

## 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?

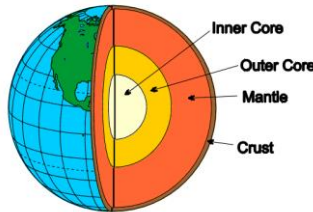
Population growth  
Global climate change  
Deforestation  
Wealth - LICs are particularly at risk as they do not have the money to protect themselves



## Structure of the Earth

The earth has 4 layers

The inner core  
The outer core  
The mantle  
The crust



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)

There are 2 theories of why plates move: convection currents and ridge push, slab pull.

Plates either crash into each other (**destructive**) move apart (**constructive**) or push past each other (**conservative**). **You must learn the plate margin diagrams in your book!**

These plates move and where they meet you get tectonic activity (volcanoes and earthquakes).

## Earthquakes and Volcanoes

### Volcanoes

- Constructive** margins – Hot magma rises between the plates e.g. 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 e.g. the Pacific Rim.
- Conservative** – no volcanoes

### Earthquakes

- 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 e.g. 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

- Property and buildings destroyed
- People injured or killed
- Ports, roads, railways damaged
- Pipes (water and gas) and electricity cables broken

### Secondary - Earthquakes

- 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

- Property and farm land destroyed
- People and animals killed or injured
- Air travel halted due to volcanic ash
- Water supplies contaminated

### Secondary - Volcanoes

- Large eruptions can cause global cooling due to ash in atmosphere
- 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

AQA

## Responses to Tectonic Hazards

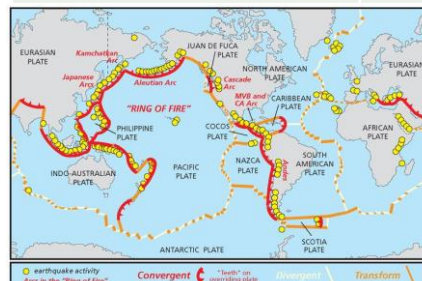
### Immediate (short term)

- Issue warnings if possible
- Rescue teams search for survivors
- Treat injured
- Provide food and shelter, food and drink
- Recover bodies
- Extinguish fires



### Long-term

- Repair and re-build properties and infrastructure
- Improve building regulations
- Restore utilities
- Resettle locals elsewhere
- Develop opportunities for recovery of economy
- Install monitoring technology



## Earthquakes – Chile (HIC) and Nepal (LIC)

### HIC Chile, February 2010

### LIC Nepal, April 2015



### Primary Effects

500 dead  
12,000 injured  
800,000 people affected  
222,000 homes destroyed



9,000 dead  
20,000 injured  
8 million people affected  
3 million homeless

### Secondary Effects

1,500 km of roads damaged by landslide  
Many coastal towns devastated by tsunami waves  
Fire at a chemical plant near Santiago

19 dead at Mount Everest due to avalanches  
Many landslides, blocking roads and rivers such as the Kali Gandaki river  
Avalanche in Langtang Region left 250 missing

### Immediate Responses

Swift response from emergency services.  
Temporary repairs to Route 5 N-S highway within 24 hours  
Power and water restored to 90% of homes within 10 days

Search and rescue teams from UK, India and China  
Half a million tents needed to provide shelter for homeless  
Financial aid pledged from many countries

### Long term responses

Chile's strong economy could be rebuilt without much foreign aid  
Housing reconstruction plan launched 1 month after the quake to help 200,000 households

Stricter controls on building codes  
International conference in June 2015 to seek technical and financial support from other countries  
Focus on tourism to increase income, reopened some sites by July 2015

**LICs suffer more than HICs from natural disasters because they are not as prepared and struggle to react effectively. Buildings tend to be of a poorer quality and are therefore more likely to collapse.**

**Emergency services tend to be less prepared and have less equipment to rescue people. There tends to be less money available to recover from the disaster.**

### Monitoring

Seismometers measure earth movement.  
Volcanoes give off gases that can be measured.

### Prediction

By observing monitoring data, this can allow evacuation before event. Can't predict earthquakes.

### Protection

Reinforced buildings and making building foundations that absorb movement.  
Automatic shut offs for gas and electricity.

