Times Standard

Not My Fault: The Best Kind of Major Earthquake

Lori Dengler for the Times-Standard

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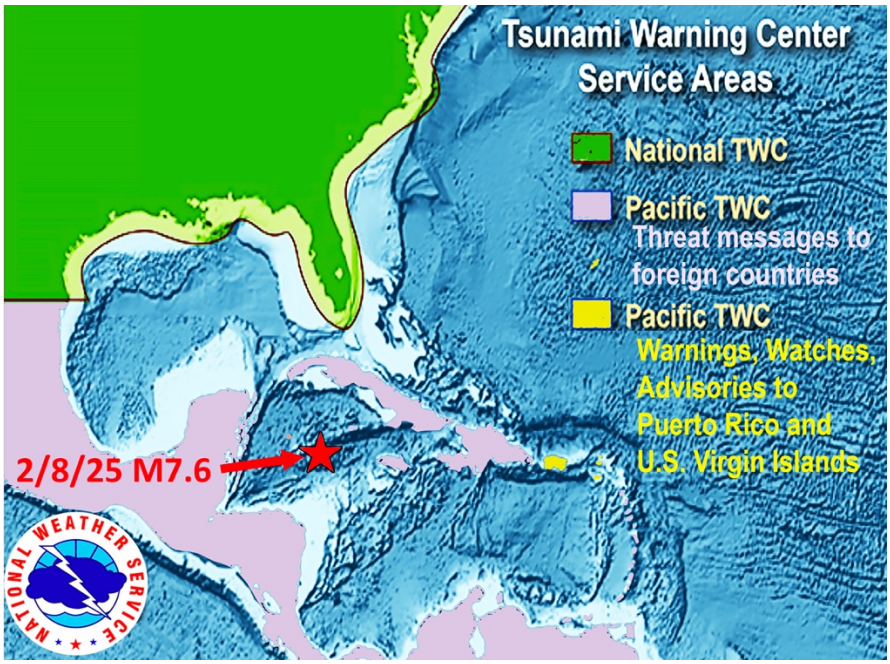

Location of the February 8 earthquake shown by red star. Colors delineate Areas of Responsibility for US tsunami warning centers. PTWC is responsible for issuing Threat messages to foreign countries (light purple). PTWC also issues Warnings, Watches, and Advisories to Puerto Rico and the US Virgin Islands (yellow). NTWC issues alerts to US States (green).

A week ago, a magnitude 7.6 earthquake struck the Caribbean Sea. It is the largest magnitude earthquake of 2025 to date. Over 44 million people live in the Caribbean region and population centers are vulnerable to strong shaking. The February 8 earthquake was located about as far from people as possible – 130 miles from the Cayman Islands, 175 miles from the east coast of Honduras, and 360 miles from Cancun on the coast of Mexico's Yucatan Peninsula.

There were no injuries and only minor damage. Why focus attention on such a "non-event"? Because this is an "easy lessons learned" temblor. It exercises our response systems with little pain and potentially much gain if we take the opportunity to learn from them.

Lesson one – not all big earthquakes occur in the Pacific. Of course, most of you know that – the Indian Ocean was the site of the third largest earthquake recorded in the instrumental era only a little over twenty years ago. But the Atlantic is usually not high on anyone's list of earthquake-prone regions. Compared to the Pacific, it produces far fewer large and deadly quakes but there are two offshoots of the Atlantic that are notable for both earthquakes and tsunami potential: the Scotia Sea in the southern Atlantic and the Caribbean.

The Scotia Sea is one of the most remote areas on the planet, wedged between the southern tip of South America and Antarctica. It owes its existence to relative movement between the Scotia plate, the south American plate and the Antarctic plate. Tectonically, it's a spectacular place producing large earthquakes – over 200 magnitude 6 and larger earthquakes since 1950, including a M8.1 in 2021. Nine volcanic centers have created small volcanic islands that make up the South Sandwich chain along its eastern edge. Five measurable tsunamis have been generated from this area in the past 25 years. It is unpopulated except for occasional research teams on South Georgia Island and poses little threat to people, although a larger quake could spawn a potentially damaging tsunami to populated areas further away.

The Caribbean Sea is nearly three times larger than the Scotia Sea but is remarkably similar in shape and characteristics. The basin is also the result of a smaller plate – the Caribbean – moving between two larger ones – the North American and South American. At least 21 potentially active volcanoes dot the Lesser Antilles along the eastern margin of the Caribbean and more than 220 earthquake of M≥6 have been recorded in the past 75 years.

