

Not My Fault: 2021 quakes in the lower forty-eight

Lori Dengler/For the Times-Standard

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A year is an artificial time unit when talking about earthquakes. Many of the earthquakes of last year are part of sequences that began earlier, and we are already seeing 2022 activity with roots in 2021. With that in mind, here is a quick overview.

Today's focus is the contiguous 48 states and adjacent territorial waters. The USGS lists 890 earthquakes of magnitude 3 and larger, the magnitude level at which they were likely to be felt if people lived nearby. Ninety-two were in the M4 range, nine M5s and two M6s.

Many of you felt the largest earthquake of the year on December 20th in the Mendocino triple junction region just west of Petrolia. The M6.2 was reported felt by over 4300 people. It is not unusual for the North Coast to feature the largest temblor of the year. Since 1990, the North Coast region has earned that title 16 times, the only area of the US mainland to claim it in double digits.

The 6.2 sequence is not yet over. Since December 20th, 200 smaller earthquakes have been recorded in the triple junction region both on and offshore of Cape Mendocino. A widely felt M4.6 aftershock occurred on January 5th, the second largest to date. Aftershocks could continue for weeks or months and there is still a small but real chance of a M5 or another 6 coming out of this sequence.

The second largest 2021 quake was midway between Lake Tahoe and Mono Lake. The July 8th M6.0 Antelope Valley earthquake made a much bigger impression than our North Coast 6.2. Over 25,000 people filed reports on the USGS Did You Feel It web site from as far away as San Diego, Portland, and Salt Lake City.

The Antelope Valley earthquake has roots in 2019. It is part of the elevated activity in the Eastern California shear zone that began in 2019 with the M7.1 Ridgecrest earthquake and continued in May 2020 with a M6.5 in Western Nevada (Monte Cristo) and 5.8 near Lone Pine the following month. Aftershock activity continued in 2021 in both the Ridgecrest and Monte Cristo region. A 4.8 aftershock on

January 4th near Mina, Nevada signaled that the Monte Cristo sequence is still far from over.

The good news about these earthquakes is that they caused no major damage. A wall collapsed in the unreinforced brick Loleta Creamery building on December 20th and both the North Coast and Antelope Valley earthquakes triggered landslides, damaged ceilings, and knocked items from shelves but no injuries were reported from either one.

California was the top 2021 earthquake producer, with 389 M≥3 earthquakes reported. This is about the same as 2020, but far below the over 1200 in 2019. The 2019 spike reflects Ridgecrest and its vigorous aftershock sequence. In the decade prior to 2019, the State averaged roughly 200 M3s a year. The continued seismic activity in the eastern part of the State is keeping our numbers elevated.

Texas took over the number two spot with 196 M≥3 earthquakes in 2021. This is more than double the 88 in 2020 and far above the 1-2 earthquake average in the decades before 2010. I wrote about the increases in Texas and Kansas seismicity three weeks ago, but until I tallied the annual totals, hadn't realized how significant a jump it was. These earthquakes are likely caused by the injection of waste fluids from drilling operations into deep wells.

Texas has recognized its induced seismicity problem for over a decade. A cluster of earthquakes in the Dallas – Fort Worth area between 2012 and 2015 led to regulations regarding waste injection in that area. Last year's activity is concentrated West Texas, where nearly 75% of the State's activity was concentrated along a 50-mile-long zone just south of the New Mexico border. Not only has the number increased, but the magnitude as well. In 2021 13 earthquakes made it into the M4 range, some strong enough to be felt in El Paso and SE New Mexico.

Nevada at 69 and Idaho (67) were nearly tied for third. In both cases, the seismicity is related to the ongoing of aftershock sequences of their respective magnitude 6.5 earthquakes in 2020. Aftershock activity has slowed this year - Nevada held the top spot in mainland quakes in 2020 with 545 M3s and Idaho had nearly 300.

There were no big surprises in US activity. For the sixth straight year, seismicity in Oklahoma has declined. From 2014 to 2016 Oklahoma was the shakiest spot in the lower forty-eight with a peak of 863 M≥3 earthquakes in 2015. Like Texas, this seismicity is related to waste fluid injection. Regulations on injection rates and volumes imposed in 2015 and a reduction in Oklahoma oil production since

2019 are likely both responsible for only 26 induced earthquakes last year, the lowest annual number since the era of waste fluid injection began.

One of the most vigorous sequences of the year didn't make it into my contiguous-48 category. Between November 19 and December 14, 160 earthquake of 3 or larger were recorded on the Blanco fault 220 to 300 miles west of the Oregon coast which puts them outside of the US territorial limit. The sequence produced 18 earthquakes in the magnitude 5 range and two that reached 5.8. But even these largest quakes were only lightly felt on the coast because of the great distance. Oregon did claim the #5 spot with all but four of its 36 quakes on the part of the Blanco fault within 200 miles of the coast.

What does all of this bode for 2022? Aftershock sequences will continue, there will be surprises, and we are one year closer to the next significantly damaging US quake.

Note: almost all of this information can be gleaned from the USGS <https://earthquake.usgs.gov> – interpretations and errors are my own.

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