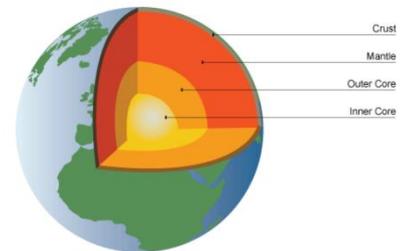


## Natural Hazards

- A natural hazard is a natural event such as an earthquake or flood which interacts with people and human activities. This can be seen through Dreg's hazard model. If there is no interaction between the natural event and people it is not a hazard and there is no disaster.
- An average of 100,000 people between 2002 and 2012 were killed by natural hazards. Examples of natural hazards this year include Storm Brian and Hurricane Irma.
- Hazard risk is the chance or probability of being affected by a natural event.
- There are a range of factors affecting risk which include: **urbanisation** (50% of the world's population live in cities- densely populated urban areas are at great risk from natural hazards), **poverty** (poorer parts of the world may force people to live in areas of risk such as Lima in Peru), **climate change** (warmer world will result in more tropical storms and hurricanes, also led to droughts and famine in other areas), **farming** (many people especially in Bangladesh live on floodplains due to the fertile land for farming).
- Natural hazards can be classified into two main categories:
  - **Hydro-meteorological hazard:** Those caused by running water and its processes (hydro) and those associated with or caused by weather patterns (meteorological). (*Flooding, Hurricanes, Tornadoes*)
  - **Geophysical hazard:** Those caused by earth process. There are two types
    - Internal earth processes of tectonic origin
    - External earth processes of geomorphological origin (*Earthquakes, volcanoes*)
- People choose to live in tectonic areas for a number of reasons: earthquakes and volcanoes do not happen often, better building designs, some people are unaware of the risks, people living in poverty and have to think about money and food, more effective monitoring so people can evacuate, volcanoes can bring benefits such as fertile soils, geothermal energy (Iceland)

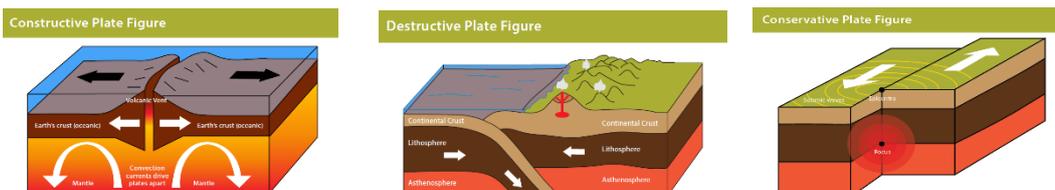
## Tectonic Hazards

- The Earth has a layered structure, including the inner core, outer core, mantle and crust.
  - **Inner core:** 6000 degrees Celsius and is made up a solid heavy metals such as iron and nickel.
  - **Outer core:** 4000 degrees Celsius, liquid metal shell for the section beneath it
  - **Mantle:** 3000 degrees Celsius, widest section of the earth, made of hot melted rock called magma
  - **Crust:** 600 degrees Celsius, made of solid rock such as granite
- The earth's **crust** is split into **plates** which are constantly moving due to **convection currents** in the **mantle**. There are two types of plate:
  - 1) **Oceanic crusts** – newer, thinner, denser, can be destroyed
  - 2) **Continental crusts** – older, thicker, less dense, cannot be destroyed
- **Plate boundary:** The border between two tectonic plates
- **Convection currents** is when heat is sent from the core to the mantle. This causes the crust to spread apart. The heat goes back into the mantle and this process is repeated.



## Plate boundaries

There are three main types of plate margin: constructive, destructive and conservative.



- **Constructive:** This is when the plates are moving away from each other. This usually happens under oceans. The oceanic plates pull away from each other, crack and fractures form between the plates where there is no solid crust. Magma forces its way into the cracks and makes its way to the surface to form volcanoes.

- **Destructive:** A destructive plate margin is where two plates are moving towards each other resulting one plate sinking beneath the other. The denser plate sinks under the lighter plate in a process known as subduction. This can create earthquakes and volcanoes.
- **Conservative:** At conservative plate margins, the plates are sliding past each other. They are moving in a similar direction, at different angles and speeds. The plates get stuck and then the pressure causes them to be released. The sudden release of pressure can result in an earthquake.

Earthquakes and volcanoes occur mainly at plate margins as there is movement within the earth's crust due to convection currents. This is because the plates are moving and there is enormous pressure build up. Some earthquakes do not occur at plate margins and can be caused by human activity such as mining. Like earthquakes the majoring of volcanoes occur in long belts that follow plate margins, for example around the edge of the Pacific Ocean (Ring of Fire). Volcanoes are also found at hot spots such as the Hawaiian Islands.

