Global Hazards: Need to know

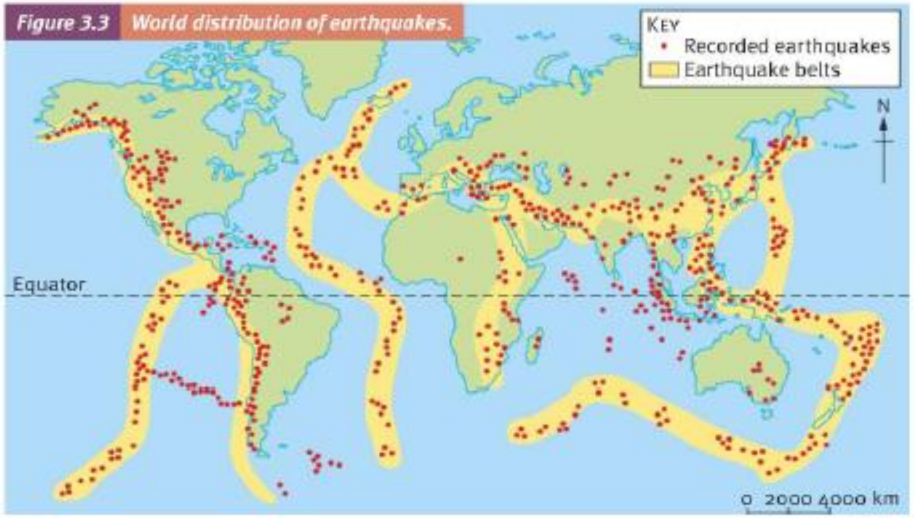
- Plate boundaries (divergent, convergent, transform)
- Structure of the earth & convection
- **Tectonic hazards**: Earthquakes & Volcanoes. Distribution patterns, causes, impacts, management
- **Climatic hazards**: Tropical Storms & Drought. Distribution patterns, causes, impacts, management.
- How to plan, predict, prepare for hazards
- Why people choose to live in hazard areas
- Case studies: LIDC – Nepal earthquake

