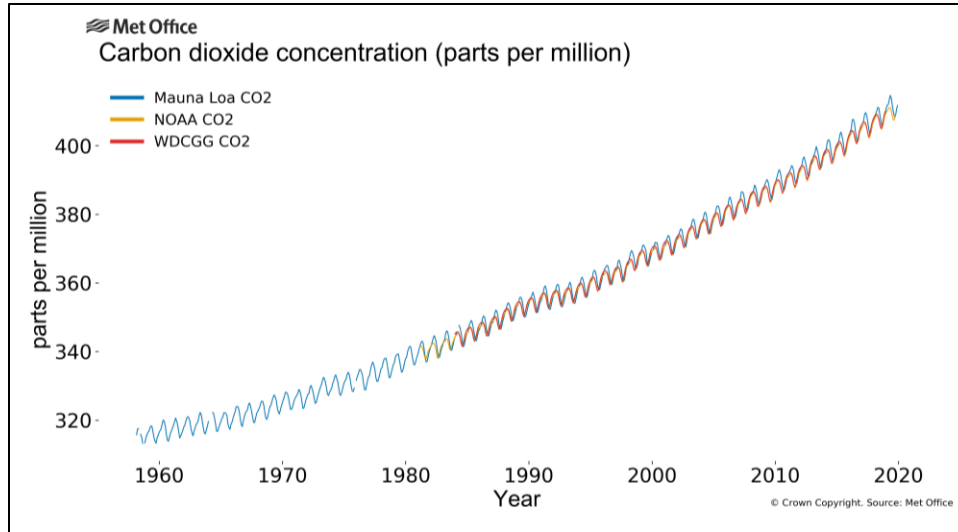
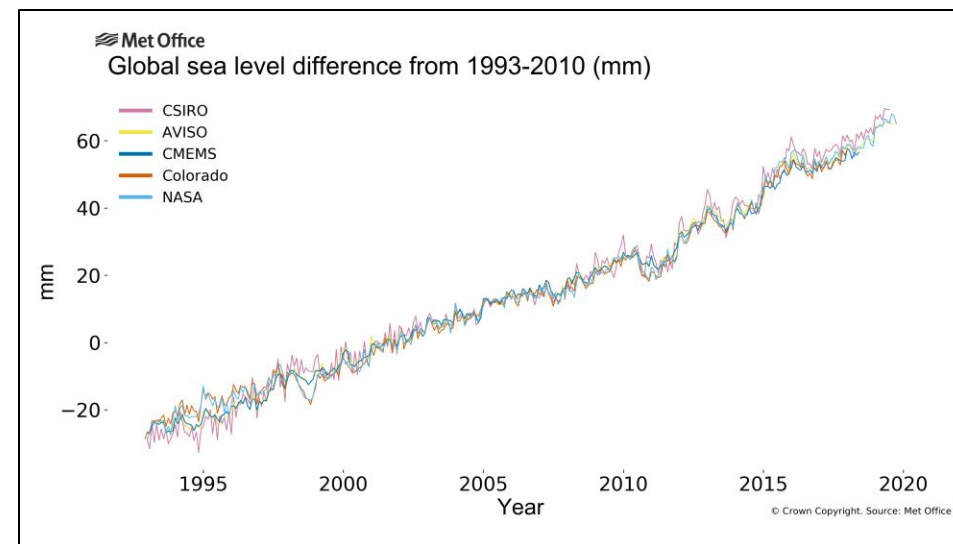
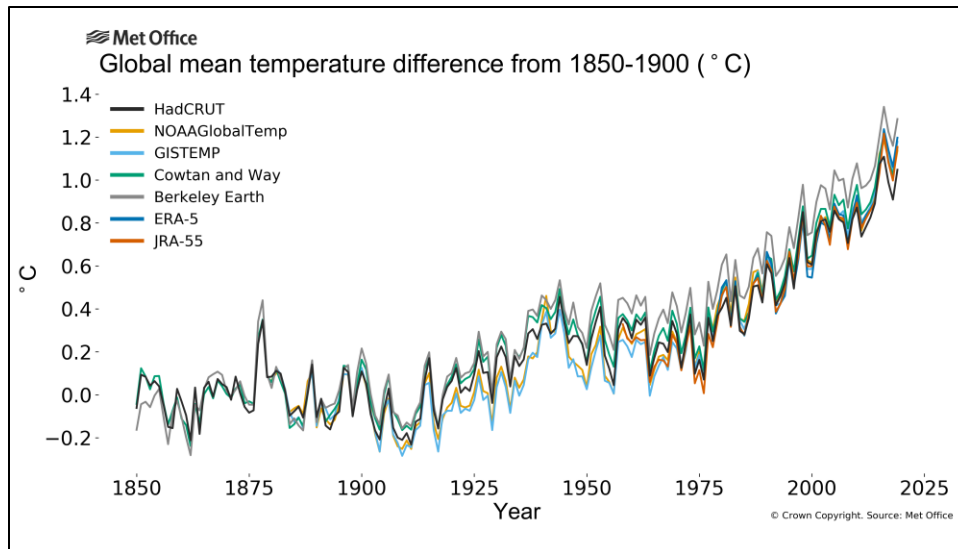
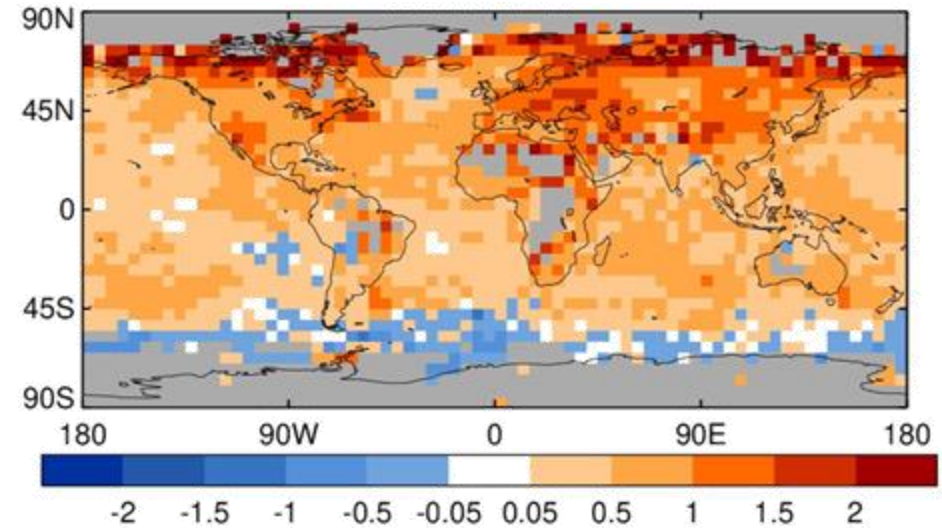


