

# CLIMATE CHANGE AND WEATHER EXTREMES



Professor Richard Allan

[@rpallanuk](#)

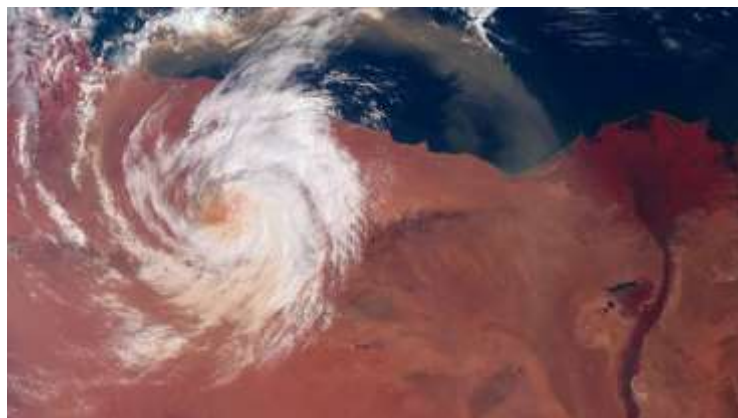
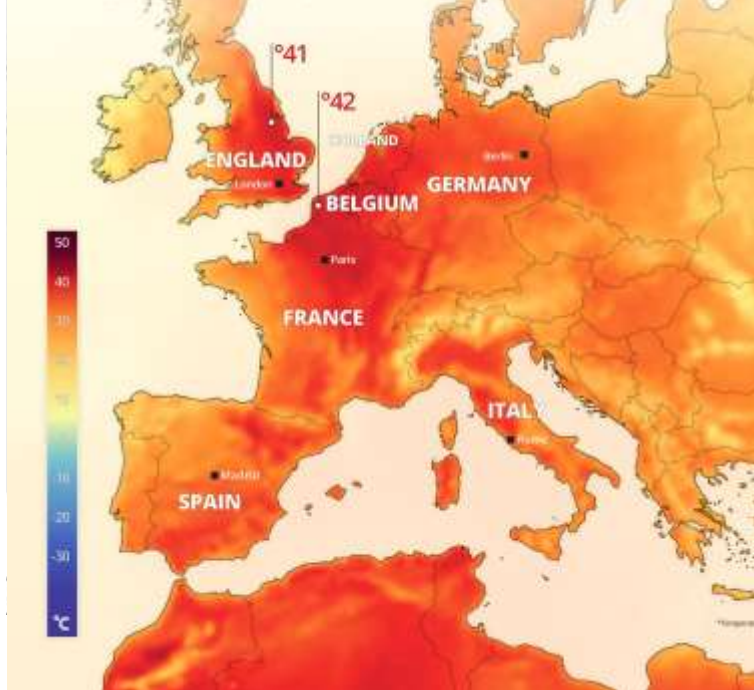
[r.p.allan@reading.ac.uk](mailto:r.p.allan@reading.ac.uk)

