

## Tsunamis activity 1: **Introduction to tsunamis**

**Description:** A general introduction to tsunamis as a teaching lesson, including facts, explanations, vocabulary, diagrams suitable for overhead projection, and links to on-line resources. This activity provides the background for the activities that follow.

**Materials:** Overheads (1. Vocabulary; 2. Parts of a tsunami wave; 3. Generation and propagation of a tsunami)

### Teacher instructions and notes:

1. To introduce the concept of tsunami, first ask the students what is a tsunami and what causes a tsunami. (Their ideas may be based on some popular movie that they have seen or on videos of the Indian Ocean Tsunami).
2. Describe the generation and movement of a tsunami, using terminology from the accompanying list of vocabulary (overhead 1). For convenience, the list could be reproduced on an overhead sheet. Students should make notes. Treat the following topics:

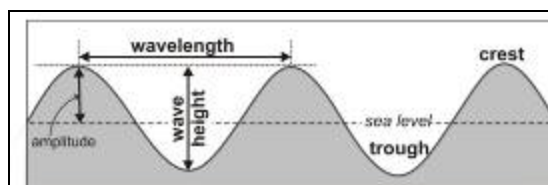
#### 2a. **What is a tsunami?**

A tsunami is a gigantic wave or series of waves, often called a wave train. The word tsunami is derived from the Japanese characters “tsu” meaning harbour and “nami” meaning wave. Explain the difference between most beach waves and tsunami waves. Tsunamis are not caused by tides. Note: although commonly a sea wave, tsunami have been generated in large lakes.

#### 2b. **What can cause a tsunami?**

Tsunamis are usually produced by a large disturbance of the sea floor that is of relatively short duration. They are most commonly triggered by earthquakes, but can also be caused by submarine volcanoes, large landslides or, less commonly, meteorite impacts.

- 2c. **Parts of a tsunami wave.** Explain the parts of the wave, using overhead 2. Have students draw a diagram of a wave and label the wave crest, wave trough, wavelength and wave height.



- 2d. **Explain how tsunami waves are generated and how they change as they move from deep water to near shore.** Use overhead 3 to illustrate the process.

Large disturbances of the sea floor cause the water column to move vertically. The resulting wave energy will spread outwards across the ocean at high speed (up to 950 kilometres per hour, the speed of a jet plane). Most tsunami waves are hardly noticeable in the open ocean because their height is relatively low (about 50 centimetres) and their length (the distance between wave crests) can be hundreds of kilometres. As a tsunami approaches the shore and water depth decreases, the wave starts interacting with the shallowing sea floor and it slows down.

The wave length decreases, causing the wave height to increase. In 20 metres of water, wave speed will be 50 kilometres per hour.

(Source: Atlas of Canada: Tsunamis [PDF] - included as part of these resources)

3. Ask the class if they think that tsunamis can be a threat to Canadian coasts. If so, which coasts?

4. Tell the class about the Grand Banks Tsunami that struck Newfoundland in 1929 and the 1964 tsunami that struck Port Alberni, BC.

Burin Peninsula, Newfoundland, November 18, 1929

On November 18, 1929, a magnitude 7.2 earthquake, with an epicentre about 250 kilometres south of Newfoundland, generated an extremely large submarine landslide. This slide triggered a tsunami that struck the southern coast of Newfoundland. Later studies by seismologists confirmed that the tsunami was not generated by the earthquake, but rather was triggered by the subsequent large submarine landslide.

Tsunami waves, varying in height between 3 and 7 metres, travelled at a speed of 140 kilometres per hour. The horizontal run-up, which is the distance travelled in-land, measured as much as 1 kilometre. The tsunami was recorded as far south as North Carolina and as far east as Portugal.

Forty communities on the south coast of Newfoundland were affected, with about 10,000 people left homeless. Twenty-eight lives were lost on Burin Peninsula in Newfoundland.

At the time, all trans-Atlantic telegraph cables from the east coast of Canada to Europe passed through the Laurentian Channel, just south of Newfoundland. It was there that the submarine landslide occurred. Consequently, the cables were severed, cutting off communication to Europe. Total damage from the tsunami was estimated at \$1 million in 1929 dollars (about \$20 million today).

Port Alberni, British Columbia, March 28, 1964

On March 27, 1964, the magnitude 9.2 Alaska earthquake, the second largest earthquake reported at the time, triggered a tsunami that travelled to areas along the Pacific Northwest, Japan, Hawaii and Australia. In Canada, waves struck portions of the Queen Charlotte Islands and Vancouver Island. The worst hit area was Port Alberni, where the tsunami caused about \$5 million in damage (1964 dollars; \$25 million in 2006 dollars). The community was struck by three main waves between 00:20 and 3:30 (Pacific Standard Time) on March 28. No one was killed in Canada, but 130 people lost their lives elsewhere across the Pacific Ocean.