Climate change

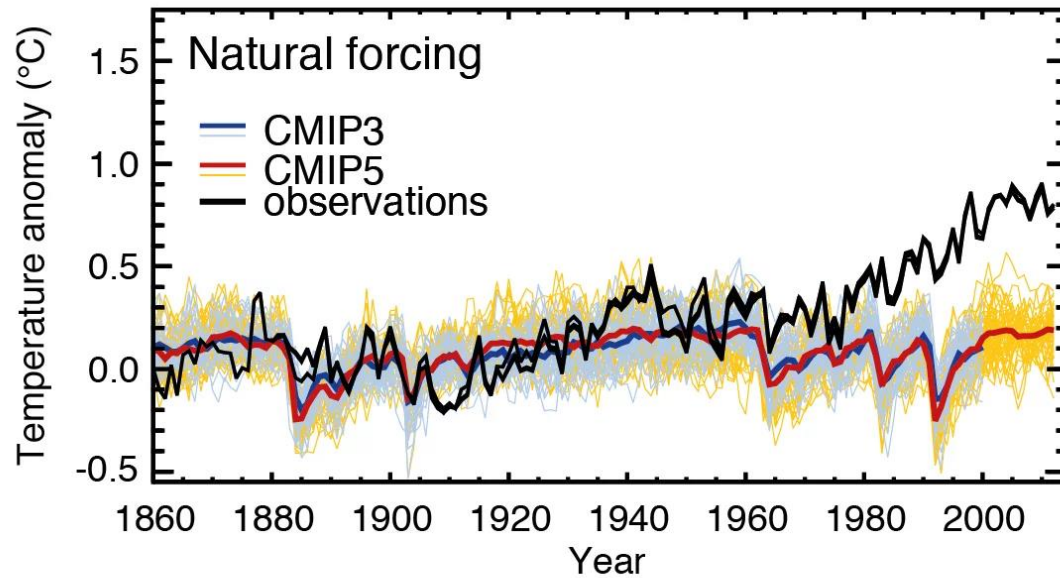
Climate is changing



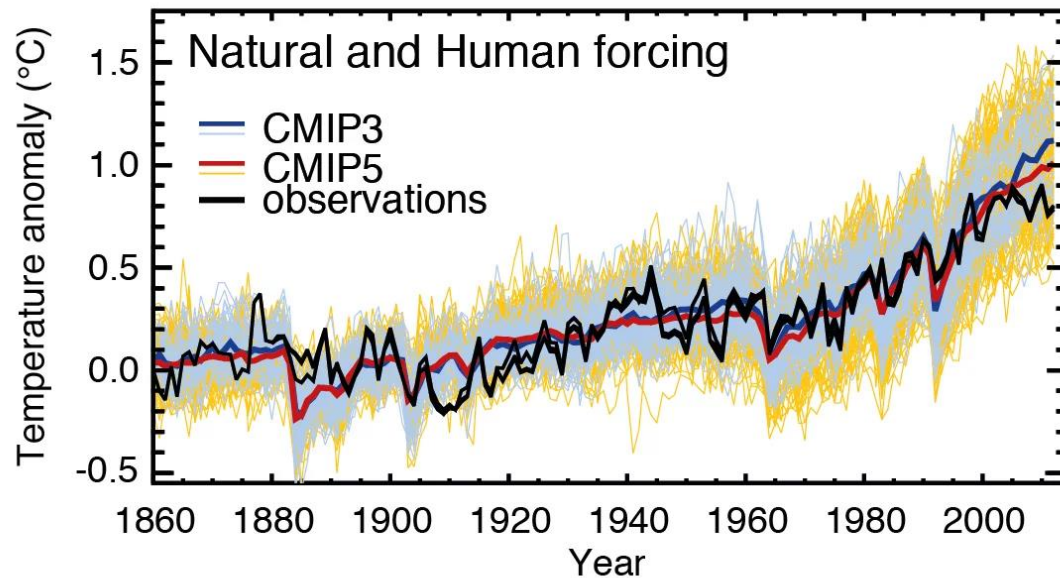
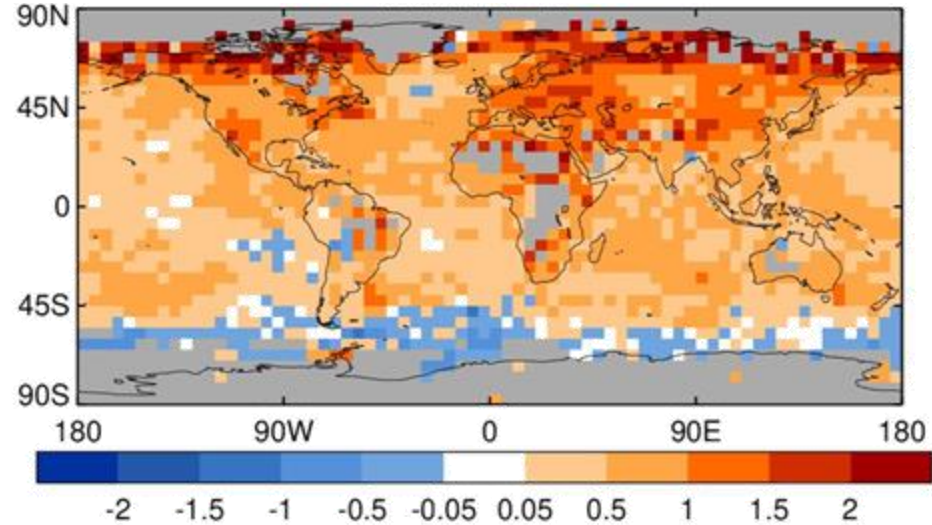
Observed warming 2009 – 2019 relative to 1961 - 1990



