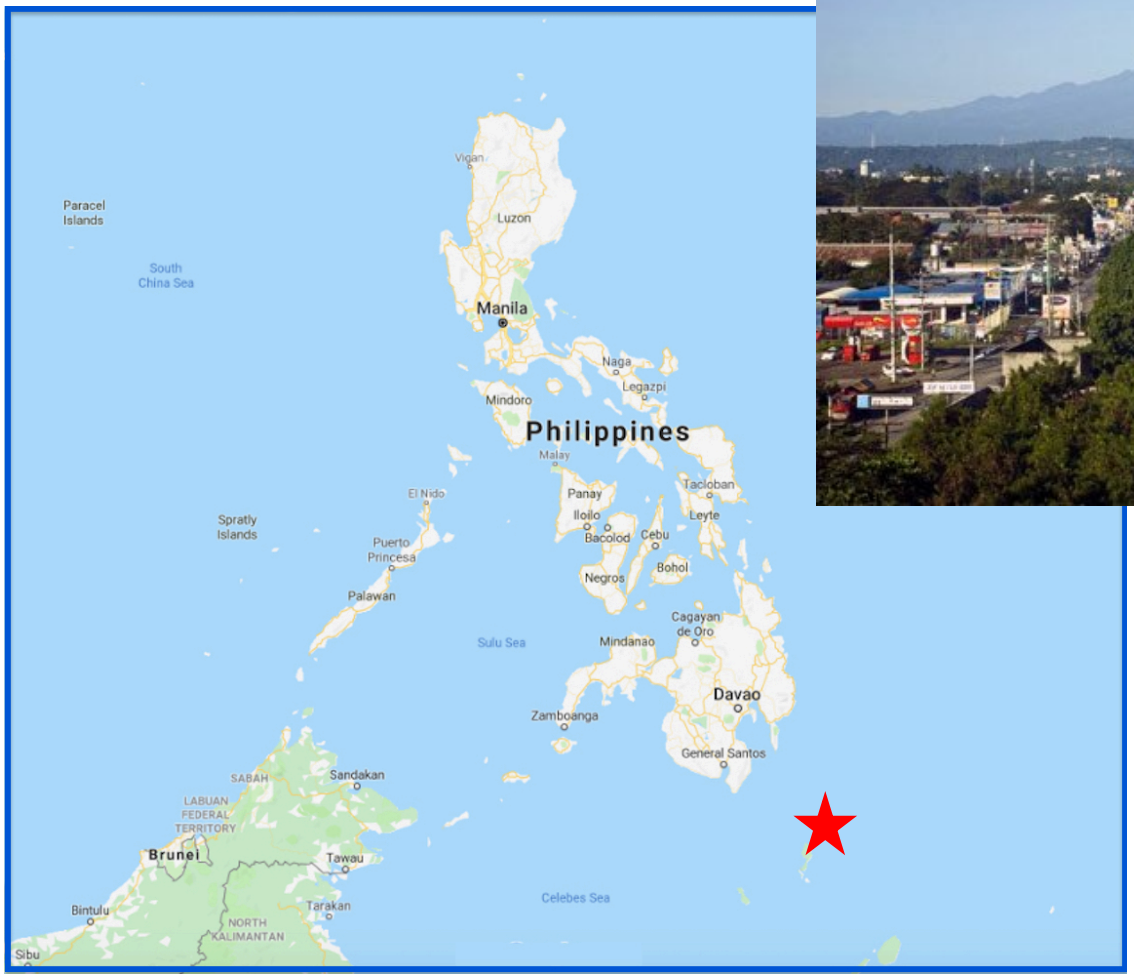
Magnitude 7.0 PHILIPPINES

Thursday, January 21, 2021 at 12:23:05 UTC

Latitude 5.007° N
Longitude 127.517° E
Depth 95.8 km

A magnitude 7.0 earthquake shook parts of the southern Philippines on Thursday night 311.9 km (193.8 mi) southeast of Davao, Philippines. There are no reports of damage or injuries. There are no tsunami warnings.



Davao, Philippines

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The Modified-Mercalli Intensity (MMI) scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking. Intensity is dependent on the magnitude, depth, bedrock, and location.

Severe shaking was felt in the area closest to the earthquake.