In the open ocean, waves travelled at speeds of 830 kilometres per hour. When the tsunami entered Alberni Inlet, the waves had slowed to about 50 kilometres per hour. The sea surged up the Somass River, with the highest wave being 4.3 metres and a wave run-up of 1 kilometre inland. It destroyed houses and automobiles, and buildings were dragged seaward. A total of 260 houses were damaged.

(Source: Atlas of Canada: Tsunamis [PDF] - included as part of these resources)

5. Review with students the damages that can be caused by tsunamis: fatalities, flooding, buildings destroyed, coastal erosion, damages to harbour facilities, fishing industry, coastal transportation routes and bridges, etc.

## Vocabulary

**Tsunami:** A series of gigantic ocean waves caused by submarine movements. (Occasionally occur in large lakes.)

**Japanese:** The language from which the word tsunami came. Tsunami is derived from the characters “tsu” meaning harbour and “nami” meaning wave.

**Run-up:** Maximum distance inland the water travels, measured from the normal sea level shoreline.

**Time travel:** The time that it takes for the tsunami to travel from the source area to a specific place on the ocean.

**Crest:** The highest part of a wave above the still-water line.

**Trough:** The lowest part of a wave below the still-water line.

**Wave height:** The vertical distance between the crest and trough of a wave.

**Amplitude:** The height of the crest above the still-water line ( $\frac{1}{2}$  wave height).

**Wavelength:** The horizontal distance between two consecutive crests or two consecutive troughs.

**Sea level:** The height of the surface of the sea.

**Tide:** The rise and fall of the ocean waters which happens twice a day.

**Ring of Fire:** The Pacific Ocean is surrounded by a system of tectonically active mountain chains, island arcs and deep ocean trenches that is sometimes called a Ring of Fire. Earthquakes and volcanoes are associated with this ring of fire.

**Earthquake:** Shaking and vibration at the surface of the Earth caused by underground movement. An earthquake can cause a tsunami.

**Epicentre:** The point on the earth's surface directly above the location of an earthquake.

**Volcano:** An opening in the Earth's crust which allows movement of molten rock (known as magma) and hot gases from within the Earth to the Earth's surface. A submarine volcano can cause a tsunami.

**Landslide:** A downslope movement of soil and/or bedrock due to gravity. Landslides may be caused by an earthquake. A large landslide can cause a tsunami.

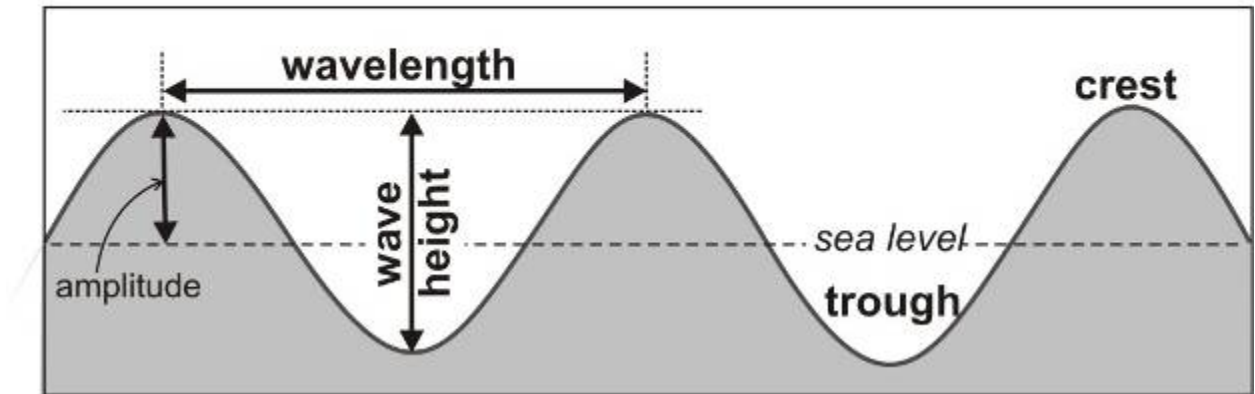
**Submarine:** Occurring under water (sea or lake)

**Meteorite:** A natural object originating in outer space that survives passage through the Earth's atmosphere and impacts the Earth's surface. Meteorite impact in the ocean can cause a tsunami.

*(Many of the definitions were obtained at  
[oceanexplorer.noaa.gov/edu/lessonplans/lessonplans.html](http://oceanexplorer.noaa.gov/edu/lessonplans/lessonplans.html) )*

## Parts of a tsunami wave

# Tsunami Wave



## Generation and propagation of a tsunami

### Tsunami

