



Tsunami

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Why talk about tsunamis?

Twenty-four tsunamis have caused damage in the United States and its territories during the last 204 years. Just since 1946, six tsunamis have killed more than 350 people and caused a half billion dollars of property damage in Hawaii, Alaska, and the West Coast. As a tsunami nears the coastline, it may rise to several feet or, in rare cases, tens of feet, and can cause great loss of life and property damage when it comes ashore. Tsunamis can travel upstream in coastal estuaries and rivers, with damaging waves extending farther inland than the immediate coast. A tsunami can occur during any season of the year and at any time, day or night.

What are tsunamis, and what causes them?

Tsunamis are ocean waves produced by earthquakes or underwater landslides. The word is Japanese and means “harbor wave,” because of the devastating effects these waves have had on low-lying Japanese coastal communities. Tsunamis are often incorrectly referred to as tidal waves, but

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a tsunami is actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour in the open ocean. In the open ocean, tsunamis would not be felt by ships because the wavelength would be hundreds of miles long, with an amplitude of only a few feet. This would also make

them unnoticeable from the air. As the waves approach the coast, their speed decreases and their amplitude increases. Unusual wave heights have been known to be over 100 feet high. However, waves that are 10 to 20 feet high can be very destructive and cause many deaths or injuries.

Tsunamis are most often generated by earthquake-induced movement of the ocean floor. Landslides, volcanic eruptions, and even meteorites can also generate a tsunami. If a major earthquake is felt, a tsunami could

reach the beach in a few minutes, even before a warning is issued. Areas at greatest risk are less than 25 feet above sea level and within one mile of the shoreline. Most deaths caused by a tsunami are because of drowning. Associated risks include flooding, contamination of drinking water, fires from ruptured tanks or gas lines, and the loss of vital community infrastructure (police, fire, and medical facilities).

From an initial tsunami generating source area, waves travel outward in all directions much like the ripples caused by throwing a rock into a pond. As these waves approach coastal areas, the time between successive wave crests varies from 5 to 90 minutes. The first wave is usually not the largest in the series of waves, nor is it the most significant. Furthermore, one coastal community may experience no damaging waves while another, not that far away, may experience destructive deadly waves. Depending on a number of factors, some low-lying areas could experience severe inland inundation of water and debris of more than 1,000 feet.

Learn whether tsunamis have occurred in your area by contacting your local emergency management office, National Weather Service office, or [American Red Cross chapter](#). If you are in a tsunami risk area, learn how to protect yourself, your family, and your property.

Awareness Information

[The West Coast/Alaska Tsunami Warning Center \(WC/ATWC\)](#) is responsible for tsunami warnings for California, Oregon, Washington, British Columbia, and Alaska.

The Pacific Tsunami Warning Center (PTWC) is responsible for providing warnings to international authorities, Hawaii, and U. S. territories within the Pacific basin. The two Tsunami Warning Centers coordinate the information being disseminated.

All tsunamis are potentially dangerous, even though they may not damage every coastline they strike. Damaging tsunamis are very rare. Our coastlines are vulnerable, but tsunamis are infrequent. Understand the hazard and learn how to protect yourself, but don't let the threat of tsunamis ruin your enjoyment of the beach.

The WC/ATWC and PTWC may issue the following bulletins:

- **WARNING:** A tsunami was or may have been generated, which could cause damage; therefore, people in the warned area are strongly advised to evacuate.
- **WATCH:** A tsunami was or may have been generated, but is at least two hours travel time to the area in watch status. Local officials should prepare for possible evacuation if their area is upgraded to a warning.
- **ADVISORY:** An earthquake has occurred in the Pacific basin, which might generate a tsunami. WC/ATWC and PTWC will issue hourly bulletins advising of the situation.

- **INFORMATION:** A message with information about an earthquake that is not expected to generate a tsunami. Usually only one bulletin is issued.

Be familiar with the tsunami warning signs. A strong earthquake lasting 20 seconds or more near the coast may generate a tsunami. A noticeable rapid rise or fall in coastal waters is also a sign that a tsunami is approaching.

Tsunamis most frequently come onshore as a rapidly rising turbulent surge of water choked with debris. They are not V-shaped or rolling waves, and are not “surfable.”

Tsunamis may be locally generated or from a distant source. In 1992, the Cape Mendocino, California, earthquake produced a tsunami that reached Eureka in about 20 minutes, and Crescent City in 50 minutes. Although this tsunami had a wave height of about one foot and was not destructive, it illustrates how quickly a wave can arrive at nearby coastal communities and how long the danger can last.

In 1957, a distant-source tsunami generated by an earthquake in the Aleutian Islands in Alaska struck Hawaii, 2,100 miles away. Hawaii experienced \$5 million in damages from that tsunami.

