

# The 3 Things You Need to Know About Tsunamis

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The coastal zone of Oregon and Washington is a lovely place to live, work, and play. The region is also home to earthquakes and tsunamis. People can live, work, and play more safely in this beautiful region by understanding the risks and taking appropriate action.

**People engage in a variety of risky behaviors every day, and we successfully manage those risks**--often without a second thought. Probably the riskiest thing we do is drive cars. We are not ignorant of the risks. In fact, we mitigate our risks in many ways. We have traffic safety laws and police to enforce them. We require seatbelts, driving exams, vision tests. We require insurance to cover accidents that we know will happen.

**Living in tsunami country means that we have an additional risk that we must manage.** We need to understand the risks of tsunamis and mitigate their impacts as best we can—just like we do with vehicle safety. To continue the car analogy, getting our “tsunami drivers license” requires a short but essential education. But, once we “get it” about tsunamis we will know what to do—either today or many years from now.

**The hardest thing for people to fully understand is that we get two kinds of tsunamis.** They are very different and require very different responses. Local tsunamis (less frequent but devastating) occur when we have a huge local earthquake and minutes later huge tsunamis destroy vast areas killing thousands. Distant events (more frequent but rarely dangerous) occur when the earthquake occurs somewhere else and hours later small waves arrive as predicted inconveniencing hundreds. Many people mix these together in their planning and therefore don't realistically prepare for either event.

**Another challenge is how the tsunami threat seems to have appeared out of nowhere.** Researchers have only recently demonstrated our vulnerability to subduction zone earthquakes and local tsunamis (The Big One). Theories of plate tectonics emerged only in the 1960's. Mt. St. Helens' eruption in 1980 prompted a new look at the Cascadia subduction zone. The first academic papers documenting our vulnerability were published in the early 1990's. Oregon's “SB 379 Line” mapped the first official tsunami zones in 1995. It is only in the past 20+ years that we have come to understand that we live on one of the largest and most dangerous natural hazards in the country.

**The 2004 Sumatran earthquake and Indian Ocean tsunamis were a wake-up call the Cascadia region.** Our subduction zones are nearly identical. Similar events happen here on average every 300 to 500 years. The last Cascadia Big One occurred 309 years ago. The next Big One could happen today, or it could also happen a hundred years from now, but we're edging into the range of average recurrences.

**Luckily, education can vastly improve our odds for surviving the local Big One.** It can also help us better manage the unnecessary chaos of a distant event warning.

# The 3 Things You Need to Know About Tsunamis

## 1. Was It a Local Event or a Distant Event?

If you **feel** a strong and long earthquake then it is a **local** event. (The earthquake can last 5 minutes or more.) Duck, cover, and hold-on until the shaking stops. Then immediately run for high ground (above 70 feet). You have less than 30 minutes to evacuate the inundation zone! Do not return to the area for 12 hours. Tsunamis are a series of surges and the first one is often not the biggest. Do not expect to be able to drive anywhere, or to use telephones or cell phones.

If you **hear** a warning on the TV, siren, or NOAA Radio, it is a **distant** event. Relax. That means the earthquake happened somewhere else and we're getting a warning that a tsunami is on its way. There are no earthquake issues, and you have plenty of time to evacuate if needed. (It takes 3-4 hours for a tsunami to get here from Alaska, and 6-10 hours from more distant locations like Japan or Chile.) Most people won't need to go anywhere. Those who do, often need to go only a few blocks. The challenge is that you need to be out of the inundation zone for 12 hours. Make friends in high places!

## 2. Where are the Danger Zones?

For **local** earthquakes and tsunamis, the danger zones are defined on official tsunami inundation and evacuation maps. Sometimes these areas are surprisingly large. Identify the dangerous areas where you live, work, shop, and play. Note the routes you will need to take to get to safety. The general rule is to get above 70' to 100' elevation for local events. After a while you will develop an "eye for the landscape" and instinctively know if you're safe, or not. Ask for maps at your local fire department or City Hall.

For **distant** tsunamis the inundation is much less. People need to evacuate beaches, waterways and extreme low areas only. Most people don't need to go anywhere. As a general guideline, consider the inundation to be similar to that of a severe winter storm at high tide. Since there is no local earthquake, there are no earthquake issues (no shaking, no subsidence, no damage to infrastructure.)

## 3. How Do I Reconnect with Loved Ones?

Have a family agreement for what to do if you get separated in a disaster. For a **local** event, teach everyone to get to safety, stay there, and reconnect when it's over. Do not reenter the inundation zone for 12 hours. (BTW, Pets naturally flee disaster areas. Find them on high ground looking for you!) Identify a non-local person for everyone to call as soon as they can. (Non-local means other states, not Portland.) Although it may take a while, family members can eventually reconnect through this common contact. When phones don't work, try texting; or your car's OnStar; or a satellite phone; or a HAM radio.