**Earthquake, Chile** 🌐 Occurred on the 27<sup>th</sup> February 2010 and measured 8.8 on the Richter scale. The earthquake occurred at a destructive plate margin which also had a series of aftershocks. The earthquake occurred out to sea so caused tsunami waves and warnings. Chile is a HIC and is ranked 38<sup>th</sup> out of 193 countries based on GDP.

**Primary effects:** 500 people killed (social), 12,000 injured (social), 4500 schools destroyed (social and economic), cost of earthquake US\$30billion.

**Secondary effects:** 1500km of roads damaged, tsunami waves, fire at a chemical plant.

**Immediate Responses:** Emergency services acted swiftly, international aid received, power and water restored to 90% of homes in 10 days, 30,000 small emergency shelters were built.

**Long term Responses:** A month after the earthquake a housing reconstruction plan was launched by the government, the strong economy was rebuilt without foreign aid.

**Earthquake, Nepal** 🌐 Occurred on the 25<sup>th</sup> April 2015 and measured 7.9 on the Richter scale. The earthquake occurred at a destructive plate margin and the epicentre was 50miles north west of the capital Kathmandu. **Nepal** is a LIC and is ranked 109<sup>th</sup> out of 193 countries based on GDP.

**Primary effects:** 9000 died, 20,000 injured, 3 million homeless, electricity and water supplies affected, 50% of shops destroyed

**Secondary effects:** Ground shaking caused avalanches which blocked road, avalanche on Mount Everest killed 19 people, landslides led to flooding

**Immediate Responses:** Search and rescue teams arrived quickly from the UK, half a million tents needed for shelter, 300,000 people migrated to Kathmandu

**Long term Responses:** Roads repaired and landslides cleared, thousands of homeless people to rehoused, 7000 schools to be re-built, tourism to be boosted by reopening heritage sites.

**Reducing Risk management strategies-** *You should think about which one is best for volcanoes and earthquakes.*

**Monitoring** involves using scientific equipment to detect warning signs of events such as a volcanic eruption. Scientists can look at changes in the ground deformation and gases which are released as magma rises. Earthquake usually occur without warning.

**Prediction** uses historical evidence and monitoring. This allows scientists to make predictions about when and where a tectonic hazard happens.

**Protection** involves designing buildings to withstand tectonic hazards. Walls can be reinforced with steel and concrete to reduce movement, shock absorbers to absorb the ground shaking, open areas for easy evacuations, automatic shutters to prevent broken glass from falling.

**Planning** focusses on identifying and avoiding places most at risk. Hazard maps can be produced for the world's major volcanoes and show the areas likely to be affected. They can ensure that high value land is protected such as hospitals and schools.

### Weather Hazards- Global Atmospheric Circulation

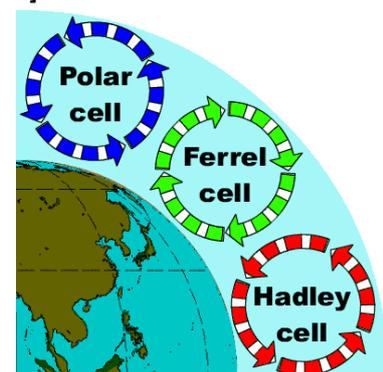
Global atmospheric circulation = the movement of air around the Earth to try and balance the temperature.

Air that is **sinking towards** the ground surface forms areas of **high** pressure (**anticyclone**), e.g. at the North Pole. Winds on the ground move **outwards** from these areas. **[High pressure = lots of air pressing down on the ground]**

Air that is **rising from** the ground surface forms areas of **low** pressure on the ground (**cyclone**), e.g. at the Equator. Winds on the ground move **towards** these areas of low pressure. **[Low pressure = not much air pressing down on the ground]**

The circular air movement are known as cells.

- Falling limb- falling air- hold moisture- anticyclone (Polar and Hadley)
- Rising limb- rising air- clouds-cyclone (Ferrel)



## Tropical Storms

A tropical storm is a huge storm that develops in the Tropics (in the USA and Caribbean these are called hurricanes and in south east Asia they are cyclones). Tropical storms are incredibly powerful and can cause devastation to small islands and coastal regions.