Pangbourne Rotary Club, The Bull, 27th January 2025





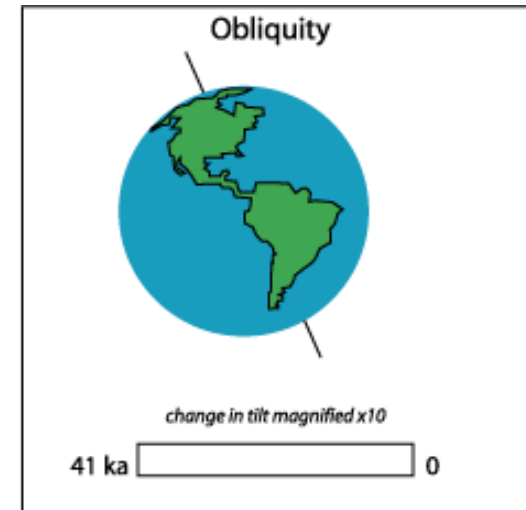
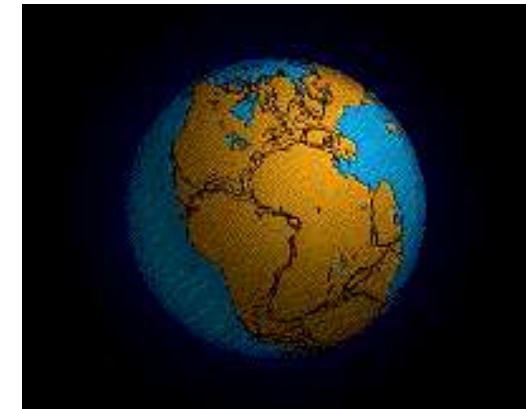
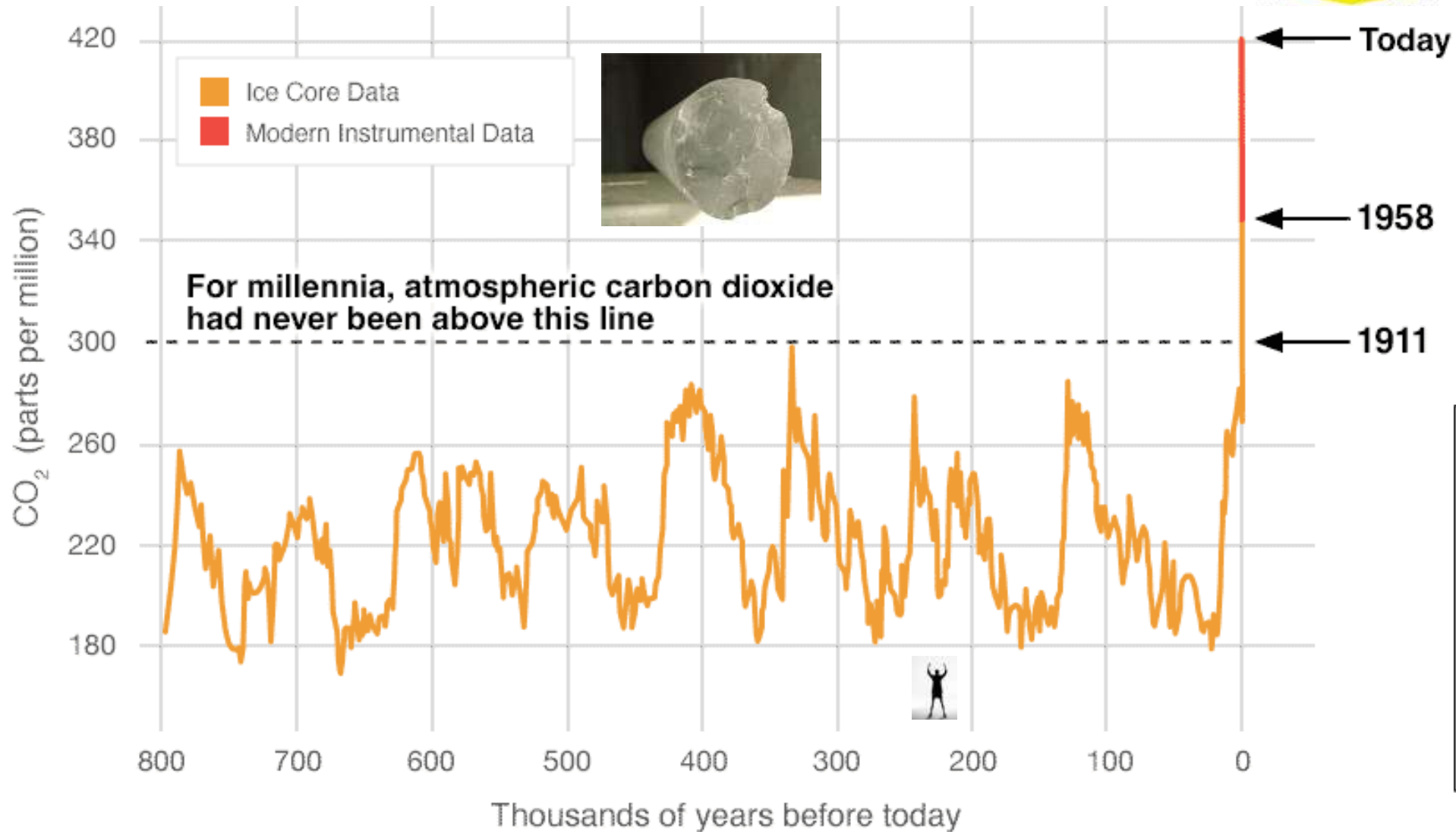
## Europe hit by scorching heatwave



