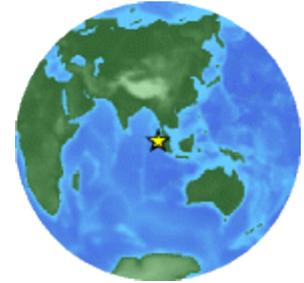


# Magnitude 7.7 NORTHERN SUMATRA, INDONESIA

Tuesday, April 6, 2010 at 22:15:02 UTC



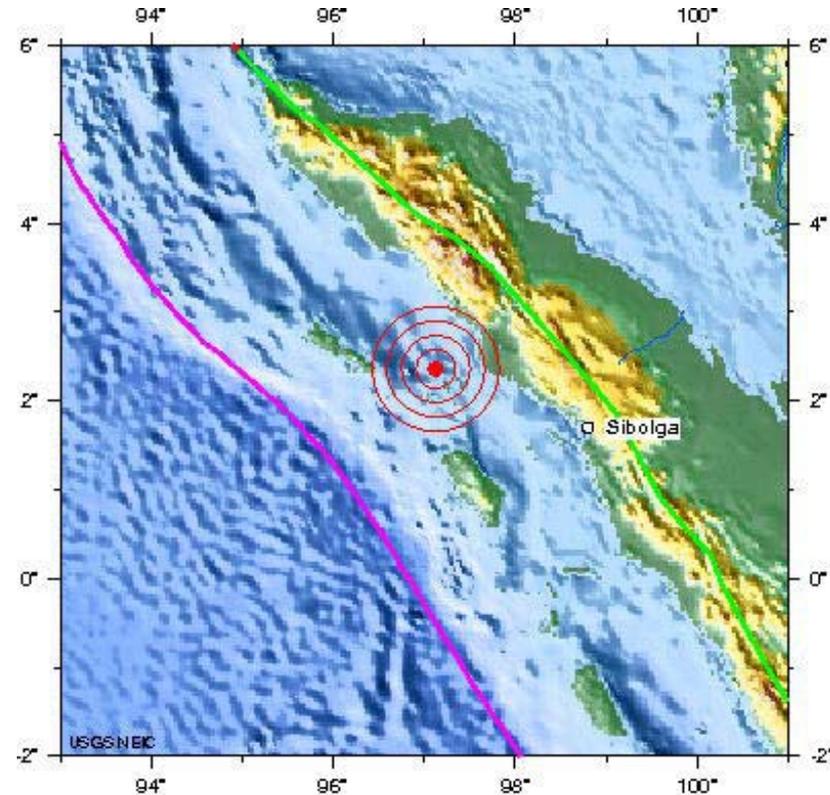
USGS

A major 7.7 earthquake occurred Tuesday 205 km (125 miles) west-northwest of Sibolga, Sumatra, Indonesia. There was widespread panic as residents rushed to higher ground. Local media report that hundreds of houses have been damaged, and there are electricity blackouts across the province. Following the earthquake, people remained out on the streets, wary of aftershocks.



Residents sit on a truck as they prepare to flee after an earthquake in Banda Aceh on Sumatra island, Indonesia, Tuesday, April 6, 2010. A 7.7 earthquake shook Indonesia's northwest island of Sumatra early Tuesday, prompting a brief tsunami warning and sending residents rushing for higher ground.

(AP Photo/Heri Juanda)



