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Climate Change and UK Highways maintenance

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This presentation covers the following areas

- Observations of past climate change
- Basic climate science
- Predictions of future climate
- Implications for Highway Maintenance
- Questions and answers



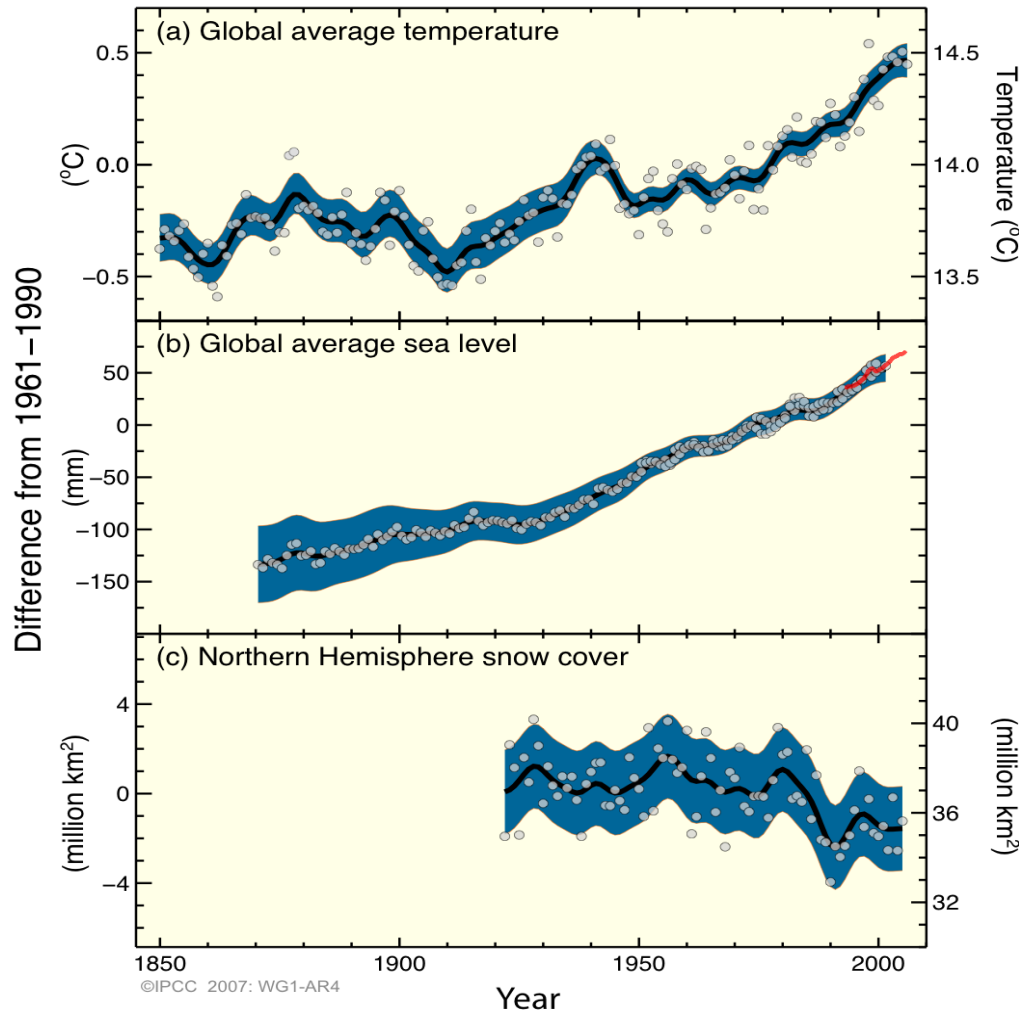
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Observations of past climate change



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Changes in temperature, sea level and Northern Hemisphere snow cover



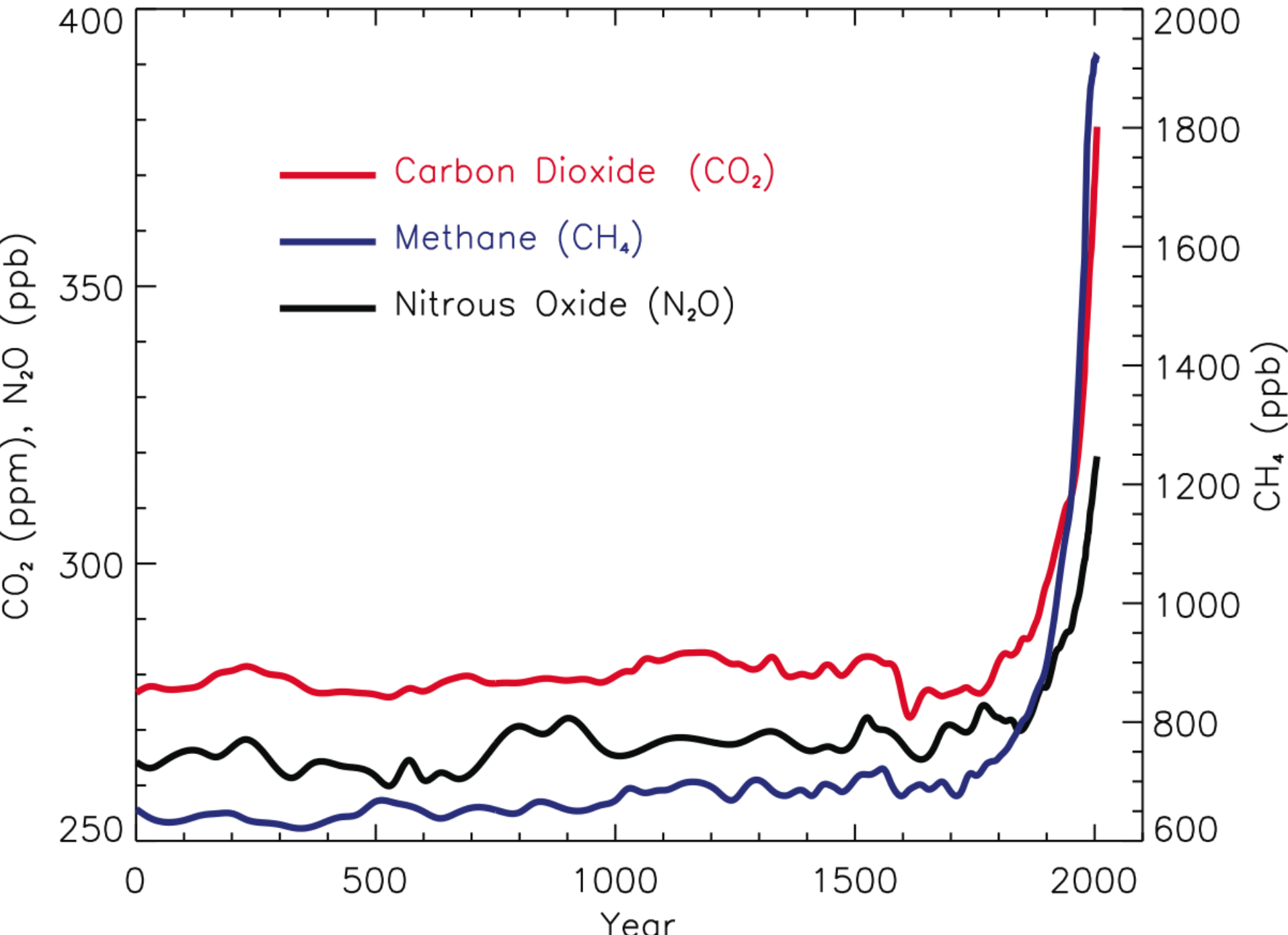
Plus massive reductions in Arctic sea ice and global glaciers