# ONGOING CLIMATE CHANGE

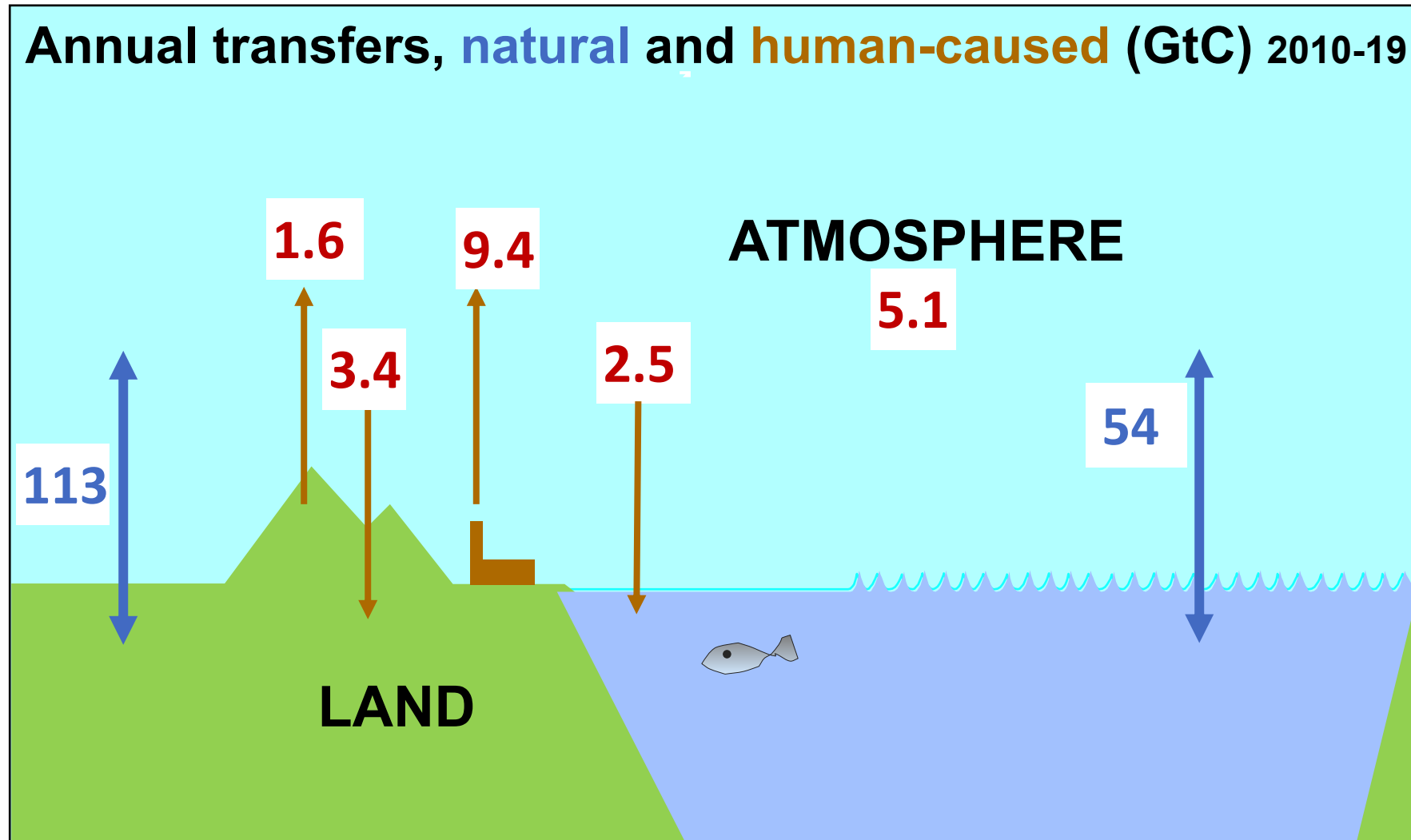


# The climate has always changed. But...





# Natural & human-influenced carbon cycle



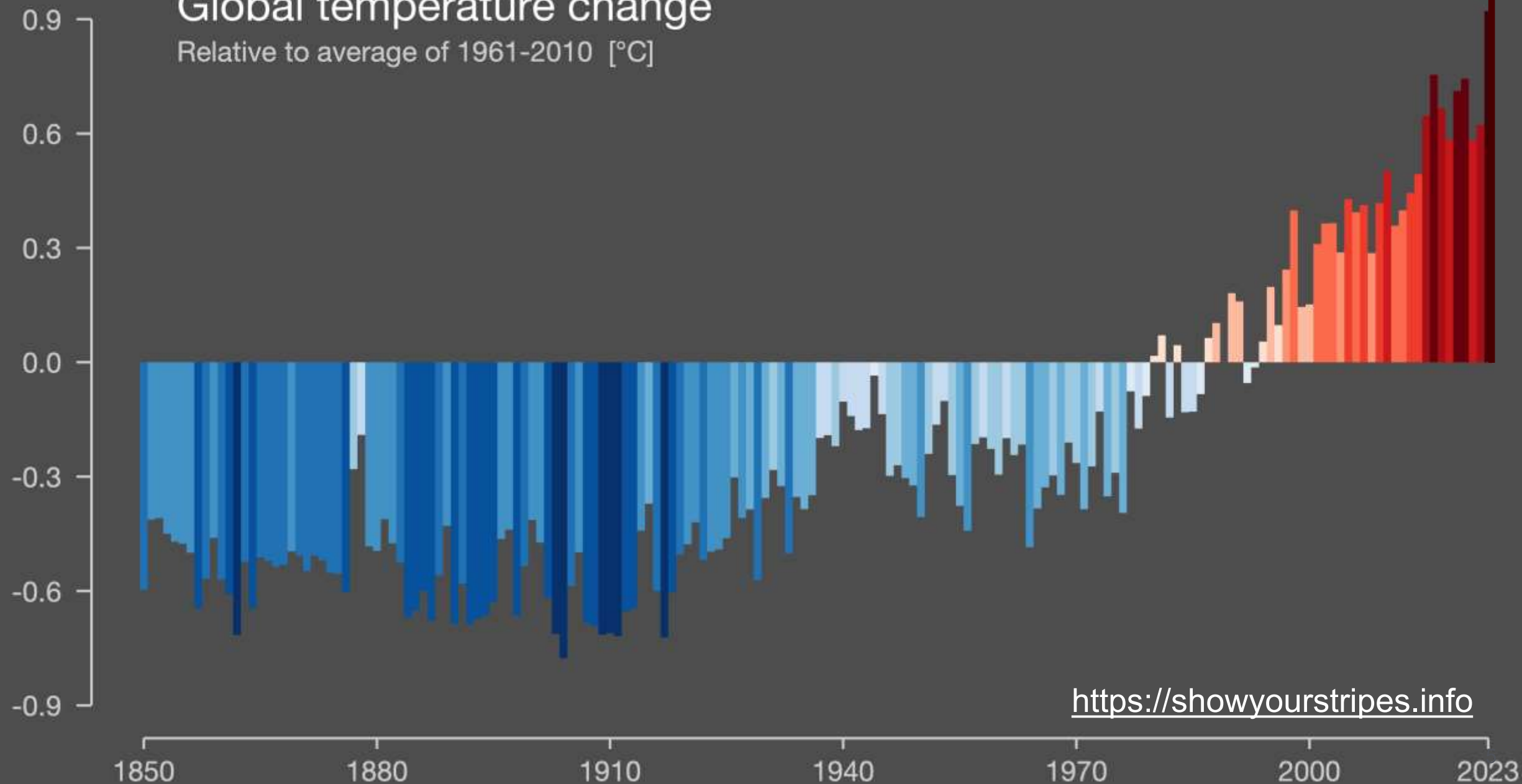
- Human activities have tipped the natural carbon cycle out of balance
- This is driving increases in atmospheric CO<sub>2</sub> concentrations