*Images courtesy of the U.S. Geological Survey*

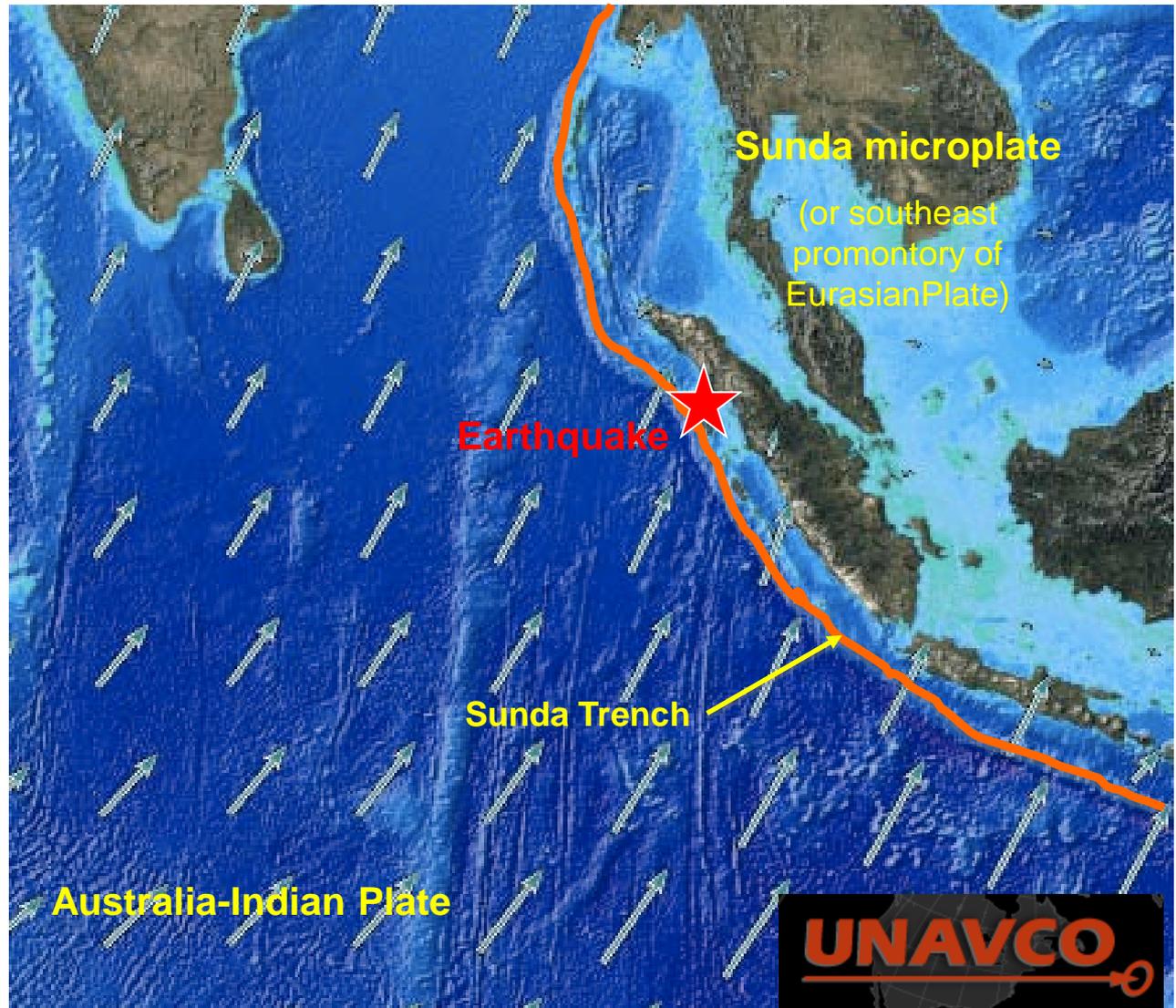
# Magnitude 7.7 NORTHERN SUMATRA, INDONESIA

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The red star shows the epicenter of the earthquake while the arrows show the direction of motion of the Australia-Indian Plate.

At the location of this earthquake, the Australia-Indian Plate moves north-northeast with respect to the Sunda microplate at a velocity of approximately 60-65 mm/yr.

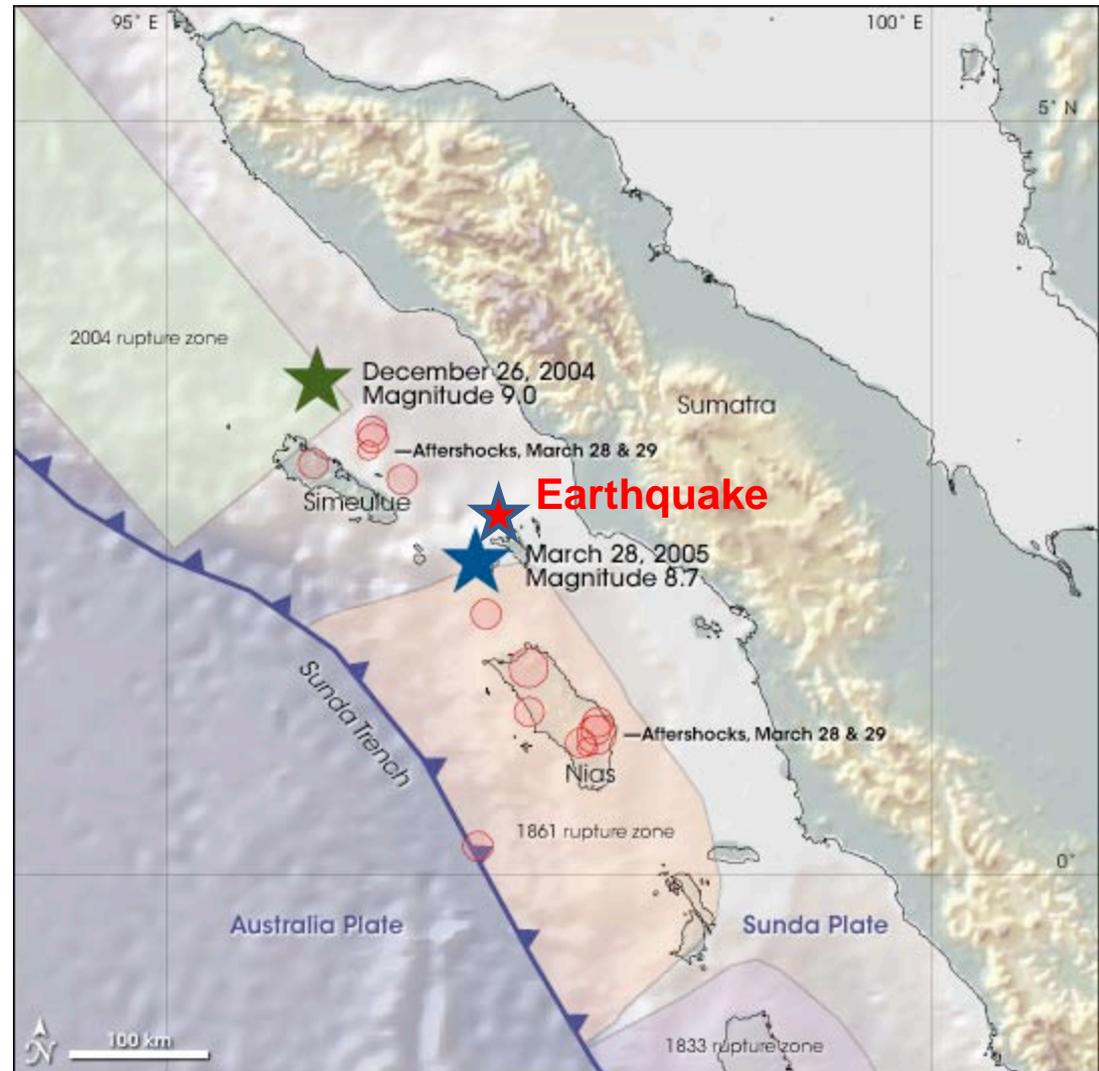
The Sunda trench axis strikes approximately N 37°W. The Indian Ocean crust is moving in an azimuth of ~ N 23°E relative to Southeast Asia, giving an angle of obliquity of 60°.



