

Magnitude 7.8 NEAR THE COAST OF ECUADOR

Saturday, April 16, 2016 at 23:58:37 UTC

A magnitude 7.8 earthquake occurred near the coast of Ecuador. According to a statement from the government, more than 1,550 people were injured, 235 dead, at least 370 buildings were destroyed and another 151 buildings and 26 schools were affected by the quake. The Pacific Tsunami Warning center issued a Tsunami Threat Message of possible waves reaching 0.3 to 1 meter above tide level for some Ecuadorian coasts. There were preventative evacuations in coastal areas because of possible tsunami risks.

A police officer stands on debris, next to buildings destroyed by an earthquake in Pedernales, Ecuador, Sunday, April 17, 2016 local time.

The strongest earthquake to hit Ecuador in decades flattened buildings and buckled highways along its Pacific coast, sending the Andean nation into a state of emergency.

(AP Photo/Dolores Ochoa)



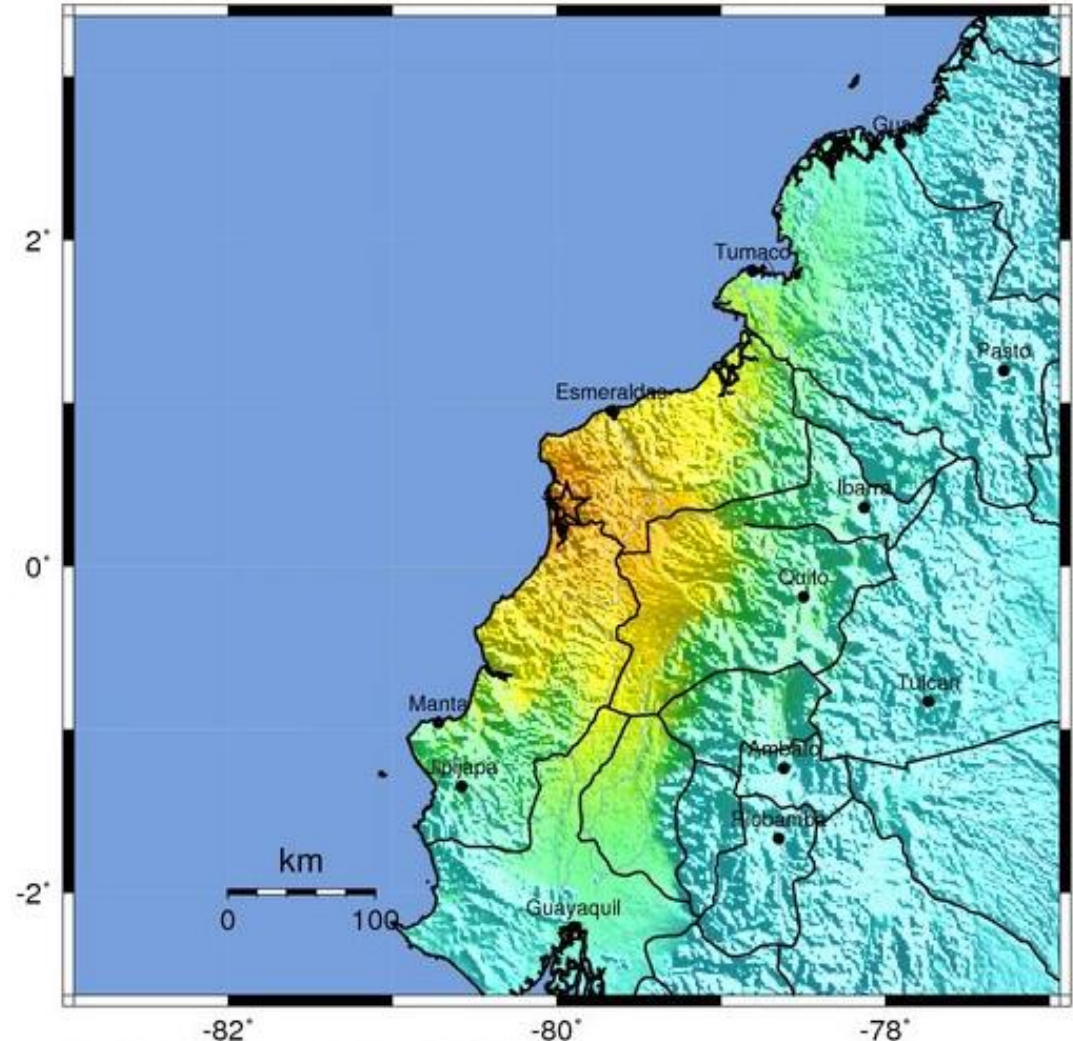
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The Modified-Mercalli Intensity scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking.

