

## **Not My Fault: Terra not so firma: A 2018 midterm report**

Lori Dengler/For the Times-Standard  
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Halfway through 2018 and time for a report on terra firma and what's been shaking so far this year. The good news is that it's been relatively quiet, both locally and globally.

The global average for a six-month period is just under 80 magnitude 6 or larger earthquakes and this year's 44 is the lowest total in the past 18 years. No magnitude 8 or larger quakes so far and only five in the M7 range. The largest quake of the year was the M7.9 on January 23 located in the Gulf of Alaska. It was too far from population centers to cause damage, but felt as far away as Vancouver, nearly 1200 miles away.

Alaska aftershocks continue to the present. Since the main earthquake, over 2100 aftershocks of M3 or larger have been recorded. How can an aftershock be distinguished from a new earthquake? It's not difficult in the case of the January 23 earthquake. There were no earthquakes in this area beforehand. The 7.9 earthquake hits and boom, the area lights up with earthquake activity - over 1000 smaller quakes the first week. The next week, just under 300. The week after, about 200. The most recent aftershock was yesterday and we are now down to 10 - 16 per week.

The deadliest quake was a M7.5 on February 26, located in the Southern Highlands of Papua New Guinea. The death toll in the main earthquake was 160. Like the Alaska earthquake and all large temblors, it also produced aftershocks. Unlike Alaska, these aftershocks affected populated areas and caused additional damage and at least 40 additional casualties. Twelve other earthquakes caused deaths in 2018 but the tolls were all much smaller and the 261 total earthquake casualties this year is still well below the long-term average.

What about the U.S.? Outside of Alaska, Hawaii (more below) has experienced extraordinary earthquake activity, but the contiguous 48 states have been relatively quiet. Twenty-nine earthquakes of magnitude 4 or larger have been reported so far, below the 35 to 40 six-month average of the past three decades. The largest was the January 25 M 5.8 on the Mendocino fault 100 miles west of Cape Mendocino, too far offshore to cause any damage.

Earthquake activity naturally fluctuates and six months is too short a window to be given much significance. Most earthquakes are caused by natural tectonic forces that we have no control over. But past decade has seen a sharp and unprecedented rise in human-caused earthquakes in Oklahoma (and to a lesser degree Texas and Kansas), related to the injection of drilling and fracking waste fluids into deep wells. It reached a high in 2015 with 33 Midwestern M4s. Oklahoma adopted regulations limiting the volume and rate of injected fluids in 2016, and it appears to have had an effect. Only eight M4 earthquakes have been detected so far this year - still well above the pre-injection era, but a significant decline from a few years ago. There may be a new injection hotspot however. Central Nebraska reported 15 earthquakes of magnitude 2 or larger since April, including an M4.1 and nine M3s. How unusual is this? In the past decade only ten quakes in this size range had been detected. All of the recent activity has been centered close to waste-fluid injection wells.

Hawaii is the most interesting U.S. earthquake story of 2018. Hawaii seismicity begs the question, what is an earthquake? If you do a search on the USGS web site (info on how to do this below), you will come up with a whopping 74 M4 and larger events, including 35 of over M5. Looking at the USGS epicenter map more closely, notice that most epicenters are denoted by circles, but near the Kilauea summit, there are a number of diamonds. Diamonds mean explosions and all but one of the M5 and larger events fit into this category. The USGS uses diamonds for any type of explosion - from quarry blasts to underground nuclear tests. Explosions produce seismic waves just like rupture along a fault and people on the island of Hawaii have been feeling the near-daily vibrations from collapse-induced explosions at Kilauea for the past five weeks. But explosions are not earthquakes and appear differently on seismograms. They are rich in compressional waves and weak in the stronger side-to-side transverse waves that cause most damage in earthquakes.

Hawaii has had plenty of real earthquakes as well. The M 6.9 on May 4 was the result of slip on a fault and was followed by aftershocks. Prior to the current eruptive phase that began in early May, about ten small quakes were detected daily near Kilauea. Since mid June, that number has been between 500 and 800. The spike is caused by deformation and stress related to the movement of magma. Earthquake shaking has damaged structures near the summit and shows no sign of slowing down.

Six months is a very short window to describe earthquake behavior and it takes less than a minute for the story to change. Just because it's been a relatively seismically quiet year so far, don't assume it will stay that way. The next six months could continue the quiet trend, be much more active or somewhere in between. My prediction – there will be surprises and the best way to counteract any unpleasant ones is to take action to prepare now.

Note: How to search the USGS earthquake catalog. Go to <https://earthquake.usgs.gov/earthquakes/map/> and select Search Earthquake Catalog under the tool icon in the upper right corner. Choose the magnitude and date range and select the geographic region. You can display the results in map format or as a downloadable spreadsheet (select CSV under output options).

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