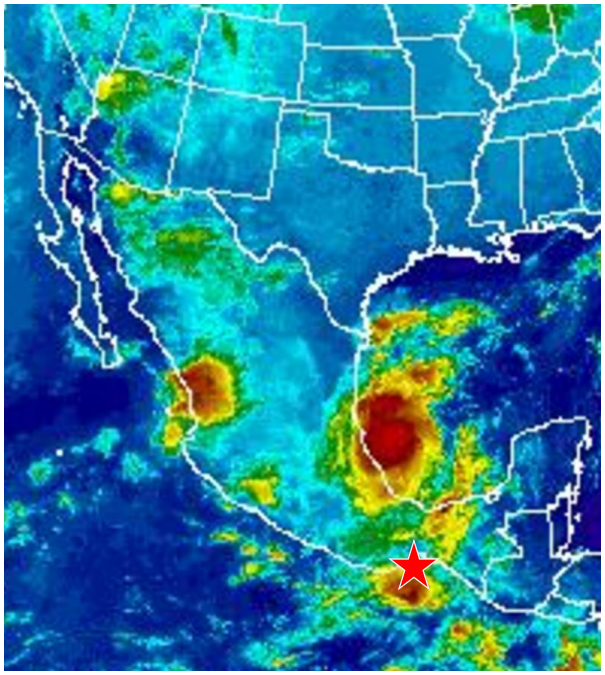
Magnitude 8.1 OFFSHORE CHIAPAS, MEXICO

Friday, September 8, 2017 at 04:49:21 UTC

A magnitude 8.1 earthquake has occurred offshore Mexico. It was felt as far away as Mexico City and Guatemala City. This occurred as heavy rains from Hurricane Katia were approaching from the east. There are early reports of 32 deaths from this earthquake, with homes, schools and hospitals damaged.



Red star is epicenter from USGS
Image of Hurricane Katia courtesy NOAA

Left: Residents in Juchitan, Oaxaca state, Mexico stand on debris of a partially collapsed building felled by this earthquake, one of the most powerful ever to strike Mexico. AP image

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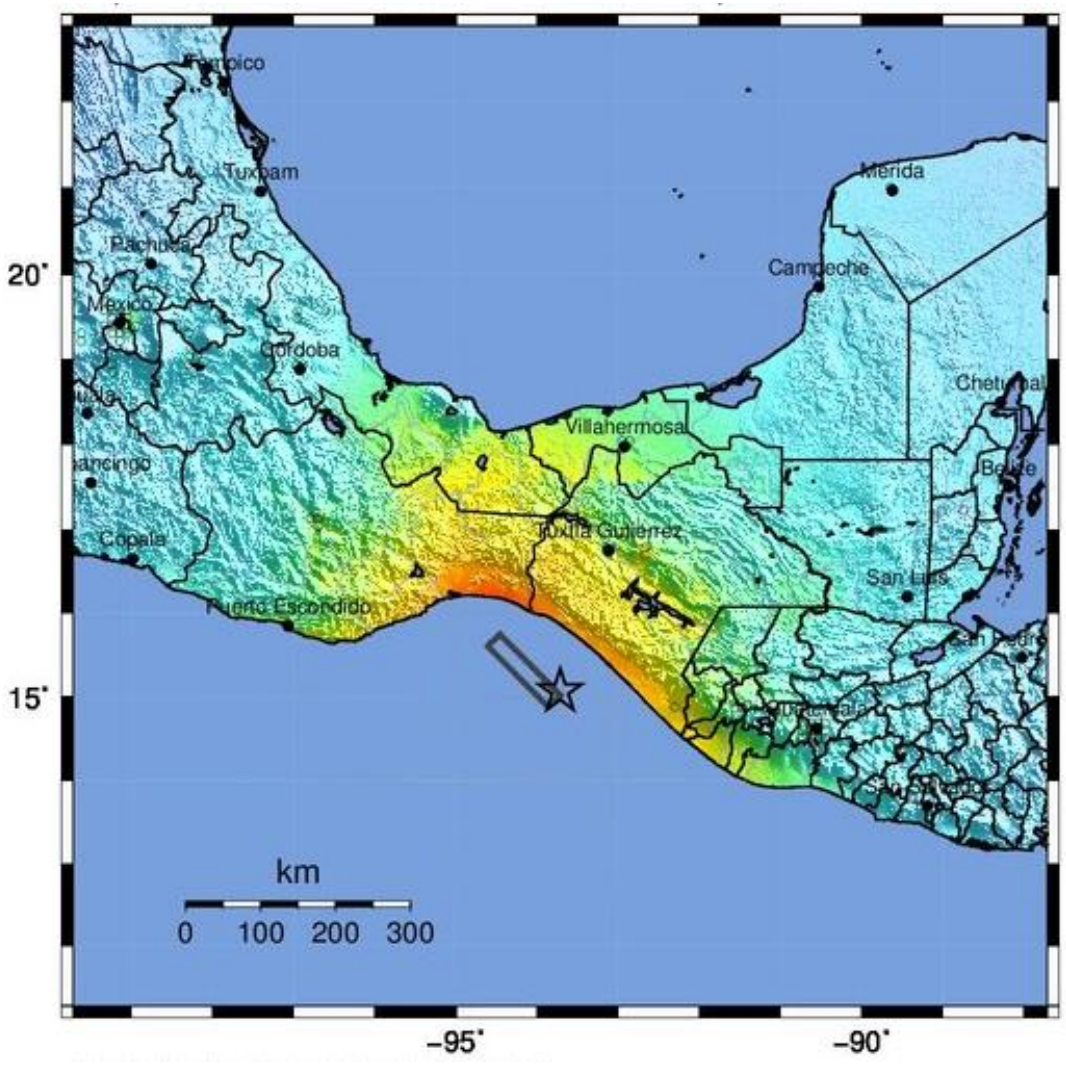
The Modified-Mercalli Intensity scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking.