- CO<sub>2</sub> concentrations highest in at least 2 million years

Values in billions of tonnes of Carbon per year from IPCC (2021) Chapter 5

Updates: [globalcarbonbudget.org](https://globalcarbonbudget.org)

# Global temperature change

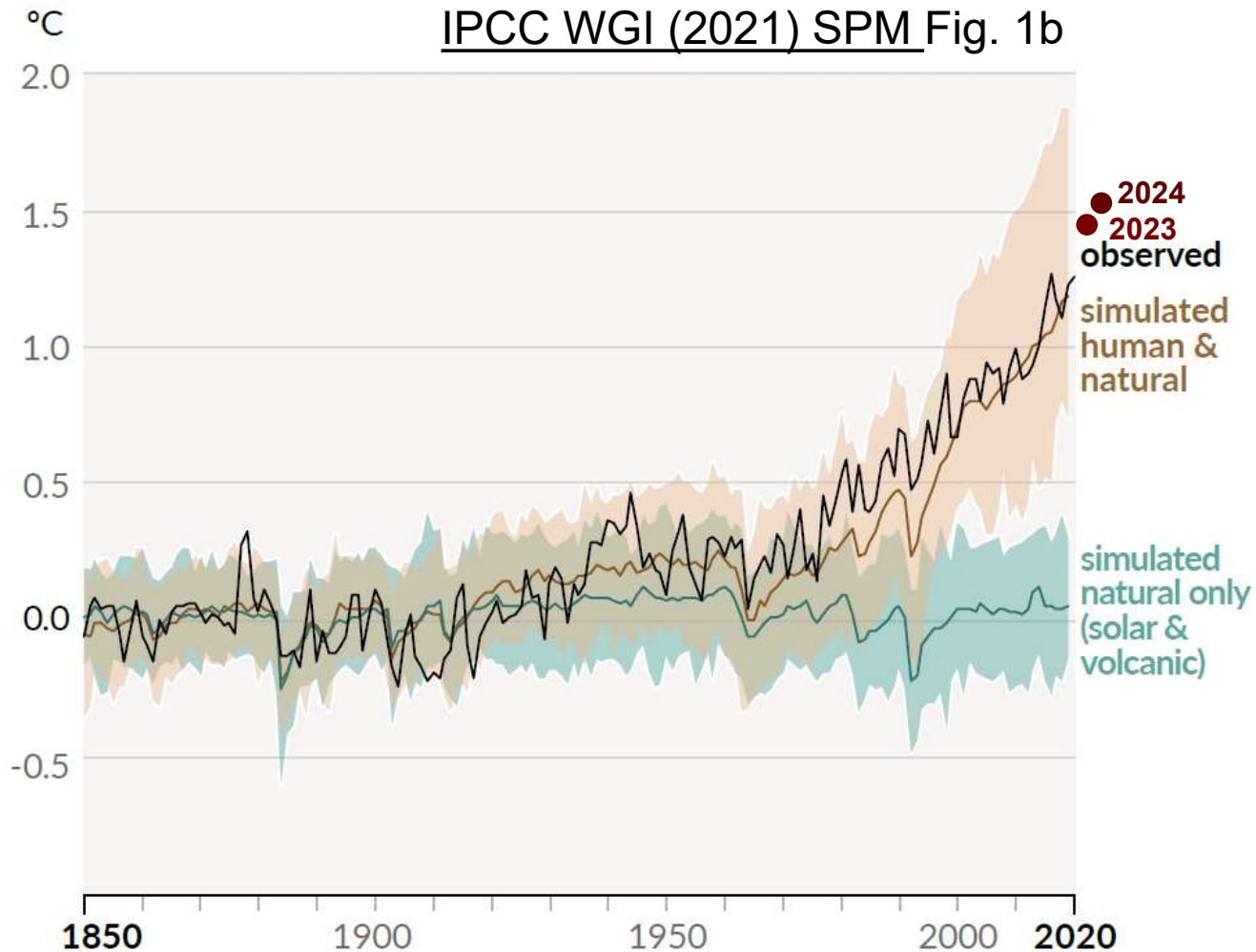
Relative to average of 1961-2010 [°C]



