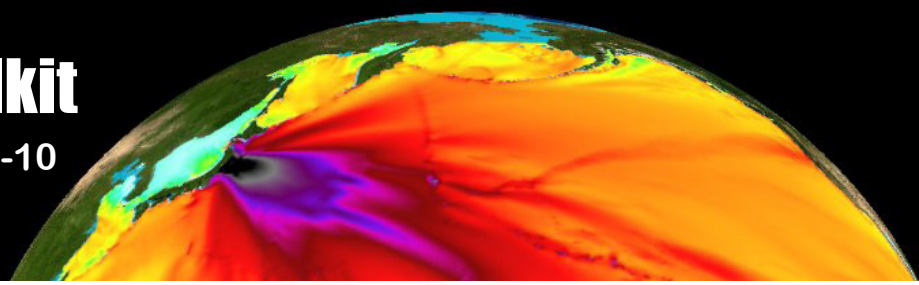
NCEI Educator Toolkit

Historic Tsunamis: Grades 4 -10
NGSS: 4-ESS2-2, HS-ESS3-1



Quick Facts

For reference and incorporation into the Independent Reflection

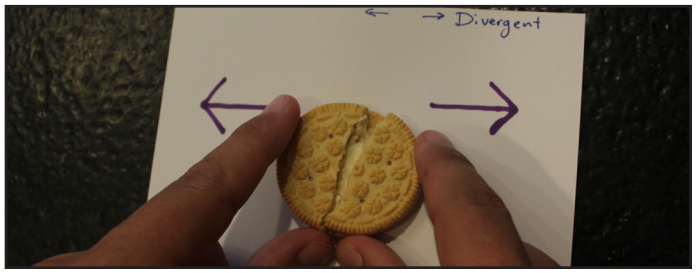
- Earthquakes are responsible for almost 90% of the tsunamis on record.
- Tsunamis are caused by a large and sudden displacement of the water in the ocean.
- Earthquakes occur due to the movement of tectonic plates with three major boundary types: convergent boundaries where the plates move towards each other, divergent boundaries where the plates move away from each other, and transform boundaries where the plates rub against each other in a parallel motion.
- Tsunamis are mostly generated by large earthquakes at convergent plate boundaries and specifically at subduction zones where one plate slides under the other.

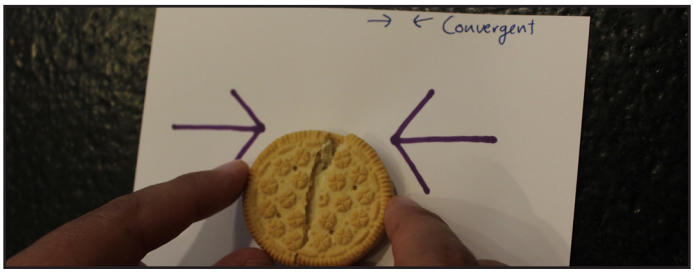
Photo Credit: Richard Madsen

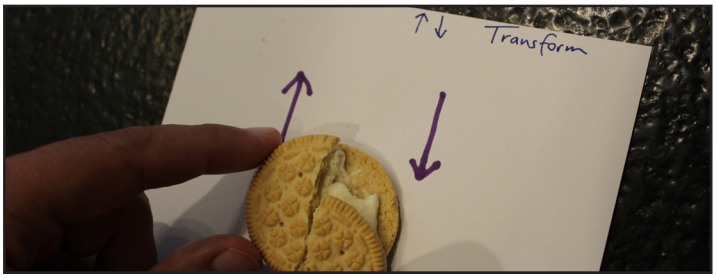
- When they strike land, most tsunamis are less than 10 feet high, but in extreme cases they can exceed 100 feet when they strike near the source.
- In the deep ocean, a tsunami wave can move as fast as 500 mph.
- Warning systems use observation systems that include seismic and water-level networks from around the world to quickly relay information to Tsunami Warning Centers in order to create accurate and timely warnings.

Introduction Demonstration

Support hands-on problem-solving







Setup:

- Label one paper convergent, another divergent, and the third as transform.
- Set a cookie on each paper.
- Take off the top half of each cookie carefully and break in half.
- Replace the piece back onto the creme of the cookie.