This region experienced severe shaking from this earthquake.

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



USGS Estimated Shaking Intensity

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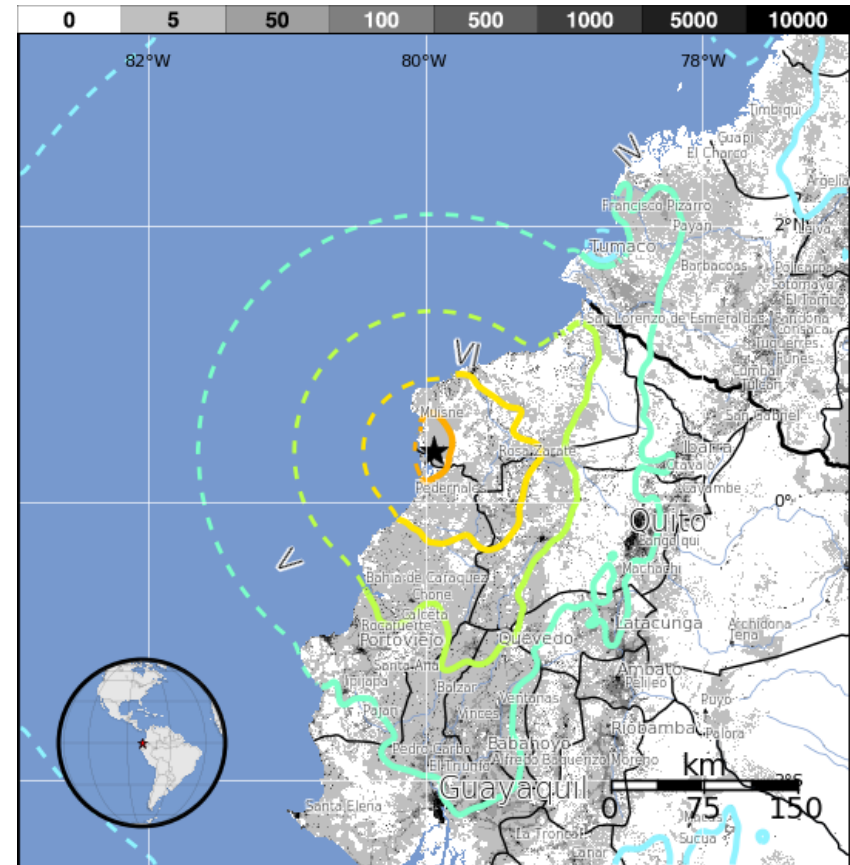
USGS PAGER

Population Exposed to Earthquake Shaking

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

Approximately 31,000 people experienced severe shaking from this earthquake.

MMI	Shaking	Pop.
I	Not Felt	--*
II-III	Weak	167 k*
IV	Light	7,166 k*
V	Moderate	6,228 k
VI	Strong	1,226 k
VII	Very Strong	454 k
VIII	Severe	31 k
IX	Violent	0 k
X	Extreme	0 k



