Teacher Guide

Welcome to Teachable Moments! Our goal is to provide timely and accurate information to develop knowledge about a newsworthy earthquake for audiences from middle school through college. Please use the slides to get a concise, but thorough overview of the recent earthquake and then use them as is, or customize it for your students and curriculum.

New for the 2024-25 school year:

1. **Color-coding for grade levels.** ALL **middle school** + HS **high school** + C **college**

1. **Check out the new Slide Guide: Slides or pdf that will guide your students through the slide deck:** middle school pdf high school pdf college pdf

2. **New Geography slide(s): A quick hit about the city or area that gives you cross-curricular connections:** geography, physics, chemistry, biology, environmental science or even history.

3. **NGSS Connections linked to questions in the Slide Guide are located in the notes sections below each slide guide.**

4. **Fill in the blank sub-plans:** The first two pages can be completed and used all year (hint: sheet protector). The rest are for you to modify or fill-in to customize your sub-plans to fit what you’re doing.

Magnitude 7.4 PHILIPPINES

Friday, October 10, 2025 at 01:43:59 (UTC)

ALL

Latitude 7.265°N
Longitude 126.755°E
Depth 58.1 km

A magnitude 7.4 earthquake occurred at 9:43 am local time Friday morning about 3 km (1.9 miles) east of Manay town in Davao Oriental province at a depth of 58.1 km (36.1 miles).

Reports indicate at least seven people were killed, while towns near the epicenter suffered structural damage and authorities warned of strong aftershocks.

Tsunami warnings were issued for coastal areas within 300 km of the epicenter, prompting evacuations in at least six provinces before being lifted two hours later.

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ALL

In this photo provided by the 10ID DPAO, Philippine Army, residents stand beside a landslide, triggered by a strong earthquake, hit an area at Pantukan town, Davao de Oro province, southern Philippines on Friday, Oct. 10, 2025. (10ID DPAO, Philippine Army via AP)

Magnitude 7.4 Philippines
Thursday, October 10, 2025 at 01:43:59 UTC

ALL

Mindanao Island sits in the Ring of Fire; because of the tectonic action occurring in this region, Mindanao has 10 mountain ranges which includes volcanoes. The highest peak on the island goes to 9724 feet, Mt. Apo. Roman Catholic is the dominant religion in most regions, but has other Christian, and Muslim populations.

The island has 6 regions, one of which is the Davao region. The Davao Oriental province was the epicenter of this earthquake. Its economy includes agriculture with Palay (rice with husks), and corn being dominant crops. Mining and quarrying, education, human health, and social work have made increases in economic importance in the last year.

Tourism is also an important industry with beach resorts, scuba diving, hiking, and visits to museums being the most popular.

ALL

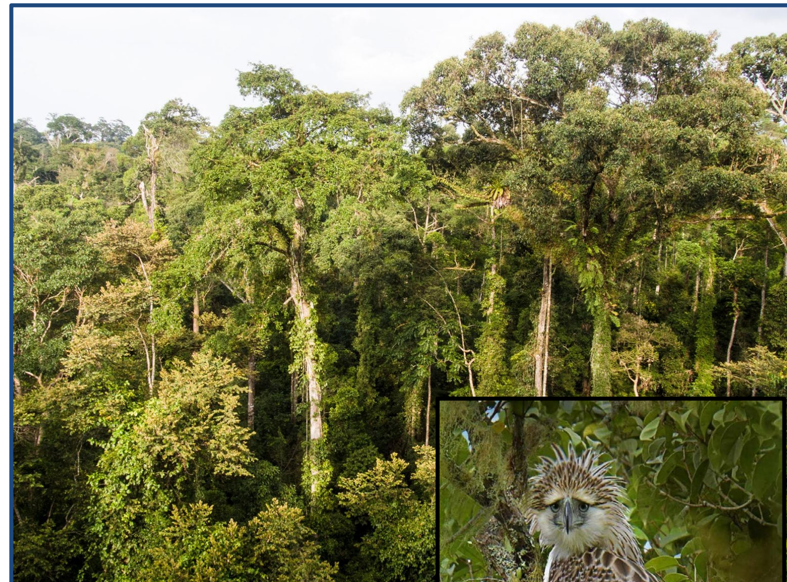
Magnitude 7.4 Philippines

Thursday, October 10, 2025 at 01:43:59 UTC

Mindanao itself is a highly biodiverse area. The Davao Oriental province includes the Mount Hamiguitan Wildlife Sanctuary which became a UNESCO World Heritage site in 2014. It is 5315 feet above sea level and includes 5 ecosystems: agroforest, dipterocarp forest (example image on the right), montane forest, mossy forest and mossy pygmy forest. It is home to 1380 species many of which are endemic.

Critically endangered species include the Philippine eagle, and cockatoo. The multitude of endangered, threatened and vulnerable species makes this a difficult place to visit because there are the required permits are very limited - even to scientists.

Habitat loss, hunting and armed conflict on the Mindanao Island have contributed to loss of biodiversity and conservation efforts.



