

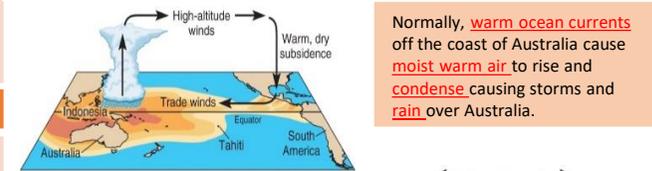
Global pattern of air circulation	
Atmospheric circulation is the large-scale movement of air by which heat is distributed on the surface of the Earth.	
Hadley cell	Largest cell which extends from the Equator to between 30° to 40° north & south.
Ferrel cell	Middle cell where air flows poleward between 60° & 70° latitude.
Polar cell	Smallest & weakest cell that occurs from the poles to the Ferrel cell.



Distribution of Droughts

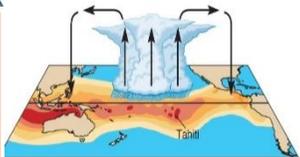
Drought can occur anywhere throughout the world but they are more frequent between the tropics of Cancer and Capricorn. Many countries in Africa suffer from severe drought, such as Ethiopia but Australia also suffer.

Causes of Drought: El Nino effect

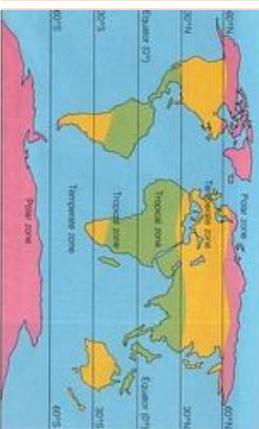


Normally, **warm ocean currents** off the coast of Australia cause **moist warm air** to rise and **condense** causing storms and **rain** over Australia.

In an El Niño year (every 2-7 years) the **cycle reverses**. Cooler water off the coast of Australia reverses the wind direction leading to **dry, sinking air** over Australia causing **hot weather** and a **lack of rainfall**.



Climate Zones	
The global circulation system controls temperatures by influencing precipitation and the prevailing winds. This creates distinctive climate zones.	
Temperate Climate	Mid-latitude, 50° - 60° north & south of the Equator. Here air rises and cools to form clouds and therefore frequent rainfall. e.g. UK.
Tropical Climate	Found along the Equatorial belt, this zone experiences heavy rainfall and thunderstorms. E.g. Brazil.
Polar Climate	Within the polar zones cold air sinks causing dry, icy and strong winds. E.g. Antarctica.
Desert Climate	30° north and south of the equator, sinking dry air leads to high temperatures without conditions for rainfall. E.g. Libya.

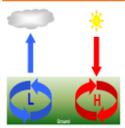


Topic 1 Global Hazards

Extremes in weather conditions

Wellington, New Zealand Very high wind speeds (248mkm/h) due to the surrounding mountains funneling wind.	Puerto Lopez Found along the equator, high temperatures lead to rapid condensation and heavy rainfall.
The Atacama, Chile The Andes mountains block moist warm travelling any further west. This causes rainfall to the east, but a rain shadow to the west.	Mawsynram, India This village sees a lot of rain each year (11m per yr). This is due to the reversal of air conditions/directions from sea to land. In the summer, this contributes to monsoons.

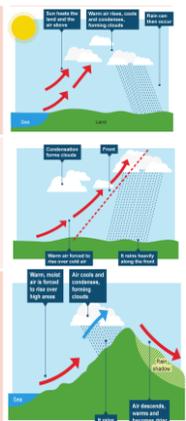
High and Low Pressure		What is wind?
High Pressure Caused by cold air sinking. Causes clear and calm weather	Low Pressure Caused by hot air rising. Causes stormy, cloudy weather.	Wind is the movement of air from an area of high pressure to one of low pressure.



Types of wind **Types of precipitation**

Katabatic Winds	Winds that carry air from the high ground down a slope due to gravity. e.g. Antarctic.
Trade Winds	Wind that blows from high pressure belts to low pressure belts.
Jet Streams	These are winds that are high in the atmosphere travelling at speeds of 225km/h.

Convective Rainfall	When the land warms up, it heats the air enough to expand and rise. As the air rises it cools and condenses. If this process continues then rain will fall.
Frontal Rainfall	When warm air meets cool air a front is formed. As the warm air rises over the cool air, clouds are produced. Eventually steady rain is produced.
Relief Rainfall	When wind meets mountains, the warm air is forced to rise quickly and cool. This leads to condensation and eventually rainfall. When the air descends however, little very rainfall falls, creating a rain shadow.



What is precipitation?

This is when water vapour is carried by warm air that rises. As it gets higher, the air cools and the water vapour condenses to form a cloud. As water molecules collide and become heavier, the water will fall to Earth as precipitation.