The coastline near the earthquake experienced severe shaking.

Modified Mercalli Intensity	Perceived Shaking
X	Extreme
IX	Violent
VIII	Severe
VII	Very Strong
VI	Strong
V	Moderate
IV	Light
II-III	Weak
I	Not Felt

Image courtesy of the US Geological Survey



USGS Estimated shaking intensity from M 8.1 Earthquake

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IRIS Teachable Moments

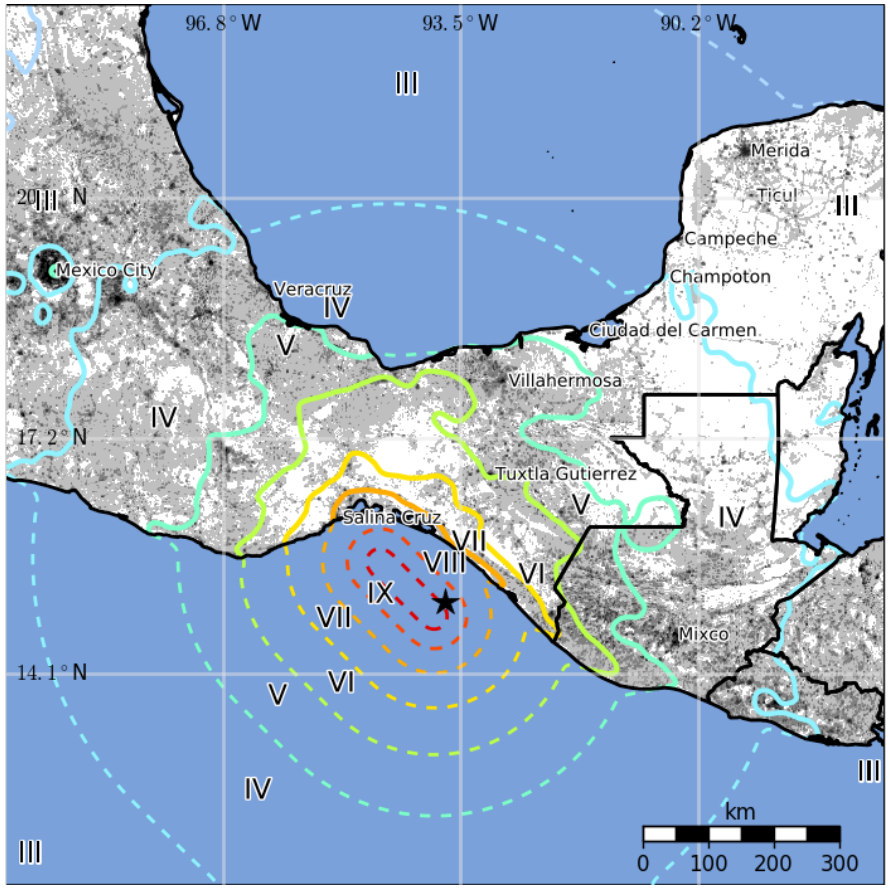
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

The USGS estimates that 547,000 people felt severe shaking from this earthquake.

MMI	Shaking	Pop.
I	Not Felt	--*
II-III	Weak	22,225 k*
IV	Light	40,108 k
V	Moderate	22,031 k
VI	Strong	4,325 k
VII	Very Strong	972 k
VIII	Severe	547 k
IX	Violent	0 k
X	Extreme	0 k

USGS PAGER

Population Exposed to Earthquake Shaking



The color coded contour lines outline regions of MMI intensity. The total population exposure to a given MMI value is obtained by summing the population between the contour lines. The estimated population exposure to each MMI Intensity is shown in the table.

