

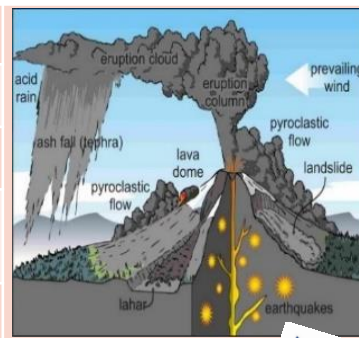


## The structure of the Earth

<b>The Crust</b>	Varies in thickness (5-10km) beneath the ocean. Made up of several large plates.
<b>The Mantle</b>	Widest layer (2900km thick). The heat and pressure means the rock is in a liquid state that is in a state of convection.
<b>The Inner and outer Core</b>	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

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

## LIC -CS: Nepal Earthquake 2015



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

**Causes**  
On a destructive plate margin, involving the Indo Australian and Eurasian plates. The **magnitude 7.9 earthquake** was **50 miles** to the north west of Nepal's capital Kathmandu. The plates are colliding at about **45mm** per year. .

**Effects**  
**9000 people died** and 8 million affected. Many **emotionally affected**. **3 million homeless**. **7000 schools destroyed**  
**Avalanche on Mt Everest** killed at least 19 people along with **landslides**

**Management**  
Search and rescue teams inc. helicopters for those trapped on Mt Everest. Hall a million tents. 300 000 people migrated to Kathmandu. June 2015 International conference to discuss rebuilding.

- Radioactive decay of some of the elements in the core and mantle generate a lot of heat.
- When lower parts of the mantle molten rock (Magma) heat up they become **less dense** and **slowly rise**.
- As they move towards the top they cool down, become **more dense** and **slowly sink**.
- These **circular movements** of semi-molten rock are **convection currents**
- Convection currents create **drag** on the base of the tectonic plates and this causes them to move.

## 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.

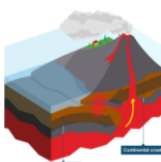
### PROTECTION

**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

## 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.

## 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

These are hazards caused by land and tectonic processes.

### Meteorological Hazard

These are hazards caused by weather and climate.

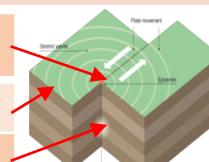
## Causes of Earthquakes

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**.



## Unit 1a



# The Challenges of Natural Hazards

## HIC - CS: Chile 2010



### Causes

Formed on a destructive plate boundary involving the Nazca and South American plate. **The magnitude was 8.8** on the Richter scale. **The earthquake struck just off the coast of Chile** causing a tsunami warning to be issued.

### Effects

Around **500 people** killed. 12 000 injured and **800 000 people** affected. **220 000 homes** and **4500 schools** destroyed. Cost of **US\$30 billion**. 1500 km of roads destroyed. **Several coastal towns devastated by tsunami waves**.

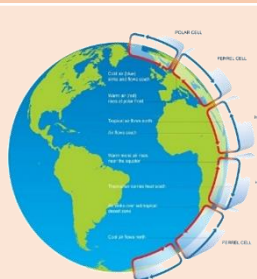
### Management

Emergency services quick to act. **Temporary repairs happened within 24 hours**. Power restored to **90% of homes** in 10 days. **Helping reconstruction plan to help 200 000 homes** affected. Strong copper economy rebuilt without foreign aid.

## 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.

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



## Distribution of Tropical Storms.

## High and Low Pressure

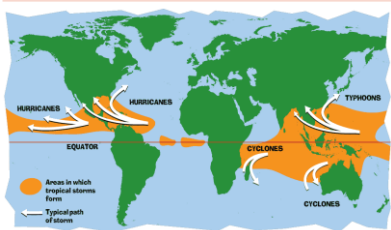
They are known by many names, including **hurricanes (North America)**, **cyclones (India)** and **typhoons (Japan and East Asia)**. They all occur in a band that lies roughly **5-15°** either side of the **Equator**.

### Low Pressure

Caused by **hot air rising**. Causes **stormy, cloudy weather**.

### High Pressure

Caused by **cold air sinking**. Causes **clear and calm weather**.



## Formation of Tropical Storms

- 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
- 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**.
- With trade winds blowing in the opposite direction and the rotation of earth involved (Coriolis effect), the thunderstorm will eventually start to **spin**.
- When the storm begins to **spin faster than 74mph**, a tropical storm (such as a hurricane) is officially born.
- 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**.
- 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

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**.

## 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 **2<sup>nd</sup> 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.

## Case Study: Somerset Levels 2014



### Causes

Wettest January on record (since 1910) caused by a succession of depressions over the Atlantic Ocean. 350mm rain fell in Jan and Feb 100mm more than average. High tides and storm surges in the Bristol Channel. Rivers had not been dredged in 20 years.

### Effect

- Over 600 house flooded.
- Many people cut off from supplies.
- Cost of the flood **£10 million**
- 1000 livestock evacuated.
- Floodwater heavily contaminated with pollutants.
- Local roads and railway blocked.

### Management

- Villages cut off were accessed by boats.
- £20 million flood action** planned by Somerset County Council – To include: 8Km of river Tone and Parret dredged; Road levels raised; River banks raised; by 2024 consideration will be given to a tidal barrage at Bridgewater.

## 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.