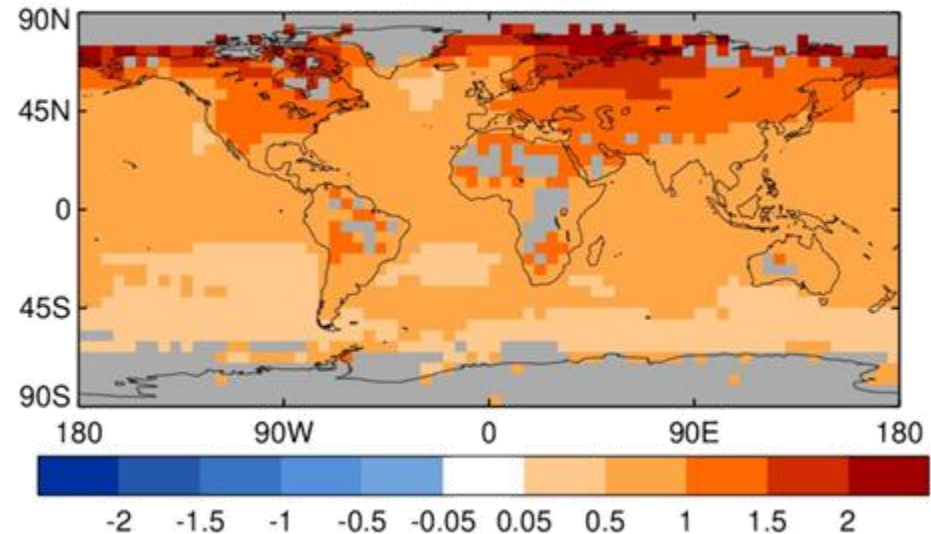
Role of greenhouse gases



Observed warming 2009 – 2019 relative to 1961 - 1990



Average model output output

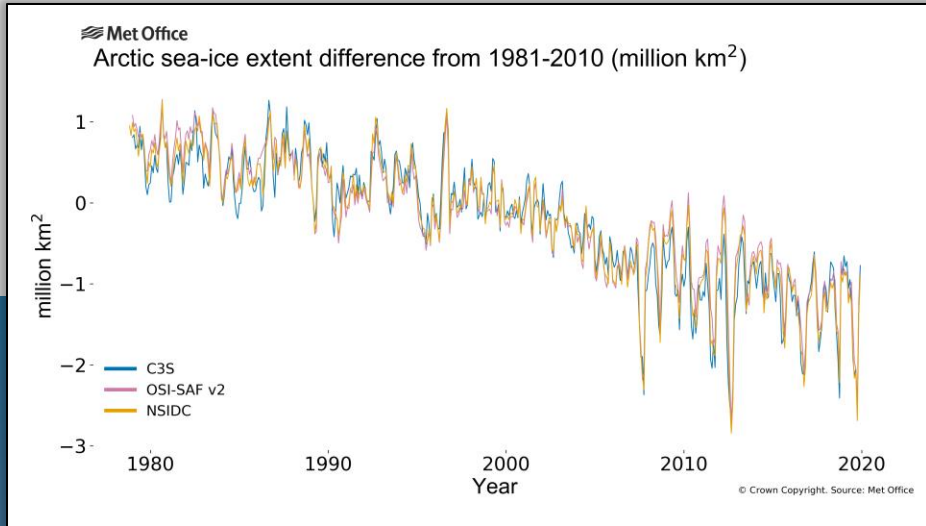


A tipping point



Arctic Sea Ice Loss

The September minimum Arctic sea ice extent in 2019 was the 2nd lowest on record.



Over the last four decades, September Arctic sea ice extent has declined by over 87,000 km² per year equating to an average of 12% per decade.*

Annual loss

87,055 km²

An area greater than Scotland.

Surface area of Scotland = 80,226km² (World Bank)

Decadal loss

870,550 km²

An area greater than the UK, Ireland and France combined.

