Department of Meteorology

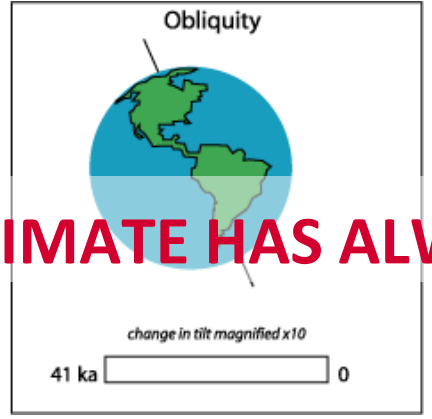
University of Reading

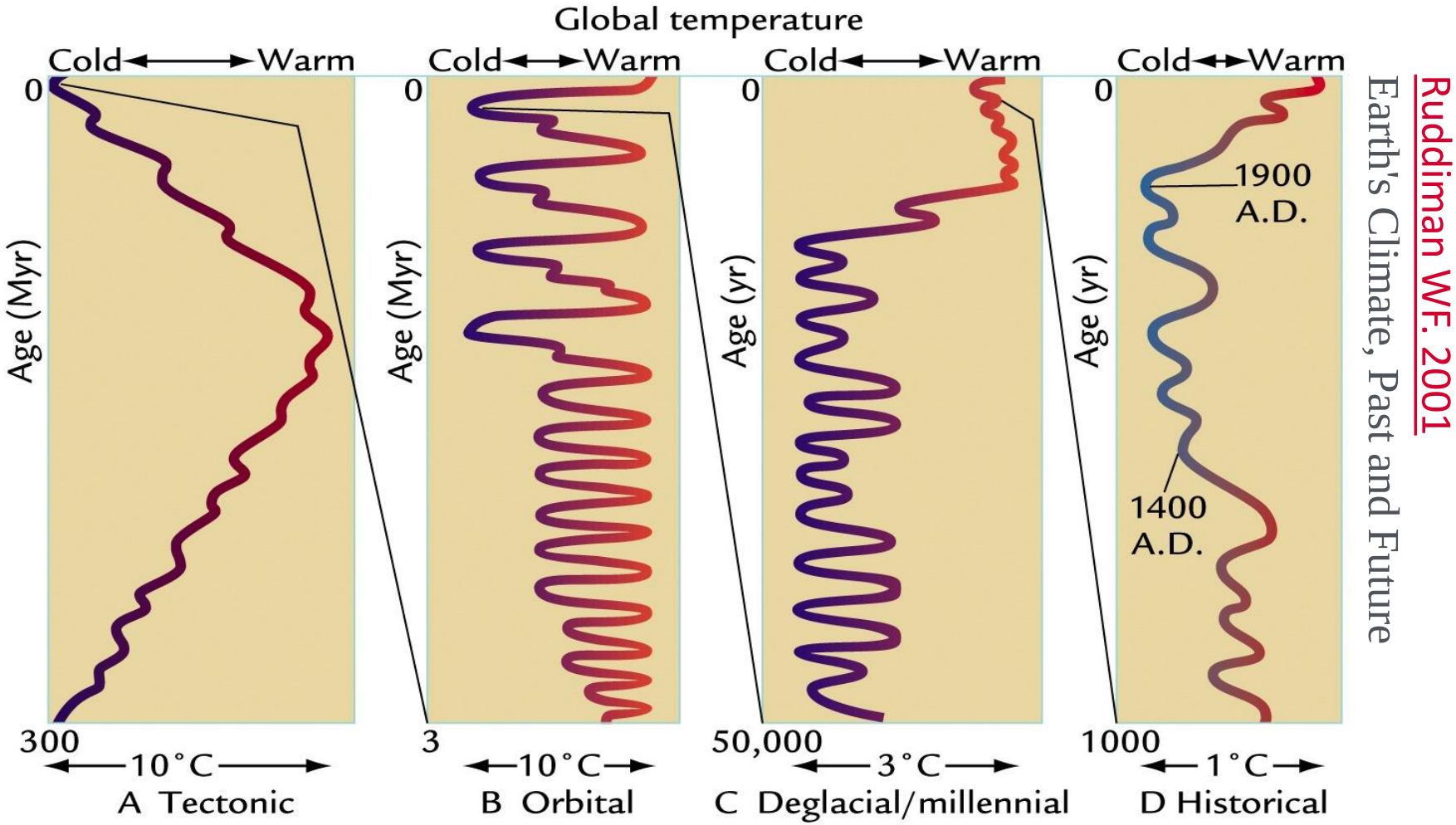
THE SCIENCE OF CLIMATE CHANGE

Professor Richard Allan @rpallanuk r.p.allan@reading.ac.uk

Virtual Global Citizens Conference, 12th November 2020

EARTH'S CLIMATE HAS ALWAYS BEEN CHANGING





Ruddiman WF. 2001
Earth's Climate, Past and Future

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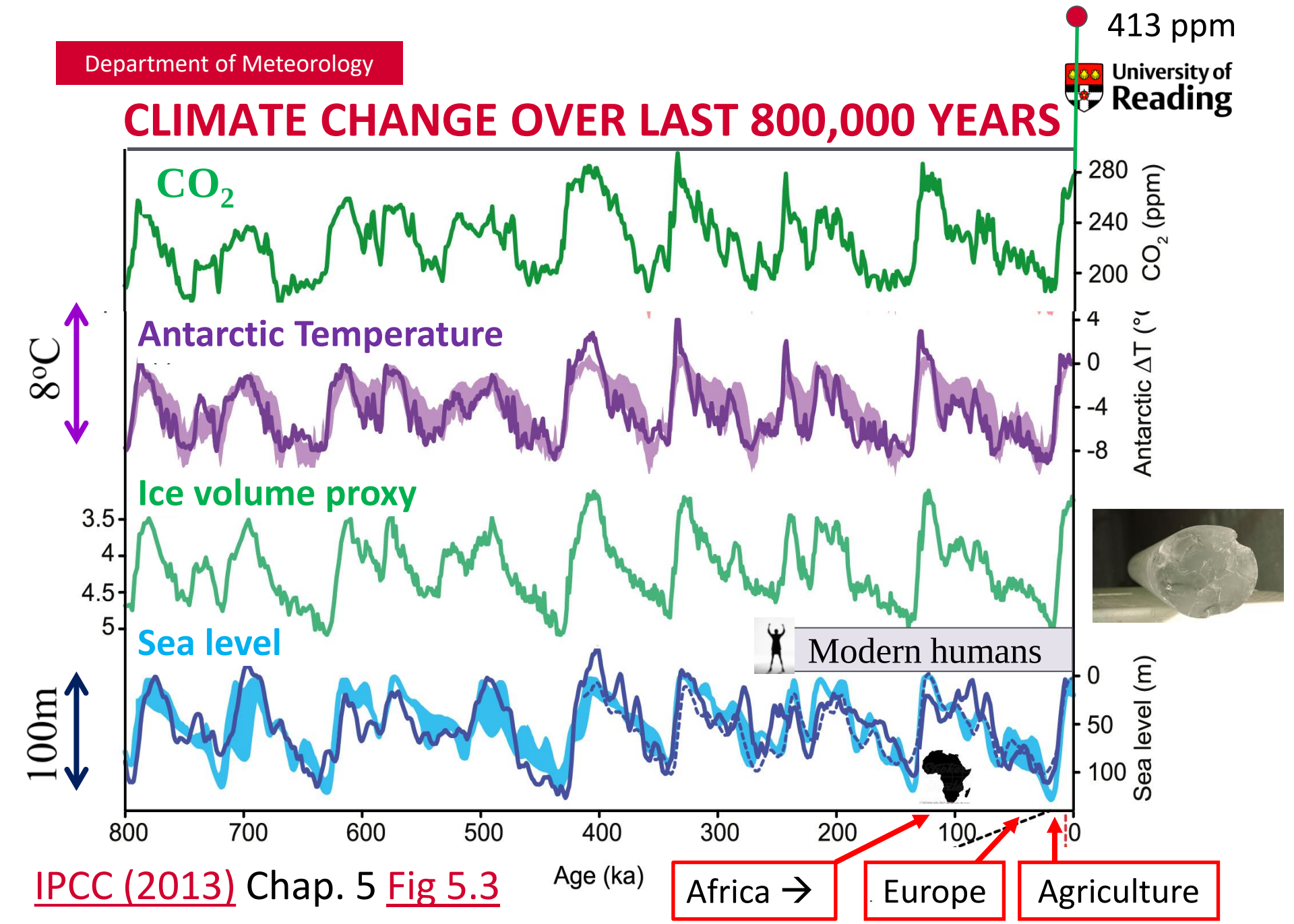
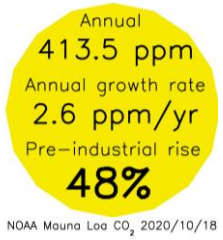
CLIMATE CHANGE OVER LAST 800,000 YEARS



IPCC (2013) Chap. 5 Fig 5.3



