Times-Standard
Times-Standard / Humboldt Beacon

Not My Fault: A sea change in post-tsunami field investigations

Lori Dengler/For the Times-Standard
Posted: May 10, 2017

The April 25, 1992 Cape Mendocino earthquake was not the only event of 1992 to impact the emerging Cascadia story. A second 1992 earthquake and tsunami played a pivotal role in tsunami science and in developing the methodology now used to assess tsunami hazards posed by Cascadia and other fault zones.

Few people outside of Central America know much about the magnitude 7.7 earthquake that struck offshore of Nicaragua in the evening of September 1, 1992. It wasn't the largest magnitude or the deadliest quake of that year and at first glance, it wasn't unexpected or unusual. But as media reports began to arrive from coastal communities, it soon became clear this wasn't a typical 7.7. Two things were unusual. First, the ground shaking wasn't particularly strong. The epicenter was less than 50 miles offshore but even people in the closest coastal towns described the shaking as mild or moderate and some didn't feel it at all. Second, it produced a very large tsunami, measuring over 30 feet at one location and noticed along 180 miles of coastline. And the tsunami was deadly, accounting for almost all of the 170 casualties.

Seismologists call quakes like this a "tsunami earthquake", an earthquake that produces a much larger tsunami than expected for its magnitude. It immediately caught the interest of geologists, seismologists and tsunami scientists on both sides of the Pacific. Major advances had been made in tsunami modeling in the 1980s. There were methods of translating earthquake fault motion into numerical models to generate a tsunami. Computers could now handle the speed and memory requirements to propagate the tsunami to the coastline and onto land. The modeling community was eager to test how well their methods worked. There had been no major tsunamis anywhere in the world for nine years prior to Nicaragua so as soon as it was clear a significant tsunami had been generated, researchers were eager to collect data.

This wasn't the first time scientists had organized to study earthquake effects. The exhaustive study of the 1906 earthquake coordinated by Professor Andrew Lawson at UC Berkeley remains to this day an example of how to study shaking patterns, damage and surface faulting. Japanese scientists and engineers had studied tsunamis in Japan since the late 19th century. USGS geologist George Plafker spent years studying the geologic and tsunami impacts of the great 1960 Chile and 1964 Alaska earthquakes. But Nicaragua was different. It was driven by the need of the modelers to acquire detailed data over transects showing how the tsunami water height varied with location and topography.

Gathering the data would require a team effort and tsunami water height measurements are ephemeral. Rain, wind, cleanup and other human activities can quickly erase a delicate debris line or high water mark. Obtaining one or two measurements wasn't sufficient to thoroughly test models. Getting funds to launch scientific studies usually requires years of writing, peer review, and evaluation before dollars are granted. There were a few organizations that funded post earthquake reconnaissance but an event where there was almost no shaking damage was different. It would need collaboration. Two of the US scientists were able to get emergency additions to their existing NSF grants and the USGS pitched in to assist. They worked with Japanese colleagues and assembled a group of four US and six Japanese scientists.

My colleague and friend Costas Synolakis was a member of the group. He had worked on tsunami models for years, but had never seen the impacts of an actual tsunami before. Costas described his first day in Nicaragua, "I rented a car, and headed west, I felt I couldn't go wrong, eventually I would reach the beach. I really didn't see much, then tried to find my way back, it was miserable, raining, and many cars without lights." Back at the hotel, he connected with Professor Abe and the Japanese group. Abe asked him what he had seen and Costas said not much, just a debris line. Abe responded, "No damage? You don't know how to look. I was there myself today and there was a lot of damage. Tomorrow, you join the Japanese team and you learn."

And thus the first International Tsunami Survey Team (ITST) was born. They collected about 50 water height measurements, sediment deposits, interviewed eyewitnesses and mapped out impacts. Although the driving force had been collecting water heights for modeling purposes, this first ITST included a sedimentary geologist, a seismologist and an urban planner. The basic ITST framework had been established – an interdisciplinary, international group of scientists, deploying quickly and collecting data in a uniform, consistent manner. Before the end of the year, an even deadlier tsunami would strike Indonesia and the method would repeat. In the next decade, 11 more damaging tsunamis would occur and ITST groups responded to every one. One of those tsunamis was in 1998 and it struck Papua New Guinea. It would be my first ITST experience. And my companion and colleague to Papua New Guinea would be the urban planner who was part of that first team.

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