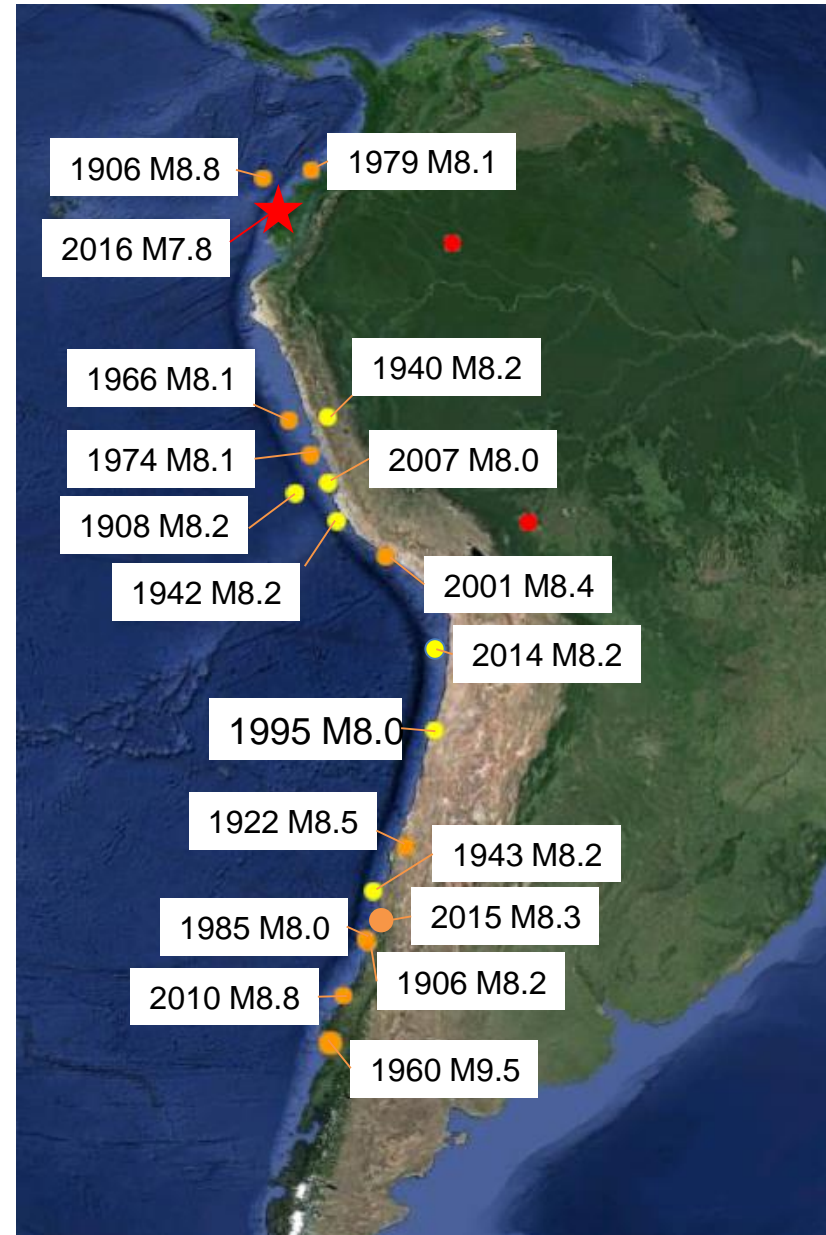
The color coded contour lines outline regions of MMI intensity. The total population exposure to a given MMI value is obtained by summing the population between the contour lines. The estimated population exposure to each MMI Intensity is shown in the table below.

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Earthquakes with magnitude ≥ 8.0 are designated as “great” earthquakes. The USGS has published a list of great earthquakes that have occurred since 1900. Eighteen great earthquakes have locations and depths consistent with hypocenters on the Nazca – South America plate boundary.

Although this M7.8 earthquake falls short of great earthquake magnitude, its epicenter is shown by the red star on the map. This epicenter is located within a “gap” in the great earthquake distribution between those of the 1966 M8.1 offshore central Peru and the 1906 M8.8 earthquake near the Ecuador Colombia border.