Magnitude 7.4 PHILIPPINES

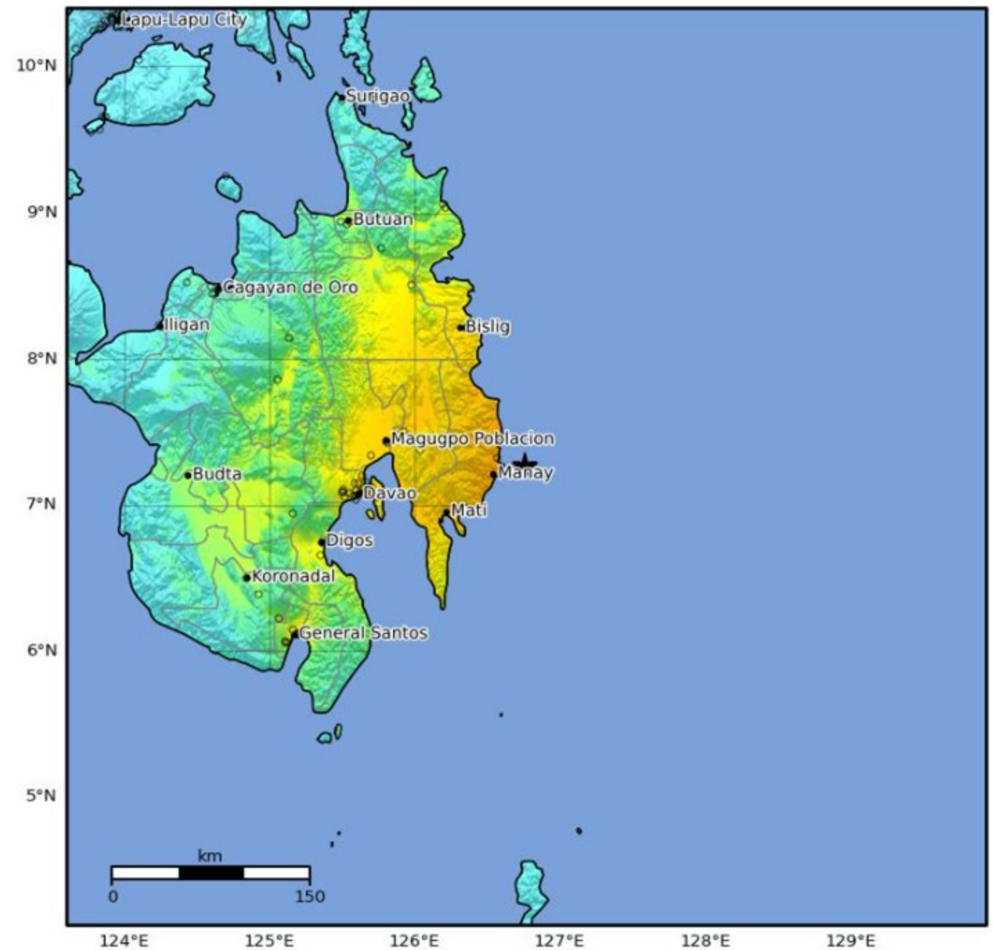
Friday, October 10, 2025 at 01:43:59 (UTC)

ALL

The Modified-Mercalli Intensity (MMI) scale is a ten-stage scale, from I to X, that indicates the severity of ground shaking.

Intensity is based on observed effects and is variable over the area affected by the earthquake and is dependent on earthquake size, depth, distance, and local conditions.

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



Magnitude 7.4 PHILIPPINES

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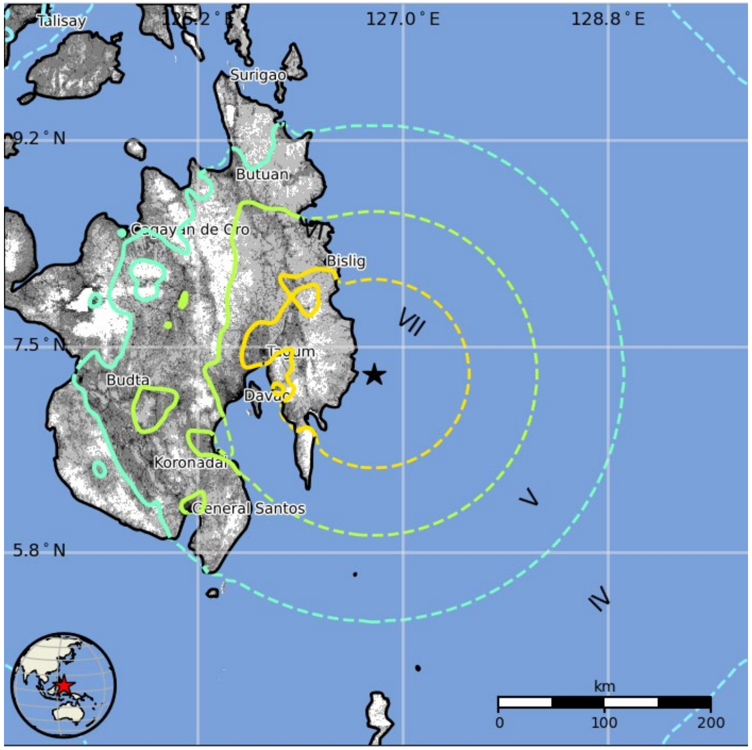
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels. The USGS estimates that approximately 30,000 people felt severe shaking from this earthquake.

MMI	Shaking	Population
I	Not Felt	0 k*
II-III	Weak	1,498 k*
IV	Light	9,714 k*
V	Moderate	8,680 k
VI	Strong	5,967 k
VII	Very Strong	2,287 k
VIII	Severe	30 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 contour lines. The estimated population exposure to each MMI Intensity is shown in the table.

