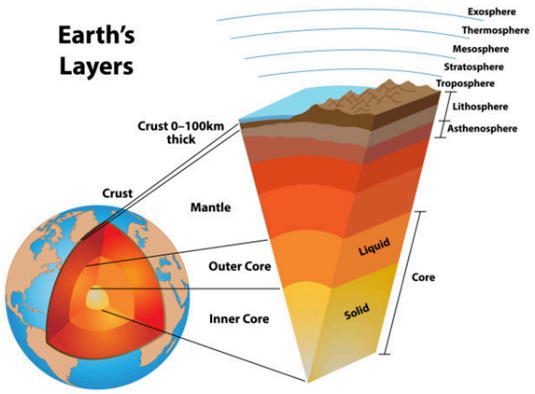
Unit 3: Tectonic Hazards

Parts of the earth and more...



The interior of the earth – the layers and their characteristics:
The interior of the earth consists of; solid inner core, molten outer core, mantle and crust.

The earth's crusts – the difference between Oceanic and Continental Crust:

The continental crust is the layer of rocks that forms landforms. The oceanic crust is the uppermost layer of the oceanic portion of a tectonic plate. Oceanic crust is the outermost solid layer of the lithospheric tectonic plates under the oceans that covers much of the Earth's surface.

The earth's crust – the way it is split up into different plates. How these plates are made up of Oceanic and Continental crust:
The earth's crust is split into tectonic plates. Those tectonic plates are made of oceanic and continental plates. These plates move around each other, going against each other or drifting apart or moving alongside each other.

Why the plates move – convection currents: The plates move to convection currents. The heat rising and falling in the Earth's mantle creates convection currents. Convection currents occur due to the radioactive decay in the Earth's core. These convection currents cause the tectonic plates to move. The movement of these tectonic plates can cause earthquakes, volcanoes et cetera.

The different plate boundaries. What is happening at each boundary? An example of where in the world this happens and the tectonic disasters that is causes:

- Destructive (Oceanic and Continental): At destructive plate boundaries, the plates are crashing into each other destroying the land (Destructive, destroying, crashing). Destructive plate boundaries can cause earthquakes and volcanoes. when the plate subducts into the mantle, it melts and turns into magma in the subduction zone. Pressure builds and the magma escapes through weak points of the plate and emerges through a composite volcano. When two continental plates move against each other, neither plate can sink, which forms mountains. The collision point can cause earthquakes.
- Constructive (Oceanic away from Oceanic): At a constructive plate boundary, the plates move away from each other releasing magma which cools down and forms new land (Magma, Boundary, Land).

The plates move apart from one another. When this happens the magma from the mantle rises up to make (or construct) new land in the form of a shield volcano. The movement of the plates over the mantle can cause earthquakes.

- Collision (Continental and Continental): If two continental plates collide, neither can sink and so the land buckles upwards to form fold mountains. This is called a collision boundary. Earthquakes can occur at collision boundaries. A collision between two continental plates crunches and folds the rock at the boundary, lifting it up and leading to the formation of mountains and mountain ranges.
- Conservative (plates moving alongside each other): At conservative plate boundaries, the plates are rubbing past each other. The land is neither destroyed nor created. It stays the same (rubbing, plate, created). The plates move past each other or are side by side moving at different speeds. As the plates move, friction occurs and plates become stuck. Pressure builds up because the plates are still trying to move. When the pressure is released, it sends out huge amounts of energy, causing an earthquake.

Key features and issues caused by an Earthquake (including tsunamis):

- The effects from earthquakes include ground shaking, ground rupture, landslides, tsunamis
- Earthquakes are caused due to sudden lateral or vertical movements in the crust of the Earth. Or we can say that when tectonic plates ride over the other and cause the collision The largest faults are formed on the surface of the Earth due to boundaries between moving plates.
- Advantages: Earthquakes are very useful to humans because they provide a picture of what's going on underground. This can make oil and gas extraction more efficient, and allows scientists to monitor the progress of water during geothermal energy extraction.

Key features and issues caused by a volcanic eruption:

- Health concerns after a volcanic eruption include infectious disease, respiratory illness, burns, injuries from falls, and vehicle accidents related to the slippery, hazy conditions caused by ash.
- Some other disadvantages that volcanic eruptions cause include property damage, eruption can occur at any moment, contributes to climate change as it releases gases, and causes volcanic slides.
- Some advantages of volcanic eruptions include, the soil is fertile, tourist attraction, geothermal energy, hot springs, precious metals found - increases job opportunities.