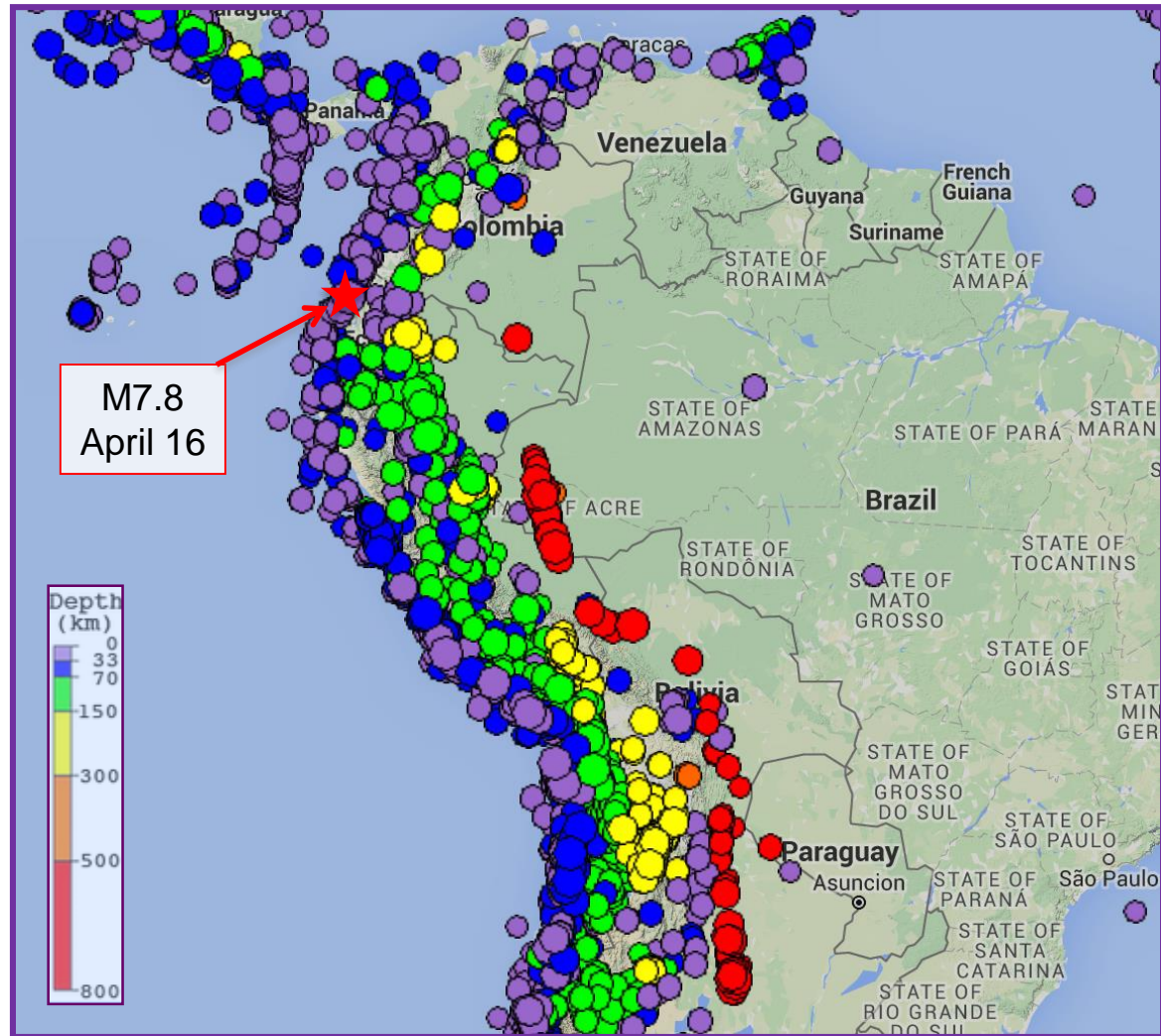


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This map shows seismicity along the west coast of South America from northern Chile to northern Colombia. The epicenter of the April 16, 2016 earthquake is shown by the red star.

Earthquakes are color-coded by depth as shown by the legend in the lower left corner. Depths of earthquakes increase from west to east across the Nazca – South America subduction zone plate boundary. Earthquakes deeper than 100 km occur within the subducting Nazca Plate.



