THE WALL STREET JOURNAL. ONLINE

December 29, 2004

COMMENTARY

Why There Was No Warning

By COSTAS SYNOLAKIS
December 29, 2004; Page A8

In the aftermath of the horrific Asian tsunamis of Dec. 26, that has killed more than all 20th- century tsunamis combined, many attempts will be made to place blame or quickly "fix" this problem. A little reflection on the history of past reaction to destructive tsunamis may help.

The history of tsunami hazard mitigation tracks well with the history of destructive tsunamis in the U.S. Following the 1946 Alaska tsunami that destroyed the Scotch Cap lighthouse in Unimak, Alaska, and then killed 173 people in Hawaii, the Pacific Tsunami Warning Center (PTWC) was established in Hawaii by a predecessor agency to the National Oceanic and Atmospheric Administration (NOAA).

Historical Picture Archive/CORBIS
'Under the Wave off Kanagawa,' by Hokusai

Following the 1960 Chilean tsunami that killed 1,000 people in Chile, 61 in Hawaii, and 199 in Japan, the International Tsunami Information Center, sponsored by the U.N., was formed to coordinate tsunami warning efforts of the Pacific countries. Many research and mitigation efforts were focused on the distant tsunami problem, ignoring the local tsunamis that we now know as far more common. Following the 1964 Alaskan tsunami that killed 120 people in the U.S., the Alaska Tsunami Warning Center in Palmer, Alaska, was established to confront the local tsunami problem. In 1968, the International Coordination Group for the Tsunami Warning System in the Pacific was formed by Unesco. Its purpose was to assure that tsunami watches, warning and advisory bulletins are disseminated throughout the Pacific to member states in accordance with specific procedures. It presently has 26 member states out of the 129 that participate in the U.N. Intergovernmental Oceanographic Commission (IOC). No membership fees are required, but a member country has to petition for the service and identify local disaster management officers capable to interpret and act in the event of a tsunami warning.

In 1992, a Ms 7.2 earthquake in California generated a tsunami that killed no one. It was the first subduction zone earthquake recorded on the U.S. west coast with modern instruments. It triggered concern that larger earthquakes could generate large local tsunamis along the heavily populated west coast. In response, the National Tsunami Hazard Mitigation Program (NTHMP) was formed in 1997.

* * *

Two innovations of the program were to create a tsunami forecasting capability and to introduce the concept of tsunami-resilient communities. At the same time, tsunamis started being reported around the Pacific Rim, on average about once a year. The National Science Foundation (NSF) funded even junior scientists and encouraged them to conduct field surveys to gather data to help validate the models and thus help build NOAA's forecasting capability. Combined, these innovations constitute a major advance in tsunami hazard mitigation for both local and distant tsunamis. Currently, inundation maps exist for many communities in the U.S.

To forecast tsunamis, tsunami measurements from the deep ocean are required. It took about 30 years to transform the idea of measuring tsunamis in the deep ocean to actually reporting such data in real time. The technical feat of transmitting data from an instrument on the sea floor at great ocean depths to a tsunami warning center in real time required exceptionally creative engineering. The new tsunami measuring technology has given science a new instrument -- the tsunameter -- that provides tsunami researchers and practitioners with the basic information to understand and predict tsunamis.

The second technology required to predict tsunamis is numerical models of tsunami dynamics. The tsunameter/model combination has transformed the warning function from tsunami detection to tsunami forecasting. In operational use, the tsunameter/model will eventually lead to accurate tsunami forecasts that save lives. Accurate forecasts lead to fewer false alarms that cost in lost productivity and in lost confidence in the warning system.

* * *

The images from Sri Lanka, India and Thailand that have filled our screens -- and the descriptions from survivors -- are sadly all too familiar, at least to those of us who have conducted tsunami field surveys. At times, some of us thought that we were revisiting images from Flores in 1992, or East Java in 1994, Irian Jaya in 1996, Papua New Guinea in 1998, and Vanuatu in 1999 -- to just mention catastrophes in countries with similar landscape and coastal construction.