Disaster Management:

Natural Disaster	***Predict***	***Prepare***	***Prevent***

Earthquake	Laser beams can be used to detect plate movement. A seismometer is used to pick up the vibrations in the Earth's crust. An increase in vibrations may indicate a possible earthquake. Radon gas escapes from cracks in the Earth's crust. Levels of radon gas can be monitored - a sudden increase may suggest an earthquake.	Practice Drop, Cover, and Hold On with family and coworkers. Make an Emergency Plan: Create a family emergency communications plan that has an out-of-state contact. Protect Your Home: Secure heavy items in your home like bookcases, refrigerators, televisions and objects that hang on walls. Stock on non perishable foods.	We cannot prevent natural earthquakes from occurring but we can significantly mitigate their effects by identifying hazards, building safer structures, and providing education on earthquake safety. By preparing for natural earthquakes we can also reduce the risk from human induced earthquakes.
Tsunami	Tsunamis are detected by open-ocean buoys and coastal tide gauges, which report information to stations within the region. Tide stations measure minute changes in sea level, and seismograph stations record earthquake activity.	First, protect yourself from an Earthquake. Get to high ground as far inland as possible. Be alert to signs of a tsunami, such as a sudden rise or draining of ocean waters. Listen to emergency information and alerts. Evacuate: DO NOT wait! If you are in a boat, go out to sea.	Avoid building or living in buildings within several hundred feet of the coastline. If you do live in a coastal area, elevate your home to help reduce damage. Take precautions to prevent flooding. Have an engineer check your home and advise about ways to make it more resistant to tsunami water.

Volcano	Seismographic detection of earthquakes can help predict volcanoes as there are usually tremors and earthquakes before the eruption of a volcano. The number and the magnitude of earthquakes increases before an eruption due to the movement of magma under the earth's crust. Magma and gas under the crust can push the slope of a volcano upwards, therefore signalling a possible volcano eruption in the near future. Gases usually escape a volcano before an eruption, so, by sighting smoke rising from a volcano, that could signify that the volcano is close to eruption.	Make an emergency plan Avoid building anything close to the volcano Don't allow hikers to go up the volcano Have a shelter in place plan if your biggest risk is from ash Make sure to have emergency money, a radio, a tent, water and food supply in case you have to evacuate the area and are displaced for some time. Keep important documents in a safe place. Create password protected digital copies. Enquire what your homeowner's insurance policy would cover when a volcano erupts.	Listen for emergency information and alerts. Follow evacuation or shelter orders. ... Avoid areas downstream of the eruption. Protect yourself from falling ash. Do not drive in heavy ash fall.

Hurricane	Satellites, reconnaissance aircraft, Ships, buoys, radar, and other land-based platforms are important tools used in hurricane tracking and prediction. While a tropical cyclone is over the open ocean, remote measurements of the storm's intensity and track are made primarily via satellites.	Make a plan Secure the exterior of your house and bring in any fragile exterior items. Install storm shutters. Check wall hangings and art; make sure they are secure. Power up by filling up car gas tanks, test your generator, charge your phone, be prepared for power outages. Find a shelter room. Prep an emergency kit. Store important documents. Unplug appliances.	Install Shutters. Invest in Hurricane Glass. Secure Windows and Doors. Brace Garage Doors. Reinforce Roofing. Remove/Elevate Valuables. Create Flood Barriers.

Case studies:
Earthquake - central italy earthquake Volcanic eruption - Choice
2004 Indonesian Tsunami
San Andreas Fault