Image courtesy of the US Geological Survey

Magnitude 7.4 PHILIPPINES
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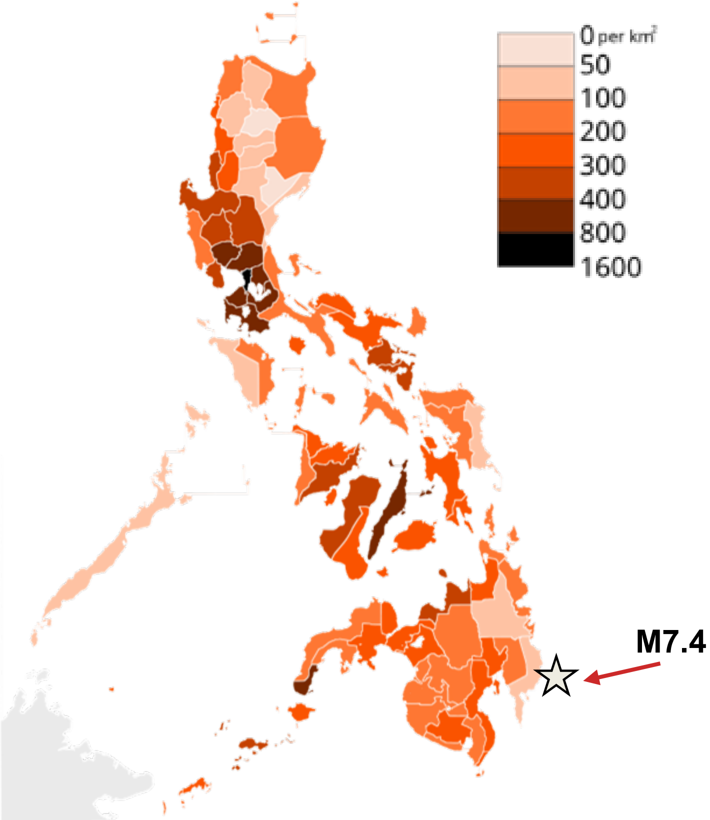
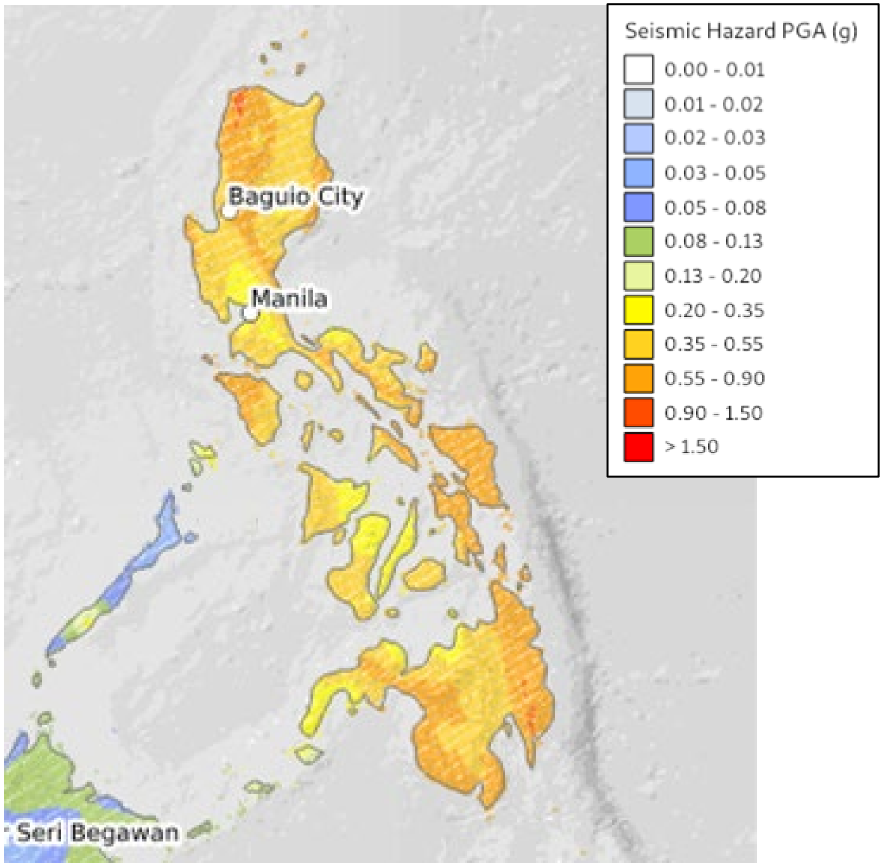
Due to its location along subduction zones, the entire country of the Philippines experiences a quite high seismic hazard. The October 10 earthquake occurred ~80 mi east of Davao, Mindanao island’s largest city. Thankfully, this region is less densely populated compared to other regions in the north and west of the country.