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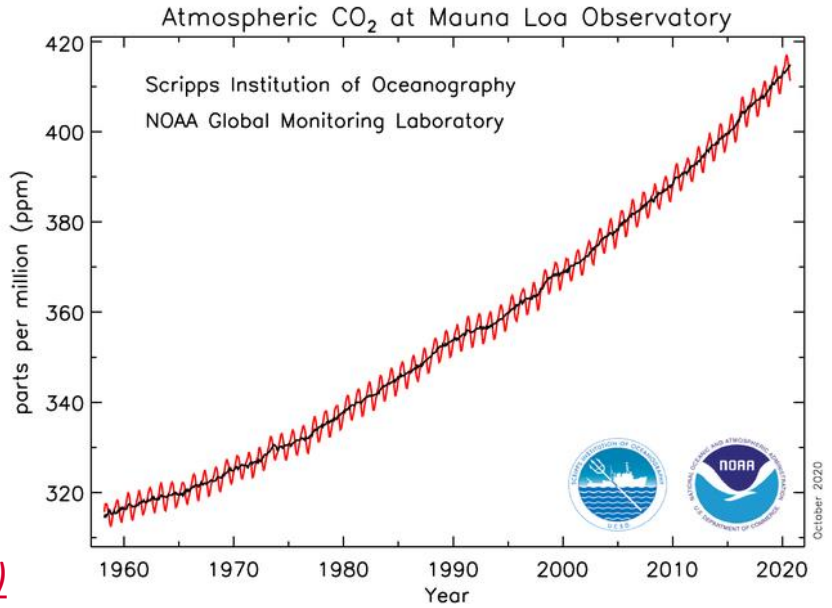
CO_2 EMISSIONS ARE HEATING PLANET

- Increases in greenhouse gases heat the planet by reducing how easily Earth can cool to space through infra-red emission
- More small pollutant "aerosol" particles cool the planet by reflecting sunlight
- More energy is arriving than leaving: Earth is heating up…

Currently energy is accumulating at rate equivalent to every person currently alive using 20 kettles (2kW) each to boil oceans (or about 300 trillion watts) Allan et al. (2014)