Image courtesy of the US Geological Survey

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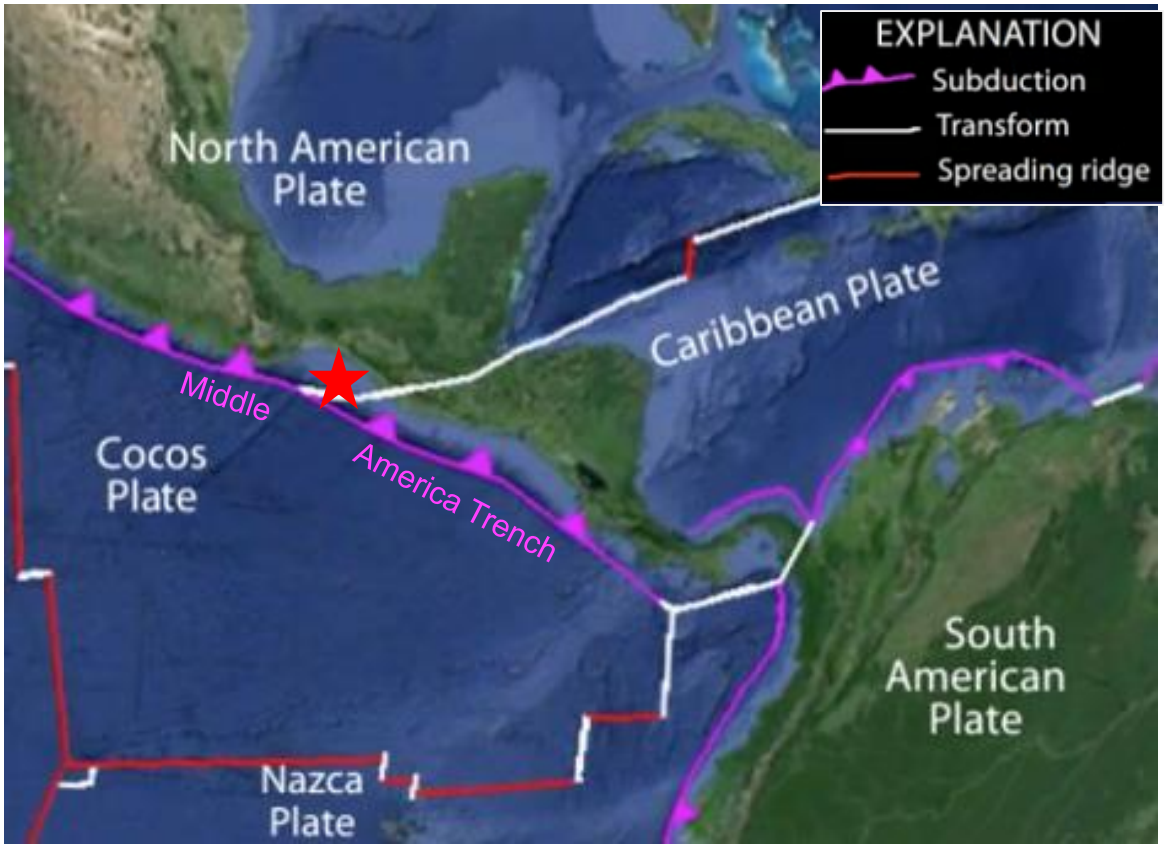
The red star shows the epicenter of this earthquake.

Southwest of the epicenter, the Cocos Plate subducts beneath the North American Plate along the Middle America Trench.

To the southeast, the Cocos Plate subducts beneath the Caribbean Plate along the trench.

The transform boundary between the Caribbean and North American plates intersects the Middle America Trench near the epicenter.



Many earthquakes on the continental side of the Middle America Trench result from thrust faulting. However, this earthquake resulted from normal faulting. Given the 70 km depth, this earthquake most likely occurred within the top of the Cocos Plate due to extensional forces as the subducting plate bends as it dives beneath the continent.