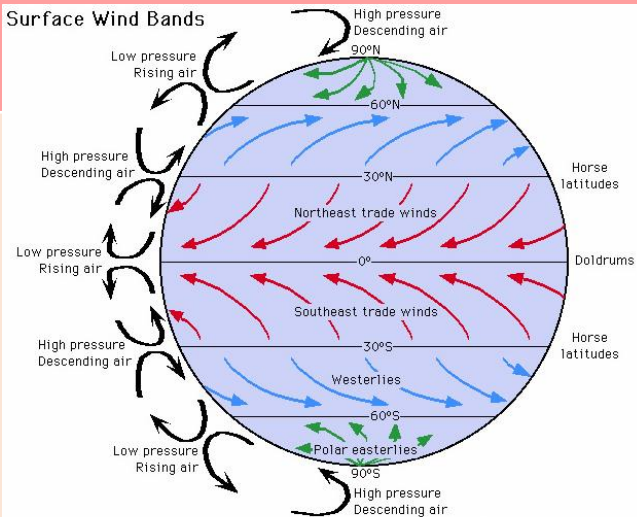
### Planning

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.

### Surface Wind Bands

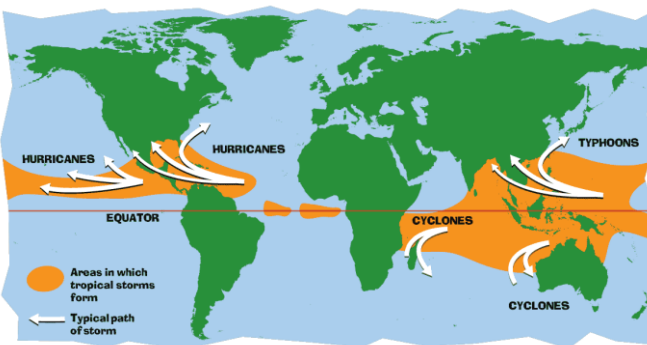


Adapted from Duxbury, Alyn C. and Allison B. Duxbury. An Introduction to the World's Oceans, 4/e. Copyright © 1994 Wm. C. Brown Publishers, Dubuque, Iowa.

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

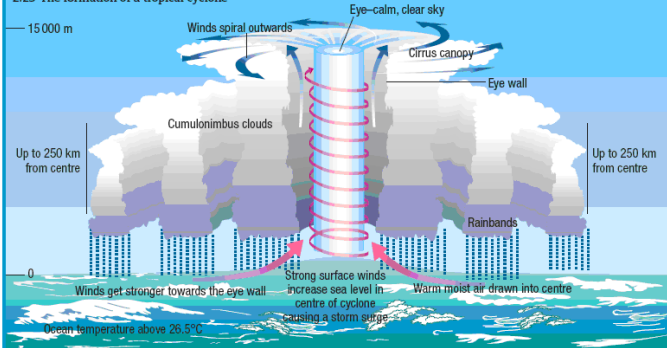
Occur in low latitudes between 5 and 30 degrees north and south of equator. Ocean temperature needs to be above 27 degrees C. Happen between summer and autumn



## 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.

### 2.23 The formation of a tropical cyclone



### Hurricane Katrina, Louisiana USA August 2005

#### Primary Effects

1800 killed  
300 000 homes destroyed  
80% of New Orleans flooded  
3 million people without electricity  
Habitats destroyed

#### Secondary Effects

230 000 jobs lost from damaged businesses  
Water supply polluted  
Hundreds of thousands homeless  
Total cost of damage \$150 billion

#### Immediate Responses

70-80% of New Orleans evacuated before hurricane reached land  
State of emergency declared in Louisiana and Mississippi  
Emergency shelters set up in public buildings  
50 000 people rescued  
Charities provided hot means and aid

#### Long-term Responses

Government provided \$16 billion to rebuild  
Some houses rebuilt on stilts  
Some areas zoned no build areas  
Repaired flood defence costing \$14.5 billion (mainly levees)

#### Prediction

Monitoring wind patterns allows path to be predicted. Use of satellites to monitor path to allow evacuation

#### Planning

Avoid building in high risk areas  
Emergency drills  
Evacuation routes

#### Protection

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 – lightening 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.



### Boscastle 2004

Very heavy rainfall fell very quickly. The soil was already saturated so rain water ran down the valley sides towards Boscastle.

#### Social Effects



No lives were lost.  
The worst injury was a broken thumb.  
1000 cars were swept away.

#### Economic Effects



Income from tourism was lost. The Witchcraft Museum was destroyed.  
Vast numbers of insurance claims.