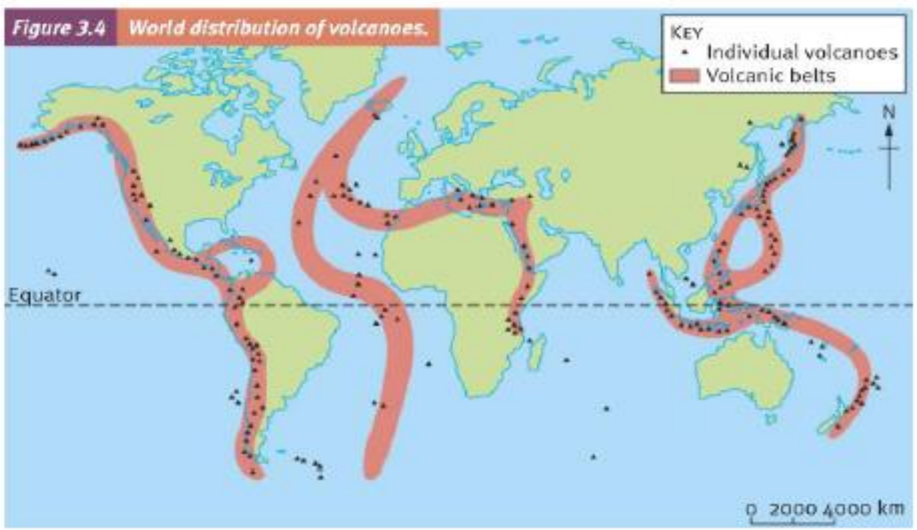
  LIDC - Typhoon Haiyan, Philippines

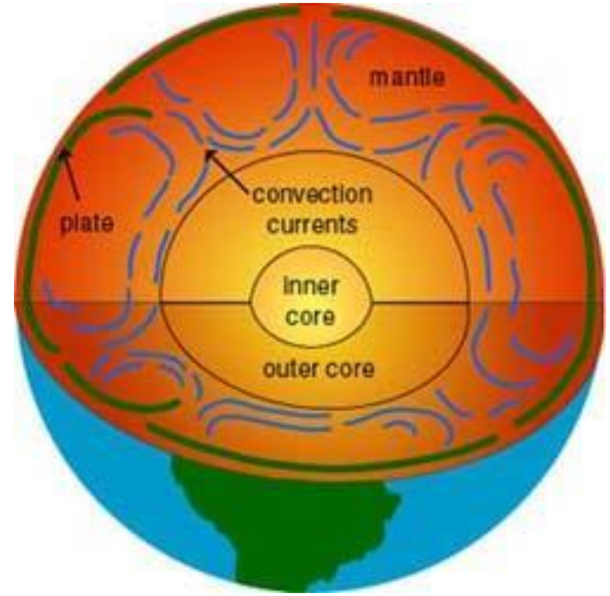
  AC - heatwave, UK 2003 or 2012.

Tectonic Hazards

A natural hazard is an extreme natural event or process that causes loss of life and/or extreme damage to property and creates severe disruption to human activities







Describe the distribution of tectonic hazards? …………………………………………………………

……………………………………………………………………

……………………………………………………………………

……………………………………………………………………

Explain the link between the location of tectonic hazards and continental plates :

……………………………………………………………………

………….. ……………………………………………………………

……………………………………………………………………

Explain convection: ………………………………………

……………………………………………………………………

………….. ……………………………………………………………

What happens when the plates meet?

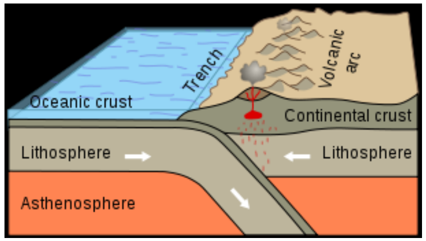
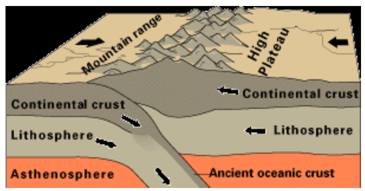
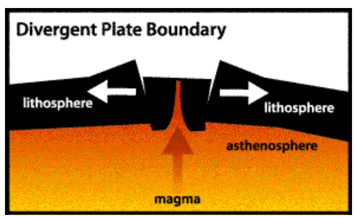
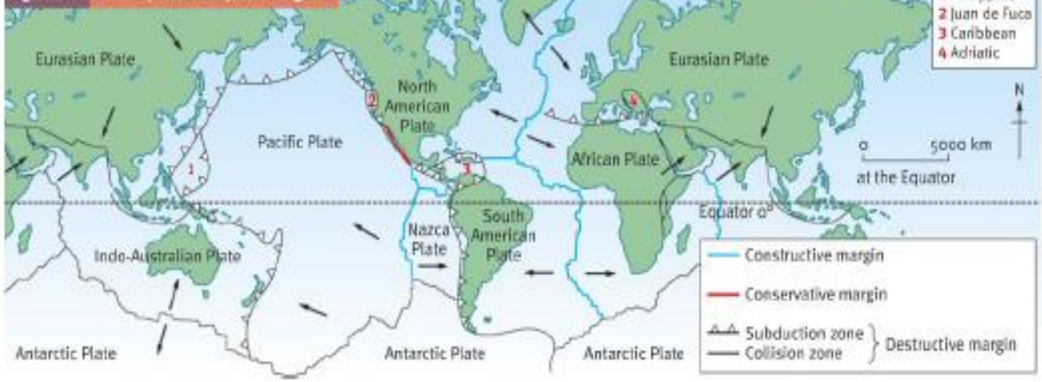
Type of Margin	Description of Changes	Earthquake / Volcanic activity	Examples
Destructive (oceanic and continental)		Oceanic crust is denser than continental crust = **<u>subduction</u>** occurs (sinks into the mantle) Sinking crust melts under friction & pressure…forms magma = creates volcanoes	Nazca plate, South America
Collision (two continental)		If both plates are continental, then they are both too light to really subduct. C**<u>ollision</u>** occurs = forms mountain chains	Himalayas
Constructive (under the Ocean)		When plates diverge under the ocean, magma rises to the surface to create new land. As magma rises it cools, forming mountains / volcanoes / land.	The **<u>Mid-Atlantic Ridge</u>** is the biggest area of divergence
Conservative		Where plates slide past each other. Creates a lot of earthquakes as friction builds up then one plate jumps forward.	San Andreas Fault, California