1. Central Italy earthquake
   Location: Central Italy
   Date: 24 August 2016 at 03:36:32 CEST
   Casualties: death of 297 people: 234 in Amatrice, 11 in Accumoli and 49 in Arquata del Tronto. At least 365 injured had to be treated in hospitals, mainly in Rieti and Ascoli Piceno,
   Brief events: A 6.2 magnitude earthquake struck central Italy at 03.36 (local time) on 24 August 2016 at a shallow depth of approximately 6km. Another 4.8 magnitude earthquake followed at 06.28 (local time) on 26 August causing more damage to crumbled buildings and hampering rescue efforts further. According to the US Geological Survey (USGS), the earthquake was caused by shallow normal faulting in the Central Apennines, where the Eurasia plate moves towards the northeast with respect to Africa (at an average rate of 24mm a year).
   Brief response: 3D computer models were used to help damage assessment of the Basilica of Saint Francis of Assisi and the Church of Sant'Agostino. The data for building the models was collected by robots deployed by the European project TRADR. Two ground robots and one drone were used inside the San Francesco Basilica, one drone was used inside the Sant'Agostino church, and two drones were used on the outside of both churches.

2. Volcanic eruption: Mount ontake
   Location: Japan’s Honshu Island
   Date and time: September 27th, 2014, at 11:52 a.m. local time. Casualties: 57 deaths
   Injuries: 69 injuries

- Prominent active volcano, which was a 3,067-metre (10,121ft) volcano.

- Ash reached 3 kilometers down the mountain.
- The ash was up to 40-50 cm thick resulting in the atmosphere to be harmful and unsafe.
- The snow surface melted due to the heat from the eruption, which led to landslides and flows down the mountain.
- They could have predicted the eruption better by monitoring the seismic activity, gas emissions, ground deformation, or geological observation. Even Though these methods aren't 100% accurate, they do give a slight idea of an upcoming eruption. This would have helped as they could have evacuated residents, hikers, and tourists from the area which would have decreased the deaths, injuries, loss of belongings/properties, homelessness and other problems that were caused.
- Comparing Japan's response to the Mount ontake eruption to the Philippines Mount Pinatubo, the death toll of Japan's eruption was significantly lower compared to philippines. Japan had a death toll of 57 people, however, the Philippines had a death toll of 722 people. This helps to prove that Japan had a better response to the eruption due to the country being high income which allows them to have better resources to respond to disasters like this. More than 350 people died during the eruption, most of them from collapsing roofs. Disease that broke out in evacuation camps and the continuing mud flows in the area caused additional deaths, bringing the total death toll to 722 people, which further proves that the philippines weren't prepared enough to control the situation that the eruption created.

3. 2004 Indonesian Tsunami
   Location: the West Coast of Northern Sumatra in the Indian Ocean (Indonesia, Sri Lanka, India, Maldives, and Thailand sustaining massive damage)
   Time/date: Sunday 26 December 2004, at 7:59 am local time
   Casualties: 225,000 deaths
   Homeless: 1.7 million homeless

- A magnitude, 9, earthquake occurred off the West Coast of Northern Sumatra in the Indian Ocean.
- This caused the Indian Ocean tsunami that affected 13 countries
- There was no Indian Ocean tsunami warning system in place
- Many of the countries surrounding the Indian Ocean are LEDCs so they could not afford to spend much on preparation and prevention.
- Ports were ruined as well as crops and farmlands
- The seafloor near the earthquake was raised several meters. The displacement of water above the sea floor triggered the tsunami
- A powerful undersea earthquake that struck off the coast of Sumatra island, Indonesia, set off the 2004 Indian Ocean tsunami, also known as the Christmas or Boxing Day tsunami,

4. San Andreas Fault

Location: San Francisco, the coast of Northern California, United States. Time/date: Wednesday 18 April 1906, at 5:12 am local time
Casualities: 3,000+
Homeless: 250,000

Total property loss: $350 million.

- An earthquake of magnitude 7.9 rocked the Coast of Northern California.
- The fault in which this earthquake originated from was the San Andreas fault.
- Within a short time, relief shipments of food and clothing reached the city, and several tens of millions of dollars in financial aid arrived from foreign sources, including Europe, Japan and China, and other parts of America.
- Much of the city was built to be earthquake and fire resistant before itself due to the numerous earthquakes and forest fires the state experiences.
- The San Andreas fault is about 270 miles long, resulting in the tremors of the earthquakes being felt from Los Angeles in the south to Coos Bay, Oregon, in the north.
- The damage was most severe in San Francisco and other cities near the fault such as San Jose, Salinas and Santa Rosa.
- After the earthquake followed a massive fire, which was only extinguished after 4 days due to rain.
- The fire destroyed many properties, further adding to the rebuilding costs of the area.