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

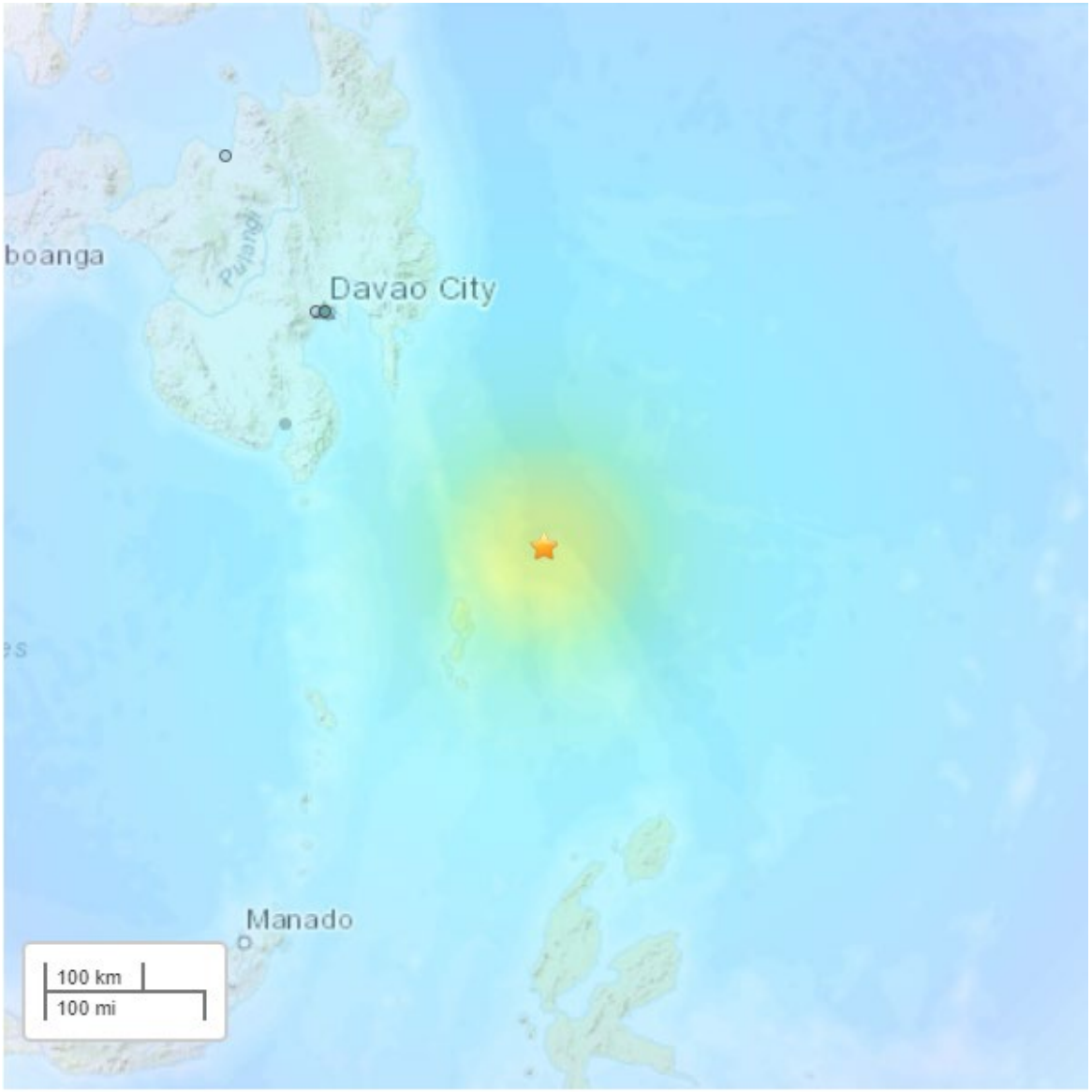

Image courtesy of the USGS

USGS estimated shaking intensity from M 7.0 Earthquake

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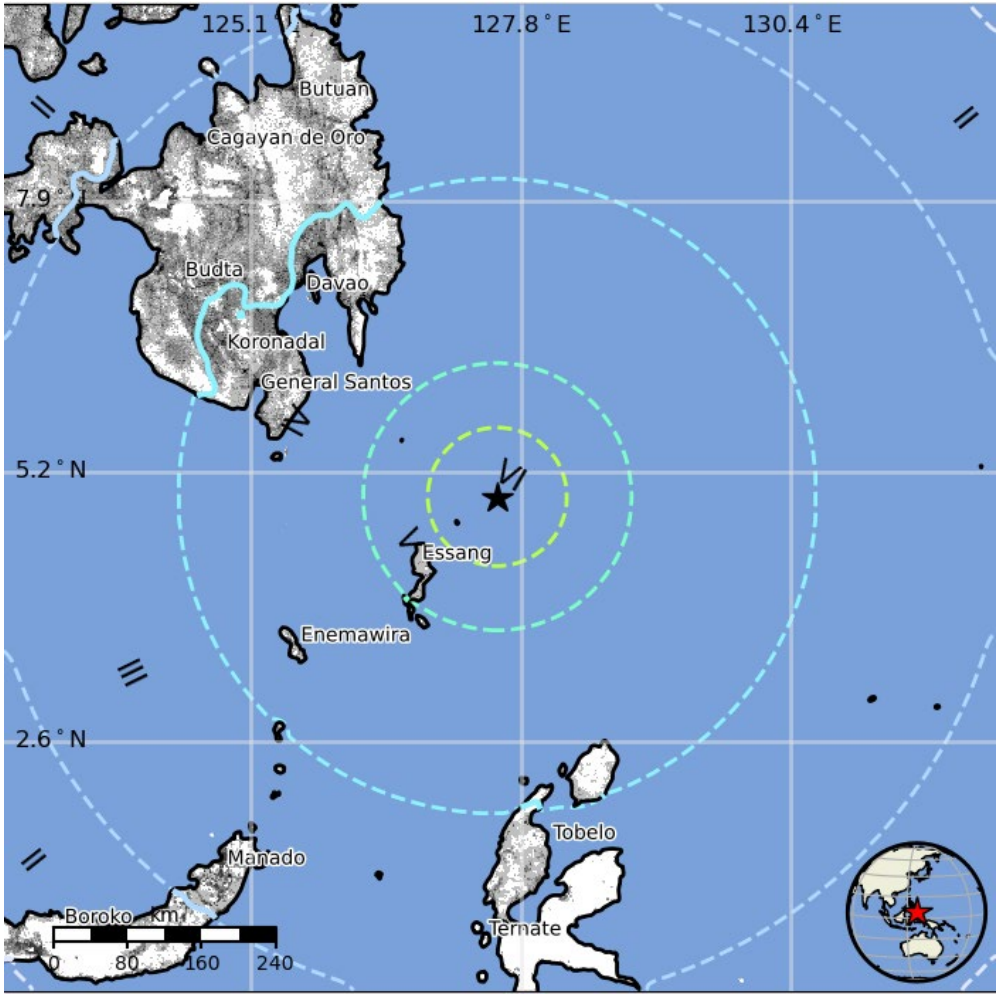
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

