
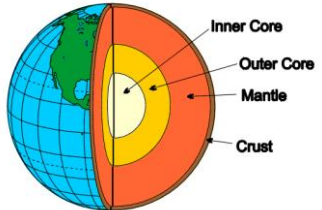


What are Natural Hazards?	
Natural hazards are physical events such as earthquakes and volcanoes that have the potential to do damage humans and property. Hazards include tectonic hazards, tropical storms and forest fires.	
What affects hazard risk?	
Population growth Global climate change Deforestation Wealth - LICs are particularly at risk as they do not have the money to protect themselves	

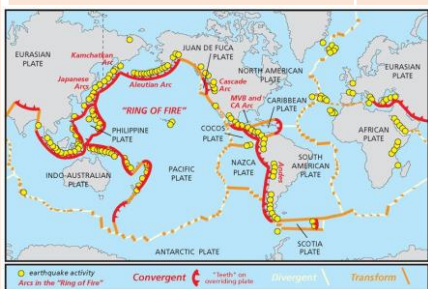
Structure of the Earth	
The earth has 4 layers	
<p>The inner core The outer core The mantle The crust</p> <p>The crust is split into major fragments called tectonic plates. There are 2 types: Oceanic (thin and younger but dense) and Continental (old and thicker but less dense)</p> <p>These plates move and where they meet you get tectonic activity (volcanoes and earthquakes).</p>	
<p>There are 2 theories of why plates move: convection currents and ridge push, slab pull.</p> <p>Plates either move against each other (destructive margin) away from each other (constructive) or next to each other (conservative)</p>	

Earthquakes and Volcanoes	
Volcanoes	Earthquakes
<ul style="list-style-type: none"> Constructive margins – Hot magma rises between the plates eg. Iceland. Forms Shield volcanoes Destructive margins – an oceanic plate subducts under a continental plate. Friction causes oceanic plate to melt and pressure forces magma up to form composite volcanoes eg the Pacific Rim 	<ul style="list-style-type: none"> Constructive margins – usually small earthquakes as plates pull apart. Destructive margins – violent earthquakes as pressure builds and is then released Conservative margins – plates slide past each other. They catch and then as pressure builds it is released eg San Andreas fault. .

Effects of Tectonic Hazards	
Primary effects happen immediately. Secondary effects happen as a result of the primary effects and are therefore often slightly later.	
Primary - Earthquakes	Secondary - Earthquakes
<ul style="list-style-type: none"> Property and buildings destroyed People injured or killed Ports, roads, railways damaged Pipes (water and gas) and electricity cables broken 	<ul style="list-style-type: none"> Business reduced as money spent repairing property Blocked transport hinders emergency services Broken gas pipes cause fire Broken water pipes lead to a lack of fresh water
Primary - Volcanoes	Secondary - Volcanoes
<ul style="list-style-type: none"> Property and farm land destroyed People and animals killed or injured Air travel halted due to volcanic ash Water supplies contaminated 	<ul style="list-style-type: none"> Economy slows down. Emergency services struggle to arrive Possible flooding if ice melts Tourism can increase as people come to watch Ash breaks down leading to fertile farm land

Unit 1 The challenge of Natural Hazards

Responses to Tectonic Hazards	
Immediate (short term)	Long-term
<ul style="list-style-type: none"> Issue warnings if possible Rescue teams search for survivors Treat injured Provide food and shelter, food and drink Recover bodies Extinguish fires 	<ul style="list-style-type: none"> Repair and re-build properties and infrastructure Improve building regulations Restore utilities Resettle locals elsewhere Develop opportunities for recovery of economy Install monitoring technology