Population Density of the Philippines



Seismic Hazard of the Philippines



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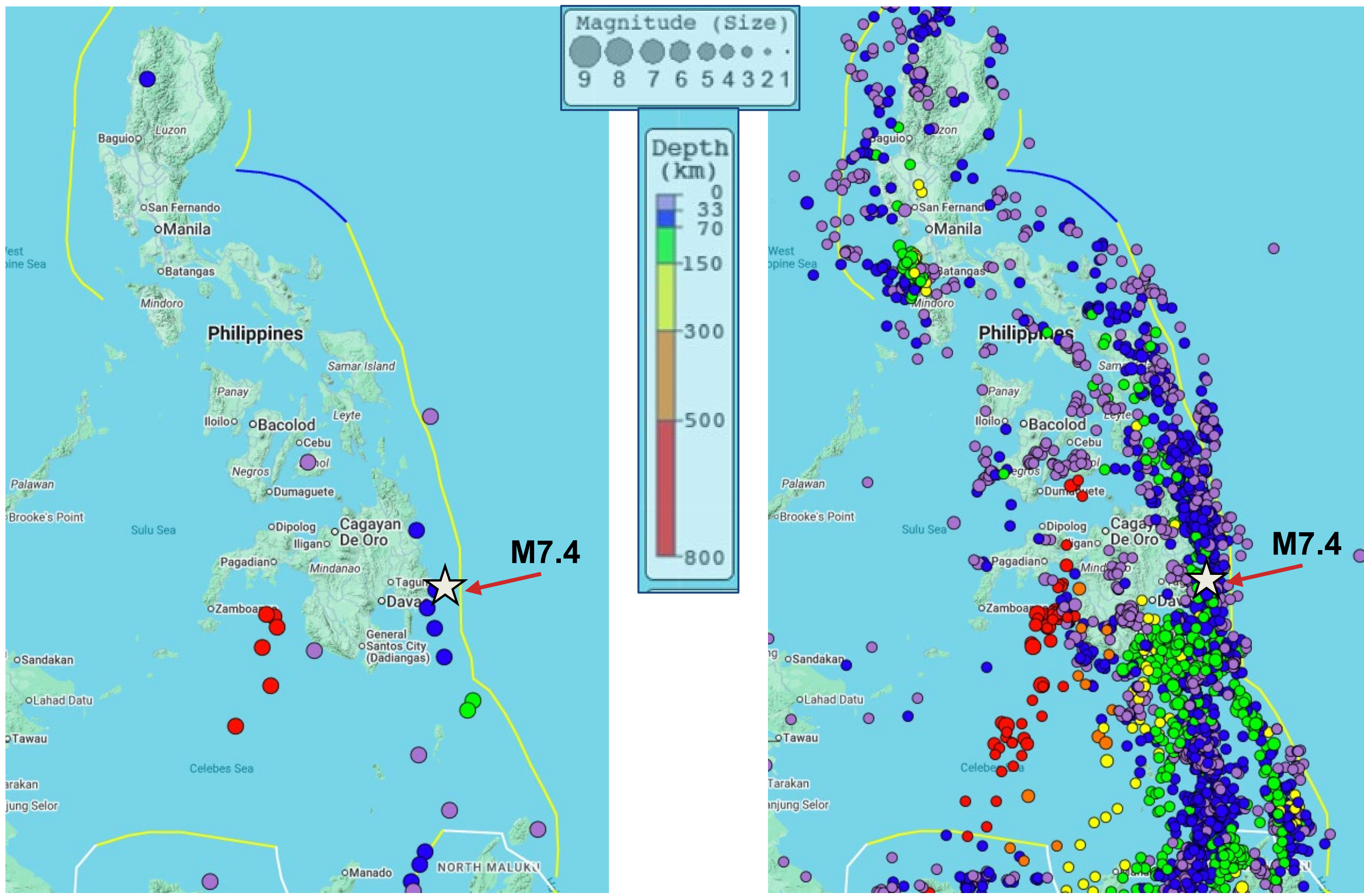
Historical seismicity 2000–2025 in the region of the October 10, 2025 earthquake, with location marked by white star. Image on the left shows earthquakes >M7; Image on the right shows earthquakes >M5 for the same period.

Earthquakes are color coded by depth as shown by the legend between the maps. Depths of earthquakes increase from east to west across the subduction zone boundary between the Philippine Sea and Sunda Plates.



Created using the Interactive Earthquake Browser (IEB)

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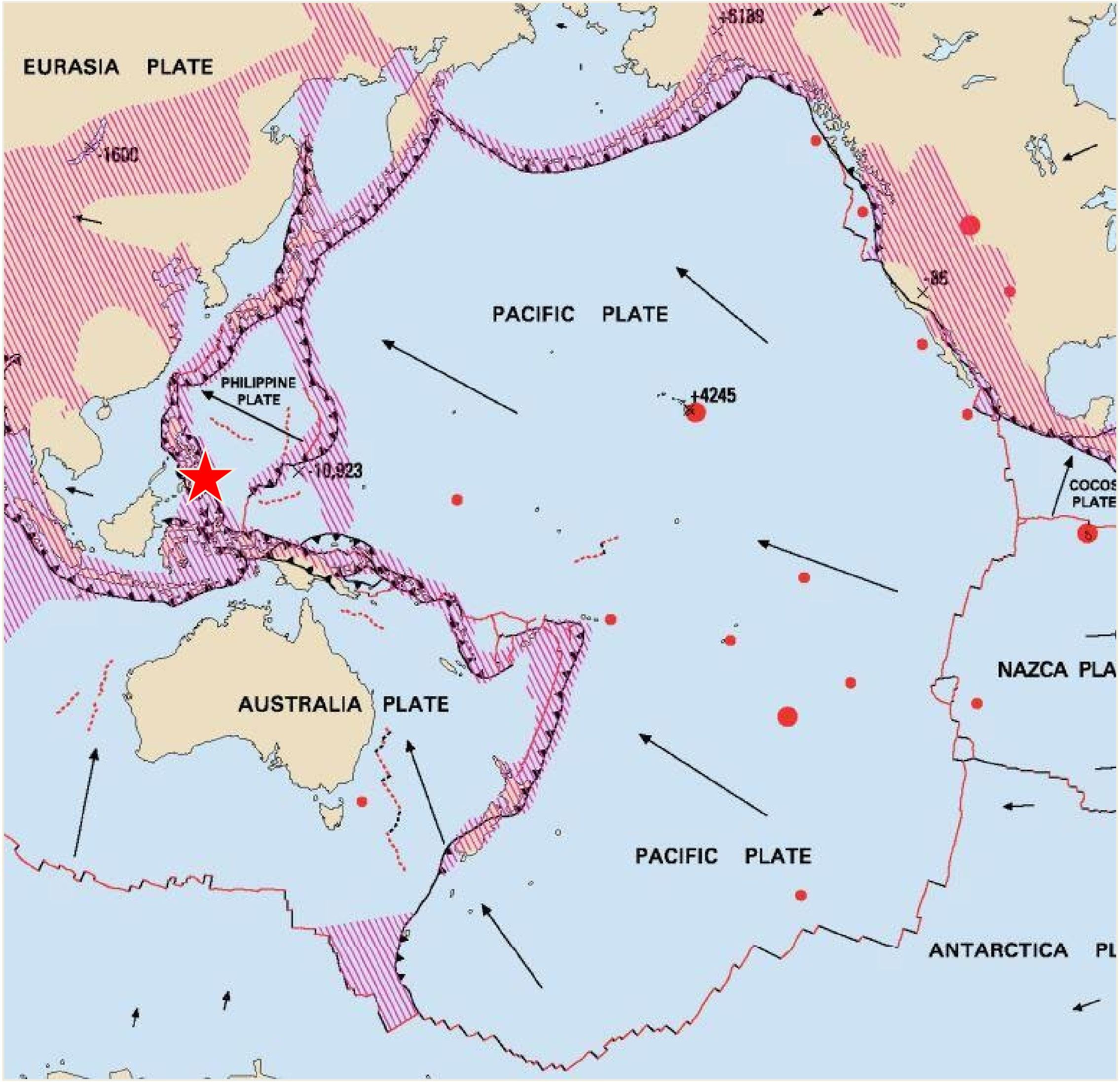
The Philippines are located along the western side of the Pacific Plate's "Ring of Fire" – between the large Eurasian Plate to the north and west and the smaller Philippine Plate to the east.



