



RMetS

Royal Meteorological Society

Advance the understanding of weather and climate and its application for the benefit of all



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Antarctic Survey

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Climate Change Communication Training

Communicating and acting about climate change

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Ellie Highwood (RMetS)

@RMetS



Myths v Facts

MYTH 1: Younger people are more worried about climate change than older people

- concern is high across all generations
- however younger people are angrier and a little more fatalistic with 1 in 5 under 35s believing it is too late to fix climate change versus 1 in 10 over 50s
- 89% of young people feel concerned about climate change but only a third are talking about it with their friends

MYTH 2: People know what to do but aren't willing to pull their weight : 'Say-do' challenge

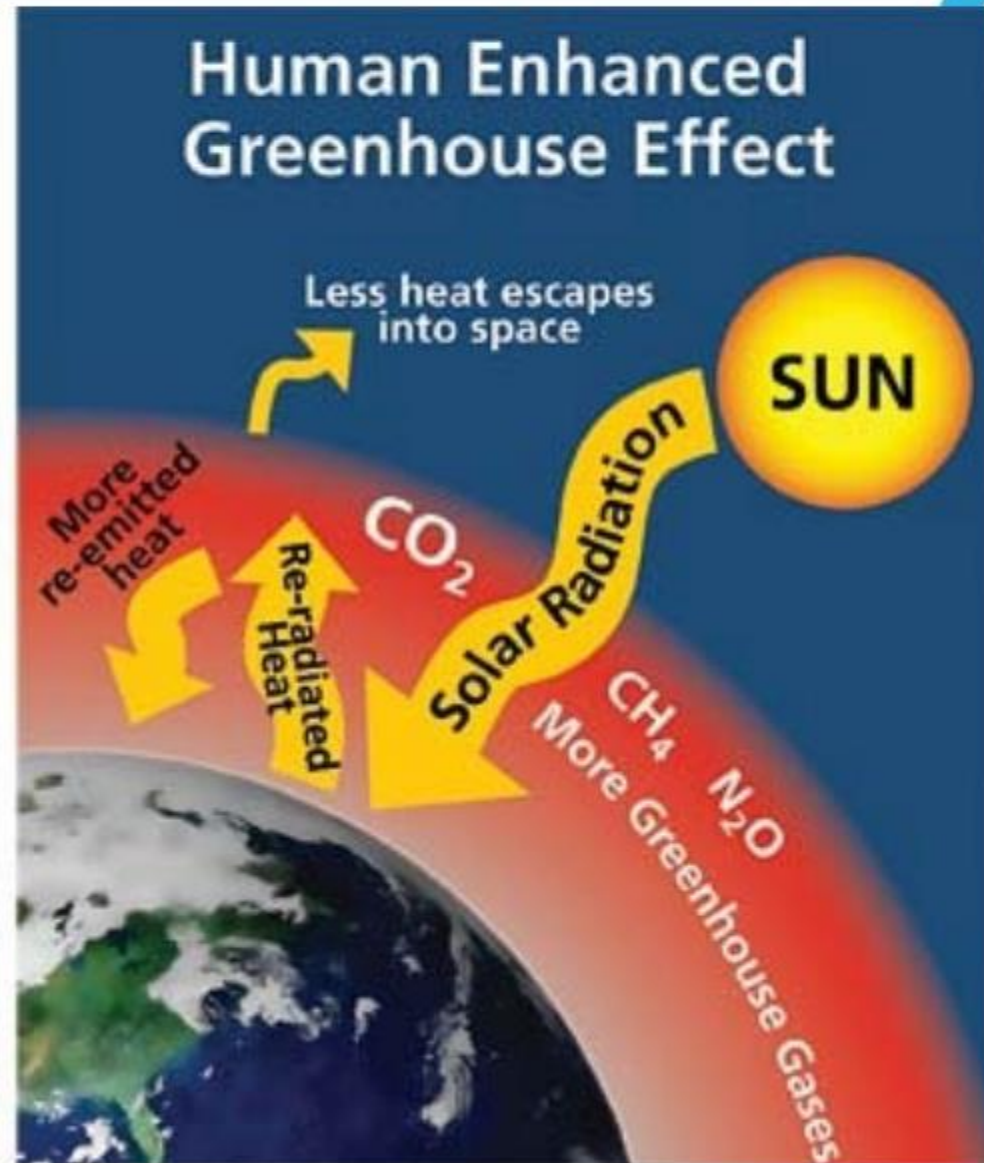
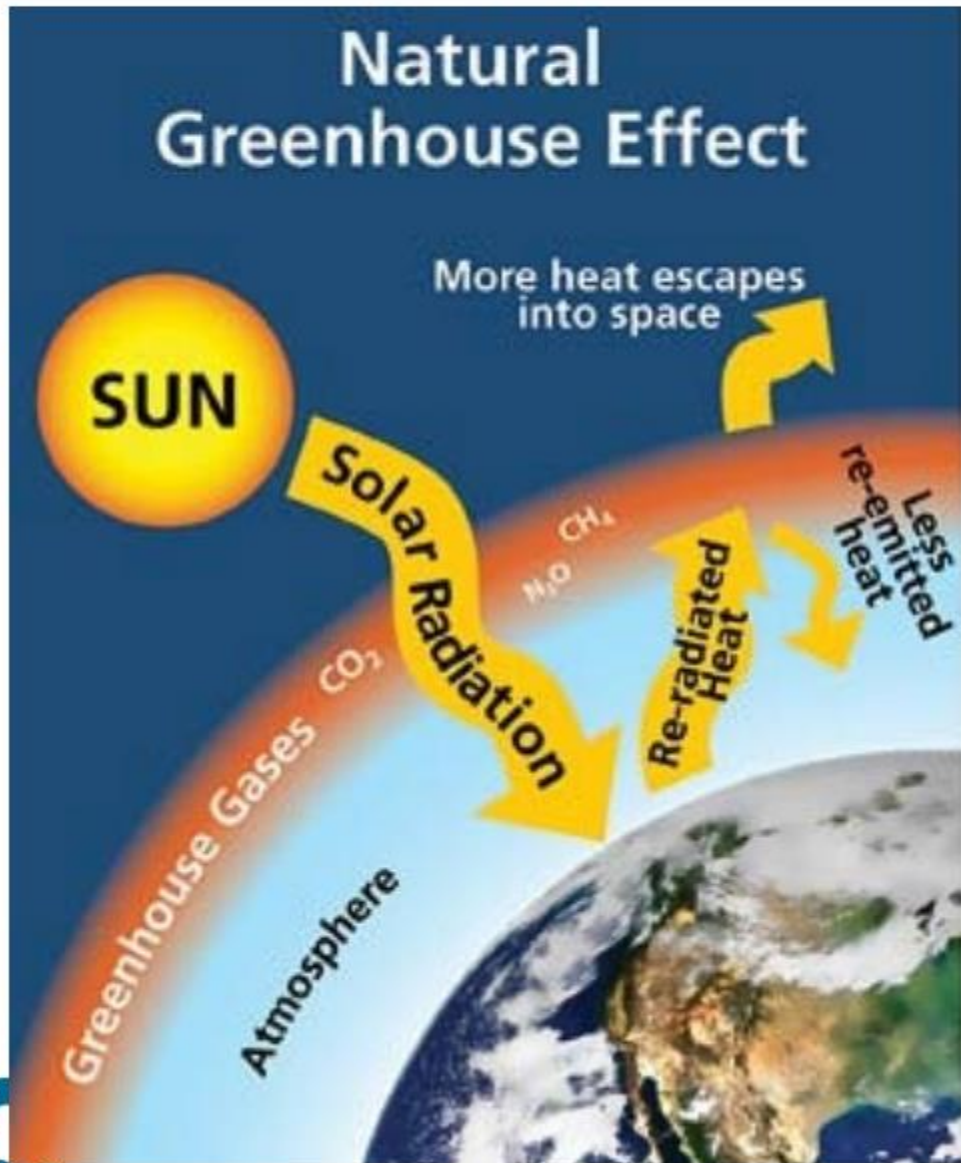
- actually people think they are doing enough already – little change in behaviour over last 7 years
- people overestimate the value of low impact changes and underestimate that of high impact changes.



Climate is what you expect, weather is what you get.

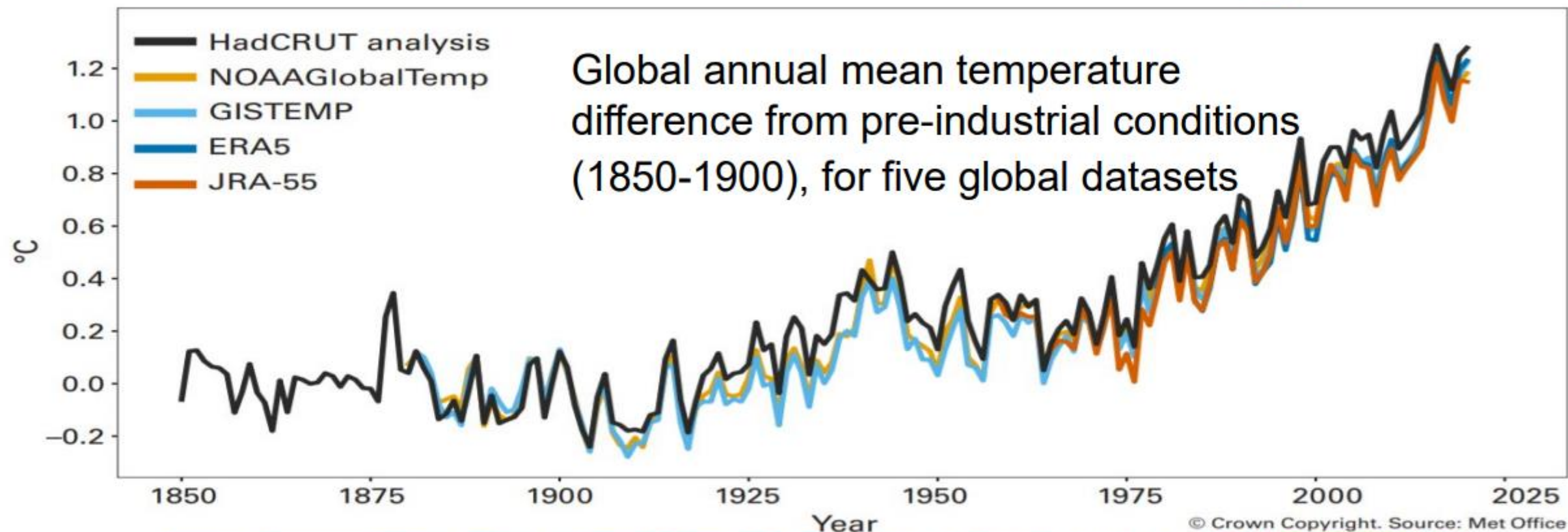
- **Weather** describes the conditions of the atmosphere at a certain place and time
- **Climate** describes the average weather over a period of time (30 years by World Meteorological Organisation)
- When the **climate changes**, this can also impact the weather