The response of local residents and tourists, however, was unfamiliar, at least to tsunami field scientists for post-'90s tsunamis. In one report, swimmers felt the current associated with the leading depression wave approaching the beach, yet hesitated about getting out of the water because of the "noise" and the fear that there was an earthquake and they would be safer away from buildings. They had to be told by tourists from Japan -- a land where an understanding of tsunamis is now almost hard-wired in the genes -- to run to high ground. In another report, vacationers spending the day on Phi Phi were taken back to Phuket one hour after the event started. In many cases tsunami waves persist for several hours, and the transport was nothing less than grossly irresponsible.

Contrast these reactions with what happened in Vanuatu, in 1999. On Pentecost Island, a rather pristine enclave with no electricity or running water, the locals watch television once a week when a pick-up truck with a satellite dish, a VCR and a TV stops by each village. When the International Tsunami Survey Team visited days after the tsunami, they heard that the residents had watched a Unesco video prepared the year before, in the aftermath of the 1998 Papua New Guinea tsunami disaster. When they felt the ground shake during the 1999 earthquake, they ran to a hill nearby. The tsunami swept through, razing the village to the ground. Out of 500 people, only 3 died, and all three had been unable to run like the others. The tsunami had hit at night.

* * *

The angry questions that hundreds of thousands of family members of victims are asking, especially in Sri Lanka and India, are "what happened?" -- and "why did no one warn us before the tsunami hit?" The Pacific Tsunami Warning Center had issued a tsunami bulletin and had concluded that there was no danger for the Pacific nations in its jurisdiction. Why didn't it extend its warning to South and Southeast Asia? It is perhaps clear with hindsight that an Indian Ocean tsunami warning center should have been in place, or that the Indian Ocean nations should have requested coverage from the PTWC.

Clearly, the hazard had been grossly underestimated. To give governments the benefit of the doubt, the last transoceanic tsunami that had hit the region was in 1882, and this was caused by Krakatoa's eruption. Other large earthquakes along the Sumatra trench had not caused major tsunamis, or if they had, they had not been reported as devastating. Floods occur nearly every year, as do storms. Natural hazards that are less frequent tend to be ignored. No nation can be ready for every eventuality -- as 9/11 painfully demonstrated -- at least before a major disaster that identifies the risk. Without the governments of Indian Ocean nations having identified the risk, they probably did not feel they needed the services of the PTWC, however free. Even simple and inexpensive mitigation strategies such as public education possibly did not even occur as a possibility. The rapid tourist development of Sri Lanka may also have contributed to the government's inaction toward suggesting that some of the region's most beautiful shorelines may have hidden dangers.

* * *

But the occurrence of this massive and destructive tsunami does prove that megatsunamis can occur in the Indian Ocean. The Intergovernmental Oceanographic Commission should continue its efforts to develop a long-term approach to tsunami hazard mitigation through a coordinated program involving assessment, warning guidance, and mitigation aimed at at-risk communities. Improved numerical wave propagation models, new scientific studies to document paleotsunamis, and the deployment of tsunameters will help better monitor tsunami occurrences and develop inundation maps that will guide evacuation plans. As is done among Pacific nations, Indian ocean scientists, disaster managers, policy makers, and local communities need to work together toward the common goal of creating tsunami-resistant communities with access to accurate, timely tsunami warnings. A tsunami warning center needs to be established as soon as practical in the region, and the PTWC should act as an interim warning center.

Many developing countries do not have the resources and will need substantial assistance. Even among nations in the Pacific rim, only three have comprehensive inundation maps, and none, including the U.S., have probabilistic tsunami flooding maps that reflect the realities of the past 30 years. Unesco's IOC and the U.S. should help the effort in implementing the U.N.'s global tsunami hazard mitigation plan before the next Asian tsunami disaster strikes.

Mr. Synolakis is professor of civil engineering at the University of Southern California.