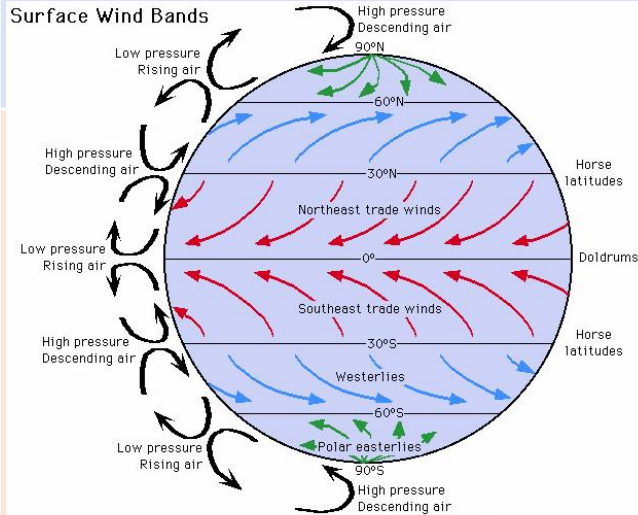


Comparing Earthquakes – Christchurch, New Zealand (HIC) and Haiti, Caribbean (LIC)	
Haiti, January 2010	Christchurch, February 2011
Primary Effects	
316,000 deaths 250,000 homes destroyed Transport and communication links badly damaged.	181 people died. 2,000 injured Roads and bridges were severely damaged in places.
Secondary Effects	
1 in 5 people lost their job. People squashed into shanty towns in unsanitary conditions. Disease spread. Difficult to get aid into the area.	The number of guests to hotels fell by 75% in the month after the earthquake/ Large icebergs carved into Tasman Lake. Christchurch could no longer host Rugby world cup matches so lost the tourist income.
Immediate Responses	
810,000 people placed in aid camps. Lack of immediate aid due to poor planning. 4.3 million people provided with food rations.	Search and rescue was there within a few hours. 300 Australian police were flown in. International aid (\$6-7 million) was provided. Police organised evacuations.
Long term responses	
6 months after 98% of the rubble on the roads hadn't been cleared. 1 million people still without a home 1 year later. Support was offered to those who had lost a job through food for work projects.	The Red Cross provided grants to families with children under 5. 4898 million in building claims were paid. Temporary housing were provided. Roads and homes were cleared.
LICs suffer more than HICs from natural disasters because they are not as prepared and struggle to react effectively	

Monitoring	Prediction
Seismometers measure earth movement. Volcanoes give off gases	By observing monitoring data, this can allow evacuation before event
Protection	Planning
Reinforced buildings and making building foundations that absorb movement Automatic shut offs for gas and electricity	Avoid building in at risk areas Training for emergency services and planned evacuation routes and drills.

Global atmospheric circulation

At the equator, the sun's rays are most concentrated. This means it is hotter. This one fact causes global atmospheric circulation at different latitudes.



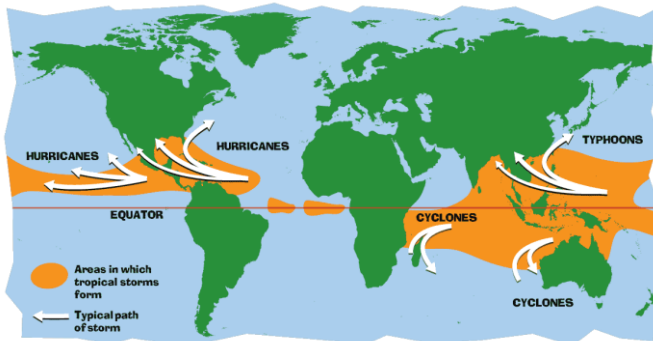
Adapted from Duxbury, Aljn C. and Alison B. Duxbury. *An Introduction to the World's Oceans, 4/e.* Copyright © 1994 Wm. C. Brown Publishers, Dubuque, Iowa.

High pressure = dry
Low pressure = wet

As the air heats it rises – causing low pressure. As it cools, it sinks, causing high pressure. Winds move from high pressure to low pressure. They curve because of the **Coriolis effect** (the turning of the Earth)

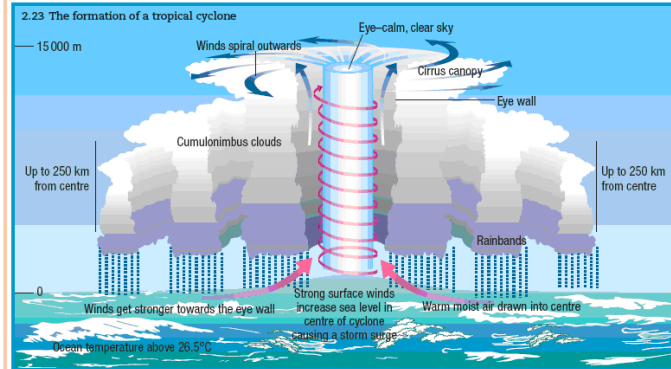
Tropical Storms

Occur in low latitudes between 5 and 30 degrees north and south of equator. Ocean temperature needs to be above 27 degrees C. Happen between summer and autumn



