

Earthquakes: an Introduction

- What are earthquakes?
- How may earthquakes affect me?
- Why should I care now?
- What can I do about it?
- Where can I learn more about earthquakes in Washington?

Earthquakes cause strong shaking and can trigger tsunamis, landslides, and liquefaction (soil destabilization).

All of these can damage buildings, roads, and bridges.

Washington has three main sources of earthquakes that affect coastal areas: Cascadia, shallow, and deep earthquakes.

In the next 50 years, there is:

- A 10-14 % chance of a magnitude 9 Cascadia earthquake.
- A 30% chance of a magnitude 8 Cascadia earthquake.
- A 15% chance of a magnitude 6.5 or greater shallow earthquake.
- An 84% chance of a magnitude 6.5 or greater deep earthquake.

Preparing for earthquakes can help you stay safe:

- **Make an earthquake kit or “go bag.”**
- **Know how to survive: drop, cover, and hold.**
- **Take precautions or retrofit around your home.**
- **Advocate for local preparedness measures.**

What is an earthquake?

Earthquakes are sudden releases of energy that happen when the land shifts along an underground crack, or *fault*. Earthquakes cause the ground to shake, and can lead to vertical or sideways movement of the ground surface. The shaking and movement can damage buildings, roads, and bridges. Earthquakes may also trigger secondary events such as:

1. Liquefaction – eruption of soil and water from below ground, causing ground failure.
2. Tsunamis – extremely dangerous waves often caused by large earthquakes. See Tsunamis: an Introduction (<https://wacoastalnetwork.com/chn/coastal-hazards/tsunami/>) to learn more about tsunamis and how to prepare for them.
3. Landslides – when steep slopes fail. See Landslides: an Introduction (<https://wacoastalnetwork.com/chn/coastal-hazards/landslide/>) to learn more about landslides and how to prepare for them.



How may earthquakes affect me?

If you live in an area that is prone to earthquakes, such as Washington State, you are in danger of being injured or having your home or office damaged or destroyed in an earthquake.

Your community can also be impacted by the secondary impacts from an earthquake: liquefaction, tsunamis, and/or landslides.



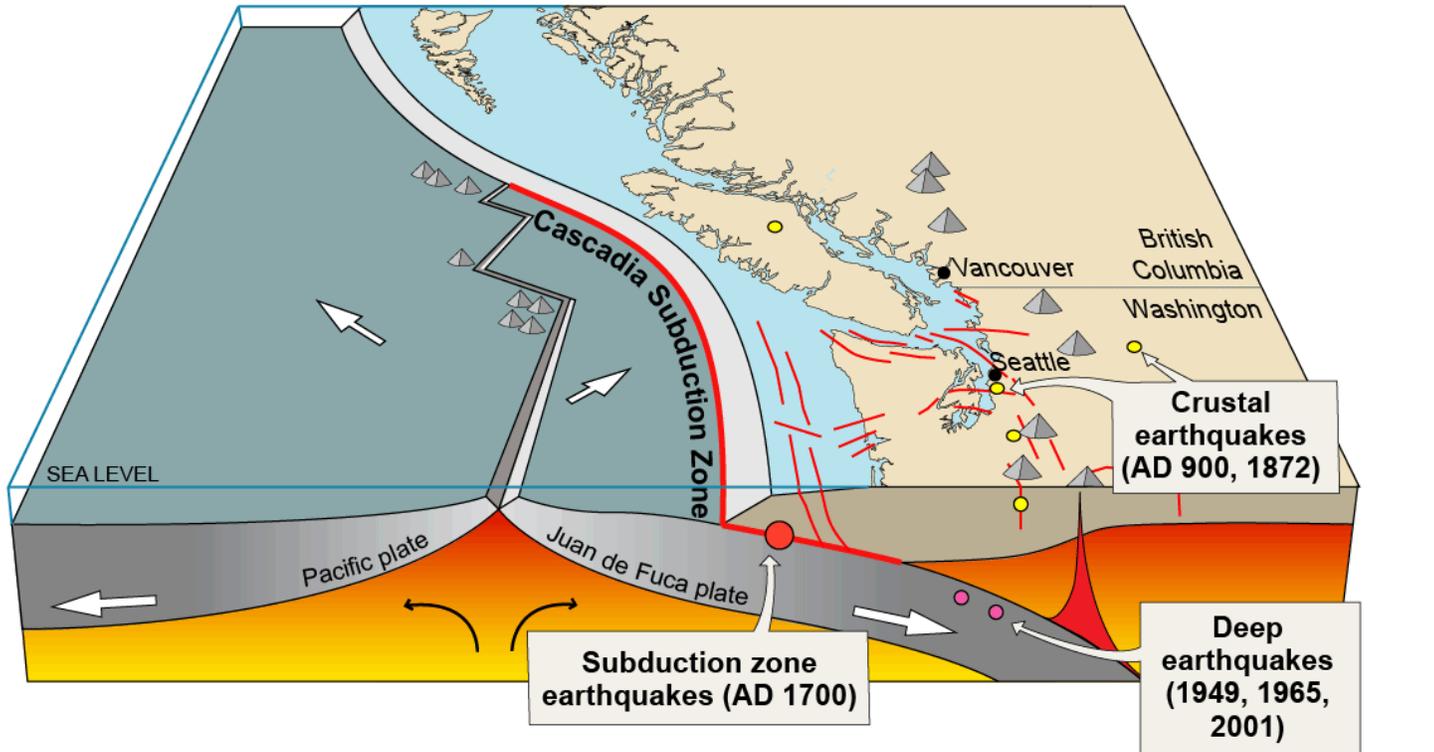
Structural damage (left) and vented sands from liquefaction (right) from the 2011 Christchurch earthquake in New Zealand.