Surface area of UK, Ireland & France = 862,977km² (World Bank)

40 year loss

3.48 million km²

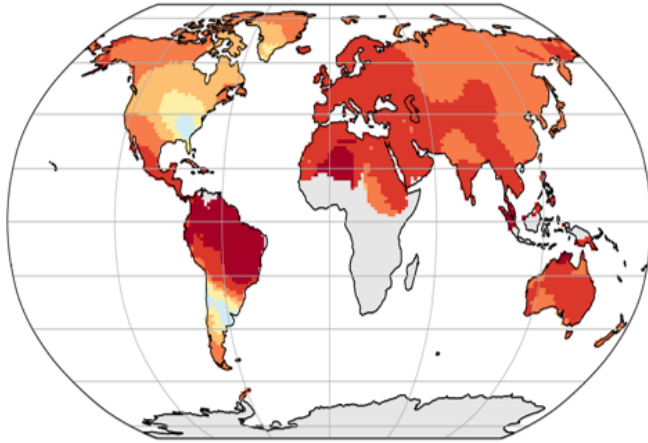
An area greater than India, Bangladesh and Bhutan combined.

Surface area of India, Bangladesh & Bhutan = 3,473,283 km² (World Bank)

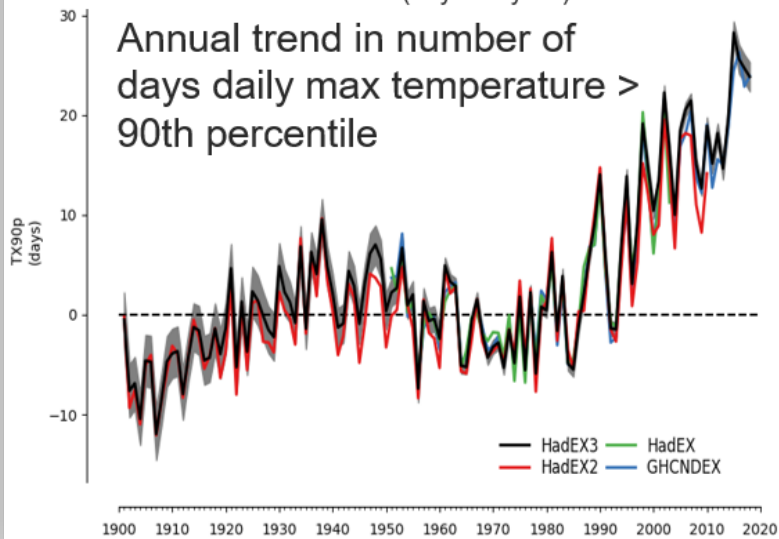
*Source: HadISST.2.2.0.0 dataset. Produced by the Met Office. Met Office and the Met Office logo are registered trademarks. © Crown Copyright 2019, Met Office 01101

More extremes in a warming world

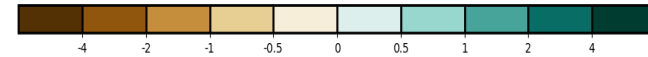
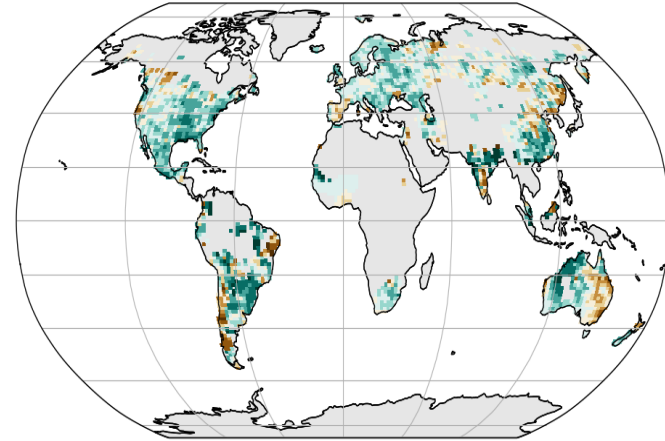
HadEX3 – changes in temperature extremes
1950-2018



