What is a tsunami?

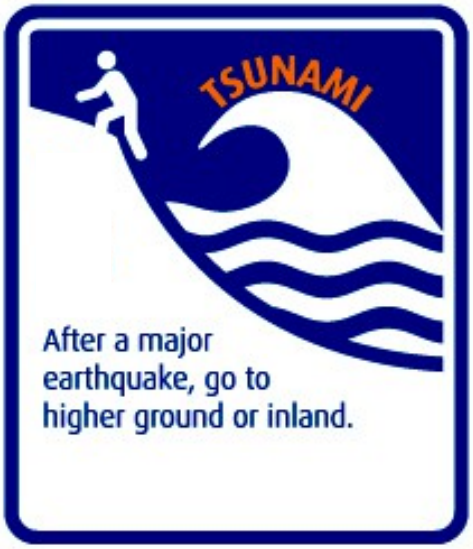
A tsunami is a natural hazard consisting of a series of long, surge-like waves generated when a large volume of ocean water is rapidly displaced. Tsunamis are known for their capacity to violently flood coastlines, causing devastating property damage, injuries and loss of life.

Most tsunamis are caused by major subduction zone earthquakes, where there is significant displacement of the ocean floor. Such tsunamis produce the most extensive inundation area, i.e., the area subjected to flooding.

Coastal and underwater landslides, and volcanic eruptions, can occasionally cause tsunami too. As some landslides and eruptions are not associated with shaking, you should always evacuate if the ocean suddenly recedes or if there is roaring like a jet engine from the ocean.

There are two types of earthquake-generated tsunami: local and distant. A local tsunami is normally associated with a major earthquake, while a distant tsunami is generated far away and you will likely be notified by officials if any actions are necessary.

Tsunami waves differ from ordinary coastal waves in that the entire column of water from the ocean floor to the surface is affected. Tsunami waves contain considerable energy; they can travel further inland compared to ordinary coastal waves. A tsunami may not look like a wave at all, but will have very strong currents under its surface.



A tsunami is a series of waves. The first wave to arrive at the coast is often not the largest, and each wave may be separated by up to an hour or more. Waves may continue for up to twelve hours, so you must stay away from the shore until local officials tell you it is safe to return.

There is no way to be certain how high a tsunami is going to be.

The following document covers the majority of frequently asked questions (FAQ) regarding the tsunami threats to British Columbia.

Frequently Asked Questions (FAQs) for tsunami in British Columbia

FAQs for tsunami in British Columbia

1. What kind of earthquake may cause a tsunami?

The most dangerous tsunami threat to the BC coast will follow a major, "megathrust" earthquake along the Cascadia Subduction Zone (CSZ), located about 100 km west of Vancouver Island. Such an earthquake, commonly called “The Big One”, will cause ground shaking lasting three to five minutes. The shaking will be so strong it will be difficult to stand in many places. The best available science suggests that residents along any BC coastline plan for tsunami flooding. Since the tsunami risk differs in each area, check with your municipality to see what the recommended evacuation distances are for your work, home, school and recreational areas.

Although the CSZ earthquake is the greatest tsunami threat, **any strong earthquake** could trigger an underwater or coastal landslide, which would generate a localized tsunami. For this reason, it is recommended that all coastal areas be evacuated after any strong earthquake.

2. What is a major earthquake?

A major earthquake, i.e., a sudden, violent shaking of the Earth's crust, produces strong shaking that may last more than a minute or might make it difficult to stand. To protect yourself, always "Drop, Cover and Hold On" until the shaking stops, and then head to higher ground, inland or the upper storey of a stable building immediately if you are in a tsunami hazard area.

3. Why shouldn’t I wait for an official warning if I feel a major earthquake?

Strong shaking IS your warning! When an earthquake produces strong shaking, possibly lasting more than a minute or making it difficult to stand, or if the shaking lasts for a minute or more, move away from the coastline and adjacent low-lying areas and seek higher ground immediately. Do not count on official notices to warn you to evacuate because the earthquake may damage communication systems, and officials may not have enough time to get to coastal areas at risk to warn you.

4. Is a tsunami just one big wave?

A tsunami consists of a series of waves that may last for up to twelve hours. A tsunami may not look like a big wave, but more like a rapid rise and fall in the ocean level. The first wave from a Cascadia Subduction Zone earthquake could arrive in the Tofino area in 20 minutes, and Greater Victoria in 75 minutes, but the largest wave may not arrive until later (please see FAQ#6 for more details). It is important to stay away from coastal and low-lying areas until your local officials to tell you it is safe to return.

