Worldwide Surge in 'Great' Earthquakes Seen in Past 10 Years

Linda Carroll, NBC News, 10-25-14

The annual number of “great” earthquakes nearly tripled over the last decade, providing a reminder to Americans that unruptured faults like those in the northwest United States might be due for a Big One.

Between 2004 and 2014, 18 earthquakes with magnitudes of 8.0 or more rattled subduction zones around the globe. That's an increase of 265 percent over the average rate of the previous century, which saw 71 great quakes, according to a report to the annual meeting of the Geological Society of America this week in Vancouver, British Columbia.

It’s clear that recent "great" earthquakes "triggered" related major quakes, says study author Thorne Lay, distinguished professor of earth and planetary sciences at the University of California, Santa Cruz.

“If we look at all earthquake magnitudes, the past 10 years is not unusual in terms of the rate of events; the rate increases are just seen for events with magnitudes larger than 7.5 or so," he said. "This suggests that great events were ‘catching up’ on the plate boundary motions in several regions with fortuitous similar timing.”

And by fortuitous, Lay means that he thinks it’s just coincidence that all those big earthquakes happened over the last 10 years.

Related quakes strike along same faults

So Lay isn’t suggesting that an earthquake in Japan or Sumatra is going to trigger a big one in the Cascadia subduction zone, the line along the coasts of Washington, Oregon and northernmost California where the oceanic plates dive under the continental plate.

But, he says, a big earthquake at one end of a subduction zone might trigger others further down along the same fault. “This happened in Sumatra, where the great 2004 event activated the adjacent 2005 event, and those two activated a slightly more distant 2007 event,” he said.

So what does that mean for the Cascadia subduction zone?

“The offshore fault appears to be fully locked up by friction, with strain building up until the next large earthquake rupture releases it,” Lay says.

But nobody can predict exactly when that might happen, or what it will be like.

“The last 10 years have been interesting for seismologists because we have learned that great subduction zone earthquakes occur in many different ways and there do not seem to be any simple rules to predict the kind of behavior to expect,” says Peter Shearer, a professor of geophysics at the Institute of Geophysics and Planetary Physics at the Scripps Institution of Oceanography at the University of California, San Diego. “Thus we can’t reliably assess at this point whether the Cascadia subduction zone will eventually break mostly in a single giant earthquake or a series of large earthquakes.”

He said more study of past Cascadia quakes and those elsewhere, along with analysis of the recent crop of great quakes, might lead to better predictions.

One of the researchers scoping out Cascadia’s history of ancient earthquakes is Benjamin Horton, a professor in the department of marine and coastal science at Rutgers University.

Horton has trenched and cored in the muds along the coasts of British Columbia and the northwest United States looking for evidence of earthquakes big enough to trigger massive tsunamis. And he’s found evidence of 12 major earthquakes over a 6,000-year period, an average recurrence interval of 500 years. But that’s just an average, he says, adding that the time between big quakes could be anywhere from 350 to 1,000 years.

“Cascadia is a really interesting story because there are no written records of a large earthquake there,” Horton says. “The last time it ruptured was January 26, 1700 A.D., over 300 years ago. The European colonizers hadn’t reached the West Coast yet. We know about it because of the tsunami that resulted from it hit Japan, where historical records of samurai talk about an orphan tsunami, which means a tsunami without a parent earthquake.”

Those records helped scientists figure out that the 1700 earthquake was a whopper.

“It was somewhere between 8.9 and 9.2” and may have ruptured along a 600-mile span of the western U.S. and Canada, Horton says. “It’s very analogous to the Sumatra event of 2004.”

And that fits right in with magnitudes seen in subduction zone earthquakes.

“The size of earthquakes is related to the surface area of the fault that slips,” Shearer said. “The San Andreas Fault and other transform, or strike-slip, faults are very long but not very wide as they cut vertically through the earth’s brittle upper crust. In contrast, subduction zone faults are both long and wide as they cut at a very shallow angle through the crust. Thus the surface area for the fault slip can be much larger for subduction zone earthquakes than for transform faults and the corresponding magnitudes for subduction zone earthquakes can be much greater. The largest transform fault earthquakes are about magnitude 8.5, whereas subduction zone [earthquakes] can be as large as magnitude 9.5.”

Horton and his team look for signs of a big tsunami in the layers of shoreline mud and at the bottom of the deep sea. “Within the muds we find sand layers deposited by the tsunamis. And in

the submarine canyons you also find evidence. Ground shaking causes movement of sediments from the continental shelf out to the deep sea bottom.”

Because of the wide range in recurrence intervals it’s impossible to determine how worried we should be, Horton says. “It’s not like you can say they occur every 500 years so the next one won’t be till 2200 and we don’t need to worry,” he adds. “The average interval is every 500 years, but it can be much smaller.”