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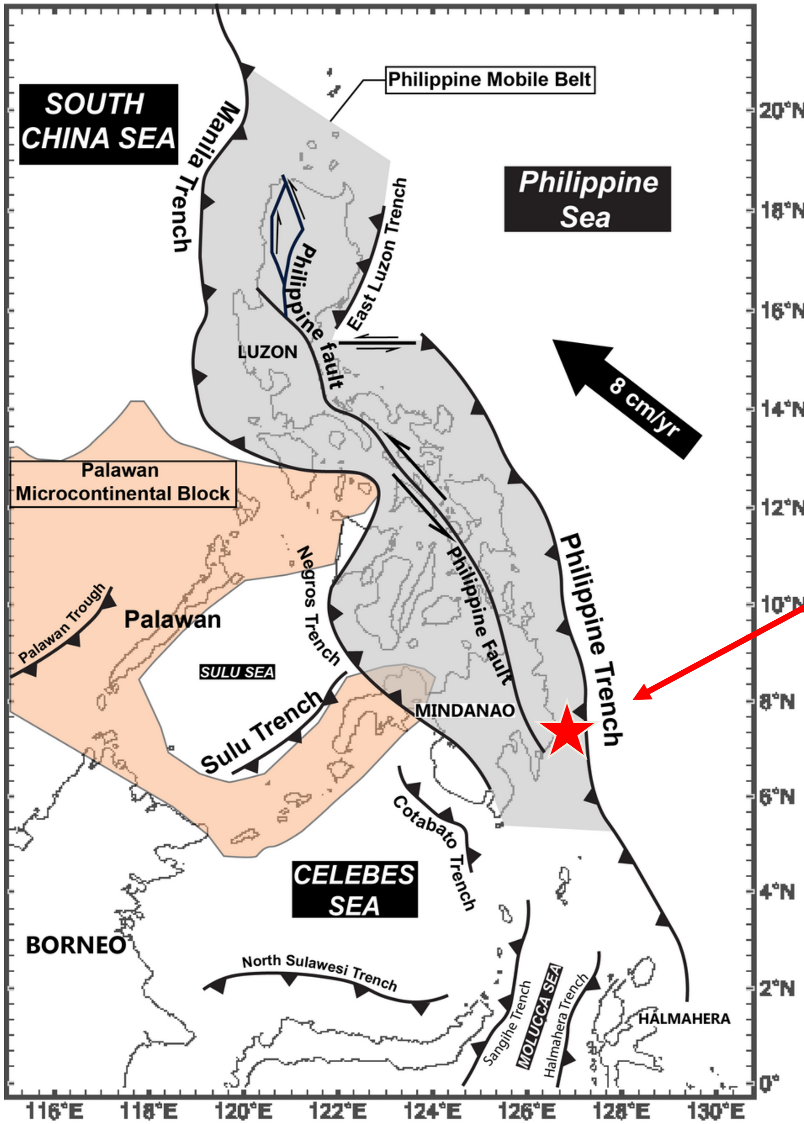
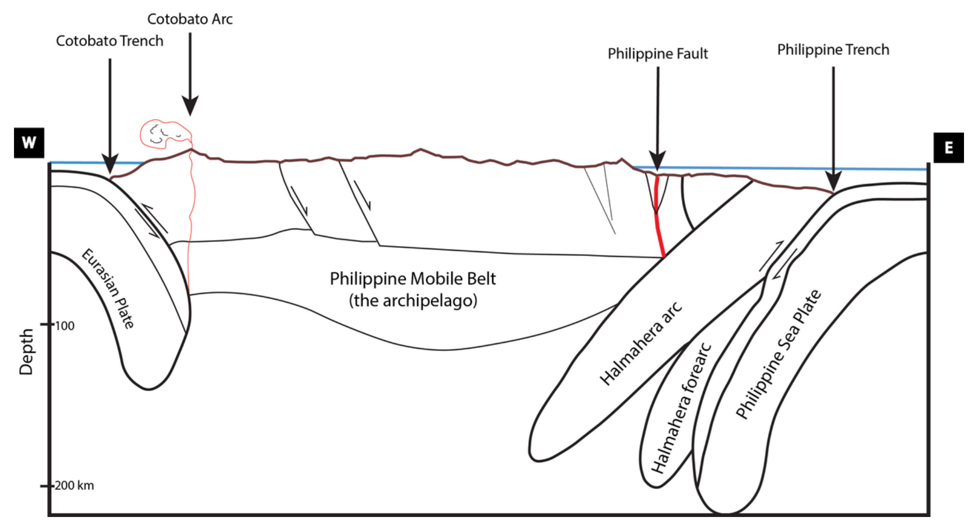


The Philippines are in a very tectonically active region with subducting oceanic plates along both the east and west sides of the archipelago. The Philippine Fault, a major strike-slip fault, runs up the middle. A complex set of other subduction zones and faults riddle the region.

