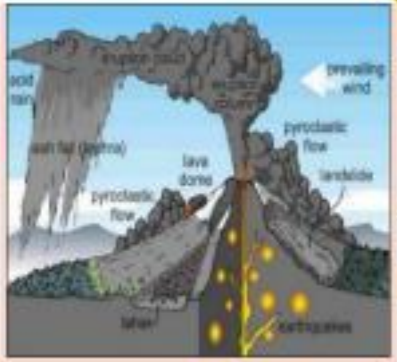
The structure of the Earth

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.

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 (1000ºC). They travel at 450mph.
Volcanic bomb	A thick (viscous) lava fragment that is ejected from the volcano.



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.

Convection Currents

The crust is divided into tectonic plates which are moving due to convection currents in the mantle.

1	Radioactive decay of some of the elements in the core and mantle generate a lot of heat.
2	When lower parts of the mantle molten rock (Magma) 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.

LIC – Nepal 2015 Case Study

Causes
On 25 April 2015 a 7.8 earthquake struck Nepal in Asia. The earthquake occurred on a destructive plate boundary between the Indian and Eurasian plates. The focus was only eight kilometres deep and the epicentre was just 60 kilometres north-west from the capital city Kathmandu.

Effects	Responses
9000 dead, 20,000 injured, 8 million people affected, $5 billion damage Landslide and avalanches, some causing flooding.	International help and aid, helicopters used, **300 000 migrated** Roads repaired, landslide cleared, floods drained

Earthquake Management

PREDICTING

Methods include:

- 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.

PROTECTION

You can't stop earthquakes, so earthquake-prone regions follow these three methods to reduce potential damage:

- Building earthquake-resistant buildings
- Raising public awareness
- Improving earthquake prediction

Unit 1a

The Orme Academy AQA

The Challenge of Natural Hazards

What is a Natural Hazard

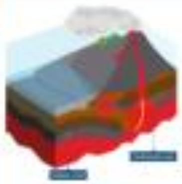
A natural hazard is a natural process which could cause death, injury or disruption to humans, property and possessions.

Geological Hazard	Meteorological Hazard
These are hazards caused by land and tectonic processes.	**These are hazards caused by weather and climate.**

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 ways up to the surface to form a volcano. This margin is also responsible for **devastating earthquakes.**

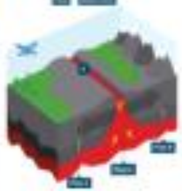


Constructive Plate Margin

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.



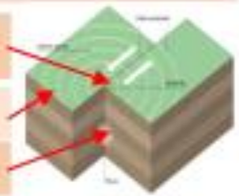
Causes of Earthquakes

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.



HIC – Chile 2010 Case Study

Causes
At 3.34 am on 27th February 2010, a powerful magnitude 8.8 earthquake occurred just off the coast of central Chile. It occurred on the destructive plate margin where the South American plate is subducted by the Nazca Plate.

Effects	Responses
500 dead, 12,000 injured, 800,000 affected, $30 billion damage. 220,000 homes were destroyed. Landslides, Tsunami, Chemical plant fire	Roads repaired in 24hr, $60 million aid raised; 30,000 shelters used. Built 200,000 new homes. Recovery took over 4 years. Chile's strong economy meant that the country didn't have to rely on aid from other countries.

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.

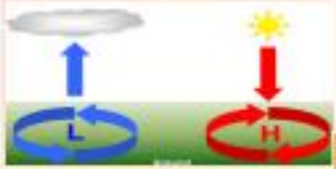
Hadley cell	Largest cell which extends from the **Equator** to between **30° to 40° north & south.**
Ferrel cell	Middle cell where air flows **poleward** between **60° & 70°** latitude.
Polar cell	**Smallest & weakness** cell that occurs from the poles to the Ferrel cell.

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 5-15° either side of the Equator.