The USGS estimates that 6,000 people felt strong shaking from this earthquake.

I	Not Felt	22 k*
II-III	Weak	20,397 k*
IV	Light	8,635 k
V	Moderate	173 k
VI	Strong	6 k
VII	Very Strong	0 k
VIII	Severe	0 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.

Image courtesy of the US Geological Survey

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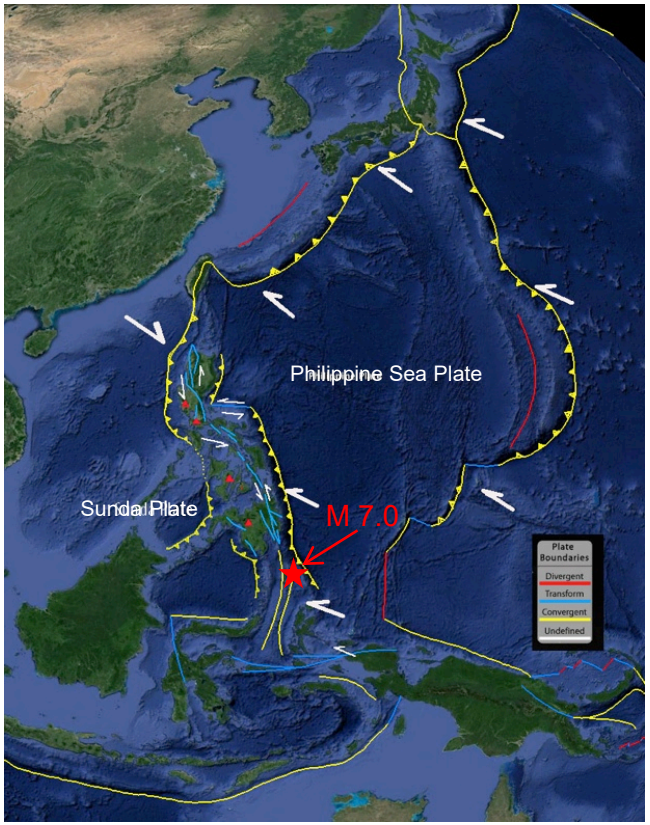
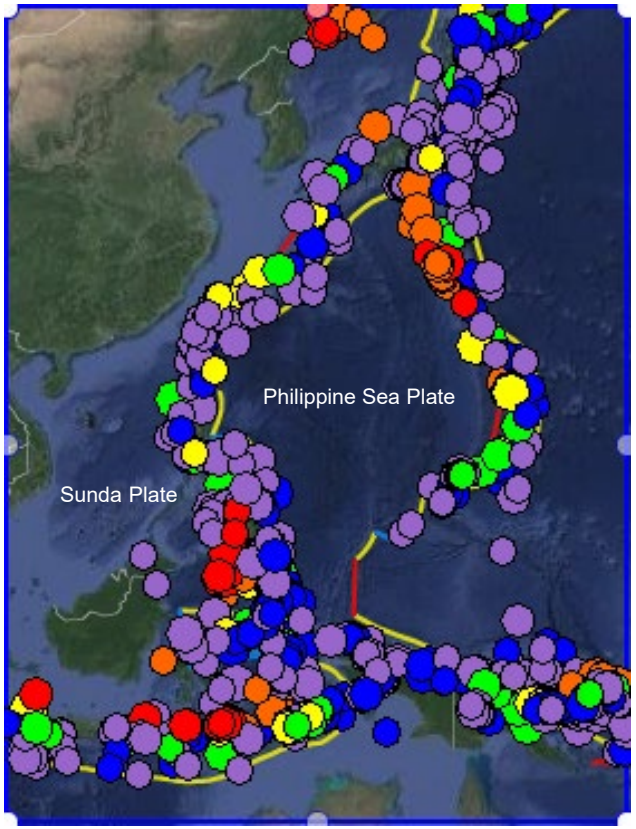
Along its western margin, the Philippine Sea Plate is complicated where it converges with, and dives beneath the Sunda Plate. Caught in the crunch, the Philippines archipelago has oceanic plates subducting beneath both its east and west sides, and the arc complex itself is marked by active volcanism (red triangles), as well as high seismic activity.



