

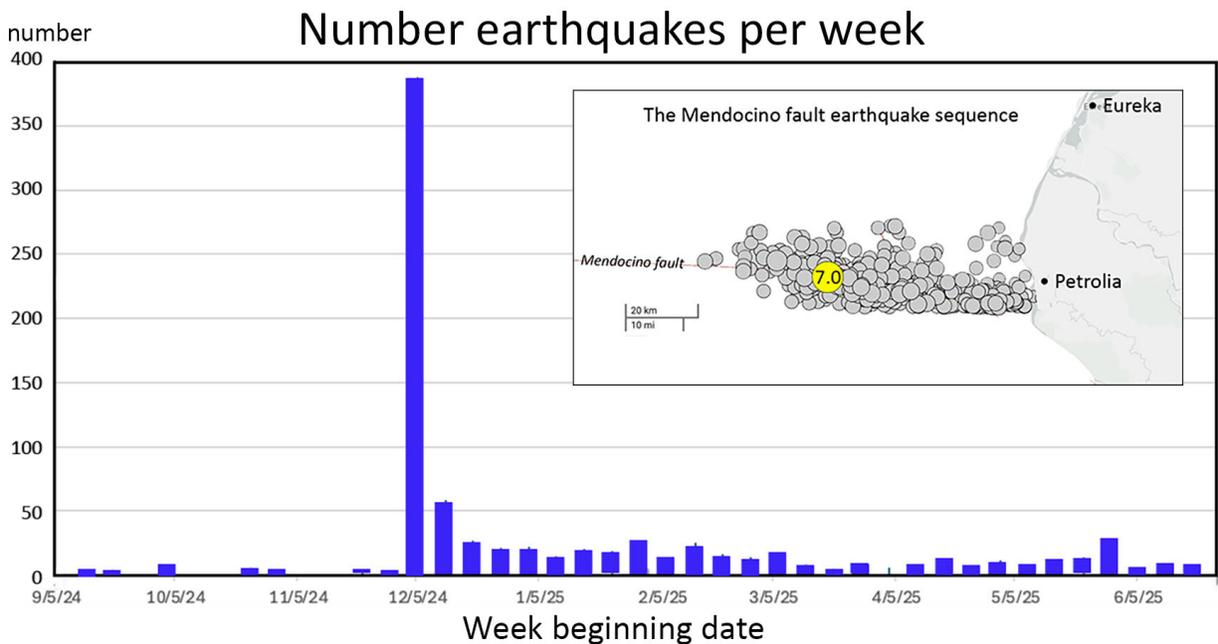
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Not My Fault: Earthquake report on the first half of 2025

Lori Dengler for the Times-Standard

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Number of earthquakes per week before and after the Dec. 5, 2024, M7 Mendocino fault earthquake, Inset shows the USGS epicenter map with the mainshock location highlighted. The graph depicts weekly totals, data to the left of Dec. 5 is typical of normal background levels (roughly three per week). Over 840 aftershocks have been recorded since Dec. 5, almost half occurring in the first week (USGS data).

2025 at the halfway point has provided earthquakes in the usual places, a few surprises, and one catastrophic seismic event. 2025's deadliest earthquake occurred on March 28, centered near Mandalay, the second most populated city in Myanmar (Burma). Nearly 5500 deaths were reported, 5342 in Myanmar, 103 in neighboring Thailand and one in Vietnam. Over 11,000 people were reported injured.

When I wrote about this earthquake (Not My Fault 4/5/2025) the death toll stood at just under 5000 and I expected the number to rise sharply. The USGS PAGER loss estimation based on population density and types of construction gave a 78% likelihood that deaths would exceed 10,000 and a 44% chance the number could hit 100,000. This disparity in these estimates and the reported toll reflect the fact that Myanmar is a closed country and actual data is hard to come by. Without the observations on the ground by outside observers, the true impact is hard to determine.

Three months out from the Myanmar quake, we know a lot about the tectonics and fault that caused the earthquake. A special session at this year's annual meeting of the Seismological Society of America included presentations and posters from international scientists and dozens of papers have been published in professional journals. But there have been no detailed site investigations by international scientists and impact studies have had to rely primarily on remote data.

The Myanmar civil war still rages on, access is firmly controlled by the military junta, and numerous reports of aid being confiscated and redirected has been reported. China has been the largest aid donor to date, deploying search and rescue teams and over \$150 million (US\$) pledged to long term recovery. The axing of USAID and termination of employees in the region meant little of the \$9 million in US proposed aid has reached people in need.

Information from government and rebel sources are wildly disparate. The earthquake occurred during Friday prayer when Muslims gather for communal prayer and many mosques collapsed. The Junta reported 500 Muslim deaths while the Democratic Voice of Burma put the number in the thousands. There are similar differences in Buddhist reporting groups.