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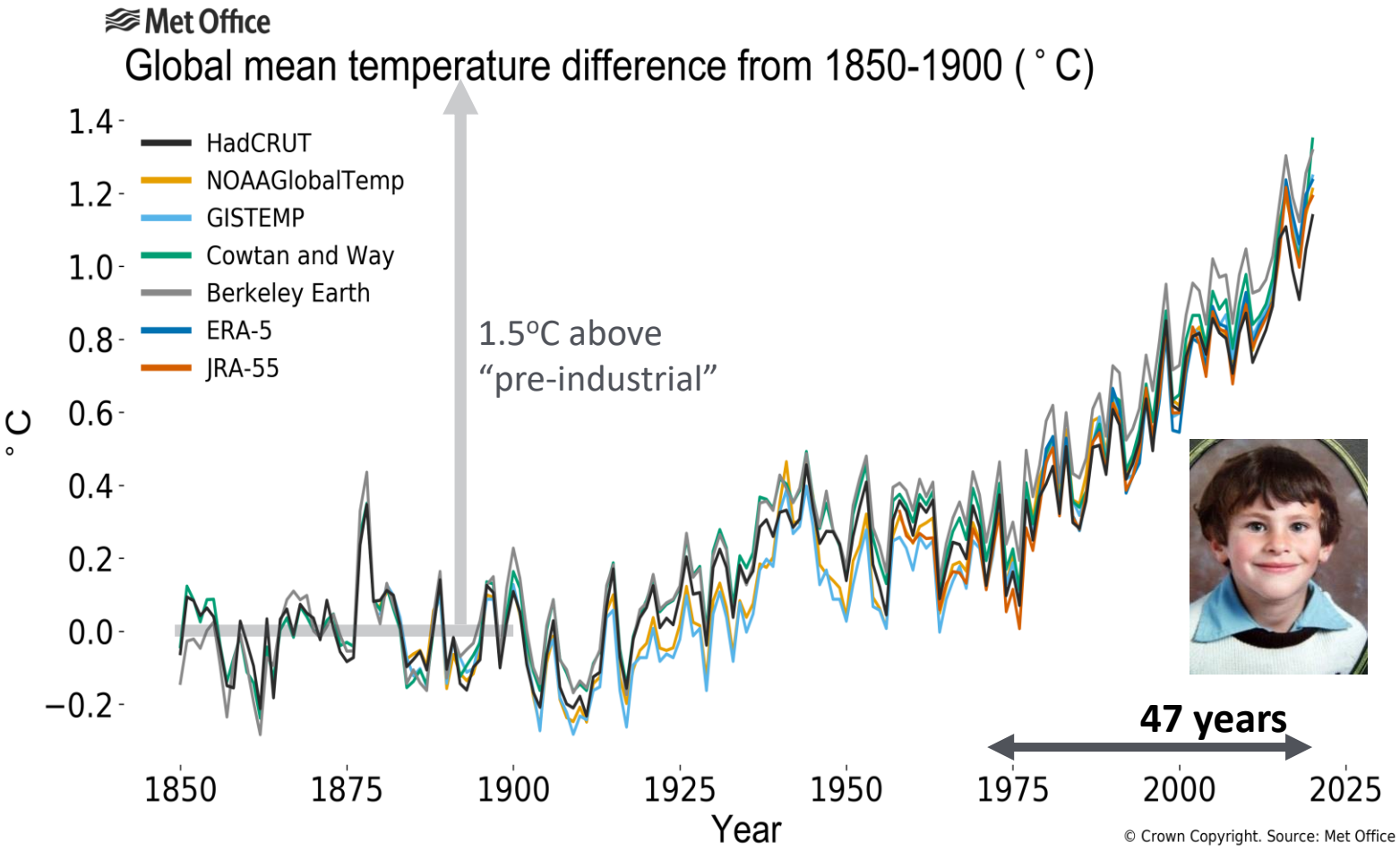
THE PLANET IS WARMING



https://www.metoffice.gov.uk/hadobs/monitoring/dashboard.html

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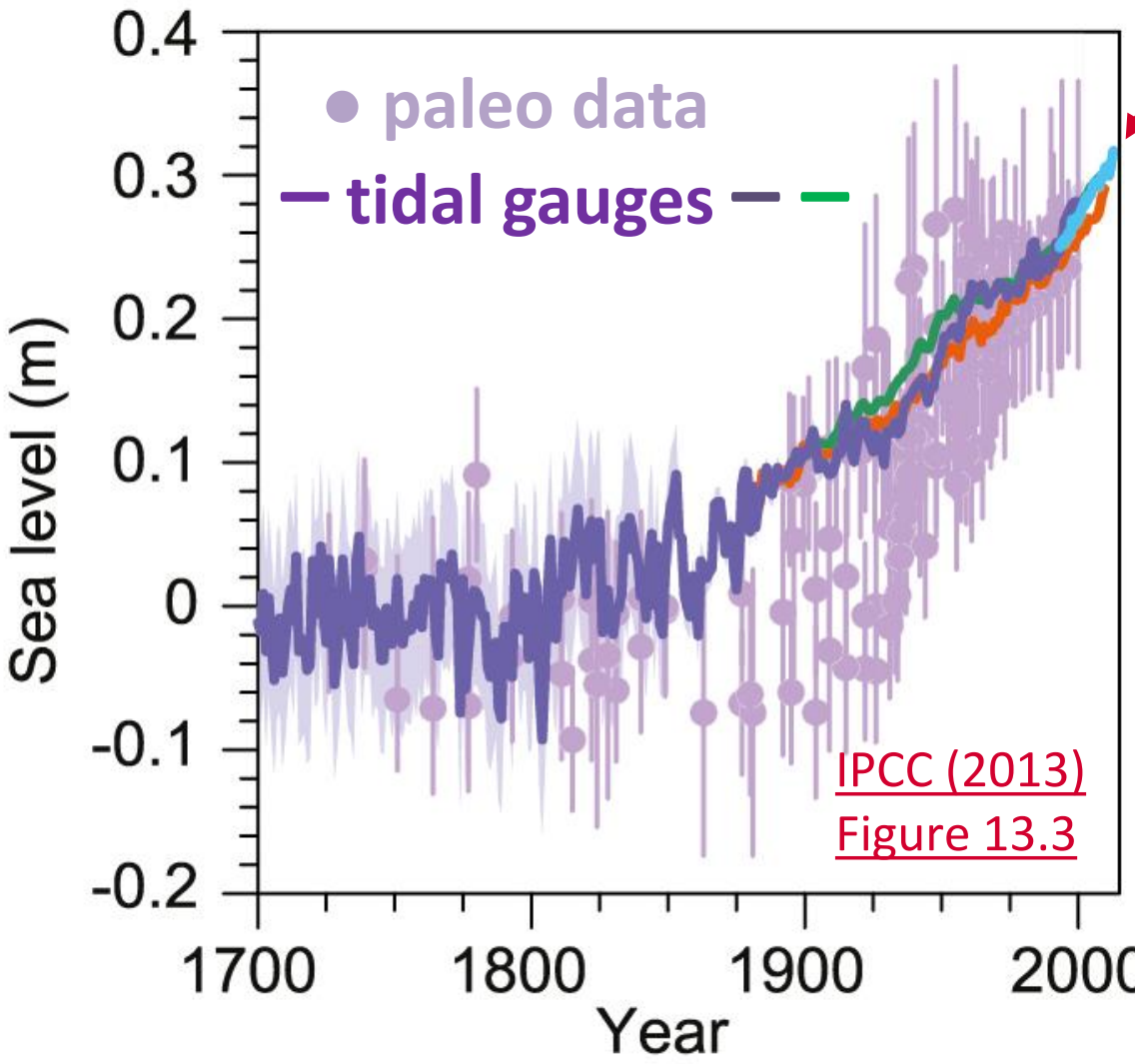
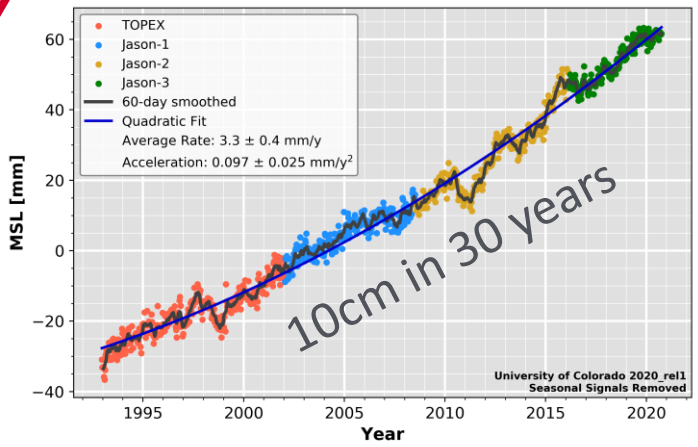
GLOBAL AVERAGE SEA LEVEL IS RISING…