“the warmth of the last 50 years is unusual in at least the last 1300 years”

IPCC, 2007

Source: Intergovernmental Panel on Climate Change (IPCC, 2007)

Concentrations of Greenhouse Gases from 0 to 2005





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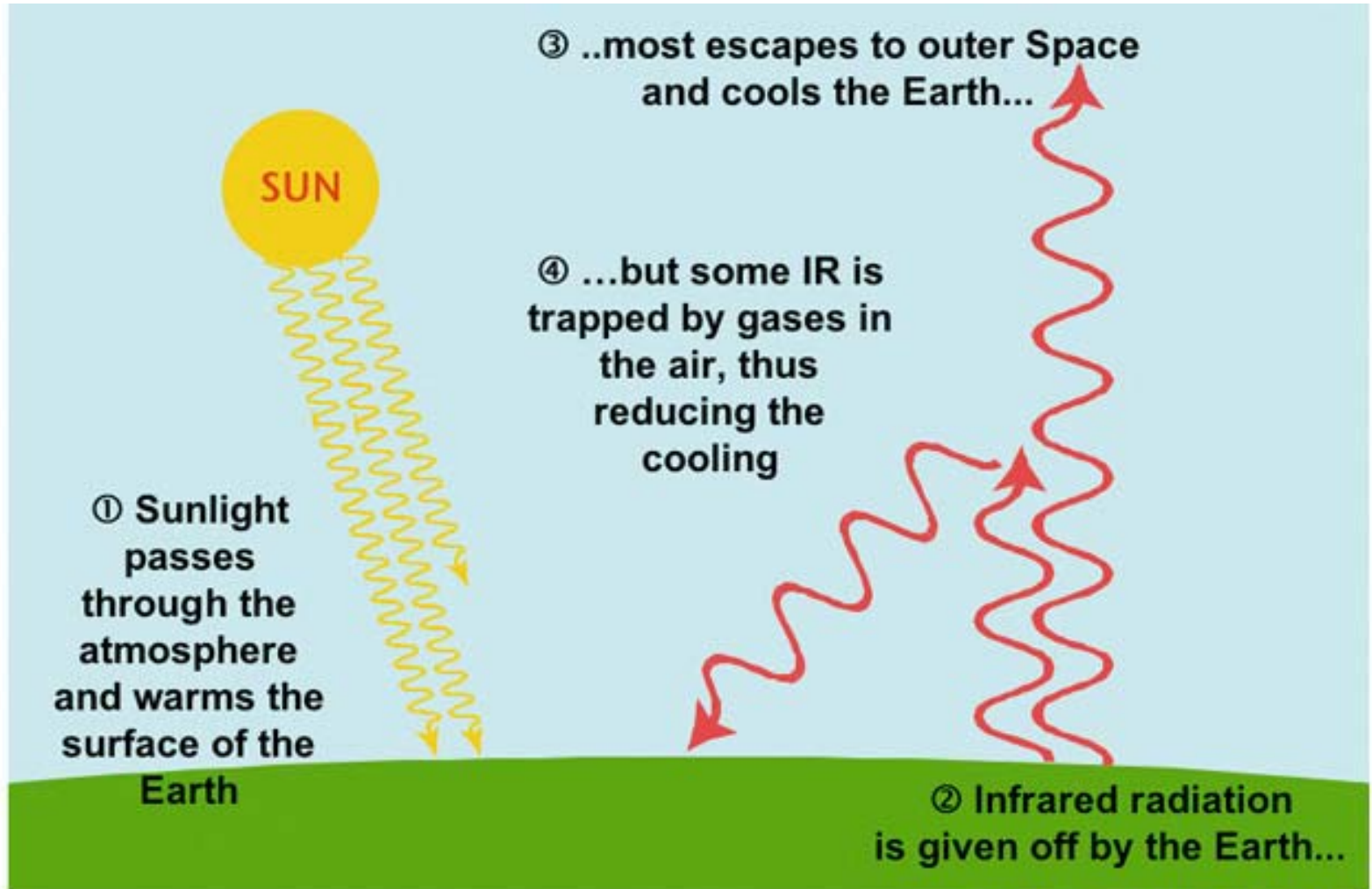


