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Not My Fault: The elusiveness of finding earthquake patterns

Lori Dengler/For the Times-Standard
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Earthquakes are clumpy. There are weeks when numerous quakes are in the news and other periods when not much seems to be happening. We've been in a little clump the last two weeks – a magnitude 7 in southern Alaska on November 30th, a M7.5 in the New Caledonia region of the Southwestern Pacific (Dec. 4th) and a M7.1 in the Southern Atlantic Ocean on Tuesday.

In a typical year, there are 16 earthquakes of magnitude 7 or larger. The number varies considerably – there were six in 1986 and in 1995, the number reached 25. To date in 2018, we've had 14 M7s and one 8, which puts us on track for an "average" year. They haven't occurred evenly. There were five in the first seven weeks of the year, none for the next six months, a M8 and three 7s in August, two in September, one in October and then the recent clump starting at the end of November.

Earthquakes are clumpy on a longer scale as well. There have only been five really large earthquakes (M9 or bigger) since the beginning of the 20th century - three between 1952 and 1964 and two since 2004. Since there are so few 9s, it's worth going down half a magnitude scale to M 8.5 and larger earthquakes. There are 16 of those. In the first 50 years of the twentieth century, there were four, seven in the next 15 years, none between 1966 and 2003, and five in the eight-year window between 2004 and 2012.

Wait you might say. There weren't many seismographs back in the early twentieth century and they were far more primitive than today's instruments. Might we have missed some? Yes we probably missed many earthquakes of M5 or less, and maybe some 6s. But an 8.5 releases the energy equivalent to about a 100 megatons of TNT, twice the size of the largest nuclear device ever tested, and is not something that could be hidden from even a primitive seismograph.

A few years ago when I was teaching Earthquake Country at HSU, I calculated the seismic energy released per decade starting in 1946. That gave me seven ten-year sets for students to compare. The average was about 1200 megatons of TNT. The decades between 1966 and 1995 were low - each at about 20% of the average. The largest release was 1956-1965 when the release was nearly 3.5 times more than the average. It's pretty safe to say the patchy occurrence of big earthquakes is real on a variety of scales.

It is basic human nature to look for patterns. Science depends on linking effects to causes and observing patterns of outcomes. To develop valid models for big earthquakes, lots of data is needed – where, when and the size of earthquakes over a long period of time. Predicting earthquakes, and particularly large earthquakes, eludes modeling in part because our data window is much shorter than their typical recurrence.

The only earthquake pattern that is somewhat predictable is aftershocks. Large quakes are followed by smaller ones. There are three active aftershock sequences in Alaska at the moment. No surprise that the Anchorage area is still experiencing felt earthquakes. Since the November 30th M 7, over 300 aftershocks have been large enough to be felt (M3 or larger), including 34 in the magnitude 4 or larger range. But aftershocks are also still being recorded following the August 12 M 6.3 on Alaska's North Slope, and in the Gulf of Alaska from the January 23 M7.9 earthquake. When I say aftershocks are "somewhat" predictable, we know they will occur, but duration and strength of aftershocks is variable. The general pattern is larger earthquakes produce more, larger and longer aftershock sequences. But like all things seismic, there is considerable variation. The North Slope aftershocks appear to be more numerous than most M 6 earthquakes.

Speaking of aftershocks, the king of current sequences is beneath the sea floor off the NE coast of Japan's main Island of Honshu. These are aftershocks of the March 11, 2011 M 9.1, still occurring more than seven years after the main earthquake. In the past year, perhaps 50 likely aftershocks were recorded. How is it possible to attribute these to aftershocks and not call them earthquakes in their own right? Statistics. Japan is a seismically active area and earthquakes happen there all the time. In the years before the 2011 earthquake, between 20 and 40 earthquakes in the M 4.5 or larger range occurred each year. This number soared after the March earthquake, with over 2100 in the rest of the year. The following year was 373, and then 166. The number has continued to decrease with 99 last year and 76 to date so far in 2018, still over twice the long-term average.

Where are we in the current earthquake "clump"? I have no idea. We could have a quiet end of the year with a handful of 6s, but there is a small but real chance of a

Mother Nature surprise like in 2004 with a 9.1 in the last week of the year. The only thing I am pretty sure of, is that the pattern won't be clear until after it happens.

Preparedness tip: over the holiday season, you may be traveling and/or have out of town visitors. It's important to remember that Nature doesn't take vacations and earthquakes or other emergencies are often more challenging in unfamiliar surroundings. No matter when you travel, familiarize yourself with the local hazards. Check weather forecasts, and be sure to know how to get to high ground if you are staying near the coast. Take your guests to your favorite local beaches, but please give them a briefing on sneaker waves and always keep an eye on the surf.

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

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