

Scary Tsunamis



Watch it online <http://www.kqed.org/quest/television/scary-tsunamis>
TV story length 9:50 minutes

QUEST SUBJECTS

- | | |
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| <p>Life Science</p> <p>Earth Science</p> <p>Physical Science</p> | <p>Biology
Health
Environment</p> <p>Geology
Weather
Astronomy</p> <p>Physics
Chemistry
Engineering</p> |
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CA SCIENCE STANDARDS

Grade 4
Earth Sciences
5. Waves, wind, water and ice shape and reshape Earth's land surface. (a, c)

Grade 6
Plate Tectonics and Earth's Structure
1. Plate tectonics accounts for important features of Earth's surface and major geological events. (a, c, d, e)

Grades 9-12
Dynamic Earth Processes (Earth Sciences)
3. Plate tectonics operating over geologic time has changed the patterns of land, sea and mountains on Earth's surface. (a, b, d)

California Geology
9. The geology of California underlies the state's wealth of natural resources, as well as its natural hazards. (b, d)

PROGRAM NOTES

In 2004, hundreds of thousands of people lost their lives due to a devastating tsunami in the Indian Ocean. Could California be in danger of experiencing such a disaster? For Bay Area researchers, the 2004 tragedy provided a rare opportunity to study these deadly forces of nature. They want to learn everything they can about predicting tsunamis before a massive one strikes a little closer to home.

In this segment you'll find...

- ⦿ an explanation of how tsunamis are formed.
- ⦿ what researchers learned from the 2004 Indian Ocean tsunami.
- ⦿ information about the D.A.R.T. tsunami warning system.



TOPIC BACKGROUND

A tsunami, from a Japanese term that means "harbor wave," is a series of ocean waves caused by sudden displacements in the sea floor. If this phenomenon occurs in deep water, a tsunami might be only a few inches or a foot high and never be noticed.



However, when a disturbance happens close to the coastline, a tsunami can devastate coastal communities within minutes. In addition to leaving a wake of local destruction, extremely large disturbances in the sea floor can also affect coastal areas thousands of miles away. That's what happened with the December 2004 tsunami in the Indian Ocean. It struck the coasts of 14 countries from Southeast Asia to northeastern

Africa, killing about 188,000 people (the combined death toll of the earthquake and tsunami).

Tsunamis occur when a disturbance of some sort displaces a large mass of water from its equilibrium position. Waves travel in all directions away from the disturbance, much like the ripples you see after throwing a rock into a pool of water. Landslides, volcanic eruptions, nuclear explosions and impacts from asteroids and other objects from outer space can all cause tsunamis, but earthquakes in oceanic and coastal regions are the most common cause. The magnitude of an earthquake, its depth and the amount of vertical sea floor deformation all help determine the size of a tsunami.

In the open ocean, a tsunami's ripple-like waves can travel at speeds up to 550 miles per hour, the same as an airplane in flight. And because tsunamis have such long wavelengths (measured at about 300 to 600 feet between two successive waves), they also lose very little energy as they travel. Therefore, a tsunami will not just disappear. As it approaches the shallower waters near the coast, tsunami waves slow down and grow in height, sometimes to 100 feet. A wave may break far offshore or it might form a step-like wave with a steep breaking front. Waves may be gentle and cause little damage in one place and be violent and large in another. The first wave in the series may or may not be the largest. It's virtually impossible to predict exactly when this phenomenon will occur or how a tsunami will behave when it reaches the shore, but scientists are getting closer to pinpointing where they will happen, and they are implementing tsunami warning systems in many of these areas.

VOCABULARY

Geology

the scientific study of the origin, history and structure of the earth

Hazard

a source of danger

Magnitude

a measure of the amount of energy released by an earthquake, as indicated by the Richter scale

Plate tectonics

the formation, destruction, movement and interaction of the earth's lithospheric plates

Sediment

fragments of organic or inorganic material that come from the weathering of rock and are carried and deposited by wind, water or ice

Subduction Zone

regions where portions of the earth's tectonic plates are diving beneath other plates into the earth's interior

Tsunami

a wave generated by abrupt, vertical movement of the sea floor caused by earthquakes, volcanic eruptions, landslides or asteroid impact

PRE-VIEWING

- What is a tsunami?
- What major tsunamis do you know about? Where and when did they occur and what damage did they cause?
- Start KWL chart

VIEWING FOCUS

NOTE: You may choose to watch the television segment twice with your students: once to elicit emotional responses and get an overview of the topic and again to focus on facts and draw out opinions.

- How are tsunamis created?
- What can we learn by studying the sand deposits left behind after a tsunami?
- What evidence is there that a major tsunami could strike in the Pacific Northwest?
- How does the D.A.R.T. system work?
- What kinds of effects do you think a massive tsunami would have on the Bay Area?

