

THE CHALLENGE OF NATURAL HAZARDS: WEATHER HAZARDS

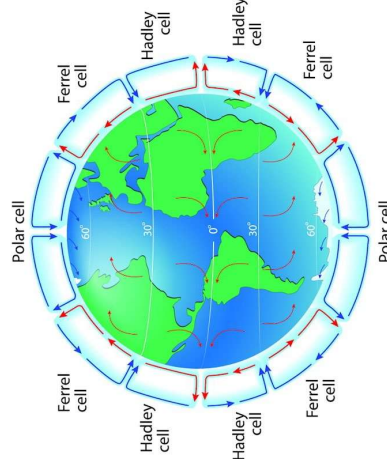
GLOBAL ATMOSPHERIC CIRCULATION

3 cells operate circulating air through the troposphere – whole system is driven by the equator.

Hadley cell: Air rises at the equator (creates low pressure and rainfall) – when it reaches the atmosphere it can't go any further to travels north or south, then cools and falls creating low pressure and dry conditions at 30°.

Ferrel cell: Air descends at the tropics as it is pulled down by the adjacent air in the Hadley cell. Here the air is driven by the Hadley and Polar cells.

Polar cell: At around 60° this warm air rises, leading to clouds and rain. The air will then flow back to the poles.



PRESSURE BELTS

Descending air = high pressure = no clouds and rain.

Rising air = low pressure = clouds and rain.

Poles – high pressure = dry.

60° – low pressure = wet, e.g. the UK.

Tropics – high pressure = dry (home to hot deserts).

Equator – low pressure = very wet (home to tropical rainforests)



TROPICAL STORMS

Form within the tropics between 5 and 30 degrees north and south (not actually along the equator).

Hurricanes: Atlantic and Eastern Pacific Oceans.

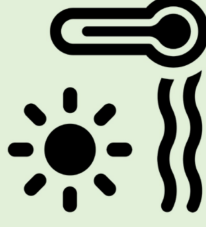
Typhoons: West of the North Pacific Ocean.

Cyclones: Indian and South Pacific Oceans.



STAGES OF A TROPICAL STORM

- 1) Ocean needs to be at least 27°C (to a depth of 60–70m).
- 2) Air is heated and warm air rises rapidly, drawing in moisture, causing strong winds.
- 3) Rising air cools and condenses to form tall cumulonimbus clouds – this releases latent heat.
- 4) The winds start to spin upwards due to the Coriolis effect (the effect of the earth's axis).
- 5) Centre of the storm = eye – calm drier conditions.
- 6) Trade winds steer storm towards the land.
- 7) Once it makes landfall the storm loses its source of power – this is why most storm damage happens by the coast.



EXTREME WEATHER IN THE UK

- Prolonged rainfall
- Strong winds (named storms)
- Droughts and heatwaves
- Extreme cold

MANAGING EXTREME WEATHER IN THE UK

Flooding: Environment Agency monitors river levels and gives warnings, flood barriers installed.

Names storms: Met Office issues warnings, travel companies cancel services, high bridges closed, etc.

Droughts and heatwaves: Water companies can place restrictions on use if needed.

Extreme cold: Local councils grit roads.

CLIMATE CHANGE IN THE UK

- The top 10 warmest years on record have occurred since 2002
- Six of the 10 wettest years on record have occurred since 1998
- Fewer very cold days

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PRIMARY IMPACTS

The direct impacts (caused either by the strong wind, heavy rain or storm surges) –

they happen during or immediately after the event, e.g. damage to and destruction of buildings, loss of life through drowning (90% of deaths in tropical storms), power lines blown down, crops washed away, and huge storm surges.



SECONDARY IMPACTS

The indirect impacts (caused by the primary

impacts) – they happen in the coming hours, days and weeks, e.g. thousands of people losing their homes and becoming homeless, outbreaks of waterborne disease, loss of crops or fishing boats could lead to a loss of income and affect food supplies, shops could be shut due to a loss of power, education may be disrupted by schools closing.



IMMEDIATE RESPONSES

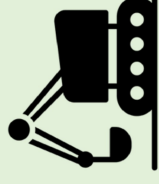
Emergency aid/ assistance given within the first few

hours/days – vital to reduce death toll, e.g. search and rescue, medical care such as pain relief and emergency surgery, temporary shelter, providing food and clean water.



LONG-TERM RESPONSES

Take place in the weeks and months after – focus on rebuilding and helping people return to normal lives, e.g. restoring essential utilities, repairing/ rebuilding domestic and commercial buildings, repairing transport links. Also measures to reduce future damage.