The subduction zone surrounding the immediate region of this event last slipped during the M8.6 earthquake of March 2005, and today's event (red star) appears to have occurred within the rupture zone of that earthquake.

Within a few years, almost the entire length of the Sumatra megathrust has ruptured:

- two M7.3 earthquakes 125 km to the north in 2002 and 2008;
- a M9.1 earthquake that ruptured to within 125 km north of this earthquake in 2004;
- a M7.9 earthquake 250 km to the south in 2007;
- a M8.4 earthquake 375 km to the south in 2007;
- and a M7.5 earthquake 260 km to the south near in 2009.

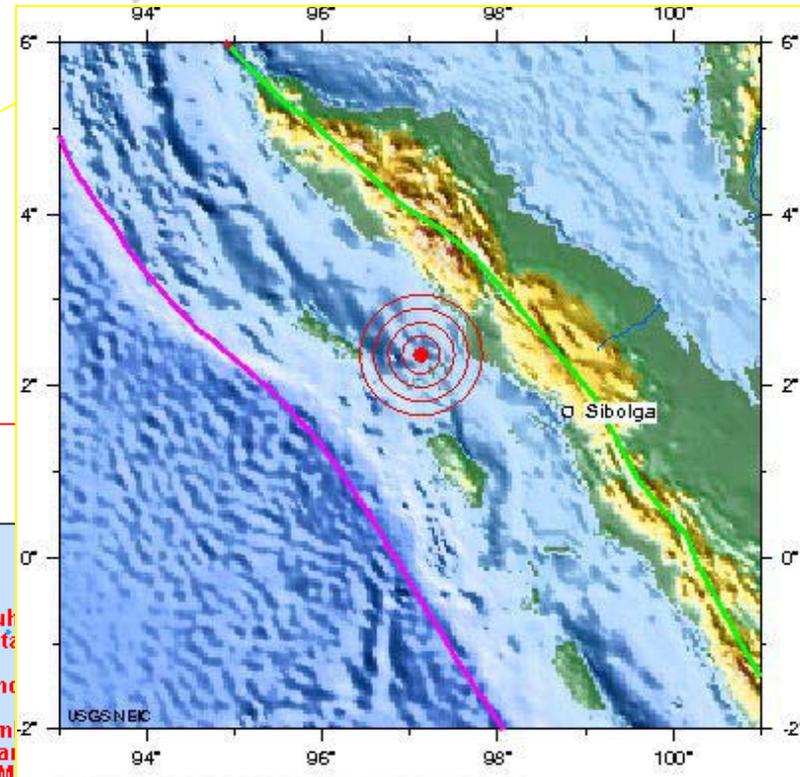




# Magnitude 7.7 NORTHERN SUMATRA, INDONESIA

Tuesday, April 6, 2010 at 22:15:02 UTC

In most subduction zones, motion of the subducted plate is nearly perpendicular to the trench axis (purple line). In some cases, for example Sumatra, the convergent motion is oblique to the trench and a strike-slip fault is observed running near or along the volcanic chain (green line).



## Major Volcanoes of Indonesia

(with eruptions since 1900 A. D.)