<https://showyourstripes.info>

# It is indisputable that human activities are causing climate change

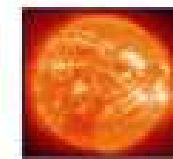
IPCC WGI (2021) SPM Fig. 1b



► Observed warming is driven by emissions from human activities



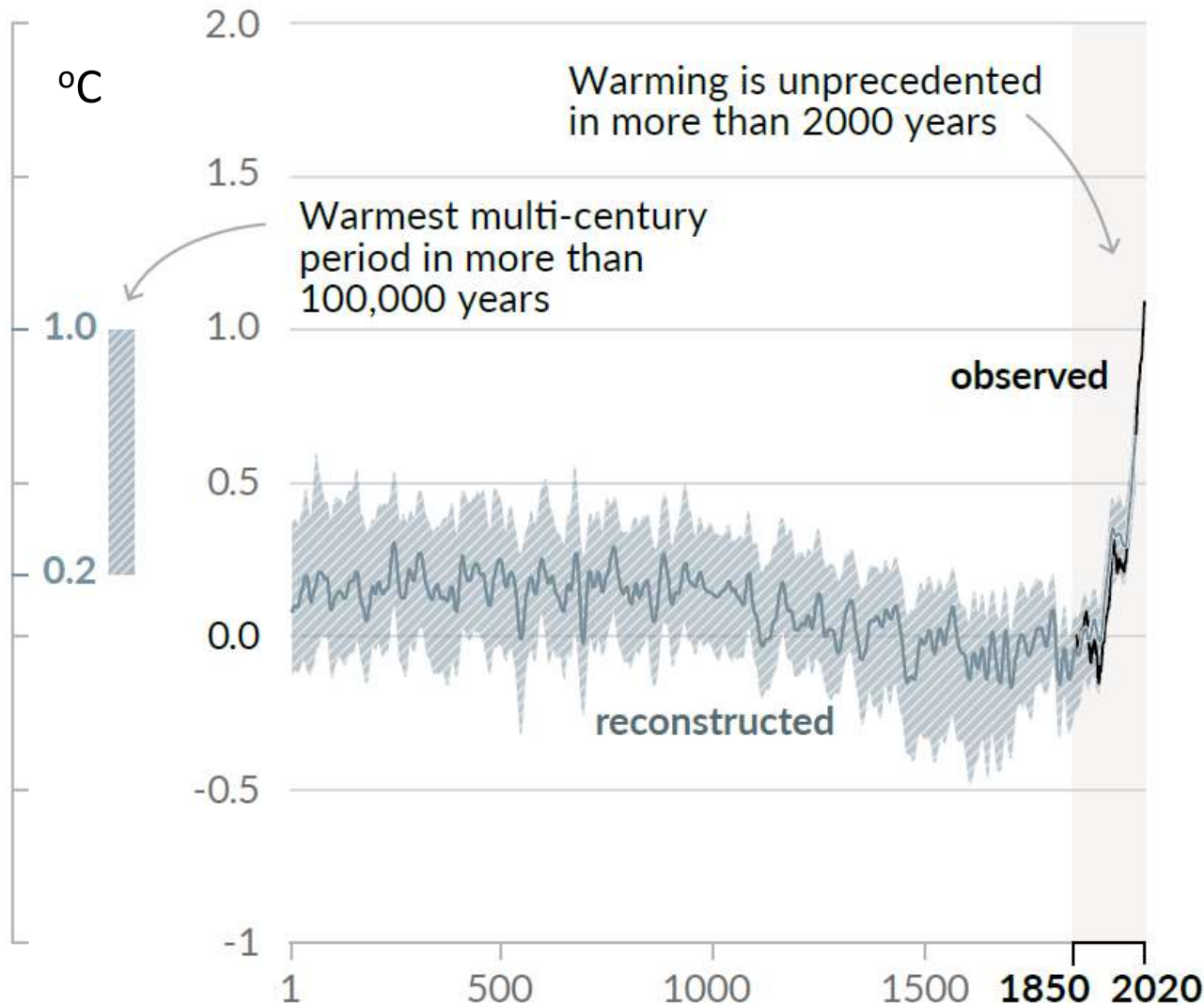
► Greenhouse gas warming has been partly masked by aerosol cooling