For all media see:

- Segment Summary Student Sheet
http://www.kqed.org/quest/downloads/QUEST_SegSum_StudentSheet.pdf
- Personal Response Student Sheet
http://www.kqed.org/quest/downloads/QUEST_PersResp_StudentSheet.pdf

QUEST, PBS and NPR LESSON PLANS and RESOURCES

NOTE: Resources from the Teachers' Domain collection require a fast and free registration.

The Science of Tsunamis: Seeking Understanding in the Wake of Tragedy PBS

<http://www.pbs.org/newshour/extra/teachers/lessonplans/science/tsunamis.html>

An **Online NewsHour** extra, this lesson plan includes a demonstration of how tsunamis are formed and an in-depth look at the origin of the 2004 Indian Ocean tsunami.

Waves of Destruction: Tsunamis PBS

<http://www.pbs.org/wnet/savageearth/tsunami/index.html>

This essay from **Savage Earth** includes information about how tsunamis are formed and what happens when they reach ground. Included is video footage of a tsunami survivor, images of tsunami debris and a "Tsunami Attack" animation showing the creation and movement of a tsunami.

Once and Future Tsunamis Teachers' Domain

<http://www.teachersdomain.org/resource/ess05.sci.ess.watcyc.oncetsunami/>

Explore key tsunamis dating as far back as 3.5 billion years, and look at a hypothesized future tsunami disaster in this interactive world map from **NOVA Online**.

Waves of Destruction Teachers' Domain

<http://www.teachersdomain.org/resource/nat08.earth.geol.tec.waves/>

This video segment from **Nature** details the anatomy of a tsunami and explores the possibility that animals sensed the devastating 2004 Indian Ocean tsunami before it hit shore.

Anatomy of a Tsunami Teachers' Domain

<http://www.teachersdomain.org/resource/ess05.sci.ess.watcyc.anatomytsunami/>

This interactive from **Nova Online** details how the 2004 Indian Ocean tsunami was triggered and what happened once the waves hit coastlines both near to and far from its source.

Discuss **Scary Tsunamis** on the QUEST Blog

<http://www.kqed.org/quest/blog/2009/07/28/producers-notes-scary-tsunamis/>

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The Bay Institute
www.bay.org

California Academy of Sciences
www.calacademy.org

Chabot Space and Science Center
www.chabotspace.org

East Bay Regional Park District
www.ebparks.org

Exploratorium
www.exploratorium.edu

Girl Scouts of Northern California
www.girlscoutsbayarea.org

Golden Gate National Parks Conservancy
www.parksconservancy.org

The J. David Gladstone Institutes
www.gladstone.ucsf.edu

Lawrence Berkeley National Laboratory
www.lbl.gov

Lawrence Hall of Science
www.lawrencehallofscience.org

Monterey Bay Aquarium
www.mbayaq.org

Monterey Bay Aquarium Research Institute
www.mbari.org

Oakland Zoo
www.oaklandzoo.org

The Tech Museum of Innovation
www.thetech.org

UC Berkeley Natural History Museums
<http://bnhm.berkeley.edu/>

U.S. Geological Survey
www.usgs.gov

MORE EDUCATIONAL RESOURCES FOR USING QUEST MULTIMEDIA TO ENHANCE 21st CENTURY SKILLS IN TEACHING AND LEARNING

Why Use Media in Science Education?

www.kqed.org/quest/downloads/QUEST_Why_Media_08-09.pdf

- “As science educators, we know how important critical thinking and new technology skills are in the scientific community...” ([read more](#)).

Science Multimedia Analysis

www.kqed.org/quest/downloads/QUEST_Science_Multimedia_Analysis_08-09.pdf

- “By increasing students’ awareness of the intersections between media and science, we give them the tools to think like scientists...” ([read more](#)).

How to Use Science Media for Teaching and Learning

http://www.kqed.org/quest/downloads/QUEST_Media_Tips_08-09.pdf

- If we consider all forms of media “texts” from which students gather information, we can use similar literacy strategies to engage them in video, audio, blogs and Explorations. Once students have obtained information from multiple media sources, how do they share what they have learned? Through their own media-creation projects, of course!

Using Google Maps to Create Explorations

http://www.kqed.org/quest/files/download/52/QUEST_ExplorationCreation.pdf

- Do you like the science hike Explorations on the **QUEST** site? Use this place-based educational guide for educators and group leaders to create similar science-based maps with youth.

OTHER WAYS TO PARTICIPATE IN QUEST



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KQED 88.5 FM San Francisco & 89.3 FM Sacramento
Mondays at 6:30am and 8:30am



WATCH

KQED Channel 9
Tuesdays at 7:30pm