Basic climate science



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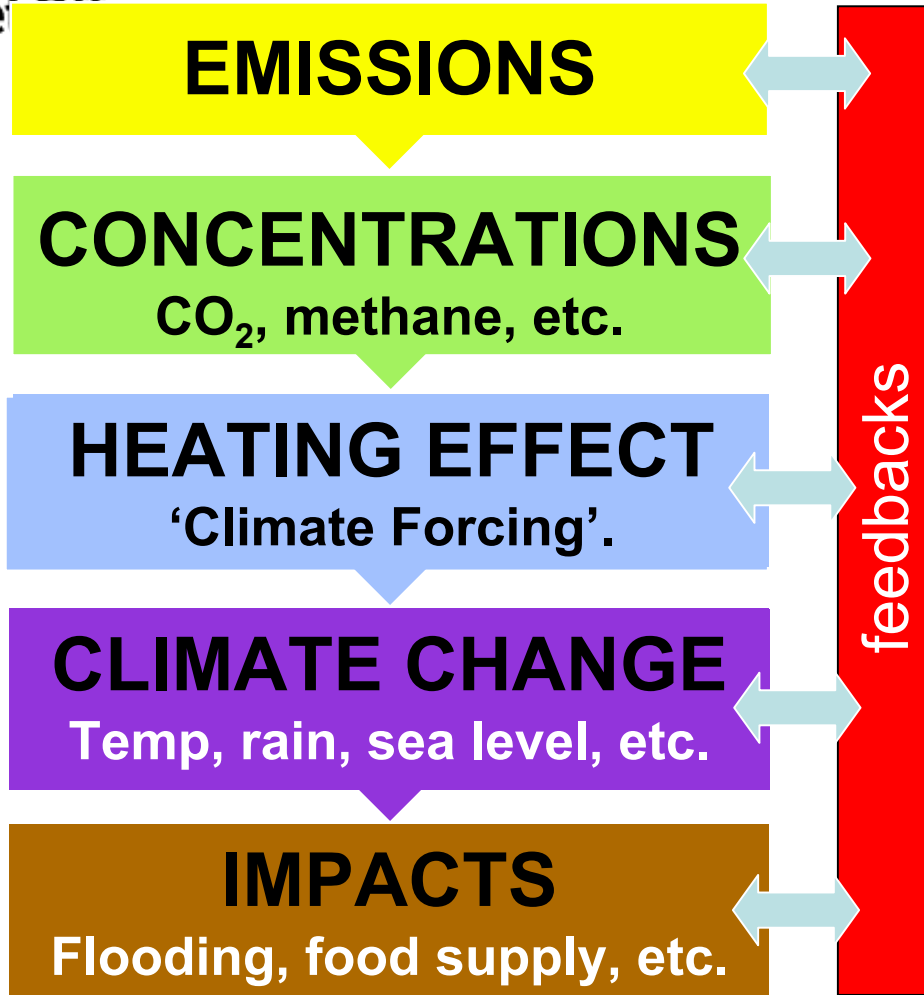
The greenhouse effect



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Stages in predicting climate change



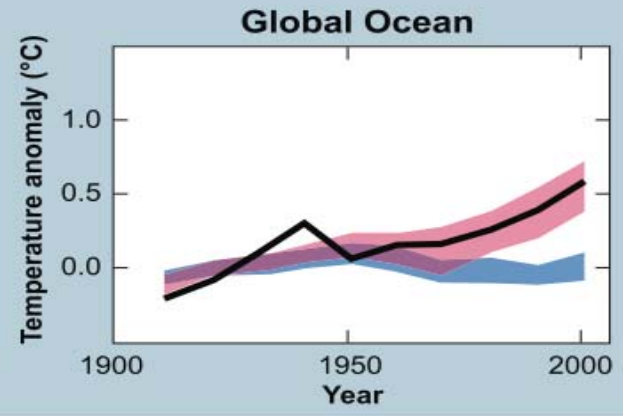
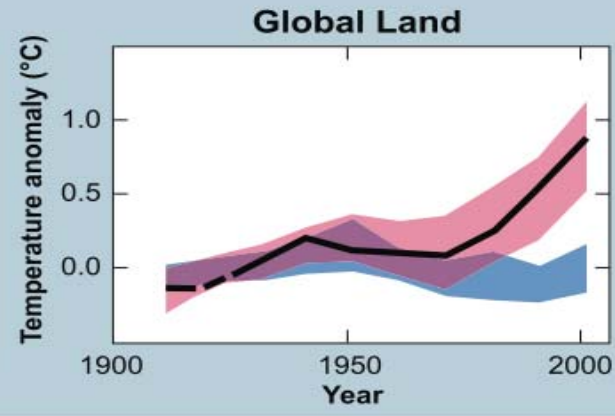
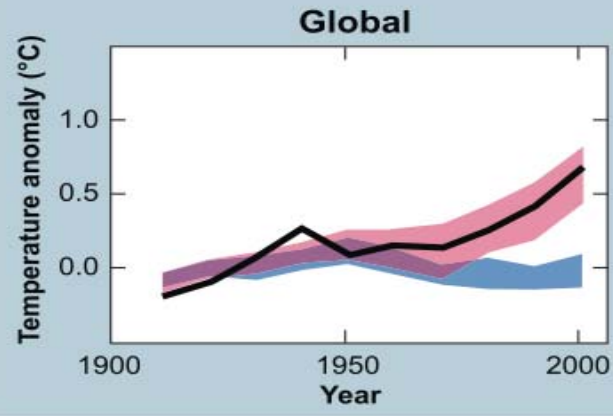
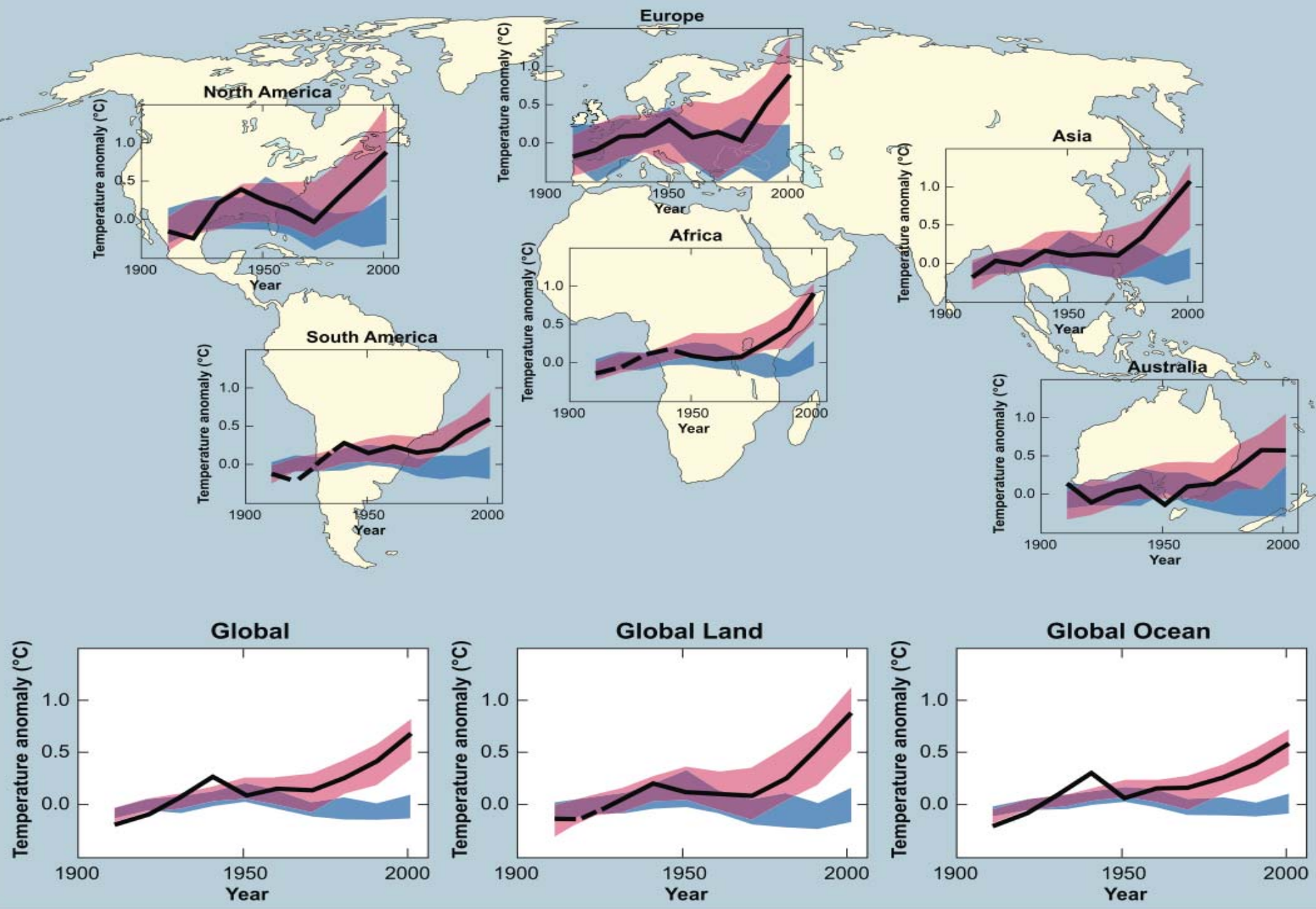
Scenarios from population, energy, economics models

