and over the next hour my fears were realized as the initial magnitude numbers kept creeping up. When the first reports of a possible tsunami made the news, the magnitude had risen to an 8.8. It would end up a M9.1, rupturing more than 750 miles of the subduction zone megathrust from northern Sumatra to Myanmar, the longest fault rupture ever measured.

I watched the story unfold aghast in between assisting in Christmas dinner preparations. My entire geophysics career had taken place had taken place during a relatively quiet period of earthquake activity. Between 1946 and 1966, eight earthquakes of magnitude 8.5 and larger struck the planet, including the monster Chilean quake of May 1960 that at M9.5 remains the largest instrumentally recorded earthquake. After 1966, the mega-quake pipeline shut down for nearly 40 years, producing a number of earthquakes in the low magnitude 8 range but no monsters and no ocean-wide tsunamis.

Stuart Weinstein had a more stressful experience in 2004 than I did. He was the duty scientist at the Pacific Tsunami Warning Center (PTWC) in Hawaii that day. PTWC was responsible for supplying tsunami information to 26 countries in the Pacific in addition to alerting Hawaii and U.S. territories but had no arrangements with countries in the Indian Ocean. He watched as the feeds from one seismic station after another around the globe clipped (signal too large to stay on scale). He was quickly joined by a second scientist Barry Hirshorn and the two of them remained on duty throughout the night and into the next day.

It took less than 15 minutes for Stuart and Barry to locate the earthquake and recognize it had the potential to produce a major tsunami. But they had no ability to send alerts to any of the countries at risk. Tsunami warning systems involve much more than just detection – they also require an ability to receive the information and alert local populations. Stuart and Barry were frantically trying to find contacts in countries that might still have time to issue alerts before the tsunami hit.

Nearly seven hours after the earthquake, they were able to notify the Somalia government. A civil war raged at the time and the government had no ability to contact the coastal communities. If by chance they had gotten an alert out, it is doubtful that anyone would have

responded as tsunamis were essentially unknown. At least 142 people died in Somalia that day, and most estimates put the toll in the hundreds.

My colleague Jose Borrero would be among the first international team of scientists to visit Indonesia two weeks after the earthquake. I would join him and others on a longer reconnaissance in Indonesia three months later. It was a brutal trip in many ways. The civil war was still raging, no infrastructure remained in coastal communities, and navigational charts were useless due to the profound changes the earthquake had caused in coastline topography. In most of the places we studied, 80% or more of the population had perished.

There was one bright spot. Our last stop was Simeulue Island off the coast of Banda Aceh, Sumatra. It was the closest population center to the 2004 epicenter and the first tsunami surges arrived only eight minutes after the shaking began. We fully expected to see a worse story of devastation and loss of life as we had along the Sumatra coast. Much to our surprise, almost everyone on the Island had survived. Out of a population of over 75,000 only seven had died in the tsunami.

No one had died in Langi village where we visited. Off the grid with no governmental warning system, not a single man, woman, or child perished in Langi, even though their village was demolished by 45-foot tsunami waves. Everywhere we went we were followed by throngs of curious children and other villagers in stark contrast to the depopulated coastlines of Sumatra.

Why the difference? Simeulue Islanders have lived on the Island for over 5000 years undisturbed by outside invasions. They have intact cultural traditions and an oral history of past tsunamis. Whenever an earthquake of long duration occurs on the Island, they grab the children, put anyone not capable of walking into a cart and push them up the hill. Than they stay put for days.

Large earthquakes are common in Indonesia and trigger these self-evacuations every two to three years. The last time a large tsunami followed was in the early 1900s, five generations earlier. When I asked Langi villagers why they evacuated even when most of the time no tsunami followed, they looked at me as if I were crazy. Every earthquake is an opportunity to practice our evacuation skills was their response. On that late December day in 2004, that practice paid off.

Much has changed in the Indian Ocean since 2004. PTWC was given the temporary responsibility of issuing tsunami threat information until late 2006 when the Indian Ocean Tsunami Warning System, run by a consortium of Indian Ocean countries became operational. But seven deadly tsunamis have struck the Indian Ocean region since the Warning Center was inaugurated, five in Indonesia. The September 2018 earthquake and tsunami that struck Sulawesi claimed over 4300 lives.

Indonesia's tsunamis are almost all near-source, generated by earthquakes close to populated areas. Disseminating warnings with only minutes to tens of minutes of alerting time is difficult anywhere, but particularly in regions where communication infrastructure is limited. Much better to follow the example of the Simeulue Islanders and consider EVERY long-lasting earthquake a potential tsunami generator and IMMEDIATELY walk to higher ground.

Note: Paula Dunbar passed in 2020, and I lost a valued colleague and great friend. But anyone can access her life's work at https://www.ngdc.noaa.gov/hazard/tsu_db.shtml.

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