

CLIMATE CHANGE – AN OVERVIEW

Global warming is a crisis for life on earth (Sir David Attenborough)¹

The climate

There is an important difference between “climate” and “weather”. “Weather” refers to atmospheric conditions in the short term (“the weather forecast”), whereas “climate” is the average of weather patterns over the longer term. Global climate is influenced by many interacting systems, including the atmosphere, oceans, land and ice, which together are called the climate system².

Scientists have developed an understanding of the earth’s climate system through years of observations. We know that global warming is the result of greenhouse gas emissions (especially carbon dioxide - CO₂ - and methane) caused by human activity, principally (but not only) from the burning of fossil fuels².

The increase in global average surface temperature is the most obvious evidence of a changing climate, and has consistently exceeded 1°C above pre-industrial levels in recent years. In the UK, of the top ten warmest years recorded for UK average surface temperature, eight have occurred since 2002³.

The northernmost latitudes are warming at twice the rate of the rest of the world. In the winter of 2017-18, parts of the Arctic experienced record-breaking warmth, up to 50° Fahrenheit warmer than usual⁵.

Climate change is already making the weather more extreme

The rising temperature is leading to wider changes to our weather, throwing natural systems out of balance⁴:

- As the oceans warm, hurricanes and typhoons are becoming more intense and destructive
- Climate change affects the planet’s water cycle: the risk of both heavy rains and extreme droughts is increasing
- Droughts are associated with longer wildfire seasons
- As the planet warms, heatwaves become more intense

Dangerous climate thresholds

Climate models suggest that there could be thresholds for abrupt change in the climate system, due to processes reaching critical thresholds and to the interactions between them.² Major risks include:

- Loss of tropical and boreal forests
- Changes in ocean circulation (including concern about weakening of the Gulf Stream) linked to warming of the seas
- The melting of arctic sea ice, the antarctic ice sheet and the Greenland ice sheet leading to substantial rises in sea levels, inundating low-lying islands and coasts
- Thawing of permafrost soils in northern latitudes releasing methane

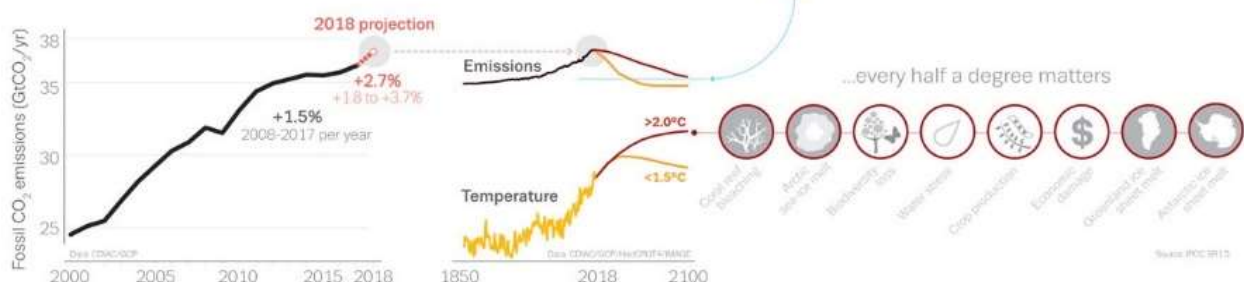
Global Carbon Budget 2018

Renewables rising fast but not yet enough to reverse emissions trend

Fossil CO₂ emissions are projected to rise **more than 2%**

Efforts to decarbonise are not yet strong enough to overcome growing global energy needs

Emissions need to rapidly decrease to **zero** to limit climate change and its impacts...

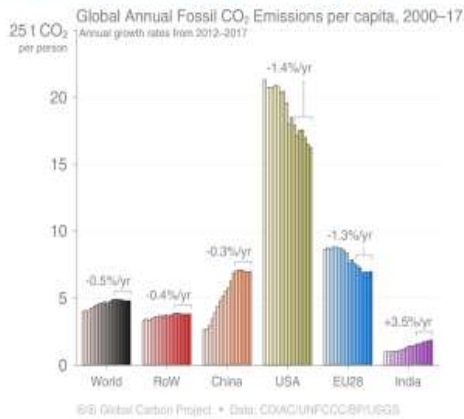


Source: Infographic from the Global Carbon Project⁶



Per capita CO₂ emissions

The US has high per capita emissions, but this has been declining steadily. China's per capita emissions have levelled out and is now the same as the EU. India's emissions are low per capita.