Where: Tropical storms form over warm oceans (above 27 degrees Celsius- this is found in the tropics) form in the summer and autumn when sea temperatures are at their highest, 5-15 degrees north and south of the equator- this is because there is not enough spin at the equator from the rotation of the earth. The effect of the earth's rotation is called the Coriolis effect (a tropical storm is a spinning mass of clouds). In tropical regions the intense heat makes the air unstable causing it to rise quickly.

Formation:

Strong upward movement of air draws water vapour up from the warm ocean → evaporated air cools as it rises and form thunderstorm clouds → the condensed air releases heat which powers the storm and draws more water from the ocean → several small thunderstorms join and form a giant spinning storm, surface winds reach 75 miles an hour → storm develops an eye at the centre, this is where air descends rapidly, the outer edge of the eye is the eyewall where most intense winds and rains are → storm is carried across the ocean by prevailing winds → reaching land the storm's energy supply is cut off. Friction with the land slows it down and it begins to weaken.

Climate change and tropical storms: There is strong evidence that there has been an increase in global temperatures over the last few decades. **Distribution:** in the future tropical storms may affect areas outside of the current hazard zone, such as the South Atlantic and hurricanes could become more powerful. **Frequency:** there is no strong evidence that tropical storms will increase but their intensity might increase. **Intensity:** hurricane intensity has risen in the last 20 years.

Typhoon Haiyan- Tropical storm 🌍

Between 2<sup>nd</sup> and 11<sup>th</sup> November 2013 Typhoon Haiyan occurred a category 5 storm which hit the Philippines. The Philippines is a Southeast Asian country in the Western Pacific, comprising more than 7,000 islands. Huge areas of coastline and several towns were devastated by winds of up to 170mph and waves as high as 15m. In some areas, 281.9 mm of rainfall was recorded, much of which fell in under 12 hours. Waves of up to 7 m in height battered the coast. Strong winds and low atmospheric pressure cause the sea level to rise and form a destructive storm surge. The Philippines is a fairly poor part of the world with minimal investment in prediction, planning and protection schemes. The province of Leyte in the Philippines took the full force of the storm. The city of Tacloban was one of the worst affected places with 220,000 people left homeless. Most of the destruction in Tacloban was caused by a 5m high storm surge (similar to a tsunami).

Impacts: 6,300 people killed, 600,000 displaced, 30,000 boats destroyed, crops destroyed, 6 million people lost their source of income, flooding caused landslides, shortages of water resulted in cholera.

Responses: international government and aid agencies responded quickly, 1200 evacuation centres set up, rebuilding of roads and airports, cash for work programmes- people paid to clear debris

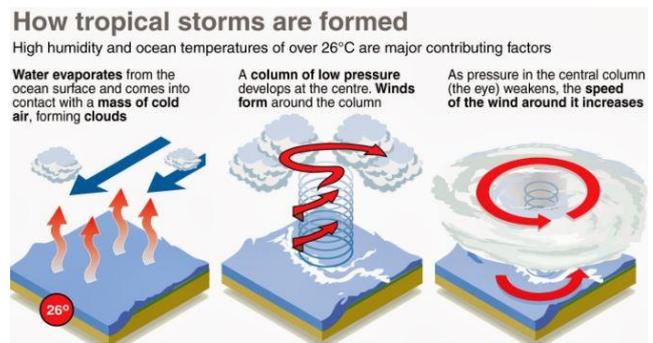
Reducing the effects of tropical storms: Monitoring and prediction (Hurricane Watch- advises that hurricane conditions are possible, Hurricane Warning- advises that hurricane conditions are expected and people should evacuate if necessary) Protection (windows/doors/roofs reinforced, sea walls built, houses built on stilts, shutters over windows) Planning (raising individual and community awareness- National Hurricane Preparedness Week in the USA)

## Weather Hazards in the UK

Weather is a description of the day-to-day conditions of the atmosphere. Climate is the average weather over a long period of time. Extreme weather is when a weather event is significantly different from the average or usual weather pattern. This may take place over one day or a period of time (e.g. flooding, drought, snow storms).

The climate for the UK can be described as temperate. Temperate climates have moderate temperatures. Temperate climates can be divided into those that are continental (influenced by land) or maritime (influenced by sea). The UK's position as an island means that it has a temperate maritime climate. **This means that the UK has cool winters and mild summers.** The UK can be considered as a roundabout as it is the meeting point of several types of weather from different directions. This helps to explain why we experience such varied weather and can be affected by extreme weather events.

Evidence: **1976.** Hottest summer since records began. This cause a severe drought. Temperatures reached 35.6 degree Celsius. **1987.** The great storm. Hurricane force winds which killed 18 people in the UK. **2006.** Tornado, London (Kensal Rise). Caused moderate to severe damage to at least 100 properties – 29 were deemed unfit for habitation due to damage, injured 6 people and caused £10 million in damages. **2018.** Storm Eleanor brought winds of up to 100mph when it hit the UK coast.



