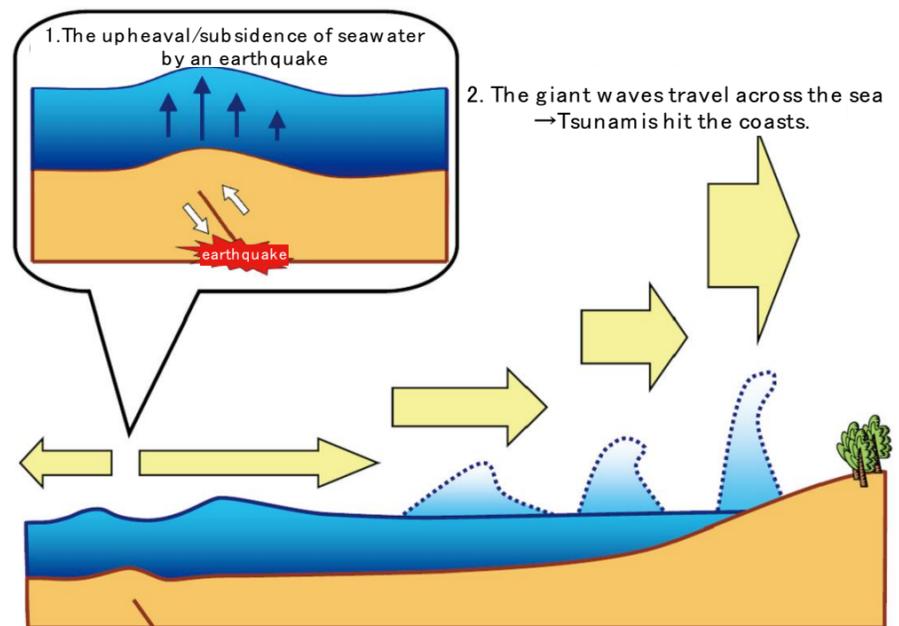


# Tsunami

The word *tsunami* (pronounced tsu-NAH-mee) is Japanese; it is derived from *tsu*, which means *harbor*, and *nami*, which means *wave*. A tsunami is a series of huge waves. It washes against the coast several times with great speed and force.

## How are tsunamis caused?

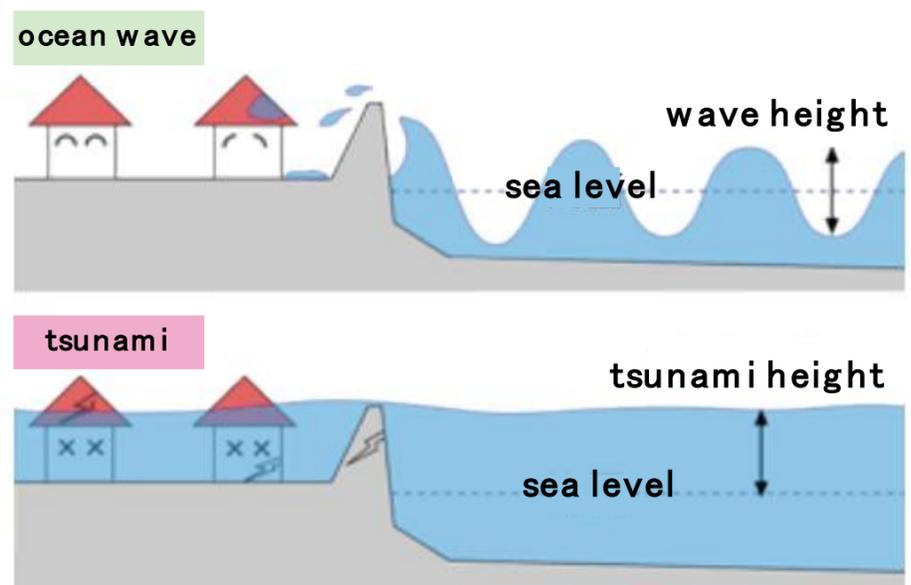
Sometimes an underwater earthquake causes a huge displacement of water which can generate a tsunami. These giant waves travel thousands of miles across the sea. Not only earthquakes but also landslides, volcanic eruptions, explosions, and even the impact of cosmic bodies, such as meteorites, can generate tsunamis.



