

Not My Fault: The great state of Alaska wins the quake game once again

Lori Dengler/For the Times-Standard

Posted: January 16, 2019

And the envelope please. Drum roll. The winner for the US state with largest earthquake of 2018 is ALASKA! It claimed the runner-up as well. The winner for the state with the largest number of earthquakes is ALASKA! The winner for the state with the most damaging earthquake of the year is ALASKA!

For the first two categories, this comes as no surprise. The state always has the most earthquakes and for the last 19 years, has been the magnitude champ. Alaska has only lost the largest title eight times in the past fifty years. In 1980, 84, 91, 94 and 95 California's North Coast took the prize, Southern California won twice and Idaho's Borah Peak earthquake was the largest back in 1983. It's no stretch to say Alaska is the odds on favorite to win again this year.

The reason is simple – more than 70% of the world's earthquakes and 90% of the seismic energy release occurs along subduction zones. The United States has only two subduction zones to claim (excluding US territories in the Pacific) and the Alaska-Aleutian zone is four times longer and much more active than the Cascadia subduction zone.

So the big 2018 Alaska quakes were all on the subduction zone, right? As in most things seismic, the answer is a little more complicated. The largest US earthquake of 2018 was the M7.9 Gulf of Alaska on January 23. At first glance it looks to be on the subduction zone, but a closer look shows it to be nearly 60 miles from the trench. That would be ok if it was on the down-dip side of the subduction zone.

Subduction zones are like giant ramps where a large slab (plate) of the earth's outer surface is pulled by gravity beneath another slab. Earthquakes mark the descent, and in some cases reach depths of over 400 miles, and appear on an epicenter map to be hundreds of miles from the trench, the spot where the plate first starts its descent. The January 23rd earthquake was on the wrong side of the trench, before the plate begins its deep dive. It was also the wrong kind of earthquake. Most large earthquakes on the interface between the plates are

thrust events, reflecting the compressive forces driving subduction. The Gulf of Alaska quake was strike-slip, with the two sides of the fault moving horizontally.

Earthquakes don't read the plate tectonics rulebook and the January 23rd earthquake was just doing what all earthquakes do – responding to the regional stresses of our dynamic planet. Subduction is a complex process and forces act on the plate as it begins to bend many tens of miles before the plate descends. This was the likely genesis of the M7.9. The good news is that the earthquake was too far from populated areas to cause significant shaking damage and the strike-slip faulting meant no significant tsunami in this case.

The November 30th M7.0 Anchorage earthquake the second largest US quake of the year and also unusual. It was nearly ten miles beneath the subduction zone interface and was caused by normal faulting in response to extensional stresses, the opposite of what would be expected along the plate boundary. Like the Gulf of Alaska earthquake, this earthquake illustrates the complexity of subduction zones. Once the slab begins to descend, stress is not just concentrated at the plate boundary interface. For a locked subduction zone like Alaska, gravity continues to pull creating down-slab tension. The November 30th earthquake may have gotten an additional boost in tension from bending because the plate begins to descend more steeply.

Most large Alaska earthquakes are located in the remote Aleutian Islands with sparse populations and little impacts on human society. The Anchorage earthquake was centered only 9 miles north of the city center and exposed about 270,000 people to very strong ground shaking. At least 750 buildings were significantly damaged and loss estimates exceed \$30 million and was declared a federal emergency. The good news is that there were no deaths or serious injuries. Both stricter earthquake building codes put into place after the 1964 M9.2 earthquake and preparedness outreach efforts like ShakeOut have been cited as reasons for the limited impacts.

All earthquakes have lessons. We live atop the Cascadia subduction zone and similar forces are in place here and in other subduction zones. Most of us are aware of the potential for major earthquakes along the subduction zone interface but we could also be affected by the more unusual tremors experienced by Alaska last year. The North Coast experienced a M5.4 earthquake near Willow Creek in 2008 and a M5.6 near Weitchpec in 2013 that were within the subducted slab and caused by extensional

stress like the Anchorage earthquake. It is certainly possible that these forces could generate earthquakes of magnitude 6 or larger.

The other lesson is that building codes and preparedness/awareness works. This earthquake was a direct hit on Anchorage; although minor damage was common, no buildings collapsed and there were no major injuries (<https://www.pbs.org/newshour/nation/strict-building-codes-helped-anchorage-withstand-quake>).

Anecdotal evidence on social media suggests that preparedness drills like ShakeOut do work. Many people were spreading the Drop, Cover, Hold On message. But there is plenty more to do. Nonstructural damage like furniture toppling over and items flying off shelves was widespread and the cause of most injuries. Something for us in the seismic capital of the lower 48 to work on as well!

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

<https://www.times-standard.com/2019/01/16/lori-dengler-the-great-state-of-alaska-wins-the-quake-game-once-again/>