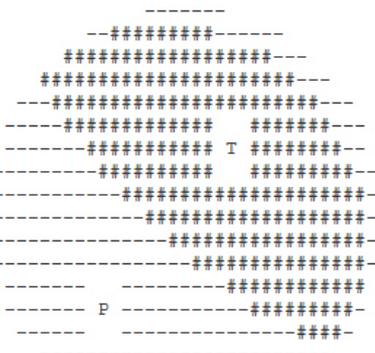
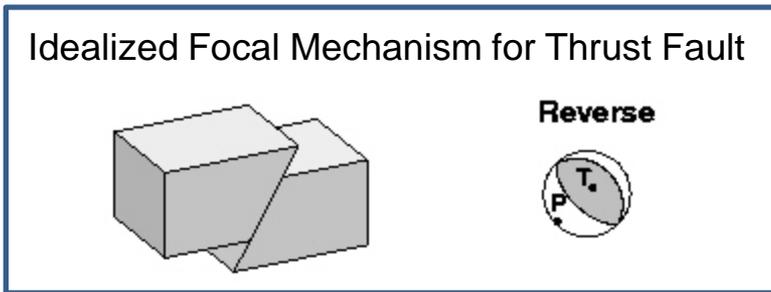


The geography of Indonesia is dominated by volcanoes that are formed due to subduction of the Australia-Indian Plate beneath the Sunda microplate.

# Magnitude 7.7 NORTHERN SUMATRA, INDONESIA

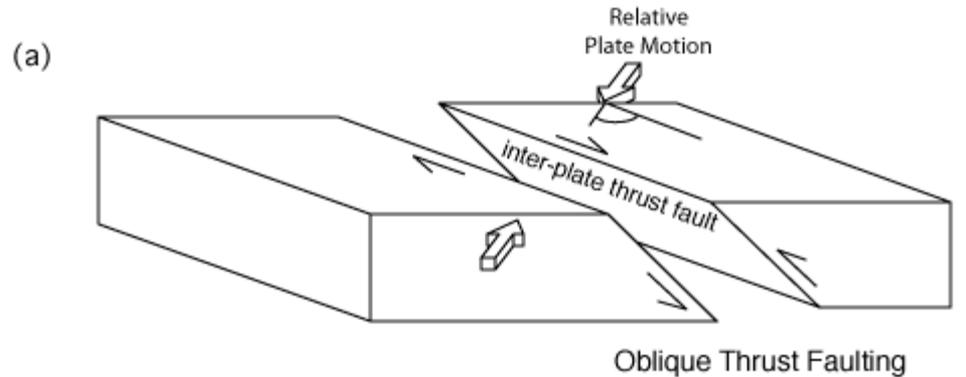
Tuesday, April 6, 2010 at 22:15:02 UTC

This Sumatra earthquake occurred as a result of thrust faulting on or near the subduction interface plate boundary between the Australia-India and Sunda plates. On the basis of the currently available fault mechanism information and earthquake depth, it is likely that this earthquake occurred along the plate interface.

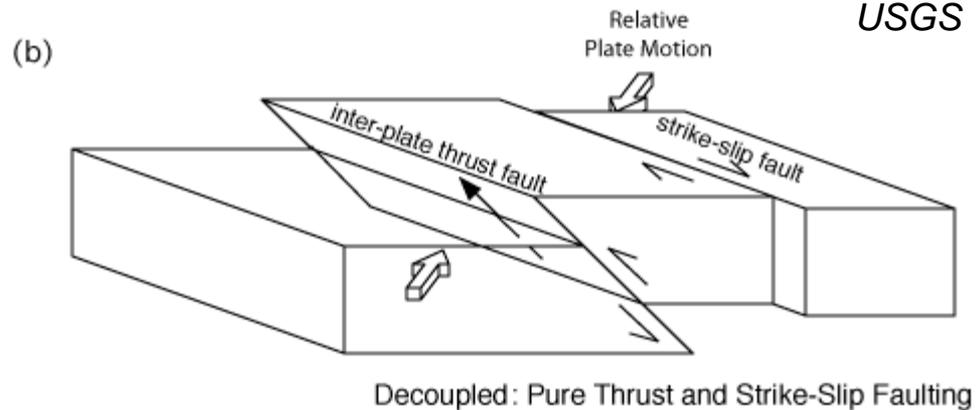


USGS Centroid  
Moment Tensor  
Solution

The tension axis (T) reflects the minimum compressive stress direction.  
The pressure axis (P) reflects the maximum compressive stress direction.



