

# Scientists set up tsunami warning system

## Rare tidal wave phenomenon could affect island shores

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The ground began to shake at 10:15 in the morning, starting with a sharp, vertical thrust. Then the land began to roll, like ripples in water. People were thrown to the ground, church walls cracked and smokestacks fell over.

Eyewitnesses said that almost immediately, the sea began to retreat, exposing reefs and fish flopping on the sea floor.

It was Oct. 11, 1918, a Monday, and the shifting of the earth along underwater fault lines had displaced a huge volume of water.

It would soon be back, barreling along in a wave 20-feet high that stormed ashore, washing away homes and killing dozens on the northwest coast of the island.

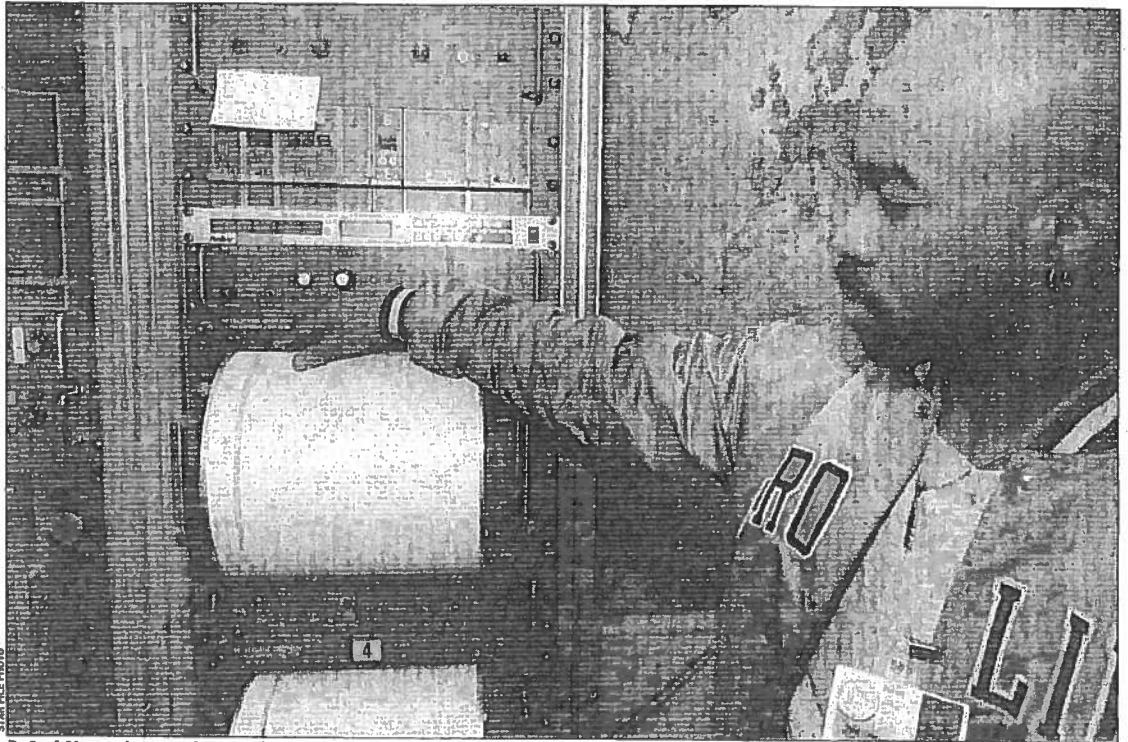
"A great sea wave broke upon the shore, drowning many persons and destroying native huts," U.S. Reps. Harry Fielding Reid and Stephen Taber wrote in a 1919 report in the wake of the disaster.

Hundreds of trees were uprooted and enormous blocks of limestone were lifted up and carried inland.

Thirty-two people in Aguadilla drowned, and 300 huts were washed away.

That wave came without warning.

Now, 85 years later, a team of scientists is working to educate islanders about the threat of tsunamis and developing a warning network.



Rafael Abreu, data analyst at the Cerrillos sensor in Ponce, is seen in this file photo.

Tsunamis are relatively rare, and the temblor in 1918 — estimated to have been 7.5 on the Richter scale — caused more damage and death than the wave.

"It's not an event that occurs very often in Puerto Rico," said Christa von Hillebrandt, head of the Puerto Rico Seismic Network and co-leader of the island's tsunami task force, the

Puerto Rico Tsunami and Warning Mitigation Program. "But if it occurs, a lot of people would be affected."

With dramatically increased population, much of it along the coast, the potential for damage is far greater than it was in 1918, she said.

