BY BARBARA STAHURA

WALL OF WATER: TSUNAMI

A Deep-ocean Assessment and Reporting of Tsunamis (DART) buoy is deployed in the Pacific Ocean from the NOAA Ship *Ronald H. Brown* in October 1999. *Credit: NOAA Center for Tsunami Research*

It is difficult to imagine a wall of water rapidly moving in from the ocean that had been so peaceful just a few moments earlier. Yet that was the terrifying reality on Dec. 26, 2004, as a powerful earthquake beneath the Indian Ocean set in motion a tsunami of immense proportions. The large waves killed more than 200,000 people and destroyed communities across South and Southeast Asia.

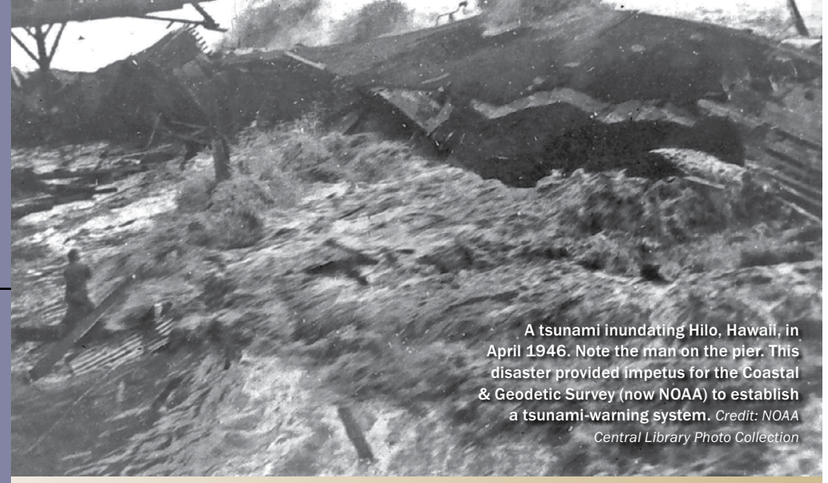
There have also been several deadly tsunamis in the United States. In 1946, a magnitude 8.0 earthquake in the Aleutian Islands resulted in a tsunami that killed 159 people in Hawaii. The magnitude 9.2 "Good Friday" earthquake of 1964 caused 106 deaths in Alaska, four deaths in Oregon, and 13 deaths in California. Although most tsunamis happen in the Pacific, the Atlantic Ocean and Caribbean Sea are not immune. In 1918, a magnitude 7.5 earthquake northeast of Puerto Rico killed 140 people.

Tsunami (soo-NAH-mee) is a Japanese word meaning "harbor wave." It is a series of long ocean waves created by the sudden displacement of water. Tsunamis are distinguished from ordinary ocean waves by the great length between wave peaks, often exceeding 100 miles in the deep ocean. Most tsunamis are generated by undersea earthquakes, but they can be caused by other sudden displacements of sea water, such as submarine landslides, volcanic eruptions, and in very rare instances, meteor strikes.

There are two types of tsunamis: local tsunamis and teletsunamis. A local tsunami is the result of an earthquake or water-displacement event occurring very close to shore. People in local tsunami-affected areas have only minutes to act. Teletsunamis are waves that travel from the source across the open ocean. These may take several hours to reach affected populations. There can be five minutes to one hour between the wave crests, and the series of wave crests can last for hours. The first wave may not be the largest. The second wave is often deadlier because it carries more debris.

NOAA's National Weather Service (NWS) operates two U.S. Tsunami Warning Centers (TWCs) that are staffed 24 hours a day, seven days a week. The TWCs are responsible for issuing tsunami advisories, watches, warnings, and information to emergency-management officials and the public. Warnings are broadcast through NOAA Weather Radio All Hazards, NOAA Weather Wire, the Emergency Alert System, and the Emergency Managers Weather Information Network, and can be accessed at http://www.weather.gov/view/national.php?map=on.

The West Coast & Alaska Tsunami Warning Center in Palmer, Alaska, is responsible for the U.S. Atlantic, Gulf of Mexico, Alaska, U.S. West Coast, and the British Columbia and Atlantic coasts in Canada. The Richard H. Hagemeyer Pacific Tsunami Warning Center in Ewa Beach, Hawaii, provides warnings to most countries in the Pacific Basin as well as to Hawaii and all other U.S. interests in the Western Pacific, Puerto Rico, and the U.S. Virgin Islands.



A tsunami inundating Hilo, Hawaii, in April 1946. Note the man on the pier. This disaster provided impetus for the Coastal & Geodetic Survey (now NOAA) to establish a tsunami-warning system. *Credit: NOAA Central Library Photo Collection*

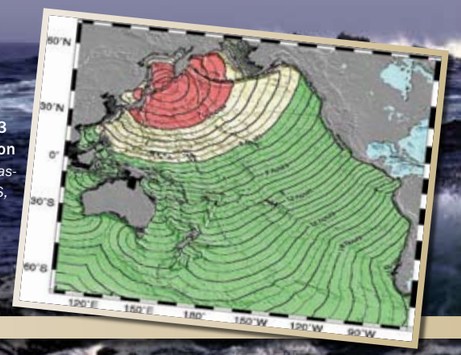
Tsunami forecasting is the key critical element of tsunami-warning operations. It is achieved by: monitoring and processing of seismic data and water-level measurements; data interpretation; model forecasting; warning creation, issuance and dissemination; data monitoring; and warning cancellation.

Once seismic information indicates an undersea or coastal quake, NOAA monitors the gauges and deep-ocean detectors to determine whether a tsunami has formed and, if so, its severity. Using sophisticated numerical modeling, NOAA produces faster and more reliable forecasts of its movement, called "transoceanic propagation," and where it will strike. The models also reveal inundation patterns for the at-risk coastal areas. NOAA's NWS issues tsunami watches and warnings — similar to hurricane and other severe weather watches and warnings — based on these models. Warnings and education save lives in the event of a tsunami.

As part of its Tsunami Warning System, NOAA's NWS established TsunamiReady, an initiative promoting tsunami preparedness in the United States that brings together federal, state, and local emergency management agencies, the public, and the NWS warning system. A voluntary program, TsunamiReady helps coastal communities gain the skills and education to prepare for and survive a tsunami.

NOAA's Tsunami Warning Centers work with other agencies, including the U.S. Geological Survey, the Federal Emergency Management Agency, and other federal, state, and local agencies through the National Tsunami Hazard Mitigation Program. NOAA's NWS office in Honolulu operates the International Tsunami Information Centre (ITIC), which was established in 1965 by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific, and Cultural Organization, or UNESCO.

NOAA Tsunami Warning Centers – www.noaa.gov/tsunamis.html
TsunamiReady – www.tsunamiready.noaa.gov
NOAA Center for Tsunami Research — http://nctr.pmel.noaa.gov/DART/index.html
West Coast/Alaska Tsunami Warning Center — http://wcatwc.arh.noaa.gov



A travel-time map of a tsunami that resulted from a magnitude 8.3 earthquake near the Kuril Islands on Nov. 15, 2006. *Credit: West Coast/Alaska Tsunami Warning Center, NOAA/NWS, http://wcatwc.arh.noaa.gov/previous.events/11.15.2006/11-15-06.html*