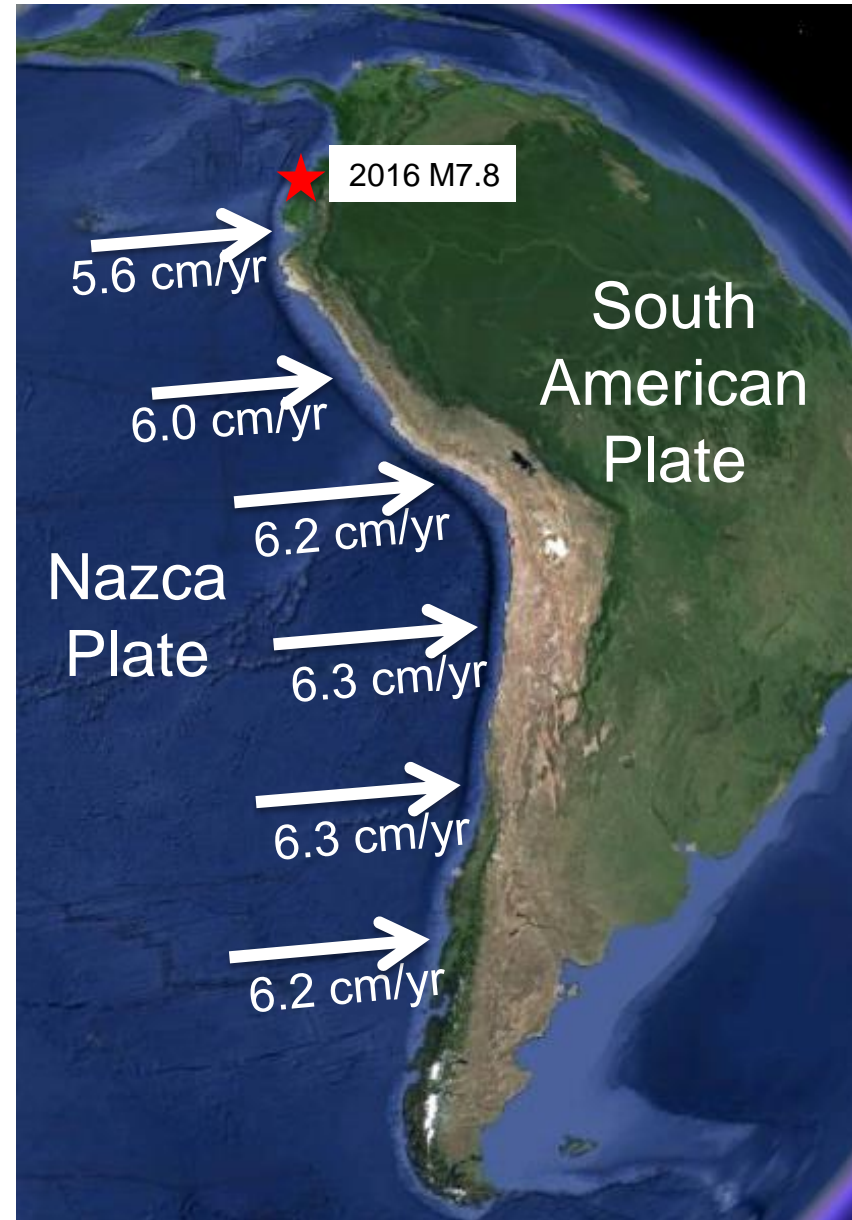
Map created using the IRIS Earthquake Browser (IEB).

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Because lithospheric plates are actually spherical shells on Earth's surface, relative plate motions are best described as relative plate rotations. This means that rates of relative plate motion change with location on a long plate boundary such as the Nazca – South America Plate boundary. The map on the right illustrates how the convergence rate of the Nazca Plate toward the South American Plate ranges from 5.6 cm/yr to 6.3 cm/yr.

