## Times Standard

## Not My Fault: When disasters arrive at the same time

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Coldest temperatures in twenty years and unseasonable snowfall at the time of the October 2016 M6.6 earthquake in Italy hampered response and recovery (Italian fire department drone footage).

Friday morning a magnitude 4.9 earthquake occurred on the Mendocino fault about 54 miles west of Cape Mendocino. There was nothing unusual about the size or location – the Mendocino fault is one of the most active in the State and at least one magnitude 5 or larger earthquake occurs every year and quakes as large as 7 every few decades.

Friday's quake was too far from populated areas to cause damage and far too small to pose a tsunami threat. It was felt from Mendocino County to Crescent City and inland by some in Red Bluff and Chico. But it made me ponder the question of more than one type of disaster occurring at the same time, what I call a double whammy.

January was a very wet month. The Eureka National Weather Service Office recorded 11.85 inches at Woodley Island, 178% of normal for the month. January 2024 comes in at number 15 for wet Januarys since the NWS started recording data in 1886. The ground is incapable of holding any more water and hillslopes are saturated. Had Friday's quake been in the 7 range, we might have experienced a double whammy.

Double disasters have also been on my mind because of a meeting I attended last week. The USGS has hosted a Northern California Hazards Workshop since 1996. It's an opportunity for researchers to catch up on current studies and lessons from both recent and older earthquakes. It had been a small in-person affair held in the SF Bay Area until COVID struck in 2020 but then it went virtual, allowing a much larger number of participants and folks like me to participate.

I don't generally care for virtual meetings – stuck in a zoom room where interaction is mainly via chat. But Sarah Minson the USGS meeting coordinator and her team do a remarkable job keeping discussions going and coming up with provocative topics. This year's meeting featured many sessions that would only be of interest to those pretty deep in the weeds of seismology, but there were several that could intrigue a much broader audience.

On the top of my list was "Earthquakes and Climate Change," an examination of how climate change may exacerbate earthquake impacts. Does climate change make an earthquake more likely; can earthquakes trigger more secondary calamities like fires and landslides in a warming world and are the odds of a double whammy such as a flood and quake occurring at the same time increased?

There is no evidence that climate change impacts the rate and magnitude of earthquakes, but secondary effects such as tsunami, landslides, and fires could be more hazardous. I've been in on discussions of tsunami vulnerability and sea level rise for a number of years. Even relatively small increases in water level can expose more areas to inundation and erosion and change flow behavior.

The earthquake community has been well aware that ambient conditions such as how dry or wet the ground is can make a difference in the likelihood of earthquake-triggered liquefaction, fires, and slope failures and hamper response and recovery. Great earthquake-triggered conflagrations such as 1906 San Francisco and 1923 Tokyo were featured in my introductory seismology classes more than a half century ago. Closer to home, the greatest property loss in the 1992 Cape Mendocino earthquake sequence was the Scotia fire triggered by the midnight aftershock.

We know that climate change has increased the likelihood and size of wildfires. It doesn't take much imagination to conclude that the potential for earthquakes to trigger large fires is increased with a drier, hotter atmosphere. On the opposite side of the volatile climate change-induced weather swings are the occasional much wetter winters. Saturated ground is more likely to liquefy, and wet hillslopes fail in strong shaking.

The talk in the session that really grabbed my interest was about increasing the likelihood of two (or more) major disasters independently occurring at the same time. Daniel Swain a climate scientist from UCLA spoke about 'hydroclimate whiplash' and how our warming world makes it more likely a great flood, storm, or fire could happen at the same time.

A warming atmosphere increases the ability of the air to hold water. Swain used the example of a sponge. Warmer air means the sponge is bigger – it can soak up more water and release more when squeezed. In warm conditions, this atmospheric sponge will suck more water from the ground making it dryer making it easier for fires to spread. In wet conditions, atmospheric rivers contain more water and can result in more intense rainfall. This climate whiplash also lengthens the dry time of year making fire season last far longer.

Scenarios are a great way to plan and prepare for future earthquakes. After our 1992 earthquake, the California Geological Survey compiled a scenario of the likely impacts of a Cascadia subduction zone earthquake on our area. Many other scenarios have been compiled for other faults. There have also been scenarios for great storm events such as the USGS-led ARkStorm flood studies released in 2010 and 2022. ARk stands for an atmospheric river with a 1000-year return period.

Swain was involved with the 2022 revision of the ARkStorm study but mentioned that until asked to give last week's talk, he had never thought about a major earthquake and storm/flood event occurring at the same time. The more he looked at the issue, the more he became convinced of the need to do cumulative effects scenarios for double whammy events. Simple statistics shows that the probability of an earthquake occurring in extreme dry or wet ambient conditions is greater now than it used to be.

Friday's 4.9 made me think about what might happen on the North Coast if the earthquake had been a 7.5 occurring at the same time as an even more intense rain event as the one on January 12th. First – power would be out throughout the County. The earthquake shaking would have triggered numerous electrical 'faults' (when wires get too close together). Phone service would also be out – too many people trying to call at the same time and landline infrastructure damage. There would be far more landslides and road/bridge closures. No internet or television.

The best source of information will be radio stations and NOAA Weather radios, but you might be in an area where no information source can reach you for a while. That means you and your neighbors are the only emergency responders in the first hours or even days afterwards. We've been saying impacts like this are likely for a really big quake – magnitude 9 on the Cascadia subduction zone. But climate change has lowered the bar – it might not take a magnitude 9 to really cut us off from one another. Just a double whammy – a large earthquake and large storm occurring at the same time.

One other possible consequence – the ground can shake more strongly when really wet. I have a good friend in Petrolia who texted me right after Friday's 4.9. "Strong, close. Hi 4 or 5" was his comment. He nailed the magnitude, but the earthquake was nearly 60 miles away from him. It was the saturated ground that amplified the experience.

Just one more reason to take earthquake preparedness seriously.

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