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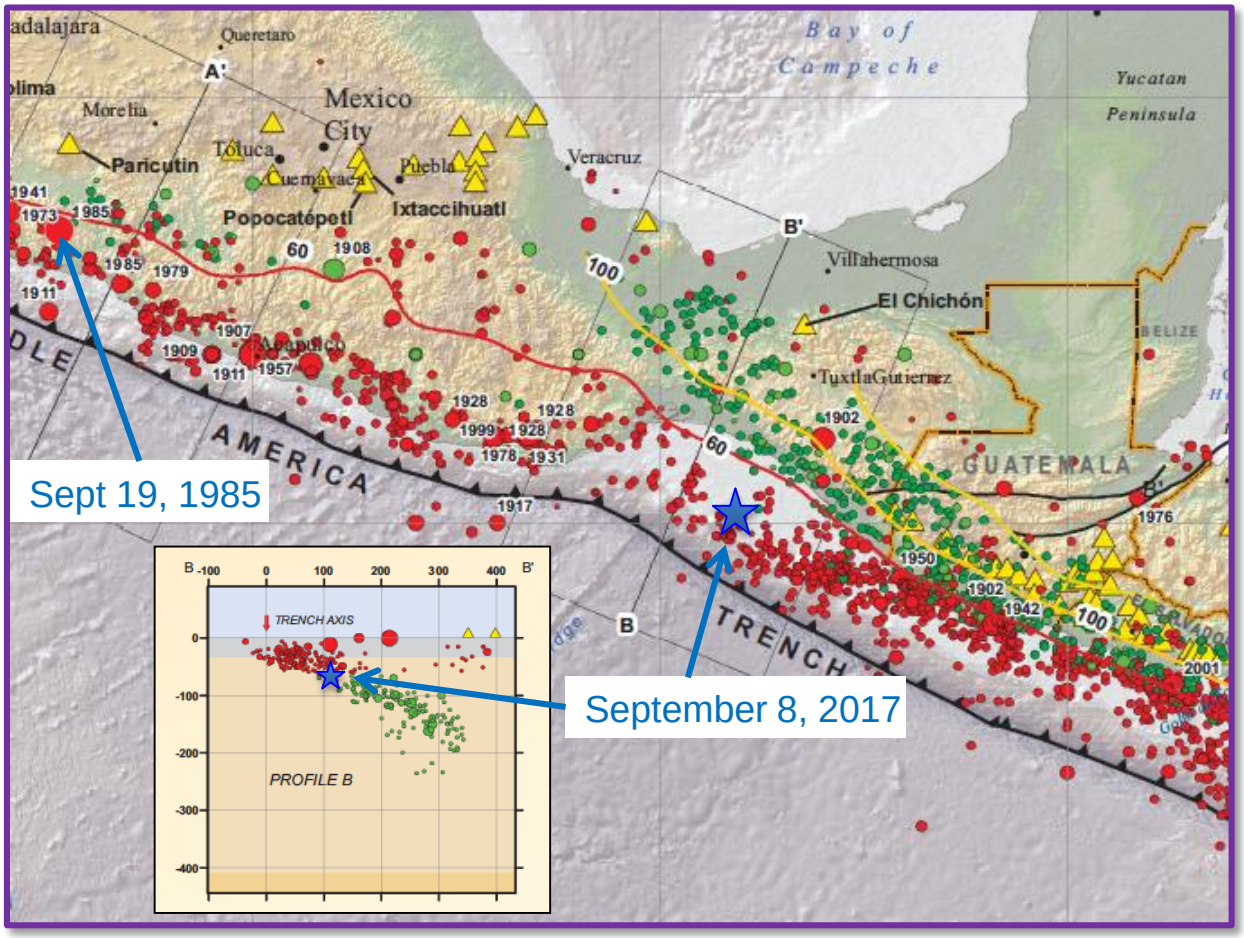
This magnitude 8.1 earthquake is shown by the blue star on the map and cross section. The epicenter of the 1985 magnitude 8.0 earthquake that damaged Mexico City is also shown. Map shows historic seismicity that indicates shallow earthquakes near the trench and deeper away from the trench as reflected also in the cross section as the Cocos plate dives.



