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NOAA and Tsunamis

Tsunamis do not have a season and do not occur regularly or frequently. Yet they pose a major threat to the coastal populations of the Pacific and other world oceans and seas. Nothing can be done to prevent them, but the adverse impact on the loss of life and property can be reduced with proper planning.

The National Oceanic and Atmospheric Administration oversees the U.S. Tsunami Program with its mission to provide a 24-hour detection and warning system and increase public awareness about the threat of tsunamis. The NOAA National Weather Service operates two tsunami warning centers that continuously monitor data from seismological and tidal stations, evaluate earthquakes that have the potential to generate tsunamis and disseminate tsunami information and warning bulletins to government authorities and the public. The West Coast/Alaska Tsunami Warning Center in Palmer, Alaska, and the Richard H. Hagemeyer Pacific Tsunami Warning Center in Ewa Beach, Hawaii, are the operational centers of a vigilant 24-hour U.S. tsunami warning system for the Pacific Rim.

General Information about Tsunamis

A tsunami is a series of ocean waves generated by any rapid large-scale disturbance of the sea water. Most tsunamis are generated by earthquakes, but they may also be caused by volcanic eruptions, landslides, undersea slumps or meteor impacts.

The waves radiate outward in all directions from the disturbance and can propagate across entire ocean basins. For example, in 1960 an earthquake in Chile caused a tsunami that swept across the Pacific to Japan. Tsunami waves are distinguished from ordinary ocean waves by their great length between peaks, often exceeding 100 miles in the deep ocean, and by the long amount of time between these peaks, ranging from five minutes to an hour. The speed at which tsunamis travel depends on the ocean depth. A tsunami can exceed 500 mph in the deep ocean but slows to 20 or 30 mph in the shallow water near land. In less than 24 hours, a tsunami can cross the entire Pacific Ocean.

In the deep ocean, a tsunami is barely noticeable and will only cause a small and slow rising and falling of the sea surface as it passes. Only as it approaches land does a tsunami become a hazard. As the tsunami approaches land and shallow water, the waves slow down and become compressed, causing them to grow in

height. In the best of cases, the tsunami comes onshore like a quickly rising tide and causes a gentle flooding of low-lying coastal areas.

In the worst of cases, a bore will form. A bore is a wall of turbulent water that can be several meters high and can rush onshore with great destructive power. Behind the bore is a deep and fast-moving flood that can pick up and sweep away almost anything in its path, such as what happened in Papua New Guinea in 1998 when more than 2,000 people were killed and villages destroyed. Minutes later, the water will drain away as the trough of the tsunami wave arrives, sometimes exposing great patches of the sea floor. But then the water will rush in again as before causing additional damage. See http://nctr.pmel.noaa.gov/PNG/png_pmel.html

This destructive cycle may repeat many times before the hazard finally passes. Persons caught in the path of a tsunami have little chance to survive. They can be easily crushed by debris or they may simply drown. Children and the elderly are particularly at risk, as they have less mobility, strength and endurance.

Tsunamis typically cause the most severe damage and casualties very near their source. There the waves are highest because they have not yet lost much energy to friction or spreading. In addition, the nearby coastal population, often disoriented from the violent earthquake shaking, has little time to react before the tsunami arrives. The largest tsunamis, however, can cause destruction and casualties over a wide area, sometimes as wide as the entire Pacific Basin. These types of Pacific-wide tsunamis may happen only a few times each century.

NOAA's Role in the U.S. Tsunami Program

Four NOAA agencies contribute to the U.S. Tsunami Program: National Weather Service, NOAA Research, NOAA Ocean Service and NOAA Satellites and Information Service. NOAA represents the U.S. as a member of the International Coordination Group for the Tsunami Warning System in the Pacific, administered by the Intergovernmental Oceanographic Commission of UNESCO.

As with any natural hazard, the more informed the public is, the better are the chances for survival. A strong public education program is one of the components of the National Tsunami Hazard Mitigation Program (NTHMP), a cooperative federal-state program created to help reduce the impacts of potential tsunamis to U.S. coastal areas. The NTHMP is a partnership between NOAA, the U.S. Geological Survey, the Federal Emergency Management Agency, the National Science Foundation, and the 28 U.S. Coastal States, Territories, and Commonwealths. Primary goals of NTHMP are to: 1) raise awareness of the affected population; 2) develop integrated tsunami maps and models that can be used to develop improved warning guidance and evacuation maps; 3) improve tsunami warning systems; 4) incorporate tsunami planning into state and federal multi-hazard programs. Go to <http://www.pmel.noaa.gov/tsunami-hazard/> for additional information about the NTHMP.

The DART buoy program is an effort to maintain and improve the capability for the early detection and real-time reporting of tsunamis in the open ocean. Originally developed by the NOAA Pacific Marine Environmental Laboratory as part of the NTHMP, the buoys send warning signals if they sense a change in sea level. Today, the NOAA National Data Buoy Center operates 39 tsunami buoys located in the Pacific and Atlantic Oceans, Caribbean Sea, and Gulf of Mexico and shares information from buoys operated by Chile, Australia, Indonesia, and Thailand. Go to <http://www.ndbc.noaa.gov/dart.shtml> for a map of current buoy deployments and real time data.

In 1946, a tsunami originating in the Aleutian Islands struck Hawaii and more than 150 people died. The tragedy prompted the development of a warning system for Hawaii and in 1949 the Pacific Tsunami Warning Center was established. Today the Richard H. Hagemeyer Pacific Tsunami Warning Center provides warnings to Hawaii, other U.S. interests in the Pacific Basin, countries participating in the Tsunami Warning System in the Pacific, and Indian Ocean and Caribbean Sea countries. The center is named for the late director of the National Weather Service Pacific Region who ran the U.S. Tsunami Program for 19 years. During his tenure, the Ewa Beach complex was modernized with many technological upgrades. Hagemeyer also was instrumental in advancing tsunami warning systems around the world. For additional information, visit <http://www.prh.noaa.gov/ptwc/>.

The West Coast/Alaska Tsunami Warning Center was established in 1967 as a direct result of the great Alaska earthquake that occurred March 27, 1964. Of 132 deaths, 122 were attributed to the Pacific-wide tsunami generated by the magnitude 9.2 earthquake. The Center's area of responsibility consists of Canadian coastal regions, Puerto Rico, the Virgin Islands, and the ocean coasts of all U.S. States except Hawaii. See <http://wcatwc.arh.noaa.gov>.

The Tsunami Ready Community program was created by the NOAA Weather Service to help communities become prepared for tsunamis through better planning, education and awareness. The program is voluntary and communities must meet certain criteria to receive the designation. Information on how to apply may be found at <http://wcatwc.arh.noaa.gov>.

The NOAA Weather Service hosts the International Tsunami Information Center in Honolulu, Hawaii, for the UNESCO Intergovernmental Oceanographic Commission. Publications and other tsunami information may be downloaded from <http://ioc3.unesco.org/itic/>

Tsunami data is archived at the NOAA National Geophysical Data Center in Boulder, Colo. <http://www.ngdc.noaa.gov/seg/hazard/tsu.shtml> Visit

<http://www.ngdc.noaa.gov> for additional information including photographs and slide sets.

The NOAA Ocean Service operates an extensive network of tide gauges used by the warning centers to determine if a tsunami has been generated. Additional information may be obtained from <http://tidesandcurrents.noaa.gov/>.

For more information visit the NOAA Tsunami Web site at: <http://www.tsunami.gov/> or contact [Delores Clark](#) in Honolulu, Hawaii, at (808) 532-6411; [Jana Goldman](#) in Silver Spring, Md., at (301) 713-2483.