Year 10| Geography | The Challenges of Natural Hazards

Managing Volcanoes

Warning signs	Monitoring techniques
Small earthquakes are caused as magma rises up.	Seismometers are used to detect earthqakes
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

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.

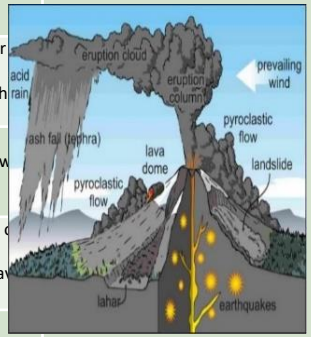
Protection Preparing for a tropical storm may involve construction projects that will improve protection	**Aid** Aid involves assisting after the storm, commonly in LICs.
Development The scale of the impacts depends on the whether the country has the resources to cope with the storm.	**Planning** Involves 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.

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 th volcano.
Lahar	A volcanic mudflow which usually runs dow a valley side on the volcano.
Pyroclastic Flow	A fast moving current super-heated gas and ash (1000°C). They tra at 450mph.
Volcanic Bomb	A thick (viscous) lava fragment that is ejected from volcano.



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.

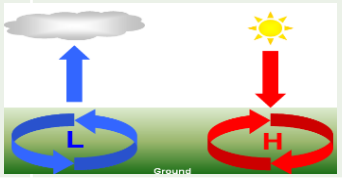
Hadley Cell	Largest cell which extends from the **Equator** to between **30°** to **40° north and south.**
Ferrel Cell	Middle cell where air flows **poleward** between **60° & 70°** latitude.
Polar Cell	**Smallest & weakest** cell that occurs from the poles to the Ferrel Cell

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

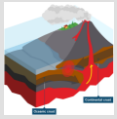
Low Pressure	High Pressure
Caused by hot air rising, Causes stormy, cloudy weather.	Caused by cold air sinking. Causes clear and calm weather.



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 that is in a state of convection.
The Inner and outer core	Hottest section (5000 degrees). Mostly made of iron and nickel is 4x denser than the crust. Inner section is solid whereas the outer layer is liquid.

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.

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

YEAR 10 | Geography | The Challenges of Natural Hazards

Case Studies – Tectonic Hazards

LIC – Gorkha, Nepal (2015)

Causes

On a Convergent Collision plate margin, involving the Indian & Eurasian plates.
The magnitude 7.8 earthquake was only 60km northwest of the Capital Kathmandu. With a very shallow focus of 8.2 km deep.

Effects

8,841 people died, over 16,800 injured and **1 million made homeless.**
50 per cent of schools destroyed and 26 hospitals collapsed. Kathmandu airport damaged, including the runway and rubble blocked roads. Villages were cut off due to the mountainous terrain.
The earthquake triggered an avalanche on Mount Everest that swept through Everest Base Camp. There was a reduced supply of water, food and electricity.

Management

Nepal requested international help. Many countries **responded with appeals** or **rescue teams**. Heavily relied on **international aid**, e.g. **$274 million** of aid committed to recovery efforts - **$126 million from UK's Disasters Emergency Committee (DEC).**
Temporary shelters were set up with Red Cross providing tents for 225,000 people.
However, by November 2018, it was estimated that 34% of people were still living in temporary accommodation or in homes that were unrepaired.
Facebook activated safety check features so local people could inform family and friends they were safe.

HIC – Amatrice, Italy (2016)

Causes

Collision between the African and Eurasian plates.
The magnitude 6.2 earthquake was southwest of Norcia and Northwest of Amatrice. With a very shallow focus of 5.1km deep. The earthquake was felt as far as 100 miles away in Rome.

Effects

Severe damage on the surface, with towns and villages in the regions of Umbria, Lazio and Marche suffering the most damage.
298 people died, 400 people injured and **4454 homeless.**
293 historic buildings destroyed.
Over half of the buildings in Amatrice were destroyed or damaged. Unsafe buildings were cordoned off – making tourism difficult in the town centre.
Landslides blocked roads, making access to the area difficult.
Ninety per cent of barns and stalls for sheep, goats, and cattle in the affected area were destroyed, alongside the mechanical milking systems. As a result, farmers struggled to milk by hand, leaving their cattle at risk of mastitis, an udder-tissue disease. Farmers struggled to make a living in the aftermath of the earthquake.

