

fact sheet • tsunami detection and warnings

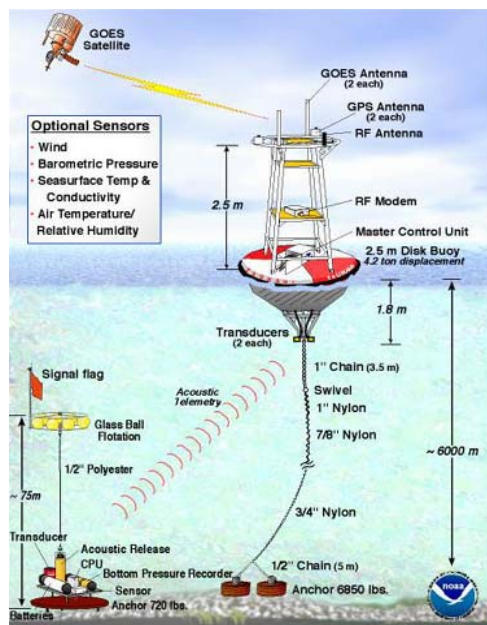


U.S. DEPARTMENT OF COMMERCE • U.S. DEPARTMENT OF THE INTERIOR

Tsunamis are a series of very long waves generated by any rapid, large-scale disturbance of the sea. Most are generated by sea floor displacements from large undersea earthquakes, the remainder produced by volcanoes and large undersea landslides. A tsunami can exceed 500 mph in the deep ocean but slows to 20 or 30 mph in the shallow water near land. Tsunamis can cause great destruction and loss of life within minutes on shores near their source, and some tsunamis can cause destruction within hours across an entire ocean basin.

Approximately 85 percent of tsunamis occur in the Pacific region but they are known to happen in every ocean and sea. Before December 26, 2004, the last cross-ocean tsunami in the Indian Ocean that resulted in thousands of casualties and widespread destruction occurred in 1883. Although infrequent, tsunamis are a significant natural hazard with great destructive potential. They can only be dealt with effectively through programs of warning, mitigation, and education.

The National Oceanic and Atmospheric Administration (NOAA) 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. NOAA 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.



Tsunami Warning System buoys (DART). *Graphic by NOAA Pacific Marine Environmental Laboratory, Seattle.*

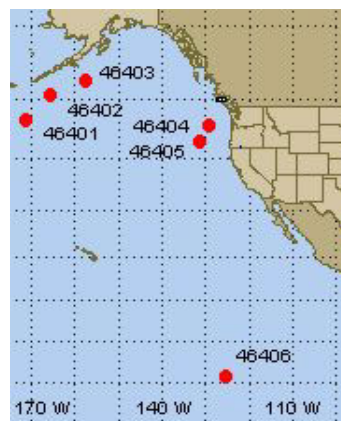
The U.S. Geological Survey contributes to tsunami warning by providing high-quality data from global and national seismic station networks, by issuing accurate and timely earthquake alerts and assessments, and through basic research on historical tsunamis and their effects.

The Pacific Tsunami Warning Center in Hawaii and the West Coast/Alaska Tsunami Warning Center in Alaska are the operational centers of the 24-hour U.S. tsunami warning system for the Pacific Rim. The Pacific Tsunami Warning Center provides warnings for tsunamis to most countries in the Pacific basin.

The U.N. Intergovernmental Oceanographic Commission established the International Coordination Group for the Tsunami Warning System in the Pacific in 1968. Its function is to assure that tsunami watches, warnings, and advisory bulletins are disseminated throughout the Pacific to 26 member states.

Global Earthquake Monitoring and Alerting by the U.S. Geological Survey

The U.S. Geological Survey operates the National Earthquake Information Center (NEIC) and, jointly with the National Science Foundation, the Global Seismographic Network (GSN). Together, these efforts allow the rapid characterization of earthquakes worldwide, as seismologists at NEIC routinely obtain and analyze data from GSN stations



DART buoy locations in the Pacific. NOAA's Pacific Marine Environmental Laboratory developed the Deep-ocean Assessment and Reporting of Tsunamis (DART) buoy that uses sensors to measure a tsunami as a way for an early-warning device in the deep ocean. Following successful research tests, the system made the move to operations in October 2003.

within minutes of an earthquake and issue earthquake bulletins, alerts and other products. Currently about 80 percent of the 130 stations of the GSN are available in near-real-time, and can be used for tsunami warning purposes. USGS NEIC staff work closely with personnel at the Pacific and Alaska Tsunami Warning Centers to ensure the timely transfer of critical data for the assessment of tsunami potential, such as source location, depth and magnitude. Since the 1960s, the USGS has worked with the PTWC and ATWC to install seismic stations and provide data supporting tsunami warning. The National Tsunami Hazard Mitigation Program, which was designed to maximize the efficiency of detecting tsunami threats, issuing warnings and responding to tsunami damage, relies on a number of GSN stations and ongoing cooperation between USGS, NOAA, FEMA and the western U.S. coastal states.

