The Earth's Crust

- There are **two** types of crust; continental an oceanic.
- The plates meet at plate margins.

	Continental Crust	Oceanic Crust
Thickness (km)	30-90	5-10
Oldest rock (years)	4 billion	200 million
Main rock type	Granite	basalt

Types of Plate Boundary

Destructive Plate Boundaries

- Plates move together.
- Denser oceanic crust sinks under the lighter continental crust.
- Oceanic crust melts and is destroyed in the subduction zone to form magma.
- Magma rises to the crust through a vent.
- A composite cone volcano erupts violently and earthquakes happen too.
- Fold mountains and ocean trenches are also found at these plate boundaries.
- Example: Nazca and South American Plates, West Coast of South America.

Constructive Plate Boundaries

- Plates move apart, usually under the ocean.
- Magma rises to fill the gap.
- Shield volcanoes are formed with a non-violent eruption.
- Submarine earthquakes happen too.
- Mid-ocean ridges are formed as the sea floor spreads to form newly created oceanic crust.
- Example: North American and Eurasian Plate in the Mid-Atlantic to form Iceland.

Conservative Plate Boundaries

- Plates slide past each other, either in the same or opposite directions.
- The plates become locked together.
- Pressure and tension in the Earth builds up.
- Eventually the rocks give way along a line of weakness or fault.
- The plates jerk past each other and seismic energy is released in waves as an earthquake.
- Example: North American and Pacific Plates in West coast of USA, causing earthquakes in California (San Francisco, 1989 and Los Angeles, 1994.

The Earth's Crust

	Continental Crust	Oceanic Crust
Thickness (km)		
Oldest rock (years)		
Main rock type		

Destructive Plate Boundaries

Types of Plate Boundary

Constructive Plate Boundaries

Conservative Plate Boundaries

Tectonic Hazards - Volcanoes

Why do plates move?

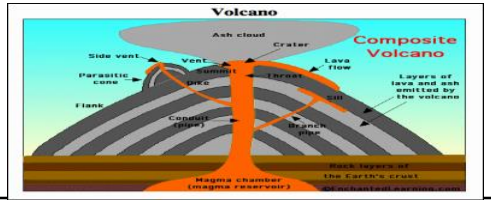
Scientists once believed that convection currents in the mantle, generated by high temperatures were the main reason plates moved. It is now thought that plate movement is driven by the heavier, denser tectonic plate sinking into the mantle at ocean trenches.

This drags the rest of the plate with it and is called *slab pull theory.*

Where plates move together crust is destroyed and where plate move apart new crust is created.

Composite Volcanoes

- Steep slopes.
- Tall cone with narrow base.
- Made up of alternative layers of ash and lava.
- Viscous, less hot, slow-flowing lava, flows short distances.
- Formed at a destructive plate boundary.
- E.g. Krakatoa, Indonesia and Mount St Helens, USA.



Active Volcanoes

- Volcanoes that could erupt at any time.

Dormant Volcanoes

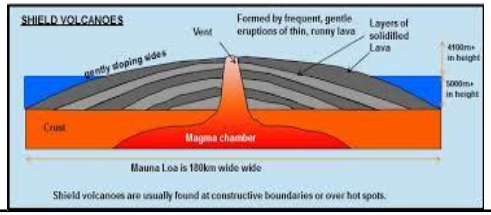
- Volcanoes that are inactive. They have not erupted in living memory, but could become active in the future.

Extinct Volcanoes

- Volcanoes that have not erupted in the last 10 000 years.

Shield Volcanoes

- Gentle slopes
- Low cone with a wide base
- Made of numerous lava flows
- Low viscosity-hot and runny lava, flows long distances.
- Formed at a constructive plate boundary.
- E.g. Mauna Loa, Hawaii and Heimaey, Iceland.



Tectonic Hazards - Volcanoes

Why do plates move?