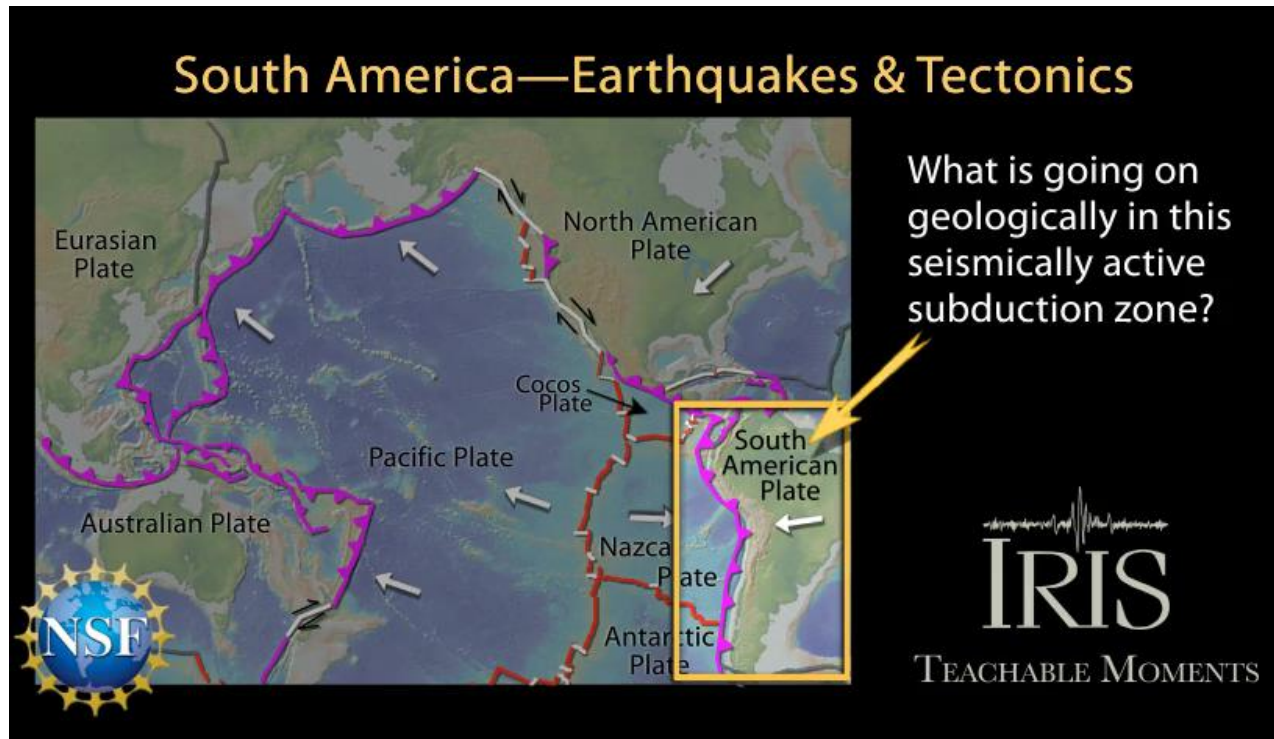
These rates have recently been updated using Global Positioning System (GPS) observations from islands on the Nazca Plate and numerous GPS stations in South America. At the location of the April 16, 2016 M7.8 Ecuador earthquake, the rate of convergence is about 5.6 cm/yr.



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This magnitude 7.8 earthquake is typical of subduction zone earthquakes on the shallow portion of the Nazca – South America Plate boundary. Earthquakes also occur within the shallow portions of both plates near the boundary; within the top portion of the Nazca Plate as it bends to descend into the deeper mantle; and at depths greater than 100 km within the subducting Nazca Plate.



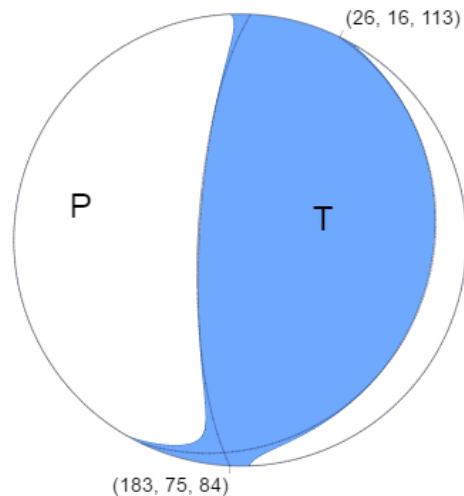
Animation exploring plate tectonics and earthquakes of the Nazca – South America plate boundary region.

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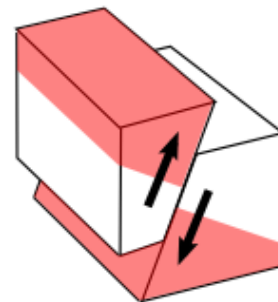
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This earthquake occurred as the result of shallow thrust faulting on or near the plate boundary between the Nazca and Pacific Plates.

At the location of the earthquake, the Nazca Plate subducts eastward beneath the South America Plate at a velocity of 56 mm/yr. The location and mechanism of the earthquake are consistent with slip on the primary plate boundary interface, or megathrust, between these two major plates.