Carbon cycle and chemistry models

Gas properties

Coupled climate models

Impacts models



models using only natural forcings
 models using both natural and anthropogenic forcings
 observations

©IPCC 2007: WG1-AR4



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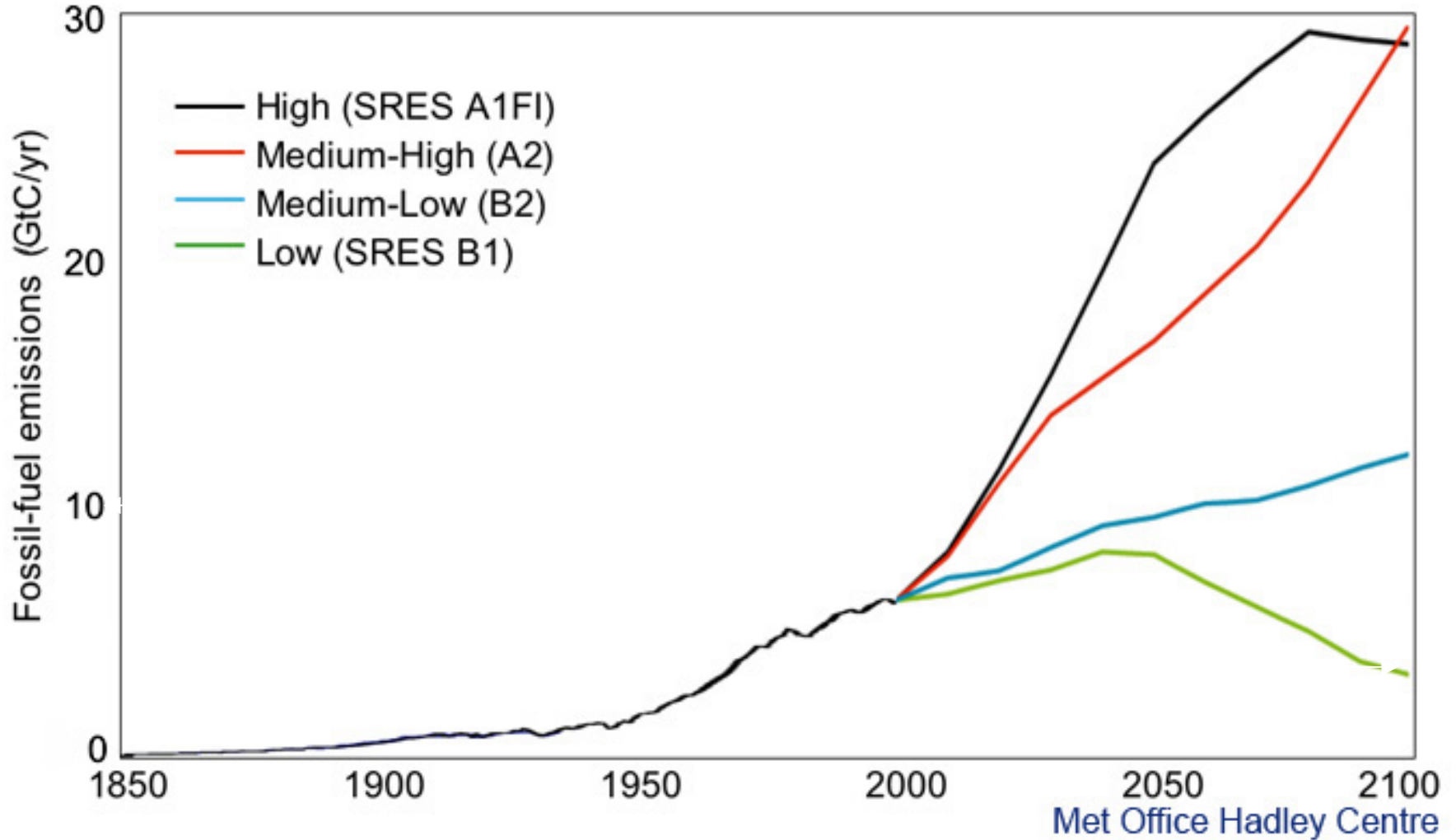