(source Japan Meteorological Agency website)

## Difference between tsunamis and ocean waves

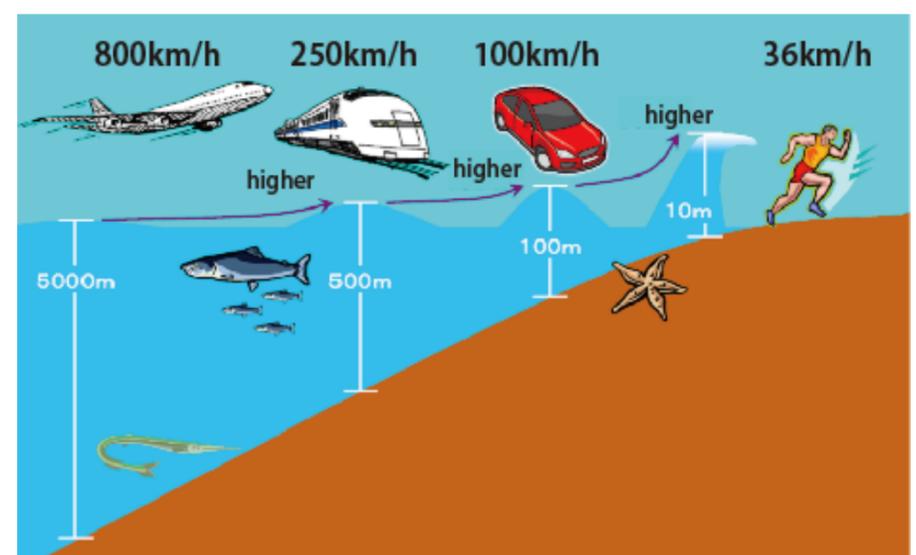
Tsunamis occur as a result of the movement of a huge volume of seawater from the seabed to the sea surface, whereas ocean waves are caused by the movement of wind over the sea surface. Tide embankments can protect us from ocean waves, but are sometimes overwhelmed by tsunamis.



(source Okamura, M. "Nankai jishin ni sonaeru")

## Tsunami speed

Tsunami speed changes with the depth of the sea. An underwater earthquake at a depth of 5,000m can generate a tsunami of speeds up to 800km/h. As a tsunami comes closer to the coast, its speed and wavelength decrease, but its height increases.

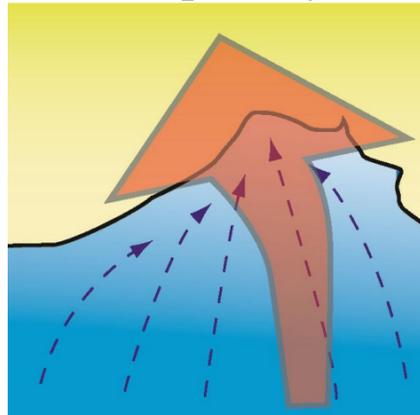


(source Japan Meteorological Agency website)

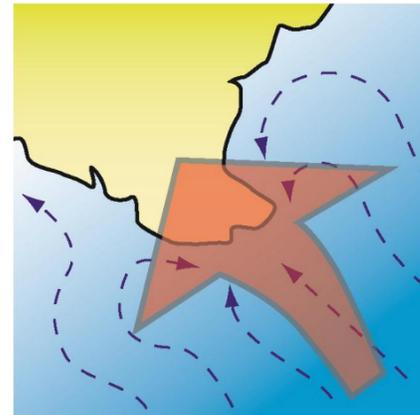
# Landforms increase tsunami height

There are many different types of coasts. We usually enjoy calm seas, but they can be very dangerous when a tsunami occurs. The height of a tsunami increases over time as it gathers increasingly huge amounts of water and carries it to the inner parts of a bay. In the case of a complex shaped bay, this changes in accordance with each village location. On certain occasions in the past, the tsunamis have been higher than predict.