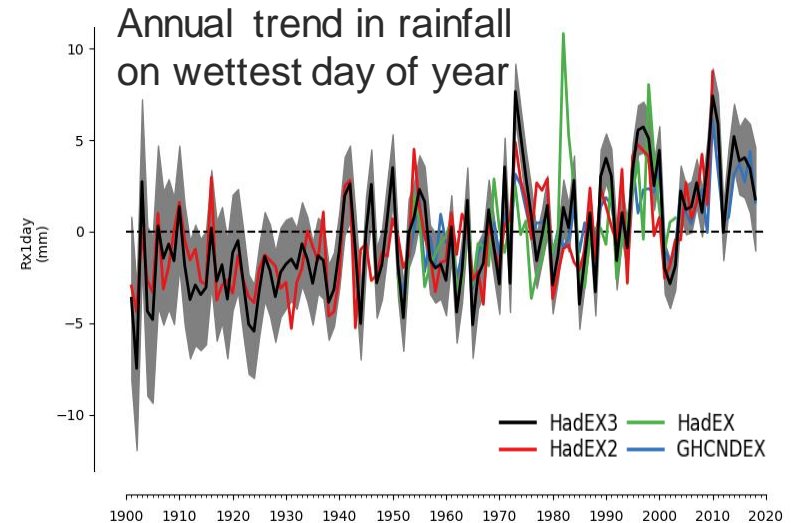
Trend (days/10 year)



HadEX3 – changes in rainfall extremes
1950-2018



Trend (mm/10 year)



Impacts of a warming world

Flooding



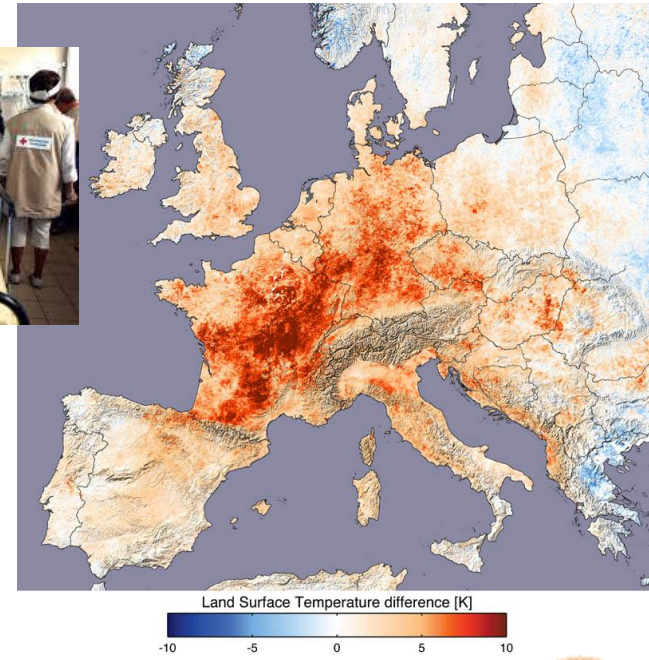
Met Office

UK heavy rainfall / floods

Extended periods of extreme winter rainfall are now 7 times more likely.

x7

Heatwaves and health



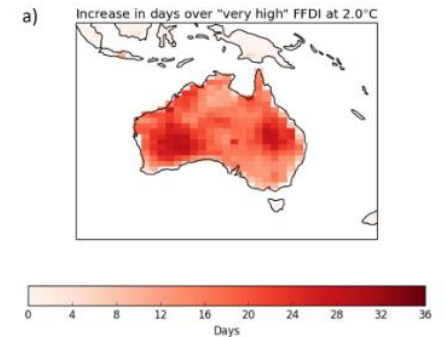
Wildfires



Category	Forest Fire Danger Index
Catastrophic* (code red)	100+
Extreme	75 - 99
Severe	50 - 74
Very high	25 - 49
High	12 - 24
Low - Moderate	0 - 11