Composite Volcanoes

Active Volcanoes

Dormant Volcanoes

Extinct Volcanoes

Shield Volcanoes

Tectonic Hazards - Earthquakes

Causes

- Plates slide past each other, either in the same or opposite directions.
- The plates become locked together.
- Pressure and tension in the Earth builds up.
- Eventually the rocks give way along a line of weakness or fault.
- The plates jerk past each other and seismic energy is released in waves as an earthquake.

Responses (*The Three Ps*)

- Earthquake proof buildings (**P**repare)
- Earthquake drills. (**P**lan)
- Earthquake prediction. (**P**redict)

Measuring Earthquakes

- The Richter Scale - Measures the magnitude of an earthquake using a seismometer. It is a logarithmic scale, going up by the power of 10 each time.
- The Mercali Scale – measures the likely damage of an earthquake on a scale of 1-12.

Effects

- Primary Effects
- people die.
- People are injured.
- Buildings roads and bridges destroyed.
- Homelessness.

Secondary Effects

- Fires due to leaking gas pipes.
- Disease like cholera spread due to lack of water and poor. sanitation in refugee camps.
- Food shortages due to destruction of crops and livestock.
- Other hazards Tsunamis and landslides.

Earthquake Case Studies

Earthquake	HIC-Seattle (USA)	LIC-Gujarat (India)
Causes	Pacific and North American plates slide pest each other.	Indo-Australian Plate pushes under the Eurasian Plate.
Effects	One dead and 250 injured. Panic, buildings evacuated, roads and railway lines buckled and buildings swayed.	20 000 dead, 160 000 injured and 600 000 homeless. Economic losses were estimated at US$2-4 billion. Whole villages and many streets destroyed.
Responses	Injured treated by paramedics, people sent home from work whilst buildings were checked. Earthquake proof buildings, research into seismic activity.	Rescue efforts only began after 48 hours, so people searched the rubble for family and friends. Rescue workers only had shovels. Foreign aid was sent and the army called in to help. Foreign aid was also used to rebuild.

Tectonic Hazards - Earthquakes

Causes

Responses (*The Three Ps*)

Measuring Earthquakes

Effects

- Primary Effects
- Secondary Effects

Earthquake Case Studies

Earthquake	HIC-	LIC-
Causes		
Effects		
Responses		

Climatic Hazards – Tropical Storms

Causes

- Large areas of tropical ocean where the water temperature is above 26.5°c
- A considerable depth of warm water, usually 70 metres.
- A strong upward movement of very moist warm air.
- Strong winds blowing in the same direction.

As a tropical storm begins to develop, warm air rises in a spiralling motion, drawing up huge amounts of evaporated water which cools and condenses to form towering banks of cloud. As this happens a vast amount of energy is produced. This energy powers the storm. As the storm builds more and more water is drawn upwards. The clouds grow larger, wind speed increases and the likelihood of very heavy rainfall increases.

Responses

- Immediate responses
- Emergency services on alert.
- Evacuate the area.
- Rescue and treat any victims of the storm.
- Forecasting and alerts through media and internet.

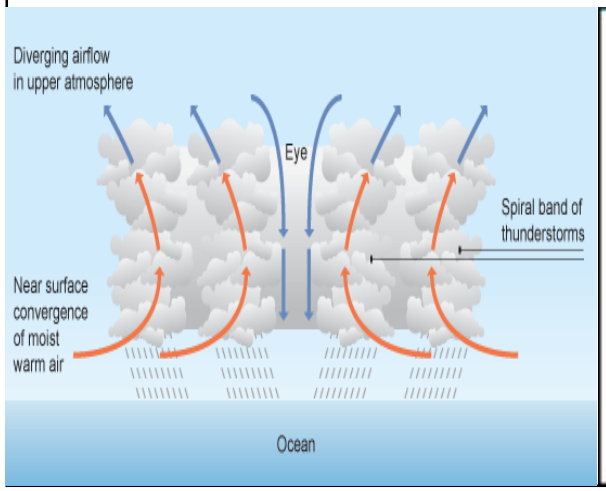
Long-term responses

- Rebuilding damaged houses and infrastructure.
- Setting up and improving current protection systems.
- Refugee camps set up.