Plan for a Tsunami

Develop a Family Disaster Plan. Please see the **“Family Disaster Plan”** section for general family planning information. Tsunami-specific planning should include the following:

- Learn about tsunami risk in your community. Contact your local emergency management office or American Red Cross chapter. Find out if your home, school, workplace or other frequently visited locations are in tsunami hazard areas. Know the height of your street above sea level and the distance of your street from the coast or other high-risk waters. Evacuation orders may be based on these numbers.
- If you are visiting an area at risk from tsunamis, check with the hotel, motel, or campground operators for tsunami evacuation information and how you would be warned. It is important to know designated escape routes before a warning is issued.

If you are at risk from tsunamis, do the following:

- Plan an evacuation route from your home, school, workplace, or any other place you’ll be where tsunamis present a risk. If possible, pick an area 100 feet above sea level or go up to two miles inland, away from the coastline. If you can’t get this high or far, go as high as you can. Every foot inland or upwards may make a difference. You should be able to reach your safe location on foot within 15 minutes. After a disaster, roads may become impassable or blocked. Be prepared

to evacuate by foot if necessary. Footpaths normally lead uphill and inland, while many roads parallel coastlines. Follow posted tsunami evacuation routes; these will lead to safety. Local emergency management officials can help advise you as to the best route to safety and likely shelter locations.

- Practice your evacuation route. Familiarity may save your life. Be able to follow your escape route at night and during inclement weather. Practicing your plan makes the appropriate response more of a reaction, requiring less thinking during an actual emergency situation.
- Use a NOAA Weather Radio with a tone-alert feature to keep you informed of local watches and warnings. The tone alert feature

Assemble a Disaster Supplies Kit

Please see the section “Disaster Supplies Kit” for general supplies kit information. Tsunami-specific supplies should include the following:

- Disaster Supplies Kit basics.
- Evacuation Supplies Kit in an easy-to-carry container (backpack) near your door.

will warn you of potential danger even if you are not currently listening to local radio or television stations.

- Talk to your insurance agent. Homeowners’ policies do not cover flooding from a tsunami. Ask about the National Flood Insurance Program.
- Discuss tsunami with your family. Everyone should know what to do in case all family members are not together. Discussing tsunamis

ahead of time will help reduce fear and anxiety, and let everyone know how to respond. Review flood safety and preparedness measures with your family.

How to Protect Your Property

- Avoid building or living in buildings within several hundred feet of the coastline. These areas are more likely to experience damage from tsunamis, strong winds, or coastal storms.
- Make a list of items to bring inside in the event of a tsunami. A list will help you remember anything that can be swept away by tsunami waters.
- Elevate coastal homes. Most tsunami waves are less than 10 feet. Elevating your house will help reduce damage to your property from most tsunamis.
- Follow **flood** preparedness precautions. Tsunamis are large amounts of water that crash onto the coastline, creating floods.
- Have an engineer check your home and advise about ways to make it more resistant to tsunami water. There may be ways to divert waves away from your property. Improperly built walls could

make your situation worse. Consult with a professional for advice.

Media and Community Education Ideas

- If your community is at risk, build and publicize locations of tsunami evacuation routes. Post signs directing people to higher ground away from the coast.
- Review land use in tsunami hazard areas so no critical facilities, such as hospitals and police stations; or high occupancy buildings, such as auditoriums or schools; or petroleum-storage tank farms are located where there is a tsunami hazard. Tsunami damage can be minimized through land use planning, preparation, and evacuation.
- Publish a special section in your local newspaper with emergency information on tsunamis. Localize the information by printing the phone numbers of local emergency services offices, the American Red Cross chapter, and hospitals.
- Periodically inform your community of local public warning systems.
- Work with local emergency services and American Red Cross officials to prepare special reports for people with mobility impairments on what to do if an evacuation is ordered, and develop plans to assist them with evacuation if necessary.
- Interview local officials and insurance companies about the proper types of insurance to cover a flood-related loss. Include information on the economic effects of disaster.

What to Do if You Feel a Strong Coastal Earthquake

If you feel an earthquake that lasts 20 seconds or longer when you are on the coast:

- Drop, cover, and hold on. You should first protect yourself from the earthquake.
- When the shaking stops, gather your family members and evacuate quickly. Leave everything else behind. A tsunami may be coming within minutes. Move quickly to higher ground away from the coast.
- Be careful to avoid downed power lines and stay away from buildings and bridges from which heavy objects might fall during an aftershock.

What to Do When a Tsunami WATCH Is Issued

- Listen to a NOAA Weather Radio, Coast Guard emergency frequency station, or other reliable source for updated emergency information. As the energy of a tsunami is transferred through open water, it is not detectable. Seismic action may be the only advance

warning before the tsunami approaches the coastline.

