

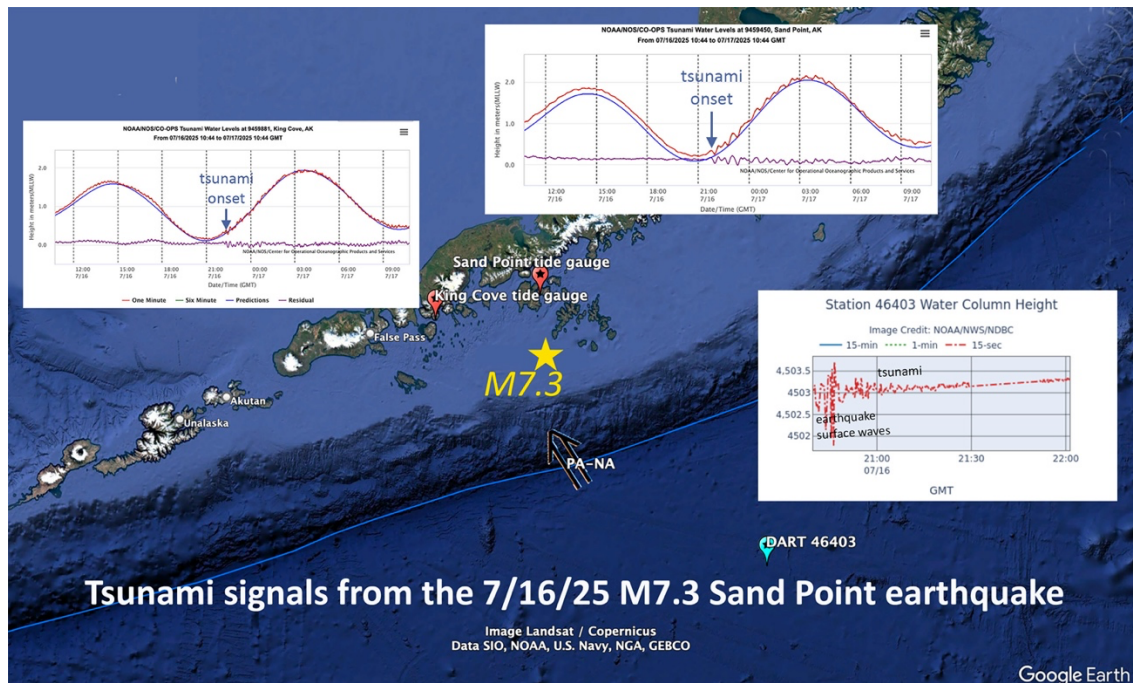
Times Standard

Not My Fault: Tsunami fears trigger alert messages

Lori Dengler for the Times-Standard

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A summary of tsunami recordings from the July 16 M7.3 Sand Point earthquake. Epicenter is shown by the yellow star. The two upper graphs are from the tide gauges at Sand Point and King Cove. The red line is the water level recording, the blue line is the predicted tidal variation, and the purple line at the bottom is the difference between the two. The bottom right graph is from the ocean bottom pressure recorder (DART) 200 miles away from the epicenter. The initial larger part of the signal is from the earthquake surface waves. The tsunami is the longer period later part of the signal.

Tsunamis made it into the news this month. On Wednesday July 16, a magnitude 7.3 earthquake struck south of the Alaska Peninsula, and four days later, a 7.4 occurred off the east coast of Russia's Kamchatka Peninsula. Both triggered tsunami alert messages, evacuations, and reminders of how the tsunami warning system should work.

We were never placed in an alert category following either of these earthquakes. The National Tsunami Warning Center (NTWC) issued a tsunami WARNING for Alaska coastlines four minutes after the Alaska (Sand Point) earthquake and the initial bulletin stated they were evaluating other areas. The second bulletin 30 minutes later made it clear no tsunami was headed to the West Coast. We were never considered to be at risk of a tsunami after the Kamchatka event.

I get alerts on my phone whenever large earthquakes and tsunami bulletins are issued. Both of these earthquakes got my attention. Major quakes from these areas have produced damaging tsunamis in the past and it is important to keep close track. They were also of similar size to our December 5 earthquake and the warning protocols are similar.

The July 16th Sand Point earthquake warrants the closest look. It takes about five hours for a tsunami generated in that area to reach the northern California coast. Whenever an earthquake in the magnitude 7.1 to 7.6 range occurs in Alaska or the North American west coast, a tsunami WARNING is issued as soon as preliminary analysis confirms the location and size for all coastlines with 250 km (155 miles) of the source. If the earthquake had been in the M7.6 to 7.8 range, the warning zone would have been twice as large, and for earthquakes of 7.9 and larger, that initial warning would have been more than 1000 miles.