IPCC (2013)
Figure 13.3

Satellite Altimeter data



http://sealevel.colorado.edu/

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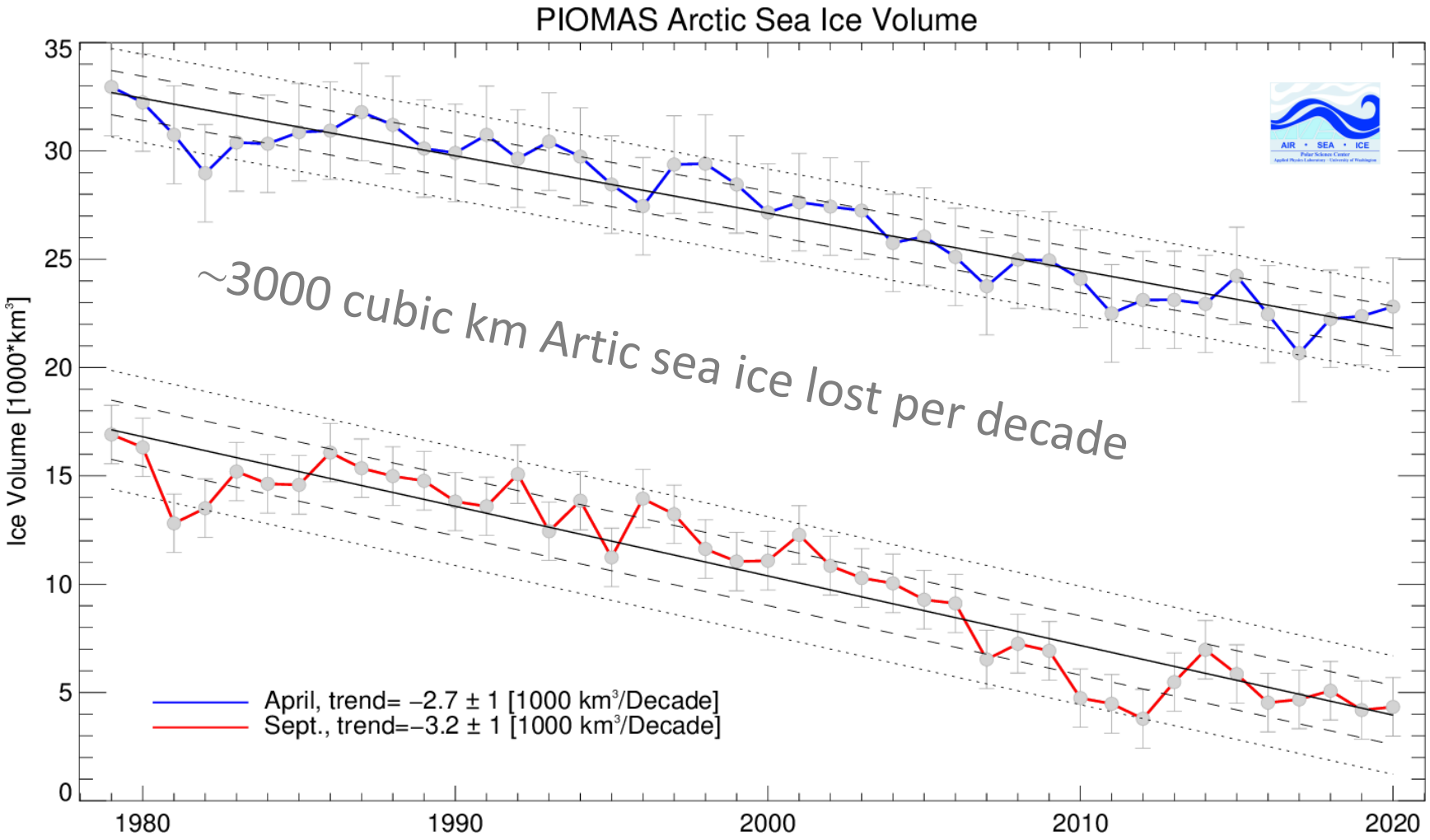
ARCTIC SEA ICE IS MELTING



