Mapping 100 Years of Earthquakes, in 3-D

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Linda Poon, The Atlantic, 10-15-15

Since 1900, there have been more than 10,000 "strong" earthquakes—with magnitudes of 6 or greater—around the world, according to the U.S. Geological Survey. But what exactly does that *look* like?

Richie Carmichael, a software developer at Esri, a company that provides geographic information system (GIS) software, has created a visualization of all that seismic activity: an interactive 3-D globe. Using data from USGS and Wikipedia, Carmichael plotted where and how large earthquakes were in any given year between 1900 and 2015.

"A 3-D display is uniquely suited to representing global phenomena," says Carmichael in an email. "Print and digital 2D maps are often truncated on or near the poles and close the international date line. With a globe it is possible to view quakes in the polar regions and pacific without page breaks."

Users can rotate the virtual globe to see a specific area, and filter the data by the largest or deadliest earthquakes, as well as by the cause of the quakes—like those brought on by nuclear activity.

In the chart below the globe, the clustering of dots—each dot representing one event—seems to suggest that earthquakes are becoming more frequent. Indeed, a recent study by USGS researchers found that there were more than twice as many "large" earthquakes (defined here as magnitudes 7 or above) in the first quarter of 2014 than there were back in 1979. The planet saw a record number of earthquakes last April, with 13 quakes with magnitudes of 6.5.

"We have recently experienced a period that has had one of the highest rates of great earthquakes ever recorded," according to Tom Parsons, a research geophysicist at USGS.

But this doesn't mean "The Big One" is coming. Most researchers agree that the frequency spike is most likely random. Plus, this isn't the first time we've seen an uptick in quakes: between 1950 and 1965, the earth shook more than usual, too. As the USGS explains, "A temporary increase or decrease in seismicity is part of the normal fluctuation of earthquake rates. Neither an increase or decrease worldwide is a positive indication that a large earthquake is imminent." In fact, Parson's study shows that since 1979, the average rate of major earthquakes has been roughly 10 a year.

What has increased, however, is the quality of surveillance. The USGS has more than 2,000 seismic sensors—many of which are in the U.S—and the agency plans to eventually establish a network of more than 7,000 sensors in the U.S. alone. That will allow for denser coverage in at-risk urban areas. To better track quakes outside of the U.S. border, the agency has tapped into the power of Twitter, monitoring tweets to detect quakes in as little as 29 seconds after an event.

As detection has become more advanced, so has earthquake-resistant technology. Recently, a San Francisco hospital became the first U.S. building to use a thick goo that can absorb 80 to 90 percent of an earthquake's energy. And in India, civil engineers are testing the use of old crushed tires to strengthen the base of buildings to reduce vibration. Their test has shown that when the rubber is mixed with sand, it's possible to improve seismic resistance by as much as 50 percent.

This is a good thing, since Bill McGuire, a professor at the geophysical and climate hazards at University College London, suggests that the ever-changing climate could very will shake up the Earth more in the future. As temperatures rise rise—along with sea levels—more stress will be put on the crust of the Earth:

GPS measurements reveal that the crust beneath the Greenland ice sheet is already rebounding in response to rapid melting, providing the potential—according to researchers—for future earthquakes, as faults beneath the ice are relieved of their confining load. The possibility exists that these could trigger submarine landslides spawning tsunamis capable of threatening North Atlantic coastlines. Eastern Iceland is bouncing back too as its Vatnajökull ice cap fades away. When and if it vanishes entirely, new research predicts a lively response from the volcanoes currently residing beneath. A dramatic elevation in landslide activity would be inevitable in the Andes, Himalayas, European Alps and elsewhere, as the ice and permafrost that sustains many mountain faces melts and thaws.

"The bottom line is that through our climate-changing activities we are loading the dice in favour of escalating geological havoc at a time when we can most do without it," he concludes. We best speed up those tests on infrastructure that can resist quake damage—especially in cities.