

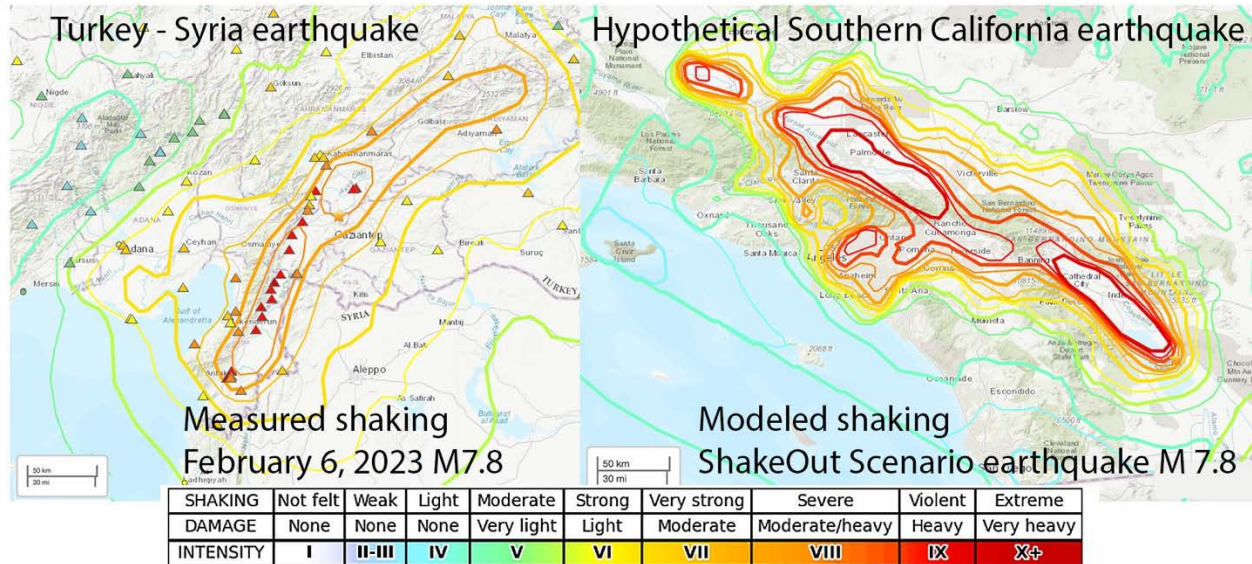
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Not My Fault: Don't turn your attention away from Turkey

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Comparison of actual shaking (triangles) in the Turkey – Syria M7.8 with modeled shaking for a 7.8 earthquake on the Southern San Andreas fault (USGS).

It's been nearly three weeks since magnitude 7.8 and 7.5 earthquakes forever changed the lives of millions of people living in the Turkey – Syria border region. No longer front-page news, the full scope of the disaster is emerging, and inevitable comparisons are being made to other earthquake-prone areas of the world.

The death toll is nearly 51,000, second only to 2010 Haiti as the worst shaking-damage earthquake of the 21st century. Tourists and visitors from 44 different countries were among those killed, including three US citizens.

The tally of damages is staggering. The Turkey government estimates nearly 350,000 structures collapsed and over four million others were damaged in the sequence to date. Roads and infrastructure were severed. Turkey President Erdogan reported 2.2 million people had left the earthquake zone. The government is struggling to supply housing and basic needs to a million more who opted to stay in their homes or lacked the means to leave.

In Northern Syria, less reliable information is available, but the humanitarian crisis may be more dire. This area is home to 4 million people, 2.8 million already displaced by civil war prior to the earthquake. Supplying relief, especially to rebel-held regions, has been onerous and slow. Response and relief needs are exacerbated by severe cold and winter conditions.

Reconnaissance teams are beginning to report back on the earthquake impacts to the landscape. Both the 7.8 and 7.5 produced spectacular faulting. At least five different fault segments ruptured in the mainshock along a 190-mile zone with offsets large enough to be seen by satellites. The 7.5, on a different fault, produced nearly 80 miles of surface rupture. The complexity of faulting produced chasms in the ground surface as wide as a football field and offsets of over 20 feet.