Figure 3.9 Global plates and plate margins.



The tectonic plates are moving in different directions.

The movements have different effects on the landscape of the Earth.

- Plates that are moving in opposite directions form a **constructive** boundary.
- Plates that move towards each other form either a **destructive** boundary or a **collision** boundary.
- Plates sliding by each other form a **conservative** boundary.

Plates and plate boundaries

The earth's crust is broken up into pieces. These pieces are called plates. Heat rising and falling inside the mantle creates **convection currents**. The convection currents move the plates. The movement of the plates, and the activity inside the earth, is called **plate tectonics**.

Plate tectonics cause earthquakes and volcanoes. The point where two plates meet is called a **plate boundary**. Earthquakes and volcanoes are most likely to occur either on or near plate boundaries.

Fault: A fracture in the Earth's crust that shows signs of movement

Continental drift: the movement of the continents over time through plate tectonics

Subduction Zone: the area of a destructive plate boundary where one plate descends beneath another

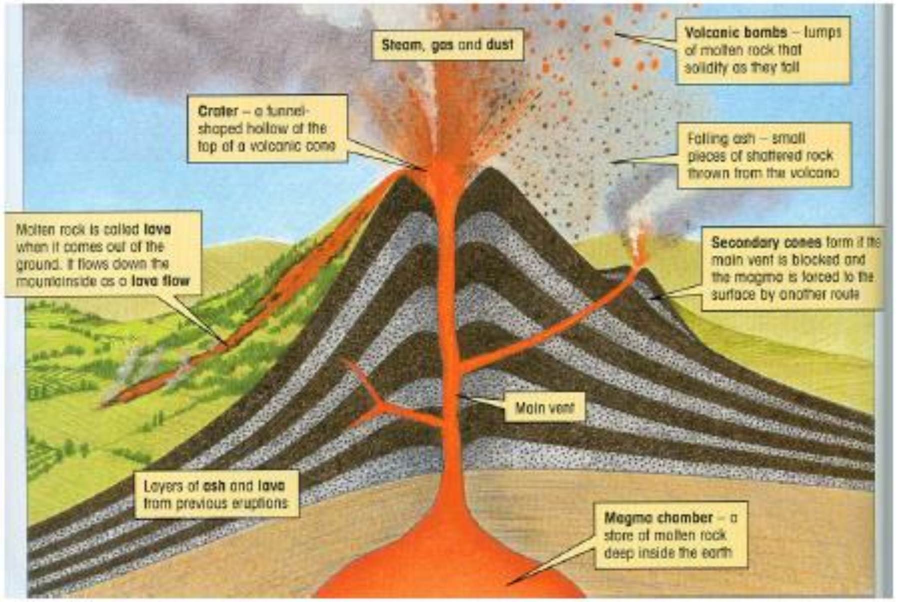
Destructive: where plates collide together, forcing one plate downwards to form either volcanoes or mountains or trenches

Constructive: where plates are moving apart, allowing magma from the mantle to reach the earth's surface + create new land

Conservative: where plates slide past each other, causing lots of earthquakes

Continental Crust: lighter, permanent land that forms our continents

Oceanic Crust: denser crust under the oceans, constantly recycled



How to predict volcanic eruptions?