5. Is it safe after the first wave?

Since a tsunami consists of a series of waves, and the largest wave may arrive at the coast much later, it is not safe to go back to coastal or low-lying areas until instructed to do so by your local officials.

6. How long after a local, major Cascadia Subduction Zone (CSZ) earthquake will a tsunami arrive?

This table presents **estimates** of arrival times (hh:mm) for sites along the British Columbia coast, based on computer modelling for tsunami waves generated by a magnitude 9.0 Cascadia Subduction Zone megathrust earthquake off the southwest coast of British Columbia.

Projected Local Tsunami Arrival Times

Location	Time until first tsunami wave arrives *likely not highest wave (hh:mm)
Tofino	0:20
Ucluelet	0:25
Port Alberni	1:05
Winter Harbour	0:30
Port Renfrew	0:35
Sooke Harbour	0:55
Esquimalt Harbour	1:10
Victoria's Inner Harbour	1:15
Sidney	2:00
Fulford Harbour	2:05
Boundary Bay	2:10
Delta/Richmond	2:15
Burrard Inlet	2:30
Nanaimo	2:35
Bella Bella	0:40
Gwaii Haanas, Haida Gwaii	0:55
Prince Rupert	2:50

The above estimates are preliminary and will require comprehensive studies for validation using detailed tsunami models for each area. The arrival times above are for the first tsunami wave front, and are relative to the time of the earthquake.

Most major subduction zone earthquakes, including CSZ, have a characteristic which means it is likely that the first wave to arrive onshore will be a trough; this means the water may recede before the first tsunami wave peak arrives. As mentioned above, the first wave may not be the highest.

For details on the computer modelling used to compile this table, please see FAQ#8, below.

7. How fast will the waves and currents be?

Each wave will have a different flow speed with varying currents so it is difficult to predict how fast they will be. The speeds may be fast enough, on the order of 10 knots, to be dangerous so be sure to listen to your local officials and stay away from coastal areas if you are instructed to do so.

8. How accurate is the computer modelling?

Tsunami modelling accuracy depends on many variables, such as knowledge of the potential fault rupture area and displacement, the availability of high resolution seafloor bathymetry and accurate definition of the coastline. Modelling is primarily focused on determining tsunami arrival times and maximum probable heights. The science of tsunamis is constantly changing, and additional modelling will be developed and applied as time and funding permits, and as further geoscientific knowledge is gained.

Detailed seafloor contours and focussed computer models are necessary for a more thorough examination of these and other areas along the BC coast.

9. Why was a 9.0 Cascadia Subduction Zone (CSZ) earthquake scenario used to develop the model?

A 9.0 CSZ earthquake scenario was used as it is the most probable tsunami-producing scenario to occur in our region. This does not mean that a 9.0 CSZ earthquake is the only type of earthquake that may occur. Any strong earthquake could cause an underwater or coastal landslide, which could in turn trigger a localized tsunami.

10. How will I know a tsunami is coming after a distant earthquake, e.g., from Japan or Alaska?

Your local emergency program and Emergency Management British Columbia (EMBC) monitor a number of sources that notify of distant tsunamis including the West Coast Alaska Tsunami Warning Centre (WCATWC), soon to become National Tsunami Warning Centre (NTWC), and the Pacific Tsunami Warning Centre (PTWC). Each of these agencies will issue one of three alerts: a Watch, an Advisory, or a Warning. Emergency management personnel will notify you if any action is required via local and social media and other channels. You can also view and receive alerts directly by following @NWS_WCATWC and @EmergencyInfoBC on Twitter, or by texting 'follow NWS_WCATWC' and 'follow EmergencyInfoBC' to 21212 to receive SMS updates.

11. What is the difference between a tsunami Watch, Advisory and Warning?

Tsunami Warning:

A "Warning" is the highest level of tsunami alert. Warnings are issued due to the imminent threat of a tsunami from a large undersea earthquake, or following confirmation that a potentially destructive tsunami is underway. They may initially be based only on seismic information as a means of providing the earliest possible alert. Warnings advise that appropriate actions be taken in response to the tsunami threat. Such actions could include the evacuation of low-lying coastal areas and the movement of boats and ships out of harbours to deep waters. Warnings are updated at least hourly, or as conditions warrant, to continue, expand, restrict or end the Warning.