The October 10 Mag 7.4 earthquake occurred along the Philippine Trench subduction zone on the east side of the island chain.



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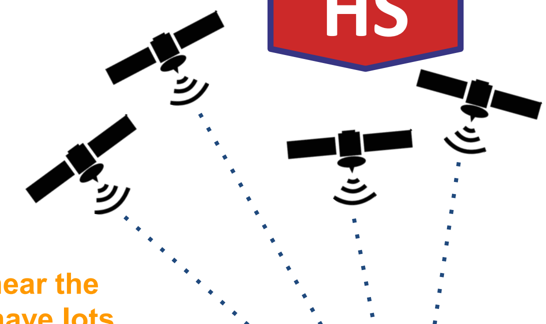
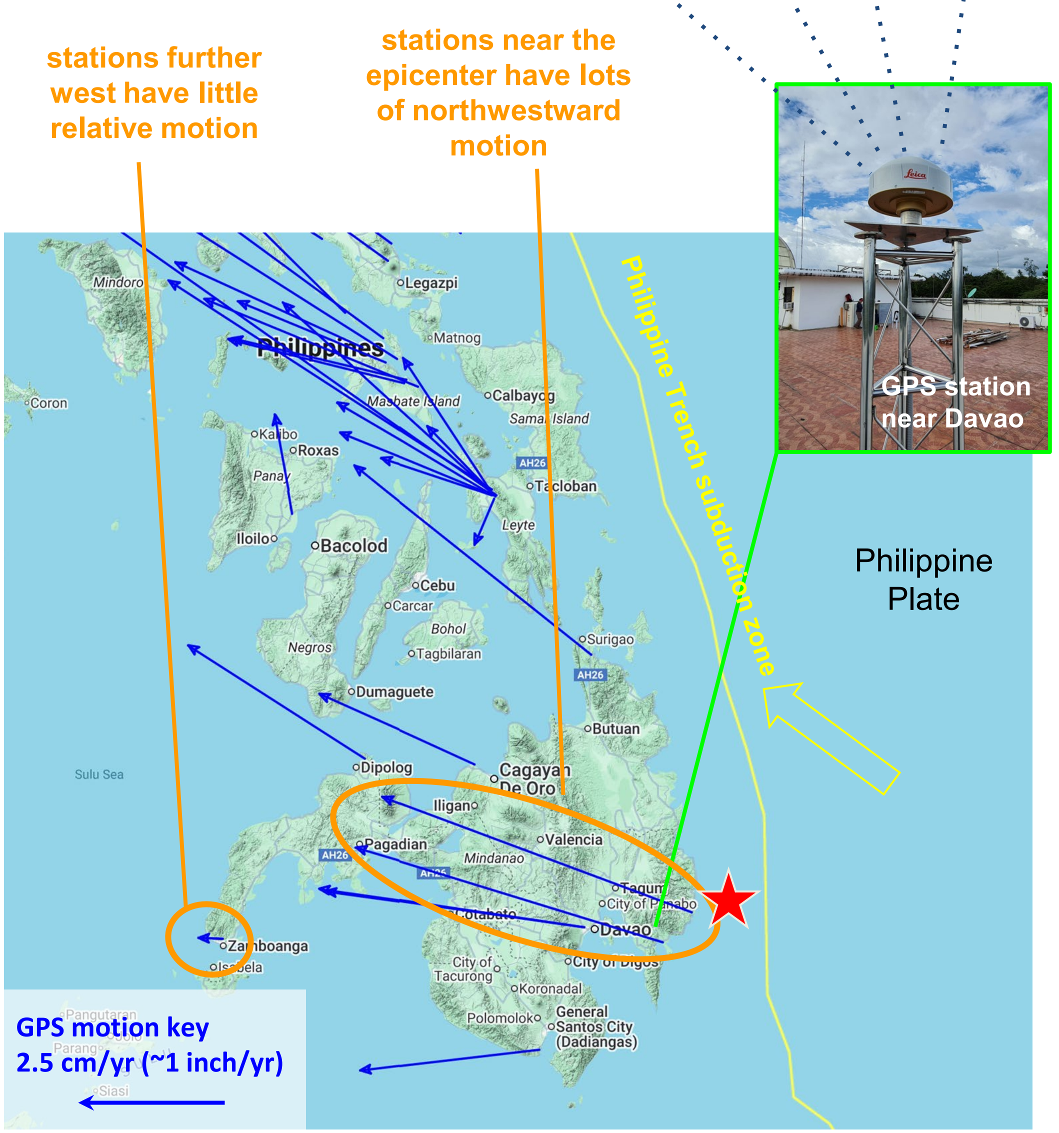
Regional Tectonic Plate Motions

The Philippines have GPS stations that record the long term motion from plate tectonics. GPS stations receive signals from satellites and use the time offset between when the signal leaves the satellite and when it arrives at the station to determine distance. With signals from 4 or more stations, it can determine its location and velocity.

Compared to stable parts of the Eurasian Plate, stations near the the epicenter more moving northwest at >5.5 cm/yr (>2 inch/yr) as the Philippine Plate pushes northwestward. Stations on the western side of the country move much slower.