Sequence of a Tropical Storm

1. Air is heated above warm tropical oceans
2. Air rises under low pressure conditions
3. Strong winds form as rising air draws in more air and moisture causing torrential rain
4. Air spins due to Coriolis effect around a calm eye of the storm
5. Cold air sinks in the eye so it is clear and dry
6. Heat is given off as it cools powering the storm
7. On meeting land, it loses source of heat and moisture so loses power.



Typhoon Haiyan, Phillipines 2013

Primary Effects	Secondary Effects
<ul style="list-style-type: none"> At least 6300 people died 90% of the houses in Tacloban were destroyed or damaged The storm surge destroyed 905 of the city of Tacloban. Trees were uprooted and blocked roads 	<ul style="list-style-type: none"> 670,000 families were made homeless 77% of farmers and 74% of fishermen lost their main source of income \$2.86 billion of damage was caused

Immediate Responses	Long-term Responses
<ul style="list-style-type: none"> The United Nations appealed for £190 million for emergency aid (the UK donated £50 Million). 1215 evacuation centres were set up. Widespread looting and violence led the government to deploy soldiers to restore law and order. 	<ul style="list-style-type: none"> By April 2014, services had been restored to 560 schools, 220 rural health centres and 30 hospitals. In addition, 1500 km of roads and 1100 km of drainage canals had been repaired. Schemes were also set up to give cash for training or cash for work.

Prediction	Planning	Protection
Monitoring wind patterns allows path to be predicted. Use of satellites to monitor path to allow evacuation	Avoid building in high risk areas Emergency drills Evacuation routes	Reinforced buildings and stilts to make safe from floodwater Flood defences eg levees and sea walls

Extreme weather in the UK



Rain – can cause flooding damaging homes and business
Snow & Ice – causes injuries and disruption to schools and business. Destroys farm crops
Hail – causes damage to property and crops
Drought – limited water supply . Can damage crops
Wind – damage to property and damage to trees potentially leading to injury
Thunderstorms – lightning can cause fires or even death
Heat waves – causes breathing difficulties and can disrupt travel.

UK weather is getting more extreme due to climate change. Temperatures are more extreme and rain is more frequent and intense leading to more flooding events. Since 1980 average temperature has increased 1 degree and winter rainfall has increased.



November / December 2010 – The Big Freeze

A long period of heavy snow and cold weather as cold air from N Europe and Siberia was over the UK

Social Effects



Several people died of hypothermia and accidents on icy roads
 Water froze in pipes causing them to burst leading to flooding. 40 000 homes without water for over a week
 7000 schools closed in December leading to disruption

Economic Effects



Transport disrupted and some drivers trapped in cars for 15 hours
 People could not get to work
 Christmas shopping was affected
 Estimated cost of damage due to lost business £1.6 billion (reducing GDP by 0.5%)

Environmental impacts



Frost damaged crops esp. sugar beet
 Use of gas and electricity increased increasing CO2 emissions

Management strategies

Gritters on roads to reduce accidents but supplies were limited
 Warning to restrict travel to only essential journeys
 Closing schools
 Getting individuals to stock up on essential supplies



Climate change will affect tropical storms too. Warmer oceans will lead to more intense storms – but not necessarily more frequent ones

Climate Change – natural or human?

Evidence for climate change shows changes before humans were on the planet. So some of it must be natural. However, the **rate** of change since the 1970s is unprecedented. Humans are responsible – despite what Mr Trump says!

Causes

Natural

- **Orbital changes** – The sun's energy on the Earth's surface changes as the Earth's orbit is elliptical its axis is tilted on an angle.
- **Solar Output** – sunspots increase to a maximum every 11 years
- **Volcanic activity** – volcanic aerosols reflect sunlight away reducing global temperatures temporarily

Human

- **Fossil fuels** – release carbon dioxide with accounts for 50% of greenhouse gases
- **Agriculture** – accounts for around 20% of greenhouse gases due to methane production from cows etc. Larger populations and growing demand for met and rice increase contribution
- **Deforestation** – logging and clearing land for agriculture increases carbon dioxide in the atmosphere and reduces ability to planet to absorb carbon through photosynthesis.

