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Not My Fault: 2018 earthquake summary: what makes a quake deadly?

Lori Dengler/For the Times-Standard
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What a difference six months can make. Back in June, global earthquake activity and casualties had been well below average and there were no tsunamis of note. A single earthquake in August more than doubled the seismic energy output of the preceding seven months and an earthquake and tsunami in Indonesia made this the deadliest for earthquakes in the past three years.

The largest earthquake was the August 19th magnitude 8.2 near the Fiji islands. It's not surprising to have an earthquake of this size. The USGS collects statistics on the number and frequency of different sized earthquakes and most years will have one earthquake in the magnitude 8 range, but this earthquake was a bit unusual. It was very deep, centered 370 miles beneath the surface. That's about as far as the distance between Eureka and the mouth of the Columbia River – only straight down.

Deep earthquakes are an enigma. Seismologists divide earthquakes into three depth categories. The overwhelming majority (83%) are shallow, less than 70 km (43 miles). Another 13% are intermediate (70 – 300 km; 43 – 186 miles), leaving just under 4% in the truly deep category, at depths of greater than 186 miles. The deepest earthquake recorded was near Vanuatu in the SW Pacific at a whopping 457 miles beneath the surface.

Temperatures increase with depth on the planet and in most places, heat makes earth materials too plastic to rupture at depths below 40 miles. All deep earthquakes are associated with subduction zones, where an oceanic plate is pulled by gravity beneath another plate. And of the nearly two-dozen subduction zones on the planet, only a handful (Peru/Chile, Tonga, Kuril, Indonesia, Philippines), produce earthquakes as deep as the August 19th tremor. The mechanism is a topic of debate among seismologists. All proposed models involve interactions of the material within the subducted slab and the complex thermal, stress and chemical regime at depth that allow sudden slip to still occur at these amazing depths.

While many deep earthquakes fill the magnitude 6 and 7 ranges, the August 19th earthquake is only the third M8 in instrumental history. The largest was a M8.3 in the Sea of Okhotsk in 2013. This year's deep tremor is now tied for second with the similar-sized 1994 Bolivia earthquake. The good news about deep earthquakes is that don't cause damage. Even places atop the epicenter are still hundreds of miles away from the earthquake focus. They are, however, often felt more widely. The 1994 Bolivia earthquake was felt in Toronto, Canada, more than 4000 miles away. They also pose no tsunami threat, as the fault deformation never reaches the sea floor.

The Fiji earthquake did release a lot of energy, equivalent to about 30,000 kilotons of TNT, accounting for 40% of the total earthquake energy release in 2018. And it was not the only large deep earthquake in 2018. A magnitude 7.9 occurred 18 days later in the same area and immediately took 4th place on the large deep quake list. These earthquakes, along with a second 7.9 (Gulf of Alaska 1/23) released two thirds of all the seismic energy of 2018.

While the big quakes carry the energy load, the 2018 big three did not kill a single person or cause a single injury. The two near Fiji were too deep and the Gulf of Alaska earthquake was too far from populated areas to cause damage. It was left to the next tier of earthquakes to cause the most human impacts. The worst was the M7.5 on the Indonesian island of Sulawesi on September 28 that killed an estimated 2,256 people.

The Palu earthquake, named after the nearby city of 335,000 people, contained all the elements that make an earthquake a catastrophe. The earthquake was shallow, only 12 miles deep. Nearly a million people lived close enough to the epicenter to experience very strong shaking. Many buildings in the region weren't built to withstand strong shaking. The regional geology was unstable and susceptible to liquefaction and landsliding. And the earthquake produced a tsunami that hit populated areas in as little as 3 minutes after the earthquake.

Just like energy, only a few earthquakes accounted for the lions' share of the 3,155 casualties in 2018. The Palu quake accounted for 71% of the earthquake deaths. Add in the second deadliest of the year, the M6.9 Lombok, Indonesia quake on August 5th (513 deaths), and 87% of seismic deaths are accounted for. This year's casualty numbers were the largest in the past three years, close to the long-term median annual number of 3,670.

Not all the damaging quakes of 2018 were large. Two small quakes triggered deadly mine collapses. A M4.1

killed 5 miners in Poland in June and a tiny M2.2 triggered a South African mine collapse that reportedly killed 7. A M4.6 in central Java, Indonesia destroyed 300 homes and killed 7 and a M4.9 in Colombia killed 2. The only reason such small tremors become deadly is because of construction methods and failure to enforce earthquake-resilient building regulations.

Preparedness tip for the New Year: Document your home/residence. Use your phone or a camera to take photos of the outside and the interior. Store in the Cloud and on a thumb drive, or make prints and store with your out-of-the-area contact. This has two benefits – first the information to help you document potential damage and losses if an earthquake, fire or other event strikes and second, it will provide you a good stack of info for photo albums on what you were up to in 2019.

Next week – tsunamis and other disasters of 2018

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