



TSUNAMI



IF AN EARTHQUAKE OCCURS...



AND YOU MUST HOLD ONTO SOMETHING TO KEEP FROM FALLING...

HEAD FOR HIGH GROUND...



AS STRONG EARTHQUAKES CAN CAUSE TSUNAMIS

Modified from
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National Oceanic and Atmospheric Administration
National Weather Services

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MINERAL RESOURCES DEPARTMENT

TSUNAMIS

What is a Tsunami ?

A tsunami is a series of travelling ocean waves of extremely long length and period, generated by disturbances associated with earthquakes occurring below or near the ocean floor. A tsunami proceeds as an ordinary gravity wave in the deep ocean with speeds of up to 1,000 kilometres per hour (km/hr), but when it enters the shallower water the waves steepen and increase in height, inundating low-lying areas; and where local submarine topography is steep, the waves may break and cause great damage. It is in these shallow waters that tsunamis become a threat to life and property, for they can crest to heights of 30-50m and strike with devastating force.

Tsunamis are also called seismic sea waves and more popularly "tidal waves". The name tidal wave is misleading and should not be used for earthquake-generated sea waves. because these waves are not related to tides.

What Causes a Tsunami ?

Most tsunamis are generated by shallow focus earthquakes along areas of subduction. Underwater volcanic eruptions and landslides can also generate tsunamis. The Suva tsunami in 1953 was caused by massive underwater slumping of sediments during an earthquake. An earthquake-generated tsunami is caused by displacement that drops or lifts part of the sea floor rapidly (along a fault). This imparts enormous potential energy into the overlying water mass with drastic changes in the sea level over the affected region, generating a series of sea waves (tsunami). Tsunami generation is dependent on factors such as an earthquake's magnitude and depth, water depth in the region, the amount of vertical displacement of the sea floor and the speed of this displacement.

How Does a Tsunami Work ?

Tsunamis travel outward in all directions from the generating area. Their speeds depend on the depth of water, so that the waves undergo slowing down or speeding up over an ocean bottom of varying depth. In the deep and open ocean, they travel at speeds of 500 to 1,000 km/hr. The length of the waves from crest to crest can be as much as 500 to 650 kilometres and the height from trough to crest may be no more than 30 to 60 centimetres. A tsunami has enormous energy of motion and unlike other waveforms a tsunami extends through the entire water column from sea surface to the ocean bottom.

Upon reaching shallower water, *the* speed of the advancing tsunami wave diminishes, its wave length decreases, and its height may increase greatly, owing to the piling up of water. Configuration of the coastline, shape of the ocean floor, and character of the advancing waves play important role in the destruction brought by tsunamis along any coast. The first visible indication of an approaching tsunami is often a recession of

water and therefore any withdrawal of the sea should be considered a warning of an approaching wave. A tsunami is not one wave and the time lapse between the passage of successive wave crests at a given point usually is from 10 to 45 minutes. Destructive oscillations may continue for several hours, and several days may pass before the sea returns to its normal state.

Tsunamis are most dangerous when they are generated near shore because they strike a very short time after their generation. They could strike within minutes.

Have There Been Recent Destructive Tsunamis ?

At least seven tsunamis have occurred in the Pacific rim resulting from near-shore earthquakes in the ten years from 1975 causing loss of life and property. These have been: Hawaii, 1975, 2 lives lost; Philippines, 1976, 8,000 lives lost; Indonesia, 1977, 189 lives lost; Indonesia, 1979, 40 lives lost; New Guinea, 1979, 100 lives lost; Colombia, 1979, an estimated 500 lives lost; and Sea of Japan, 1983, approximately 100 lives lost.

How Far Can a Tsunami Travel ?

A large tsunami generated anywhere in the Pacific is capable of causing destruction at long distances. One such example is that generated by the 1960 Chilean earthquake. This large (magnitude 9.2) earthquake caused the most destructive Pacific-wide tsunami of recent history. About 2,000 people were killed in Chile by the joint action of the earthquake and the tsunami, another 3,000 were injured and about 2,000,000 were made homeless. The waves were estimated to be about 20m high. Further from Chile, the tsunami arrived at Suva 13 hours later and damaged several ships anchored at Walu Bay. The tsunami caused 61 deaths in Hawaii, 20 in the Philippines and 100 more in Japan. The damage in monetary terms was immense. The wave-heights were estimated to be about 11m at Hilo, Hawaii and 6m at various places in Japan. This shows that tsunamis generated even at distant locations can be highly destructive.