Reverse/Thrust/Compression



Block model



**Focal
Sphere**

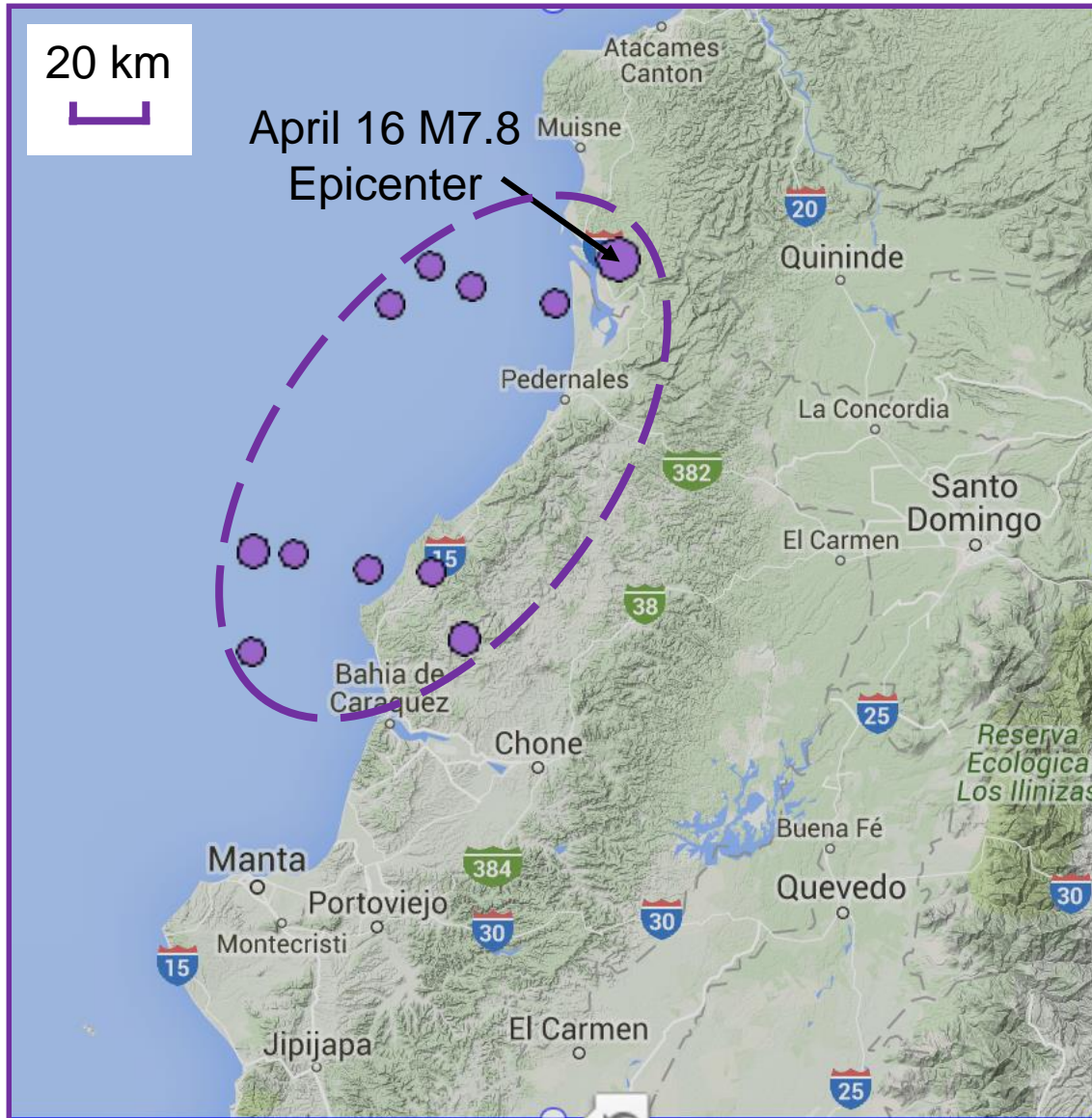


**2D Projection
of Focal Sphere**

Shaded areas show quadrants of the focal sphere in which the P-wave first-motions are away from the source, and unshaded areas show quadrants in which the P-wave first-motions are toward the source. The letters represent the axis of maximum compressional strain (P) and the axis of maximum extensional strain (T) resulting from the earthquake.