How large of an earthquake can happen in Washington, and when?

Washington has three sources of earthquakes that are hazardous in coastal areas:

- large offshore earthquakes along the Cascadia subduction zone,
- shallow earthquakes on crustal faults, and
- deep earthquakes in subducting oceanic crust

Each of these sources operates on its own timeline and has a typical magnitude (size of earthquake) range. We expect magnitude 9 Cascadia earthquakes in Washington every 300-500 years, and the last such earthquake was in the year 1700. Shallow earthquakes vary in their frequency, depending on the fault, but they are not as large, and will typically be no larger than magnitude 7.5. However, since there are so many of these faults, there is usually an earthquake of this type every few decades. The most common type of earthquake in Washington are deep earthquakes, which occur every 30-50 years, mainly in the Puget Sound region, and generally do not exceed magnitude 7.5



Source	Max. Size	Recurrence
● Subduction zone	M 9+	200–600 years
● Deep Juan de Fuca plate	M 7+	30–50 years
● Crustal faults	M 7+	Hundreds of years?

- ▲ Volcano
- Active crustal fault
- Active plate boundary fault

*figure modified from USGS Cascadia earthquake graphics at <http://geomaps.wr.usgs.gov/pacnw/pacnweq/index.html>

Earthquake sources, sizes, and recurrence in Washington State.

Why should I care now?

If you live in earthquake country, you need to know what to do before, during, and after an earthquake.

What can I do about it?

By preparing now, you can be safer in an earthquake. Below are steps to take before, during and after the next earthquake hits.

Before an earthquake:

- Make an earthquake kit with:
 - first aid supplies
 - dust mask
 - sturdy shoes

- water filter or purification tablets
 - tarp
 - blanket
 - warm waterproof clothes
 - non-perishable food
 - flashlight
 - tools
 - medicines
 - Comfort items
- Make your home safer. Do not store heavy objects above head level on shelves near where you sit or sleep, strap hot water tanks to walls, have a seismic retrofit done—bolt to foundation, reinforce masonry. Know how to turn off the water, gas, and electricity to your home.
 - If you are a homeowner, consider buying earthquake insurance and getting your house seismically retrofitted.
 - Know what to do if you feel an earthquake.

During an earthquake:

- “Drop, cover, and hold” is how to survive an earthquake. Get under a table or desk, and hold onto the leg until the shaking stops. If there is no table to get under, curl up and protect your head with your arms. Beware of heavy items overhead.
- If you are in a tall building, or a brick building, stay inside! Broken glass and bricks raining down are a major source of injuries in earthquakes.

After an earthquake:

- Once the shaking has stopped, get to a safer place if you are in a damaged structure
- Turn off the gas, water, and electricity to your home
- Expect many aftershocks
- Use your go bag to care for yourself



A well-stocked earthquake kit can protect your family's health and safety after an earthquake.

Where can I learn more about earthquakes in Washington?

See:

- Pacific Northwest Seismic Network: <https://pnsn.org/outreach/about-earthquakes>

WASHINGTON COASTAL HAZARDS RESILIENCE NETWORK (<https://wacoastalnetwork.com/>)

- US Geological Survey earthquake hazards: <https://www.usgs.gov/natural-hazards/earthquake-hazards> OR <https://earthquake.usgs.gov/>
- Cascadia Region Earthquake Group: <https://crew.org/>
- Incorporated Research Institutions for Seismology (IRIS): https://www.iris.edu/hq/earthquake_resources/

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