Changing pattern of these Hazards

Tropical Storms	Scientists believe that global warming is having an impact on the frequency and strength of tropical storms. This may be due to an increase in ocean temperatures.
Droughts	The severity of droughts has increased since the 1940s. This may be due to changing rainfall and evaporation patterns related to gradual climate change.

Distribution of Tropical Storms.

They are known by many names, including hurricanes (North America), cyclones (India) and typhoons (Japan and East Asia). They all occur in a band that lies roughly between the tropics of Cancer and Capricorn and despite varying wind speeds are ferocious storms. Some storms can form just outside of the tropics, but generally the distribution of these storms is controlled by the places where sea temperatures rise above 27°C.

Formation of Tropical Storms

- 1 The sun's rays heat large areas of ocean in the summer. This causes warm, moist air to rise over the particular spots
- 2 Once the temperature is 27°, the rising warm moist air leads to a low pressure. This eventually turns into a thunderstorm. This causes air to be sucked in from the trade winds.
- 3 With trade winds blowing in the opposite direction and the rotation of earth involved (Coriolis effect), the thunderstorm will eventually start to spin.
- 4 When the storm begins to spin faster than 74mph, a tropical storm (such as a hurricane) is officially born.
- 5 With the tropical storm growing in power, more cool air sinks in the centre of the storm, creating calm, clear conditions called the eye of the storm.
- 6 When the tropical storm hits land, it loses its energy source (the warm ocean) and it begins to lose strength. Eventually it will 'blow itself out'.

Case Study: UK Drought 2012



Causes

The drought was caused by less rain, warmer temperatures, dry soils and high water usage.

Effects	Management
<ul style="list-style-type: none"> Difficult to get water for crops and animals 20 million faced hose pipe bans Wildfires in South Wales, Surrey and Scotland 	<ul style="list-style-type: none"> Permits issued to water companies to allow water to be extracted from rivers Hosepipe bans Campaigns to use less water in homes

Case Study: Typhoon Haiyan 2013



Causes

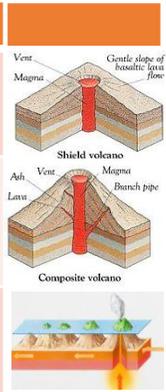
Began as tropical depression on 2/11/13 and gained. Became a Category 5 "super typhoon". Warm water, lack of land and low wind shear.

Effects	Management
<ul style="list-style-type: none"> Over 6300 deaths. 130,000 homes destroyed Half a million affected Water and sewerage systems destroyed caused diseases. Emotional grief for lost ones. 	<ul style="list-style-type: none"> The UN raised £190m in aid. USA & UK sent helicopter carrier ships deliver aid remote areas. Filipino soldiers deployed to restore order

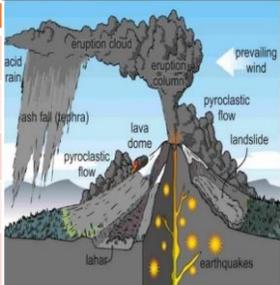
The structure of the Earth	
The Crust	Varies in thickness (5-10km beneath the ocean. Made up of several large plates.
The Mantle	Widest layer (2900km thick). The heat and pressure means the rock is in a liquid state that is in a state of convection.
The Inner and outer Core	Hottest section (5000 degrees). Mostly made of iron and nickel and is 4x denser than the crust. Inner section is solid whereas outer layer is liquid.

Convection Currents	
The Lithosphere is divided into tectonic plates which are moving due to convection currents in the asthenosphere.	
1	Radioactive decay of some of the elements in the core and mantle generate a lot of heat.
2	When lower parts asthenosphere heat up they become less dense and slowly rise .
3	As they move towards the top they cool down, become more dense and slowly sink .
4	These circular movements of semi-molten rock are convection currents
5	Convection currents create drag on the base of the tectonic plates and this causes them to move.

Types of volcanoes	
Shield	Made of basaltic rock and form gently sloping cones from layers of runny lava. Location: hot spots and constructive margins. Eruptions: gentle and predictable
Composite	Most common type found on land. Created by layers of ash and lava. Location: Destructive margins Eruptions: explosive and unpredictable due to the build of pressure within the magma chamber.
Hotspots	These happen away from any plate boundaries. They occur because a plume of magma rises to eat into the plate above. Where lava breaks through to the surface, active volcanoes can occur above the hot spot. E.g. Hawaii.



