

YEAR 8 UNIT 1: Changing Climate

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.

Evidence for climate change

Earth's temperature has changed over the last 2.6 million years. Scientist know this by collecting a range of evidence that is trapped or stored in the environment around us.

Geological fossil evidence	Plants and animals fossils/remains which favour certain environmental conditions have been found in contractionary conditions, thus suggesting periods of a warmer and colder time. E.g. Mastodon in USA.
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Ocean Sediment	Layers of sediment that has built up over time have provided scientist trapped oxygen isotopes. Scientist have used them to calculate and understand that atmospheric temperature have indeed changed.
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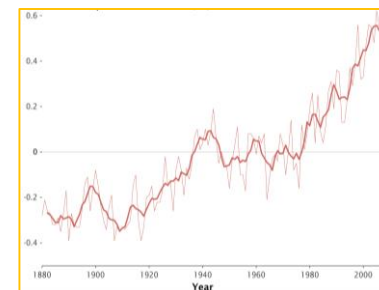
Ice Cores	Ice cores are made up from different layers that each represents a different historical time. By exploring the water molecules of these cores, scientist have calculated fluctuating temperatures of the atmosphere.
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Historical records	Historical records from ancient cave paintings, diaries and written observations have provide evidence of climate change through personal accounts from the people through them.
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The Quaternary Glacial period

The quaternary period is the last 2.6 million years. During this period temperatures have always fluctuated. The cold 'spikes' are the glacial periods, whereas the warm points are the interglacial periods.

Today's temperature is higher than the rest of the period. Despite alternate cold and warm moments within this period, global temperatures have increased above average in the past 100 years. This current trend is what's become know as global warming.



Natural Greenhouse effect

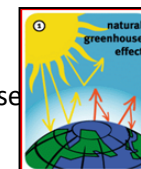
The Earth is kept warm by a natural process called the Greenhouse Effect.

As solar radiation hits the Earth, some is reflected back into space. However, greenhouse gases help trap the sun's radiation. Without this process, the Earth would be too cold to support life as temperature would average as -18°C instead of $+15^{\circ}\text{C}$.

Enhanced Greenhouse Effect

Recently, there has been an increase in humans burning fossil fuels for energy.

These fuels (gas, coal and oil) emit extra greenhouse gases. This is making the Earth's atmosphere thicker, therefore trapping more solar radiation but causing less to be reflected. As a result, our Earth is becoming warmer.



Greenhouse Gases

Most greenhouse gases occur naturally. Some greenhouse gases have greater potential to increase global warming than occurs as different gases trap and absorb different amounts of radiation.

Carbon Dioxide - Accounts for 60% of the enhanced greenhouse gases. It is produced by burning fossil fuels through producing electricity, industry, cars and deforestation.

Methane - Accounts for 15% of the enhanced greenhouse gases. 25x more efficient than Carbon dioxide. Produce from landfills, rice and farm animals.



Recent Evidence for climate change.

In the past 100 years, scientists have become pretty good at collecting accurate measurements from around the world. These measurements have suggested a trend that the climate is yet again changing.

Global temperature data

Evidence collected by NASA suggests average global temperatures have increased by more than 0.6°C since 1950.

Ice sheets and glaciers

Evidence from maps and photos have shown many of the world's glaciers and ice sheets are melting. E.g. the Arctic sea ice has declined by 10% in 30 years.

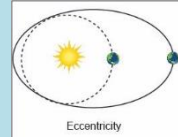
Sea level Change

Evidence from the IPCC has shown that the average global sea level has risen by 10-20cms in the past 100 years. This is due to the additional water from fresh water ice and thermal expansion of the ocean due to higher temperatures.

Evidence of natural change

Climate change has occurred in the past without human ever being present. This suggests that there are natural reasons for the climate to change.

Milankovitch cycle



Milutin Milankovitch argued that climate change was linked to the way the Earth orbits the Sun, and how it wobbles and tilts as it does it. There are three ideas that are thought to change climate.

1. **Eccentricity:** Changes in the shape of Earth's orbit.

2. **Obliquity:** Changes in how the Earth tilts on its axis.

3. **Precession:** The amount the Earth wobbles on its axis.

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 out sunlight and results in cooler global temperatures.

Global Impacts of Climate Change

Extreme Weather - Sea levels have risen by 20 cm since 1901. due to thermal expansion, melting glaciers and ice caps. Some coastal countries are now disappearing such as the Maldives in the Indian Ocean.

Rising Sea levels - Sea levels have risen by 20 cm since 1901. due to thermal expansion, melting glaciers and ice caps. Some coastal countries are now disappearing such as the Maldives in the Indian Ocean.

Impacts of climate change on the UK

The UK's climate is also changing. It is expected to increase in average temperature, have warmer, but wetter winters and have warmer and drier summers. However, not all the impacts to the UK will be negative, there are clear benefits for a changing climate.

Negatives – Coastal flooding, extreme heat, extreme weather, water shortages.

Positives – More tourism related jobs, more jobs in industry due to increased need for coastal defences and Farmers could potentially grow new foods used to warmer climates.

Rising Sea levels: Tuvalu - Tuvalu is a group of tiny islands in the South Pacific. Most islands are low-lying with the highest point being 4.5m above sea level. Population is 11,000 people and the economy relies mainly from exporting copra.

Impacts from Climate Change

Social - Water supply due to droughts becoming more common, wells are becoming polluted by seawater and high tides are starting to threaten homes and roads.

Economic - Increased levels of salinization affecting soil for agriculture, coastal erosion is destroying productive farmland, and the main runway threaten by flooding.

Environmental - Ocean acidification is reducing fish stocks around the island. Warmer temperatures are destroying fragile ecosystems such as coral reefs.

Management

Campaigning internationally for a reduction in carbon emissions. Migration to safer islands off the coast of New Zealand. Low sea walls have been constructed to prevent erosion and flooding. Japan supporting coral reef restoration by introducing new species to damaged reefs.

Climate Change Management

Mitigation is reducing or preventing the effects of something from happening. These strategies are:

- Alternative energy - solar, wind, tidal power reduces the use of fossil fuels, so less CO₂ is produced
- Reduce meat and dairy consumption
- Carbon capture—storing waste gases deep underground
- Planting trees—encouraging afforestation reduces CO₂ levels in the atmosphere during photosynthesis
- International agreements - countries sign treaties e.g. the Kyoto Protocol in 2005 to reduce carbon emissions.