Gas measurements – sulphur dioxide & carbon dioxides increases as magma rises

Seismic readings – earthquakes increase & become shallower as magma rises

Satellite imagery – measures 'bulges' as magma moves up the volcano

Temperature /acidity of soil – increased acidity & temp as magma rises

Why would people choose to live near volcanoes? What advantages are there?

Positive and negative effects of an eruption

Positive	Negative
The dramatic scenery created by volcanic eruptions attracts tourists. This brings income to an area.	Many lives can be lost as a result of a volcanic eruption.
The lava and ash deposited during an eruption breaks down to provide valuable nutrients for the soil. This creates very fertile soil which is good for agriculture	If the ash and mud from a volcanic eruption mix with rain water or melting snow, fast moving mudflows are created. These flows are called *lahars*.
The high level of heat and activity inside the Earth, close to a volcano, can provide opportunities for generating geothermal energy.	Lava flows and lahars can destroy settlements and clear areas of woodland or agriculture.
	Human and natural landscapes can be destroyed and changed forever.

Management of volcanoes

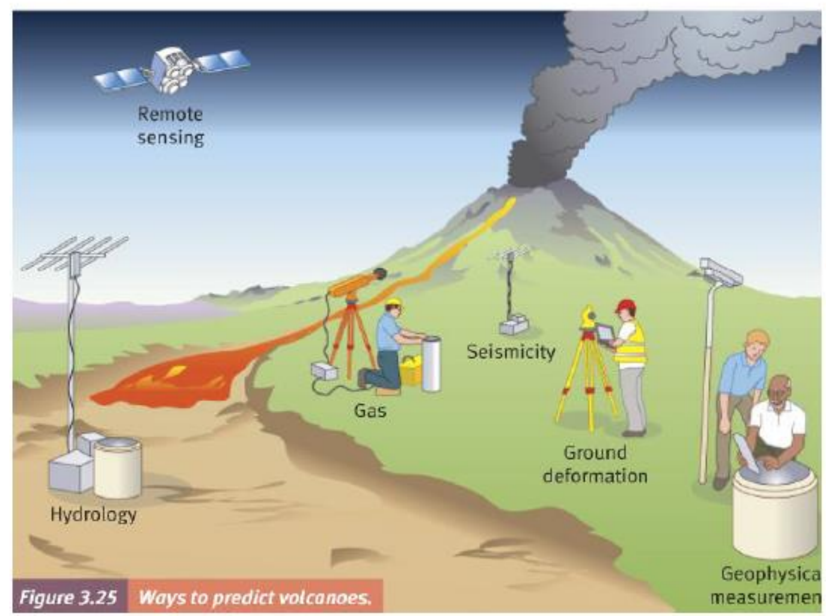
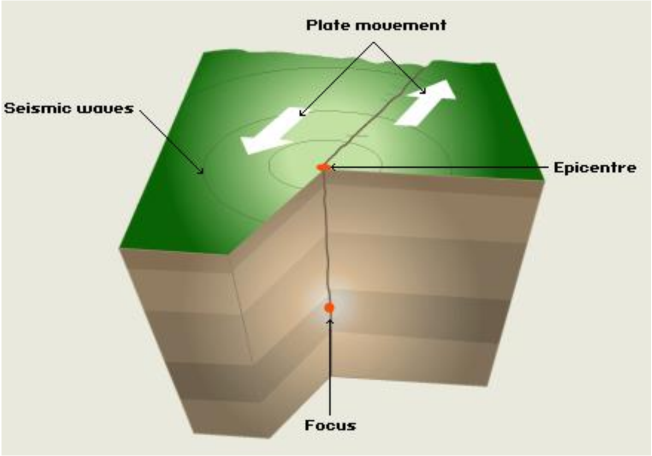
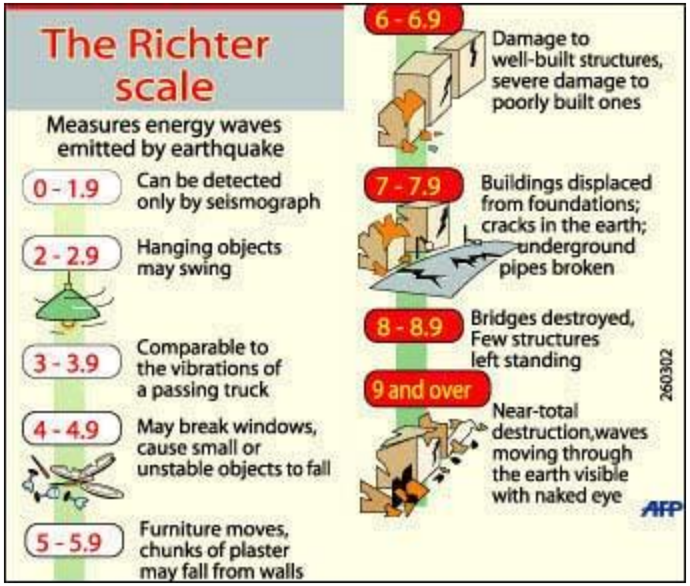