USGS



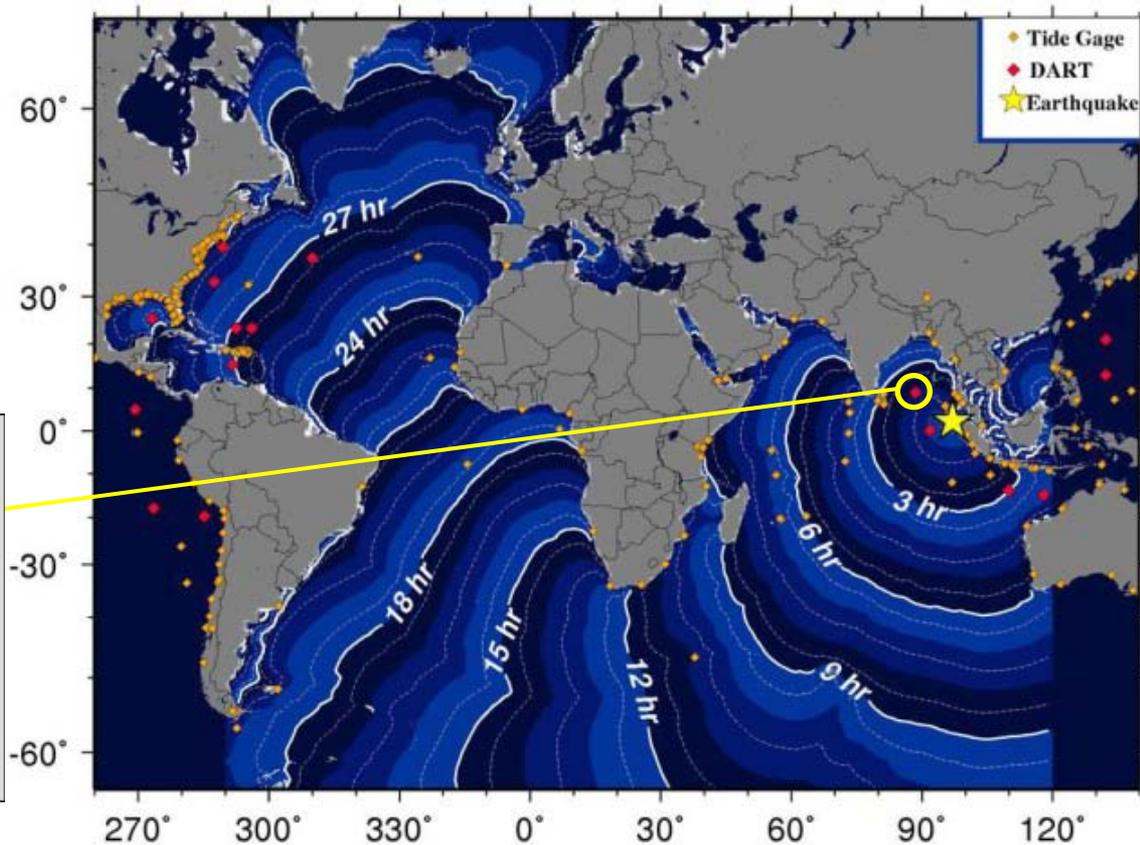
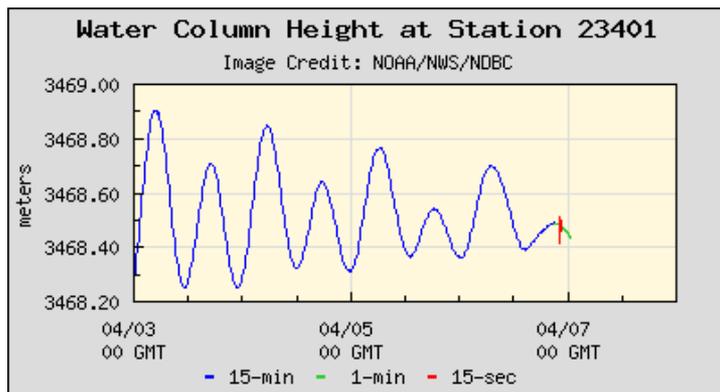
USGS

# Magnitude 7.7 NORTHERN SUMATRA, INDONESIA

Tuesday, April 6, 2010 at 22:15:02 UTC

This map shows projected tsunami travel times from this earthquake.. This map indicates forecasted times only, not that a wave traveling those distances has actually been generated. Tsunami monitoring systems have been strategically deployed near regions with a history of tsunami generation, to ensure measurement of the waves as they propagate towards coastal communities and to acquire data critical to real-time forecasts.

A nearby tsunami buoy detected a small elevation in wave height from this earthquake (indicated in red on the graph below). This caused a local tsunami watch to be issued for Indonesia but that watch has now been cancelled.