psc.apl.washington.edu/research/projects/arctic-sea-ice-volume-anomaly/

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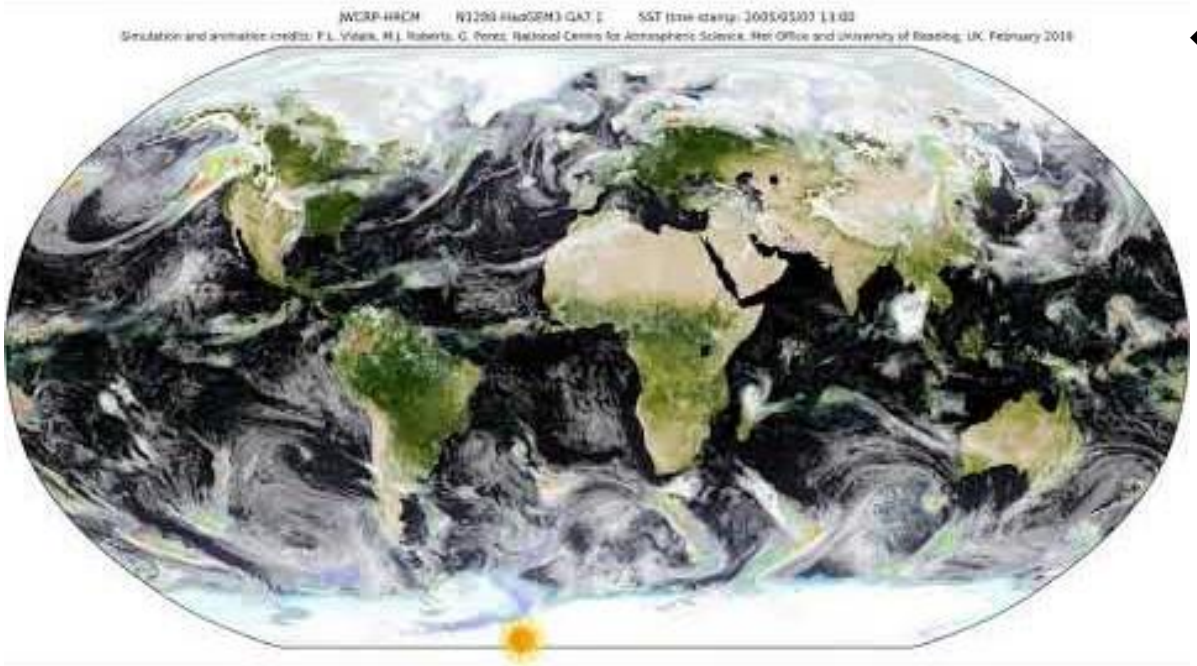
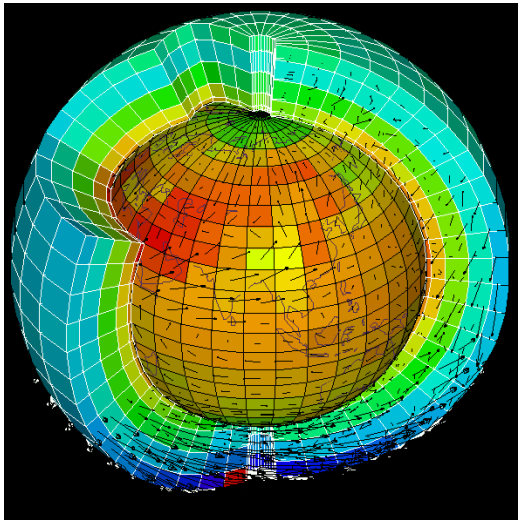
WHAT ARE THE PREDICTIONS?

- Physics of atmosphere, ocean & land encapsulated in millions of lines of computer code to construct climate simulations used to:
  - understand past climate change
  - project how climate will change over future decades and centuries



← By Pier Luigi Vidale (NCAS, University of Reading)



NATURAL FACTORS CAN'T EXPLAIN WARMING

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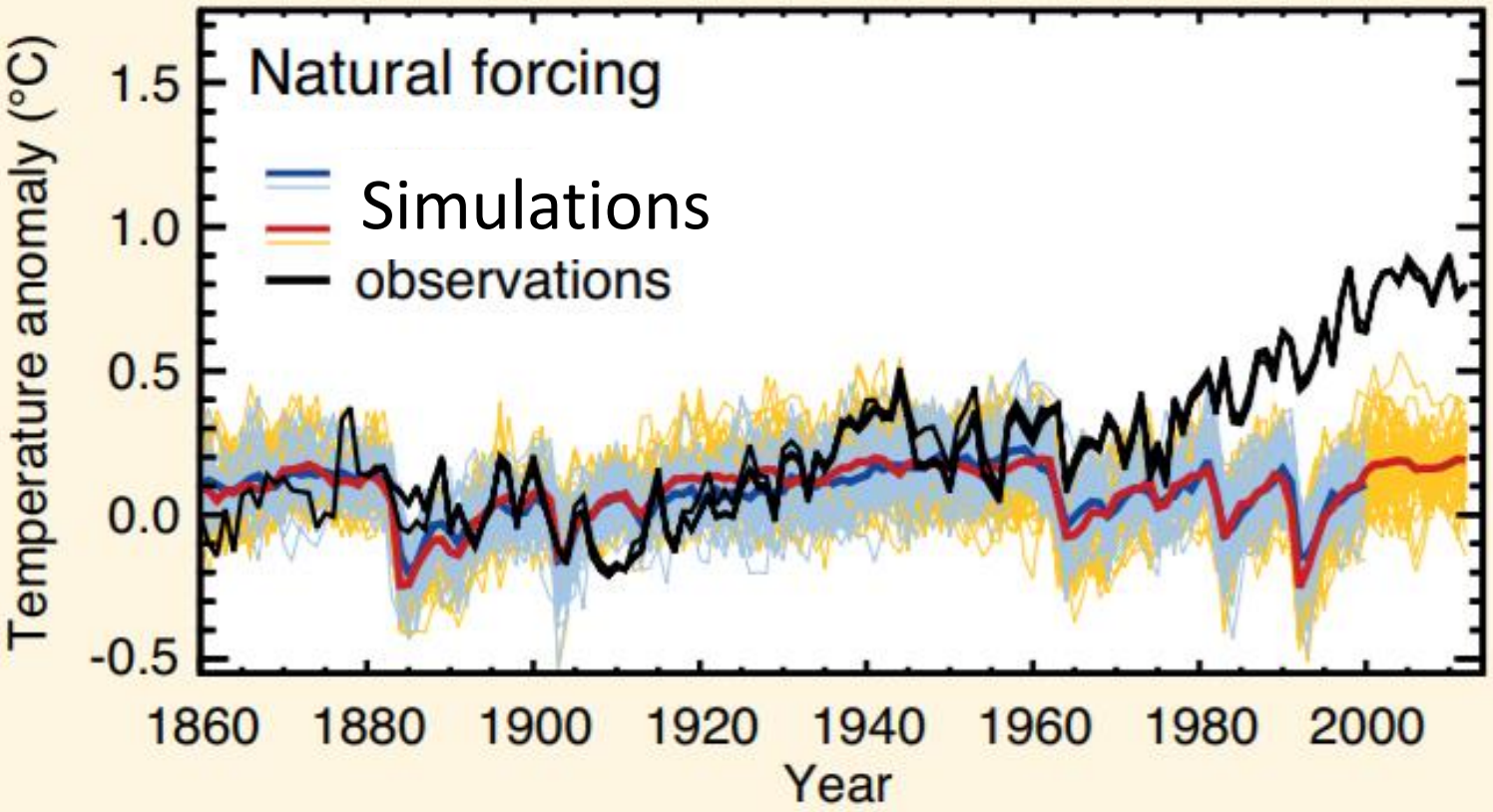

