UNFCCC Climate Kiosk at CoP9, 11 December 2003

CLIMATE CHANGE
An introduction

Geoff Jenkins, Hadley Centre, Met Office, Exeter, UK

- Introduction: the greenhouse effect and climate modelling
- How has climate changed, and is Man responsible?
- How will climate & sea level change in the future?
- Certainties, uncertainties and probabilities

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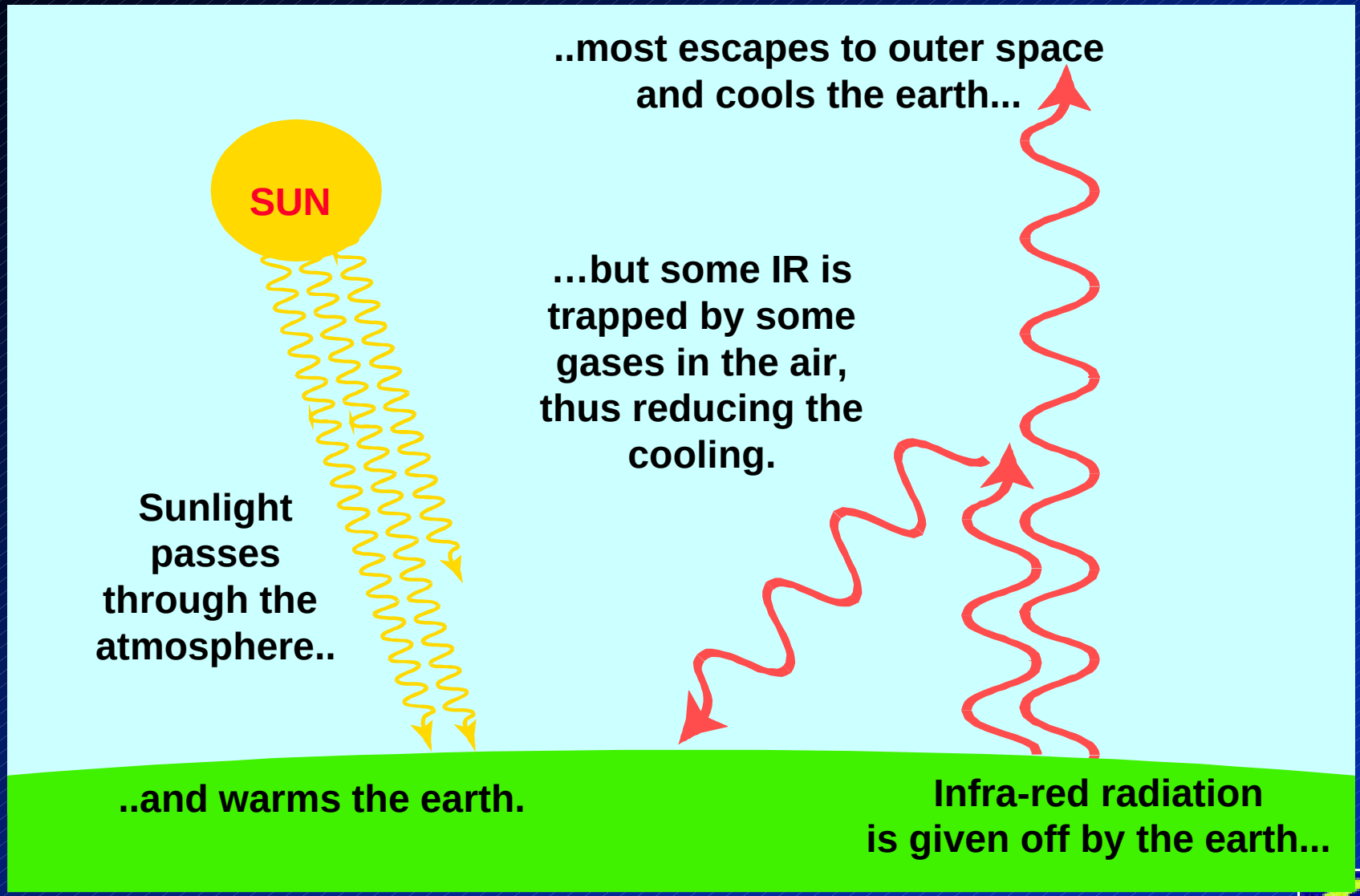
THE GREENHOUSE EFFECT