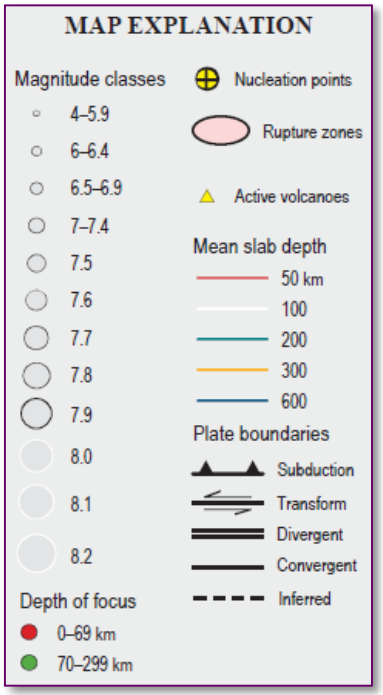


Image source:
U.S. Geological Survey
Open-File Report 2010–1083-F

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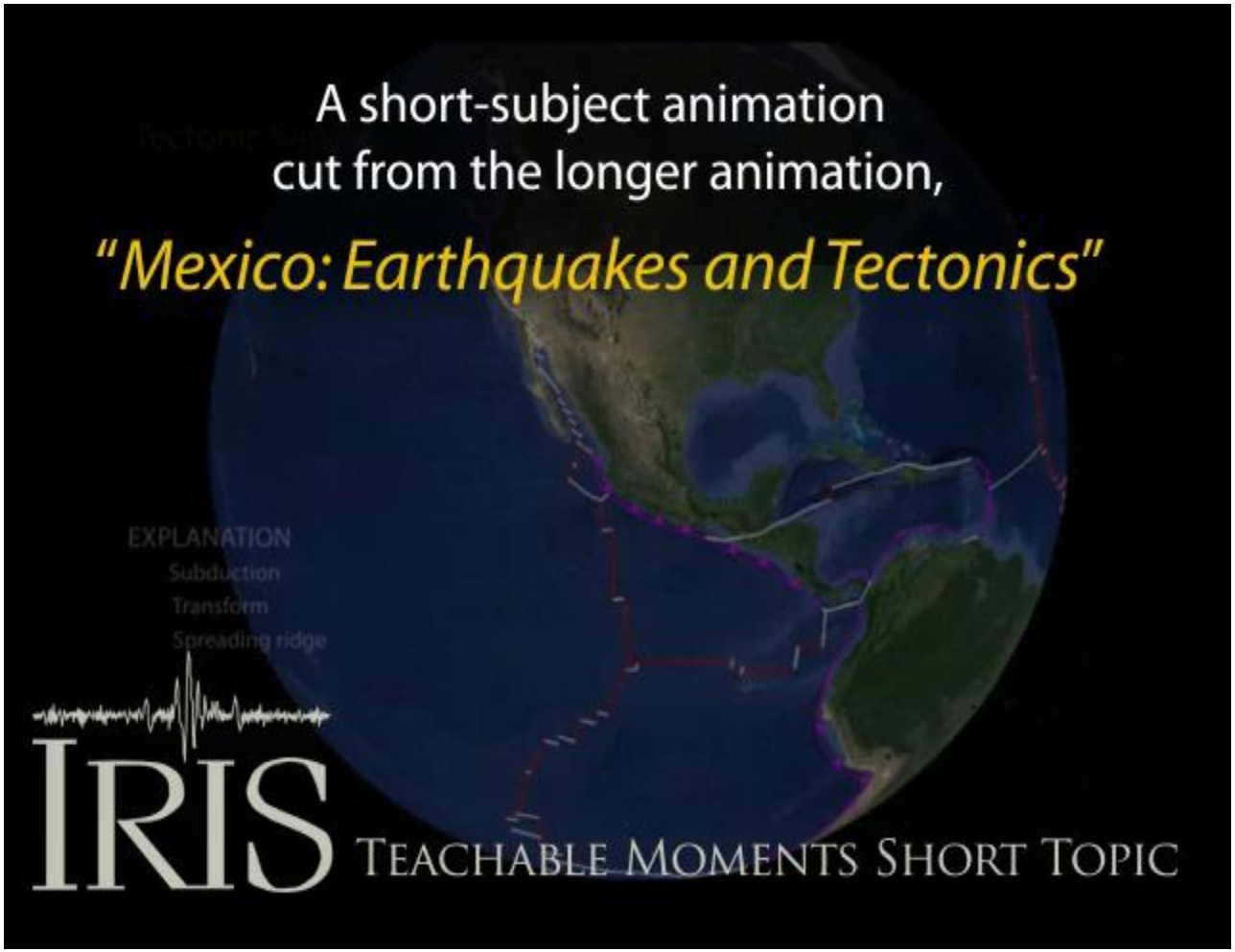
Animation of the regional tectonics of SW Mexico.



(*Extracted from: http://www.iris.edu/hq/inclass/animation/235*)

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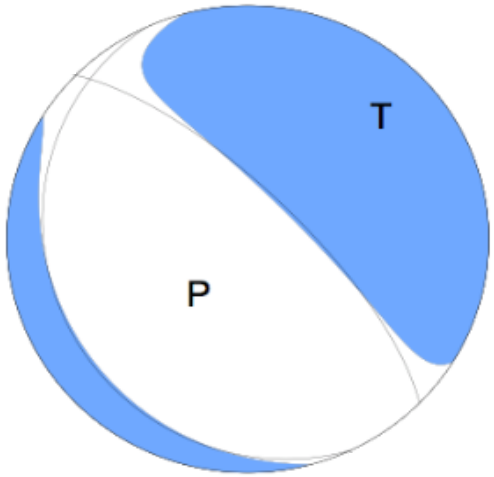
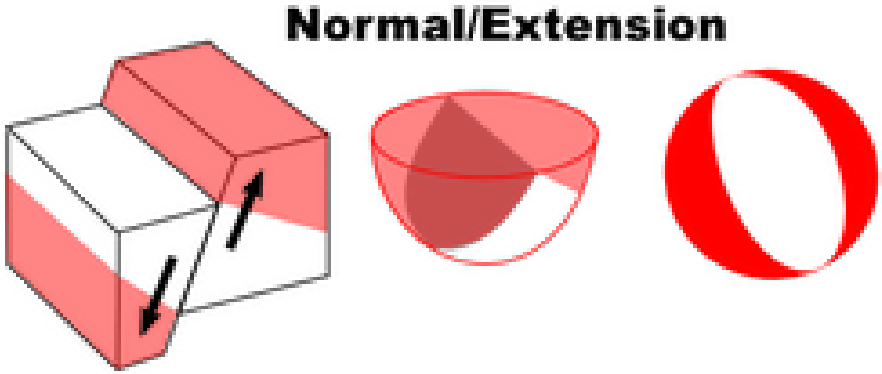
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Because an earthquake occurs as slip on a fault, it generates primary (P) waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white). The orientation of these quadrants determined from recorded seismic waves determines the type of fault that produced the earthquake.



USGS W-phase Moment Tensor Solution

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



In this case, the focal mechanism indicates this earthquake occurred as the result of normal faulting.

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Aftershocks can result in additional damage and disruption to recovery efforts. Aftershocks following this earthquake are fairly evenly distributed across a trench-parallel 80km x 50km region. Aftershocks often define the full area of fault rupture.

Aftershock sequences follow predictable patterns as a group, although the individual earthquakes are themselves not predictable. The graph shows how the number of aftershocks and the magnitude of aftershocks decay with increasing time since the main shock. The number of aftershocks also decreases with distance from the main shock.