Simplified tectonic boundaries



Magnitude 6–8 earthquakes 2000-2018

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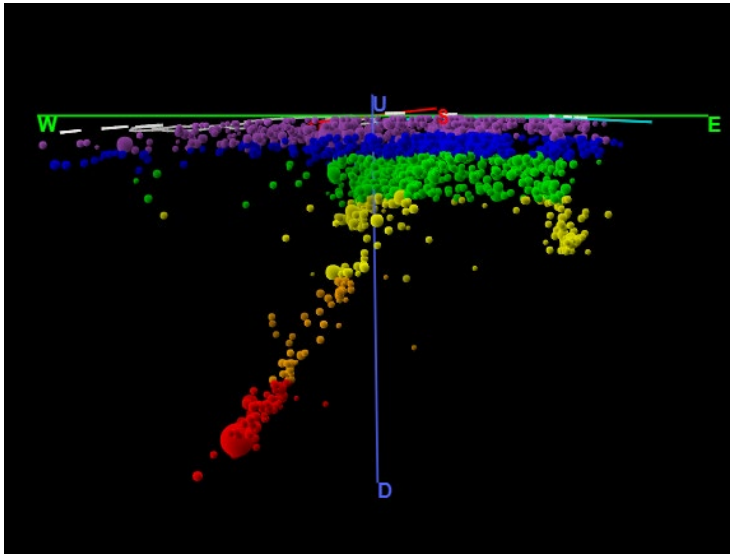
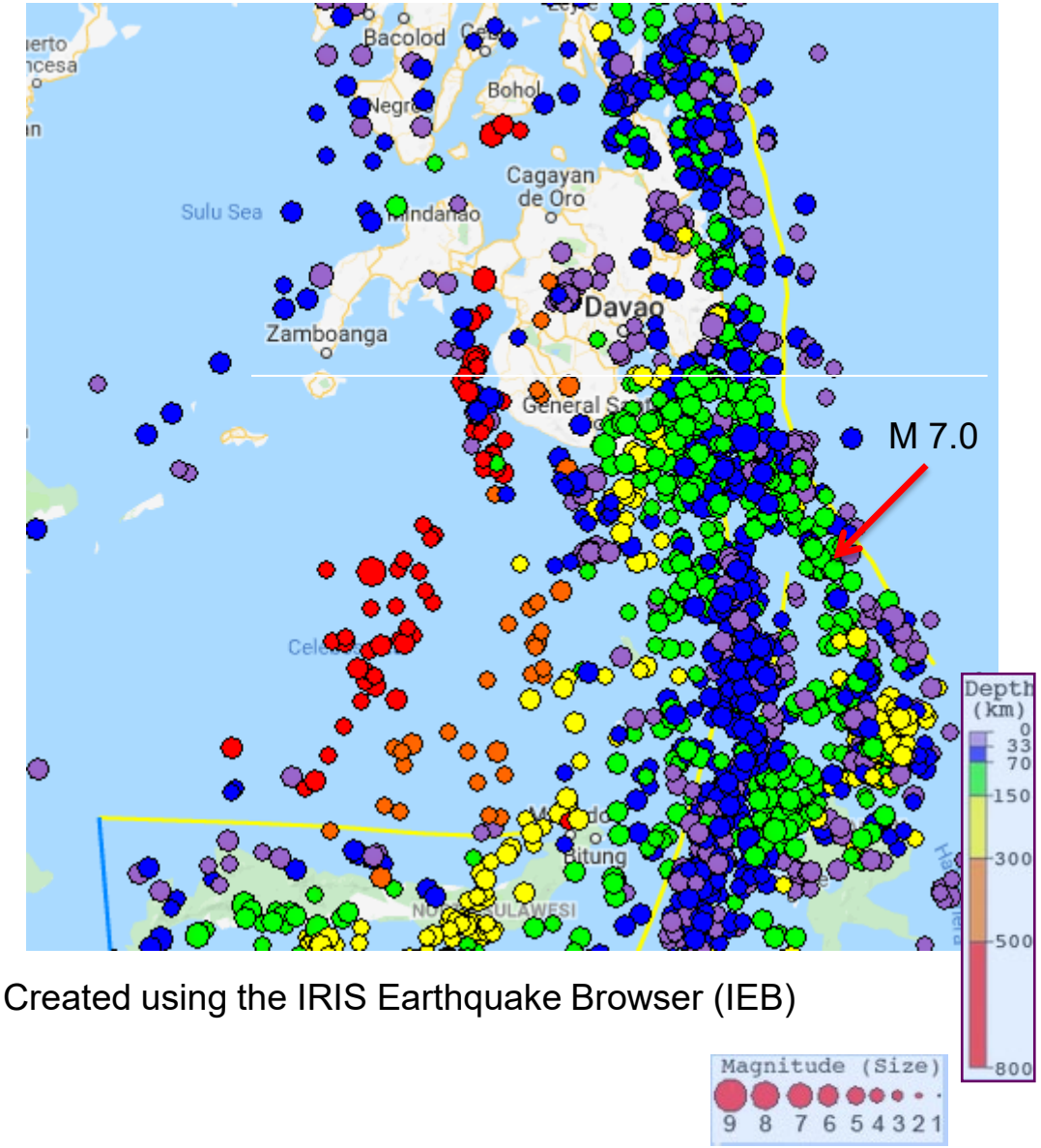
This map shows historical seismicity in this region. Earthquakes are color-coded by depth as shown in the legend in the lower right corner. Depths of earthquakes increase from east to west across the subduction zone boundary.