Materials for each small group of three students:

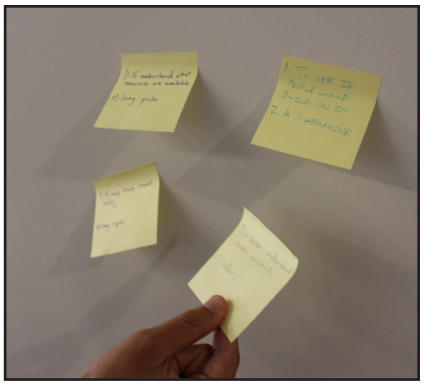
- 3 sandwich cookies with creme filling
- Markers
- 3 pieces of blank white paper

Procedure:

- Explain the physical movement of each boundary and assign each student with an action to duplicate on the cookie by carefully pushing the cookie pieces on top.
- Explain that these plate boundaries can exist underwater.
- Give each group 15 minutes to discuss which boundaries they think would create the most violent tsunamis.
- Have each group share their predictions.

Independent Reflection

Engage students to make the connection between the demonstration and the real-life scenario



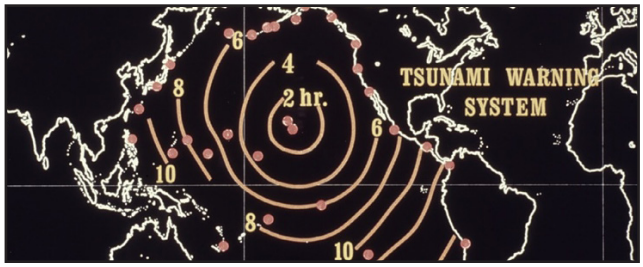
Have students individually select a tsunami in the Natural Hazards Viewer and use the plate boundaries function to identify which plate boundary the tsunami occurred near. Have each student write on a sticky note the following details:

- When did this event occur?
- Was an earthquake the reason the tsunami occurred?
- If it was connected to an earthquake, what was the magnitude of the earthquake?
- What type of plate boundary was this event nearest to?
- How many casualties and what damages were caused by the event?
- How high did the largest waves reach?

Reflect as a group and determine if predictions in the Introduction Demonstration support this information.

Extension Options

Additional resources for exploration



Explore NCEI's Story Maps:

- Tracking Tsunamis: Preserving the Historical Record

Have students create a foldable globe with a map of historic tsunami sources:

- Tsunami Sources Icosahedron

Scaffold up:

- Have each student write a one to two page fictional account of someone who survived the historic tsunami they selected using the details provided in the Natural Hazards Viewer. Make sure the narrative explores steps the fictional survivor would take to ensure safety for their community for future tsunamis.
- Take the general location of the selected historic tsunami and use the Tsunami Travel Times to Coastal Locations viewer to determine the approximate amount of time it would take for a tsunami to travel from the approximate epicenter to a location nearest to them. Have each student write out a scenario that fits the time period for how the epicenter location could alert the second location of the tsunami quickly considering the limitations of that era.

Scaffold down:

- Select one tsunami from the Tracking Tsunamis: Preserving the Historical Record to explore as a group and then lead the identification of the tsunami in the Natural Hazards Viewer to determine the nearest plate boundary type as a group.

Next Generation Science Standards

Earth and Human Activity MS-ESS3-2	Human Sustainability HS-ESS3-1
Analyze and interpret data on natural hazards to forecast catastrophic events and inform the development of technologies to mitigate their effects.	Construct an explanation based on evidence on how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

Additional Resources:

NOAA. 2017. Buoy Data Help Tsunami Preparedness. National Centers for Environmental Information. https://www.ncei.noaa.gov/news/buoy-data-help-tsunami-preparedness

NOAA. JetStream Max: World's Major Tectonic Plates National Weather Service. https://www.weather.gov/jetstream/plates_max

NOAA. 2018. Tsunamis. https://www.noaa.gov/education/resource-collections/ocean-coasts/tsunamis