Tsunami Advisory

An "Advisory" is the second highest level of tsunami alert. Advisories are issued due to the threat of a tsunami that has the potential to produce strong currents dangerous to those in or

near the water. Significant inundation is not expected for areas under an Advisory, but coastal zones may be at risk due to strong currents. Appropriate actions by emergency management personnel may include closing beaches and evacuating harbours and marinas. Additionally, local officials may opt to move boats out of harbours to deep waters, if there is time to safely do so.

Tsunami Watch

A “Watch” is the third highest level of tsunami alert. Watches are an advance alert that, based on an analysis of the event, may be cancelled or upgraded to a Warning or Advisory prior to impact. There is a potential threat to a zone contained in a Watch but communities have time to prepare. Watches are normally based on seismic information, without confirmation that a destructive tsunami is underway. Emergency management personnel and coastal residents should prepare to take action in case the Watch is upgraded.

12. What other tsunami alerts may be issued by authorities?

Information Statement

An “Information Statement” informs that an earthquake has occurred and that there is no threat of a destructive tsunami affecting Coastal B.C. These statements are used to prevent unnecessary evacuations when an earthquake felt in coastal areas has a magnitude that may raise concern about a possible tsunami.

Cancellation

A “Cancellation” cancels any previously issued alerts when no there is no longer a threat of tsunami. This notification will be the last bulletin WCATWC/NTWC and EMBC will issue for this even

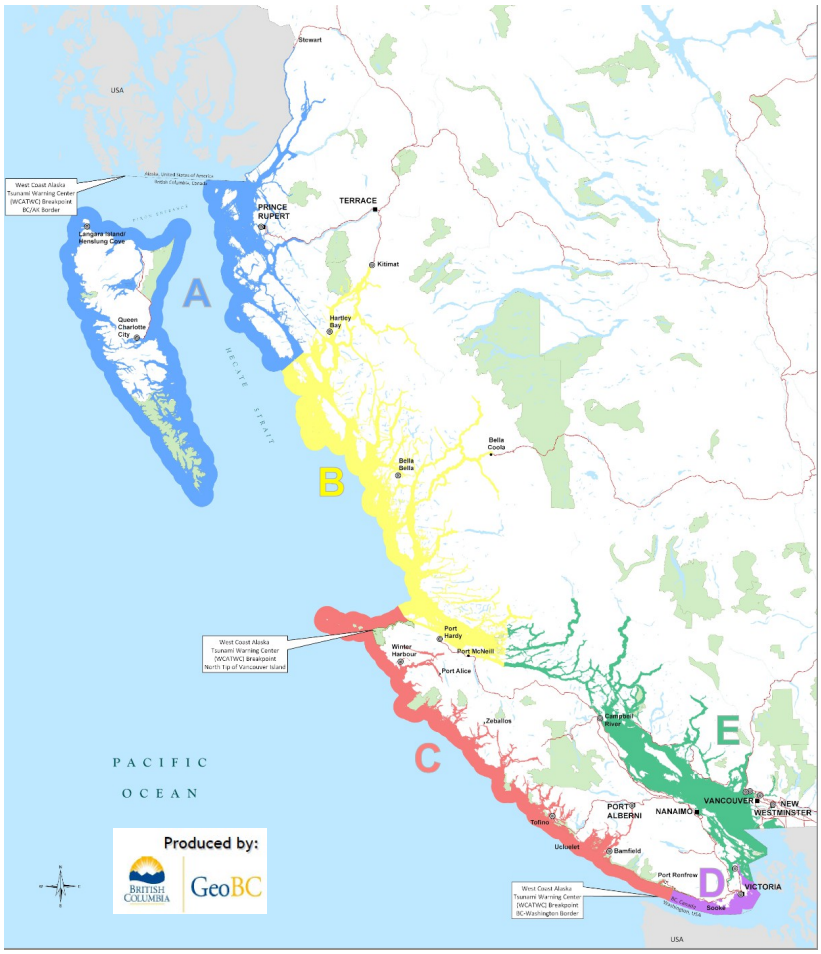
13. What is the difference between tsunami notification zones used by Emergency Management British Columbia (EMBC) and West Coast Alaska Tsunami Warning Centre (WCATWC)?

WCATWC/NTWC issues a single alert to most of coastal BC, while EMBC divides BC into five notification zones and may issue alerts to more specific areas of BC that may be impacted. Since coastal BC is such a large area, alerts issued by EMBC may not be the same as WCATWC/NTWC. For example, Zone C may be impacted by a distant tsunami, while Zones D and E will not be impacted. EMBC will consult with federal scientists to determine whether to downgrade an alert from WCATWC/NTWC. It is very important to stay tuned to local radio, TV, and credible social media for updates, and listen to local officials.