Figure 3.25 Ways to predict volcanoes.

Volcanologists – people who study volcanoes – are skilled at predicting the likelihood of an eruption. However, it is difficult to pinpoint when an eruption will happen.

- **Earthquakes** occur along faults, which are large cracks in the earth's crust. Earthquakes can happen along *any type of plate boundary*.
- A result of a build up of stress / pressure inside the earth's crust that is caused by the sudden jerking movements of the fault, and are almost impossible to predict.
- Plate movement is not smooth, plates rub & cause friction & 'stick'. Pressure builds up until the plates snap & stress is released = earthquake
- Can occur on any type of boundary (e.g. a consequence of volcanic activity or mountain building, or just be along a transform fault)
- Measured on **Richter scale** by seismometers
- Energy from the stress is released in seismic waves that spread out from the *focus* (point inside the crust where the stress is released). The *epicentre* is the point on top of crust directly above the focus. The strongest waves are found near the centre of the earthquake. This means that the most severe damage caused by an earthquake will happen close to the epicentre.





Earthquakes are measured in two ways:
- The **Richter scale** measures the magnitude of an earthquake using an instrument called a seismograph. It measures the strength of the shaking.
- The **Mercalli scale** measures the damage caused by an earthquake. It rates each quake from I to XII, depending on how much damage was done

liquefaction

Tidal waves / tsunamis

Effects of earthquakes?

Broken glass

Fires

Landslides

Diseases from stagnant water

Injury and death

Buildings destroyed

Effects of volcanic eruptions?

ash inhalation = respiratory illness

Pyroclastic flows

Consider…

How does the impact of a hazard differ between MEDC and LEDC?

Why might the impacts on an LEDC be more severe than in an MEDC?

What measures can be taken to respond to a hazard?

How might the level of development of a country affect how it can respond to a hazard?

How can we protect against damage from earthquakes and volcanoes?