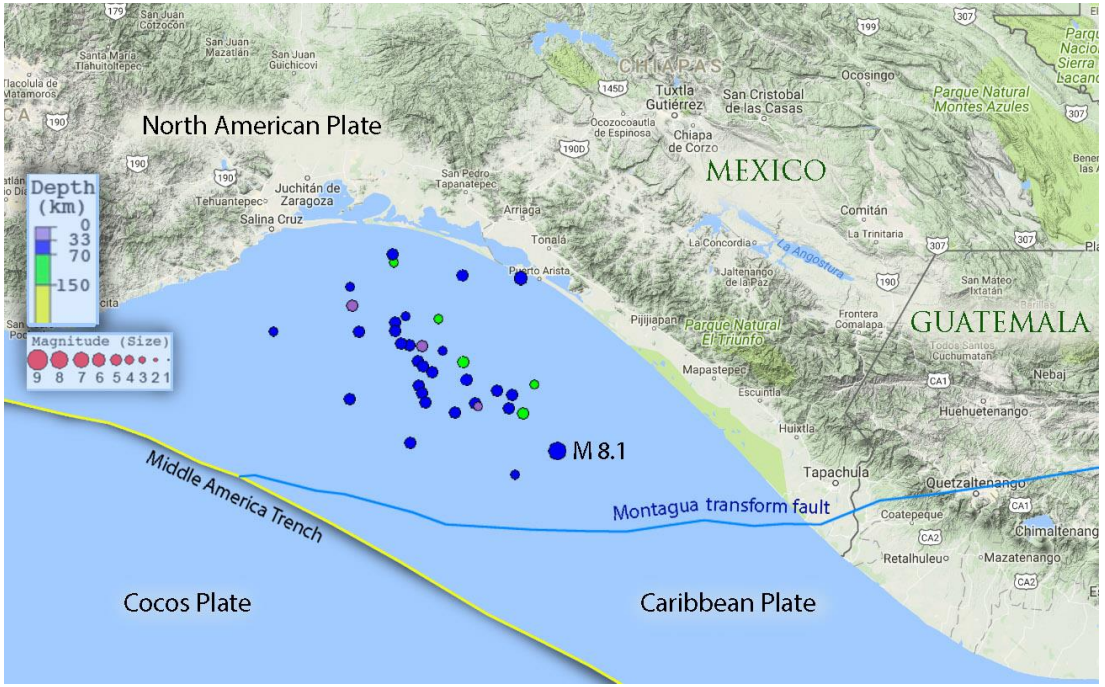

Image created in the IRIS Earthquake Browser

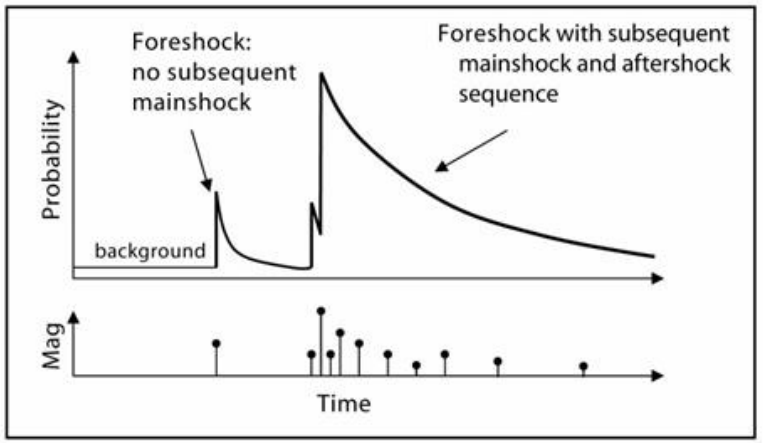

Image and text courtesy of the US Geological Survey

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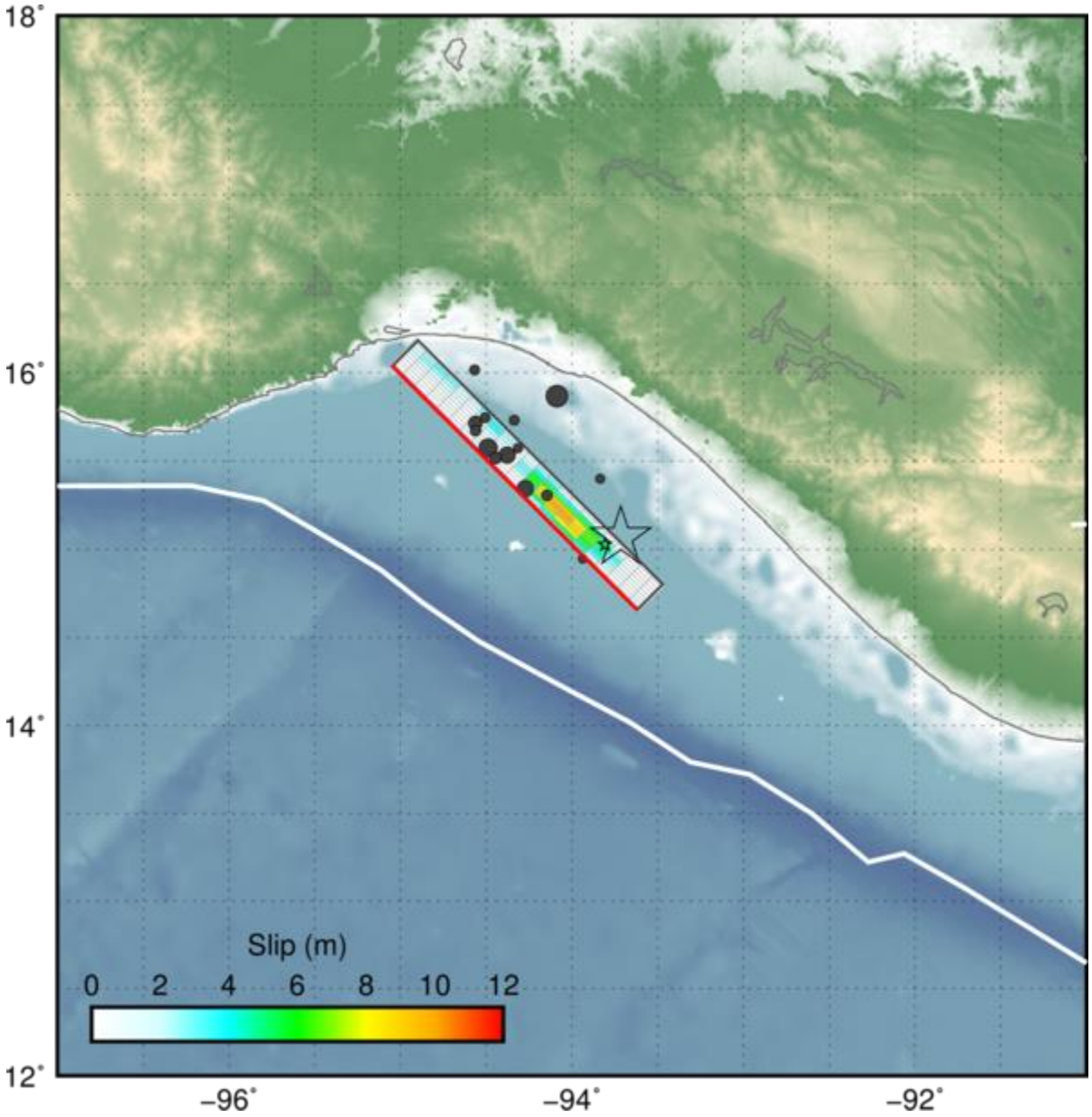
The surface projection of the slip distribution is superimposed on bathymetry in this map. The amount of slip in meters is shown in color along the fault surface.