See IPCC FAQ 10.1 and Summary for Policy Makers Fig. 6

NATURAL FACTORS CAN'T EXPLAIN WARMING

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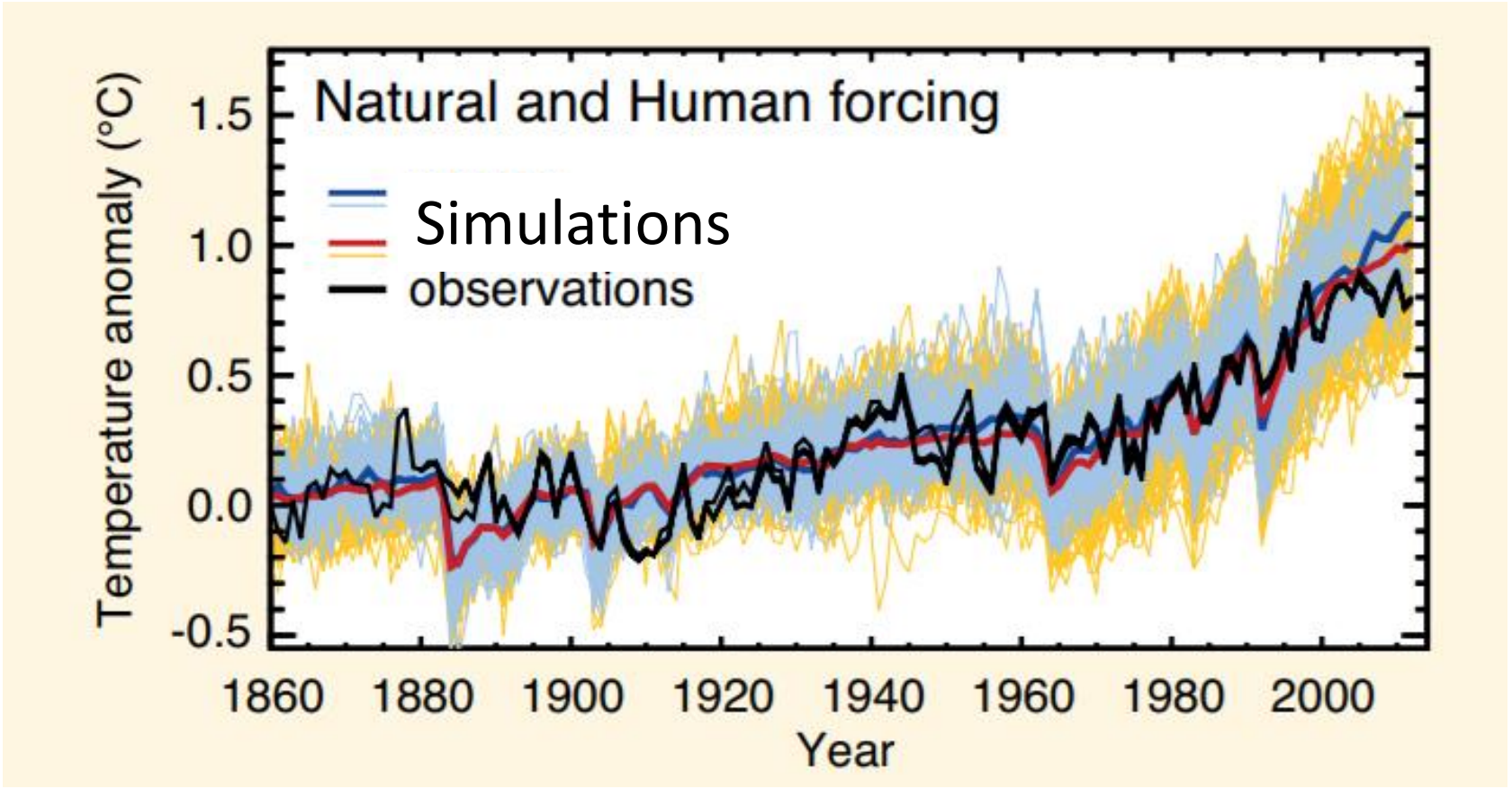