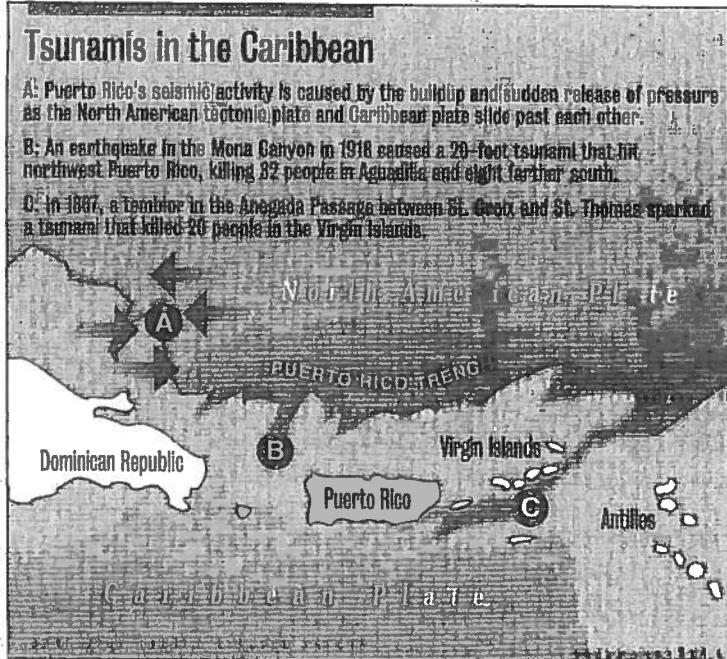
In Mayagüez alone, 30,000 people now live or work in the tsunami danger zone, and five schools are "right across the road from the beach," she said.

A tsunami in 1960 killed 61 people in Hawaii

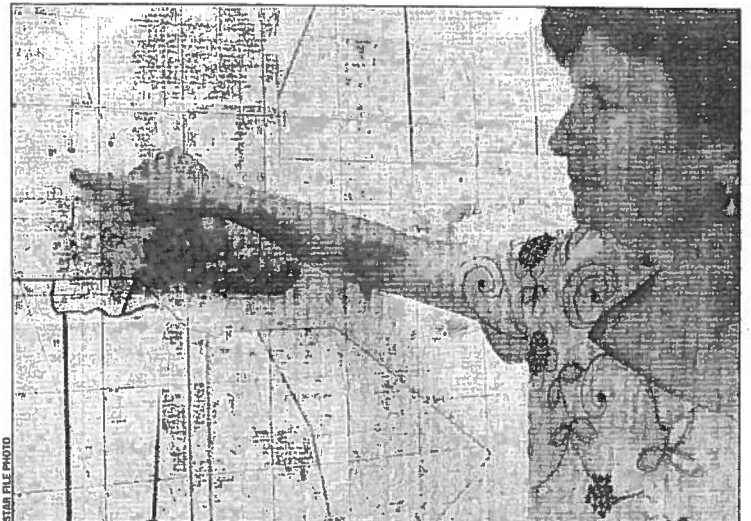
and caused millions in damage. That wave was created by a quake off the coast of Chile and took hours to arrive. In the Caribbean, seismic events are often local, and the tsunamis can hit shore in a matter of minutes, leaving little time to prepare.

"The hazard remains the same ... [but] our risk to this phenomenon has increased dramatically. Our exposure is much larger in

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SOURCE: The Puerto Rico Tsunami Warning and Mitigation Program



Christa von Hillebrandt, head of the Puerto Rico Seismic Network and co-leader of the island's tsunami task force, is seen in this file photo.

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Tsunamis

terms of people and infrastructure," Hillebrandt said.

## 2 ships never seen again

Tsunamis — Japanese for "harbor wave" — can be caused by volcanic eruptions and submarine landslides, among other disturbances, but the most common cause of the waves in the Caribbean is seismic activity, Hillebrandt said.

Puerto Rico sits near the edge of the Caribbean and North American plates, which slide past each other and make the region an active seismic zone.

The powerful offshore quake near Aguadilla in 1918, estimated to be 7.5 on the Richter scale, occurred in the Mona Canyon, where a sudden vertical shift along a fault line sent a wave careening toward the island.