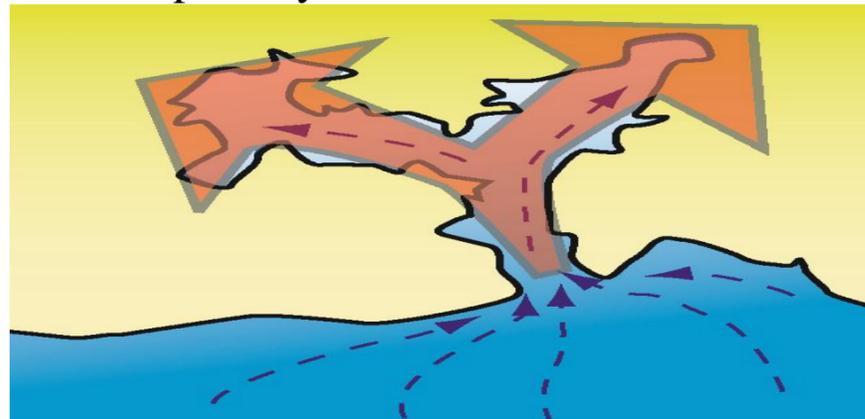
1. U-shaped bay



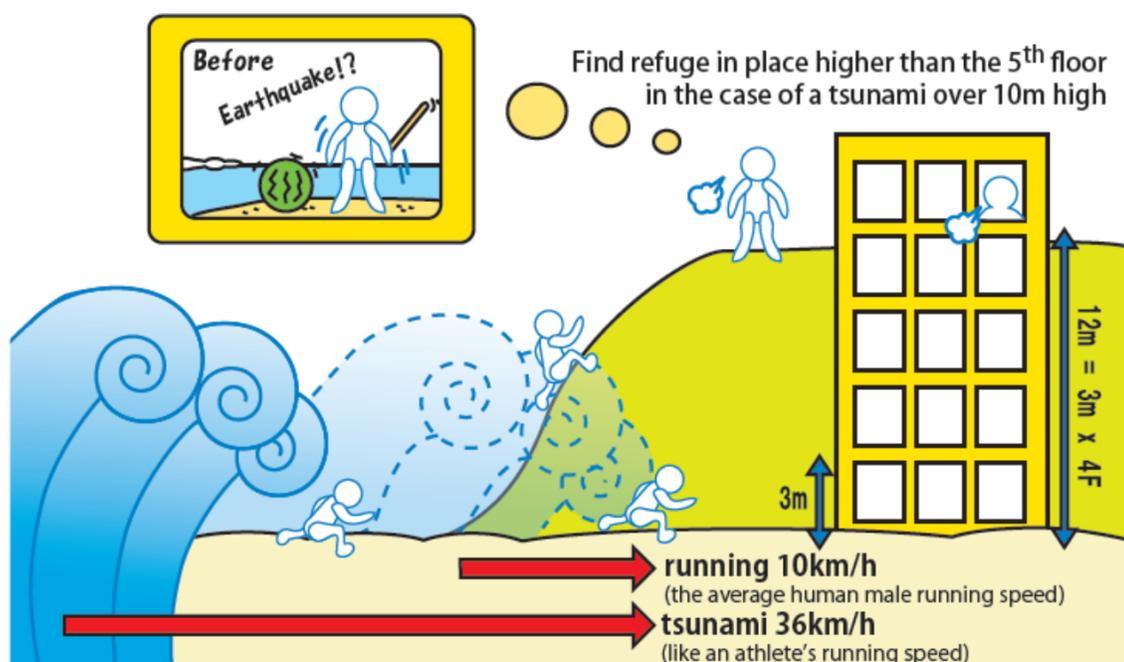
2. cape



3. Y-shaped bay



## Surviving tsunamis



### ★Run toward higher ground immediately!!

If you experience a major earthquake or one that lasts longer than a minute or if you hear the approach of a tsunami, immediately evacuate the coastal area and move inland and or to higher ground. Do not try to escape by moving along the coast because you are not safe from a tsunami unless you are inland or on higher ground.

### ★*Tsunami-ten-den-ko*

The saying originates from the Sanriku region. It urges you to flee by yourself without pausing to think, when a tsunami occurs. You have no time to go back home if you hear a tsunami coming. Evacuate from areas near the coast immediately, and stay away from them for some time because a tsunami hits the coast several times.

\* Some houses and buildings have collapsed because of powerful tsunamis.

### ★Ask a geopark tour guide

Hazard maps have been prepared for natural disasters in Japan. Get these maps and ask your geopark tour guide, also called a geoguide at our park, about the maps, information on tsunamis, the nearest safe places in the geopark and the previous disasters there. We look forward to seeing you at our geopark.



Earth Communication Group

Japanese Geoparks Network