How we (humans) warm the Earth



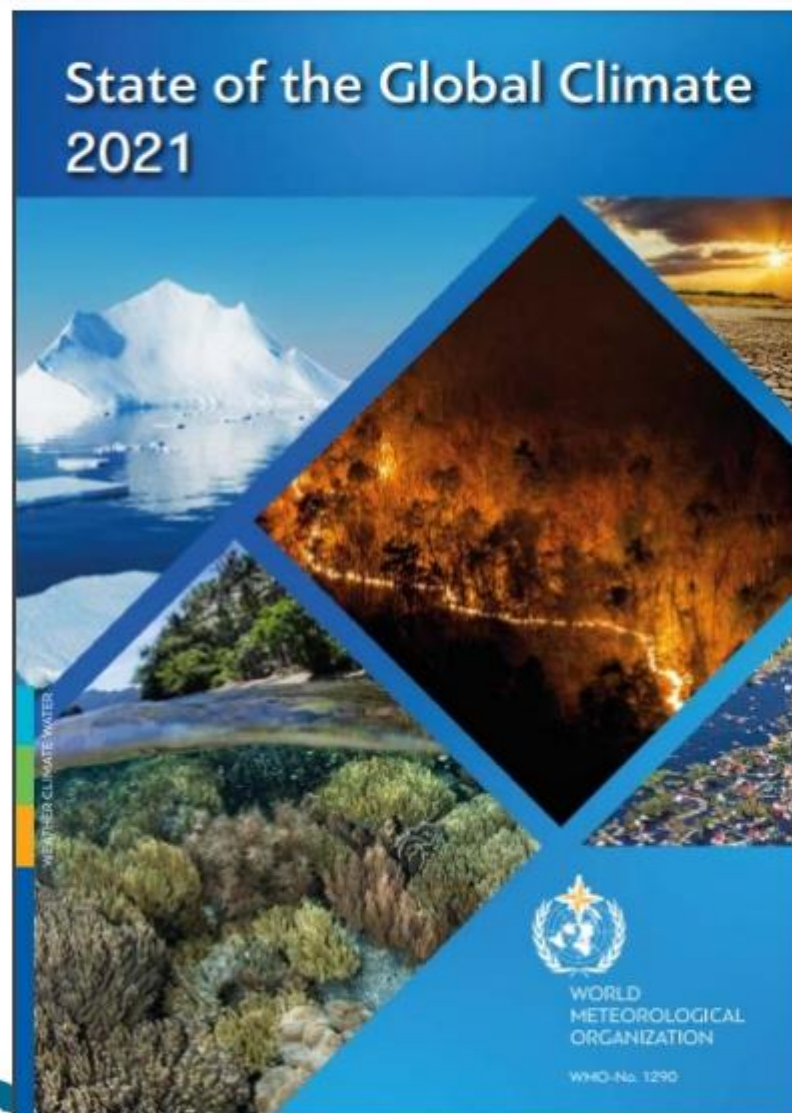
+ feedbacks

Surface temperature



Relative to average 1971- 2000
<https://showyourstripes.info/s/globe>

The story so far?



State of the Global Climate
2021

Global mean surface temperature **$1.2 \pm 0.1^\circ\text{C}$**
above baseline of 1850-1900

7 most recent years 2015-2021 **warmest on record**

2011-2020 **warmest decade** on record

First ever rainfall over Greenland ice sheet

Ice losses from glaciers & ice sheets
accelerating – **8/10 highest ice loss years since 2010**

2020: **2nd warmest year, 2nd lowest minimum Arctic sea ice extent**

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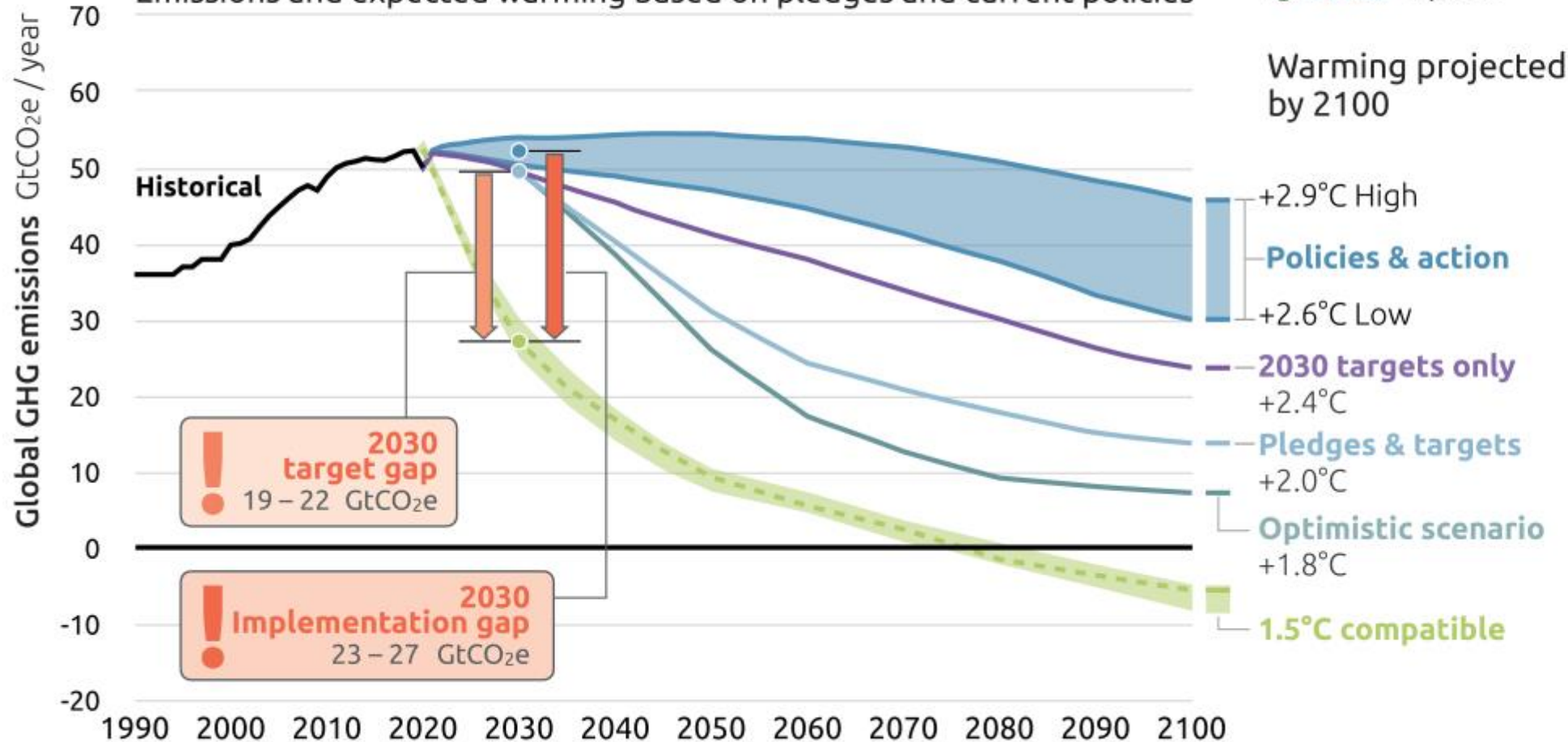
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And the future?

2100 WARMING PROJECTIONS

Emissions and expected warming based on pledges and current policies

Climate Action Tracker Nov 2022 Update



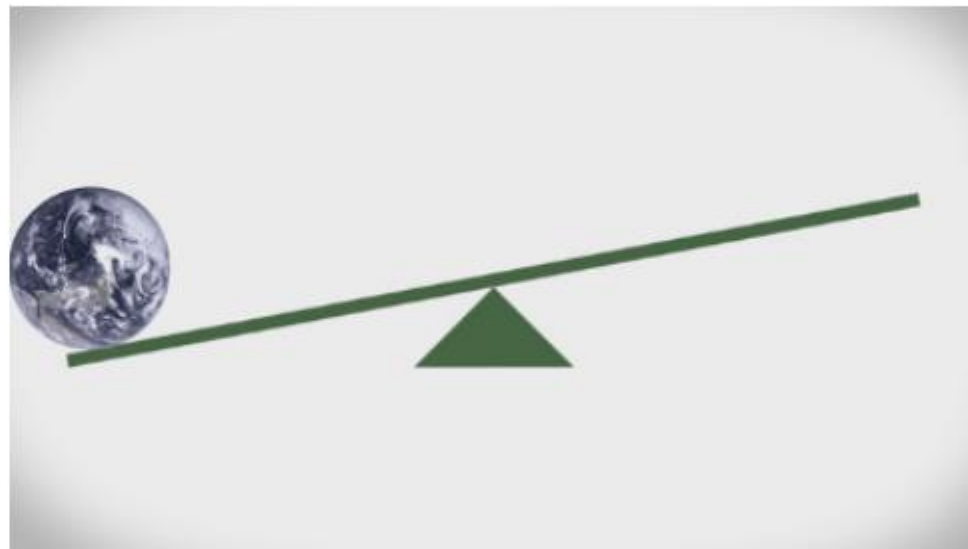
What is “Net Zero”?

Greenhouse gas emissions going into the atmosphere are balanced by removal of greenhouse gases from the atmosphere

- Point at which no longer increasing the duvet thickness
- Maybe more achievable than absolute zero carbon emissions

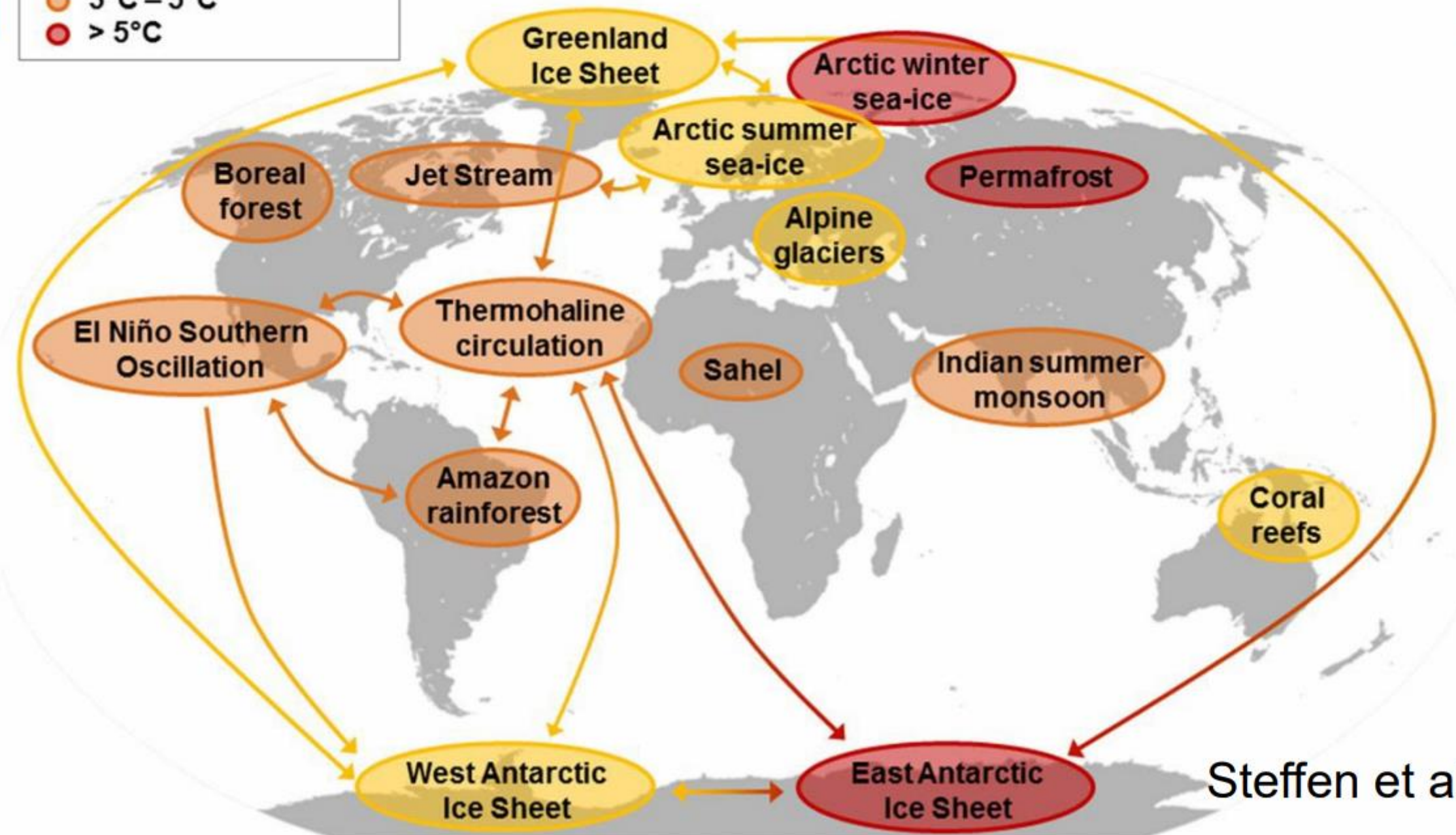
“Tipping points”

- Tipping points are parts of the climate system that we think may undergo a rapid change once the temperature reaches a certain amount.
- Often driven by feedback loops (e.g. the world warms, more water evaporates into the atmosphere, water vapour is part of the planetary “duvet” therefore planet continues to warm).