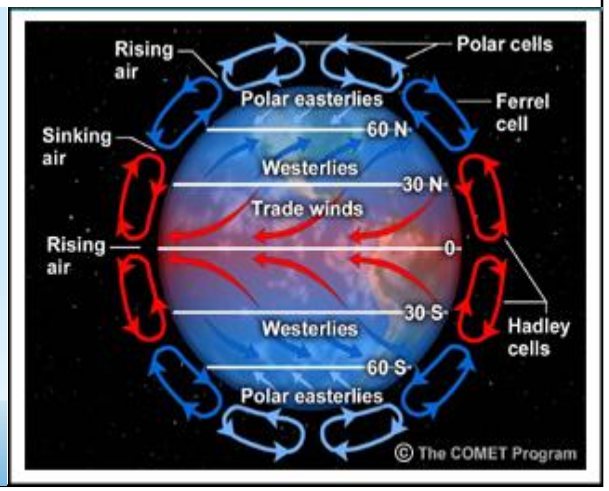
Effects

- Primary Effects
- **Strong winds**-wind speeds of up to 200km/h can damage infrastructure, trees and crops.
- **Storm surges**-low air pressure means sea levels are very high, causing huge waves and flooding.
- **Heavy rainfall**-torrential rain can cause widespread flooding.
- **Possibility of localised tornadoes.**
- Secondary Effects
- **Mudslides and landslides**-rain saturates unstable slopes
- **Polluted water supplies**-when floods subside drinking water supplies can carry diseases like cholera.

The Structure of a Tropical Storm



The General Model of Atmospheric Circulation



Climatic Hazards – Tropical Storms

Causes

Responses

- Immediate responses

Long-term responses

Effects

- Primary Effects

Secondary Effects

The Structure of a Tropical Storm

The General Model of Atmospheric Circulation

Causes

Physical causes

- Category 4 storm, with winds of over 140mph.
- Storm surges over 6 metres.
- New Orleans is built on low-lying land, mostly below sea level and it is surrounded by water.
- Low pressure over the Atlantic Ocean
- Temperature of 26.5°c

Human causes

- Global warming?

Climatic Hazards – Tropical Storms Case Study – Hurricane Katrina, New Orleans, Louisiana, USA, 2005

Effects

- Primary Effects
- 1200 people drowned in flood waters.
- Two-thirds of the city was submerged in water.
- Many offshore oil facilities were destroyed.
- One million people were made homeless.
- Levees and other defences were destroyed or failed.
- Secondary Effects
- Looting for luxury goods left in homes.
- There was a lack of food and clean water so disease spread.
- Oil prices increased in the USA and UK as supply was cut.

Responses

- Immediate responses
- National Hurricane Centre predicted where and how strong the hurricane would be.
- The mayor of Orleans ordered people to evacuate their homes by air and coach.
- 10 000 people sought refuge in the Mercedes-Benz Superdome.
- The government initially reduced $50 billion
- People were rescued from floodwaters and the injured treated.
- Long-term responses
- Engineers protected the city from storm surges a system of levees and concrete sea walls
- 30 000 national guardsmen were called into maintain law and order following riots and protests against the authorities.
- The UK sent a million army-style ready-meals to help.
- $34 billion seta side by the US government to rebuild houses and schools.
- The US government spent $800 million on rebuilding new and repairing existing flood defences.

Causes

Physical causes

Human cause

Responses

- Immediate responses

Climatic Hazards – Tropical Storms Case Study –

Effects

- Primary Effects
- Secondary Effects

- Long-term responses

Extreme Weather in the UK

Factors Affecting Weather in the UK

- The UK has a temperate maritime climate. Temperate means that there isn't a wide range in the climate, with little extremes. Maritime means influenced by the surrounding sea and the UK is a small island, with nowhere even 100 miles or more from the nearest coastline.
- High (anticyclones) and low pressure (depressions)systems bring day to day changes to the UK's weather.