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In 1997 the USGS, NOAA and the five Pacific U.S. states joined in a partnership to enhance the quality and quantity of seismic data provided to the NOAA tsunami-warning centers in Alaska and Hawaii. The project, named the Consolidated Reporting of Earthquakes and Tsunamis (CREST), now provides the warning centers with real-time seismic data over dedicated communication links and the Internet from regional seismic networks monitoring earthquakes in the five states, the U.S. National Seismic Network in Colorado, and from domestic and global seismic stations operated by other agencies. The goal of the project is to reduce the time needed to issue a tsunami warning by providing the warning centers with the technology needed to produce warnings in near real-time. At the end of the five-year project new or upgraded field instrumentation will be installed at about 56 seismic stations in the five western states.

USGS also conducts research on tsunamis and their effects, and has provided critical understanding of how sediments are transported during tsunami run-up and toward deciphering the geologic record of prehistoric tsunamis.

The Tsunami Detection and Warning System

Seismic Data: NOAA receives data from a network of seismometers that record earthquake shaking. These instruments are throughout the Pacific basin, Alaska, and the lower 48 states. This data is transmitted to computers in the Pacific and Alaska Tsunami Warning Centers.

Water Level Data: Detecting a tsunami is done by checking tide gauges and tsunami detectors, which are located in coastal areas and throughout the Pacific basin.

Bulletin and Warning Dissemination: Within the Pacific region, the information is disseminated to emergency officials, media, and the public by special communications lines, satellite, Internet, and telephones.

NOAA's Pacific Tsunami Warning Center (PTWC) was established in 1949, following the 1946 tsunami in Hawaii that left more than 150 people dead. The PTWC serves as the opera-

tional headquarters for the International Tsunami Warning System in the Pacific, working closely with the U.N. Intergovernmental Oceanographic Commission International Coordination Group to provide timely tsunami warnings to Pacific nations.

NOAA helped create the National Tsunami Hazard Mitigation Program, a multi-state, multi-agency effort designed to develop mitigation strategies to help communities prepare for tsunamis, such as designing a standard evacuation route sign system, creating inundation maps, developing communication and education tools, and encouraging tsunami research.

To increase awareness about tsunamis, the NOAA National Weather Service began the voluntary TsunamiReady Community program that helps areas prepare for such events. To date, there are 15 communities in Hawaii, Alaska, Washington, Oregon, and California that have met the TsunamiReady criteria.

The Coastal Ocean Program at the NOAA Ocean Service supported development of two tools for dealing with Tsunami Hazards: model-based inundation maps and the deep ocean warning system. Inundation maps, developed by the NOAA Pacific Marine Environmental Laboratory, identify areas that are susceptible to flooding before a tsunami occurs and are used to develop evacuation and land-use plans. The NOAA Ocean Service also operates an extensive network of tide gauges used by the warning centers to determine if a tsunami has been generated.

GEOSS

The Global Earth Observing System of Systems (GEOSS) initiative is led by the United States, Japan, South Africa, and the European Commission—with 54 nations currently participating at the ministerial level. Two key focus areas of the GEOSS initiative are “reducing loss of life and property due to disasters” and “monitoring our oceans.”

India, Indonesia, and Thailand are partners in the international effort to develop GEOSS, which provides a logical venue to undertake a coordinated global initiative to improve tsunami warning systems. Retired Navy Vice Adm. Conrad Lautenbacher, Ph.D., the NOAA administrator and under secretary of Commerce, and Charles Groat, Ph.D., the U.S. Geological Survey director, will be members of the U.S. delegation at the Feb 16, 2005, third Earth Observation Summit and will work to ensure that the development of a global tsunami warning system is a high priority for GEOSS.

For more information, visit www.noaa.gov/eos.html. For more information on tsunamis, visit www.noaa.gov/tsunamis.html.

Pacific Tsunami Warning System member nations

Australia	El Salvador	Peru
Canada	Fiji	Republic of the Philippines
Chile	France	Republic of Korea
China	Guatemala	Russian Federation
Colombia	Indonesia	Samoa
Cook Islands	Japan	Singapore
Costa Rica	Mexico	Thailand
Democratic People's Republic of Korea	New Zealand	United States of America
Ecuador	Nicaragua	

The network includes national tsunami warning centers, regional tsunami warning centers (PTWC, Hawaii; WC/ATWC, Alaska; NWPTIC, Japan; CPPT, Tahiti; and SNAM, Chile) and the International Tsunami Information Centre (ITIC) in Honolulu, Hawaii.



NOAA is dedicated to enhancing economic security and national safety through the prediction and research of weather and climate-related events and providing environmental stewardship of the nation's coastal and marine resources.



USGS serves the nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.