Underground shelters

Evacuation plans

Reinforced roofs to support against heavy ash

We cannot STOP earthquakes or volcanoes, we can only reduce the impact

Land use zoning

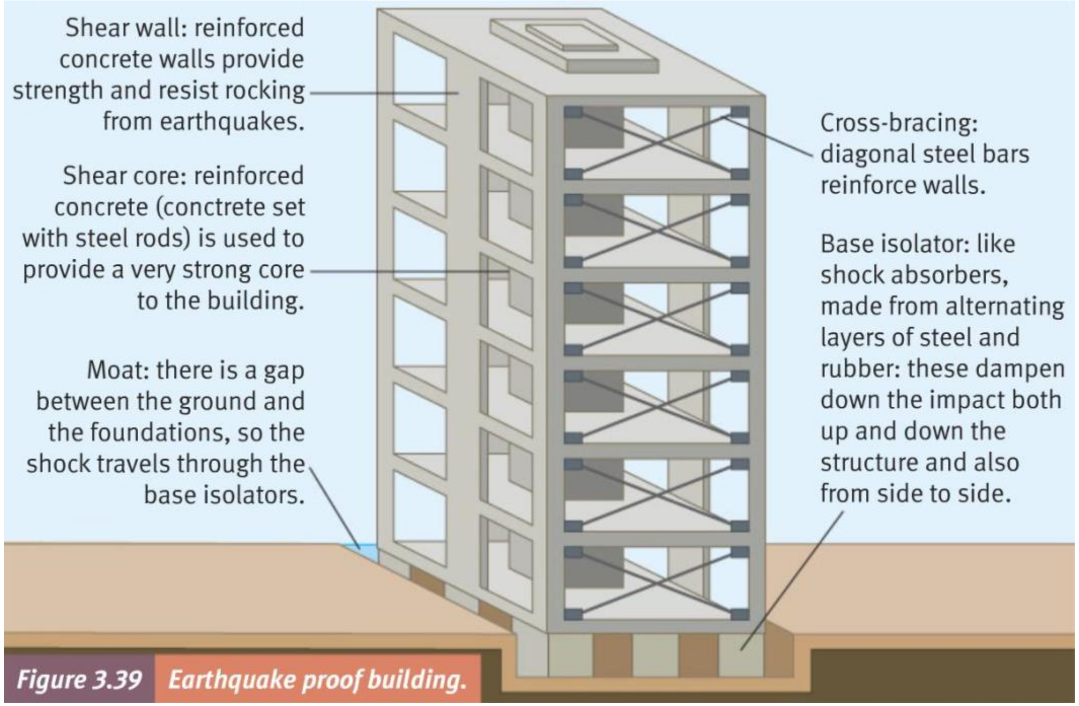


Figure 3.39 *Earthquake proof building.*

Seismometers to predict earthquakes and eruptions

Trained emergency services

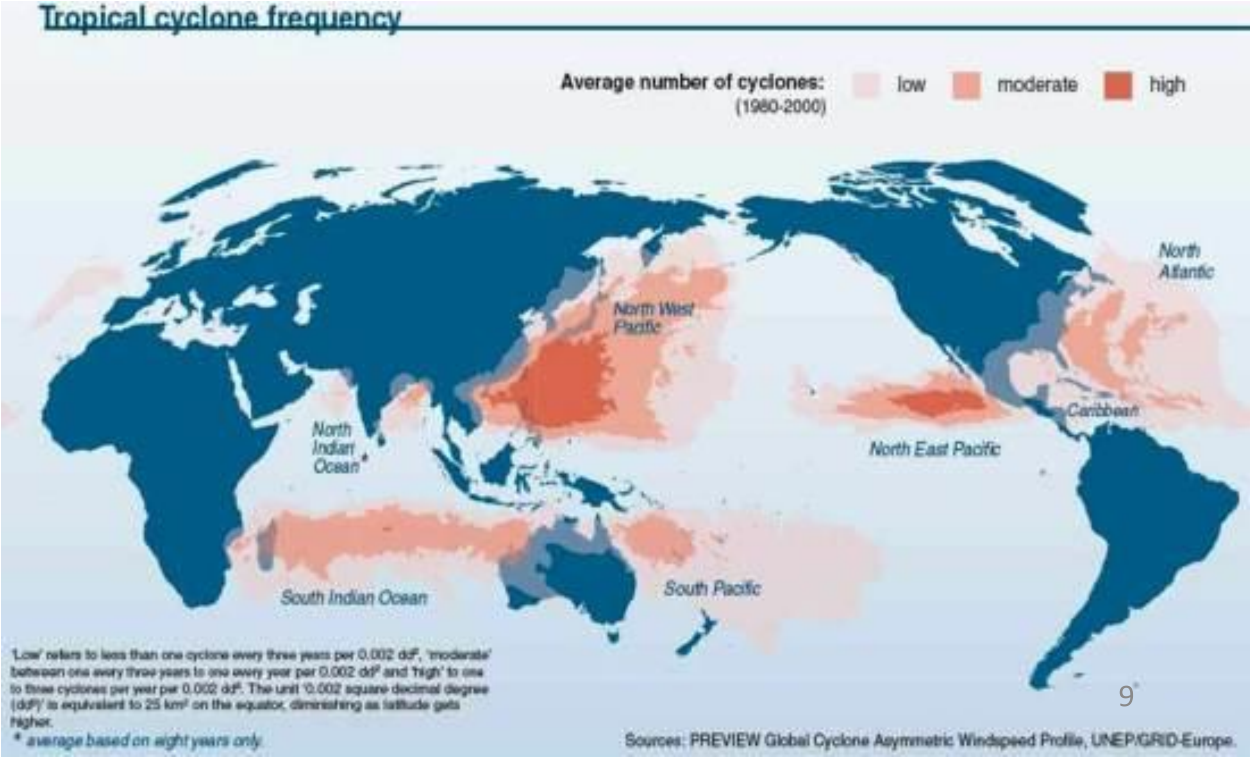
Warning systems, e.g. texts

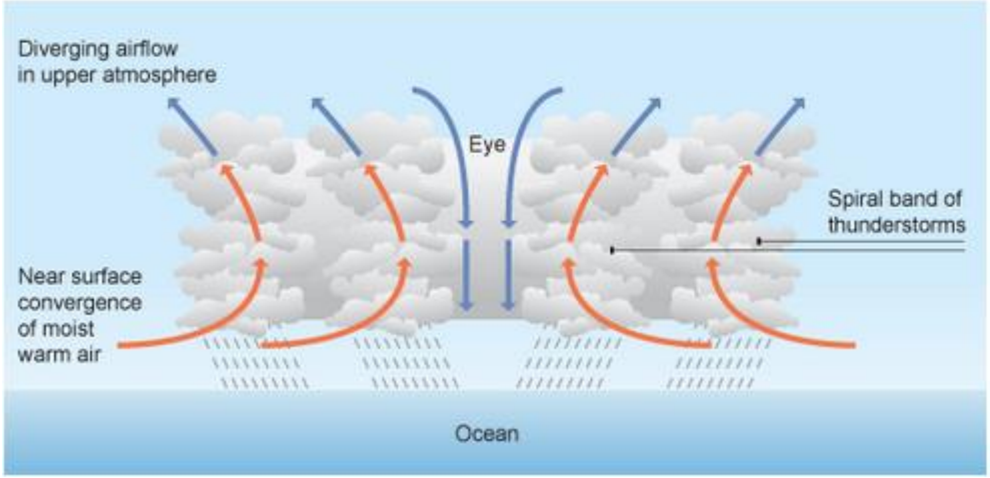
Tropical cyclone categories:

Category	Wind Speed (mph)	Damage at Landfall	Storm Surge (feet)
1	74-95	Minimal	4-5
2	96-110	Moderate	6-8
3	111-130	Extensive	9-12
4	131-155	Extreme	13-18
5	Over 155	Catastrophic	19+

- Forms over warm ocean waters with temperatures of at least 27°C
- Form *between* the Tropics of Cancer and Capricorn
- Water must be at least 60 m deep
- Form in hottest times of the year (May-Nov in northern hemisphere, Nov - Apr in southern hemisphere)
- Low air pressure system

Tropical storms are **intense, low pressure systems (depressions)** known in different parts of the world as *hurricanes, cyclones, typhoons.*





Seen from above, hurricanes are huge circular bodies of thick cloud . The cloud brings heavy rain, thunder and lightning.

Hurricanes need a lot of heat to form and a sea surface temperature of at least 27°C, which is why they usually occur over tropical seas. They also need to be between 5 and 20° north or south of the equator.