Tipping elements at risk:

- 1°C – 3°C
- 3°C – 5°C
- > 5°C



Steffen et al. 2018

Climate change consequences impacting the UK

3 examples

Global changes – local impacts

Three consequences of climate change that have big impacts on the UK

- Extreme temperatures and heatwaves
- Sea level rise
- Flooding due to extreme rainfall

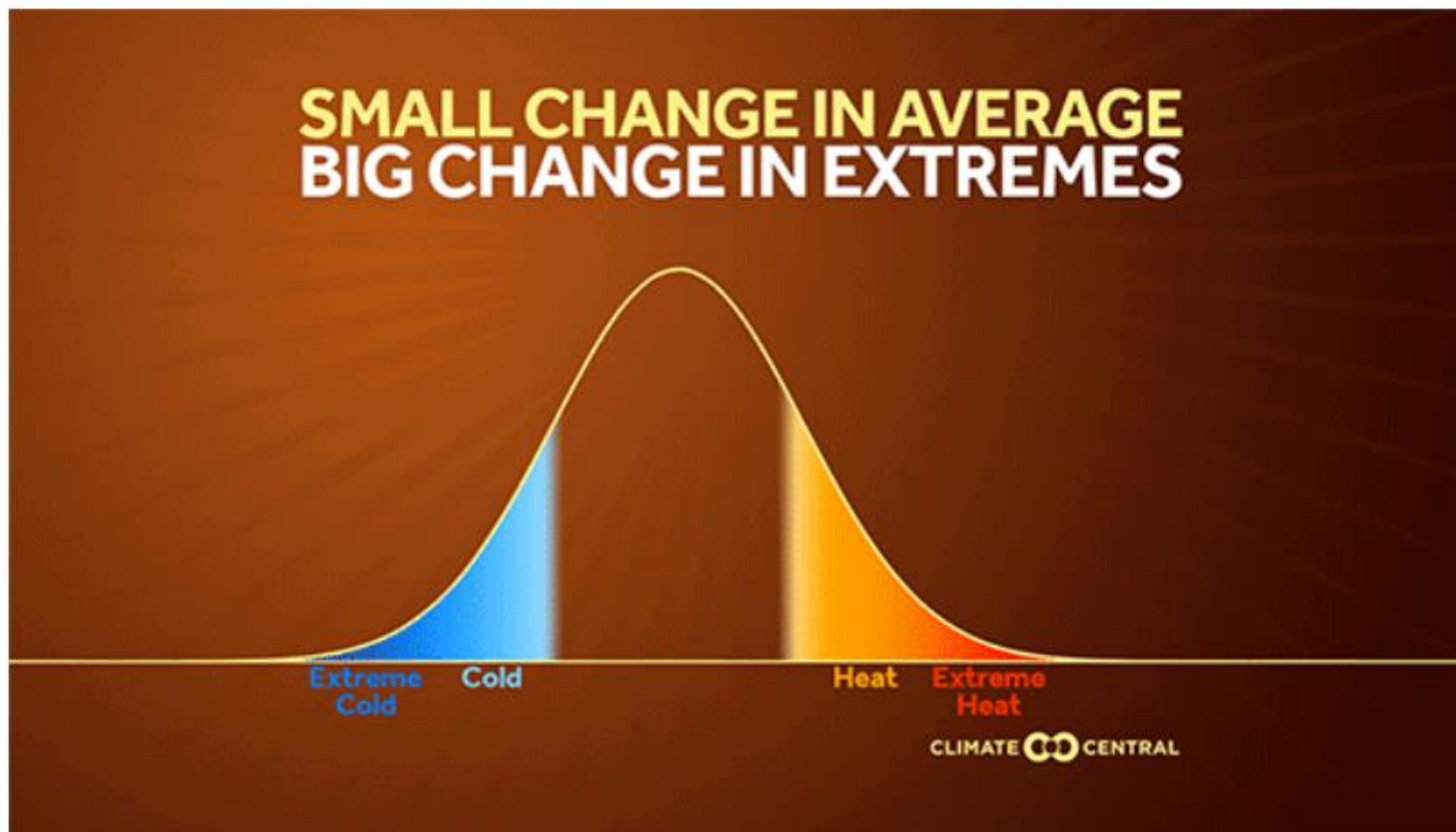
How do each of these influence/impact your context?

What are the opportunities to engage around these topics (especially as they tend to be reported in media)



Consequence 1: Heat waves

Heat waves - the new normal?



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The hottest ten years (since records began in 1884) have all been since 2000

Top ten UK's hottest years all since 2002

Met Office: UK's 10 hottest years on record occurred since 2002

Science & Environment

Climate change: UK's 10 warmest years all occurred since 2002



National Oceanic and Atmospheric Administration
U.S. Department of Commerce

[Search NOAA sites](#)

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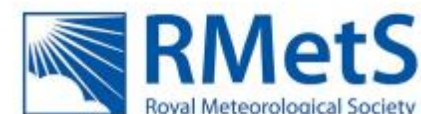
July 2020 was record hot for N. Hemisphere, 2nd hottest for planet

Arctic sea ice melted to record lows

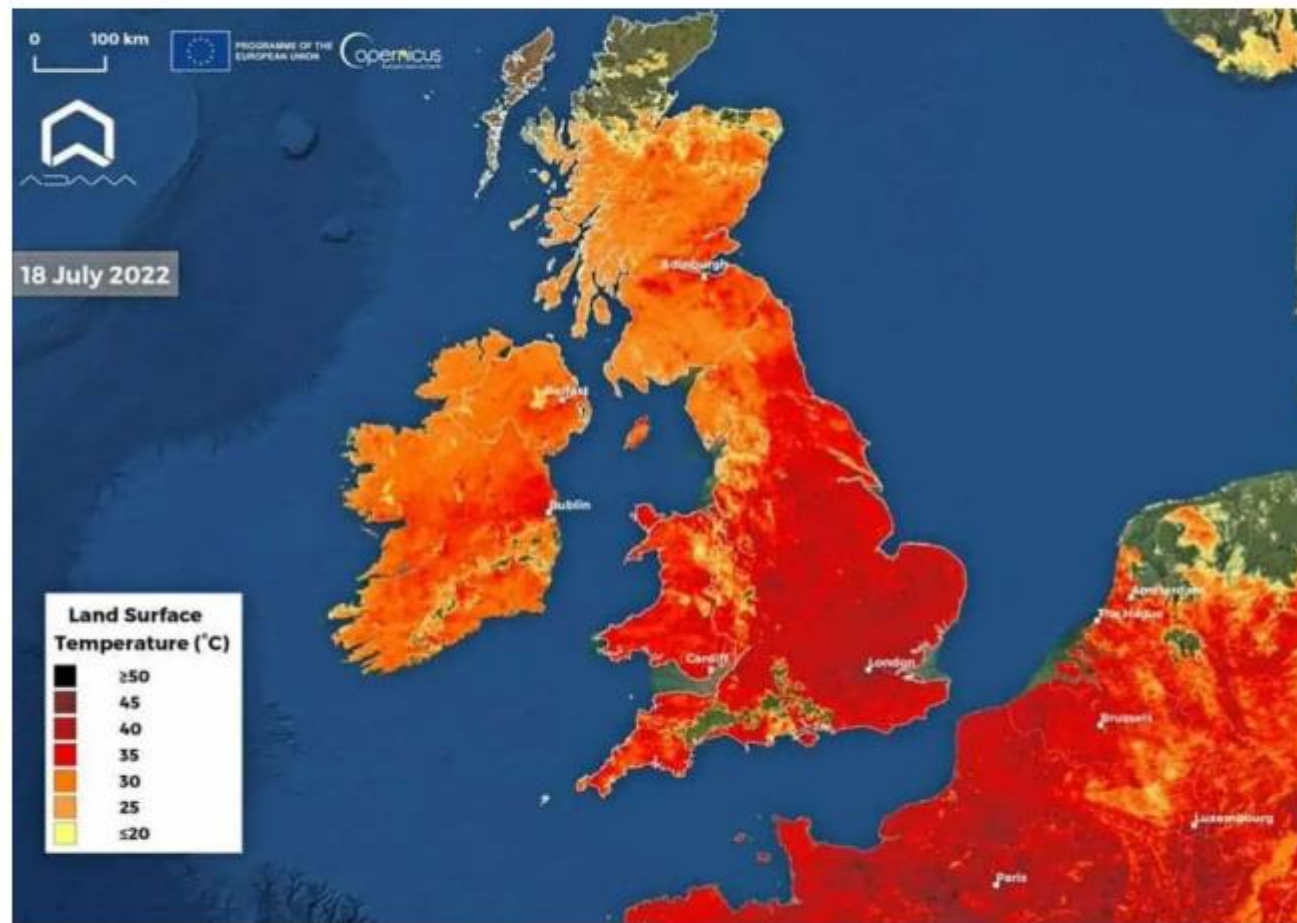


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European heatwave July 2022



Record-breaking European heatwave of July 2022

First 40°C in UK history
2800 excess deaths in over 65s (England)

Made 10 x more likely by climate change

Interesting shift from “lovely hot weather” to “danger” in media presentation



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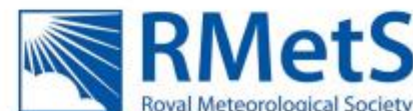