Effects of Extreme Weather in the UK

- Heatwaves
- 200 people died in the UK in the summer of 2000
- Many more were made ill with heat stroke and dehydration.
- Water supplies were affected, leading to a hosepipe ban.
- Travel was disrupted by buckled railway lines and melted roads and many London Underground trains overheated.
- Many crops and farm animals died leading to food shortages.
- However tourism increased as did the sale of warm weather clothing and snacks, such as ice cream.

Examples of Extreme Weather in the UK

Low pressure=wet, windy and cloudy.
High pressure=long periods of hot (summer), cold (winter), settled, calm, dry weather, with clear skies and potential frosts in winter.

- An anticyclone in August 2003 caused a heatwave (38.5°), the warmest for 500 years and lower than average rainfall that summer.
- In March 2013 the UK experienced a depression causing bitterly cold temperatures, very strong winds, heavy rain and flooding. Snow depths were over 40 cm in the Midlands (average=6.4cm). These strong winds and cold temperatures meant that the snow dritfed and did not thaw for several days.

- Storms and snowstorms
- Electricity pylons and trees blow over, damaging buildings and cars.
- Widespread flooding
- Snow and ice collecting on tree branches and power cables can cause them to break and cause power cuts. Snow drifts meant that it was very difficult for engineers to reach remote areas to restore power.

Reducing the Effects of Extreme Weather

- Met Office monitor and forecast weather and issue warnings.
- Environment Agency and local councils put flood defences in place.

Extreme Weather in the UK

Factors Affecting Weather in the UK

Effects of Extreme Weather in the UK

- Heatwaves

Examples of Extreme Weather in the UK

Low pressure=

High pressure=

- Storms and snowstorms

Reducing the Effects of Extreme Weather

Climate Change

Evidence of Climate Change

- Long term evidence
- pollen found in ice cores, plankton found in cores on the sea bed and tree ring evidence.
- Historical Evidence
- Measurements on simple thermometers over the last 200 years show an increase in global temperature.
- Glacial Retreat
- Glaciers have been disappearing since the 1800s
- Covers of Arctic Sea Ice
- There is less than 50% sea-ice over the Arctic than 30 years ago.
- Spring, Autumn and Winter Changes
- Certain species in the northern hemisphere seem to appear earlier.

Effects of Climate Change

Sea level rising due to the thermal expansion of sea water.
Global temperatures could increase by between 4 and 6°c by 2100.

- More frequent droughts
- Widespread coastal flooding
- Extinction of native plants and animals.
- Increased demand for water.
- Warmer winters meaning cold-related deaths are less likely but there might be more heat-related deaths in hot summers.
- More tropical diseases spreading from the tropics.

Causes of climate change

- Long-term
- Small changes in the way orbits the sun (Milankovitch cycle) the closer we get to the sun, the warmer we are.
- Increased sunspot activity means more solar radiation.
- Volcanic eruption emit dust that block out the sun.
- A possible link between changes in global ocean currents and climate change.
- Short-term
- greenhouse gas effect (carbon dioxide, methane and nitrous oxides.
- Human activity-burning of fossil fuels (coal, oil, natural gas etc.), agricultural change (use of chemicals), halocarbons and deforestation.

Manging Climate Change

- Mitigation
- Increase in use of renewable energy (wind, solar and tidal).
- Carbon capture (to store carbon dioxide produced by industry).
- Organic farming (reduction in use of chemicals). Large-scale re-afforestation projects.
- Local mitigation-cut down food waste, recycle, energy-saving measures in the home, walk or cycle instead of using the car and buy local food.
- Adaptation
- Building sea walls to prevent coastal flooding
- Changing crops to those better adapted to warmer and wetter conditions.
- Better water management and desalinisation plants.

Climate Change

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