

Not My Fault: Are earthquakes increasing? It depends on your perspective

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Posted September 24, 2022

<https://www.times-standard.com/2022/09/24/lori-dengler-are-earthquakes-increasing-depends-on-definitions/>

The Facebook post pronounced, “Earthquakes are increasing, the Big One is coming, get yourself prepared.” A few felt or damaging earthquakes often trigger posts like this. There is both truth and misconception in the statement.

Are earthquakes increasing? That depends on your definition. If you were in Berkeley two weeks ago, you may have felt earthquakes on September 11 and 15. These earthquakes were M2.9 and fall into the USGS “small” category. But more than 5000 people posted USGS Did You Feel It reports for the first and 1043 were filed for the second, even though it occurred in the wee hours of the morning. If you live in Berkeley or Oakland, you probably hadn’t felt a sharp local quake in more than three years. Feeling two little jolts only a few days apart would certainly seem like an increase.

There was nothing unusual or ominous about those two small Berkeley quakes. They were both within the Hayward fault zone, an area that has produced 14 other earthquakes since 2000 reported felt by at least 4000 people. The Hayward fault is worthy of concern. The southern portion ruptured in October 1868 producing a 20-mile-long zone of surface faulting. From the fault length and felt/damage areas, the magnitude was likely between a 6.3 and 6.7.

But there is nothing in the recent pattern of Bay Area seismicity or measured strain rates that suggests the two small September earthquakes bode something much bigger in the next few weeks or months. We can make rough estimates of areas more likely to have a strong earthquake in the near future than others. The Hayward fault is high on this list. But in more than a century of looking, we still have no reliable way of predicting quakes based on precursors or anomalous behavior.

The Bay area isn’t the only place in the US where recent earthquakes have been felt. Eleven quakes in the coterminous 48 states and Hawaii have collected at least

100 Did You Feel It reports this month. But that isn’t at all unusual. Roughly 10 quakes a month will pick up that many reports.

Another reason for increased concern is damaging quakes in the news. The two largest magnitude earthquakes of 2022 occurred this month: a 7.6 in Papua New Guinea on the 10th and a 7.6 on the 19th in Mexico. Three quakes this month were deadly. The death toll from the September 5 M6.6 in Sichuan, China has reached 93 and the Michoacán 7.6 and 6.8 aftershock claimed five lives.

A better way to approach the question of earthquake increase is to look at a longer time window. How different is this year than activity over the last half century? It’s easy to find claims that earthquake numbers increased in the 20th century. At first glance, USGS data seems to support this claim. In 1985, the total number of earthquakes reported was about 13,000 and in 2005, it had more than doubled up to 30,000.

Convinced? I hope you are asking what this number means. The USGS estimates that more than one million earthquake occur every year far more than the number reported. That’s because most earthquake are small and are undetected. Some places, like the Geysers Geothermal Area, routinely detect the tiniest of earthquakes. But most places don’t have the density or quality of instruments to note these magnitude 1 and smaller earthquakes.

Global seismic detection has improved in the past fifty years and so we see more smaller quakes in the catalog. But the network in the 60s was good enough to record the bigger quakes and restricting the analysis to M6 and larger is a better way to approach the increase question. There is variability but no trend. Many statisticians have looked at earthquake activity and, except for aftershock projections, no one has found a way to forecast earthquake activity.

Annual activity is an arbitrary way to look at earthquakes. Let’s take a longer window. Rather than use number of earthquakes, let’s use energy. Each time you go up one unit in magnitude, the corresponding energy release is about 32 times greater. That means neglecting a few magnitude 5s and even 6s won’t make much of a dent in energy release. It’s the upper 7s, 8s and 9s that are important.

When I was teaching, I took the Gutenberg Richter equation between energy and magnitude to make a rough back-of-the-envelope estimate of how much energy was release per decade. ’56 to ’65 won hands down, releasing more than three times as much energy as second place

1996 – 2005. This didn't surprise me as the 1956 to 1965 window included the two largest earthquakes (M9.5 Chile and M9.2 Alaska) in the instrumental age.

The years between 1967 and 2003 were especially quiet – the largest earthquake anywhere in the world during that 36-year stretch was an 8.4. Decades are still very short time spans compared to earthquake activity and if we had really good data spanning millennia, something might pop out. But for now, we are left with my eloquent assessment that earthquakes are clumpy. We may have decades of more active seismicity and then quieter ones.

There is no correlation between energy and death tolls. Using the same decade brackets for energy, '56 – 65 comes out with the fewest deaths and 2006 – 2015, the most. Fortunately, the planet's largest quakes – in the upper 8 to 9 range – are restricted to subduction zones, most of which are remote relative to human populations.

Circling back to the second part of the Facebook post – the Big One is coming. First, what do you mean by "Big One?" Let's not define it by magnitude. Only one of the top 20 quakes in magnitude makes it only the top ten in death toll. For me, "Big One" is any earthquake that takes a significant toll in human lives. This earthquake is coming but we can't say when.

I heartily agree with the last part of the statement: get yourself prepared. Kudos to the 70 emergency professionals who spent two days last week at the Blue Lake Rancheria's TsunamiCon – discussing plans to respond to a Cascadia earthquake and tsunami.

Register yourself, family, workplace or other organization to participate in ShakeOut. At 10:20 AM on October 20th, please join me in practicing DROP, COVER, and HOLD ON. We've made it easy on our newly revamped ShakeOut webpage <https://rctwg.humboldt.edu/great-shakeout>.

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/resources> and may be reused for educational purposes. Leave a message at (707) 826-6019 or email rctwg@humboldt.edu for questions and comments about this column, or to request a free copy of the North Coast preparedness magazine "Living on Shaky Ground."