Photo: REUTERS/Florion Goga

Burned area equivalent to
a fifth of Belgium

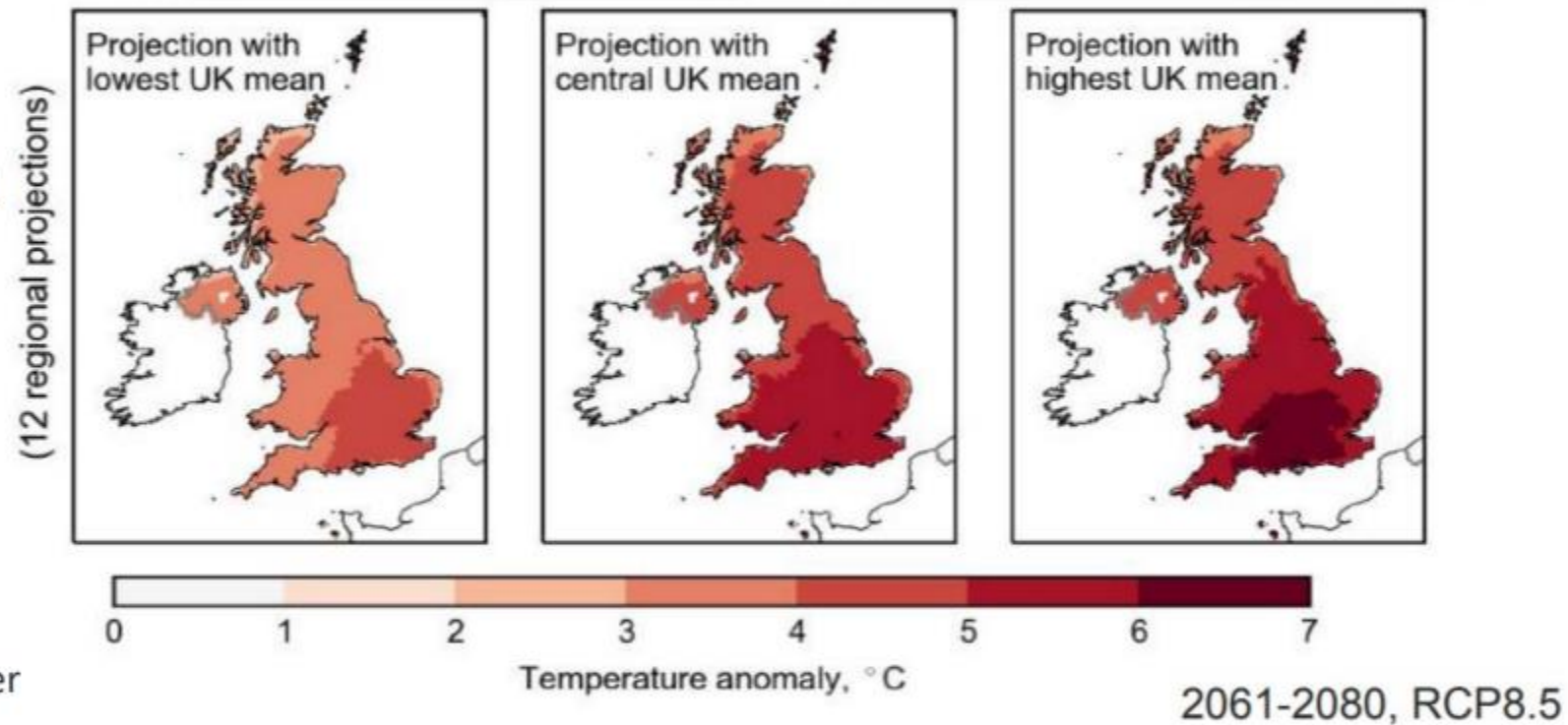
2022 burned area twice the
size of last 15 years'
average burned area

UK climate projections

Headline Result:

“All areas of the UK are projected to warm, with a greater chance of warmer, wetter winters and hotter, drier summers”

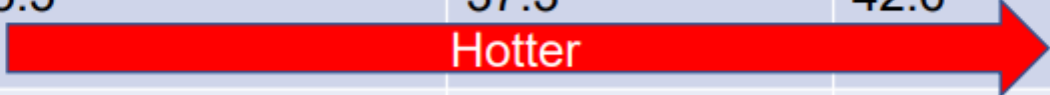
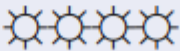

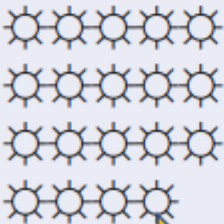




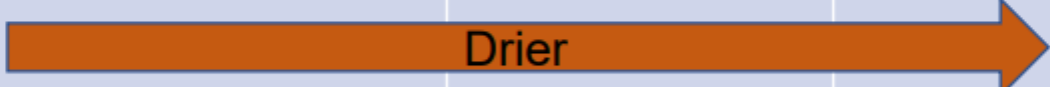
- Winter will be between 1 and 4.5°C warmer and up to 30% wetter
- Summer will be between 1 and 6°C warmer and up to 60% drier



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Local heatwaves – England (Reading)

	Current (2019)	+ 2 C global T change	+4 C global T change
Hottest summer day	35.5	37.3	42.6
			
Average number of days per month warmer than 25 deg C			
			
Average number of summer rainy days per month			
			

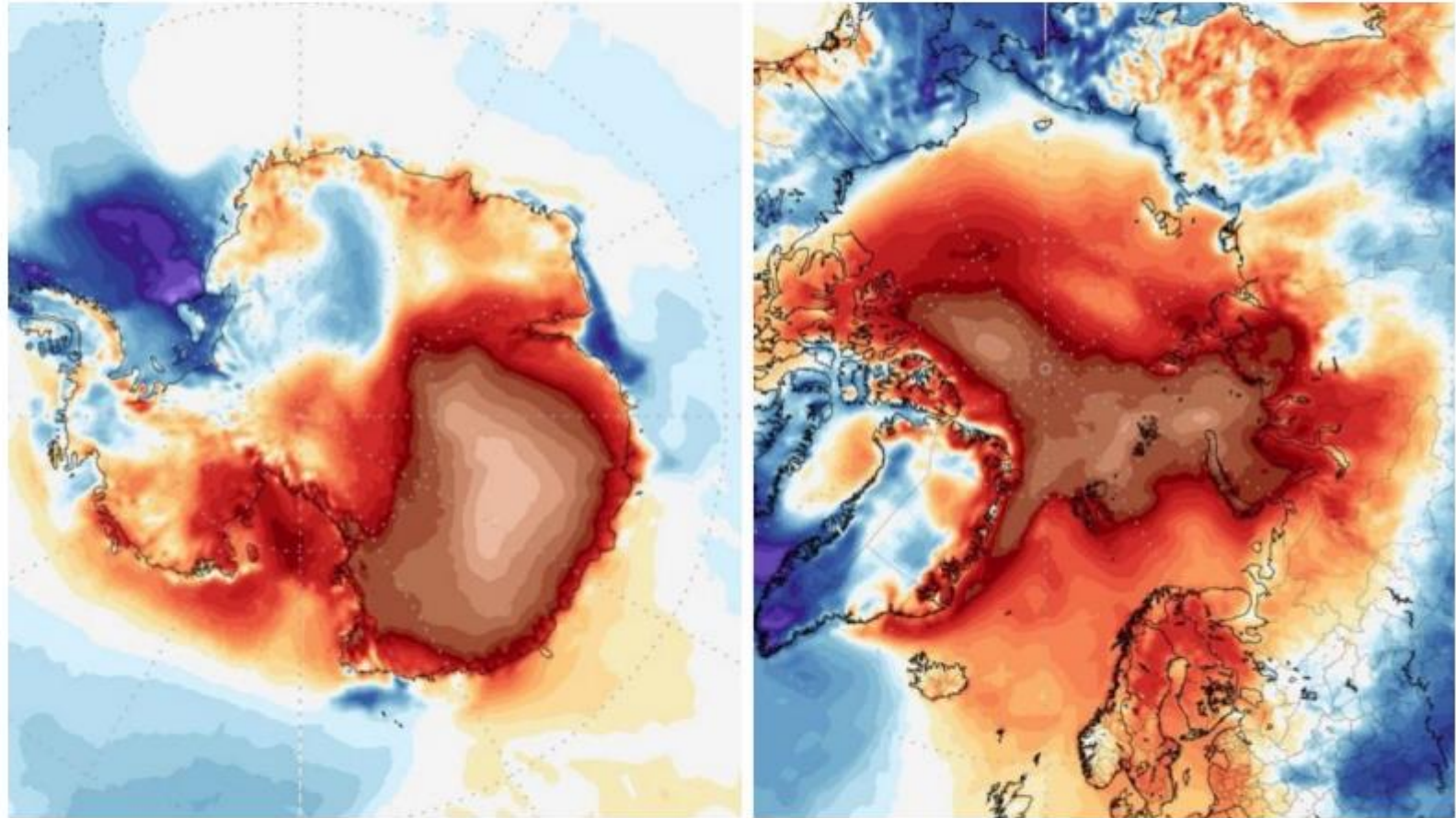
<https://www.bbc.co.uk/news/resources/idt-d6338d9f-8789-4bc2-b6d7-3691c0e7d138>

Polar heatwaves

March 2022:
simultaneous
heatwaves in the
Arctic and Antarctic

Antarctic: **+40°C**

Arctic: **+30°C**



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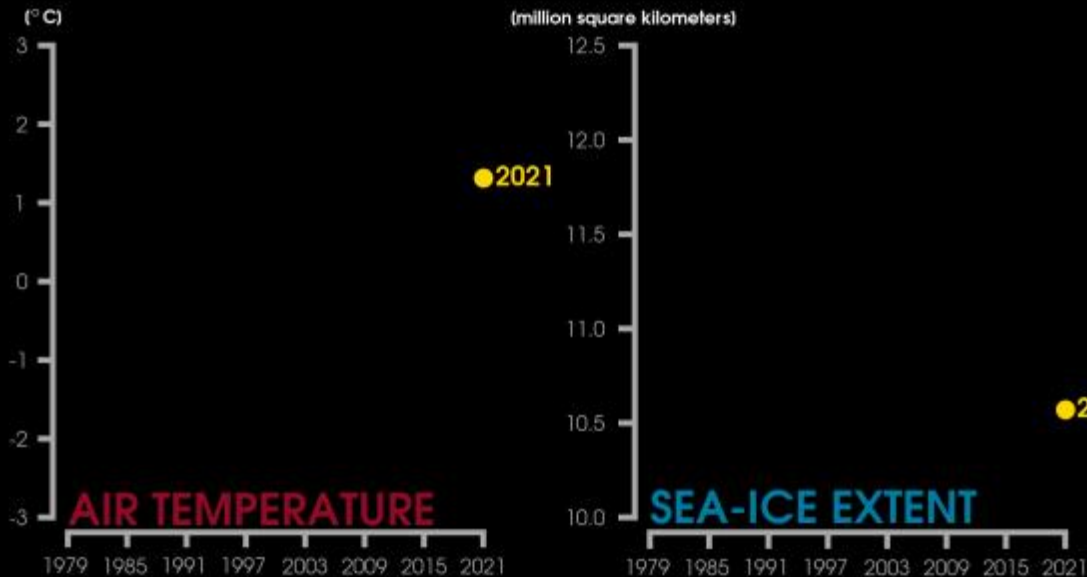
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Image: NSIDCc



Arctic sea ice loss

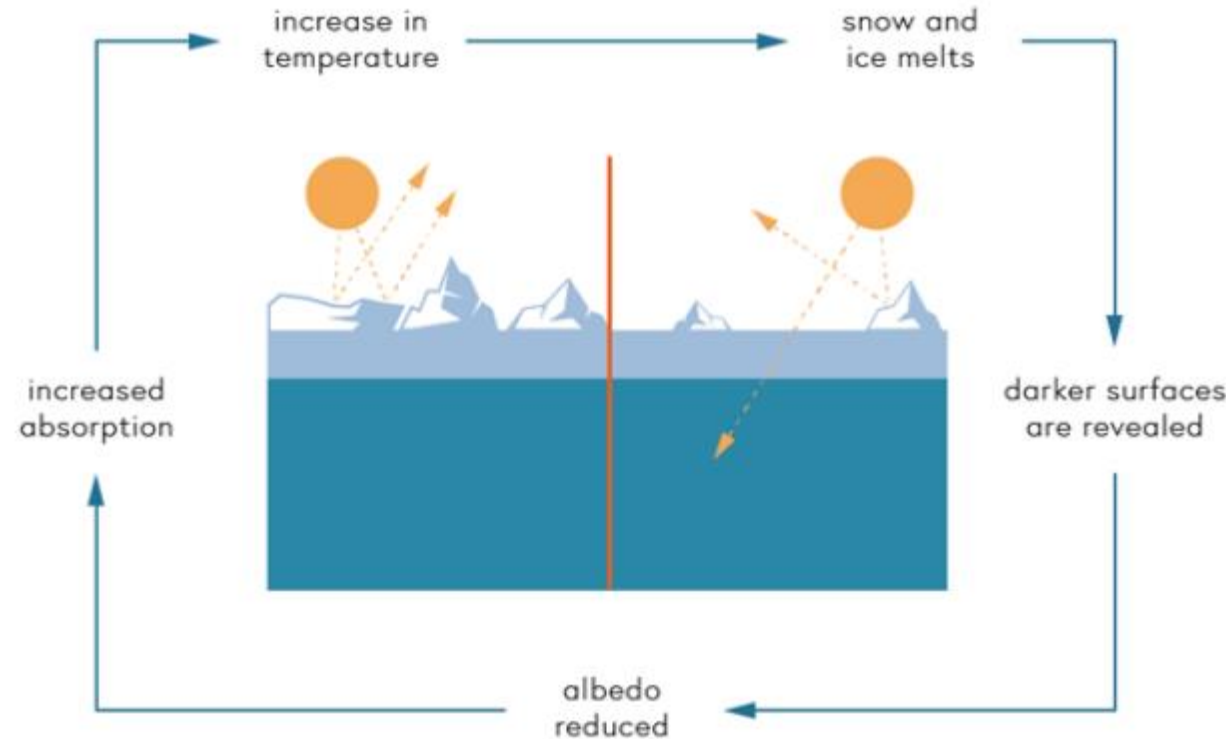
ARCTIC CLIMATE



DATA: Berkeley Earth Data using NOAA/ESRL (WRT Tool: +57°N)
SOURCE: <https://www.esrl.noaa.gov/psd/cg-bin/data/hst/da/p/timeseries.pl>
BASELINE: temperature anomalies computed from 1981-2010