A 3D cross section through the earthquake is shown below.





Created using the IRIS Earthquake Browser (IEB)

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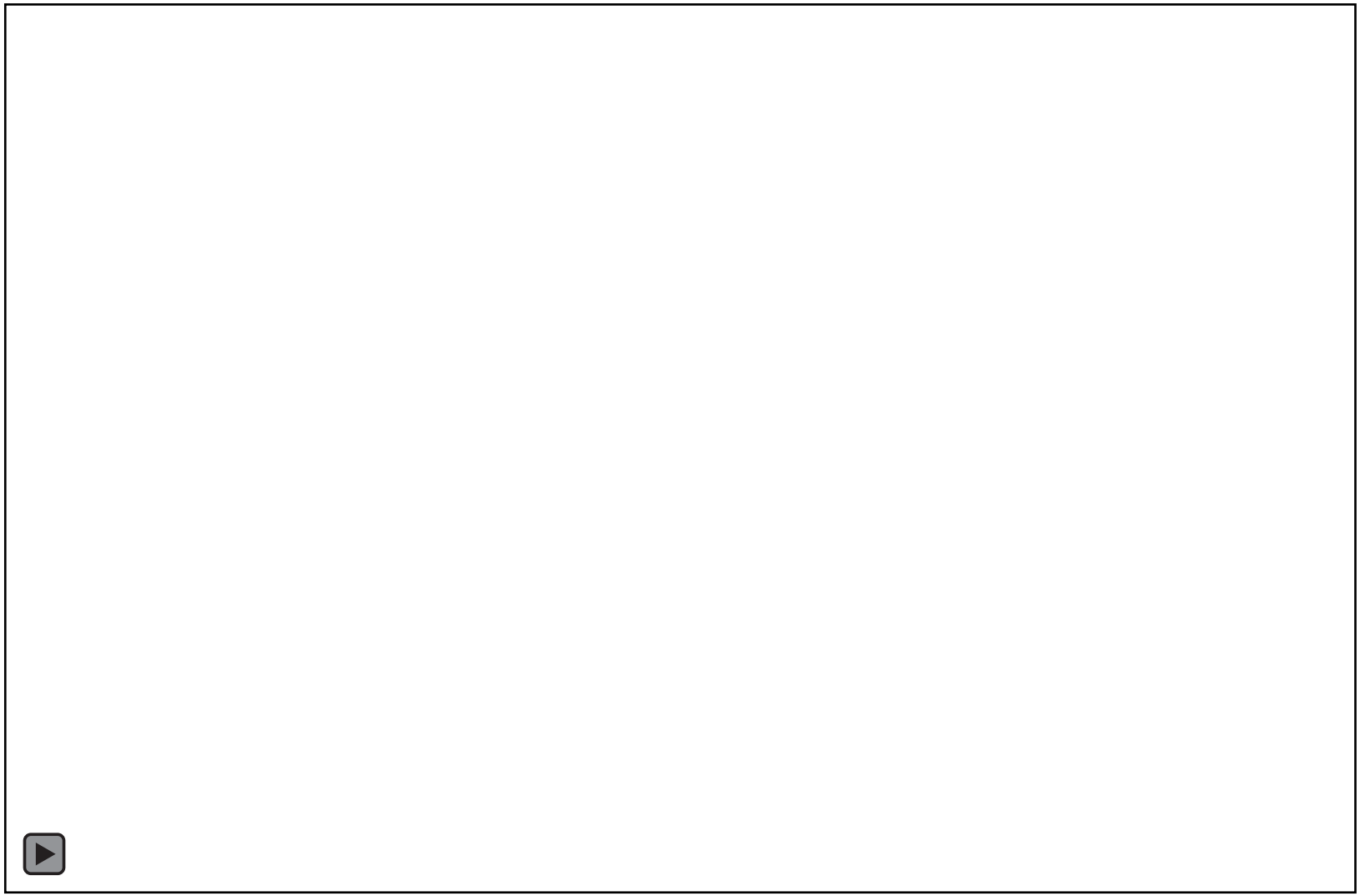
This animation explores 20 years of regional seismicity:



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This earthquake is shown by the red star on the map below. Near this earthquake, the Philippine Sea Plate moves west-northwest with respect to the Sunda Plate at a rate of 8.8 cm/yr. At the Philippine Trench, the Philippine Sea Plate subducts beneath the Philippine Islands at the location of this earthquake.