14. What is a tsunami hazard area?

A "tsunami hazard area" is an area that may be affected by flooding due to tsunami. Evacuation is recommended if you are in one of these areas during a major earthquake. Check with your local emergency program to see if you are located in a tsunami hazard area.

15. In which BC tsunami notification zone am I located?



Zone A: The North Coast and Haida Gwaii
Zone B: The Central Coast and Northeast Vancouver Island coast including Kitimat, Bella Coola and Port Hardy
Zone C: The outer west coast of Vancouver Island from Cape Scott to Port Renfrew
Zone D: The Strait of Juan de Fuca from Jordan River to Greater Victoria, including the Saanich Peninsula
Zone E: The Strait of Georgia including the Gulf Islands, Greater Vancouver and Johnstone Strait

16. When should I evacuate?

If you feel a major earthquake and you are near a shoreline you should Drop, Cover and Hold On, then evacuate immediately after the shaking stops!

There are other natural signs of an arriving tsunami: You might notice the ocean receding, a sudden rise or fall of ocean level, or hear roaring like a jet engine from the ocean. Evacuate to higher ground immediately if you witness any of these signs.

You may be asked by emergency officials to evacuate if you are in a tsunami hazard area – follow their instructions and be sure to take your emergency kit with you.

17. From where should I evacuate?

You should move away from beaches, harbours, marinas and adjacent low-lying areas if you feel a strong earthquake. Consider where you live, work and play.

18. To where should I evacuate?

If you experience a major earthquake, possibly lasting more than a minute or making it difficult to stand, move to a tsunami-safe area in your community: higher ground, inland or the upper storey of a stable building. Monitor local media for information.

19. How far inland or high up do I go?

You should check with municipal authorities for the areas where you live, work, go to school and play to find the nearest area that is safe. It may not be necessary to go to the highest point in the area, but rather out of the hazard area.

20. How should I evacuate?

You should evacuate immediately on foot or by bicycle to an area outside of the tsunami hazard areas. Only use a car if absolutely necessary as roads may be blocked or congested, and emergency response personnel will need to use them. If you must use your car, keep driving inland to make way for others evacuating along the same route. Do not block the roadway.

21. How much time do I have to evacuate?

If you are near the coast and feel a major earthquake, possibly lasting more than a minute or making it difficult to stand, you must "Drop, Cover, and Hold On", and then evacuate to higher ground or inland. The first wave from a Cascadia Subduction Zone megathrust earthquake (see FAQ#1) could be in the Tofino area within 20 minutes and Victoria in 75 minutes. Please refer to the table in FAQ #6.

22. For how long do I evacuate?

Only return to the evacuated area once you have received notification from local authorities. Tsunami waves can take many hours to arrive and the largest wave may arrive many hours after the first wave. Large aftershocks can generate their own new waves.

23. How can I help during a tsunami?

Knowing your neighbours and others on your street who might need additional assistance is a great way to be of assistance during a tsunami and other emergencies. Make connections with these people and community groups as a way to increase your community's resilience. Make sure you plan for evacuations with your family and neighbours before a tsunami strikes.

24. What if I am on the water during a tsunami?

Docked or moored: If there is a local tsunami resulting from a major earthquake and you are moored in a harbour, abandon your boat or float home immediately and get to higher ground or inland.

In harbour: If you are still in the harbour when a tsunami warning is issued, you may have time

to get to deep water. Listen to official estimated tsunami wave arrival times and plan safely. Do not motor your boat to open water if it is too close to the wave arrival time.

At sea: If you are in deep water, at least 200 fathoms or 400 metres, when a tsunami warning is issued, stay there. Tsunami waves are small in deep water and probably won't cause any damage. Stay tuned to your marine radio (Channel 16) for information and instruction on when it is safe to return to port.

Floatplanes: If you are in a floatplane in a harbour, take off as soon as possible. Land safely on a lake or another area not at risk.

25. Where can I go for more information?

To learn more about earthquake and tsunami hazards and preparedness in British Columbia, please visit:

http://www.pac.dfo-mpo.gc.ca/science/oceans/tsunamis/modele-tsunami-model-eng.html

http://wcatwc.arh.noaa.gov

http://www.earthquakescanada.nrcan.gc.ca

http://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/2015_earthquake_tsunami_smartmanual_v07.pdf

http://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/index-eng.aspx