► Warming is amplified by feedback loops involving water vapour, ice & clouds

► Natural factors do not contribute to rapid warming over past 5 decades

# Recent changes in the climate are widespread, rapid and unprecedented in thousands of years



- Global mean surface temperature increased faster since 1970 than in any other 50 year period over at least the last 2000 years
- Warmth of past decade comparable to last interglacial 125,000 years ago [*when peak sea level was 5-10m higher than today*]

[IPCC WGI 2021 SPM]



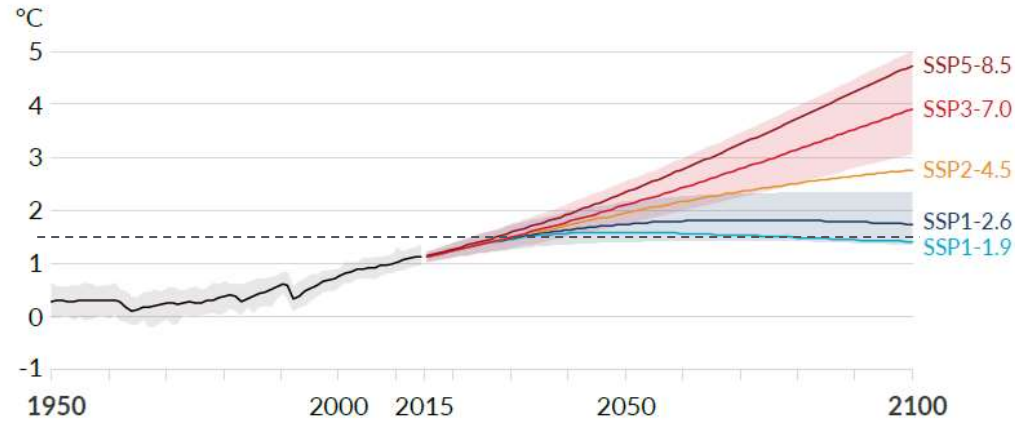
“ Continued global warming is projected to further intensify the global water cycle, including its variability, global monsoon precipitation and the severity of wet and dry events.



# Some changes in the climate system are irreversible but many changes can be slowed or stopped by limiting warming



a) Global surface temperature change relative to 1850-1900

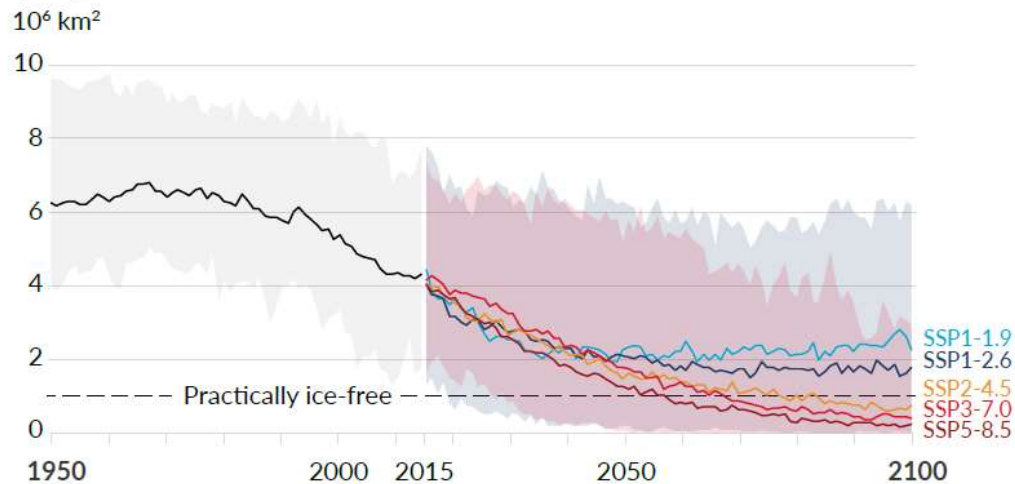


Global warming of 1.5°C and 2°C will be exceeded during the 21st century unless deep reductions in CO<sub>2</sub> and other greenhouse gas emissions occur in the coming decades