Over decades and centuries this compression accumulates and is occasionally released in earthquakes such as the Mag 7.4 earthquake on October 10, 2025.





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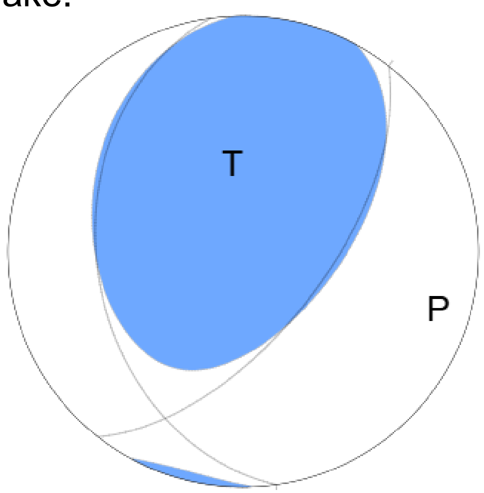
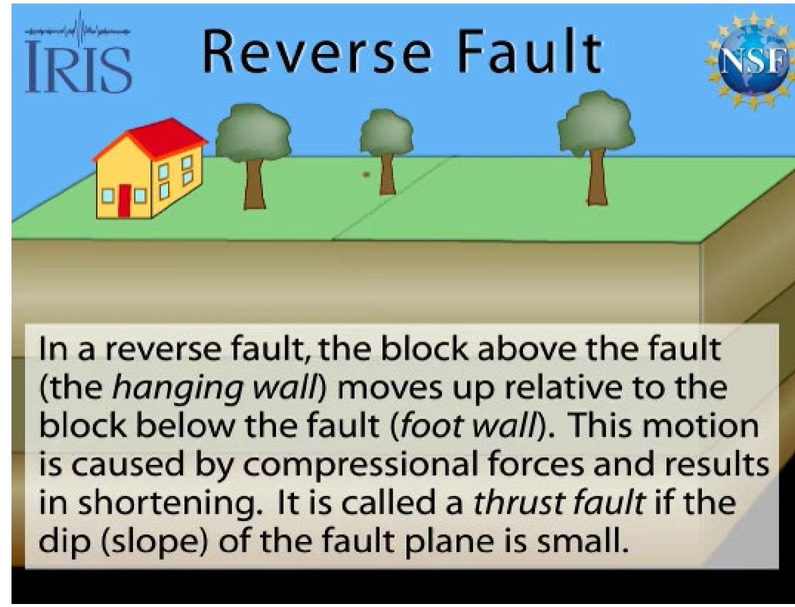
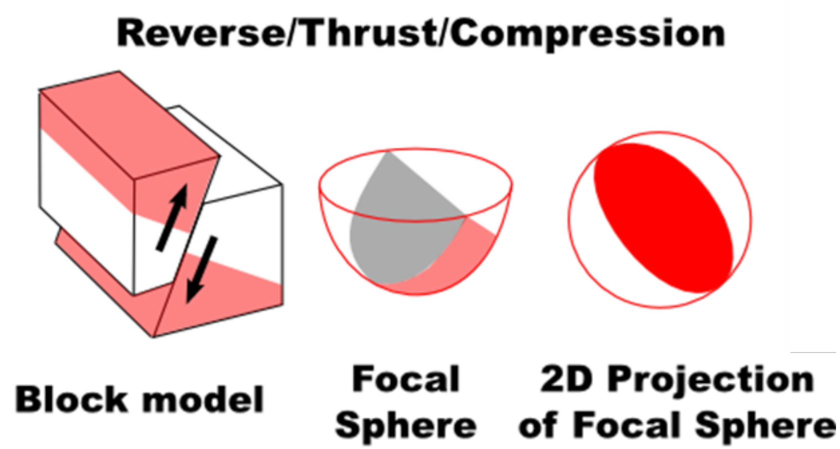
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Because an earthquake occurs as slip on a fault, it generates primary (P) waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white). The orientation 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 stres direction. The Pressure axis (P) reflects the maximum compressive stress direction.