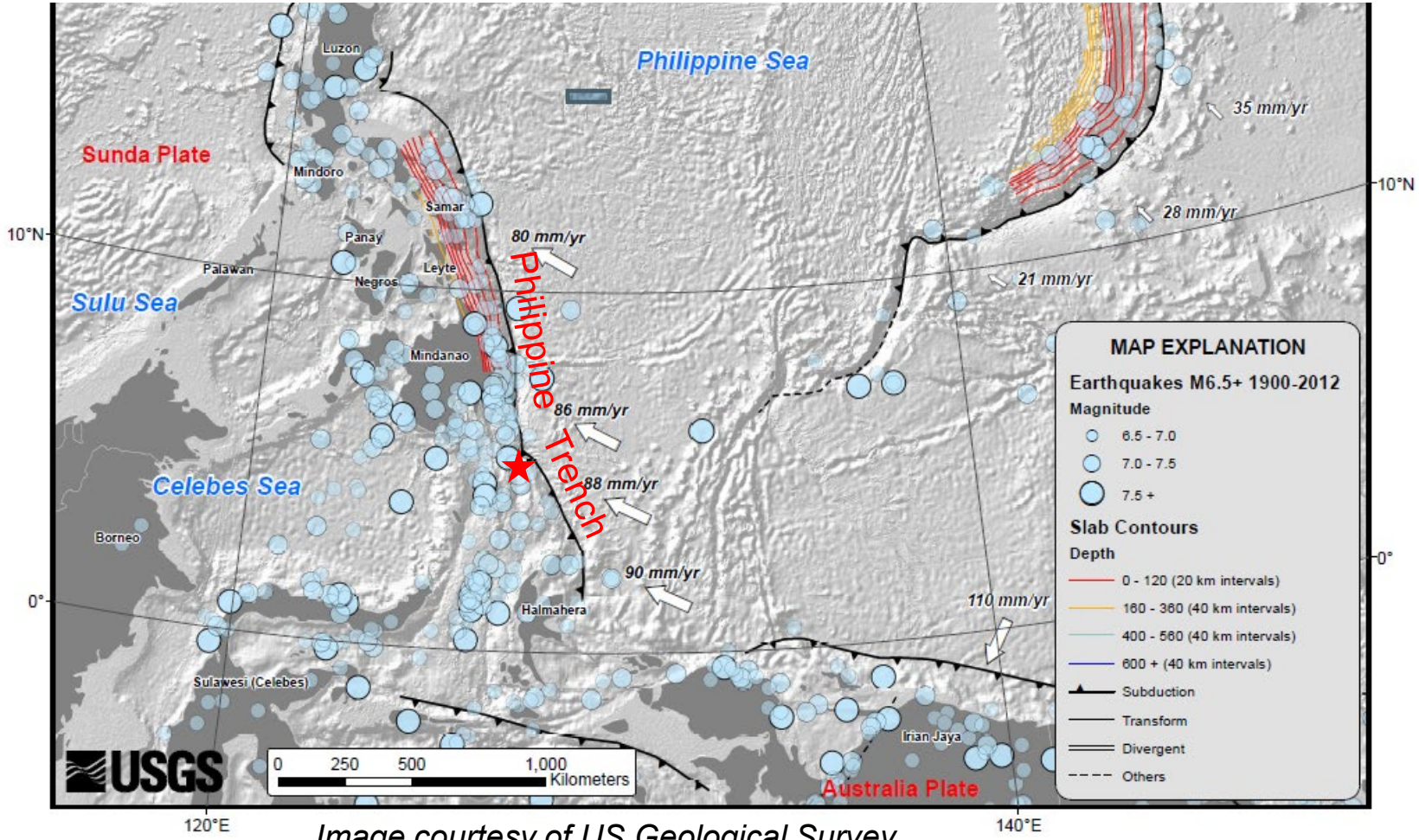

Image courtesy of US Geological Survey

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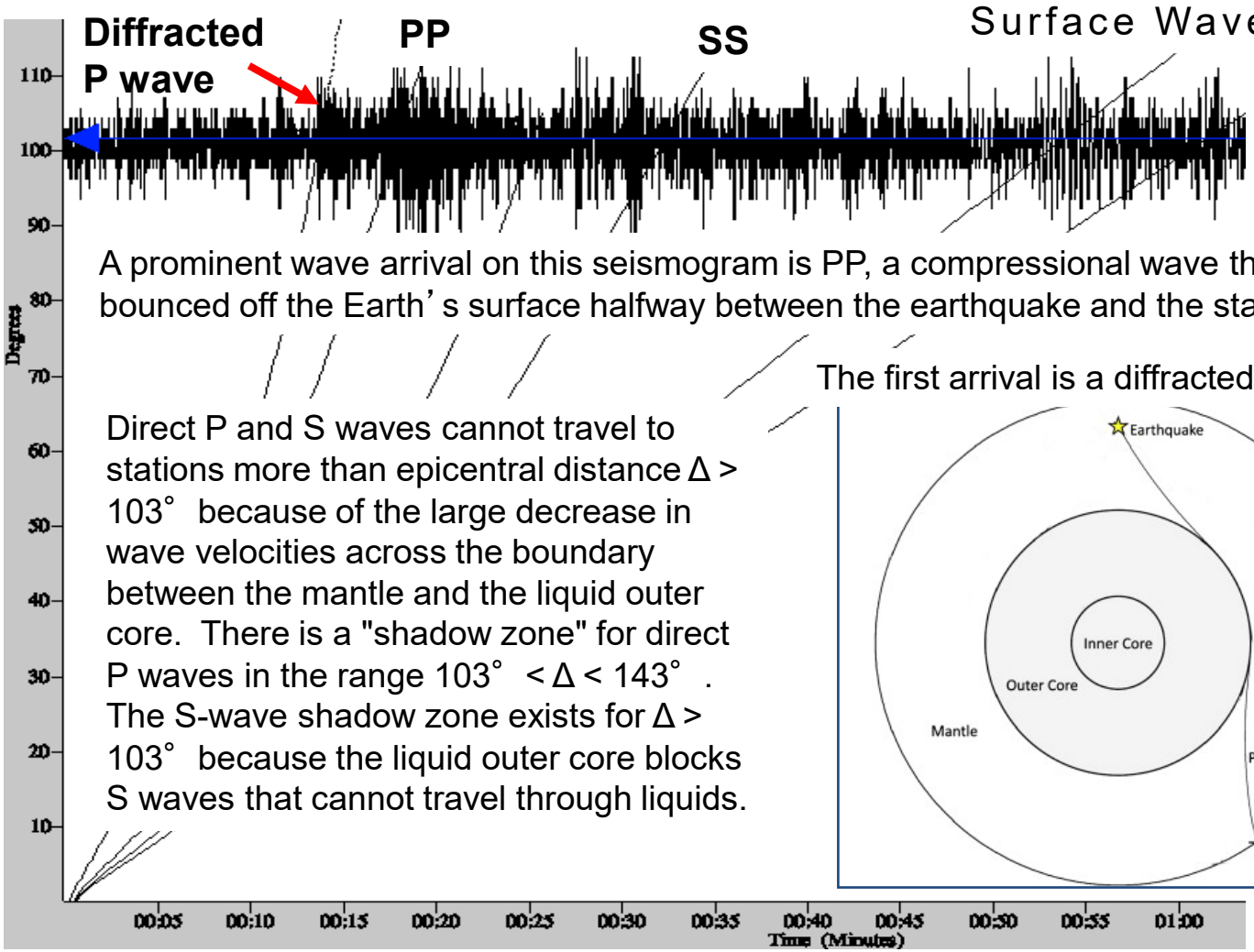
The record of the earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 11,275 km (7006 miles, 101.6°) from the location of this earthquake. At this distance and with winter storm noise, it is challenging to record a seismogram of a magnitude 7.0 earthquake.



A prominent wave arrival on this seismogram is PP, a compressional wave that bounced off the Earth's surface halfway between the earthquake and the station.