- Check your Disaster Supplies Kit. Some supplies may need to be replaced or restocked.
- Locate family members and review evacuation plans. Make sure everyone knows there is a potential threat and the best way to safer ground.
- If you have special evacuation needs (small children, elderly people, or persons with disabilities) consider early evacuation. Evacuation may take longer, allow extra time.
- If time permits, secure unanchored objects around your home or business. Tsunami waves can sweep away loose objects. Securing these items or moving them inside will reduce potential loss or damage.
- Be ready to evacuate. Being prepared will help you to move more quickly if a tsunami warning is issued.

What to Do When a Tsunami WARNING Is Issued

- Listen to a NOAA Weather Radio, Coast Guard emergency frequency station, or other reliable source for updated emergency information. Authorities will issue a warning only if they believe there is a real threat from tsunami.
- Follow instructions issued by local authorities. Recommended evacuation routes may be different from the one you use, or you may be advised to climb higher.
- If you are in a tsunami risk area, do the following:
 - If you hear an official tsunami warning or detect signs of a tsunami, evacuate at once. A tsunami warning is issued when authorities are certain that a tsunami threat exists, and there may be little time to get out.
 - Take your Disaster Supplies Kit. Having supplies will make you more comfortable during the evacuation.
 - Get to higher ground as far inland as possible. Officials cannot reliably predict either the height or local effects of tsunamis. Watching a tsunami from the beach or cliffs could put you in grave danger. If you can see the wave, you are too close to escape it.

Return home only after local officials tell you it is safe. A tsunami is a series of waves that may continue for hours. Do not assume that after one wave the danger is over. The next wave may be larger than the first one.

What to Do After a Tsunami

- Continue listening to a NOAA Weather Radio, Coast Guard emergency frequency station, or other reliable source for emergency information. The tsunami may have damaged roads, bridges, or other places that may be unsafe.
- Help injured or trapped persons. Give first aid where appropriate. Call for help. Do not move seriously injured persons unless they are in immediate danger of further injury.
- Help a neighbor who may require special assistance — infants, elderly people, and people with disabilities. Elderly people and people with disabilities may require additional assistance. People who care for them or who have large families may need additional assistance in emergency situations.
- Use the telephone only for emergency calls. Telephone lines are frequently overwhelmed in disaster situations. They need to be clear for emergency calls to get through.
- Stay out of the building if waters remain around it. Tsunami waters, like flood waters, can undermine foundations, causing buildings to sink, floors to crack, or walls to collapse.
- When re-entering buildings or homes, use extreme caution. Tsunami-driven flood waters may have damaged buildings where you least expect it. Carefully watch every step you take.
 - Wear sturdy shoes. The most common injury following a disaster is cut feet.
 - Use battery-powered lanterns or flashlights when examining buildings. Battery-powered lighting is the safest and easiest, preventing fire hazard for the user, occupants, and building.
 - Examine walls, floors, doors, staircases, and windows to make sure that the building is not in danger of collapsing.
 - Inspect foundations for cracks or other damage. Cracks and damage to a foundation can render a building uninhabitable.
 - Look for fire hazards. There may be broken or leaking gas lines, flooded electrical circuits, or submerged furnaces or electrical appliances. Flammable or explosive materials may come from upstream. Fire is the most frequent hazard following floods.
 - Check for gas leaks. If you smell gas or hear a blowing or hissing noise, open a window and quickly leave the building. Turn off the gas using the outside main valve if you can, and call the gas company from a neighbor's home. If you turn off the gas for any reason, it must be turned back on by a professional.

- Look for electrical system damage. If you see sparks or broken or frayed wires, or if you smell burning insulation, turn off the electricity at the main fuse box or circuit breaker. If you have to step in water to get to the fuse box or circuit breaker, call an electrician first for advice. Electrical equipment should be checked and dried before being returned to service.
 - Check for sewage and water line damage. If you suspect sewage lines are damaged, avoid using the toilets and call a plumber. If water pipes are damaged, contact the water company and avoid using water from the tap. You can obtain safe water from undamaged water heaters or by melting ice cubes.
 - Use tap water if local health officials advise it is safe.
 - Watch out for animals, especially poisonous snakes, that may have come into buildings with the water. Use a stick to poke through debris. Tsunami flood waters flush snakes and animals out of their homes.
 - Watch for loose plaster, drywall, and ceilings that could fall.
 - Take pictures of the damage, both of the building and its contents, for insurance claims.
- Open the windows and doors to help dry the building.
 - Shovel mud while it is still moist to give walls and floors an opportunity to dry.
 - Check food supplies. Any food that has come in contact with flood waters may be contaminated and should be thrown out.