

Tsunamis in Alaska

Alaska Division of Geological & Geophysical Surveys



A tsunami is a series of waves in a water body caused by a large and sudden displacement of water. The most common cause of a tsunami is an earthquake that disturbs the ocean floor. In Alaska, these underwater earthquakes occur at the subduction boundary between the Pacific and North American tectonic plates (known as the Alaska-Aleutian Megathrust).

What causes tsunamis?

Subduction zone earthquakes

(illustrated below, also known as tectonic tsunamis; for more information about earthquakes, see [DGGGSLC.73](#))

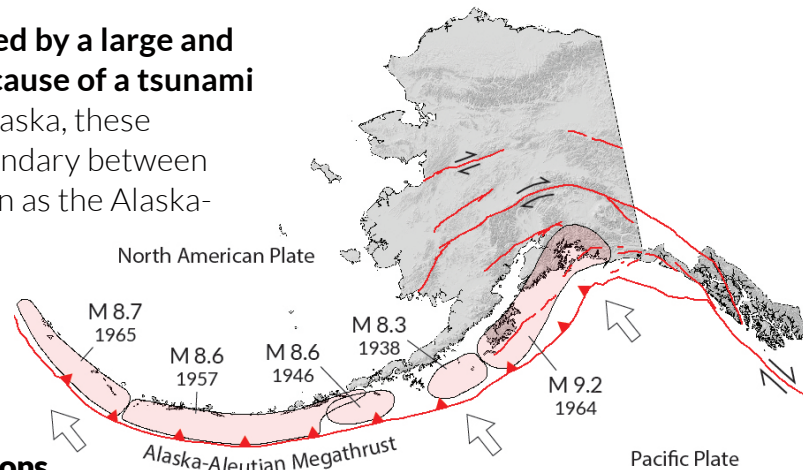
Volcanic eruptions

Calving glaciers

Underwater explosions

Meteorite impacts

Land-based and submarine landslides



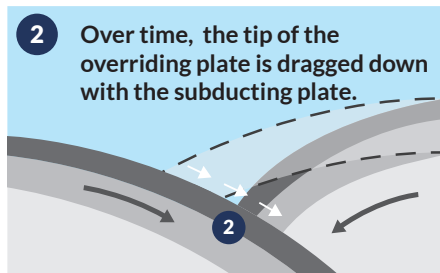
Major active faults of Alaska (red lines) and significant historic rupture patches (areas of the plate interface that have slipped in earthquakes, red shaded areas) on the Alaska-Aleutian Megathrust. The white arrows indicate the direction of Pacific plate movement relative to the North American plate.

What do tsunamis look like?

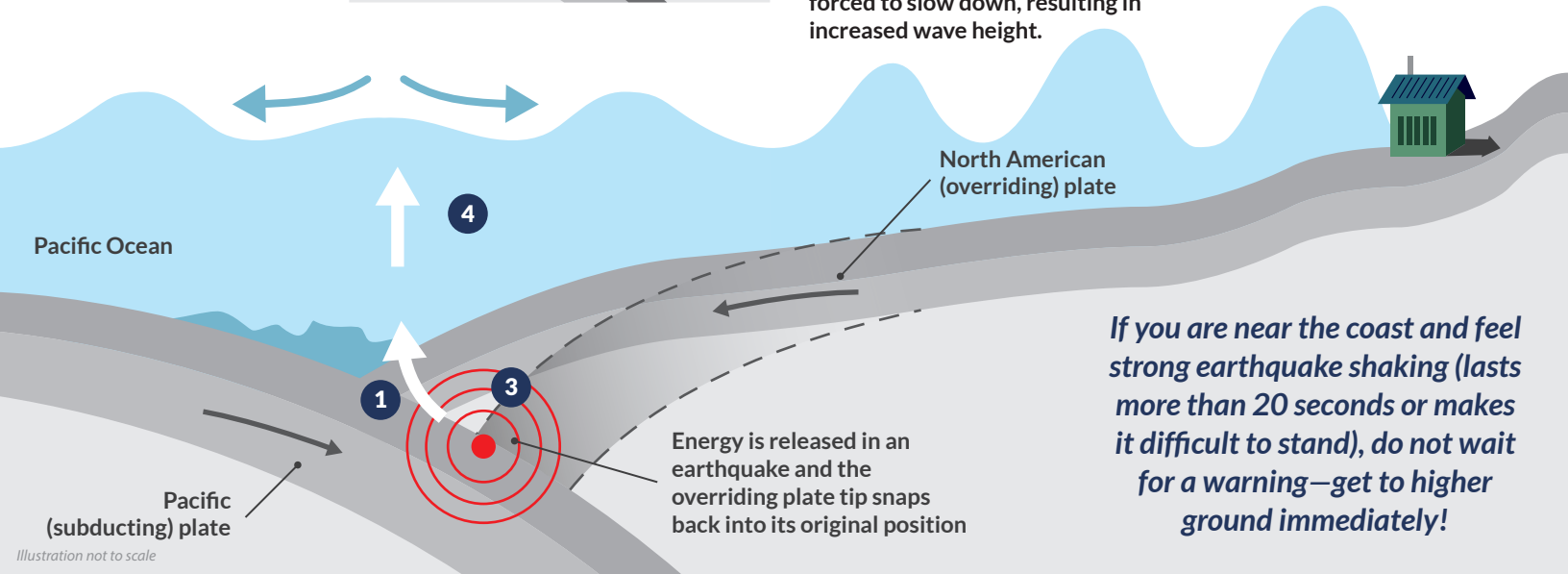
Despite popular depictions of tsunamis as large sea waves, in the open ocean tsunamis can have wavelengths of hundreds of miles and amplitudes (heights) of only a few feet! **As a tsunami enters shallow water near shore it is forced to slow down, resulting in increased wave height. Tsunami waves resemble a rapidly rising tide that does not stop at the high tide line.**