For **distant** events, phone lines will be fine (no earthquake) but they will probably be jammed. The same is true for roads and bridges. Expect traffic chaos and other hassles involved in distant event evacuations and detours. People may be stuck somewhere, perfectly safe, but unable to call for several hours. Talking to loved ones today about what they plan to do will reduce everyone's stress during the event.

## **10 Common Misunderstandings about Tsunamis**

**“Sirens mean run!”** Ironically, sirens mean relax. Sirens indicate a distant tsunami in which local residents have three or more hours to evacuate the inundation zone. If you are at home and your home is in an inundation zone, gather your medications and personal items and leave the inundation zone for 12 hours. If you are in an inundation zone when the siren sounds, but you live outside of the zone--simply go home, or visit someone out of the zone. Make friends in high places!

Consider buying a NOAA All Hazards radio. These radios serve as “personal sirens” for distant events, and immediately provide information on where the earthquake occurred and how long it will take to get here. (Think of them as “smoke detectors for the tsunami zone.”) NOAA All Hazards radios are available at marine supply and electronics stores.

**“We live on a hill, so we’re safe”** First, that’s only true if you’re home. You might live on a hill, but you’re in grave danger if you happen to be working, shopping, recreating, or driving through, an inundation zone when the Big One hits. Second, people on hills need to worry about falling off those hills during the earthquake and subsequent landslides. Don’t forget the quake!

We are residents of the north coast region and most of us travel in and out of inundation zones all day. We need to “develop an eye for the landscape” to instinctively understand when we’re in a dangerous area, and know where we would need to get to.

**“We will drive to safety”** After the local Big One, you probably won’t be able to drive due to the damage from the earthquake. Your car may well be under the rubble that used to be your garage. Even if your car is ok, the garage door probably won’t open. Even if it does, the roads will be impassable due to fallen trees and power poles, damaged bridges, and from the scores of landslides that will occur on all major roadways. Don’t waste time on a doomed strategy--plan on running to safety. If you live in an inundation zone, practice your evacuation route so you can do it in the dark. In a distant event the traffic will be a mess, but there will be no earthquake damage and you will have plenty of time to leave the inundation zone if necessary.

**“We’ll connect by phone”** In a local event, telephone poles and cell towers will topple, and any working lines will be jammed. Satellite phones may work. Critical service providers and other key individuals and agency might consider getting satellite phones. OnStar systems in cars are satellite phones. Ham radios will work and local operators are prepared. In a distant event, the phone lines will be intact but overwhelmed. Sometimes text messaging works when phone service doesn’t.

**“I have an emergency kit, so we’re covered”** I endorse emergency kits (I have one), but it is even more important to take a first-aid and CPR class. In a **local event**, your house will either be standing and you can get whatever you need from your own pantry and medicine cabinet. Or, your house will be destroyed and your kit will be useless under all of the rubble. However, you will almost certainly need to administer first-aid to

yourself, your family, and your neighbors. During a **distant event**, you won't need your kit because there was no earthquake to damage you, your house, or your supplies. Note: prescription medications can be a matter of life and death for some people. Consider identifying people in safe areas who take the same medications as you. Evacuate to their house if you're caught without medicines during the Big One. In a distant event, grab your medications as you calmly evacuate the inundation zone.

**“We'll have to camp out for a week after the Big One”** Some will, but most probably will not. Residents in outlying areas may be cut-off for several days or weeks due to landslides. But in town, it's more likely is that some neighborhoods will be devastated while others will be relatively intact. We should expect that displaced people will go to homes left standing and be taken in by neighbors. We need to prepare for this at the neighborhood level.

**“Someone will come and save us”** As good as our local emergency officials are they will have only a limited ability to help individuals under either scenario. In a distant event, their primary responsibility is facilitating the orderly evacuation of people out of the inundation zone and dealing with the inevitable heart attacks and traffic emergencies that always occur. In a local event they will be in the same boat as everyone else—unable to drive their vehicles over destroyed bridges, landslides, and debris.

Do not expect personal attention. Help yourselves, help your neighbors. Now is the time for neighborhoods, schools, businesses, civic organizations, etc., to identify their roles and responsibilities in earthquake and tsunami preparedness.