How hurricanes form

1. Warm and wet air rises and condenses to form towering clouds & heavy rainfall. It also creates a low pressure zone of air near the surface of the water.
2. Rising warm air causes the air pressure to decrease at higher altitudes. Warm air is under a higher pressure than cold air, so it moves towards the 'space' occupied by the colder, lower pressure, air to fill the gap. So the low pressure 'sucks in' air from the warm surroundings, which then also rises. A continuous upflow of warm and wet air continues to create clouds and rain.
3. Air that surrounds the low pressure zone at the centre flows in a spiral at very high speeds - at speeds of around 120 km/h (75 mph).
4. The faster the winds blow, the lower the air pressure in the centre, and so the cycle continues. The hurricane grows stronger and stronger feeding on warm air/water from below until they reach land.

In the centre is the **eye of the hurricane**. Often there will be no clouds in the eye, it will seem calmer. The eye is formed because this is the only part of the hurricane where cold air is descending, so it is calmer.

As hurricanes move inshore, their power gradually weakens because their energy comes from sucking up moist sea air so they will slow down and eventually disintegrate.

Preparation and prediction

Preparation and prediction techniques can be very different in MEDCs and LEDCs.

MEDCs have the resources and technology to predict and monitor the occurrence of storms, eg using satellites and specially equipped aircraft. They are also equipped to train the emergency services appropriately and to educate people about necessary precautions.

Bangladeshi villager affected by cyclone Sidr

Storm warnings can be issued to enable the population to evacuate or prepare themselves for the storm. People can prepare by storing food and water or boarding up their windows.

LEDCs are often less prepared. They may rely on aid (sometimes reluctantly) from MEDCs for the rescue and recovery process, as was the case with Cyclone Sidr in Bangladesh, November 2007.

Effects of tropical storms

The intense winds of tropical storms can destroy whole communities, buildings and communication networks. As well as their own destructive energy, the winds generate abnormally high waves and tidal surges. Sometimes the most destructive elements of a storm are the subsequent high seas and flooding.

MEDCs are better placed to reduce the effects of tropical storms because they have more financial, educational and technological resources to help deal with them. They better able to observe and predict storm behaviour and can invest in infrastructure to withstand storms - as well as spending more money on repairing the damage caused.

Prediction:

Using weather equipment and satellite imagery with computer models to predict the track (direction), intensity and time of tropical storms scientists can make a forecast. But it is *imprecise,* especially about the intensity.

Preparation:

- Store emergency supplies at home (e.g. dried foods, water, torches, rations, radio, blankets, etc,.)
- Have an escape route / safety bunker to hide in
- Have an emergency plan (personal one & for towns / cities / emergency services)
- Store sandbags for making buildings watertight to prevent flood damage
- Raise flood barriers/ levees against the storm surge

LIDC tropical storm case study

LIDC : Typhoon Haiyan, Philippines

- November 2013, Category 5
- Death toll 6’300 in Philippines, 28’000 injured
- Highest winds 195mph (strongest recorded)
- 281mm rainfall in 12hours, storm surge 6m (main loss of life was from flood/surge)
- Damages $3billion, 1.9million homeless
- Was predicted in advance and warnings given, but many ignored the evacuation. Government criticised for slow response
- Due to hitting LEDCs the death toll cannot be confirmed – likely to be 10’000+
- Diarrhoea, dysentery and skin infections after. Widespread looting & crime occurred.
- Managed response via the military; also the World Health Organisation and international aid ($400million) sent in
- Impact worse due to deforestation - now the mangroves will be replanted to reduce floods

Make & describe your point	Use place specific evidence (Prove it)	Explain (So What)	Link back to question
Point 1 *Typhoon Haiyan in November 2013 was the strongest ever recorded when it first reached land.*			(Describe & explain the impacts of a climatic hazard you have studied. 8 marks)
Point 2 *The primary impacts were severe and had social, economic and environmental consequences.*			
Point 3 *The impacts were made worse as emergency responses were hampered.*			