Management

Ten thousand homeless people were accommodated in 58 tent camps.
Sports halls were converted to provide shelter, and hotels on the Adriatic coasts were used to home people temporarily.
Many rescue workers arrived within an hour of the earthquake. Five thousand soldiers, alpine guides, and the Italian Red Cross were involved in searching for survivors, providing food and water, and supplying tents. Seventy dog teams and twelve helicopters were involved in the rescue effort.
Six of the Vatican's 37 firefighters have travelled to Amatrice to help civil protection workers look for survivors.
A temporary hospital was set up, and patients at Amatrice Hospital, severely damaged during the earthquake, were transferred to a nearby hospital in Rieti.
Appeals were made by the national blood donation service to ensure demand was met.
Facebook activated safety check features so local people could inform family and friends they were safe.
The Italian Government announced a €50 million emergency response. Taxes for residents were cancelled, and reconstruction work began immediately.

Case Studies – Weather Hazards

Typhoon Haiyan (2013)

Causes

Started as a tropical depression on **2rd 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 Flooding in Cumbria (2015)

Cockermouth is situated in the Lake District on the confluence between the River Cocker and the River Derwent. Cockermouth is 40km from the coastal town of Morecombe and it has a population of 7,877.

Human Causes of the Flood

Urbanisation—the towns such as Cockermouth and Keswick have increased the amount of impermeable surfaces which means that the water gets to the river channel more quickly, increasing discharge.
Blocked Sewers—inadequate sewer capacity and blockages caused sewers to back up and caused flooding incidents, for example Elliot Park in Keswick.
Dredging—The river had not been dredged for many years which reduced the river's carrying capacity causing it to burst its banks quicker.

Physical Causes of the flood

During a 7 week spell the jet stream spawned a series of deep Atlantic depressions. This resulted in a prolonged period of stormy wet weather.
There was a trailing cold front that remained fixed over Cumbria, Southern Scotland and Northern Ireland for 36hours from 19th to 20th November. This drew a conveyor of moist tropical air northwards from the Azores.
Secondly , anomalous sea surface temperatures around the Azores (2-3°c above average) caused rapid evaporation, filling the air with moisture.
Finally, the Lakeland Hills squeezed moisture from the air by forcing it aloft.
Rapid run-off in response to steep slopes, impermeable rocks, thin soils and sparse vegetation cover.
Torrential downpours in the first 3 weeks of November had filled lakes such as Basssenthwaite and Derwentwater to bursting point. Normally the lakes regulate river flows and reduce extremes, but on this occasion water was transferred rapidly into the rivers downstream because the lakes were already full.

Impacts of the flood

Across the county over 2,200 properties were flooded, 4/5 were residential. 3 bridges were completely destroyed and 20 others temporarily closed. Several major roads were impassable due to surface water and landslips (A66, A6, A591 and A592). Small businesses connected to tourism were badly affect with 40% reporting booking cancellations, over one hundred farms were flooded with losses of livestock and extensive sheets of river-deposited gravels and silt covering fields.
Floodwater in Cockermouth reached a depth of 2.5 meters inundating over 900 properties. More than 50 residents were rescued by the emergency services, and emergency relief centres were set up for those forced to evacuate their homes.
Cockermouth's Derwent House GP surgery was flooded and forced to relocate.
The floods damaged two road bridges and destroyed a footbridge in the town. Downstream bridges across the River Derwent at Camerton and Northside collapsed, the latter causing the death of a local policeman PC Bill Barker. Workington's northern suburbs were cut off from the gown centre as a result, this disrupted transport and peoples daily lives. A second bridge at Workington was badly damaged and was closed to traffic causing a 40 mile diversion. The port of Workington was closed due to river erosion of banks and quays and massive sediment deposition in the harbour.

Response and Management

The town of Cockermouth now has a flood risk management scheme which has reduced the risk of flooding to more than 400 homes and businesses. The scheme features a 120m wide innovative self-closing flood barrier that rises automatically when the river is in flood (first UK use).