March, 2011
Issue 10

Science in the News


The Great Wave off Kanagawa. Print by the Japanese artist Hokusai

TOPIC: Devastating 9.0 Earthquake and Tsunami in Japan

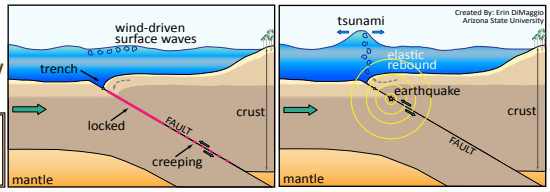
Event Dates:

March 9th, 2011 - Large foreshocks (M 7.2)
March 11th, 2011 - Magnitude 9.0 Earthquake & Tsunami

Project website: http://sese.asu.edu/teacher-resources

Event Description

On March 11th, 2011 at 12:46 AM EST (2:46 PM in Tokyo) a M 9.0 earthquake occurred ~100 km of the NE short of Honshu, Japan at a depth of 32 km. Japan lies along the Ring of Fire, where the Pacific and North American plates converge at ~83 mm/yr forming a subduction zone plate boundary. Stress builds up due to the collision of these plates, and is released during earthquakes. Large earthquakes occur frequently in Japan, and some cause devastating *tsunamis*. Tsunami is a Japanese word meaning *tsu=harbor nami=wave*. Similar to the deadly Sumatra tsunami in 2004, the M 9.0 subduction zone earthquake caused a vertical shift in the ocean floor that displaced a large volume of water creating a tsunami. As opposed to a wind generated wave that affects only the surface of the water column, a tsunami moves the entire water column. Wave heights amplify as the wall of water approaches shallow coastlines.



(right) How a tsunami is generated by an earthquake at a subduction zone.

Lesson Description

The goal of this lesson is to understand how earthquakes cause tsunamis. (1) As a class, briefly review what earthquakes are & where they occur. (2) Ask students what they know about tsunamis in general, and the one on 3/11/11. (3) Students may link the M 9.0 earthquake with the tsunami, or 'guide' them to that possibility. You think that the large earthquake in Japan caused the tsunami? Sounds good, but how are they related? (4) Pass out *SciNews-Tsunamis-EQs.pdf* worksheet, fold in half, & have students complete **Part 1** *(then flip over to Part 2)*. (5) Ask students to share their drawings or share using a projector. (6) Pre-select one or more *Science of Tsunamis* media sources and show/discuss with students. (7) Pre-select one or more *Tsunami Footage* videos and show students. **Note: page 2 of the worksheet is designated for students' notes and observations.* (8) Lastly, have students complete **Part 2**, then discuss differences between Part 1 & 2 drawings, and what they learned.

Materials:

+ **HowDoEQsCauseTsunamis.pdf:** Students to draw and label how they think an earthquake causes and tsunami. Page 2 is reserved for students' observations and notes.
+ **Science of Tsunamis Media: a list of** videos, figures, and a side show discussing the science of Tsunamis.
+ **Tsunami Footage:** multiple (non-youtube) links to watch footage of the devastation of the March 11th tsunami.

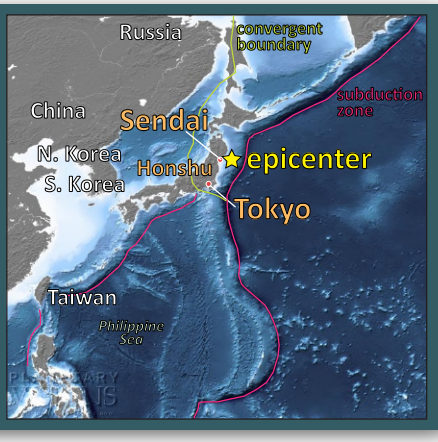
Targeted Arizona State Standards (6th & 7th grade)

(grade 6) Strand 3, Concept 1: Changes in Environments (PO2) - Describe how people plan for, and respond to, the following natural disasters (flooding).
(grade 7) Strand 6, Concept 2: Earth's Processes & Systems (PO3) - Analyze the evidence that lithospheric plate movements occur.
(grade 7) Strand 6, Concept 2: Earth's Processes & Systems (PO5) - Relate plate boundary movements to their resulting landforms (faults, trenches).

- Location -

The magnitude 9.0 earthquake occurred off the NE coast of Honshu, Japan (90 miles E of Sendai and 231 miles NE of Tokyo).

The earthquake is related to thrust faulting along the subduction zone.



- Before and After Pictures -

Source: Google via ABC News

Repeat satellite photos of Fujitsuka in Sendai, Japan before and after the M9.0 earthquake and resulting tsunami, showing nearly complete destruction.

Informational Websites: *(links provided on the SciNews website)*

US Geological Survey: *http://earthquake.usgs.gov/earthquakes*
NOAA Tsunami Centers: *http://www.tsunami.gov/*
Japan Shake Map: *http://www.japanquakemap.com/*
International Tsunami Info Center: *http://itic.ioc-unesco.org/*
IRIS EQ Teachable Moments: *http://www.iris.edu/hq/retm/#1328*
Tusnami Information for Kids: *http://www.tsunami.noaa.gov/kids.html*

Lesson Plan Suggestion: *(link provided on the SciNews website)*
International Tsunami Information Center: (K-12)Tsunami Curriculum: background reading, class/student activites, etc.

ARIZONA SPACE GRANT CONSORTIUM

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