How a tectonic tsunami is generated

- 1 At a subduction zone, two tectonic plates come together and one is forced (subducted) beneath the other.
- 2 Over time, the tip of the overriding plate is dragged down with the subducting plate.
- 3 During a megathrust earthquake, the friction holding the plates together is overcome and the overriding plate rapidly snaps back into place.
- 4 This disturbance of the sea floor lifts a column of water, creating a tsunami.



As a tsunami enters shallow water close to shore it is forced to slow down, resulting in increased wave height.



Energy is released in an earthquake and the overriding plate tip snaps back into its original position

If you are near the coast and feel strong earthquake shaking (lasts more than 20 seconds or makes it difficult to stand), do not wait for a warning—get to higher ground immediately!

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How do tsunamis cause damage?

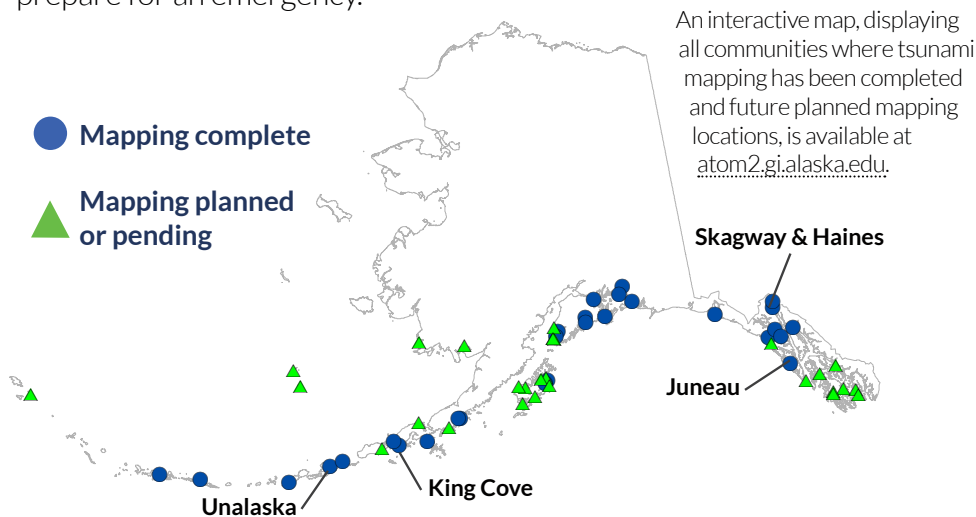
The energy from an earthquake-generated tsunami affects the entire ocean column, from sea floor to surface. Tsunamis cause damage in two ways:

- The smashing **force of incoming water on land**
- The destructive **force of water draining off the land** while carrying debris

Water fluctuations from a tsunami may last more than 24 hours and will be compounded by tides. Remember, **the first wave is not necessarily the largest!**

Mapping tsunamis

Through the National Tsunami Hazard Mitigation Program (NTHMP), DGGs collaborates with the University of Alaska Fairbanks Geophysical Institute to create tsunami inundation maps for vulnerable coastal communities in Alaska. Researchers use geologically plausible earthquake scenarios and numerical modeling of tsunami wave propagation to estimate worst-case inundation (flooding). Maps and accompanying reports (dggs.alaska.gov/pubs/tsunami) are designed to be used by community planners and emergency responders to mitigate tsunami hazards and prepare for an emergency.

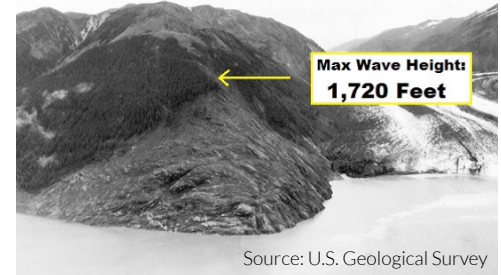


Additional Resources

Division of Homeland Security & Emergency Management:
ready.alaska.gov

National Tsunami Hazard Mitigation Program: nws.weather.gov/nthmp/

Historical tsunamis



In 1958, a magnitude 7.8 earthquake on the Fairweather fault triggered a landslide, which caused a huge tsunami in Lituya Bay, Glacier Bay National Park. **The tsunami traveled more than 1,720 feet up the mountainside** and killed two people in fishing vessels. This tsunami was not an isolated incident in Lituya Bay; at least three other fatal tsunamis have occurred there since ~1850.



The **1964 Great Alaska Earthquake triggered several tsunamis**, including one major tectonic tsunami and ~20 landslide-generated tsunamis. These tsunamis were responsible for over 90 percent of the deaths associated with the earthquake. In total, 106 Alaska residents and 16 California/Oregon residents were killed.

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