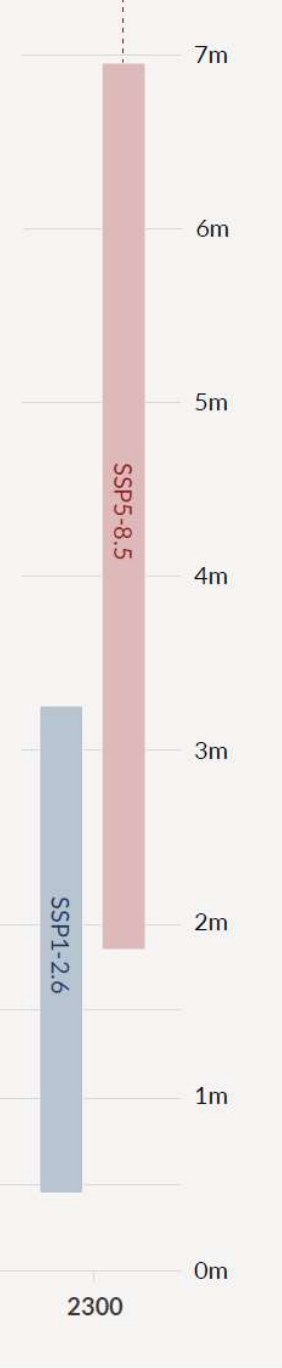
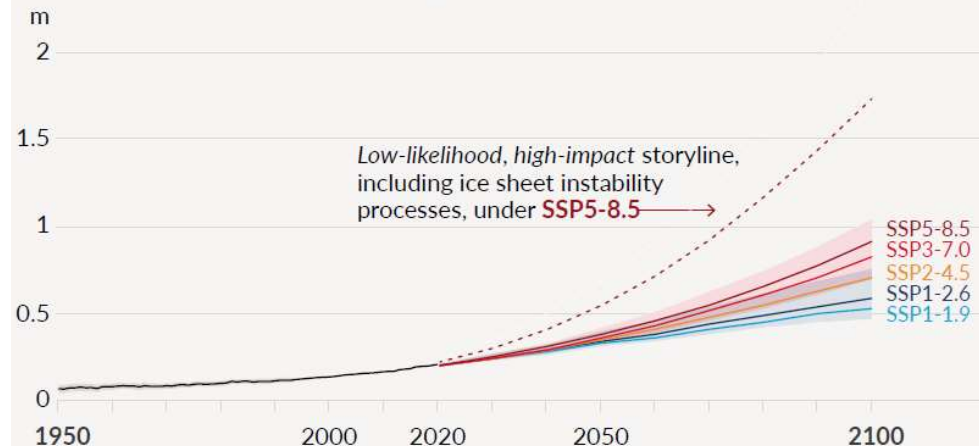
[IPCC (2021) WG1 SPM]