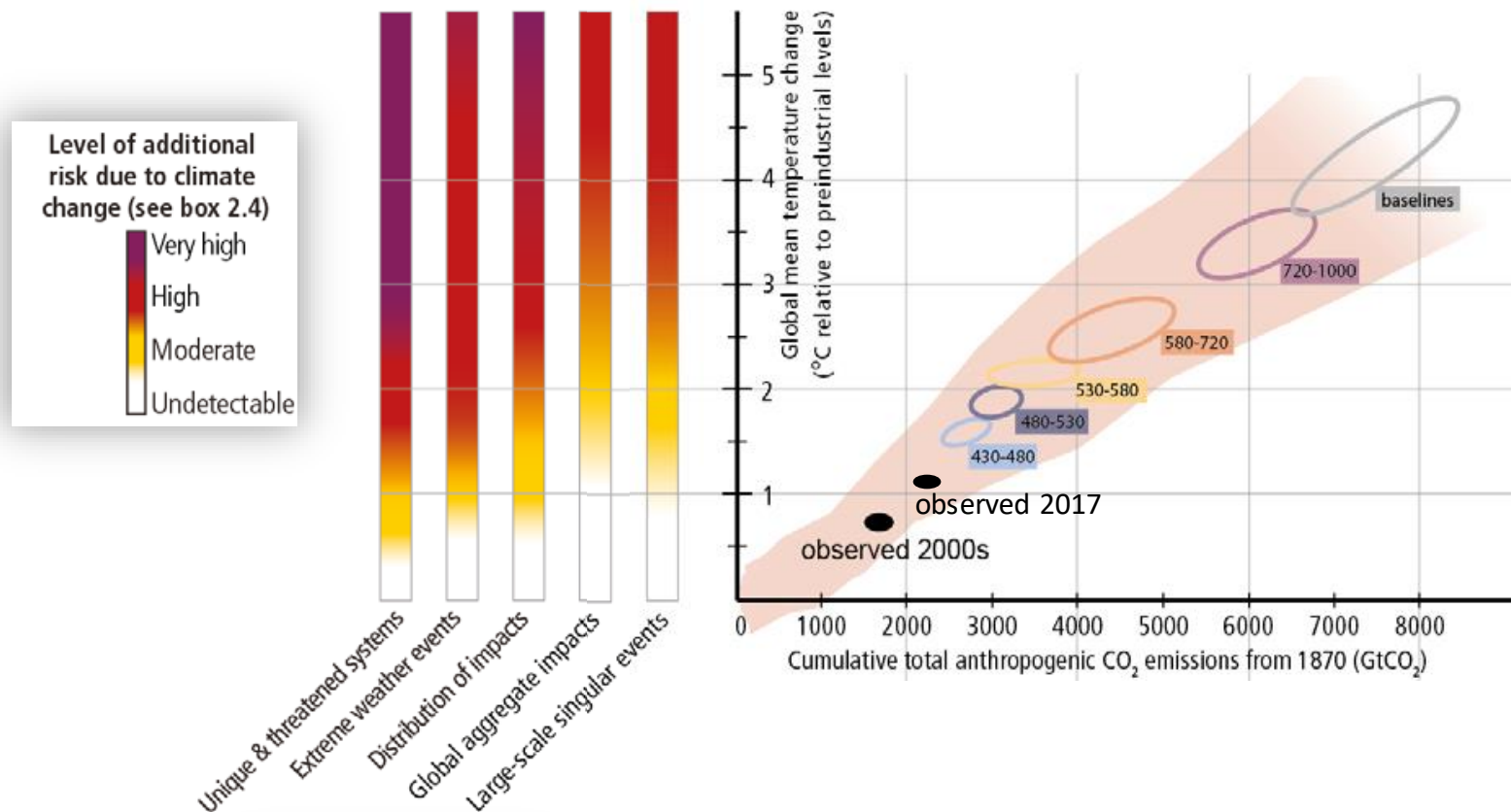
Table 1: McArthur FFDI scale of fire danger.

*Catastrophic refers to fires that spread so quickly that they present a threat to life and safety

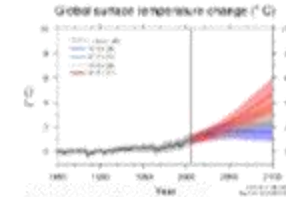


Controlling future warming: carbon budgets

(A) Risks from climate change... (B) ...depend on cumulative CO₂ emissions...



Projections of future climate



CMIP6 (SSPs)

CMIP5 (RCPs)