ALL

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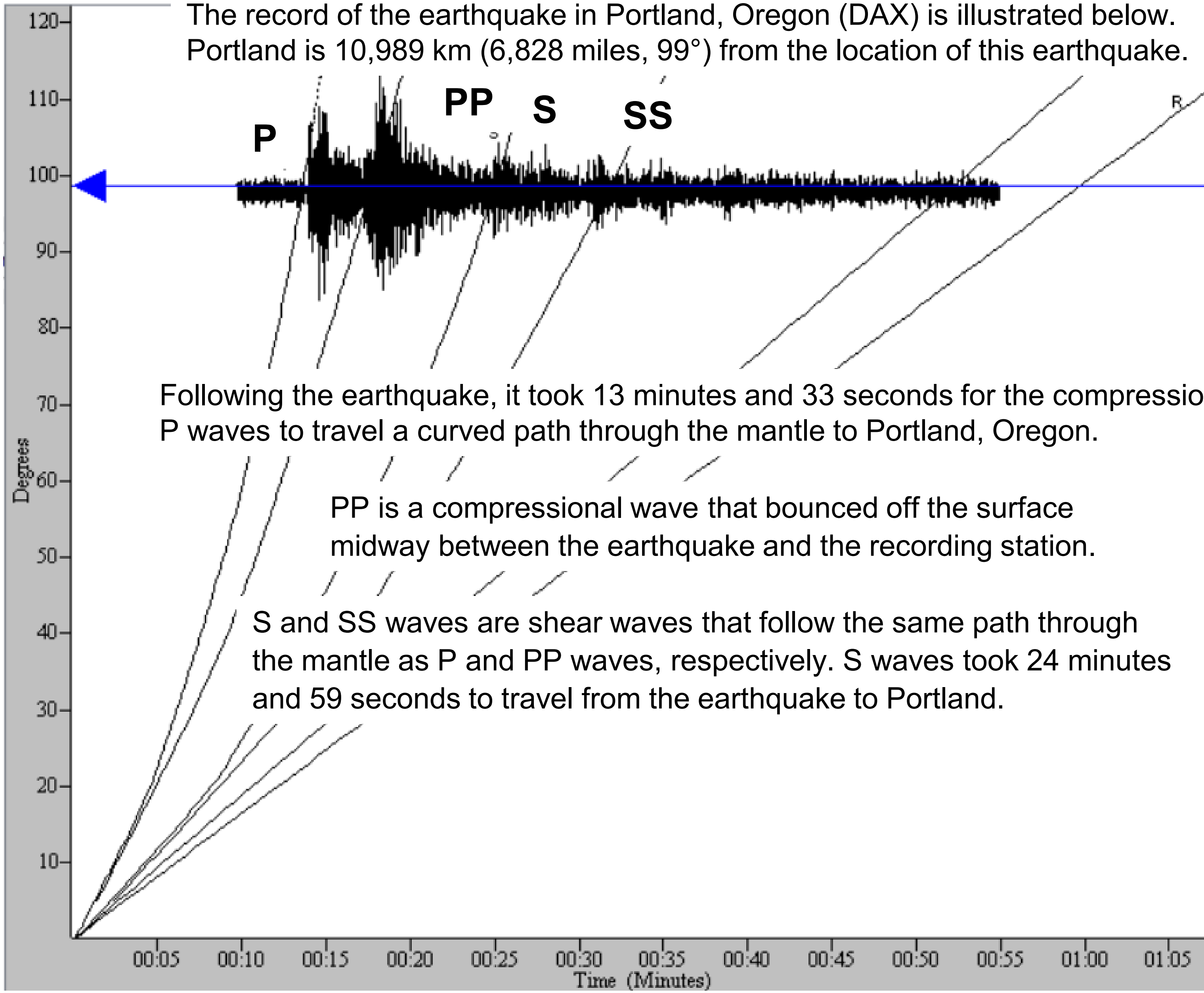
The record of the earthquake in Portland, Oregon (DAX) is illustrated below. Portland is 10,989 km (6,828 miles, 99°) from the location of this earthquake.



Following the earthquake, it took 13 minutes and 33 seconds for the compressional P waves to travel a curved path through the mantle to Portland, Oregon.

PP is a compressional wave that bounced off the surface midway between the earthquake and the recording station.

S and SS waves are shear waves that follow the same path through the mantle as P and PP waves, respectively. S waves took 24 minutes and 59 seconds to travel from the earthquake to Portland.

Slide Guide

1. Where was the epicenter of this earthquake? (What city/region was it closest to?) When did the earthquake happen? What was its magnitude?
2. How many people are estimated to have felt the earthquake?
3. Which type of boundary is this earthquake related to?
4. What impact did the earthquake have on the location in which it was felt the strongest? (buildings, streets, animals, people…)
5. What additional hazards occurred in addition to the ground shaking? (tsunamis, floods, sinkholes, landslides, fires, volcanoes…)
6. How long did it take the first P-wave to travel to the seismic station in this slide stack?
7. What are 2 more questions you have about earthquakes that can NOT be answered with this slide stack?

Extension Questions

1. Seismic waves travel through the earth. Why did you or did you not feel the earthquake?
2. If you were going to write a news story on this earthquake, what would the headline be? *HINT: Think about where this earthquake occurred, the impact it had on the people living in the area, any effects the earthquake had on the area itself.*

Slide Guide

HS

1. Where was the epicenter of this earthquake? (What city/region was it closest to?) When did the earthquake happen? What was its magnitude?
2. How many people are estimated to have felt the earthquake?
3. What relationship is shown between the seismic hazard map and population density?
4. Which plates are involved and what type of boundary are they creating?
5. What impact did the earthquake have on the location in which it was felt the strongest? (buildings, streets, animals, people…)
6. What additional hazards occurred in addition to the ground shaking? (tsunamis, floods, sinkholes, landslides, fires, volcanoes…)
7. How long did it take the first P-wave to travel to the seismic station in this slide stack?
8. What are 2 more questions you have about earthquakes that can NOT be answered with this slide stack?

Extension Questions

1. Seismic waves travel through the earth. Why did you or did you not feel the earthquake?
2. If you were going to write a news story on this earthquake, what would the headline be? *HINT: Think about where this earthquake occurred, the impact it had on the people living in the area, any effects the earthquake had on the area itself.*

C

Slide Guide

1. Where was the epicenter and hypocenter of this earthquake? (What city/region was it closest to? Longitude/latitude/depth?) When did the earthquake happen? What was its magnitude?
2. What impact did the earthquake have on the location in which it was felt the strongest? *(buildings, streets, animals, people…)*
3. Draw the block model of the fault for this earthquake. Overlay a drawing of the focal mechanism to show how the 2D projection was created. Label it with the type of fault.
4. How are the related tectonic plates involved in creating the nearby boundary? *(Include the type of boundary, and the velocity and name of the plates.)*
5. What additional hazards occurred in addition to the ground shaking? *(tsunamis, floods, sinkholes, landslides, fires, volcanoes…)*
6. Relate the area's population density to its seismic hazard level and earthquake history

Extension Question

1. What efforts have there been to mitigate impacts from earthquakes? What additional mitigation efforts should be implemented?

Teachable Moments are a service of

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