The star is the epicenter location whereas black circles are aftershock locations, sized by magnitude.

The thick white line indicates the major plate boundary

Image and text courtesy of the US Geological Survey



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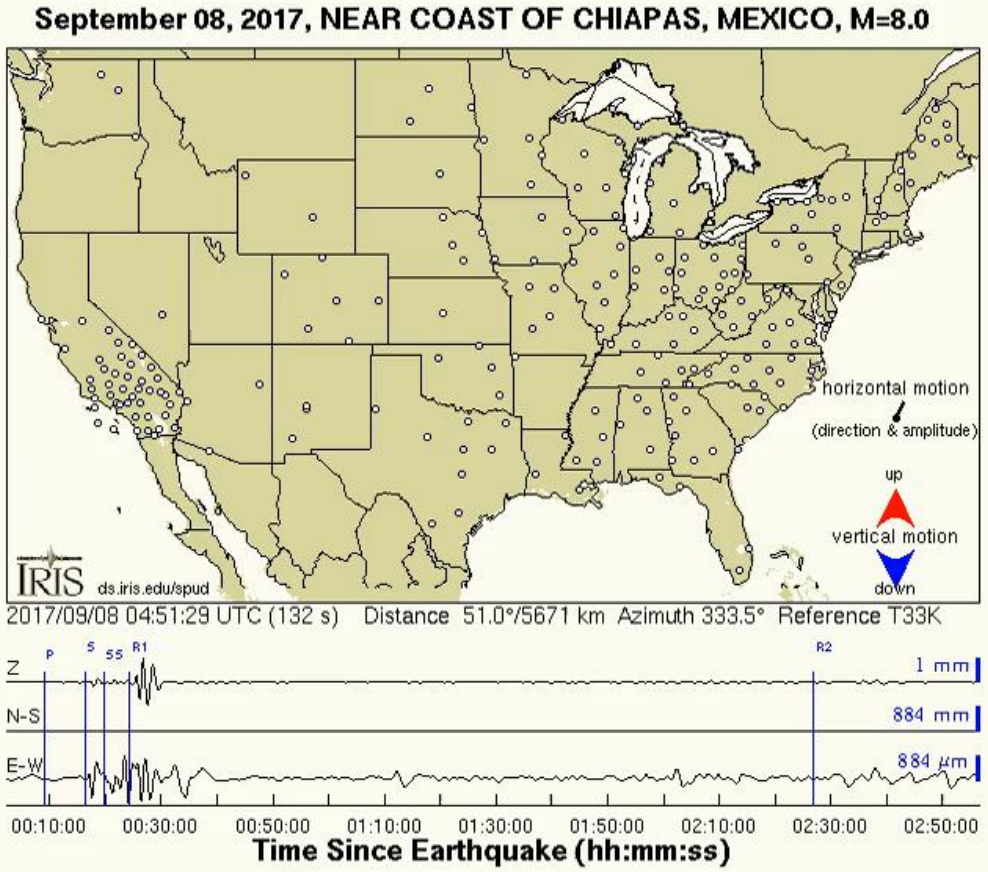
As earthquake waves travel along the surface of the Earth, they cause the ground to move.