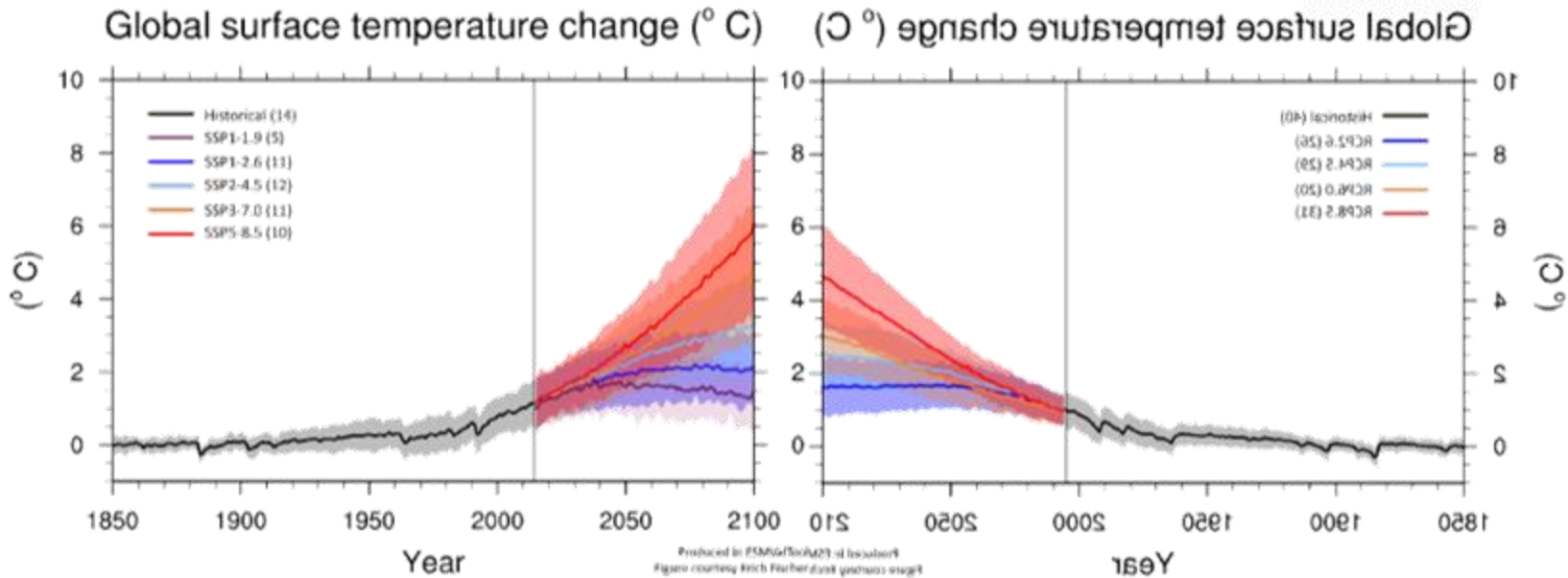
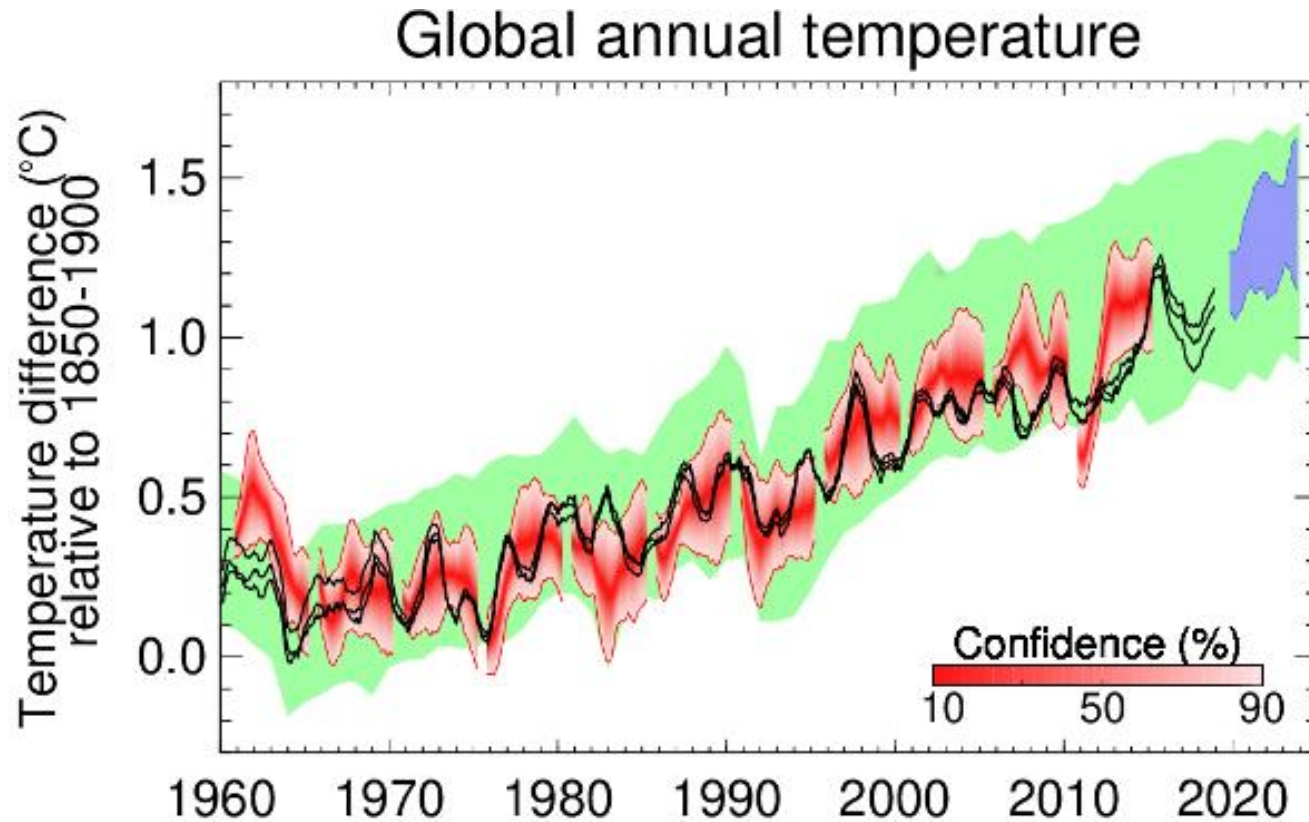