See IPCC FAQ 10.1 and Summary for Policy Makers Fig. 6

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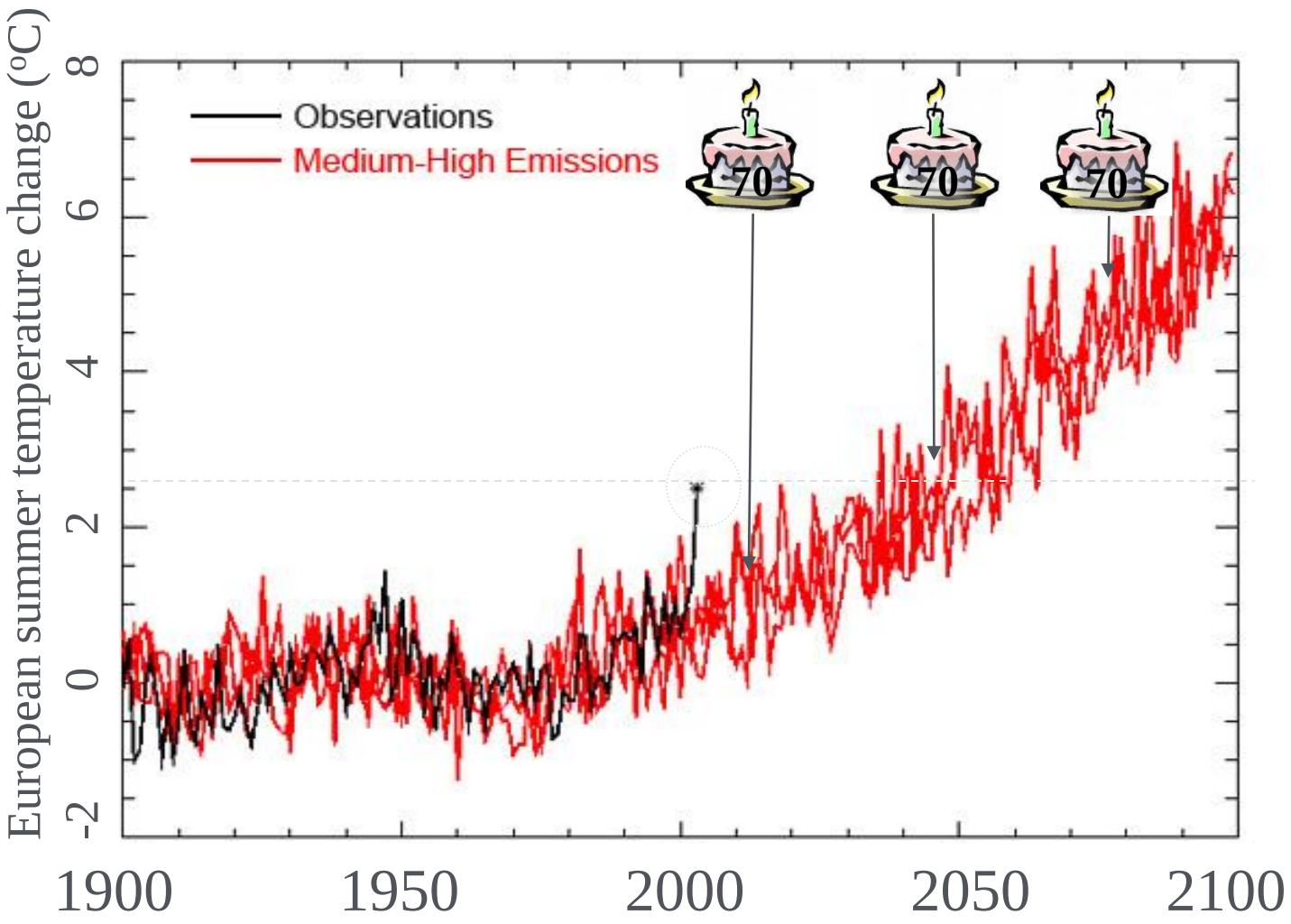
HOW WILL CLIMATE CHANGE OVER OUR LIFETIMES?



FUTURE PROJECTIONS

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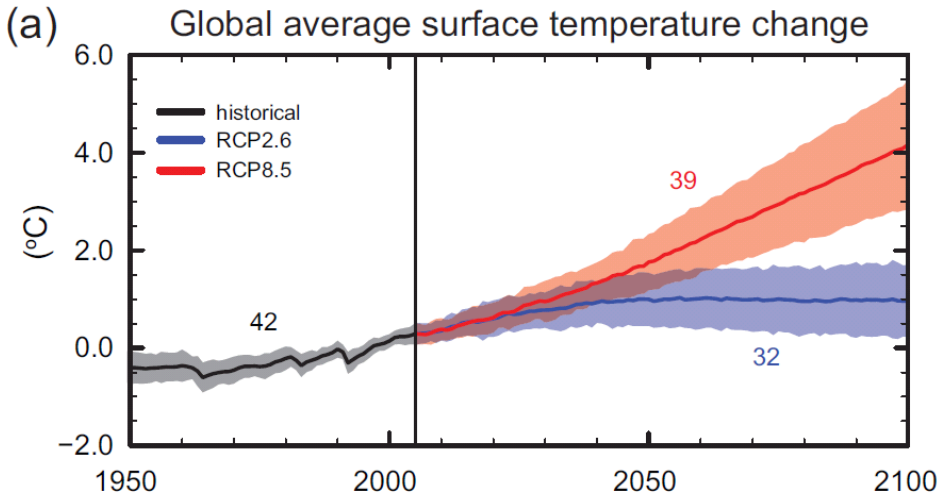
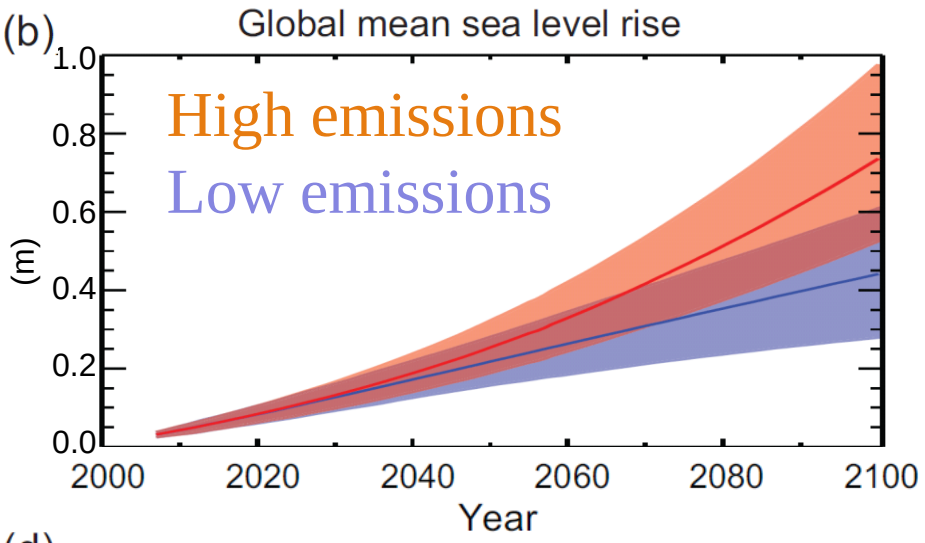
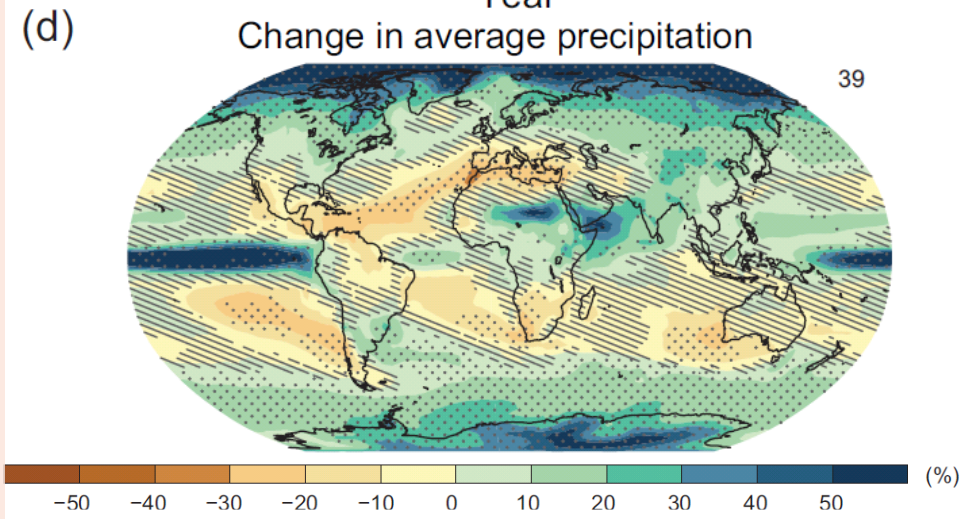




"Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions."



