

TSUNAMIS

Nature's Powerful Waves

Small changes under the sea can create huge waves.

Be informed.
Be prepared.
Stay safe.

1 What Causes a Tsunami?

Tsunamis can be caused by several events:



Strong earthquakes under the sea (80–90% of all tsunamis).



Volcanic eruptions.



A large piece of land sliding into the water.



A rock from space striking the ocean.



In the past 7 years, there have been 3 major tsunamis worldwide.



A major tsunami usually happens only once every 10 years.

2 The Waves



In the deep ocean, a tsunami wave may rise only about 300 mm (30 cm).



They are long waves that can travel very fast – some move at over 800 km/h.



They can cross an ocean in less than a day.



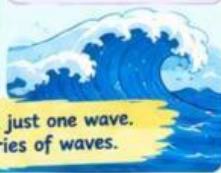
3 Tsunami vs. Tidal Wave

Tsunami

- Not a normal tide.
- A series of waves.
- The first wave is often not the largest (usually the third or fourth).
- Waves can be 5 minutes to 1 hour apart.

Tidal Wave

- Normal rise and fall of sea levels.
- Not an extreme event.



Tsunamis are not just one wave. They are a series of waves.

4 How a Tsunami Forms

Tectonic plates are always moving.



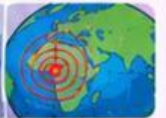
One plate subducts under another plate.

Pressure builds up, then the plate springs up. This causes an earthquake.

Large subduction zone earthquakes are responsible for most ocean-wide tsunamis.

5 Measuring and Monitoring

Hundreds of seismic monitoring stations around the world help scientists measure earthquakes.



- If a strong quake happens near or in the ocean, computers quickly measure the length, depth and location.
- These measurements help show how strong a tsunami might be.

6 What Happens When a Tsunami Approaches Land?



The wave spreads out quickly.



As it gets close to land, the force of the water builds.



You may hear a loud, sucking sound or a noise similar to a train or plane.



A drawback may happen (no water near the coast), or high waves come quickly with no warning.



Some waves can reach as high as 30 meters!



7 The 2011 Japan Tsunami

- Destroyed houses, buildings, cars, trucks and even large boats.
- Thousands of people were killed.
- Many more could have died without a warning from the Japanese Meteorological Agency.
- The warning came just 3 minutes after the 9.0 magnitude earthquake.
- Waves reached as high as 9 meters in some areas.
- Sea walls (40% of coastline) were only 3 meters in some places.



Japan has one of the best early warning systems in the world.

8 NOAA – United States



- A government agency in the U.S.
- Uses equipment on the ocean floor and surface to measure tsunamis.
- Spends \$40 million a year to protect the U.S. from tsunamis.
- Has operated a warning system for 40 years.
- Two warning centers: Oahu (Hawaii) and Palmer (Alaska).
- Jenifer Rhoades supervises NOAA's Tsunami Program.



9 Warning Signs



Roaring or sucking noise.



Ocean suddenly pulls back or rises.



Strong earthquake (> 20 seconds).



If you feel a strong earthquake or see these signs, move to higher ground immediately.



10 Key Facts



Warnings can be issued in less than 3 minutes (advanced systems).



The Pacific Ocean has 60% of the world's tsunamis.



Tsunamis cannot be prevented, but their damage can be reduced with preparation, warnings and effective action.

Prepared people save lives!

Learn • Be Aware • Stay Safe

LIVEWORKSHEETS