Figure courtesy Erich Fischer

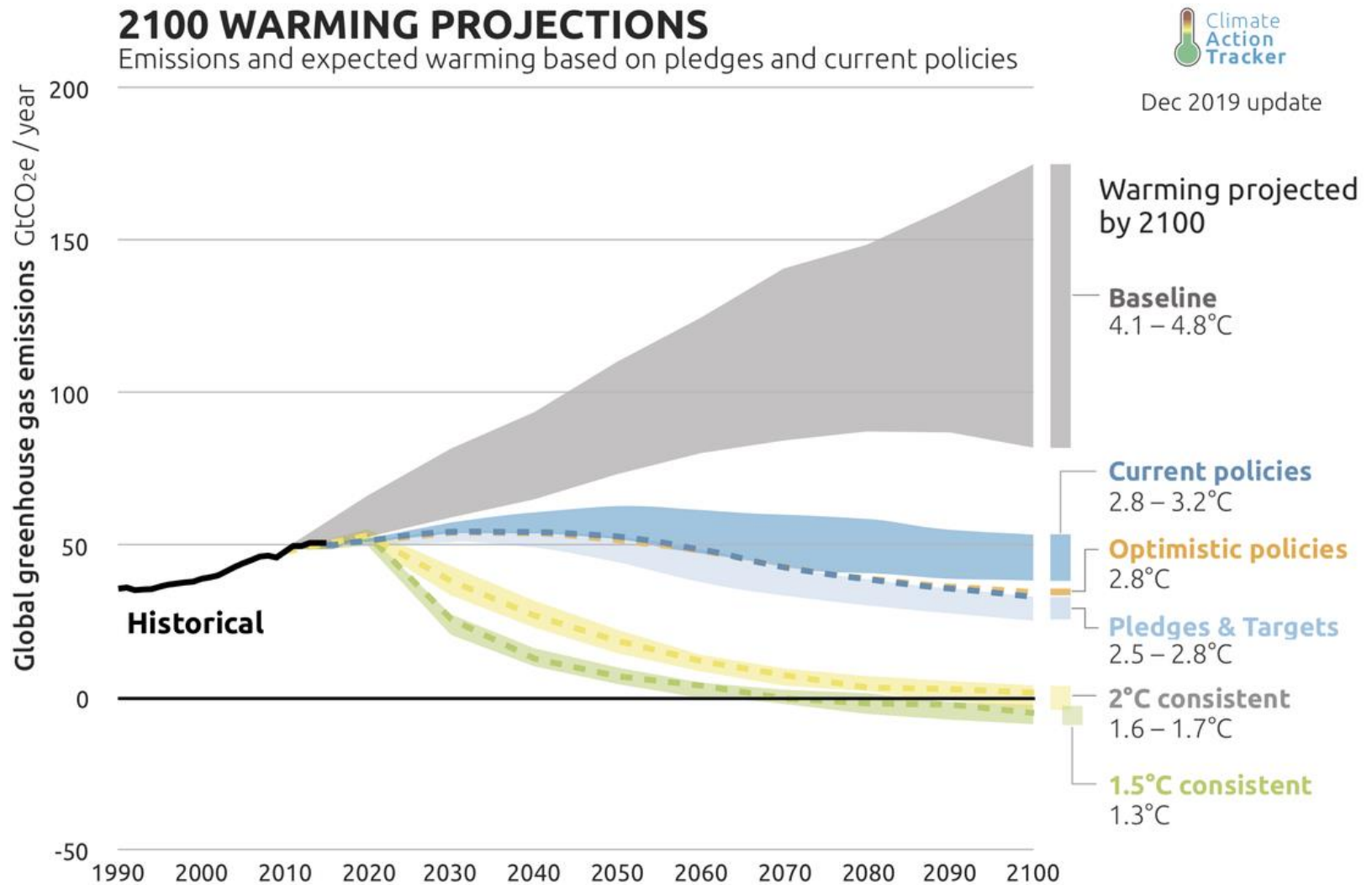


Decadal prediction



Global mean temperature change from new experimental decadal prediction system. Black: Observations; Blue: forecast; Red: previous predictions at 5-year intervals

Limiting climate change



Tipping points:

Tipping point category	Consequences of passing tipping point	Implications for UK projections
Carbon cycle / other biogeochemical cycles <ul style="list-style-type: none">- Amazon forest dieback- boreal forest dieback- Permafrost thawing	Acceleration / lock-in of CO ₂ rise and global warming	Projected UK impacts reached sooner
Cryosphere and sea level <ul style="list-style-type: none">- Greenland ice sheet- West Antarctic Ice Sheet	Acceleration / lock in of sea level rise	Projected UK coastal flooding reached sooner
Ocean / atmosphere circulation <ul style="list-style-type: none">- Atlantic Meridional Overturning Circulation (AMOC)- Jet stream	Shifts in regional climate patterns	UK climate change potentially very different to standard projections