

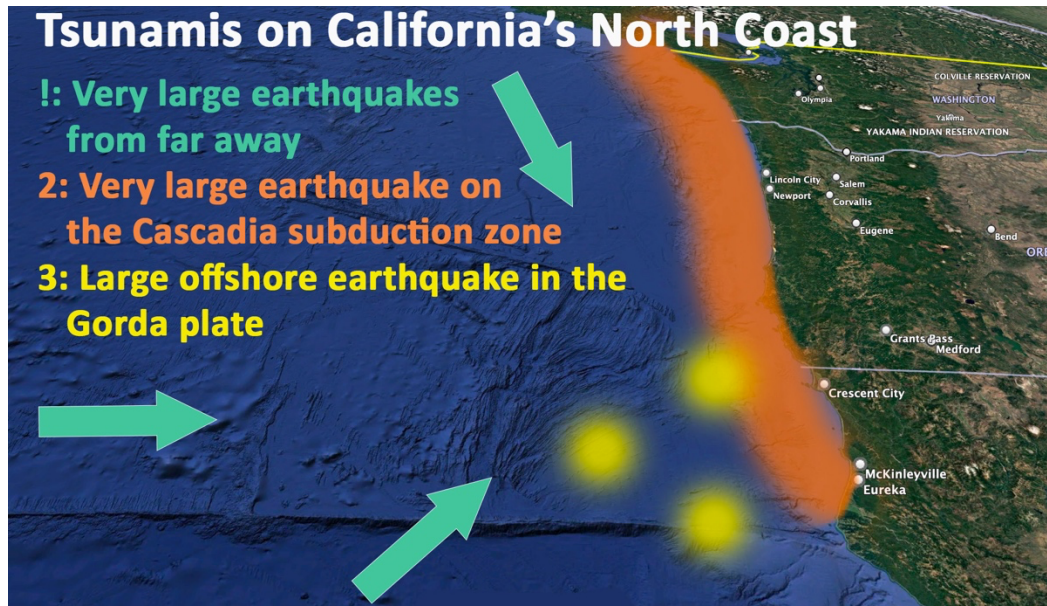
Times Standard

World tsunami day is an opportunity to improve our tsunami game

Lori Dengler for the Times-Standard

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The North Coast of California has been hit by different types of tsunamis in the past and will be again in the future. Very large earthquakes from elsewhere in the Pacific basin can send damaging tsunamis our way (green). The Cascadia subduction zone (orange) is our greatest tsunami threat. Most common are large earthquakes in the Gorda plate or Mendocino fault (yellow).

Wednesday November 5 is World Tsunami Awareness Day. Humboldt and Del Norte County have experienced two tsunami warnings in the last year and it's clear from our experiences in these events, we've got a number of areas to work on to improve our tsunami response performance.

Japan has had more experience with deadly tsunamis than any other country in the world and recognizes that tsunami safety goes beyond instrumentation, modeling, and science. In their 2015 United Nations petition to establish World Tsunami Day, the Japanese delegation emphasized that evacuation behavior and awareness of the tsunami threat is just as important as advanced technology in making sure that people survive tsunamis.

It was only a month after the 2024 World Tsunami Day that our tsunami response was found lacking. On December 5th, a magnitude 7.0 struck the Mendocino fault about 40 miles west of Cape Mendocino. Initially estimated as a 7.3, the National Tsunami Warning Center immediately issued a Tsunami Warning from Davenport near Santa Cruz to just south of Florence, Oregon.

I saw the initial location and was soon on the phone with Lauren Schmidt, then head of KMUD's news department. I didn't think a tsunami was likely because the Mendocino fault produces strike-slip earthquakes where the ground moves horizontally so both Lauren and I were pretty surprised when a WEA tsunami alert hit our phones five minutes after the earthquake. It had a much louder and more jarring tone than the ShakeAlert that had notified us to "expect shaking" in the moments before the quake and was impossible to ignore. The words "YOU ARE IN DANGER" jumped out, followed by "Move to high ground or inland now."

The National Tsunami Warning Center (NTWC) in Alaska is responsible for issuing alerts to our area. They follow a detailed protocol and issue alerts based on the magnitude and location of earthquakes relative to coastal areas. Their initial magnitude estimate was 7.3 that requires a WARNING be issued to coastlines within 250 km (155 miles) of the epicenter. That should have been an area from Bodega Bay in Sonoma County to Port Orford 50 miles north of the California – Oregon border.

That area was reasonable considering the uncertainty in the initial location and magnitude. Our tsunami warning centers are under pressure to get alerts out fast, especially when an earthquake is located nearby and the first tsunami surges could arrive quickly. But the actual warning area was more than twice as large as the protocols required and the WEA alerts sent to an even greater number of people.