Somerset is a county in south west England. The Somerset Levels and the Somerset Moors form an extensive area of low lying farmland and wetlands. The area is drained by several rivers which include the River Tone and the River Parrett which flow to the Severn Estuary. Flooding has occurred here naturally for centuries. As the area has been developed for farming and settlement, many people are now at risk from extreme flood events. It was caused by excessive rainfall caused by low pressure- 350mm of rain fell in February. It was also caused by high tides and storm surges. In addition the river had not been dredged for 20 years and was clogged with sediment.

Impacts: 600 houses flooded, 16 farms evacuated, cost Somerset County Council over £10million, floodwater was heavily contaminated with sewage and other pollutants.

Reponses: villages used boats to go shopping and attend school, £20 million Flood Action Plan, road levels have been raised, 8km of river dredged in March 2014.

### Climate change

Due to the age of the Earth it is necessary to devise a geological timeline to understand the history of the earth. We are currently in the Quaternary period which stretches from the present day to 2.6 million years ago. In the Quaternary were the glacial periods known as the Ice Age (there have been 5). During the Quaternary, many large mammalian species became extinct. This was due to climate change and hunting by humans.

The average global temperature has increased in recent years which is known as global warming. Since 1880 the average global temperature has risen by 1 °C. Global effects include changes to the world's glaciers and ice caps shrinking, low lying islands such as the Maldives being at risk.

The evidence for climate change is: warm nights, stratosphere, and ice core records to calculate past temperatures which were lower, rising sea level which has risen between 10 to 20cm in the past 100 years.

Natural causes of climate change	Human causes of climate change
<ul style="list-style-type: none"> <li>• <b>Orbital changes</b>- Milankovitch cycles - Every 100,000 years the earth's orbit changes between circular and oval. This changes the distance between the earth and the sun. This is called the <b>eccentricity</b> of the earth. When the earth is further away from the sun when it is an 'oval' orbit, the amount of <b>insolation</b> is less than when it is more circular and therefore closer to the sun.</li> <li>• <b>Solar activity</b> - Sun spots are black spots on the surface of the sun. Sometimes the sun has lots, sometimes not many. The more the sun has, the more solar energy is being fired out. The more sunspots there are the more insolation there is. The more <b>insolation</b> there is the higher the temperature on earth is.</li> <li>• <b>Volcanic activity</b> - Big volcanic eruptions can change the earth's climate. Small eruptions have no effect. Ash clouds block out sunlight and reduce the amount of <b>insolation</b> entering the earth therefore having a cooling effect e.g. Mt Pinatubo eruption in 1991 have a 0.5 degree cooling effect for a year</li> </ul>	<ul style="list-style-type: none"> <li>• Producing more greenhouse gases due to burning fossil fuels in industry to produce electricity</li> <li>• Farming-</li> <li>• Deforestation</li> <li>• Increased car ownership</li> </ul>

The impacts of climate change can be managed through mitigation and adaptation. **Mitigation:** The action of reducing the severity, seriousness, or painfulness of something. **Adaptation:** Responding to changes and adjusting accordingly in order to survive.

Mitigation: **Replanting trees** (afforestation-trees act as carbon sinks removing carbon dioxide from the atmosphere- Large scale tree planting in Luton, Bedfordshire.), **alternative energy** (hydro-electricity, nuclear power, solar, wind and tide- Hinkley Point in Somerset nuclear reactor, The **London Array** is a 175 turbine 630 MW Round 2 offshore wind farm located 20 km off the Kent

coast in the outer Thames Estuary in the United Kingdom. It is the largest offshore wind farm in the world), **International agreements** (The Kyoto Protocol(2005). Over 170 countries agreed to reduce carbon emissions by an average of 5.2% below their 1990 levels. USA and Australia refused to sign the treaty. The Paris Agreement 2015 where 195 countries adopted a legally binding climate deal.), **carbon capture** (capture 90% of CO2- happening in USA)

Adaptation: **Farming** (introducing drought resistance strains of crops, new irrigation systems, educating farmers in water harvesting techniques), **water supply** (artificial glacier project in Ladakh in India) **and reducing risk from sea levels** (sea levels have risen 20cm since 1900- restoration of mangroves, construction of sea walls- a 3m sea wall has been built in Male in the Maldives, building houses on stilts, buying land in other countries such as Sri Lanka and Australia)