

# Tsunami's effects in California offer clues about future, more powerful seismic events

March 22 2011, By Abby Sewell

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Although the effect of the tsunami was minuscule in California compared with Japan, the scattered damage is providing a rare opportunity to study how the waves work and to help officials better prepare for what could be a far more destructive seismic event along the state's coast.

Teams of scientists combed the [California](#) coast all last week, comparing damage from port to port and harbor to harbor. The result will be a set of recommendations that could give better indications of which areas are most at risk and how to mitigate damage.

"This will be our best data set of response in California from a far-afield [tsunami](#) yet," said Jose Borrero, a tsunami researcher with the consulting firm ASR Limited who traveled the length of the California coast.

The state has already published inundation maps that show which areas are believed to be at risk of flooding in various tsunami scenarios, but the new data will allow for a more detailed understanding.

The California Emergency Management Agency estimates that surges induced by the earthquake in Japan caused \$44 million in damage to coastal California, with Crescent City and Santa Cruz being hardest hit. In Crescent City, one man died when he was swept out to sea while attempting to photograph the waves, and much of the town's harbor was destroyed, crippling the local [fishing industry](#).

California faces significantly less risk than Japan of the kind of catastrophic tsunami that swallowed whole towns, killed thousands and reached five miles inland. But officials estimate a Southern California tsunami could cost billions of dollars, inundate areas like Marina del Rey, Naples and Seal Beach, and affect operations at the ports of Long Beach and Los Angeles.

About 480,000 Californians live in areas at risk of a 5-foot or greater rise in sea level, according to Lesley Ewing, a senior coastal engineer with the California Coastal Commission.

Lessons from the Japan tsunami will be the topic of discussion by experts and lawmakers Monday at the state Senate Select Committee on Earthquake & Disaster Preparation.

The last big tsunami to strike California's coast was in 1964, when a quake in Alaska caused surges that tore dozens of boats from their moorings, sinking three, in the ports of Los Angeles and Long Beach. The same temblor sent 20-foot waves crashing into Crescent City, killing 11 people there.

Unlike Japan, most of California does not have a subduction zone - a fault at which one plate slides under another - off its coast. The thrusting motion on the sea floor was what generated the massive waves that devastated Japan.

But experts say Southern California could see significant tsunamis caused by a far-away earthquake off Alaska or by undersea landslides spurred by earthquakes off California's shore. The northern portion of the state faces a greater threat from the Cascadia Subduction Zone, located off the Pacific Coast from British Columbia to Cape Mendocino in Northern California.

Scientists believe that the Cascadia zone generated a magnitude-9 earthquake in 1700 and is likely to repeat that every 500 years.

"If and when Cascadia goes in our lifetime, it will look like Japan," Borrero said.

Far-afield quakes could create 15-foot tsunami waves in Southern California, while Northern California could see waves of up to 25 feet, said John Parrish, the state geologist.

And tsunamis caused by undersea landslides could reach as high as 40 feet, although they would be localized and quick to dissipate, said Costas Synolakis, director of the Tsunami Research Center at USC.

Synolakis wants to see more measurement instruments deployed along California's coast: a tsunamograph to give a better idea of the duration of tsunami waves and meters to measure currents in ports.

Unlike tsunamis coming from quakes in Alaska, Chile or Japan, a tsunami created by an offshore quake in California could roll in with minutes rather than hours of warning, affording little time to evacuate people from homes, beaches and ports, and no time for boat owners to take their vessels to safer water.

California has not seen a major tsunami generated by a local quake in recorded history, and it might happen only once in thousands of years, if at all. But the quake and tsunami in Japan was also considered highly improbable.

USC researchers estimated in 2005 that the economic losses from a major tsunami in Southern California could reach \$40 billion, depending on the extent of disruption to freeways and ports. Other estimates suggest that a shutdown of the ports of Los Angeles and Long Beach

would cost about \$1 billion a day.

The ports reported no damage from the recent tsunami in [Japan](#), and officials said the area's geology means they are generally at minimal risk.

"A tsunami is not what's going to keep me up at night worrying - it's going to be more of the [earthquake](#) threat itself," said Tony Gioiello, chief harbor engineer at the Port of Los Angeles.

Tsunami inundation maps put forth by the state show the ports at risk of flooding, but a study commissioned by the ports found little risk that a tsunami would push water above the level of the piers. David Dykstra, a coastal scientist who worked on the study, said in any tsunami scenario, he would not expect to see a water level fluctuation at the ports of much more than 5 feet.

But even if piers stay above water, fast currents induced by rising water levels can snap mooring lines and sink or set boats adrift, endangering workers and beachgoers. Santa Catalina Island, for instance, saw docks torn apart and boats capsized by the recent speeding currents, even though the change in water level was minimal.

"One of the problems is we will never know until it happens," Synolakis said.

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