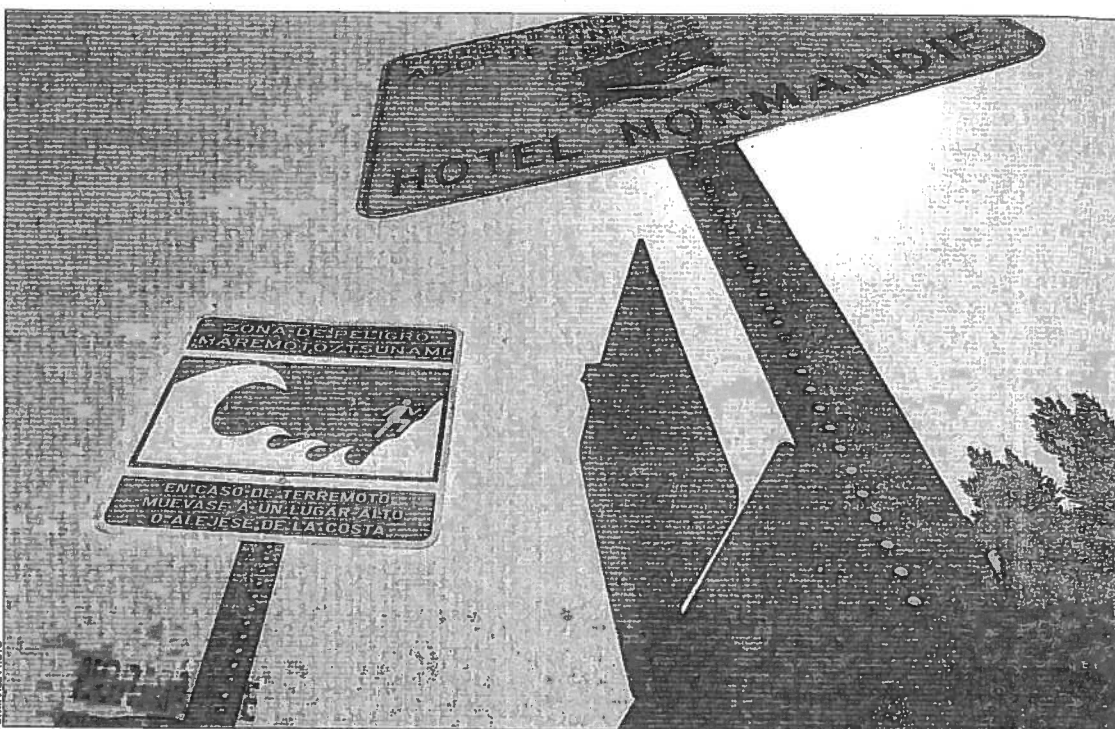
There have been dozens of tsunamis in the Caribbean in the last 500 years, according to the U.S. Geological Survey, with the two deadliest occurring in Puerto Rico and the Virgin Islands.

After a powerful offshore quake near the Virgin Islands in 1867, Navy mariners in the St. Thomas harbor described a 20-foot-high wall of water racing toward them.

"With a feeling of awe we awaited its arrival. It came rushing on, tumbling over the rocks that formed the harbor, carrying everything before it," Rear Adm. J.S. Palmer reported.

Two ships were engulfed "and never again seen," he wrote. "The small craft on shore were lifted up and thrown into the streets . . . and men in the water [were] swimming for their lives."

Terrified residents ran for their lives as it came ashore washing out businesses and "stranding their goods in unheard of directions," Palmer wrote. "The panic that seized the inhabitants was painful, [they were] rushing up the hillsides, crying for mercy and listening



Signs erected by the Tsunami Warning and Mitigation Program around vulnerable coastal areas warn residents to seek higher ground, like this one near San Juan's Normandie Hotel.

to no attempts to pacify them."

The USS Monongahela was lifted up and stranded on land.

At least 20 people were killed in the Virgin Islands, and areas of Puerto Rico's southeast coast were flooded.

Deadly tsunamis in Hawaii and Alaska prompted the states to set up a warning network, and experts here are doing just that.

Signs around vulnerable coastal areas depict waves looming up over people fleeing the coast, warning residents to seek higher

ground.

The signs are the fruit of the Puerto Rico Tsunami Warning and Mitigation Program, launched in 1997 and funded by the federal and state emergency management agencies and the University of Puerto Rico.

Experts have drawn up tsunami danger zone maps for the entire island, created a historical database of the events, trained emergency personnel and run evacuation drills.

A warning system — based on information from seismometers — like what the National

Weather Service uses to announce flood dangers, is also being developed, Hillebrandt said. Puerto Rico's network of sea-level gauges is also being expanded and improved.

But because tsunamis in the Caribbean are caused by nearby earthquakes and arrive so quickly, "the critical thing is education," Hillebrandt said, noting the need for people to learn whether they live in flood zones and determine where to seek higher ground.

"A system which is just going to alert people is never going to be enough if we really want to reduce the number of people that could die in the case of a tsunami," she said. "If you feel a strong earthquake and you're in these near-shore areas then immediately evacuate, don't wait for anyone to tell you."

## Submarine landslides scary, rare

Scientists are also concerned about the possibility of massive underwater landslides in the Puerto Rico Trench north of the island, the deepest part of the Atlantic Ocean.

There is evidence that there once was an enormous slump on the steep-walled canyon, which if it were to happen again, could set off a tsunami of devastating proportions.

"But we don't know when, or if it would be one event or several," Hillebrandt said. "And there are fewer things we can do about submarine landslides. It's much harder to detect them."

Such events are "a concern," she said, "but there's a higher probability that we'll get something from an earthquake."

So scientists continue to focus on improving their knowledge of earthquakes and tsunamis here, and developing the Caribbean alert system.

"It's good for people to know: if you see sudden changes along the shoreline, sometimes there's a tsunami," Hillebrandt said.

Like on that day in 1918, when the sea suddenly retreated and came roaring back.



In Hilo, Hawaii, a mail truck lies half buried in the shambles of a residential community after a tidal wave devastated the community.