DATA: NSIDC Sea Ice Index v3.0 (ANNUAL, Satellite)
SOURCE: <ftp://sidads.colorado.edu/DATASETS/NOAA/G02135>
GRAPHIC: Zachary Labe (@ZLabe)

Source: Zack Labe

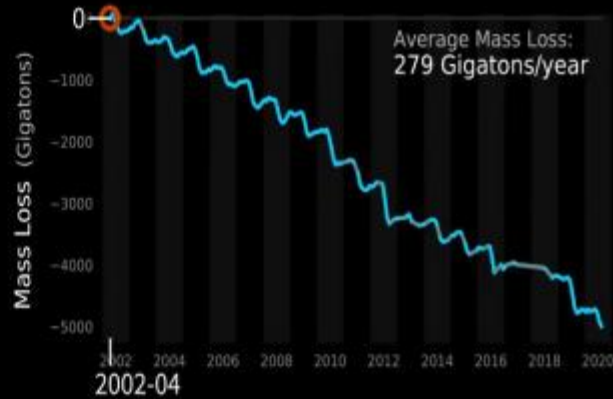


Source: Open University / Met Office

Ice loss from ice sheets



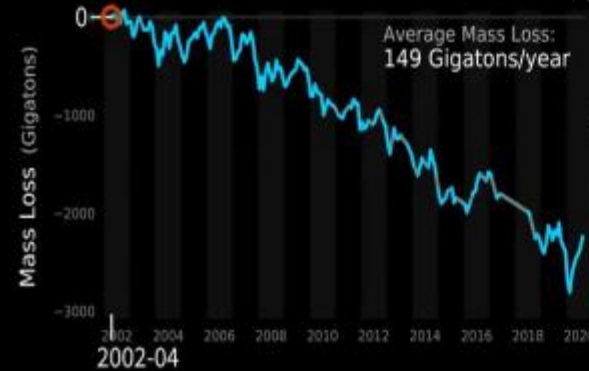
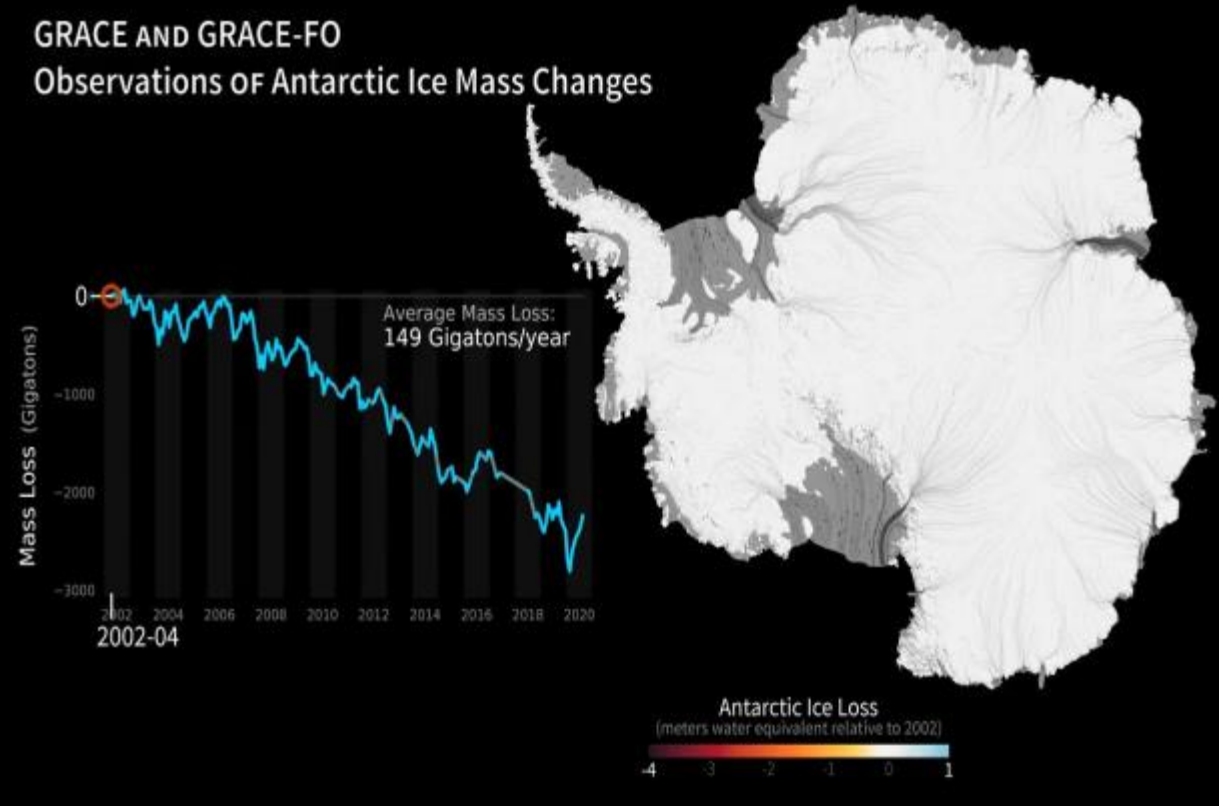
GRACE AND GRACE-FO
Observations of Greenland Ice Mass Changes



Greenland Ice Loss
(meters water equivalent relative to 2002)

-5 -4 -3 -2 -1 0 0.5

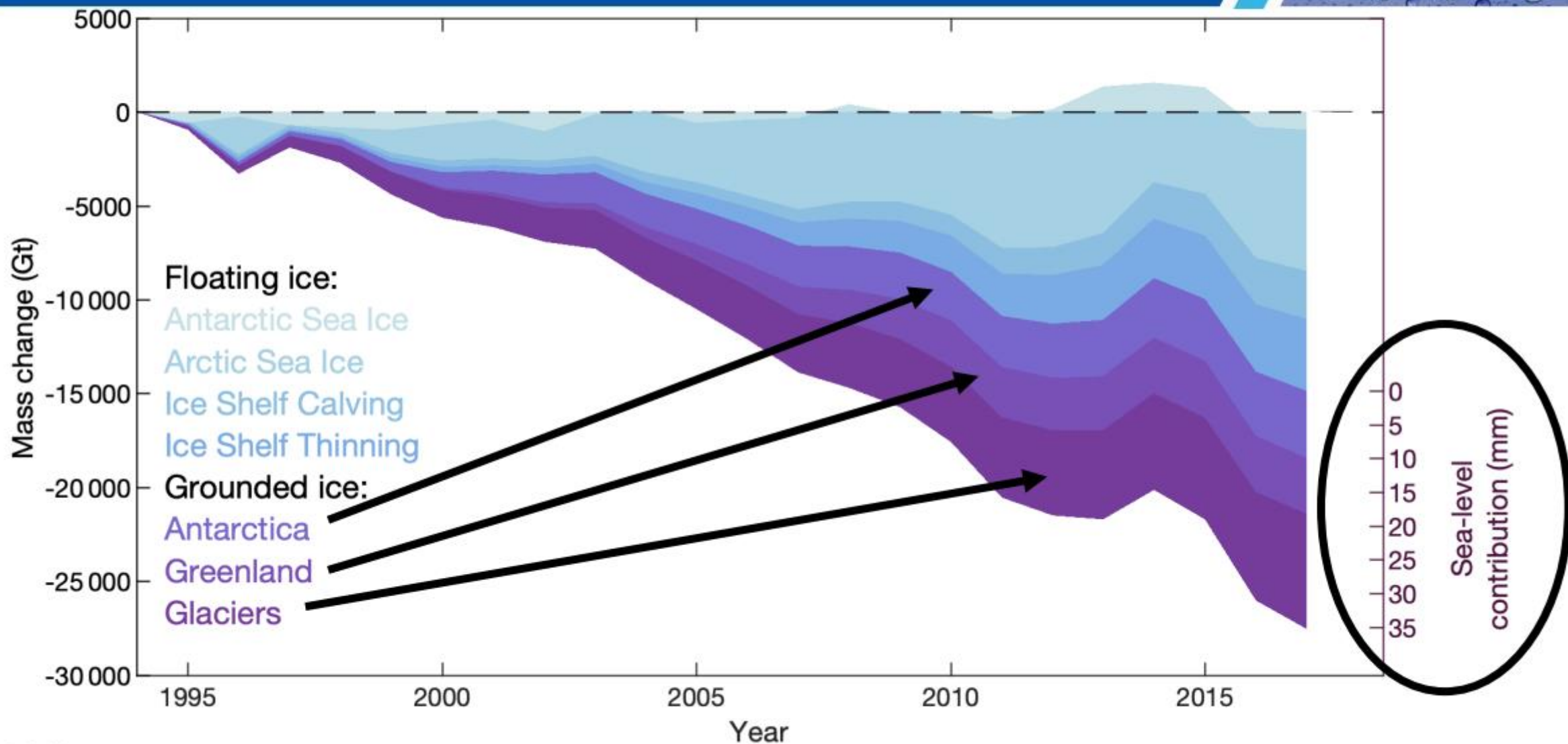
GRACE AND GRACE-FO
Observations of Antarctic Ice Mass Changes



Antarctic Ice Loss
(meters water equivalent relative to 2002)

-4 -3 -2 -1 0 1

Ice melt and sea level



Consequence 2: Sea level rise

Global sea level rise



2 metres

1.2 metres

0.3 metres
(30 centimetres)
1 "long" ruler
Approx 1 page A4



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UK sea level rise projections

Sea-level rise

Increase will generally be greater in the south than in the north

■ Range in low emission scenario ■ Range in high emission scenario

(by 2100 relative to 1981-2000)