The first arrival is a diffracted P wave.

Direct P and S waves cannot travel to stations more than epicentral distance Δ > 103° because of the large decrease in wave velocities across the boundary between the mantle and the liquid outer core. There is a "shadow zone" for direct P waves in the range 103° < Δ < 143° . The S-wave shadow zone exists for Δ > 103° because the liquid outer core blocks S waves that cannot travel through liquids.

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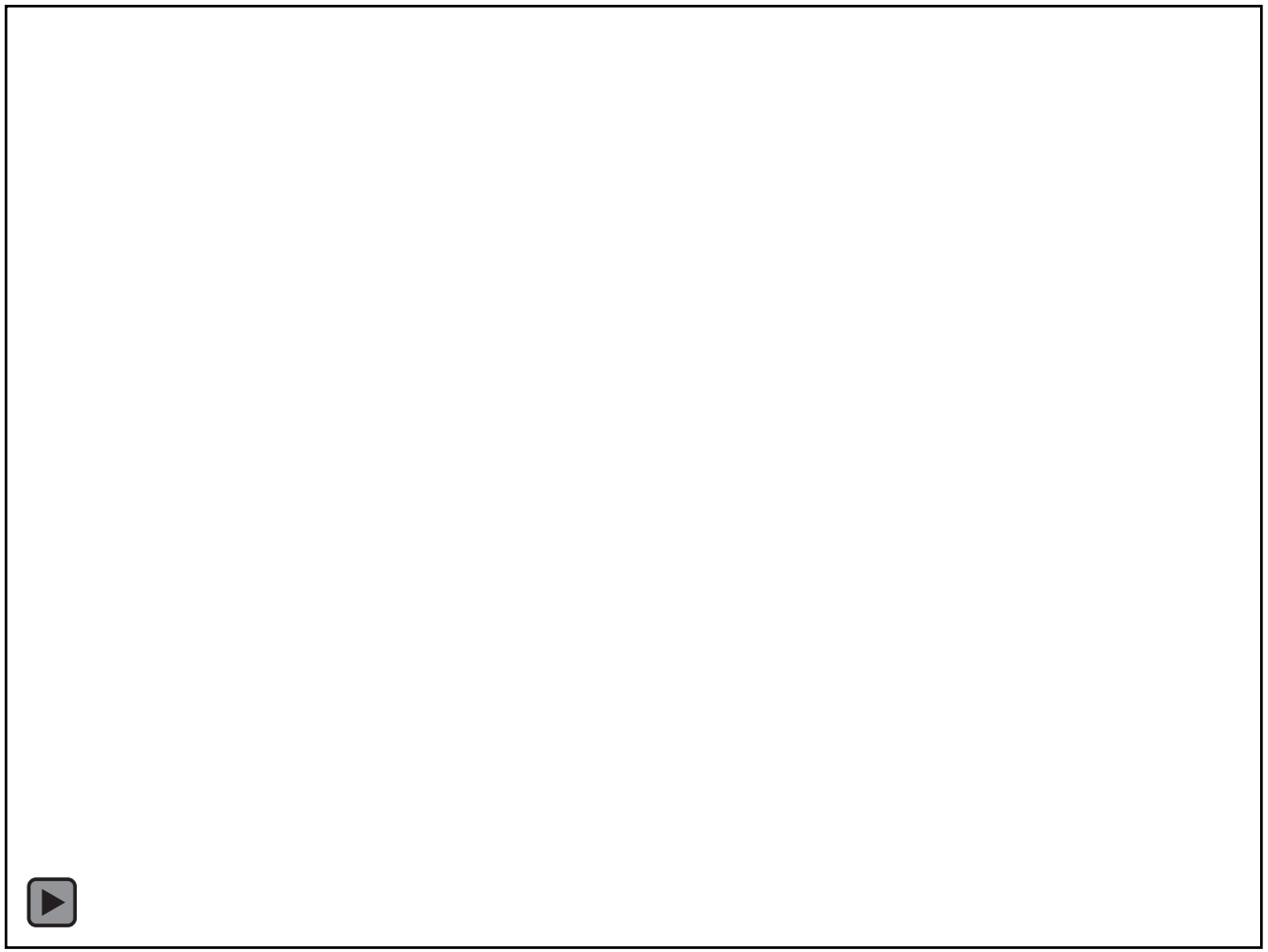
Animation explaining the seismic shadow zone.