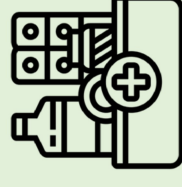
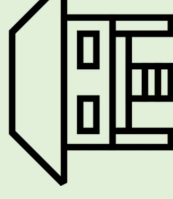
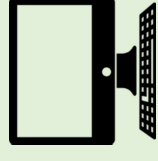
MITIGATING TECTONIC HAZARDS – MP3

Monitoring: Using satellites and aircraft to track the size, temperature and moisture levels of storms, as well as and air pressure.

Prediction: Using super-computers to predict where the storm will hit using a track cone. Computers are also used to give out advanced warnings, e.g. Hurricane Watch (48hr warning) and Hurricane Warning (36hr warning).

Protection: Reinforcing homes, e.g. window shutters, securing roofs and doors with metal straps, building homes on stilts to protect from flooding, building cyclone shelters, constructing storm drains to remove excess rainfall, building sea walls to protect against storm surges, and planting mangrove forests to absorb excess water.

Planning: Raising awareness about what to do in a tropical storm, e.g. Hurricane Preparedness Week (USA), assembling a disaster supply kit, stocking up on food, water and fuel, and knowing where to evacuate to.



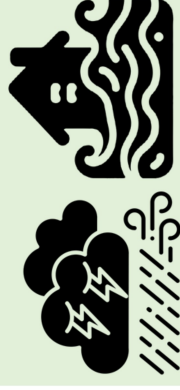
HOW WILL CLIMATE CHANGE AFFECT TROPICAL STORMS?

More frequent and intense tropical storms (category 4/5 storms)...

Global warming → ocean thermal expansion of the oceans → sea level rise. Higher storm surges → low-lying coastal areas flooded.

Storm surges are the most deadly hazard related to tropical storms!

Warmer air in the atmosphere can hold more moisture → heavier rainfall → more destructive flooding during tropical storms.



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QUATERNARY PERIOD

2.6 million years ago to the present day.

Overall period of cooling!

Glacials:

Cooler periods – UK covered in ice last 100,000 years).

Interglacials:

Warmer periods (last 10,000 years).



EVIDENCE OF CLIMATE CHANGE

Recent:

- Melting sea ice
- Sea level rise
- Seasonal patterns (e.g. birds migrating, plants flowering)



Historic:

- Tree rings
- Fossil pollen
- Ice cores
- Observing ocean sediment



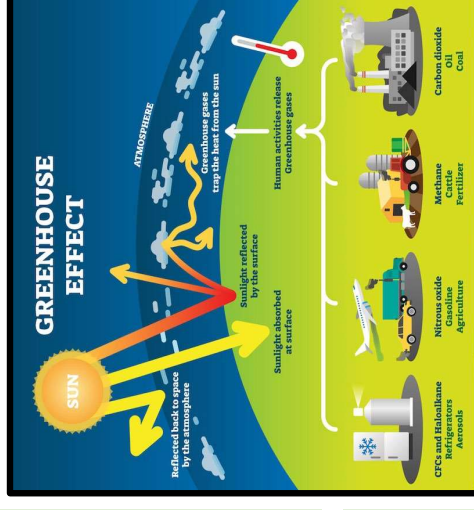
GREENHOUSE EFFECT

The Sun's infrared heat rays enter the Earth's atmosphere...

Short-wave radiation: Most solar radiation is able to pass through it to warm up the earth's surface.

Long-wave radiation: The heat given off by the earth's surface.

Greenhouse gases form a blanket within the atmosphere that traps long-wave radiation heat.



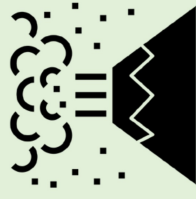
NATURAL CAUSES

Orbital changes:

- Eccentricity
- Axial tilt
- Precession

Solar output: Sunspots – dark patches on surface...

- Maximum sunspots = give off more heat
- Few sunspots = colder climate
- Volcanic activity:** Eruptions can block out sun (temporary effect)



HUMAN CAUSES

Greenhouse gases are released into the atmosphere by human activity – have increased since industrialisation...

Carbon dioxide: From burning fossil fuels and deforestation.

Methane: From rotting organic matter, burning biomass, agriculture (cattle farming).

Nitrous oxides: From fertilisers, sewage treatment plants and vehicle exhausts.



ADAPTATION STRATEGIES

Responding to the impacts of climate change by adjusting how people live or work

- Farming techniques
- Water management
- Flood defences for low-lying areas, e.g. sea walls, tidal barriers, homes on stilts

INTERNATIONAL AGREEMENTS

Paris Accord: Agreement to limit warming to 1.5°C above pre-industrial levels – signed by 195 countries.