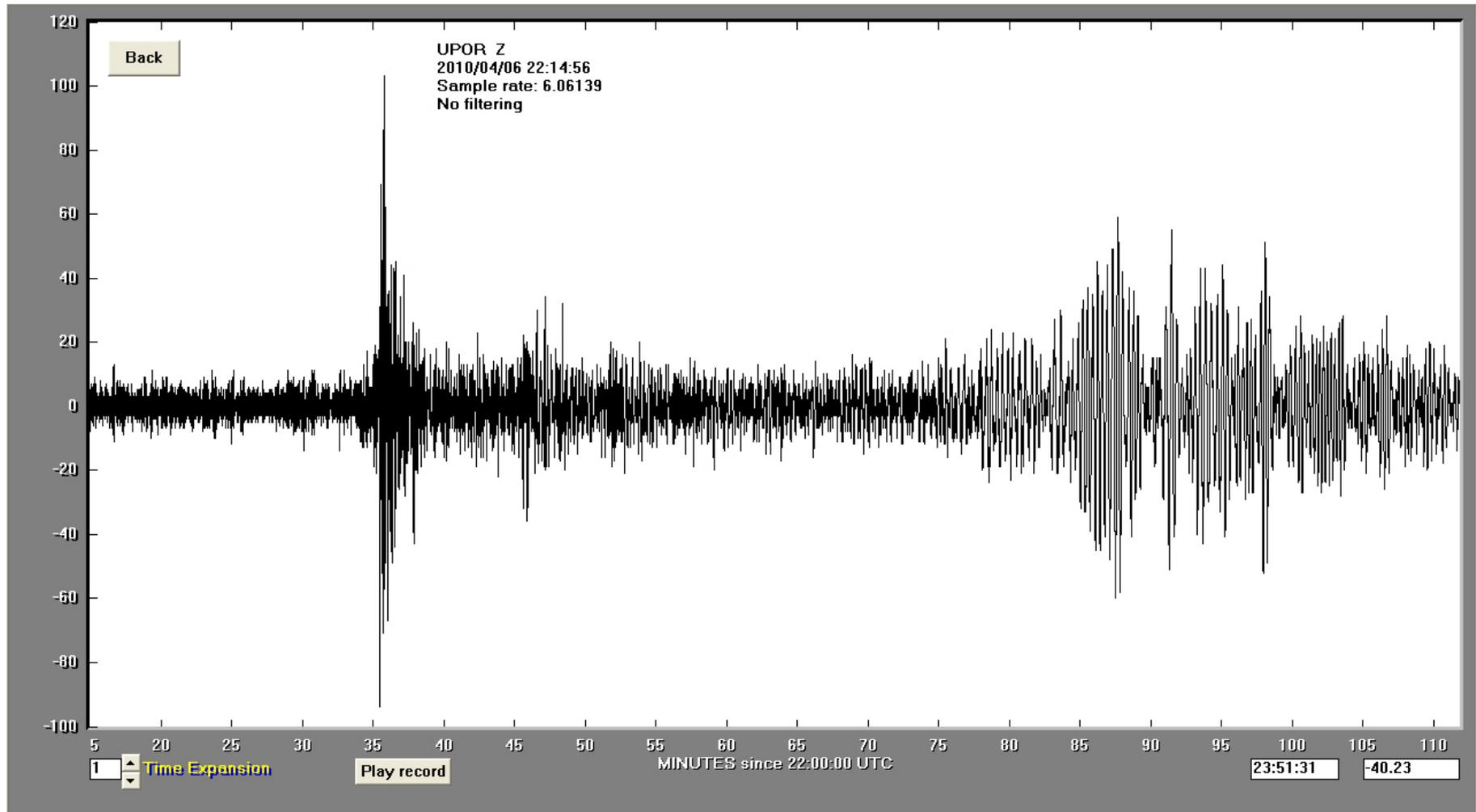


Thailand Meteorological Department (TMD)  
STB - SAIC Tsunami Buoy (DART II payload)