Could it happen in California? Yes and no.

We've had similar-sized earthquakes on the San Andreas fault system and in Eastern California in the past two centuries. The 1906 northern San Andreas earthquake (magnitude 7.9) produced 250 miles of fault rupture from Santa Cruz to Cape Mendocino, producing damage from Central California to Humboldt County. The amount of surface fault displacement was 20 feet – similar to Turkey.

There were two similar sized earthquakes in the 19th century. The Fort Tejon earthquake of 1857 on the south-central section of the San Andreas was also about a 7.9. The 1872 earthquake in the Owens Valley has magnitude estimates in the 7.4 to 7.9 range with shaking strong enough to knock mules over.

Pushing the time frame further back, there is ample evidence of M7.8 and larger earthquakes in the geologic past. Paleoseismologists have uncovered a trail of at least five great earthquakes over the past eight centuries in the south-central San Andreas prior to 1857. The southern segment of the San Andreas from the Salton Sea to Palmdale north of the Los Angeles basin has not produced a great earthquake since the settlement of Europeans and written records but paleoseismology reveals a similar shaky past. There is convincing evidence from field investigations for at least five major earthquakes, the most recent in 1680.

Concern about the south San Andreas segment led to a detailed investigation of the impacts of a future big quake in Southern California. Called the ShakeOut Scenario, the effort was led by Lucy Jones including a team of over 300 professionals from the USGS, Universities, utilities, and professional organizations, to encourage actions to reduce vulnerabilities (<https://pubs.usgs.gov/of/2008/1150/>).

The ShakeOut Scenario paints a sobering but realistic picture of what could happen in the next 7.8 earthquake in Southern California. It estimates 1,800 deaths and 50,000 injuries, and \$213 billion in economic losses. It looks at the disruption to infrastructure and damage to structures. It will be a major disaster, yet not nearly of the same scale as what happened in Turkey.

Scenarios are imagined; they are not real. The ShakeOut Scenario prescribes the rupture, the slip and the faults involved. It uses algorithms to predict the impact on structures and how people respond. It envisions an earthquake at 10 AM on a workday. Injuries and deaths are likely to be less in the night when most people are at home and possibly more at other times of day. The next actual earthquake will certainly differ in some ways from what is projected; it should get the general scope and damage projections in the right ballpark.

The Scenario includes both similarities and differences than what happened in Turkey and Syria. The magnitudes, rupture lengths, and ground shaking are likely to be similar. The disruption to infrastructure like power, water, and roads could be similar. The damage to buildings will be far less. The number of deaths and injured will be far less. Economic damages could be greater.

The biggest difference is the built environment. We have very few structures built before the advent of building codes. Global earthquakes have provided lessons on building resilience and have often led to revisions in code requirements. A structure built to code after 1986 is much more likely to withstand earthquake shaking than once built in the 1960s.

I'm pretty sure our building stock will perform better than Turkey. But California has vulnerabilities, and we can do better. Building codes don't mandate retrofits with only a few exceptions – public schools, hospitals, critical facilities. Every California city and town has concrete structures built in the 1950s and 60s with inadequate strength or poor connections between structural elements. Some cities like Los Angeles and San Francisco have implemented retrofit programs, but others haven't. It's expensive and, before an earthquake, seems a low priority issue.

Don't turn your attention away from Turkey – now is the time to put the pressure on decision makers to look long and hard at our vulnerable building stock and prioritize structures for retrofit dollars.

Next week – what if the next California quake is larger than 7.8?

Lori Dengler is an emeritus professor of geology at Cal Poly Humboldt and an expert in tsunami and earthquake hazards. The opinions expressed are hers and not the Times-Standard's. All Not My Fault columns are archived online at <https://kamome.humboldt.edu/resources> and may be reused for educational purposes. Leave a message at (707) 826-6019 or email rctwg@humboldt.edu for questions and comments about this column, or to request a free copy of the North Coast preparedness magazine "Living on Shaky Ground."