We have an antiquated system that uses breakpoints and requires uniform alerting levels between them. There are only 16 breakpoints on the entire U.S. west coast, a coastline extending over 1,200 miles. On December 5th, the 250 km radius fell 20 miles south of the Gualala breakpoint in southern Mendocino County and 45 miles north of the California – Oregon border breakpoint. That meant the warning area had to be extended to the next breakpoints both to the south and north from Davenport to the Douglas – Lane County border in central Oregon, adding nearly 200 more miles of coastline to the warning area.

It wasn't just miles that the breakpoints added, but it also extended the warning to one of the most populated areas of California, the greater San Francisco Bay Area. WEA alerts don't just get sent to people on the coast within mapped tsunami zones, they go to everyone in a county with even a small amount of coastline in the warning area. On December 5th, every resident with a cell phone capable of receiving WEA alerts from Santa Cruz County to Douglas County Oregon got the same WEA alert that I did, including the 8 million people in the Bay Area.

I spend a lot of time thinking about tsunamis. I've been working on tsunami hazards for over thirty years and currently serve on a national tsunami advisory board. I'd like to think that I am fairly well-informed. But the WEA alert wording and the warning notification area took me by surprise, as it did for all of the emergency managers in the region. We were aware that WEA alerts were being added to the tsunami notification system but had not seen the message wording or were fully aware of how wide a reach the WEAs would have.

The big problem with near source events is that there is so little time and that first alert is issued with no consultation with constituents. The wording of the alert coupled with inaccurate maps confused everyone and resulted in massive over evacuation. We were fortunate that no injuries occurred on the North Coast but there were a few minor incidents elsewhere. We had

massive traffic jams and many tried to evacuate by car even though they were out of the tsunami zone for even a worst-case tsunami.

On July 29th, a M8.8 earthquake occurred in the western Pacific offshore of Russia's Kamchatka Peninsula. Unlike December 5th, the earthquake was far away, and it took eight hours for the first tsunami waves to reach us. There was time for more detailed assessments of the threat as the tsunami was recorded on coastal tide gauges and deep ocean pressure sensors as it traveled towards us. When the models consistently showed water heights greater than 3 feet for Crescent City, a tsunami warning was issued. They did a good job - the actual water height was just under 4 feet and caused a million US\$ in damages.

Del Norte County wasn't the only coastline put into a warning. NTC had modeling evidence suggesting Trinidad might also see 3+ foot surges. The next breakpoint south of the Del Norte – Humboldt County line is Cape Mendocino. As a result, if you were in most of Humboldt County, you also got the shrieking WEA alert, even though a maximum of one foot was expected for most of the area. Much to my disappointment, the WEA wording was unchanged since last December and still said I was in danger although I live miles away from even our worst-case Cascadia tsunami hazard zone.

The first step to becoming tsunami safe is to KNOW YOUR ZONE. Pick up a brochure for your community from the NWS Office in Eureka or most county and city offices. Go to <https://rctwg.humboldt.edu/tsunami-hazard-maps> for maps and an interactive link to the State tsunami maps. Enter your home, workplace, school and other addresses to see where the tsunami zone is located. All California maps are worst-case. If you are in the green areas of the map you are safe – stay put.

There are three general categories of tsunamis that can affect us. The first is when great earthquakes occur far away, like the July 29th M8.8. There is time for NTC to assess the hazard and issue alerts. But, like last July, we also have time to provide more detailed information. The counties and the NWS issued a map showing likely peak water heights of about 1 foot for much of the Humboldt area. The only areas of concern were harbors, beaches and very low-lying areas. Caution – don't expect the next distant tsunami to be so benign. A great earthquake in Alaska could produce even larger surges than 1964.

The second is a great quake beneath our feet. Earthquakes as large as magnitude 9 have occurred here in the past and will do so again in the future. This is our worst-case event and the basis of all of our maps. The earthquake is likely to shake for minutes and severely disrupt infrastructure including telephones and alerting systems. No WEA alert. No guidance from local officials. Know your tsunami zone and if you are at risk, immediately put your tsunami plan into action and walk out of the hazard area to the nearest high ground or inland safe area.

Third is the least likely to cause damage but the most frequent – a large offshore earthquake on the Mendocino fault like last December or in the Gorda plate like the 1980 7.2. In the last century, 14 earthquakes would likely have triggered tsunami warnings. Of these, 8 were nearby M7s, and using the current protocols, would have resulted in warnings. People near the coast and in low lying areas should certainly evacuate, but most of the mapped hazard zone will not be affected.

NTWC and our tsunami system is aware of the current institutional shortcomings and has a plan to improve alerting notifications over the next few years. Unfortunately, none of this can be worked on during the government shutdown and the next offshore M7+ quake will likely result in the same notification issues as December 5th. Your best bet is to be aware.

Lori Dengler is an emeritus professor of geology at Humboldt State University, 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/taxonomy/term/5> and may be reused for educational purposes. Leave a message at (707) 826-6019 or email Kamome@humboldt.edu for questions and comments about this column or to request copies of the preparedness magazine "Living on Shaky Ground."