Source: UK Climate Projections / MetOffice

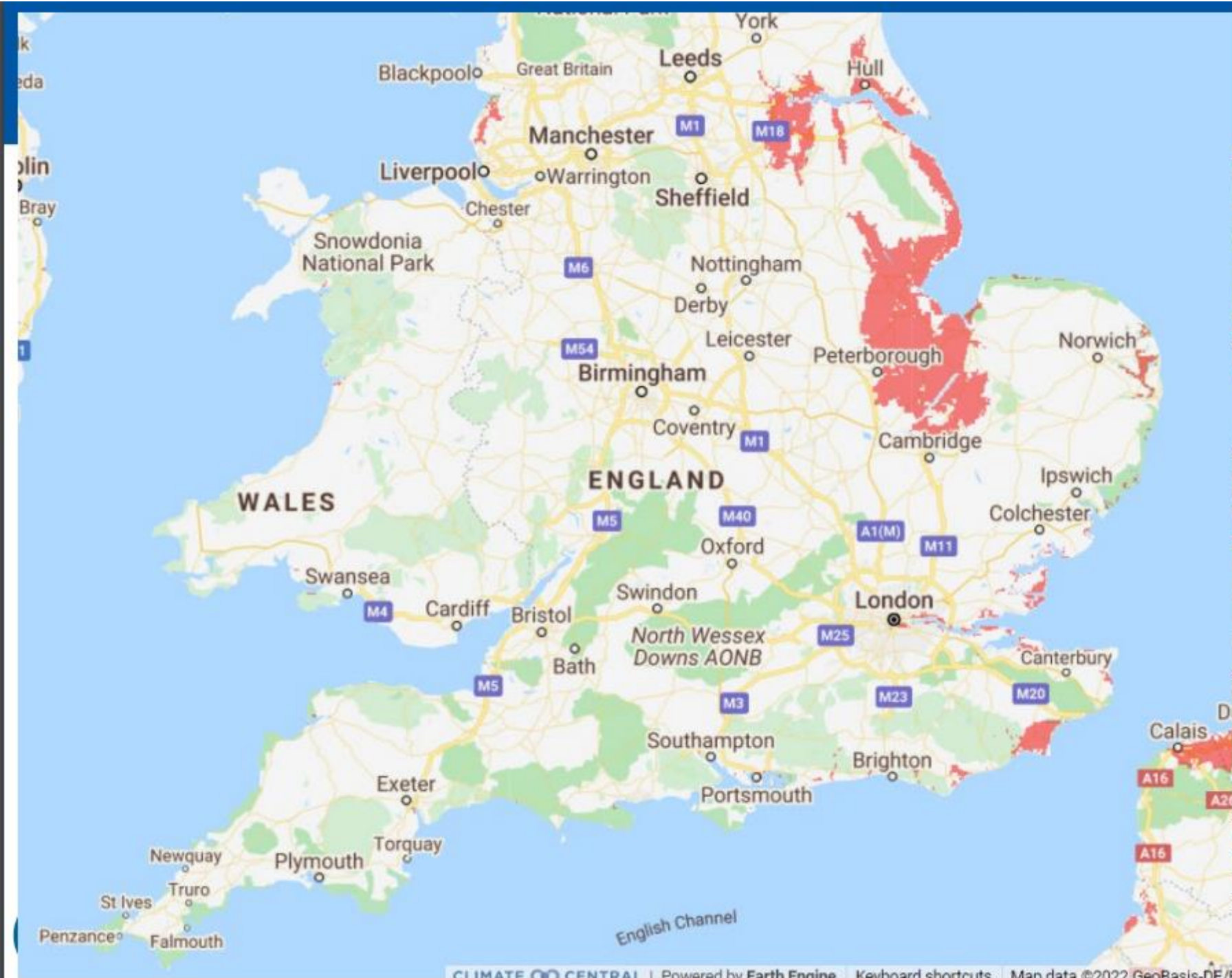
Land projected to be below tideline in 2100 with 2C warming

<https://coastal.climatecentral.org/>



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ario

Coastal erosion

By 2050:

- 1M properties at risk
- Some nuclear power stations at risk of annual flood

By 2100:

- 1600km of major roads
- 650 km of railway line
- 92 railway stations
- 55 historic landfill sites
- Agricultural land

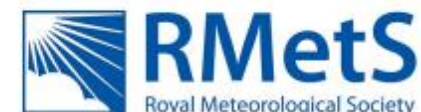


Fairbourne, Wales – the UK's first climate refugees?



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Consequence 3: flooding due to extreme rainfall

Extreme rainfall

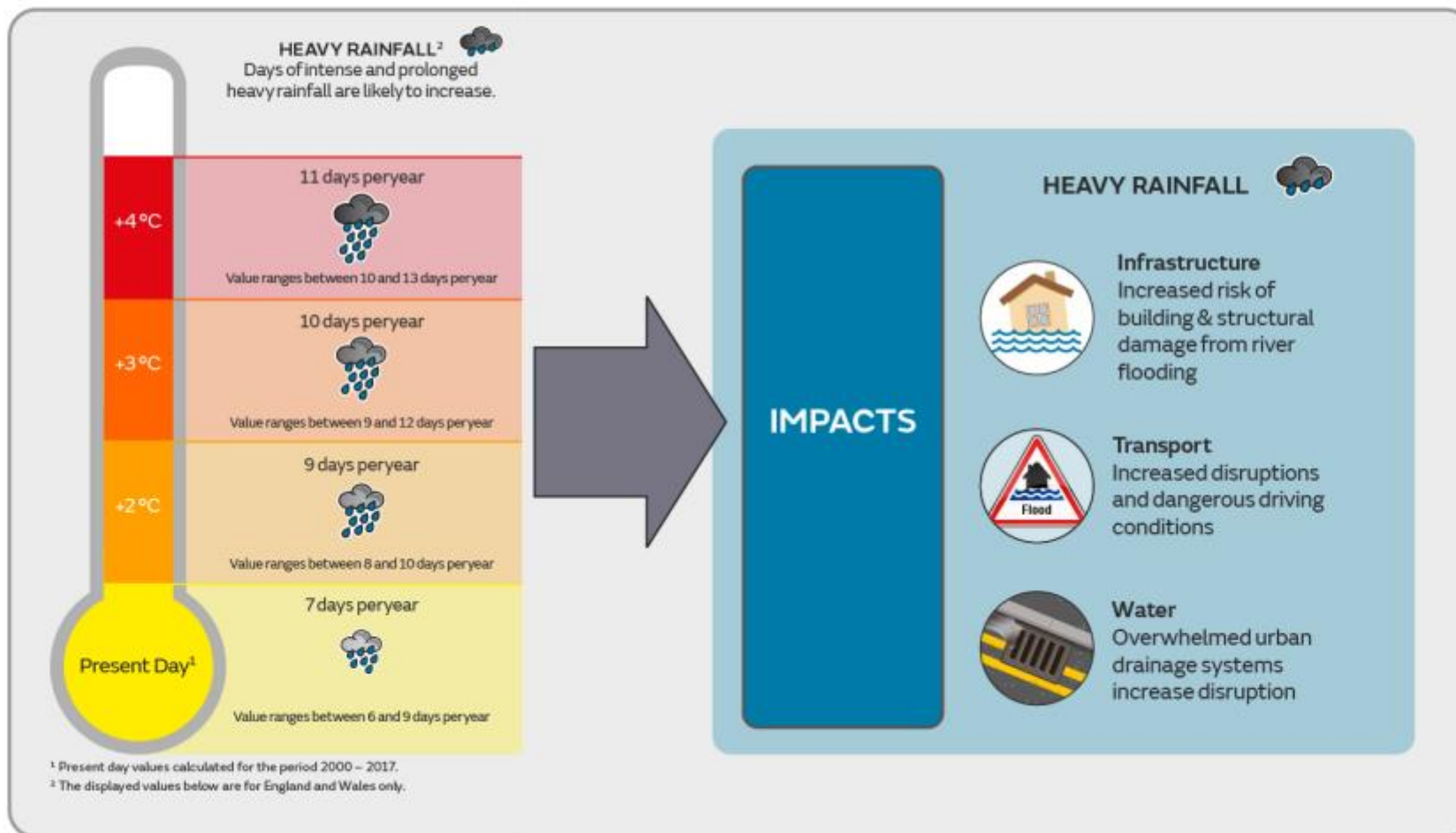
- A warmer atmosphere holds more water - ~7% for each 1 degree C
- More water in the atmosphere also means more energy which can mean storms are more severe
- Frequency of storms at any location can also be influenced by climate change as well as year to year variability
- The impact of extreme rainfall also depends on land characteristics AND previous rainfall (if already waterlogged OR extremely dry, then rainfall may lead to flooding)



Heavy rainfall projections



Global warming and future high-impact weather in the UK



Winter rainfall – Storm Desmond – river flooding

4-6 December 2015

- New record for greatest 24h rainfall (341.1mm in Honister, Cumbria)
- Biggest flood in 600 years
- 5000 homes and businesses flooded in Cumbria and Scottish Borders
- 60,000 people without power
- Some still unable to return 1 year later



Appleby – picture from BBC

Study comparing risk of this type of event with and without climate change suggests this storm was made 40% more likely by climate change

Summer rainfall – convective rainfall

In summer, extreme rainfall is usually due to short-term downpours

More intense downpours is consistent with more energy in the warmer atmosphere

Warmer land surface can produce more intense upward movement of air which can lead to more localised thunderstorms

Short-term downpours can cause local surface flooding – especially in urban areas – flash floods



Flash flooding in Peterborough July 2021 Photo Cambridgeshire Fire and Rescue service



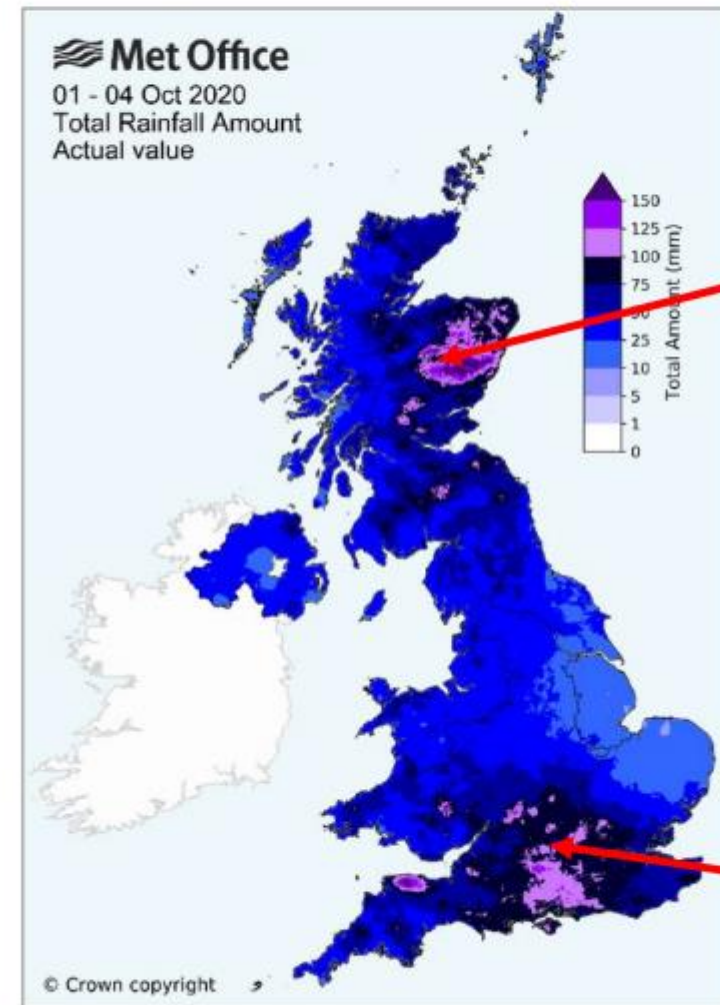
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Storm Alex 2020 – wettest day on record since 1891

- Parts of central Southern England and eastern Scotland recorded totals of 100mm or more in the first 4 days of October.
- Strong winds over Southern half of UK – disruption to power supply
- Flooding relatively low due not being already waterlogged and the steady nature of the rain giving time for water to be absorbed by soil.
- Extreme flooding in south-east France and north-west Italy washing away buildings and roads).