Predictions of future climate



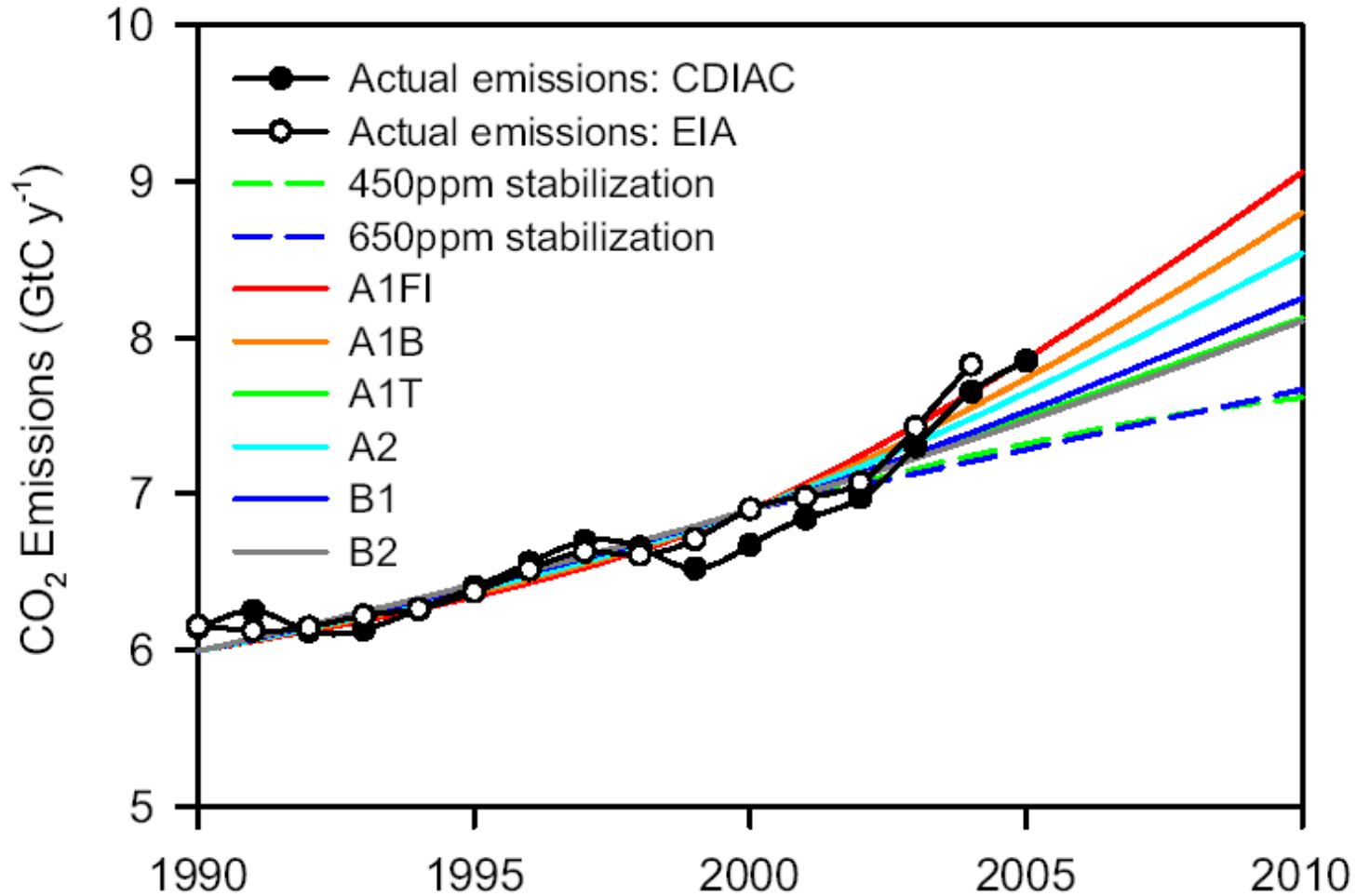
Fossil Fuel Emissions

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Global emissions scenarios exceeded