#### Environmental impacts



Rubbish and rubble were washed into the sea.

#### Management strategies

£4.5 million has been spent on a flood defence scheme.  
The scheme stretches along the valley, incorporating drainage, sewerage systems and land re-grading.  
Boscastle car park has been raised in height, which will stop the river from bursting its banks so easily.  
New drains allow water to run into the lower section of the river quickly.  
The river channel has been made deeper and wider so that it can accommodate more water.





## 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	Human
<ul style="list-style-type: none"> <li>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.</li> <li>Solar Output – sunspots increase to a maximum every 11 years</li> <li>Volcanic activity – volcanic aerosols reflect sunlight away reducing global temperatures temporarily</li> </ul>	<ul style="list-style-type: none"> <li>Fossil fuels – release carbon dioxide with accounts for 50% of greenhouse gases</li> <li>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</li> <li>Deforestation – logging and clearing land for agriculture increases carbon dioxide in the atmosphere and reduces ability to planet to absorb carbon through photosynthesis.</li> </ul>

### Evidence for Climate Change

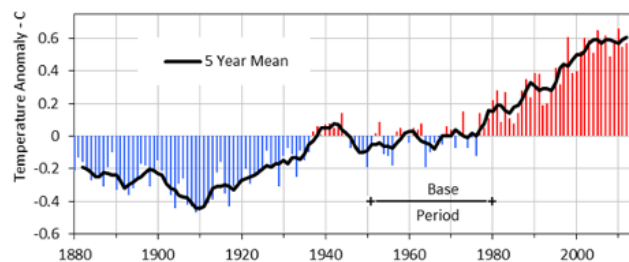


The Met Office has reliable climate evidence since 1914 – but we can tell what happened before that using several methods.

Ice and Sediment Cores	Tree Rings
<ul style="list-style-type: none"> <li>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.</li> <li>Remains of organisms found in cores from the ocean floor can be traced back 5 million years.</li> </ul>	<ul style="list-style-type: none"> <li>A tree grows one new rind each year. Rings are thicker in warm, wet conditions</li> <li>This gives us reliable evidence for the last 10 000 years</li> </ul>
	
Pollen Analysis	Temperature Records
<ul style="list-style-type: none"> <li>Pollen is preserved in sediment. Different species need different climatic conditions</li> </ul>	<ul style="list-style-type: none"> <li>Historical records date back to the 1850s. Historical records also tell us about harvest and weather reports.</li> </ul>

## Global Temperature, 1880 - 2014

Land - Ocean Index: 1951-1980 Base



Source: Goddard Institute for Space Studies (GISS) and Climate Research Unit (CRU), prepared by ProcessTrends.com, updated by globalissues.org

### Effects of Climate Change



Social	Environmental
<ul style="list-style-type: none"> <li>Increased disease eg. skin cancer and heat stroke</li> <li>Winter deaths decrease with milder winters</li> <li>Crop yields affected by up to 12% in South America but will increase in Northern Europe but will need more irrigation</li> <li>Less ice in Arctic Ocean increases shipping and extraction of oil and gas reserves</li> <li>Droughts reduce food and water supply in sub-Saharan Africa. Water scarcity in South and South East UK</li> <li>Increased flood risk. 70% of Asia is at risk of increased flooding</li> <li>Declining fish in some areas affect diet and jobs</li> <li>Increased extreme weather</li> <li>Skiing industry in Alps threatened.</li> </ul>	<ul style="list-style-type: none"> <li>Increased drought in Mediterranean region</li> <li>Lower rainfall causes food shortages for orangutans in Borneo and Indonesia</li> <li>Sea level rise leads to flooding and coastal erosion</li> <li>Ice melts threaten habitats of polar bears</li> <li>Warmer rivers affect marine wildlife</li> <li>Forests in n America may experience more pests, disease and forest fires</li> <li>Coral bleaching and decline in biodiversity such as the Great Barrier Reef (Australia)</li> </ul>



## Managing Climate Change



Mitigation	Adaption
<ul style="list-style-type: none"> <li>Alternative energy production – renewable sources will last longer but they can be expensive and are less reliable than fossil fuels</li> <li>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</li> <li>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</li> <li>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.</li> </ul>	<ul style="list-style-type: none"> <li>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</li> <li>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</li> <li>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.</li> </ul>