**“Tsunamis are waves”** A tsunami is not a “wave” which moves up-and-down, but the ocean moving sideways. Here's an analogy. When your dog laps water in his bowl, he's making “waves.” When he kicks the bowl across the floor and it slams into the refrigerator and the water spills over the side...that's a tsunami. The approaching tsunami looks more like a storm surge. Even small tsunamis carry tremendous power. Tsunamis come is a series of surges lasting up to 12 hours.

**“Tsunami preparedness is “Bad for Business”** Evidence indicates otherwise. Disney World in Orlando is in “hurricane alley”, and the county has one of the highest incidents of lightening strikes in the country. Yet, Disney World is one of the top tourist locations in the USA. Similarly, Disneyland in CA is located in a highly seismic region and it remains highly popular. The Hawaiian Islands include the largest active volcanoes on the planet. Kilauea has been actively erupting since the 1980's and new plumes began in 2008. Hawaii is also vulnerable to hurricanes, earthquakes, local tsunamis and distant tsunamis from all over the Pacific. Yet, everyone still wants to go to Hawaii. The education and attitude of local residents, businesses, and realtors toward these hazards sets the tone for how others respond. Prepared people are confident, and confident people are reassuring. Educate yourself, and train your employees to be proactive.

**“There's nothing I can do. If it happens, it happens”** Wrong. You just read several things individuals and families can do to improve their odds of surviving earthquakes and tsunamis. Know what you need to know, and enjoy living your life on the coast.

# Earthquake and Tsunami “Geologic Factoids”

## Local Event (The Big One) “Natural warning” the ground shakes here

- The Cascadia Subduction Zone (CSZ) extends north and south over 700 miles from Northern California to Vancouver Is., Canada. The CSZ is the area of overlap between two tectonic plates—the Pacific and the North American. Its western edge runs roughly parallel to the PNW coastline about 70-90 miles offshore, its eastern edge lies under the Cascade mountain range. Thus, it is literally under our feet.
- Essentially, the floor of the Pacific Ocean slowly, but continually, “subducts”, or dives under, the North American continent. The two plates move over each other at about the same rate of growth as a human fingernail. That’s not a lot, but it builds up great pressure over the centuries.
- Science has only recently discovered that the release of pressure along these plates regularly generate massive 9.0 magnitude earthquakes and large tsunamis. In particular, seafloor core samples reveal a regular deposition of sand layers explained only by shaking from large earthquakes. Recent research indicates that eruptions don’t always occur along the entire length of the CSZ, and that there have been more events in the southern range (N. CA to So. OR) than the northern range (N OR to BC)
- The north coast has had 23 CSZ quakes in the past 10,000 years. The average recurrence interval is every 300 to 500 years. However, there have been 5 events in the last 1400 years--an average recurrence interval of every 280 years.
- The last CSZ occurred 309 years ago. We know the last CSZ occurred in 1700 based on multiple sources. Excavations in PNW coastal estuaries reveal several tsunami sand deposits carbon-dated to about 300 years ago. Tree ring analysis narrows this to 1699/1700. The most recent seafloor sand layer also dates from about 300 years ago. The most compelling evidence comes from Japanese writers who described a large tsunami hitting them without an earthquake on January 26, 1700. (Our local tsunami hit them as a distant tsunami about ten hours later.) Native stories and place names also reflect an awareness of tsunamis and their cyclical nature.
- It is estimated that we have a 15% probability that we will experience a CSZ event in the next 50 years. Thus, the next Big One will very likely occur in our lifetime, or in our children’s lifetimes. Everyday brings us one day closer to the inevitable.
- CSZ earthquakes are Big Ones--magnitude 8.5 and higher. The quake will last 4-6 long minutes and will be very destructive—although not necessarily as violent as shallower earthquakes. The long, rolling, earthquake will be survivable by people but tough on buildings. More deaths will likely occur from the tsunamis than the earthquake. Aftershocks and landslides will occur for days.

## Distant Event (no earthquake) “Official warning” Radio, TV, sirens, etc.

- Tsunamis generated by distant earthquakes take time to get here and are much smaller. It takes 3-4 hours for a tsunami to get to Oregon from Alaska (our closest distant source) 8 hours from Japan, and 10+ from South America. We’re relatively well situated for distant events.
- There will be official warnings. Our tsunami buoys and warnings are effective for distant events.
- Inundations will likely be similar to a bad winter storm at high tide. That is, potentially bad in specific locations, but not catastrophic. Damage is typically limited to the beach front, waterways, maritime infrastructure, wetlands, and other low lying areas.
- The 1964 Alaskan quake and distant tsunami killed 122 people mostly in Alaska and Crescent City, CA, and members of one family camping on the beach near Newport.
- The same distant event today would likely cause more death and damage because there are more people living along the coast and more infrastructure than in 1964.