

Not My Fault: A new deadliest earthquake of the year and the North Coast

Lori Dengler/For the Times-Standard
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A magnitude 7.5 earthquake occurred Friday on the Indonesian island of Sulawesi and, sadly, it is now the deadliest tremor of the year. It's still early and the final toll is yet to be known. As I write, the Indonesian government estimates 1,347 deaths, 800 injuries and nearly 50,000 people displaced by damage. The numbers will likely climb higher as search teams reach more remote areas and debris is removed.

This earthquake is not just a tragedy in a remote area that has no bearing on us. The information that is beginning to emerge shows this to be a very interesting event that has profound implications for California and any area that has major faults near the coast.

A note of caution. To repeat, it is still early and information is preliminary. Scientific reconnaissance teams are just beginning to arrive in the affected area and it will be weeks before a definitive picture emerges. Some media reports have included misleading or erroneous information. I will attempt to sort out what we know and what is still uncertain.

Earthquakes are no surprise in Indonesia, the country that tops the globe with the number of large earthquakes year in and year out. Why so many earthquakes? Complex plate interactions. To the south of Indonesia the large Australian plate is slowly grinding its way north. To the north, the even larger Eurasian plate acts as a giant buttress. In between is a much smaller plate or group of subplates, called the Sunda plate, including much of Indonesia and Southeast Asia. The Sunda plate is figuratively between a rock and a hard place with an incredibly complex web of plate boundaries and internal faults as it responds to both external and internal stresses.

The deadly Lombok earthquakes of July and August were on upper plate faults associated with subduction of the Australian plate beneath the Sunda plate near Bali and Lombok islands. The magnitude 9.1 Sumatra-Andaman earthquake in 2004 ruptured the plate boundary between the Australian and Sunda plates from Northern Sumatra

for over 900 miles reaching almost as far north as Myanmar. And Friday's earthquake was on a large strike-slip fault that forms the boundary between two subplates within the Sunda plate.

It's easy to see the extent of the fault that ruptured by going to the USGS Latest Earthquakes page at <https://earthquake.usgs.gov/earthquakes/map/>. Pull down the settings menu and select 7days, magnitude 4.5+. Zoom into Indonesia, and you will see a string of earthquakes lined up along a 130 miles long zone. It was a shallow earthquake, only about 7 miles deep and, according to the USGS, more than a million people experienced very strong shaking.

An earthquake rupture of this size will produce a number of effects. Impacts are exacerbated in low-lying areas close to bays and the ocean by liquefaction, saturated sediments acting like a fluid while the ground is shaking. Several amateur videos show buildings that appear to collapse as the ground fails beneath them. There have also been reports of landslides. Some parts of Sulawesi are steep and entire neighborhoods may have been buried. I haven't seen any reports yet of surface fault rupture – when the fault makes it all the way to the ground surface, displacing roads, buildings and anything else that happens to be atop of it. Most faults stop a few miles beneath the ground surface, but large shallow quakes like this one could well be an exception.

All of these shaking impacts can damage buildings, especially those that haven't been designed to resist strong side-to-side motion. There have reports of partial and total building collapses including a hotel, homes, roads and bridges and other structures. Contrary to some media headlines, the majority of deaths and injuries were most likely caused by shaking. There are things communities can do to avoid these types of losses. Insist on strict building codes and zone areas where liquefaction and landslides are likely.

Shaking wasn't the only thing that happened on September 29th. A tsunami struck Palu, a city of 335,000, shortly after the earthquake. Video footage shows dramatic scenes of surges inundating coastal homes and structures. But there is a lot we don't know. While media stories estimate water heights of 12 to 20 feet high, scientific teams have yet to conduct the careful surveys needed to nail down its size and inland extent and I won't believe these numbers until the experts file their reports. The pattern and extent of water heights can constrain the likely source.

It is unusual for strike-slip earthquakes, where the ground moves horizontally, to produce a significant tsunami. Unusual, but not impossible. We know this earthquake produced strong shaking and landslides. It is possible that submarine slides were triggered offshore. Or faulting may have been more complex than it appears right now with a step-over or currently unknown offshore splay with some vertical motion as part of the mix. I am remaining cautious before jumping to any conclusions.

The good news is that you don't need to know anything about the faulting in order to protect yourself when you feel an earthquake near the coast. Tsunamis are tricky. Coastal residents in Sulawesi did get a warning – the natural warning of the ground shaking. My advice – as soon as the ground shaking abates enough for you to safely move, head to higher ground or inland away from the coast and stay there. And by staying there, I mean hours. Don't get fooled by the water appearing to calm down because another set of larger waves could still be on the way.

I expect this won't be the last you will hear from me about this earthquake. I am staying in contact with colleagues who will be working in the area and am looking forward to what they learn. I am fortunate in having many colleagues and one of them is very nearby. Jason Patton, an adjunct professor at HSU who has been a leader in the information-gathering efforts. You can read his reports at <http://temblor.net>. Just scroll down to the recent news section.

Preparedness tip of the week: California's ShakeOut drill is right around the corner. At 10:18 am on October 18th I urge everyone to practice a Drop, Cover, and Hold On drill where you work, live, go to school or play. If you live in a tsunami zone, consider practicing your evacuation route after the shaking. Register your intent to participate at <https://www.shakeout.org>. Encourage your work place, church or other organization to register as well. More about ShakeOut next week.

Lori Dengler, PhD is an emeritus professor of geology at Humboldt State University, and an expert in tsunami and earthquake hazards. Questions or comments about this column, or want a free copy of the preparedness magazine "Living on Shaky Ground"? Leave a message at (707) 826-6019 or email Kamome@humboldt.edu

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