Times-Standard
Times-Standard / Humboldt Beacon

Not My Fault: A hidden earthquake and surprising tsunami in the Southern Atlantic Ocean

Lori Dengler/For the Times-Standard
Posted February 19, 2022
https://www.times-standard.com/2022/02/19/lori-dengler-hidden-earthquakes-surprising-tsunami-in-atlantic/

Last July and August was busy for earthquakes. A magnitude 8.2 earthquake occurred in Alaska on July 28th followed by vigorous sequence of earthquakes in the Southern Atlantic two weeks later. The Atlantic earthquake merited a brief mention in my column but was upstaged by a far more damaging M7.2 in Haiti two days later.

A paper published in the journal Geophysical Research Letters last week suggests I should have been paying closer attention. "The 2021 South Sandwich Island Mw 8.2 Earthquake: A Slow Event Sandwiched Between Regular Ruptures," by Caltech seismologists takes a closer look at the sequence and finds, that for some earthquakes, standard methods for identifying the potential tsunami hazard might not be adequate.

The two US tsunami warning centers are linked to a network of seismic stations from around the world. Whenever an earthquake occurs that may be large enough to pose a tsunami threat occurs, the centers go into action. For earthquakes centered in North America, Hawaii, or the Caribbean, they are usually able to estimate location and magnitude and issue an assessment within five minutes. For earthquakes in other parts of the globe, it takes about twice as long.

On August 12, 2021 at 11:32 AM our time, a large earthquake occurred in the South Sandwich Islands area of the Southern Atlantic. The tsunami warning centers detected the earthquake and issued a Tsunami Statement – a 7.5 earthquake had occurred, and it posed no tsunami threat because it was relatively deep (about 40 miles) and far from populated areas. Tsunami Statements are the most common product issued by the tsunami centers. They mean an earthquake has happened but is unlikely to produce a measurable tsunami.

I duly noted the 7.5 earthquake in my daily earthquake recording (707 826-6020) and that a small tsunami had been detected on tide gauges in the Philippines. The following day, the USGS revised their assessment. It had actually been a double earthquake and the 7.5 had been followed by an 8.1 roughly three minutes later. By this time, any tsunami threat was long over.

The February 8th paper and publication of the recorded tsunami heights from this event points out a weakness in our current tsunami detection system and warrants a fuller discussion. The Philippines was not the only place where a tsunami was recorded. Two days ago, the Pacific Tsunami Warning Center released a summary of the tsunami. It was recorded at more than 100 sites around the globe. It was the first truly global tsunami to be recorded in three oceans (Atlantic, Pacific, Indian) since the great Indian Ocean tsunami in December 2004.

The greatest water height (4.2 feet peak to trough) was recorded on the British territory of South St. George Island, about 500 miles from the earthquake epicenter. This tide gauge is in a protected inlet and is a poor representative of the tsunami size. A better sense of the size is the recording from the coast of South Africa 2700 miles away where the height was just over 4 feet. The site was over 2700 miles from the earthquake epicenter. And yes, it was recorded at Crescent City with a peak to trough height of 1.3 feet, the largest value recorded anywhere in the Pacific. Crescent City was nearly 9000 miles away from the epicenter.

The tsunami caused no damage, but the staff at the tsunami warning centers would be the first to tell you they should have had a better handle on it. Had the earthquake been given a magnitude 8.1 initially, a threat message would have been sent to countries in the S Atlantic and Indian Oceans, and they would have debated whether to issue an Advisory for our coast. Why was it missed?

Earthquakes can be sneaky, and like our December 20th quake, are difficult to get a quick handle on when close together. Time is of the essence for tsunami warning centers, and they don't have to luxury of days or weeks to analyze complex seismograms before making a call about issuing an alert. But how could a magnitude 8 earthquake be missed?

The Caltech seismologists describe the 8.1 as a slow or silent earthquake. It didn't produce the seismic wave amplitudes that we usually see with typical large earthquakes. Most earthquakes are the result of rock fractures that grow quickly. Rupture begins at a point on a fault beneath the surface and proceeds to grow at a rate of a few miles per second, just under the speed of sound in rock. That rapid fault propagation is like a sharp kick to the

earth, producing a suite of seismic waves that we can use to estimate magnitude.

But not all earthquakes work that way. Some ruptures occur more slowly and produce much weaker seismic signals in the frequency range we usually look for them. These earthquakes are often much shallower, where the rock strength is weaker, and it is easier to get large fault slip with much less of a jolt. But just because the seismic signals are smaller, doesn't mean there is no tsunami potential. These slower ruptures may be even more effective at producing large tsunamis than more conventional earthquakes of the same size.

We've known about these so-called tsunami earthquakes for decades. In September 1992 a M7.7 earthquake occurred just off the coast of Nicaragua. The earthquake shaking was so weak that many people didn't feel it. 116 people died in the ensuing tsunami. A 7.8 in October 2010 in Indonesia's Mentawai Islands had a similar impact. The shaking was much weaker than other recent quakes yet produced a larger tsunami and killed over 400.

The South Sandwich Islands earthquake was even more difficult to assess because it was buried in the signal of the M7.5 earthquake less than three minutes before. And to make matters more complicated, it was followed by a more normal tectonic rupture less than two minutes later. The largest earthquake was sandwiched between two events with typical seismic signals.

This wasn't a big problem for the extremely remote South Sandwich Island area, but the August 12 earthquake and tsunami raises concerns about areas much closer to populated areas. Fortunately, there are other ways to assess tsunami potential, but they do require more instrumentation in all the areas where large earthquakes could occur.

View an animation by scientists at NOAA's Center for Tsunami Research at
https://www.youtube.com/watch?v=PPylDTGuM0Y

Lori Dengler is an emeritus professor of geology at Cal Poly Humboldt (formerly Humboldt State University), 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/resources and may be reused for educational purposes. Leave a message at (707) 826-6019 or email rctwg@humboldt.edu for questions and comments about this column, or to request a free copy of the North Coast preparedness magazine "Living on Shaky Ground."