# Magnitude 7.7 NORTHERN SUMATRA, INDONESIA

Tuesday, April 6, 2010 at 22:15:02 UTC

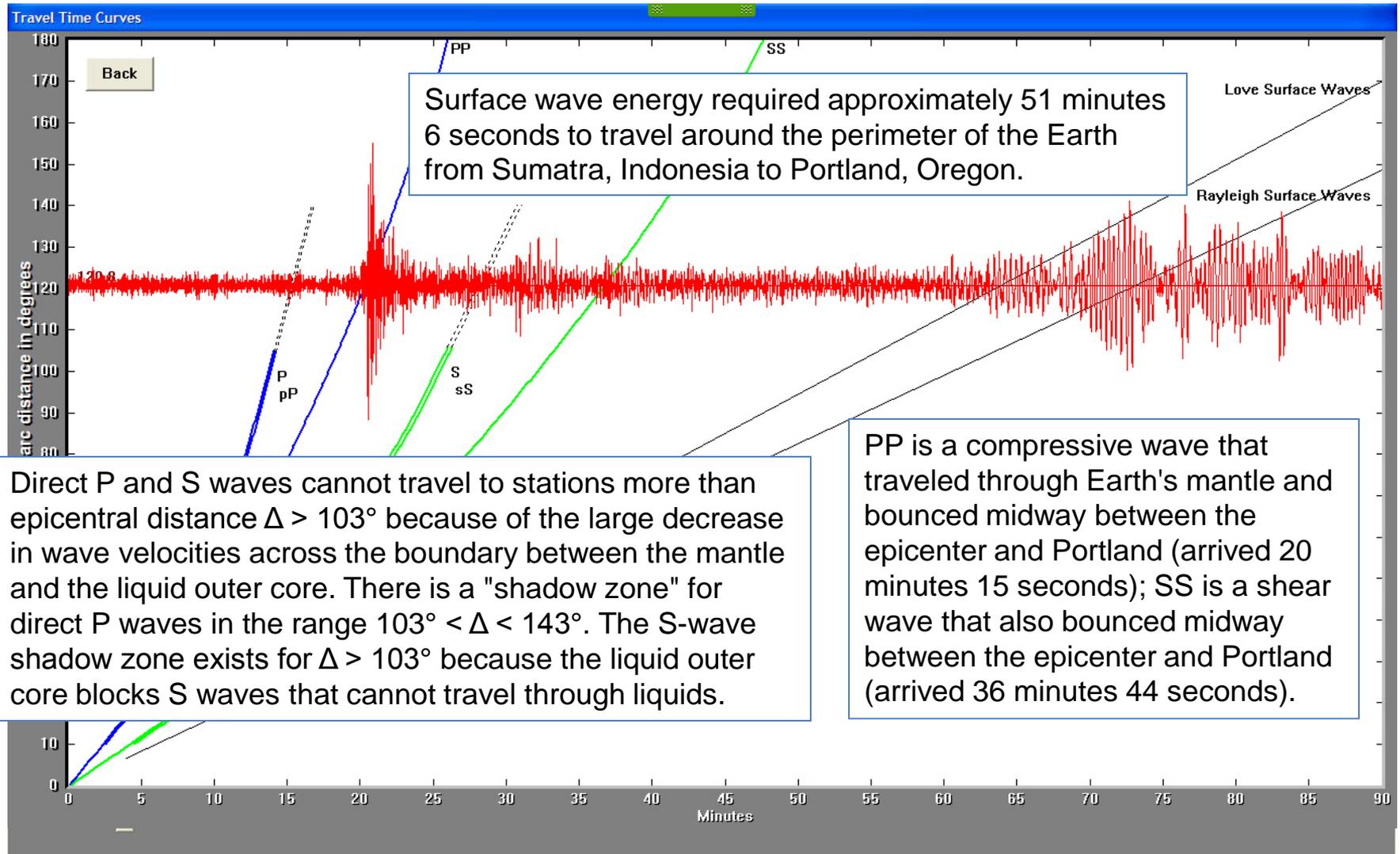
The record of the M7.7 Northern Sumatra, Indonesia earthquake on the University of Portland seismometer (UPOR) is illustrated below.



# Magnitude 7.7 NORTHERN SUMATRA, INDONESIA

Tuesday, April 6, 2010 at 22:15:02 UTC

Portland is about 13,408 km (~8331 miles, 120.79 degrees) from the location of this earthquake.



## Quick Time Required

Animation explaining the seismic shadow zone.

Epicentral distance is the angle formed by the intersection of the line from the earthquake to Earth's center with the line from the observing point to the Earth's center.

S waves are seen up to a distance of  $104^\circ$  from an earthquake, but direct S waves are not recorded after this distance.

P waves also have a shadow zone between  $104^\circ$  and  $140^\circ$ .

1.ShadowZones\_640\_med

File Edit View Window Help



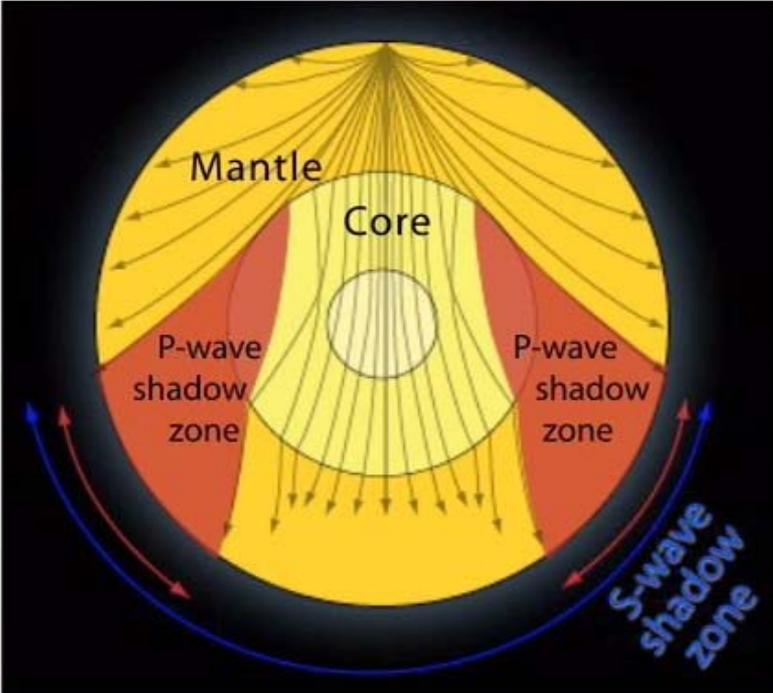
## Seismic Shadow Zones



How the mantle and core were determined using the arrival times of direct P and S body waves

