

Tsunami Leaflet

Causes and typical phenomena of Tsunamis and what to do in the event of an acute Tsunami risk or warning

Prepared by Prof. Peter Bormann

This leaflet is intended to inform those staying temporarily or for longer periods in coastal regions at risk of tsunamis

- about the causes and characteristics of tsunamis,
- where tsunamis can occur,
- how frequently tsunamis occur, with and without damage,
- what effects large tsunamis have,
- about tsunami early detection and warning,
- about questions one should be asked in regions at risk of tsunamis, and
- about preventive action and what to do in acute situations.

Summary

- Tsunamis consist of a series of consecutive, very long period sea waves. These are mostly caused by strong submarine earthquakes, but also by volcanic eruptions or landslides.
- Tsunamis can cause enormous damage to coastal areas near to their origin and cost many lives within a few minutes. But the effects of large tsunamis can also unfold on far distant coasts, as they can propagate across whole ocean basins within hours.
- The speed with which tsunamis spread depends on the water depth. In shallow water they reach speeds of around 30 to 50 km/h and in deep oceans over 800 km/h.
- The distances between the wave crests in deep, open sea is several hundred km and reduce in shallow water areas to around 10 km. The wave crests occur at intervals of around 10 minutes up to an hour.
- The wave crests are low in deep, open sea, mostly between 30 and 80 cm and are harmless. As they approach the coast, especially in shallow bays, they can reach heights of over 10 m, and in extreme cases they can be more than 30 to 50 m high, flooding flat land behind the coast up to several kilometres inland and can cause horrific devastation.
- Most tsunamis occur in the Pacific Ocean, although they also arise in all other oceans and sea areas. Although tsunamis rarely occur, they pose a great threat, as the disaster of 26.12.2004 in the Indian Ocean shows.
- The risks triggered by tsunamis can only be countered with prevention and early warning programmes and broad public information.
- To date, an operative international tsunami warning system and several national systems have only existed in the Pacific. They are currently being developed or planned for other oceans and seas.
- The existing tsunami warning systems have to date only been effective in alarming coasts that are several hundred or thousands of kilometres away from the area of origin. This enables early warning times of tens of minutes up to several hours. Warnings can then be given through various media and, in the best case, orderly evacuation of the coastal regions directly at risk can also be realised. In such cases, the disaster and civil defence organisations' instruction must always be followed.

- In the case of local, which reach nearby coastal zones within a few minutes, at best warning signals and brief instructions can be broadcast, calling upon the population to immediately evacuate the areas at risk of potential flooding. The people must then move, as soon as possible, to higher ground, locations further away from the coast or designated emergency accommodation, possibly in the upper storeys of stable reinforced concrete high-rise buildings or hotels.
- If ships or boats on the open sea receive tsunami early warnings, they should definitely not put into harbours or bays but should move as far away as possible from the coast until the all clear is given or after contacting harbour authorities who explicitly release calling at and anchoring in harbours again.
- If ships and boats in harbours or bays receive tsunami early warnings, and if the early warning time is sufficient to reach deeper open sea, they should immediately set sail. However, this can be risky for smaller and slower boats, especially in storms on high seas. The crew should then immediately go ashore and look for higher places of refuge as quickly as possible.
- A tsunami consists of several wave crests, which follow each other at intervals of tens of minutes up to more than one hour and frequently rise and accumulate in subsequent wave crest, reaching maximum heights at the coast. Therefore, people should never leave their refuges after the first wave(s) have receded. They may have to stay in the higher places of refuge for more than 5 hours and should not return to the lower-lying coastal areas until receiving an official all clear.
- Many countries at risk of tsunamis currently have neither technical-administrative early warning systems nor official plans for evacuation routes and refuges in the event of a disaster. Nevertheless, many lives can be saved by registering the following phenomena and acting as described above:
- If you are near the coast and feel a strong earthquake, you should immediately hasten to a higher refuge or a place far from the coast, as earthquakes near the coast can trigger tsunamis. However, only around 10 to 20% of all such quakes are followed by a dangerous tsunami. Nevertheless, you should not rashly return to lower areas close to the coast, but if possible should wait for an official all clear, unless you can safely assess from your position that a tsunami has not followed the initial tremors within an hour.
- If you feel strong earthquake tremors while in a building, follow the instructions in the [Earthquakes leaflet](#). If the building is located in the potential tsunami flood zone, leave the building immediately after the tremors recede and hurry to a higher location or a place further from the coast (exception: well-built reinforced concrete high-rise buildings not damaged by the earthquake).
- If you are on the coast and notice an unexpectedly fast rise or fall in the water level within minutes, you should also hurry to a higher location or a refuge further away from the coast. You should never run into bays that suddenly become dry. The first high tsunami wave will definitely follow within a few minutes.
- Inform the people near you of the phenomena you have registered and warn them accordingly.

For more details on the causes, characteristics, areas of origin and impact, frequency and effects of tsunamis and questions you should ask the authorities in regions at risk of tsunamis and what to do, please refer to the in-depth [Tsunami information sheet on the Internet: \[www.gfz-potsdam.de\]\(http://www.gfz-potsdam.de\)](#)

Please note: These informations and recommendations have been prepared to the best of our knowledge. Nevertheless, the GFZ German Research Centre for Geosciences cannot be made responsible or accept any liability whatsoever for losses incurred as a result of following the advice given here.