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Our Ocean Backyard

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The Tsunami History of Santa Cruz

The word "tsunami" generates an emotional response, much like earthquake or shark, especially if you live on the coast. It's just one of those frightening things that is beyond our control and one that most of us never want to experience. The updated tsunami inundation maps for Santa Cruz that I wrote about two weeks ago generated by the California Geological Survey based on modeling, need a reality check from my perspective. Have we experienced any tsunamis of the size they modeled, and if so, what actually happened here in Santa Cruz?

The Santa Cruz coast has been significantly impacted by just four tsunamis in the past roughly 150 years of newspaper accounts. Two of these were generated by very large earthquakes in the Aleutian Trench off the coast of Alaska, in 1946 and 1964 (magnitude 8.6 and 9.2, respectively). The third arrived from a massive 9.0 magnitude earthquake in the Japan Trench in 2011, which many of you will remember. And then there was the tsunami from the explosive volcanic eruption in Tonga this past January.

Two weeks ago I wrote about the impact of the 1946 Alaskan tsunami, which led to the only fatality that Santa Cruz has ever experienced from such an event. The 1964 Aleutian Trench earthquake was even larger and the tsunami generated produced considerable damage along the west coast from Alaska to California.

Crescent City near the Oregon border was hit hardest by that tsunami. Water levels rose eight feet and much of the low-lying downtown area was inundated as waves washed 2,000 feet inland, drowning 12 people and destroying 150 businesses. Most of the city’s downtown was either damaged or totally destroyed. Property losses approached $250 million (in 2021 dollars). Rather than being rebuilt, however, which usually occurs after a natural disaster, the blocks nearest the harbor were subsequently made into a park.

The 1964 tsunami surge raised water levels 10 feet at the Santa Cruz Small Craft Harbor, which had just been completed. As the water receded between waves, the harbor was drained and boats were left resting on the bottom. The harbor’s 35-foot dredge that had been brought in to remove sand from the new harbor was carried out into the bay where it sunk. Several days later, skin divers, Jack O’Neill and Robert Judd located the sunken dredge 70 feet off the end of the east jetty in about eight feet of water. The sunken vessel was hauled ashore by a Granite Construction Company bulldozer.

A 38-foot fishing boat, the *Big Boy* was damaged as it exited the harbor, perhaps hitting the submerged dredge. It sank quickly with two men jumping overboard, who were then rescued by another boat. Total damage to boats and infrastructure at the harbor reached nearly $7,200,000 (in 2021 dollars). Water came up to the Boardwalk steps with waves described as being eight feet high.

Forty-seven years later, the March 11, 2011, magnitude 9.0 Japan earthquake, one of the largest in the last century, was accompanied by 23 to 33 feet of seafloor uplift, which generated a tsunami that propagated both directly onshore and also out to sea. The waves spread out across the Pacific and produced elevated water levels and moderate damage from Alaska to Chile. Between the Pacific Tsunami Warning Center in Hawai’i and the U.S. National Tsunami Warning Center, watches and warnings went out across the Pacific Basin and along the west coast from Alaska to California. With accurate advance warnings, people were notified, evacuations of low-lying areas were carried out, and there was only a single fatality along the entire 1,100-mile coast of California- a photographer standing along the northern California shoreline to photograph the incoming waves didn’t take the warning seriously.

Because of the advance warnings, the Boardwalk, Municipal Wharf, and low-lying streets near the beach front in Santa Cruz were closed. City officials advised about 6,600 people in the tsunami inundation zone to evacuate. Although the warning was advisory and not mandatory, many residents in low-lying areas drove up onto the University campus or even to the crest of Highway 17. At 1,800 feet above sea level, this was playing it very safe.

The Santa Cruz Small Craft Harbor, as in past tsunamis, again received the brunt of the impact as the water was funneled into this narrow channel. Shortly before 8 a.m. the first of 8 to 10 surges swept up the harbor, each about 10 minutes apart. The surges were described as being more like a river than a big wave. Peak height of the waves reached five to six feet and waves traveled up the harbor at velocities of up to 16 miles/hour.

Boats were slammed into each other and into some of the docks. One 30-foot boat was partially sunk and drifted towards the harbor mouth and was stuck for a while under the Murray Street Bridge. One dock “just blew up. It buckled and splintered”, according to one observer. When it was all over, about 30 boats had broken free from their dock moorings, 14 sunk and dozens of others were damaged. Of the harbor’s 29 docks, 23 sustained significant damage ranging from severe cracking of floats to complete dock destruction. Total losses to harbor facilities, including docks, pilings and other infrastructure, as well as boats ultimately reached about $28 million. Damage and coastal flooding could have been much worse, however, as the tsunami from 5,000 miles away arrived at low tide.

There was significant flooding of the harbor parking areas during the January 2022 tsunami from the Tongan volcanic eruption.

The size of a tsunami and its impact can vary significantly depending on the magnitude of the earthquake and seafloor offset, the nature of the offshore bathymetry, and the coastal topography. Because most tsunamis approaching the coast of California have come from either Alaskan or South or Central American source areas, they must pass over many miles of shallow continental shelf before they reach the coastline. As a result, wave energy is significantly reduced, and damage has historically been far less when compared with many other areas around the Pacific basin. The three major tsunamis from the largest earthquakes around the Pacific Rim led to water levels up to ten feet above normal. These actual observations are far less, however, than the 18-25 feet predicted by the new tsunami model.

With so many other things to worry about, do we also need to get stressed out about tsunamis here in Surf City? The short answer for me is that it’s not up there on my list of top 10 concerns. Your odds of dying in a tsunami in Santa Cruz are far lower than virtually any other risk we all face daily, commuting over Highway 17, biking on Mission Street, or riding a motorcycle on Highway 9.