Source: Jackson et al 2018: Global Carbon Budget 2018

The top four emitters in 2018 covered 58% of global emissions: China (27%), United States (15%), EU28 (10%), India (7%)⁶. China and India experienced steep rises in 2018 at 4.7% and 6.3% respectively. The EU's emissions are nearly flat, but for the previous ten years they had been in decline.

For further information

The UN's The Intergovernmental Panel on Climate Change (IPCC)
<https://www.ipcc.ch/> provides the most comprehensive summaries of the latest research on climate science and the impacts of climate change.

UN Office for Climate Education
<http://www.oce.global/> was set up in 2018. The summary for teachers of the IPCC special report on 1.5 degrees of global warming is its first product. http://www.oce.global/wp-content/uploads/2018/12/ST1.5_070119-1.pdf

World Meteorological Organisation
<https://public.wmo.int/en> (a specialized agency of the United Nations, dedicated to international cooperation on the state of the Earth's weather and climate). For example: <https://public.wmo.int/en/our-mandate/climate/wmo-statement-state-of-global-climate>

Other impacts of climate change worldwide include^{2,4}

- Acidification of the oceans (due to the increase in CO₂)
- Biodiversity loss and coral reef bleaching
- Stress on water supplies (from drought and melting glaciers)
- Reduction in crop production affecting food supplies
- Economic damage due to many of the above

Carbon emissions around the world⁶

The global CO₂ concentration increased from ~277 parts per million (ppm) in 1750 to 405ppm in 2017 (up 46%). Half of the current rise occurred since 1980. 2016 was the first full year with CO₂ concentration above 400ppm, long held to be a symbolic milestone⁷. The current concentration is unprecedented in millions of years.

Fossil fuel emissions levelled worldwide from 2014 to 2016, but have since risen again. Carbon emissions reached a record high in 2018⁶, with fossil fuel use projected to release 2.7% more CO₂ into the atmosphere in 2018 than in 2017.

The importance of limiting global warming to 1.5°

The "Paris Agreement" of 2015/16 of the UN Framework Convention on Climate Change was signed by 190 nations, agreeing to keep the global temperature increase by 2100 to less than 2°C and as close as possible to 1.5°⁸. In 2018, the UN's Intergovernmental Panel on Climate Change (IPCC) published a Special Report⁹ summarising the new evidence that the impacts of climate change beyond 1.5°C could be very serious – with more severe impacts from the risks described earlier. The UN has assessed that carbon emissions need to drop by 45% by 2030 for global warming to be kept to a maximum of 1.5C and to zero by 2050.

More realistically, perhaps, according to the IPCC⁸, about 80% of known fossil fuel reserves would need to stay in the ground to limit the concentration of CO₂ in the atmosphere to 450 parts per million. This level would in turn give a 50% chance of limiting global warming to a maximum 2°C global average temperature rise.

References

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2. The Met Office: Climate Guide (an overview of climate, climate change and climate science and a briefing on dangerous climate thresholds) <https://www.metoffice.gov.uk/climate-guide> (accessed 08.01.19)
3. Committee on Climate Change (2018) Progress Report to Parliament.
<https://www.theccc.org.uk/publication/reducing-uk-emissions-2018-progress-report-to-parliament/> (accessed 08.01.19)
4. Climate Reality Project, Extreme Weather and the Climate Crisis
<https://www.climateRealityProject.org/extremeweather> (accessed 08.01.19)
5. US National Oceanic and Atmospheric Administration <https://www.noaa.gov/media-release/arctic-report-card-tracks-region-s-environmental-changes> (accessed 08.01.19)
6. Global Carbon Project (research partner of the World Climate Research Programme)
<http://www.globalcarbonproject.org/carbonbudget/18/presentation.htm>
7. UN Climate Change Announcement 7 May 2015 <https://unfccc.int/news/wake-up-call-ahead-of-paris-2015-400ppm-co2-level-breached> (accessed 08.01.19)
8. The Paris Agreement under the UN Framework Convention on Climate Change 2015/16:
<https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement> (accessed 09.01.19)
9. Intergovernmental Panel on Climate Change (IPCC) (2018) Special Report on Global Warming of 1.5°C. <https://www.ipcc.ch/sr15/> (accessed 09.01.19)

Professional Development Questions

1. What is the difference between climate and weather, and what are the main impacts of climate change?
2. Summarise the position on the level of carbon emissions around the world, current and projected to 2050.

FPH General CPD Questions

1. What did I learn from this activity or event?
2. How am I going to apply this learning in my work?
3. What am I going to do in future to further develop this learning and/or meet any gaps in my knowledge, skills or understanding?