High and Low Pressure

Low Pressure	**High Pressure**
Caused by hot air rising. Causes stormy, cloudy weather.	**Caused by cold air sinking. Causes clear and calm weather.**



Formation of Tropical Storms

1	The sun's rays heats large areas of ocean in the summer and autumn. 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 condition 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'.

Changing pattern of Tropical Storms

Scientist 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.

Management of Tropical Storms

Protection Preparing for a tropical storm may involve construction projects that will improve protection.	**Aid** Aid involves assisting after the storm, commonly in LIDs.
Development The scale of the impacts depends on the whether the country has the resources cope with the storm.	**Planning** Involves getting people and the emergency services ready to deal with the impacts.
Prediction Constant monitoring can help to give advanced warning of a tropical storm	**Education** Teaching people about what to do in a tropical storm.

Primary 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 can generate abnormally high waves called **storm surges**.
- Sometimes the most destructive elements of a storm are these subsequent **high seas and flooding** they cause to coastal areas.

Secondary Effects of Tropical Storms

- People are **left homeless**, which can cause distress, poverty and ill health due to lack of shelter.
- **Shortage of clean water** and **lack of proper sanitation** makes it easier for diseases to spread.
- **Businesses are damaged** or destroyed causing employment.
- Shortage of food as **crops are damaged**.

Case Study: Typhoon Haiyan 2013

Causes

Started as a tropical depression on **2nd November 2013** and gained strength. Became a Category 5 **"super typhoon"** and made landfall on the Pacific islands of the Philippines.

Effects

- Almost **6,500 deaths.**
- **130,000 homes destroyed.**
- Water and sewage systems destroyed had caused **diseases**.
- **Emotional grief** for dead.

Management

- The UN raised **£190m in aid.**
- **USA & UK sent helicopter carrier ships** deliver aid remote areas.
- **Education** on typhoon preparedness.

UK Case Study: Somerset Levels Floods 2013/14

Causes

Several storms hit the UK at once, bringing 400mm of rainfall in two months – 200mm above the normal levels for January and February. The rivers also had not been dredged (cleared out to make them deeper) adding to the flood risk.

Effects

- 600 homes were damaged costing local people £1000s. Cost of insurance for local people also went up.
- Train lines and roads such as the A361 were flooded, affecting travel.

Responses

- Temporary flood defences such as barriers and sandbags were placed
- The Somerset Levels Action Plan was developed - a 20-year plan for the Somerset Levels which will total £100 million. Part of this plan is to reintroduce dredging.

What is Climate Change?

Climate change is a large-scale, long-term shift in the planet's weather patterns or average temperatures. Earth has had tropical climates and ice ages many times in its 4.5 billion years.

Recent Evidence for climate change.

Global temperature	Average global temperatures have increased by more than **0.6°C since 1950**.
Ice sheets & glaciers	Many of the world's glaciers and ice sheets are melting. E.g. the Arctic sea ice has declined by **10% in 30 years**.
Sea Level Change	Average global **sea level has risen by 10-20cms** in the past 100 years. This is due to the additional water from ice and thermal expansion.

Enhanced Greenhouse Effect

Recently there has been an increase in **humans burning fossil fuels** for energy. These fuels (gas, coal and oil) emit **greenhouse gases**. This is making the Earth's atmosphere thicker, therefore trapping more solar radiation and causing **less to be reflected**. As a result, the Earth is becoming warmer.

Evidence of natural change

Orbital Changes	Some argue that climate change is linked to how the Earth orbits the Sun, and the way it wobbles and tilts as it does it.
Sun Spots	Dark spots on the Sun are called Sun spots. They increase the **amount of energy Earth receives** from the Sun.
Volcanic Eruptions	Volcanoes release large amounts of **dust containing gases**. These can **block sunlight** and results in cooler temperatures.

Managing Climate Change

Carbon Capture This involves new technology designed to reduce climate change.	**Planting Trees** Planting trees increase the amount of carbon is absorbed from atmosphere.
International Agreements Countries aim to cut emissions by signing international deals and by setting targets.	**Renewable Energy** Replacing fossil fuels based energy with clean/natural sources of energy.