Is a Tsunami Likely in Fiji ?

Fiji, being an island nation surrounded by ocean, is particularly vulnerable to tsunamis. However, most of Fiji's coastline is protected by coral reefs and the waves generated by tsunamis outside these reefs lose most of their energy when they break onto the reef. We may not, therefore, see gigantic waves on our shores, but we can still suffer considerable damage from smaller waves and flooding. The effect can be greatly enhanced at high tides.

Have Tsunamis Struck Fiji ?

Eleven tsunamis have been recorded in Fiji, of which three were generated within Fiji waters. The most damaging tsunami in Fiji was in 1953. It claimed five lives in Suva and Kadavu, and flooded parts of Suva City. The wave heights in Suva were estimated to be about 2m and about 5m at Nakasaleka in Kadavu. The tsunami occurred at low tide, and had it occurred at a high tide the damage would have been more severe. The tsunami resulted from a massive underwater slumping of sediments caused by an earthquake offshore from Suva. The first of the tsunami waves reached Suva only about three minutes after the earthquake. A small tsunami was generated in 1975 by a moderate earthquake in Kadavu Passage, and once again the tsunami resulted from an underwater landslide. This leaves little doubt that a large earthquake, similar to the 1953 earthquake near Suva, can generate another damaging tsunami. The 1953 disaster showed that the tsunamis are most dangerous when generated by earthquakes close to you, as you do not get any other warning that a tsunami may have been generated.

Can You be Warned of an Approaching Tsunami ?

The "Pacific Tsunami Warning Center" (PTWC), based in Honolulu, Hawaii and managed by the National Oceanic and Atmospheric Administration (NOAA) of USA issues warnings for the Pacific. It

is also the centre for the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU). Fiji is a member of this group. The warning centre has proved effective in issuing warnings to countries that are at long distances from the source of a tsunami, and has saved a lot of lives since 1952 through timely warnings. However, it is not always effective in warning people close to the tsunami source because the tsunami may have already struck coastal areas close to the source before the Center can issue a warning.

How Can You be Warned ?

The tsunami messages issued by PTWC for Fiji are relayed through the well-developed communications system, of the Fiji Meteorological Services. The authorities in Fiji study the message and decide whether or not to issue a tsunami warning for Fiji. For a distant tsunami, a tsunami watch is issued first. If a tsunami is observed six hours away from Fiji (see map), an alert for Fiji is issued, and if the tsunami is likely to cause damage, a warning for Fiji will be issued three hours before the predicted arrival of the tsunami. Tsunami watch and tsunami alert are issued to Fiji authorities; Fiji authorities issue tsunami warning to the public.

For a strong earthquake within the Fiji area a tsunami warning is pertinent to Fiji immediately; however the warning may not be issued in time to be useful. All tsunami messages will be broadcast on the radio and if a **warning is issued then you are requested to follow the advice given on the radio.** However:

Remember if you are in a coastal area and you feel strong shaking due to an earthquake, then that may be the only warning you get before a tsunami strikes. Take appropriate action as outlined in the following "Tsunami Safety Rules".

Tsunami Safety Rules

Stand by for the tsunami emergency when you hear that a large earthquake has occurred.

Head for higher ground if you feel a strong earthquake and you are near the shore. An earthquake in your area is a natural tsunami warning.

Stay out of danger areas until "all clear" is issued by the authorities, because a tsunami is not a single wave, but a series of waves.

Nature's tsunami warning - any sudden rise or fall of coastal water signals an approaching tsunami.

Pay respect to all tsunamis. A small tsunami at one point on the shore can be extremely large a few kilometres away.

Be prepared for the worst. A tsunami warning will only be issued when a tsunami exists. This means that a tsunami has been observed somewhere else and there is no way of knowing what the effect will be on the coastlines of Fiji.

All tsunamis are potentially dangerous even though they may not damage every coastline they strike.

Keep your distance. Never go down to the shore to watch for a tsunami. When you can see the wave you are too close to escape it.

Warnings apply to you if you live in a coastal area, because sooner or later, a tsunami will visit the coastline close to you.

Please co-operate. During a tsunami emergency the emergency organisations such as the Police, the Red Cross and other organisations will try to save your life.

Remember - always "Be Prepared"