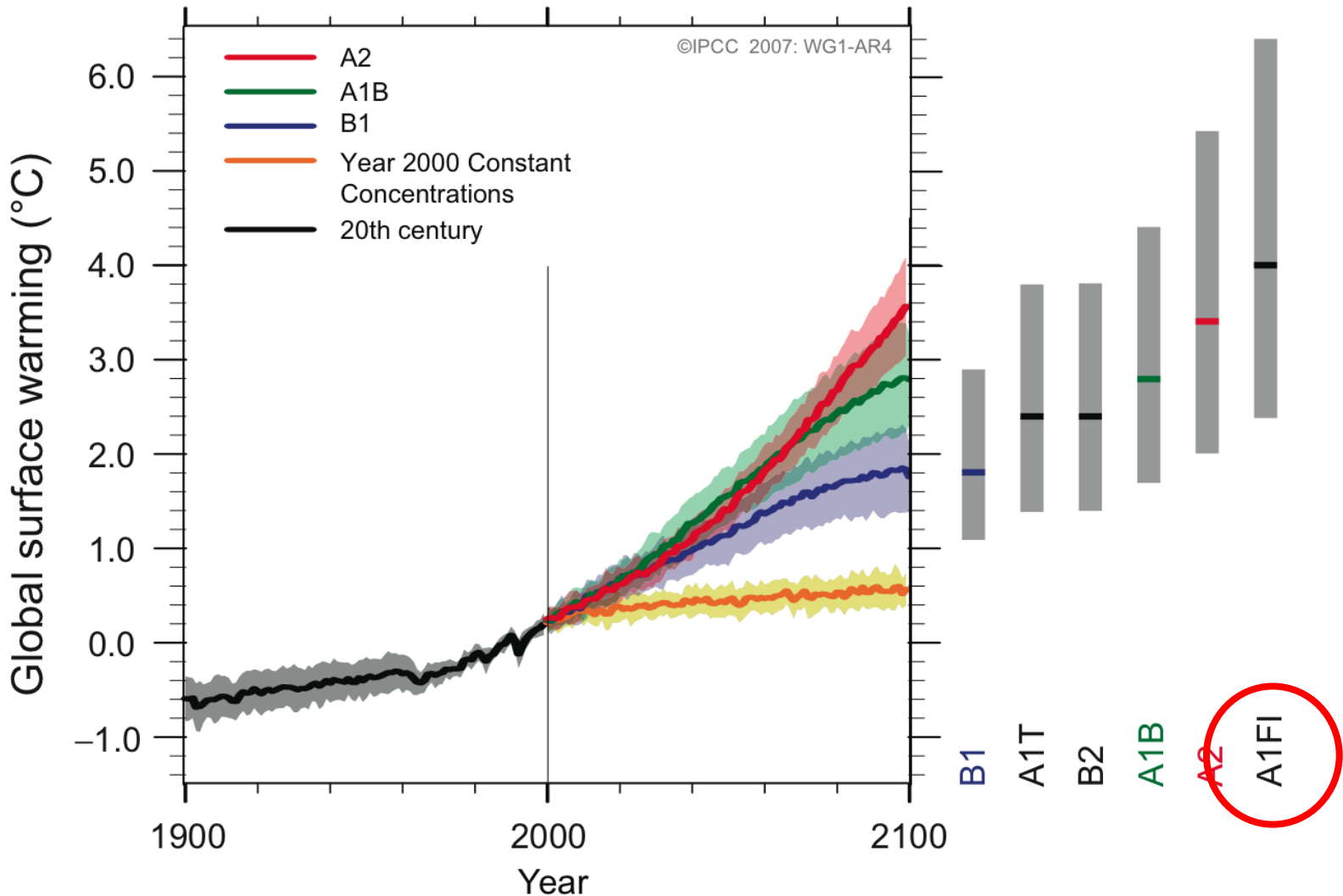
Michael Raupach et al., June 2007



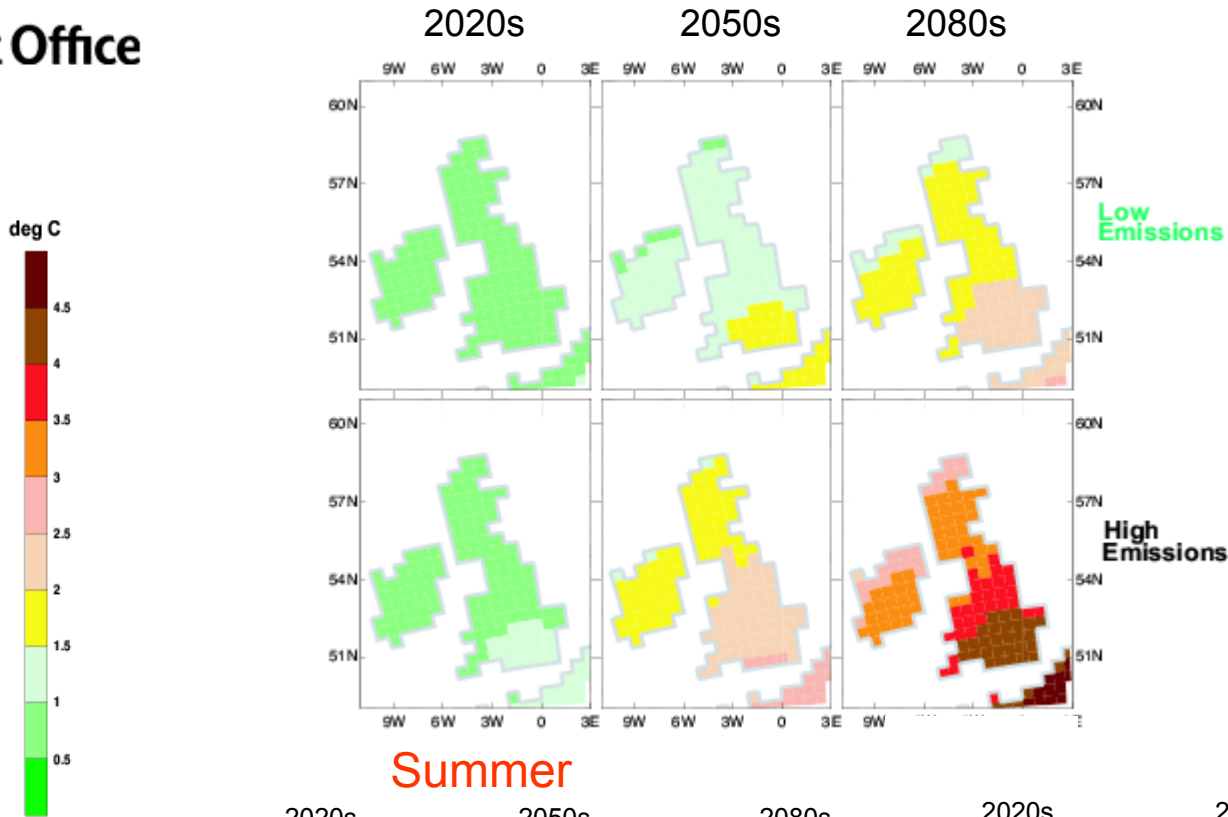
Global Temperature predictions

(IPCC 4th Assessment Report)