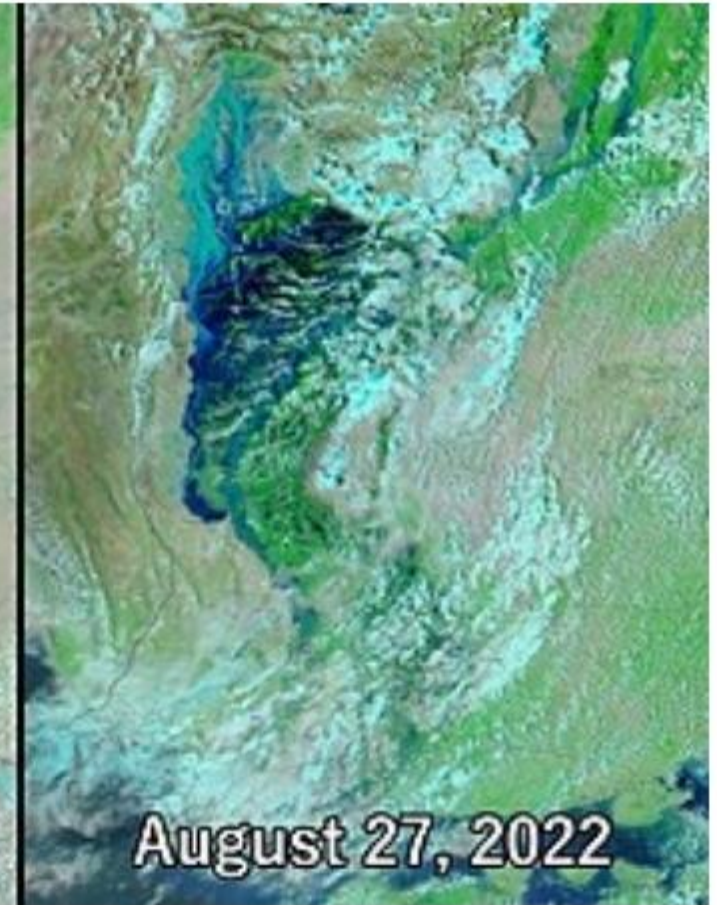
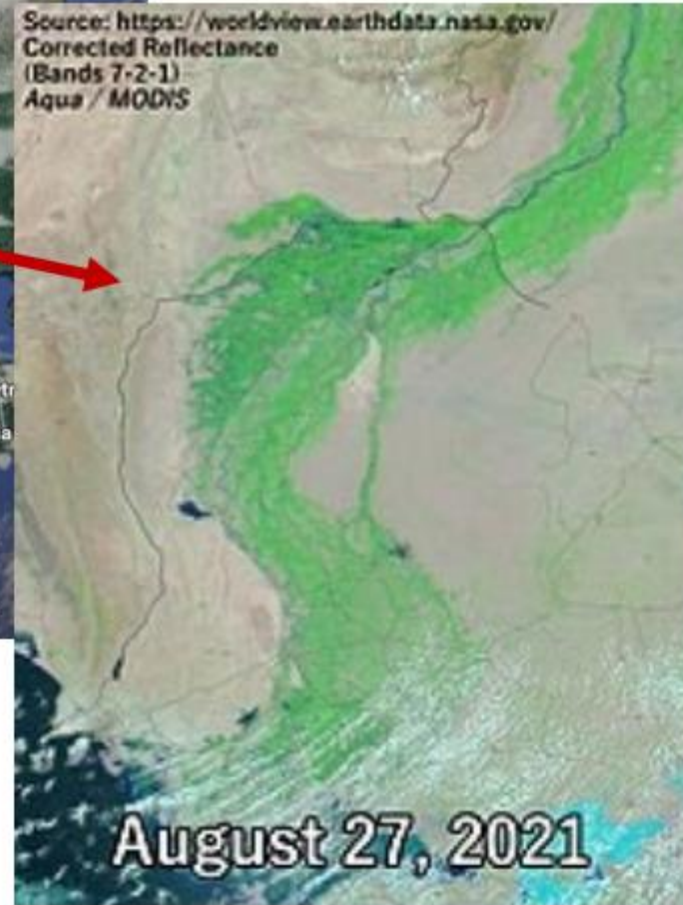
By 2100 this level of rainfall will be made 10 times more likely by human climate change



116% of
October
rainfall

156% of
October
rainfall

Sometimes things combine – Pakistan 2022



Heatwave in April – May
Glacier meltwater + stronger than usual
monsoon rains + more frequent than
usual large scale storms

33 million people displaced

Actions

Actions to reduce and protect

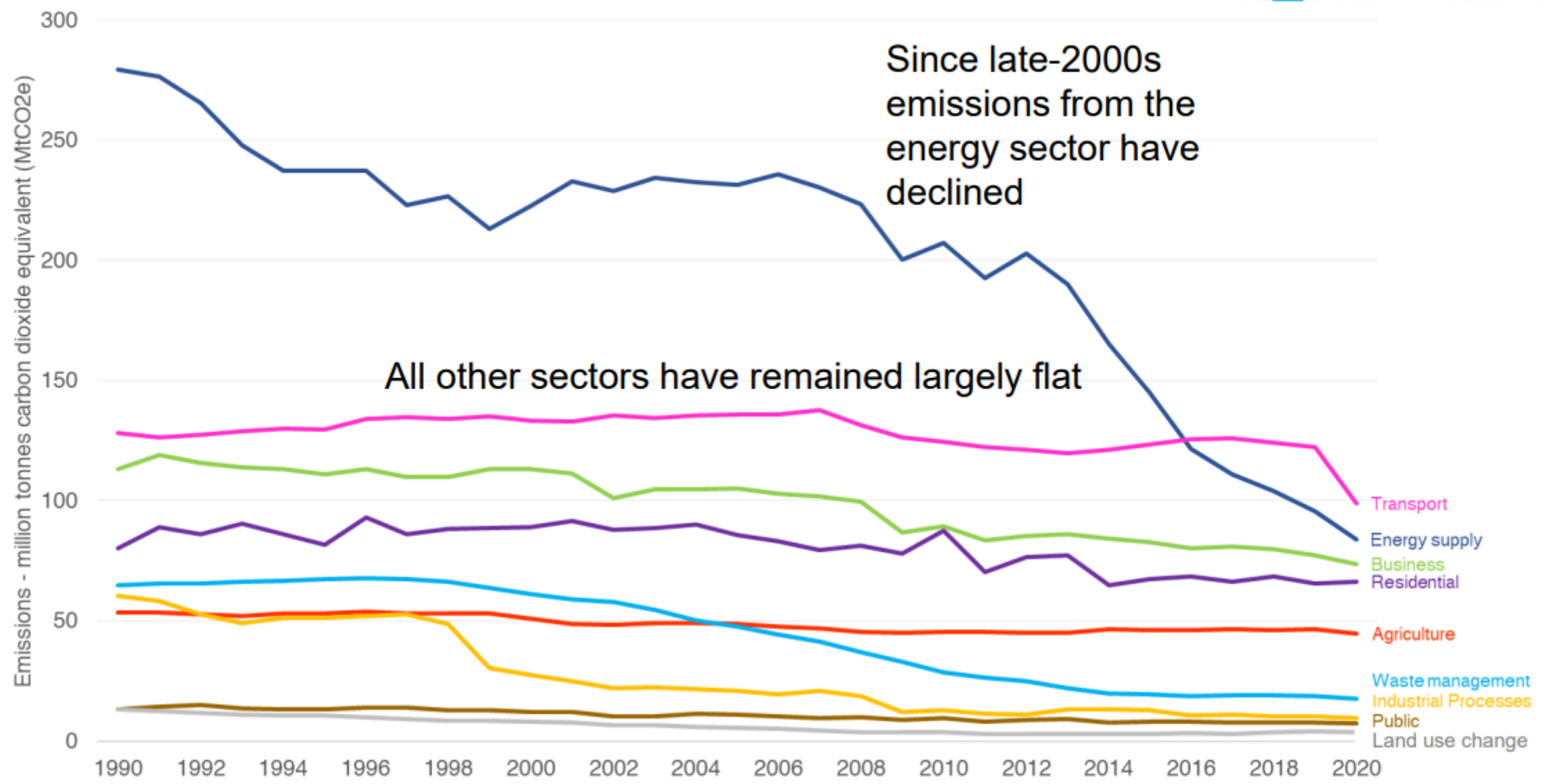


I can.. we know what to do to reduce emissions

- Save energy
- Electrify + decarbonise
- Waste less
- Protect and invest in nature
- Remove carbon with technology



UK emissions by sector, 1990-2020



Source: Final UK greenhouse gas emissions national statistics 1990-2020, BEIS, February 2022