High emissions  
Low emissions

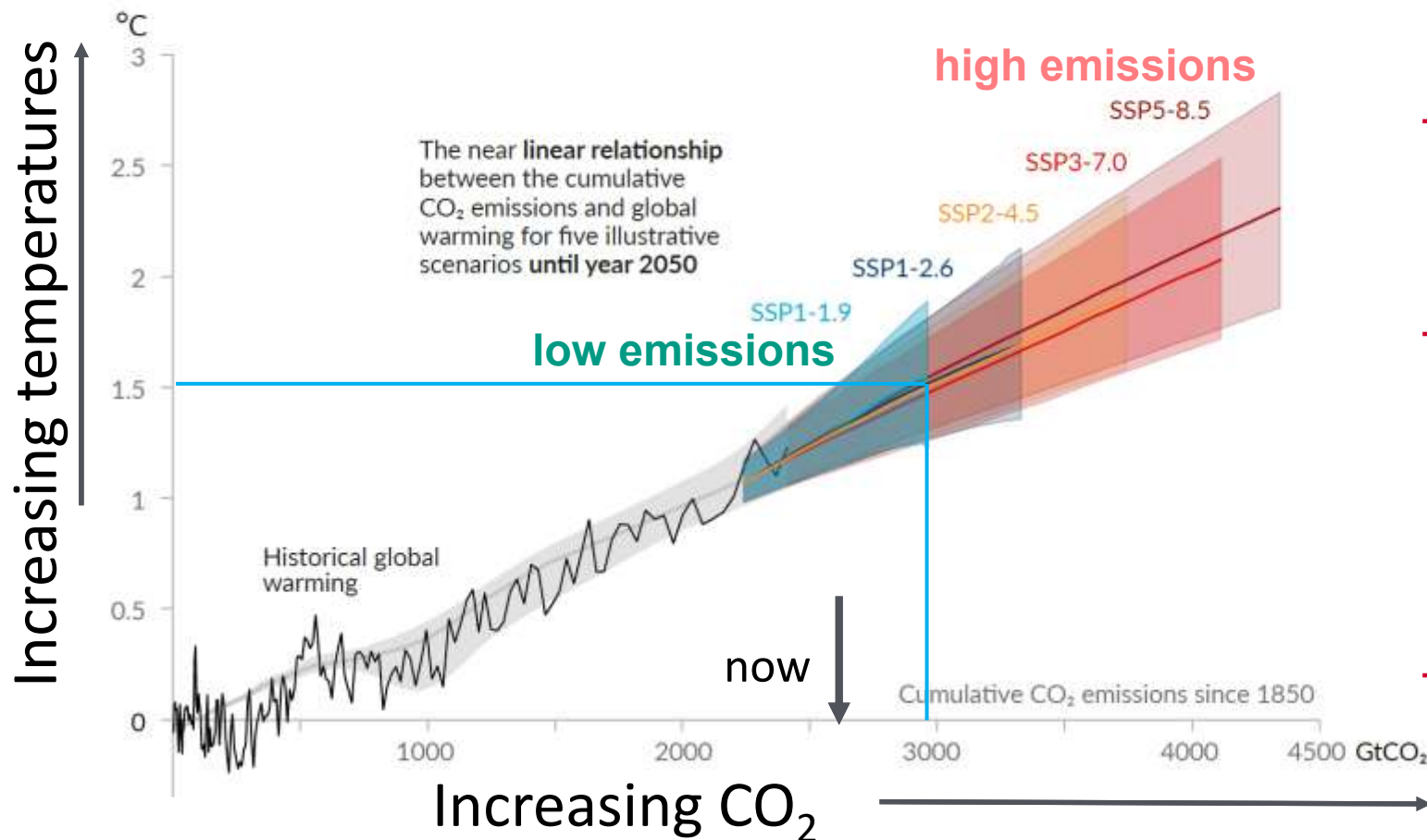
b) September Arctic sea ice area



d) Global mean sea level change relative to 1900



# Limit Carbon Emissions to Avoid Dangerous Climate Change



[IPCC WGI 2021 SPM]

Updates: [globalcarbonbudget.org](https://globalcarbonbudget.org) <250 Gt CO<sub>2</sub> budget for 1.5°C

- Act now

To keep future options open

- Act everywhere

Efforts in all sectors are needed to reach global zero CO<sub>2</sub> emissions

- Act thoughtfully

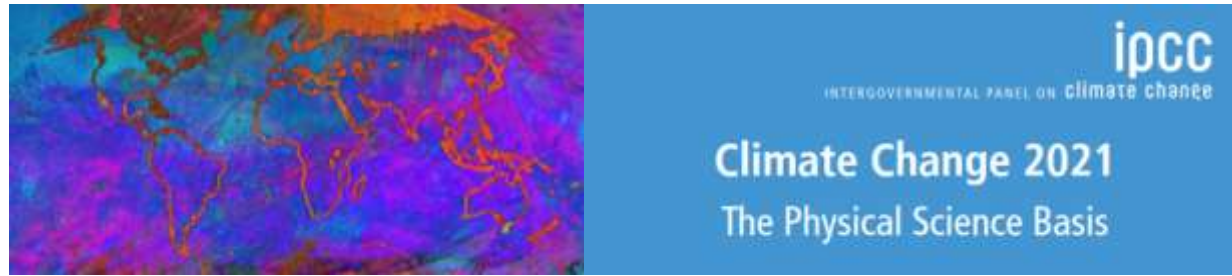
Develop strategies maximising synergies and taking into account the local context, use a wide array of measures and actions

- Act jointly

Collaboratively and including national and sub-national authorities, civil society, the private sector and local communities

Joeri Rogelj (*IPCC AR6 & SR1.5 author*)

# Summary



- Earth's climate has always varied but it is an established fact that human activities are now driving climate change
- Recent changes in climate are widespread, rapid and unprecedented in thousands of years.
- Human activities are intensifying extreme climate events, including heat waves, heavy rainfall, and droughts
- Every bit of global warming increases the magnitude of climate change including the severity of climate extremes
- Limiting warming below 2°C requires immediate, rapid, and large-scale reductions in greenhouse gas emissions