The largest earthquake in instrumental times (magnitude 7.8) occurred in 1946 on the northern coast of the Dominican Republic, but there are accounts of earthquakes noted in written accounts dating back to the 16th century that may have been larger. Not only are these quakes capable of causing shaking damage, but they can also cause tsunamis. Eighty-two credible tsunami events are listed in NOAAs Global Tsunami Database, generated by regional sources. The 1867 earthquake in what is now the U.S. Virgin Islands produced a 50-foot surge on Saba Island just south of St. Thomas.

I've been paying attention to the Caribbean since 2010 and the disastrous M7.0 Haiti quake that killed roughly 160,000 people. The earthquake was the same magnitude as our December 5th Mendocino fault quake and was caused by the same type of fault movement, the difference in impacts due to exposed population and weak buildings.

Since 2010, over 30 earthquakes of magnitude 6 and larger have struck the Caribbean including a 7.2 in August 2021 on the same fault as the 2010 quake that killed another 2200 people. In 2020 a M7.7 earthquake struck just off the south coast of Cuba also causing some damage.

The February 8th earthquake was associated with the same plate boundary that caused the 2020 7.7 and last year's 6.8. It's the transform boundary the accommodates the horizontal motion between the North American and Caribbean plates. The long-term average slip between the two is roughly an inch per year. On February 8, a 40-mile-long section of that boundary slipped as much as 30 feet in the forty seconds it took for the fault to rupture.

The remote location meant severe ground shaking damage was unlikely, but earthquakes of this size are quite capable of producing large tsunamis and the first tsunami alert was issued for the region seven minutes after the earthquake. Over the next three and a half hours 11 bulletins would be issued by the two US tsunami warning centers including a Threat message, an Advisory, and a Statement of no hazard.

Lesson two – our tsunami warning system is too complicated. The Caribbean region includes 13 sovereign states, 12 dependencies, 7 overseas territories and is adjacent to another 10

countries in the Gulf and Atlantic. Countries in the area cooperate on tsunami preparedness and warning dissemination through the International Tsunami Information Center – Caribbean Office. The Pacific Tsunami Warning Center (PTWC) in Hawaii provides foreign countries tsunami potential assessments through an agreement with UNESCO. PTWC also provides guidance to all US territories including Puerto Rico and the Virgin Islands. The National Tsunami Warning Center (NTWC) in Alaska provides alerts to all US mainland states and Alaska.

I know of nothing comparable in complexity to the way we alert for tsunamis. Seven minutes after the earthquake PTWC sent a THREAT bulletin to foreign countries in the region. The US has no authority to issue warnings to foreign governments. The initial Threat message stated an earthquake with a preliminary magnitude of 8.0 had occurred, countries and territories in the region may be at risk, listed the estimated arrival time of the first surges at 55 locations, and stated only local governments can give advice on evacuations.

Nine minutes after the earthquake, NTWC issued a Statement that they were analyzing potential threat to the US states along the Gulf and east coasts. Thirteen minutes post-quake PTWC issued a TSUNAMI ADVISORY to Puerto Rico and the US Virgin Islands that a modest tsunami is possible, it could generate strong currents in ports and harbors but wave heights likely less than three feet, people should leave beaches and harbors, and that boaters should move their vessels offshore to a depth of at least 50 feet. The arrival of the first surges in Puerto Rico was forecast to be about two hours after the bulletin was sent.

A second set of bulletins were sent roughly thirty minutes later with the revised magnitude of 7.6. Threat message #2 to foreign countries reduced the area of potential tsunami waves to areas within the Caribbean and adjacent coasts. NTWC's second Statement reported NO TSUNAMI DANGER to all US Gulf and East Coast states. PTWC's message #2 to Puerto Rico and the Virgin Islands stated the Advisory was still in place. A half hour later, PTWC issued two more bulletins, continuing the Advisory for US territories and the Threat to foreign countries. Three more bulletins were issued by PTWC, cancelling the Puerto Rico/VI Advisory at 9:09 PM Atlantic Standard time, and the regional Threat to foreign countries at 10 PM.

Congratulations if you have stuck with me. It is confusing and, if you are a newly hired dispatcher or emergency responder, very hard to keep track of what information is for you and what it means. The good news is that only a modest tsunami was recorded, and the Caribbean tsunami system got a good test just like ours did last December. Both have shown there is room for improvement.

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. Call (707) 826-6020 for daily earthquake updates. 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."