The USArray Ground Motion Visualization displays ground motions using the actual data recorded from the earthquake.

The color of each symbol depicts the amplitude of the vertical ground motion. Blue indicates downward ground motion while red represents upward ground motion. The symbols are “tailed” with the direction and length of the tail representing the direction and amplitude of the horizontal ground motion.



Animation of seismic waves crossing the US recorded by the USArray

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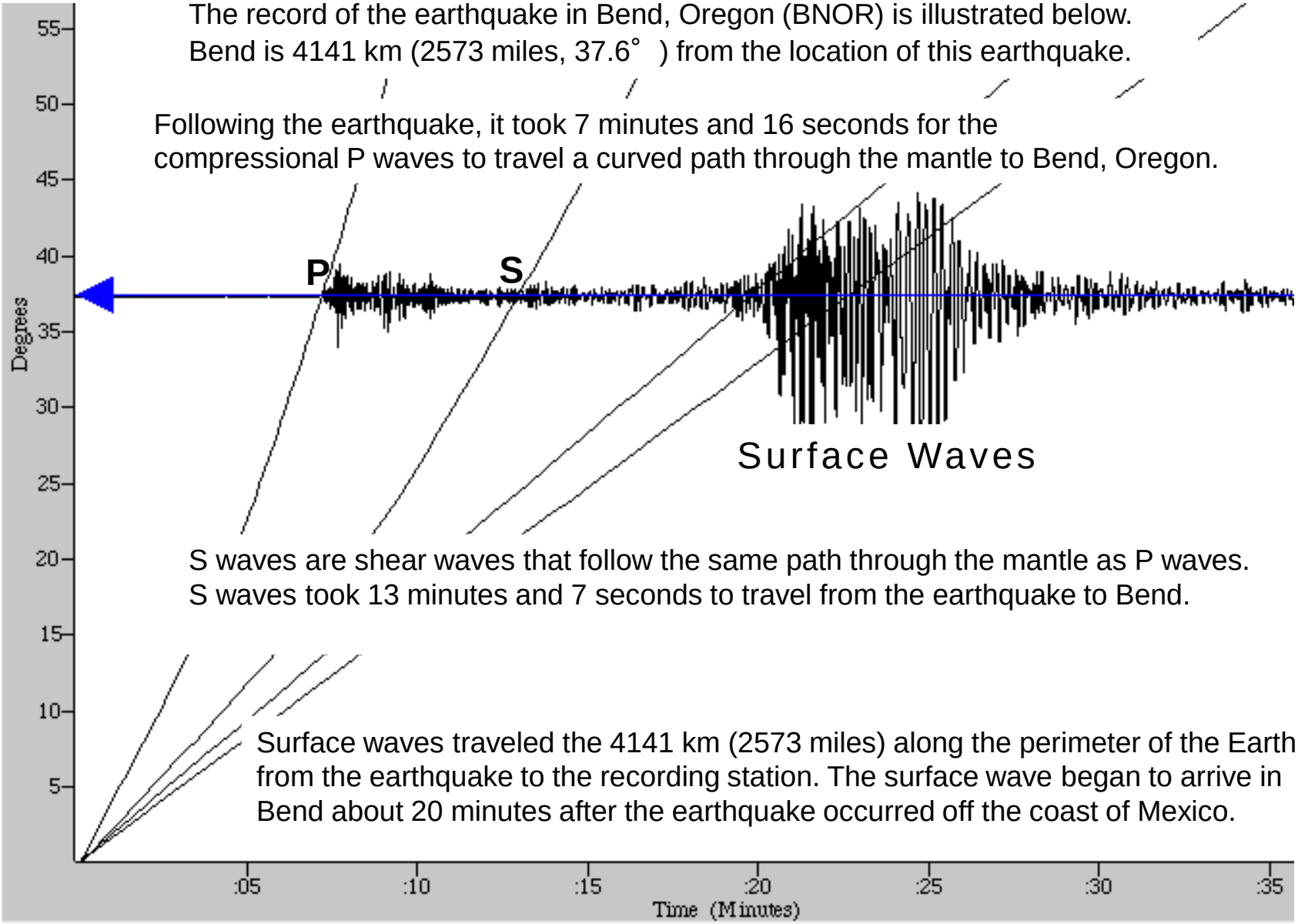
The record of the earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 4141 km (2573 miles, 37.6˚) from the location of this earthquake.

Following the earthquake, it took 7 minutes and 16 seconds for the compressional P waves to travel a curved path through the mantle to Bend, Oregon.



S waves are shear waves that follow the same path through the mantle as P waves. S waves took 13 minutes and 7 seconds to travel from the earthquake to Bend.

Surface waves traveled the 4141 km (2573 miles) along the perimeter of the Earth from the earthquake to the recording station. The surface wave began to arrive in Bend about 20 minutes after the earthquake occurred off the coast of Mexico.

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