Me Multi-model Averages and Assessed Ranges for Surface Warming



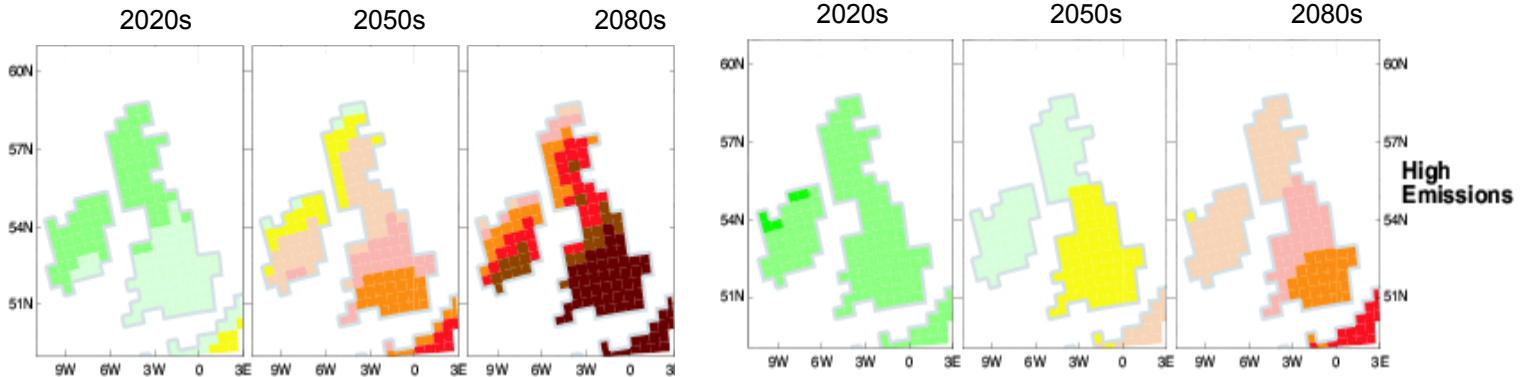
Temperature Predictions (UKCIP02)



Summer

Winter

Changes within "natural" variability





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Precipitation Predictions (UKCIP02)

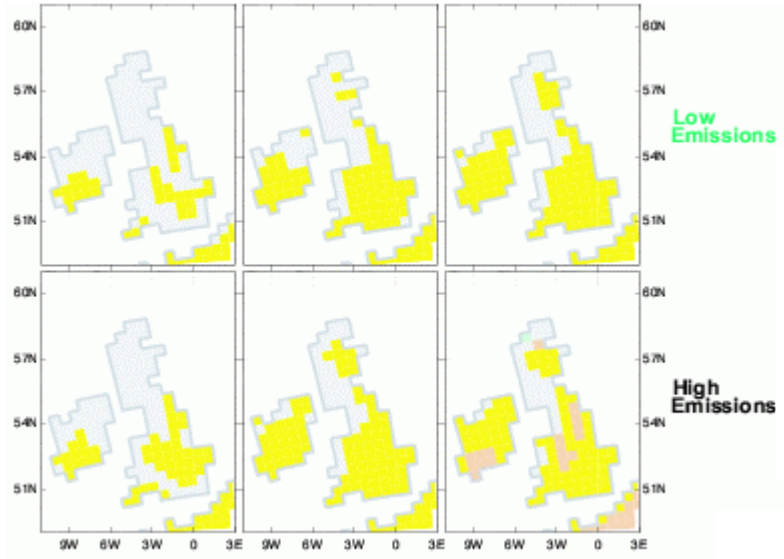
Annual

2020s

2050s

2080s

per cent

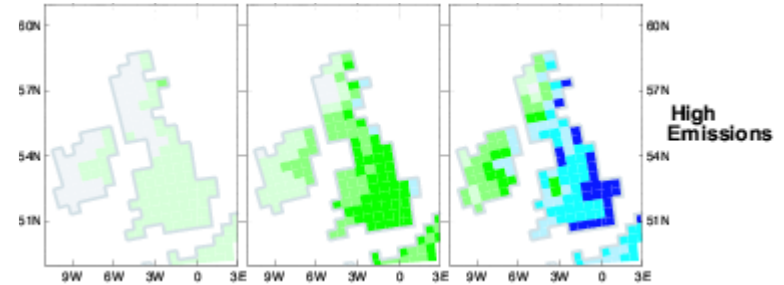


Winter

2020s

2050s

2080s

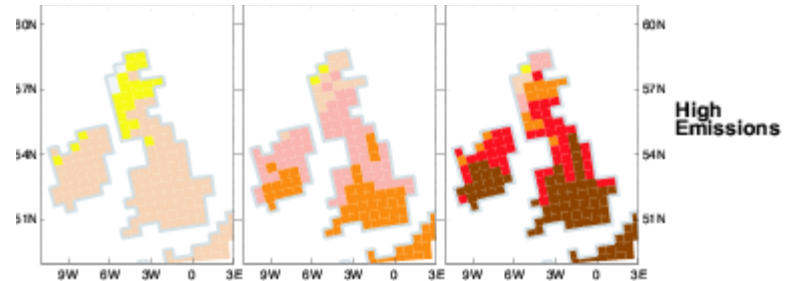


2020s

2050s

2080s

Summer



Changes within natural variability





Predicted changes to UK extremes by the 2080s

- x10 to x20 increase in hot summer days
- x10 to x20 increase in warm summer nights
- “Record” hot temperatures predicted to be 8°C hotter
- 50% reduction in frosts
- More intense storms
- Heavier downpours in Winter

UKCIP02



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Implications for Highway Maintenance - example adaptation studies



Highways Agency Climate Sensitivity Analysis

- Assessing climate change impacts on road infrastructure & building standards
(Highways Agency)