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 observed up to a distance of 104° from an earthquake, but direct S waves are not recorded beyond this distance.

P waves also have a shadow zone between 104° and 143° .



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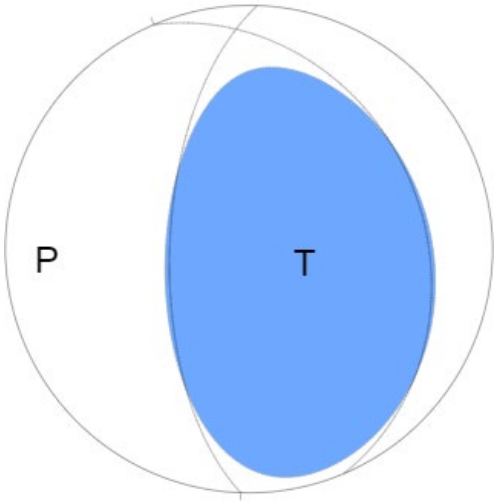
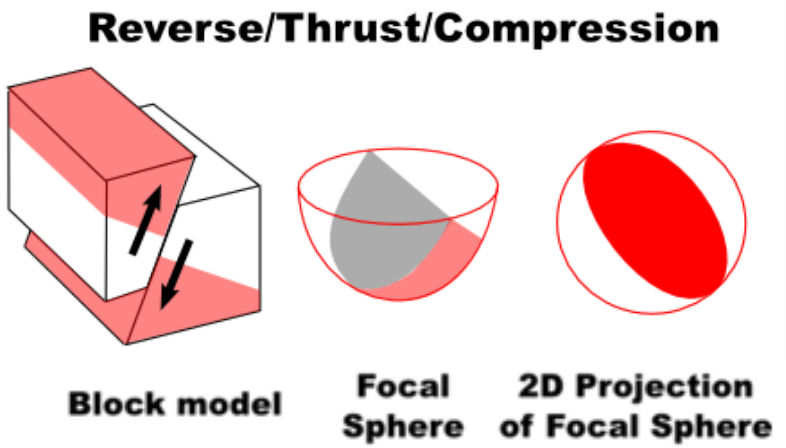
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Because an earthquake occurs as slip on a fault, it generates primary (P) waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white). The orientation 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 thrust faulting likely within the subducted oceanic lithosphere of the Philippine Sea Plate.



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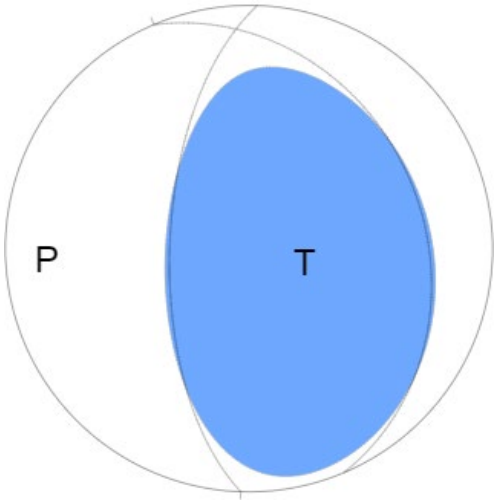
This animation explores the motion of a reverse fault, and how reverse faults are represented in a focal mechanism.

Remember, this was the focal mechanism solution for this earthquake. It was estimated by an analysis of observed seismic waveforms, recorded after the earthquake, observing the pattern of "first motions", that is, whether the first arriving P waves push up or down.



USGS W-phase Moment Tensor Solution

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