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Not My Fault: Alaska does it again

Lori Dengler/For the Times-Standard
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On Monday a major earthquake occurred south of the Alaska Peninsula. The magnitude 7.6 earthquake is currently the third largest earthquake to occur in 2020. The good news about this earthquake is that impacts were minimal. But all large earthquakes have lessons to teach and this one was no exception.

At first glance, the earthquake was no surprise. It was located south of the Alaska Peninsula, 60 miles SE of Sand Point, and only 52 miles SW of the largest (to date) earthquake of 2020, the July 22 M7.8. The July 22nd earthquake has produced 20 aftershocks of magnitude 5 and larger before last week, including two 6.1s. Technically the 7.6 is another aftershock – it's located within the aftershock zone and it's clearly related to stress changes from the 7.8.

But the 7.6 differs from most aftershocks in several ways. It's nearly as large as the main earthquake. The seismology rule of thumb is that the largest aftershock is about one magnitude unit less than the main earthquake. It was on a different fault with different fault slip than the fault that produced the 7.8. And it's been nearly three months since the 7.8 and the largest aftershocks most often occur within the first few weeks.

Rules of thumb don't carry a lot of weight in seismology. It's not uncommon for several earthquakes of near similar size to occur in a short span of time and on different but related faults. In 1992, we experienced a 7.2, 6.5 and 6.6 within an 18-hour period, all on different faults. Watching the earthquake activity in the Western US this year illustrates that months can occur between significant earthquakes that are likely regionally related. But I must admit, Monday's earthquake was a real surprise to me.

The USGS rapidly analyzes all significant earthquakes and usually produces a location, origin time, magnitude and likely fault motion within 15 to 20 minutes of occurrence. In another half hour, a model of the likely faulting is produced and an estimate of shaking strength and impacts. It's impressive how much detailed information is available so quickly. Back in 1992, it took hours just to get a magnitude for the 7.2.

Seismologists describe faulting by a focal mechanism. Informally, we call them beach balls as they look a little like a four-color beach ball with dark areas representing areas around the earthquake source where the rock compressed and light areas where they stretched. It doesn't take long to recognize the three main types of faults from the focal mechanism and Monday's 7.6 showed the classic four-quadrant pattern of a strike slip earthquake. USGS seismologists create models of possible fault slip and fault orientations and see how well the models match observed seismic records. In this case, the best fit was a strike-slip fault oriented NNW.

The surprise is that NNW was perpendicular to the Alaska-Aleutian subduction zone. The July 22nd earthquake was on a thrust fault that looks to coincide with the main subduction interface. It's what I would expect a well-behaved upper M7 or M8 to look like. What was a big strike-slip event doing here going against the grain so to speak? It's another lesson that subduction zones aren't simple. There is evidence of an offset in seismicity trends right about where the 7.6 was centered, a great tear in the subduction zone plane. The 7.8 added stress to it and the 7.6 released it.

Like July 22, the M7.6 triggered a tsunami warning. An initial bulletin was issued by the National Tsunami Warning Center (NTWC) five minutes after the earthquake, putting the Alaska Peninsula, eastern Aleutians and Cook Inlet into Warning status. The tsunami threat to the US and Canadian West Coasts was under analysis. It took them nearly two hours to declare that the tsunami was unlikely to affect us.

I assumed that any tsunami produced would be smaller than last July's. The larger the magnitude, the bigger the tsunami (usually), and thrust earthquakes are much more likely produce measureable tsunamis than strike-slip ones. Thrusting produces vertical seafloor deformation and strike-slip motion is mainly horizontal. The obvious conclusion is that the 7.6 tsunami should be much smaller than that produced by the larger quake.

My conclusion was wrong. The July M7.8 produced a nine-inch high tsunami at Sand Point. It wasn't observed on any other coastal tide gauge. Monday's 7.6 reached 2.3 feet at Sand Point and was recorded on 13 other tide gauges in Alaska, Hawaii and at Crescent City where it reached eight inches. I wasn't the only one who was surprised. The scientists at the Pacific Tsunami Warning Center issued an initial bulletin stating the earthquake posed no tsunami threat to Hawaii. Five hours and forty minutes later, they changed the status to an Advisory

after surges were already being recorded at Hawaiian tide gauges.

I don't have an answer as to why this week's tsunami was so much larger. The good thing is that it didn't cause damage and once again provides fodder for research and a better understanding of tsunami generation. But it also provides a much-needed opportunity to assess the warning system and make sure it works better when the next damaging tsunami heads our way.

Monday's earthquake illustrates why tsunamis from Alaska are my least favorite far field events. It only takes four to five hours to reach us and, if there is no operating deep sea sensor near the source, it is hard for the tsunami warning centers to make a definitive call. By the time NTWC made the call on Monday, we would have had less than three hours to coordinate an evacuation had it been necessary.

It also underlined my major pet peeve with the US tsunami warning system – two Centers and five different types of bulletins. Each bulletin is addressed to different operational areas but it's hard for most people to sort through why one states a Warning is in place and another states No Threat. We can do better.

Lori Dengler is an emeritus professor of geology at Humboldt State University, an expert in tsunami and earthquake hazards. All Not My Fault columns are archived at https://www2.humboldt.edu/kamome/resources and may be reused for educational purposes. Leave a message at (707) 826-6019 or email Kamome@humboldt.edu for questions/comments about this column, or to request a free copy of the North Coast preparedness magazine "Living on Shaky Ground."

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