IPCC (2014) WG1 Summary for Policy Makers

CLIMATE CHANGE

- Climate has always changed
- Greenhouse gases such as carbon dioxide are at their highest levels for at least the last 800,000 years
- This pollution from human activity is amplifying the natural greenhouse effect
- This is heating the planet by impeding outgoing infrared cooling to space
- Substantial changes in global temperature and rainfall patterns are projected using computer simulations
- Predicting regional climate change is a challenge
- Limit dangerous climate change requires substantial and sustained reductions of greenhouse gas emissions

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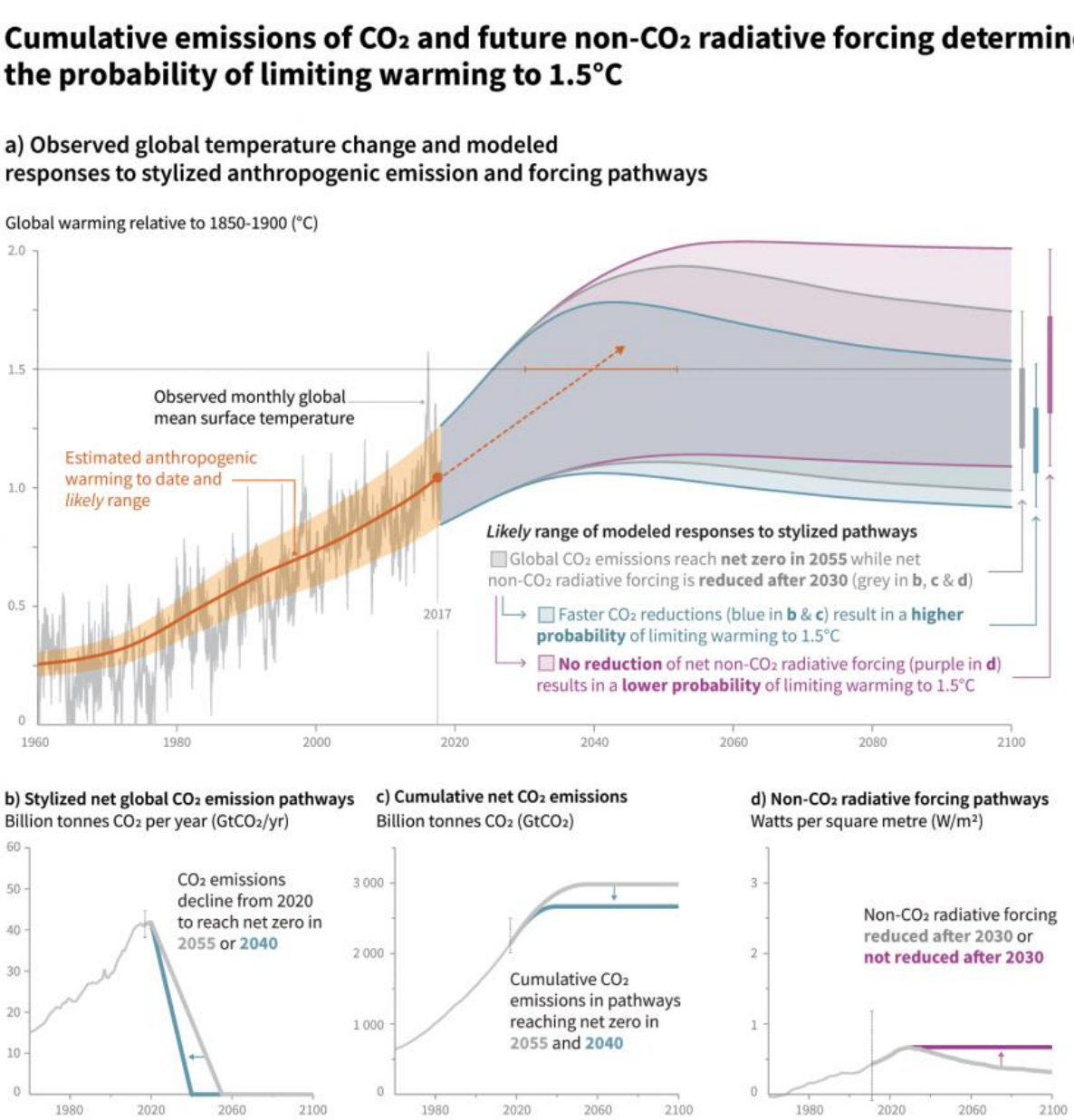
COP21 PARIS CLIMATE DEAL

source: http://www.carbonbrief.org/analysis-the-final-paris-climate-deal

- **Target**: global temperature well below 2°C; efforts to limit to 1.5°C
- **Mitigation**: pursue policies aiming to achieve INDC climate pledges; subsequent pledges progressively more ambitious; global stocktake 2018 & then every 5 years; peak global greenhouse gas emissions “as soon as possible”; “balance” between emissions & sinks 2050-2100
- **Adaptation**: $100bn/yr fund for developing countries: new collective quantified goal by 2025; periodic review of adaptive planning of Loss & damage has its own Article in the agreement — now on par with mitigation & adaptation; liability/compensation excluded.
- **Transparency:** "facilitative, non-intrusive, non-punitive” system of review will track countries’ progress; emissions trading allowed; aviation/shipping not included
- **Treaty:** deal enters force once 55+ parties, covering at least 55% of global emissions have signed up



- Act now

  To keep future options open

- Act everywhere

  Efforts in all sectors are needed to reach global zero CO_2 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 SR1.5 author)