**Changing climate poses new risks -
Helping manage investment**





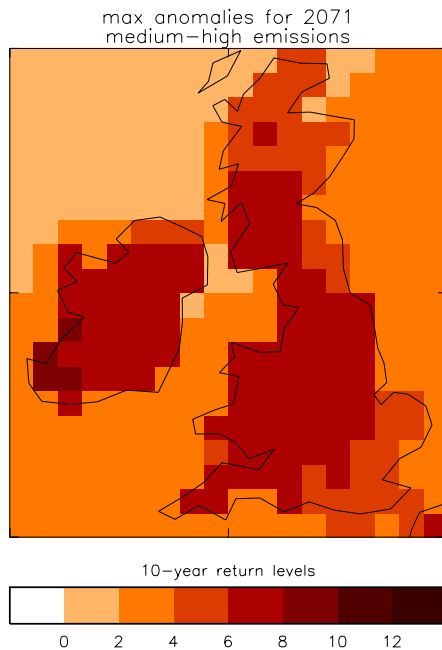
Climate Change Sensitivity Analysis

- Workshops with H.A. and Met Office staff – discuss sensitivity of activities to weather and climate
- Plan work packages to help answer the questions raised by the study

Priorities of the Highways Agency:

- Impact of changes in extreme temperature on road network.
- Impact of changes in extreme precipitation on drainage from roads and structures.
- Impact of climate change on earthwork stability and erosion.
- Impact of changes in mean and extreme wind climate on the design and operation of bridges.

Extreme Temperatures



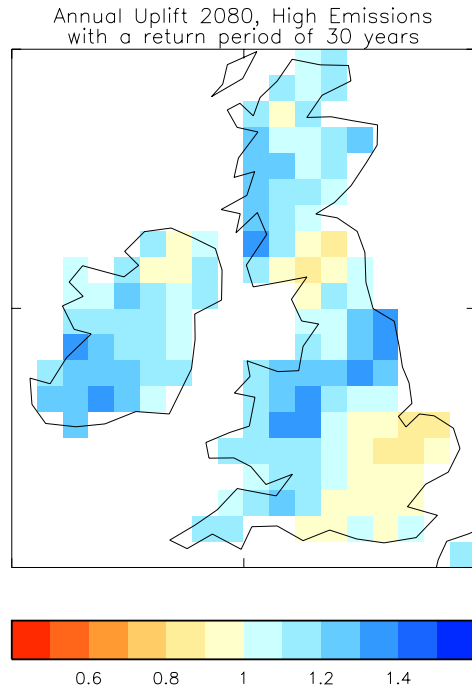
Up to a 10 °C increase in the 1 in 10 year maximum surface temperature in parts of the UK by 2071 (medium high emissions)

-revision of design structures for the future

'The impact of changes in extreme temperature and precipitation on the assets and operations of the Highways Agency'

Met Office Consultancy: Met Office & PB

Extreme Rainfall



Up to a 40% increase in the amount of precipitation for a 1 in 30 year event in parts of the UK (high emissions scenario)

- Although large uncertainties in rainfall

'The impact of changes in extreme temperature and precipitation on the assets and operations of the Highways Agency'
Climate Change Consultancy: Met Office & PB

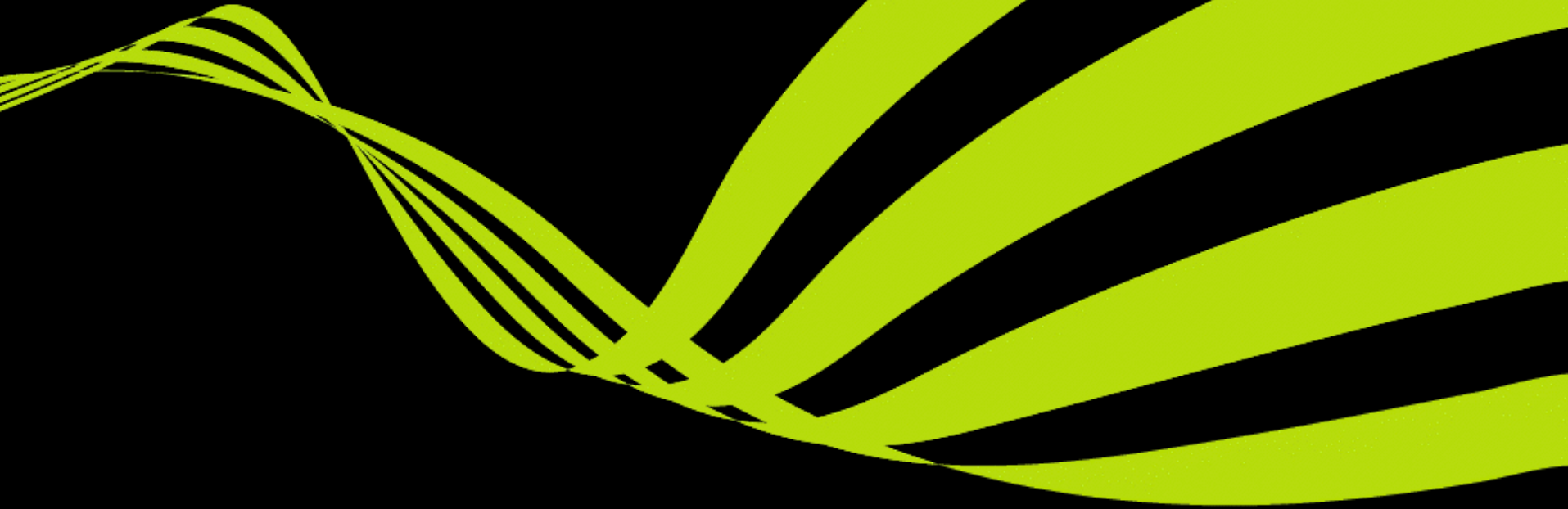


Summary

- Science provides predictions of climate change and levels of confidence in them
 - Regional temperature, precipitation and wind
 - Means and extremes
- Work with partners (e.g. Highways agency, engineering companies) to understand implications for them
 - What needs to be done, and when?



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Questions