Ceasefires were declared in the immediate aftermath of the earthquake, but all were broken or ceased by the end of April. Conflict continued unabated in areas unaffected by the earthquake and has now resumed throughout the country. The Irawaddy, a news website published by Burmese exiles, reports that Chinese relief groups have aided the Junta in taking back some rebel-held areas.

Earthquakes and other disasters can sometimes create unity among warring factions and lead to resolution. Four months after the Indian Ocean tsunami, rebel groups in the Aceh area of northern Sumatra reached an agreement with the Indonesian government to unify and rebuild the area after nearly 30 years of insurgency. Unfortunately, a different path was taken in Sri Lanka where the civil war between Tamils and the government continued for four more bloody years until government forces launched a final military offensive in 2009. Myanmar appears to be following the Sri Lankan model.

Other than Myanmar, it's been a relatively benign six months for earthquakes. Twelve other quakes caused at least one fatality, but only the January 7 M7.1 in Tibet killed more than a few people. Tibet also poses problems with clarity of information. China controls access by outsiders to Tibet. The death toll in the January earthquake is disputed. The official government tally is 126, a local Tibetan group put the number at 265 and Radio Free Asia estimates 400 people perished. When politics and disaster mix, it's hard to get a clear answer.

It's been a relatively quiet seismic half-year in the US. The largest earthquake so far was a M6.2 in Alaska's Andreanof Islands that was felt lightly by the few people living on Adak but otherwise unnoted. In the lower 48, California's North Coast did not claim the largest quake for a change. The nod goes to west Texas with a magnitude 5.4 on May 3, widely felt in west and central Texas and southeastern New Mexico.

The west Texas 5.4 is another reminder of what happens when drilling waste fluids are injected into deep wells in regions with existing faults. The injected fluids increase the subsurface pore pressures and make it easier for faults to slip. The number and size of Texas quakes increased

dramatically around 2010 when well injection became the common disposal method. This year, Texas was the only state other than Alaska to claim two quakes in the magnitude 5 range- a 5.0 occurred in the same area as the 5.4 in February.

A M5.2 was felt by many in southern San Diego county on April 14th, raising more media concerns of an overdue SoCal quake (Not My Fault 4/19/25). The Northridge earthquake in 1994 was the last major earthquake to strike the southern part of the State and last year's uptick in the number of magnitude 4 earthquakes gained a number of headlines. But this year's tally of earthquakes in the region doesn't indicate anything unusual – yet.

Closer to home, aftershocks of the December 5, 2024, M7.0 continue. We are a seismically active place so how can I tell the difference between “normal” background activity and an aftershock? It's all in the statistics and the trends. The December 5 quake ruptured a 45-mile-long section of the Mendocino fault. Before the earthquake, this part of the fault would average three quakes a week. These earthquakes were mainly small (in the M2 – 3 range) and not felt.

Plotting the number of earthquakes per week since the M7 shows a sharp increase. In the first week, nearly 400 quakes were recorded on this same segment of the fault. The following week over 50 were reported. The weekly numbers have declined since then but still remain higher than the pre-quake background level. In June, we averaged about 7 per week, twice as high as before the M7 occurred. It's not a smooth decline – we've had spurts of activity in May and a 4.6 aftershock on May 26th that was felt as far away as Piercy and Trinidad.

The USGS calculates aftershock probabilities after any US quake of M5 or larger. Aftershocks in the M3 range are nearly a certainty, there's a 24% chance of more M4s, and a 3% chance of an aftershock as large as magnitude 5. When will it be over? My guess is at least for the rest of 2025 and perhaps into 2026. Of course, there are plenty of other North Coast faults that could produce an even larger earthquake, completely unrelated to the current sequence and start a whole new set of aftershocks.

I'll sum up with an earthquake that didn't happen and indication of one possibly to come. I wrote about the Mediterranean Sea north of Crete (Not My Fault 2/8/2025). The University of Athens recorded over 1,200 earthquakes between January 25, and February 7th, the largest a 5.2. The earthquakes prompted evacuations on nearby islands and concerns of a larger earthquake or volcanic eruption. Emile Hooft of the University of Oregon has been studying the Santorini volcanic system and argues that the earthquakes were caused by horizontal movement of magma and not directly associated with volcanoes in the area and don't pose an immediate eruption threat (https://phys.org/news/2025-06-santorini-earthquakes-sideways-magma-movement.html#google_vignette). The area is currently quiet.

Another earthquake swarm is occurring right now in Japan's Ryukyu Island chain south of Kyushu. The USGS reports 75 earthquakes of magnitude 4 or larger since June 21, the largest a 5.6 four days ago. Swarms like this have occurred in the area before and haven't led to larger quakes or big eruptions. But fluids are definitely involved, and I'll be watching this spot closely to see what happens next.

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. 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."