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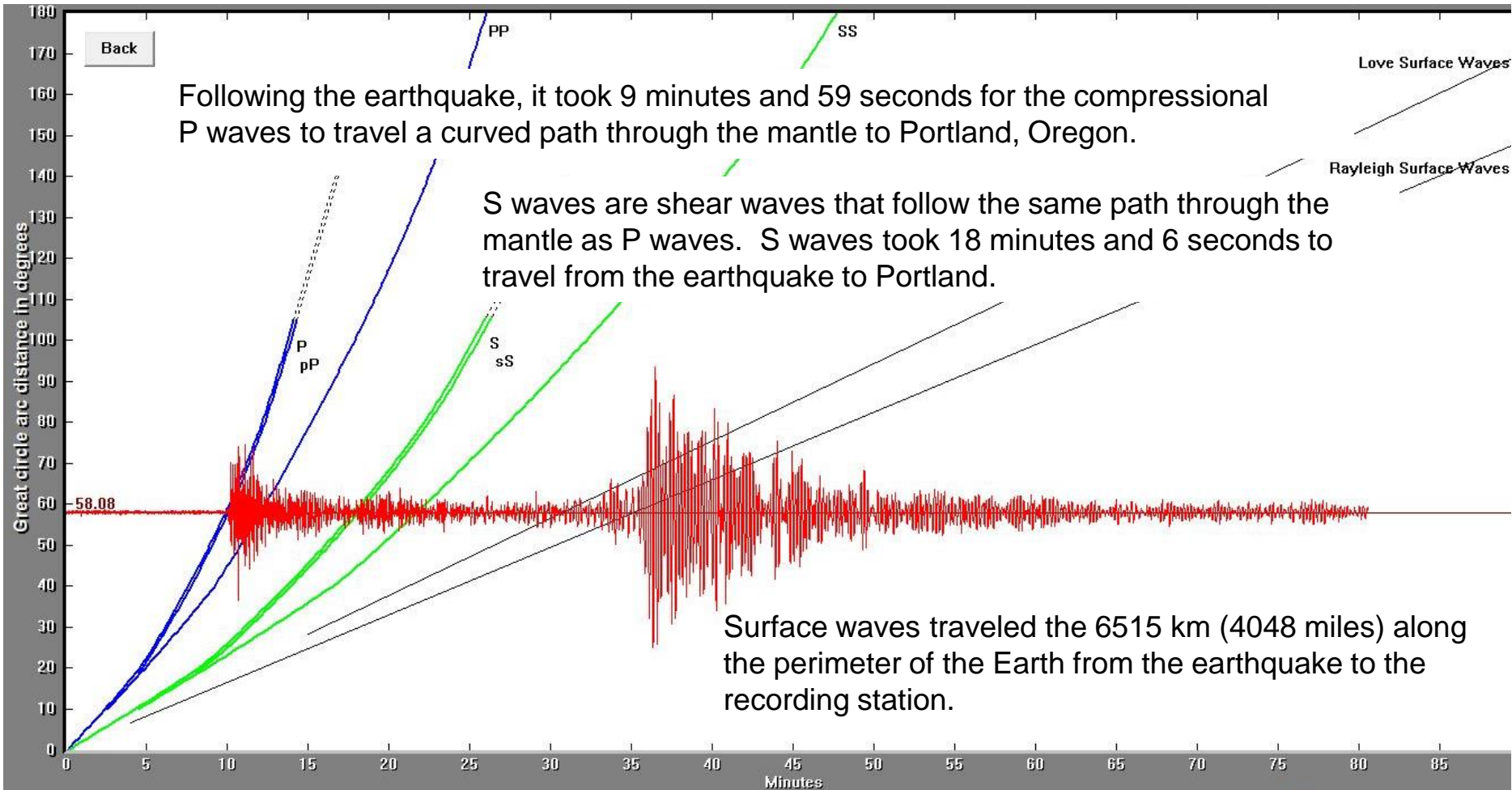
In the first 10 hours after the April 16 M7.8 Ecuador earthquake there have been 10 aftershocks. Major and great earthquakes are followed by aftershocks as rocks within and around the rupture zone of the main shock adjust to the new state of stress.

As explained by the USGS, “While commonly plotted as points on maps, earthquakes of this size are appropriately described as slip over a fault area. Events of the size of the April 16, 2016 earthquake are typically about 160x60 km in size (length x width).” The rough outline of the aftershocks does indeed have these dimensions.

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The record of the earthquake on the University of Portland seismometer (UPOR) is illustrated below. Portland is 6515 km (4048 miles, 58.7°) from the location of this earthquake.



Teachable Moments are a service of

The Incorporated Research Institutions for Seismology
Education & Public Outreach
and
The University of Portland

Please send feedback to tkb@iris.edu