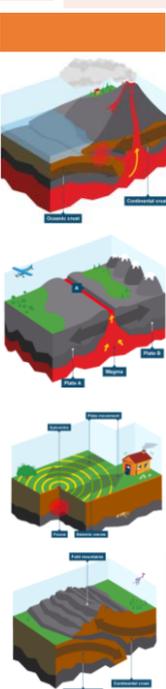
Volcanic Hazards	
Ash cloud	Small pieces of pulverised rock and glass which are thrown into the atmosphere.
Gas	Sulphur dioxide, water vapour and carbon dioxide come out of the volcano.
Lahar	A volcanic mudflow which usually runs down a valley side on the volcano.
Pyroclastic flow	A fast moving current of super-heated gas and ash (1000°C). They travel at 450mph.
Volcanic bomb	A thick (viscous) lava fragment that is ejected from the volcano.



Case Study: Nepal Earthquake 2015	
Causes	<ul style="list-style-type: none"> The Indian and Eurasian plates push together – a collision zone Shallow focus 15km below surface led to strong shaking – measured 7.8 on the Richter Scale Crust moved 3 metres in places
Effects	<ul style="list-style-type: none"> 8635 people died and over 19000 injured Historical and religious buildings destroyed Thousands homeless Mount Everest closed to hikers \$10 billion damage Schools and health centres shut
Management	<ul style="list-style-type: none"> UK gave \$126 million in aid (\$274 million total) UN and WHO distributed medical supplies Red Cross provided shelter for 225,000 Sherpas used to get relief to remote areas Facebook launched safety feature Post Disaster Needs survey completed

Managing Volcanic Eruptions	
Warning signs	Monitoring techniques
Small earthquakes are caused as magma rises up.	Seismometers are used to detect earthquakes.
Temperatures around the volcano rise as activity increases.	Thermal imaging and satellite cameras can be used to detect heat around a volcano.
When a volcano is close to erupting it starts to release gases.	Gas samples may be taken and chemical sensors used to measure sulphur levels.
Preparation	
Creating an exclusion zone around the volcano.	Being ready and able to evacuate residents.
Having an emergency supply of basic provisions, such as food	Trained emergency services and a good communication system.

Types of Plate Margins	
Destructive Plate Margin	When the denser plate subducts beneath the other, friction causes it to melt and become molten magma. The magma forces its way up to the surface to form a volcano. This margin is also responsible for devastating earthquakes.
Constructive Plate Margin	Here two plates are moving apart causing new magma to reach the surface through the gap. Volcanoes formed along this crack cause a submarine mountain range such as those in the Mid Atlantic Ridge.
Conservative Plate Margin	A conservative plate boundary occurs where plates slide past each other in opposite directions, or in the same direction but at different speeds. This is responsible for earthquakes such as the ones happening along the San Andreas Fault, USA.
Collision Zones	Collision zones form when two continental plates collide. Neither plate is forced under the other, and so both are forced up and form fold mountains. These zones are responsible for shallow earthquakes in the Himalayas.



Causes of Earthquakes	
Earthquakes are caused when two plates become locked causing friction to build up. From this stress , the pressure will eventually be released, triggering the plates to move into a new position. This movement causes energy in the form of seismic waves , to travel from the focus towards the epicentre . As a result, the crust vibrates triggering an earthquake.	
The point directly above the focus, where the seismic waves reach first, is called the EPICENTRE .	
SEISMIC WAVES (energy waves) travel out from the focus.	
The point at which pressure is released is called the FOCUS .	

Earthquake Management	
PREDICTING	Methods include: <ul style="list-style-type: none"> Satellite surveying (tracks changes in the earth's surface) Laser reflector (surveys movement across fault lines) Radon gas sensor (radon gas is released when plates move so this finds that) Seismometer Water table level (water levels fluctuate before an earthquake). Scientists also use seismic records to predict when the next event will occur.

How do we measure earthquakes?	
Mercalli Scale	Richter Scale
<ul style="list-style-type: none"> Measures how much damage is caused, based on observations, not scientific instruments. Base from 'Instrument' and 'Weak' to 'Extreme' and 'Cataclysmic'. Limitations is that its subjective due to it being based on perception. 	<ul style="list-style-type: none"> Is a scientific measurement based on the energy released. Measured by seismometers using measurement from 1 – 10 Logarithmic – each point up the scale is 10 times greater than the one before.

PROTECTION	
You can't stop earthquakes, so earthquake-prone regions follow these three methods to reduce potential damage: <ul style="list-style-type: none"> Building earthquake-resistant buildings Raising public awareness Improving earthquake prediction 	
Earthquake proof buildings ideas	
1. Counter-weights to the roof to help balance any swaying.	2. Roof made from reinforced cement concrete.
3. Foundations made from reinforced steel pillars, bail-bearings or rubber.	4. Windows fitted with shatter-proof glass to reduce breakage.
5. Lightweight materials that cause minimal damage if fallen during an earthquake.	6. Ensure gas pipes have an automatic shut off to prevent risk of fire.