UK pathways to net-zero

Aviation & Shipping

Transport

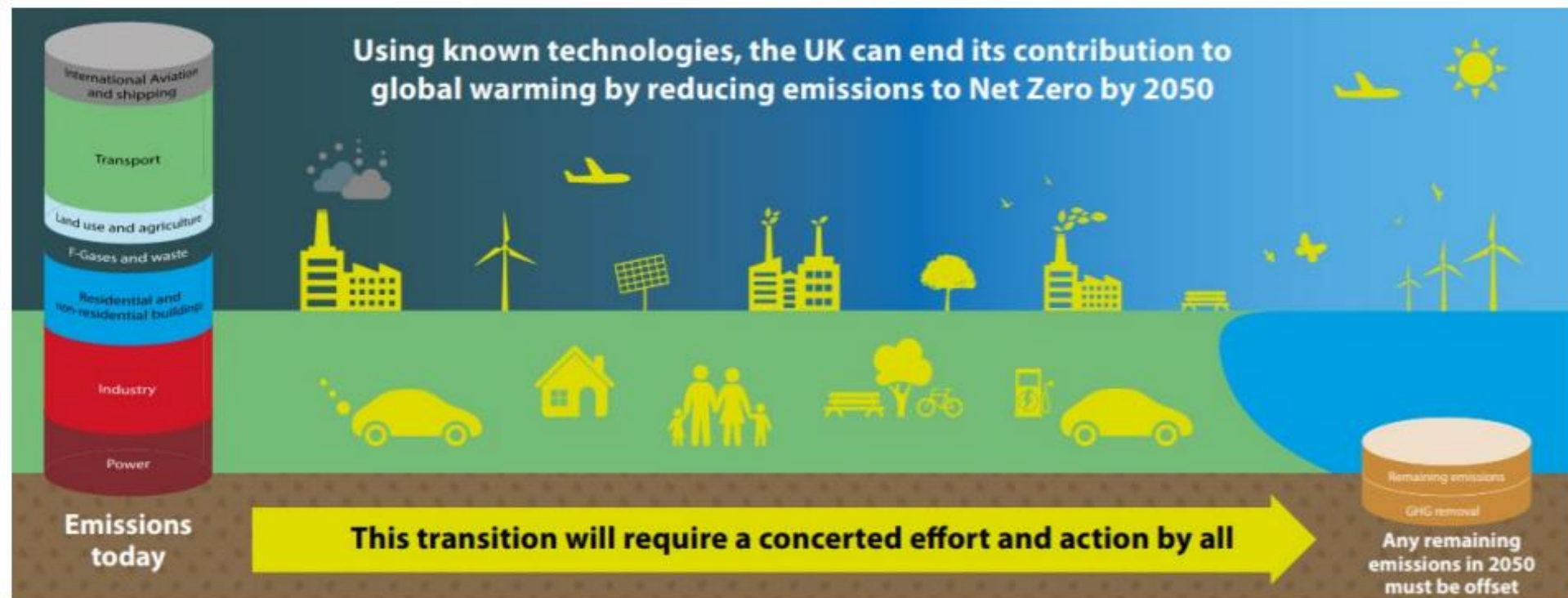
Land use and agriculture

F-gases and waste

Buildings

Industry

Power



Committee on Climate Change 2019

Decarbonisation across all sectors

UK climate policy dashboard

Tracking government progress to deliver net zero



7/10

Power
Sector



5/10

Transport
Sector



4/10

Manufacturing
and Construction



4/10

Agriculture
and Land Use



5/10

Buildings
Sector



2/10

Waste
Sector



4/10

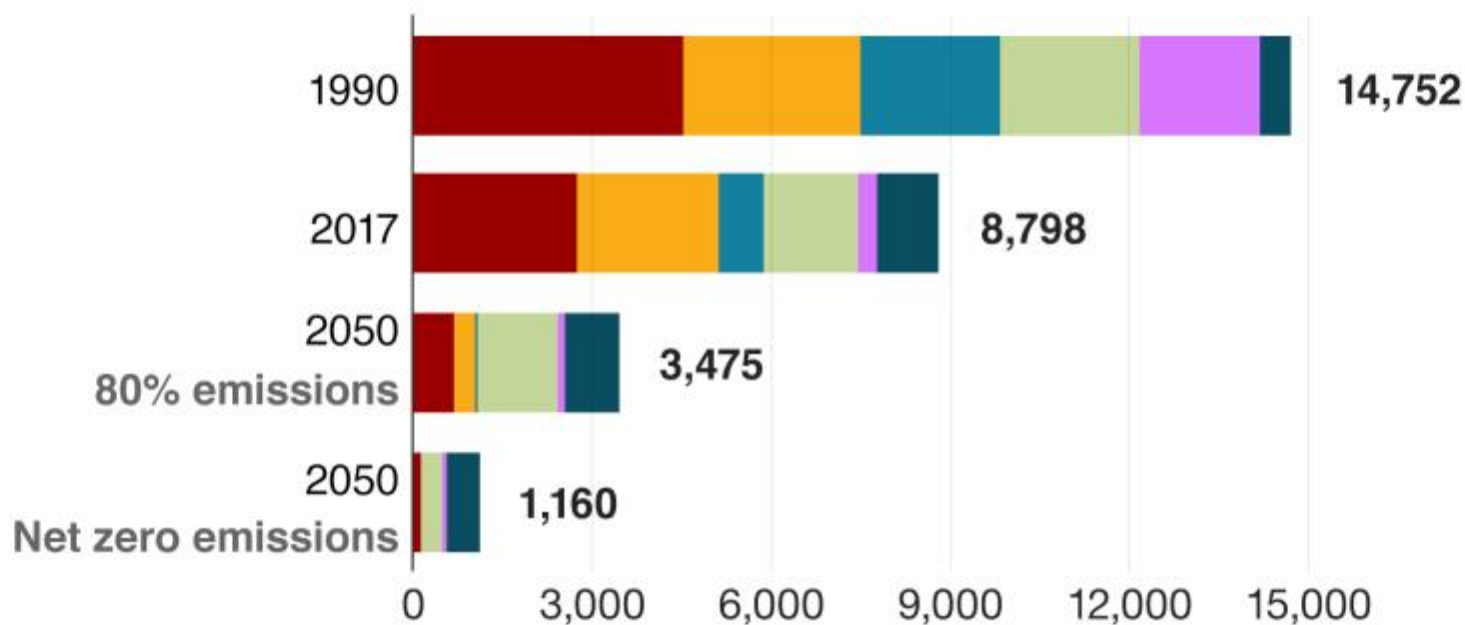
Adaptation
Area

<https://www.policyconnect.org.uk/sustainability/climate-policy-dashboard>

... on a personal level

UK Household emissions in 1990, 2017 and 2050

Annual emissions, kilogrammes of CO₂



Source: Climate Change Committee/BEIS (2019)

BBC

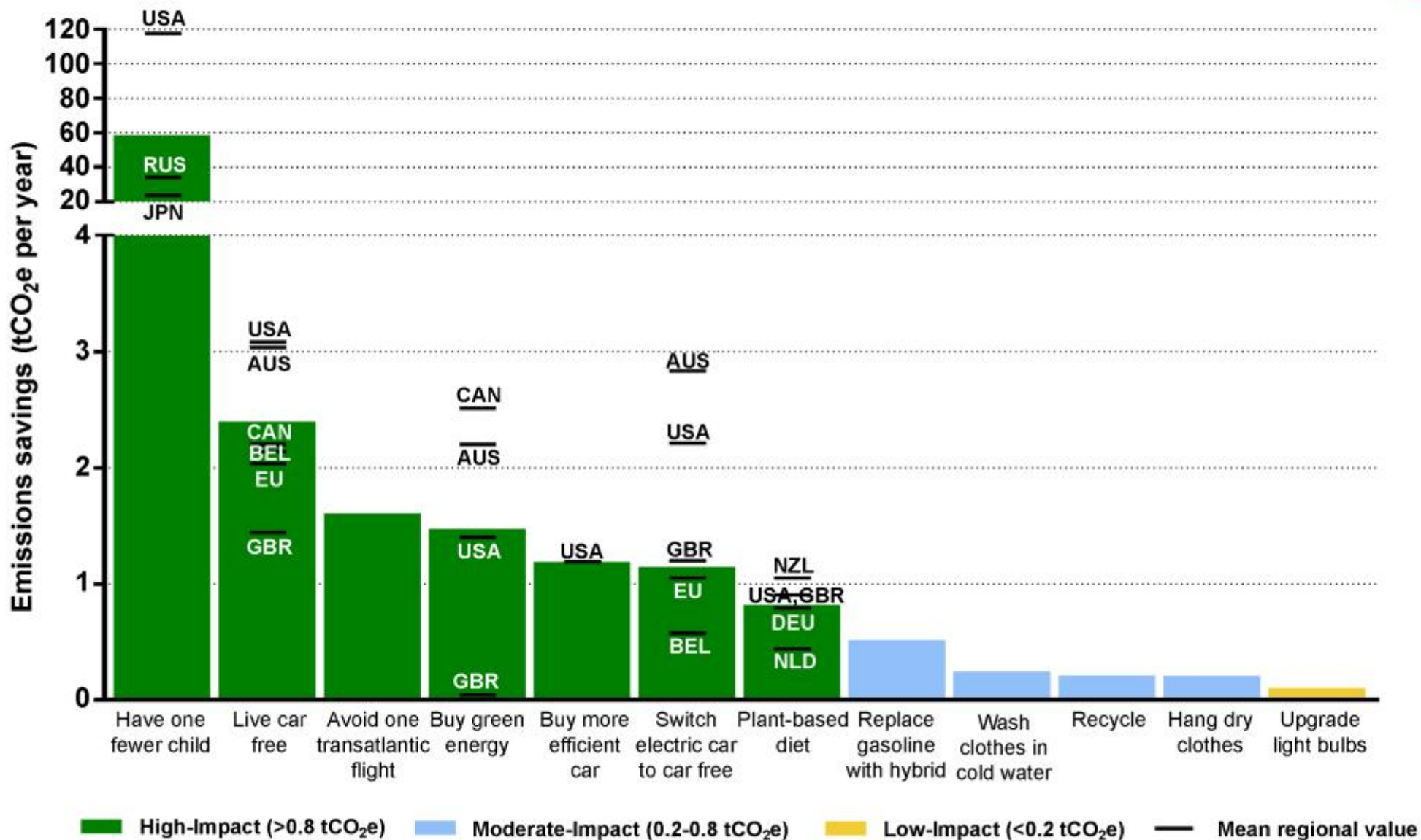
What can we do on a personal level about emissions?

1. Make your voice heard by those in power
2. Eat less meat and dairy
3. Cut back on flying
4. Leave the car at home
5. Reduce your energy use – save energy
6. Respect and protect green spaces
7. Invest your money wisely
8. Cut consumption and waste
9. Talk about the changes you make

Reducing your carbon footprint may also:

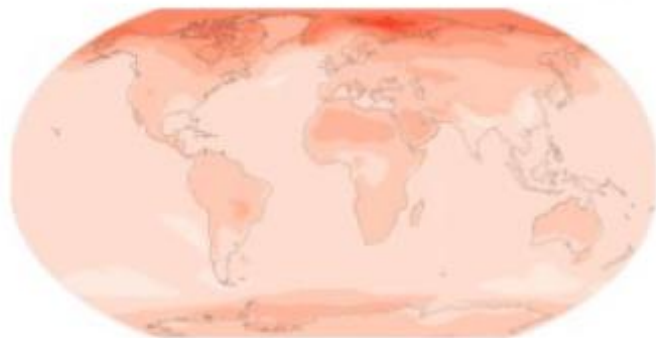
- Save you money
- Benefit your health and that of those around you
- Improve air quality

Most impactful actions

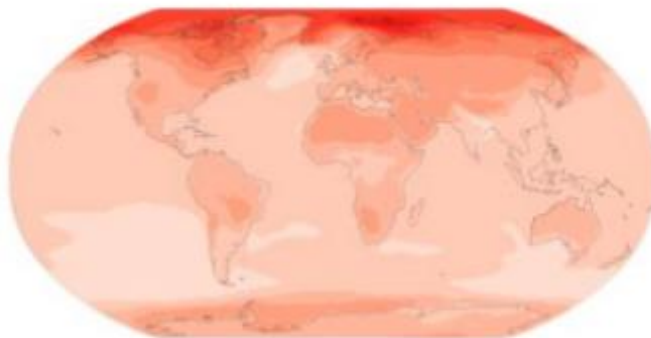


It's worthwhile... every gram matters

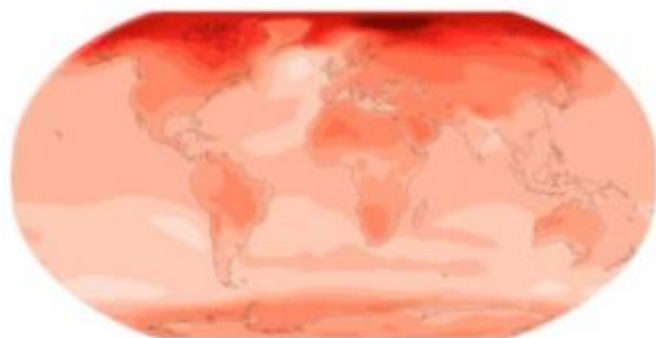
Change at 1C global warming



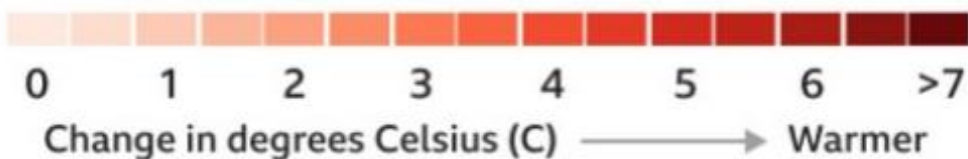
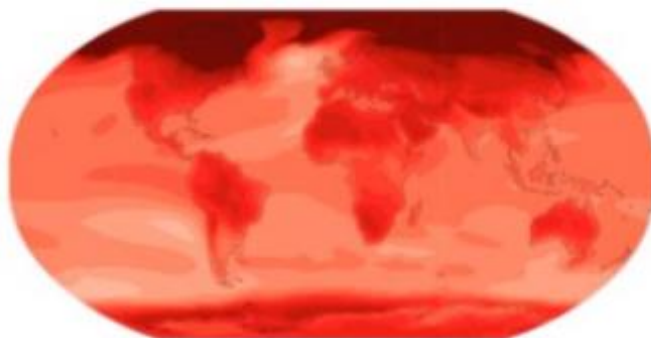
Change at 1.5C global warming



Change at 2C global warming



Change at 4C global warming



Remember also the tipping points...

It's easy ..

- Every gram matters
- Lots of options from small to large, public and private
- Many of the actions that protect against climate change or its impacts have other benefits too
 - e.g. more walking, wheeling and public transport – health benefits to individuals from exercise, and to self and others from better air quality
 - E.g. more green space – lower urban heat effect, better rainfall management, better mental health and wellbeing