Large magnitude earthquakes are harder to pin down than small ones and initial magnitude estimates can be off by a magnitude unit or more. It is always important to consider that first magnitude estimate made by the tsunami centers as likely to change. The USGS reviewed assessment came in a few minutes later revising the magnitude to 7.3 and that gave me a sigh of relief because it was unlikely that this earthquake was going to end up substantially larger.

The tsunami warning area extended from the eastern Aleutian Islands near Unimak Island to the Kenai Peninsula and included all of Kodiak Island and the interior of the Cook Inlet. This area is much larger than a 250 km radius from the epicenter. The NWS that runs our tsunami program still operates with breakpoints, pre-identified geographic locations along the coast and forecasts for weather or tsunamis have to be uniform between breakpoints. Kodiak Island which was about 500 km from the epicenter was still placed in a WARNING because the next breakpoint to the east was on the southern tip of the Kenai Peninsula.

Breakpoints were a significant issue in making the warning zone from our magnitude 7.0 earthquake last December much larger than it needed to be. The 250 km cone from the epicenter extended only into Sonoma County and north just past the Oregon border. But because of the sparse network of coastal breakpoints, the tsunami warning went as far south as Santa Cruz County, north to central Oregon and encompassed the interior coastlines of San Francisco Bay.

States have been raising concerns about breakpoints for over a decade, and everyone agrees that it leads to unnecessary evacuations. But the NWS is in the process of switching over to new systems and that process takes time. Meanwhile, the tsunami system is in limbo, and we are stuck with a framework that is hardwired to alert a much larger area than is deemed necessary.

Another aspect of the July 16th warning reminiscent of our December 5th alert is the depiction of the tsunami zone on the official government tsunami web site (tsunami.gov). This is another example of an outdated system giving an inaccurate representation of the hazard zone. Tsunami hazard mapping and evacuation areas are state responsibilities. Instead of using the vetted state maps, the tsunami centers use another NWS product, the Warning, Watch, Advisory maps used for weather hazards, to show tsunami hazard areas. We all agree that it makes no sense to show the red hazard zone extending inland to elevations in some cases

above 1500 feet. Like breakpoints, this will change some time in the future but for now we are stuck with an antiquated system.

There are real-life consequences for inaccurate depiction of the hazard. Kodiak Island was affected by both the breakpoint and tsunami zone overestimation of hazard. The island was placed in the warning zone even though it was nearly twice as far away from the likely tsunami threat, and the tsunami.gov map painted all of it in red, even Koniag Peak at an elevation of nearly 4,500 feet above sea level. A casual glance at the map might make you think there were no safe places to be on Kodiak.

The response to the warning was generally good. Cell phones quickly sent messages to most coastal residents although there was some disconnect between the speedy Wireless Emergency (WEA) alerts and other alerting systems. A friend of mine who lives on Kodiak said the sirens on the island went off more than ten minutes after they received the WEA.

There was some confusion about what areas were at risk. Officials in Yakutat 850 miles away from the epicenter sounded their tsunami sirens and Cordova (over 650 miles distant) nearly did the same. A group of Alaska tsunami experts were fortuitously on an outreach trip at Cordova at the time and explained it was not necessary. All underlying the importance of ongoing outreach and education to both officials and the public alike.

A modest tsunami was detected. It took just over a half hour for the first tsunami wave to reach Sand Point and an hour and a half to reach King Cove. Although the tsunami was only a few inches high, it illustrates features of larger events: the tsunami lasts a long time in both locations, successive peaks are more than a half hour apart, the largest amplitude is not the first cycle.

The tsunami was also recorded on the sea floor pressure sensor 200 miles away from the epicenter. Unlike tide gauges that measure coastal water heights, these deep-sea instruments (DART) measure the weight of the water above them and can register tiny tsunamis in the deep ocean far from the influence of coastlines. The DART record shows an initial high amplitude signal caused by earthquake surface waves followed by the longer period tsunami waves. This record played an important role in confirming that the tsunami was small and canceling the tsunami warning.

The Kamchatka earthquake on July 20th posed different issues. The mainshock in the sequence was a magnitude 7.4 but was preceded by a number of strong foreshocks in the 45 minutes beforehand. The largest was a magnitude 6.6, large enough to trigger a series of information statements by the tsunami warning centers. Both the Pacific Tsunami Warning Center (PTWC) and NTWC stated “no tsunami expected” following its occurrence. Twenty minutes later the M7.4 occurred, starting another series of messages, but this time with “tsunami threat” for Russian coastlines within 300 km of the epicenter, and a tsunami watch for Hawaii. In total, 13 messages were issued by the U.S. tsunami centers for the sequence.

I still don't know the full stories for either of these earthquakes and the tsunami response. I'm on an advisory committee to the U.S. tsunami program and next month we will be looking at both of these events in more details. But it is clear that there is work to be done to improve the system. I will keep you posted.

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/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."