**P waves** (primary) are compressive waves that travel through solids & liquids.

**S waves** (secondary) are shear waves that travel through solids only.



00:00:00

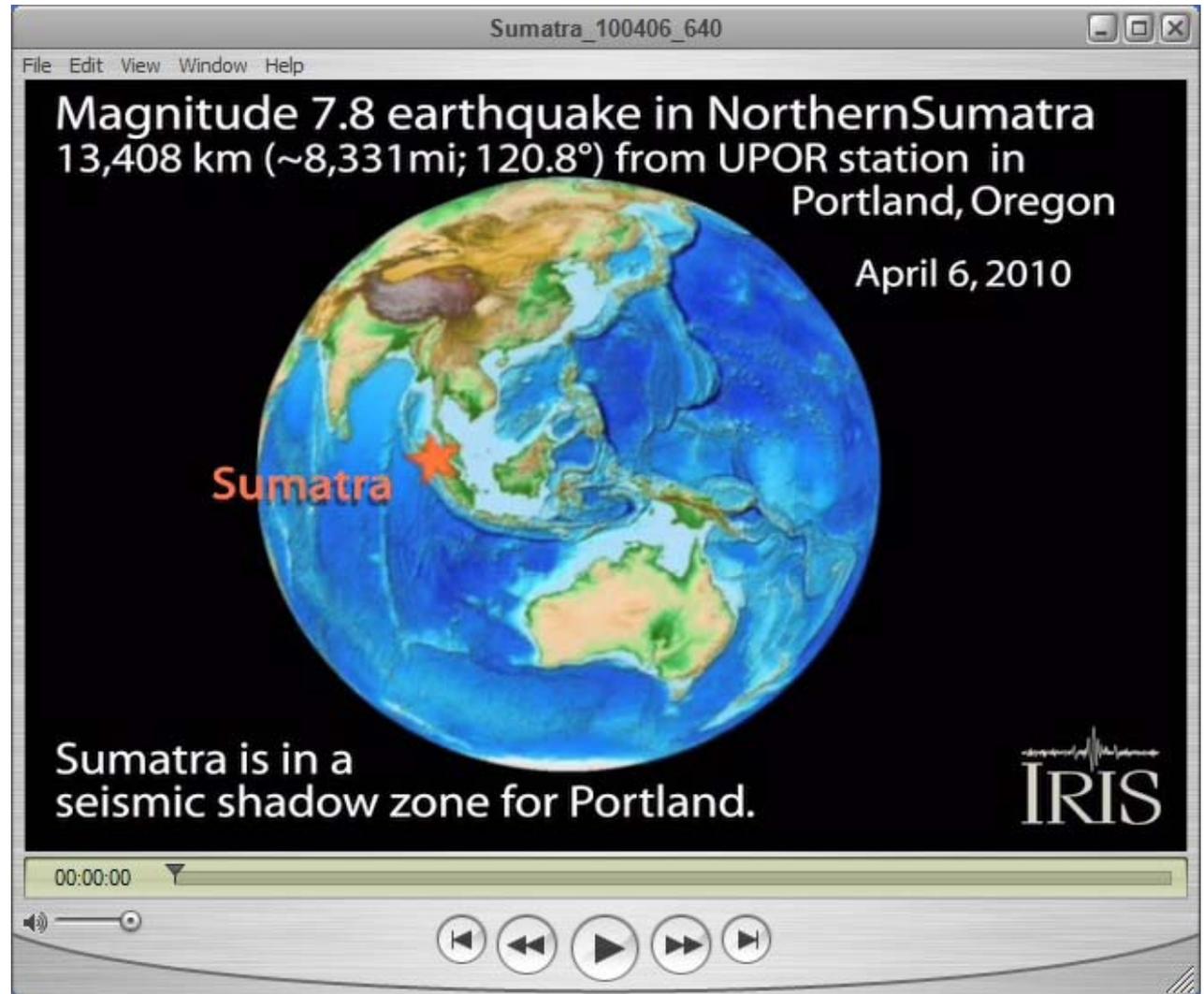







## Quick Time Required

Animation of the generalized path of seismic waves traveling from the Sumatra earthquake to a seismometer in Portland, Oregon



Sumatra\_100406\_640

File Edit View Window Help

Magnitude 7.8 earthquake in Northern Sumatra  
13,408 km (~8,331 mi; 120.8°) from UPOR station in  
Portland, Oregon

April 6, 2010

Sumatra

Sumatra is in a seismic shadow zone for Portland.

IRIS

00:00:00

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