

Not My Fault: A big earthquake in the Caribbean highlights confusion about the tsunami warning system

Lori Dengler/For the Times-Standard

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What is the most important way to tell that a tsunami is coming? Whatever warning you get first. The biggest tsunamis are caused by earthquakes nearby. You will feel the shaking before any official alert messages are issued. If you are near the coast or in a tsunami hazard zone, recognizing the shaking as a warning and heading to high ground may save your life.

Last Tuesday, a magnitude 7.7 earthquake struck the Caribbean. The earthquake was felt by many in the region and triggered a series of tsunami messages. There was confusion in the media as to what the messages meant. This is a good time to talk about the earthquake and what you should know about tsunami warnings.

The earthquake was located in the Cayman trough almost equidistant from Cuba and Jamaica. It was felt in Jamaica, Cuba, Haiti and the Cayman Islands. Some tall buildings swayed in Miami nearly 450 miles away and a few felt it on the Yucatan Peninsula, at a distance of 530 miles. Fortunately, the earthquake was too far from population centers to cause significant damage or injuries. Minor damage was reported on Grand Cayman, where the shaking caused cracks in roads and sewage mains to spill.

Large earthquakes cannot be adequately represented by a dot on a map. Epicenter maps only show where the rupture started. That representation works for smaller earthquakes where the fault length is small. Tuesday's quake ruptured a fault about 150 miles long and seismic waves are produced along the entire rupture area, not just from the spot where the rupture began. The epicenter was 160 miles to the east of Grand Cayman, but the rupture propagated to the west and ended up only 30 miles away, so it isn't surprising that some damage was observed on the island.

Earthquakes in the Caribbean are not unexpected. On January 7th, a magnitude 6.4 earthquake struck off of Puerto Rico's SW coast, causing over \$3 billion in damages to buildings and infrastructure and four deaths. Since 1900, nearly 100 earthquakes of magnitude 6 or larger have been reported in the Caribbean including three as

large as 7.7. That makes Tuesday's earthquake as large as any in the era of seismic instrumentation.

The Puerto Rico quake was over 750 miles away from Tuesday's earthquake and not directly related. But both are a result of the complex plate interactions in the region. In the Caribbean, a bit of the North American plate subducts beneath the Caribbean plate forming the Lesser Antilles and a volcanic arc that extends from Antigua to Grenada. The Caribbean plate is bounded by two nearly parallel transform faults trending roughly E-W. The southern transform parallels the north coast of South America and the northern transform slices along the north coast of Hispaniola, just south of Cuba, and heads west, cutting through Guatemala.

Tuesday's earthquake was within the northern transform section, where plate motions have created the Cayman trough, the deepest area in the Caribbean and one of the deepest parts of the Atlantic Ocean at a depth of more than 25,000 feet. It was a strike-slip earthquake, with the Cuba side of the fault moving west relative to the Jamaica side, like the way cars move on an American highway.

Whenever a large earthquake occurs beneath the sea floor, there is always a chance that a tsunami could follow. Had I been in Jamaica, Cuba or the Caymans, I would have felt the shaking and there would have been no question in my mind that the shaking was very long. It might not have felt very strong, but the length of shaking would have been a clear signal that a tsunami was possible and, if I were near the coast, this natural warning is my cue to head to higher ground, immediately.

Even if it was a tweener and I wasn't sure that it was really long enough to produce a tsunami, I would start my evacuation plans. Always better to go through the motions of evacuating and find out later that no big tsunami was produced than the opposite. As we say, when in doubt, drill it out. Consider it an opportunity to practice your evacuation skills.

But not everyone may have felt the shaking, and some tsunamis are capable of causing damage far from areas where the earthquake was felt. Nations in the Caribbean are part of the Caribbean Tsunami Warning Program and receive alert messages from the Pacific Tsunami Warning System (PTWC). The two US tsunami warning centers, PTWC and the National Tsunami Warning Center (NTWS), monitor seismic data and water level information 24-7. When an earthquake above a certain magnitude level occurs in the Pacific, NW Atlantic, Caribbean or Gulf of

Mexico occurs, they analyze the signals and assess the potential hazard.

Here's where things become confusing. These centers are a part of NOAA and US entities have no authority to issue tsunami warnings to foreign countries. For foreign countries, PTWC can only issue a threat message. Although warning/threat may sound similar, the two terms mean different things. PTWC has an agreement with nations in the Pacific and Caribbean through UNESCO's International Oceanographic Commission to provide information on potential threats after larger earthquakes occur. It is up to the countries to decide whether or not to issue a WARNING based on this information and other data they may have. On Tuesday, the threat message stated a small tsunami up to three feet high might occur at coastal areas with 190 miles of the epicenter.

PTWC issued an initial message four minutes after the earthquake. Updates were issued about every half hour until the final message cancelling the threat came out about an hour and a half later. Again the media got this wrong too - BBC saying PTWC had "withdrawn the warning". Cancellation is a normal part of the messaging process and whenever a threat message (or a warning if the alert is for US states/territories) is issued, it will always eventually be cancelled when the data from tide gauges shows the threat has substantially passed. Cancellation does not necessarily mean it is safe to return to coastal areas. That decision can only be made by local authorities.

A five-inch tsunami was observed on Grand Cayman. There was never any tsunami threat to US coastlines. All ended up ok on Thursday. But the next big quake, whether in the Caribbean, California or elsewhere in the world might not be as benign. Please remember that feeling the shaking IS THE WARNING, and take actions as if your life depended on it because it just may.

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