Evidence for Climate Change

The Met Office has reliable climate evidence since 1914 – but we can tell what happened before that using several methods.

Ice and Sediment Cores

- Ice sheets are made up of layers of snow – one per year. If you drill down you can analyse gases trapped in layers of ice for the past. Ice cores from Antarctica show changes over the last 400 000 years.
- Remains of organisms found in cores from the ocean floor can be traced back 5 million years.

Tree Rings

- A tree grows one new rind each year. Rings are thicker in warm, wet conditions
- This gives us reliable evidence for the last 10 000 years

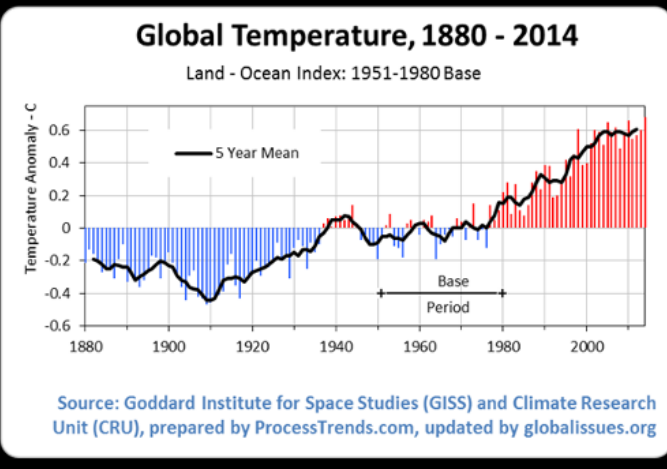


Pollen Analysis

- Pollen is preserved in sediment. Different species need different climatic conditions

Temperature Records

- Historical records date back to the 1850s. Historical records also tell us about harvest and weather reports.



Effects of Climate Change

Social

- Increased disease eg. skin cancer and heat stroke
- Winter deaths decrease with milder winters
- Crop yields affected by up to 12% in South America but will increase in Northern Europe but will need more irrigation
- Less ice in Arctic Ocean increases shipping and extraction of oil and gas reserves
- Droughts reduce food and water supply in sub-Saharan Africa. Water scarcity in South and South East UK
- Increased flood risk. 70% of Asia is at risk of increased flooding
- Declining fish in some areas affect diet and jobs
- Increased extreme weather
- Skiing industry in Alps threatened.

Environmental

- Increased drought in Mediterranean region
- Lower rainfall causes food shortages for orangutans in Borneo and Indonesia
- Sea level rise leads to flooding and coastal erosion
- Ice melts threaten habitats of polar bears
- Warmer rivers affect marine wildlife
- Forests in n America may experience more pests, disease and forest fires
- Coral bleaching and decline in biodiversity such as the Great Barrier Reef (Australia)



Managing Climate Change

Mitigation

- **Alternative energy production** – renewable sources will last longer but they can be expensive and are less reliable than fossil fuels
- **Planting Trees** – helps to remove carbon dioxide. Has the potential to increase carbon storage by 28%. However land may be limited and biodiversity is still threatened unless a wide range of trees are planted
- **Carbon Capture** – takes carbon dioxide from the emission sources and stores it underground under a cap rock. It can reduce capture of up to 90% of carbon dioxide. However, it is very expensive and unclear if the captured carbon would escape in the long term. Also it discourages development of renewable energy resources
- **International Agreements** – targets will only be met if they are legally binding (Paris 2015). Financial support is needed for LICs. However, poorer countries argue that they need to industrialise and getting richer countries to accept their responsibility is difficult.

Adaption

- **Changes in agricultural systems** – needed to react to changing rainfall and temperature patterns and changing threat of disease and pests. This is hard for poor farmers who tend to be most affected
- **Managing water supplies** – eg. by installing water efficient devices and increasing supply through things like **desalination** plants. There is an increasing threat of political stability
- **Reducing risk** – reducing risk from rising sea levels would involve constructing defences such as the Thames Flood Barrier or restoring mangrove forests, or raising buildings on stilts. These are expensive and possibly only short term measures.