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HOW QUICKLY THE CLIMATE WILL CHANGE IN FUTURE DEPENDS ON:

- **How much greenhouse gas emissions grow**
  - this depends on population growth, energy use, new technologies, etc

- **How sensitive the climate system is to emissions**
  - how clouds, ice, oceans etc respond to the extra heating; we build a mathematical model of the earth's climate system to calculate this

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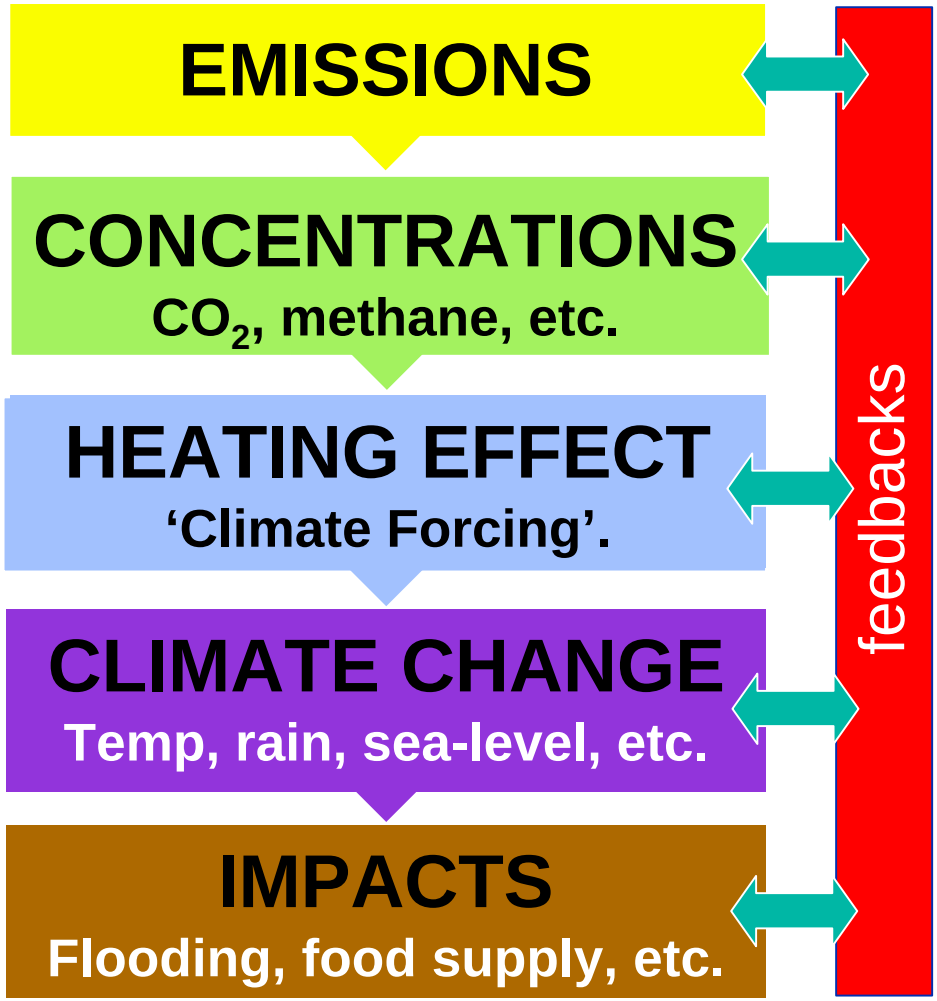
PREDICTING CLIMATE CHANGE



Scenarios from population, energy, economics models

Carbon cycle and chemistry models

Gas properties

Coupled climate models

Impacts models

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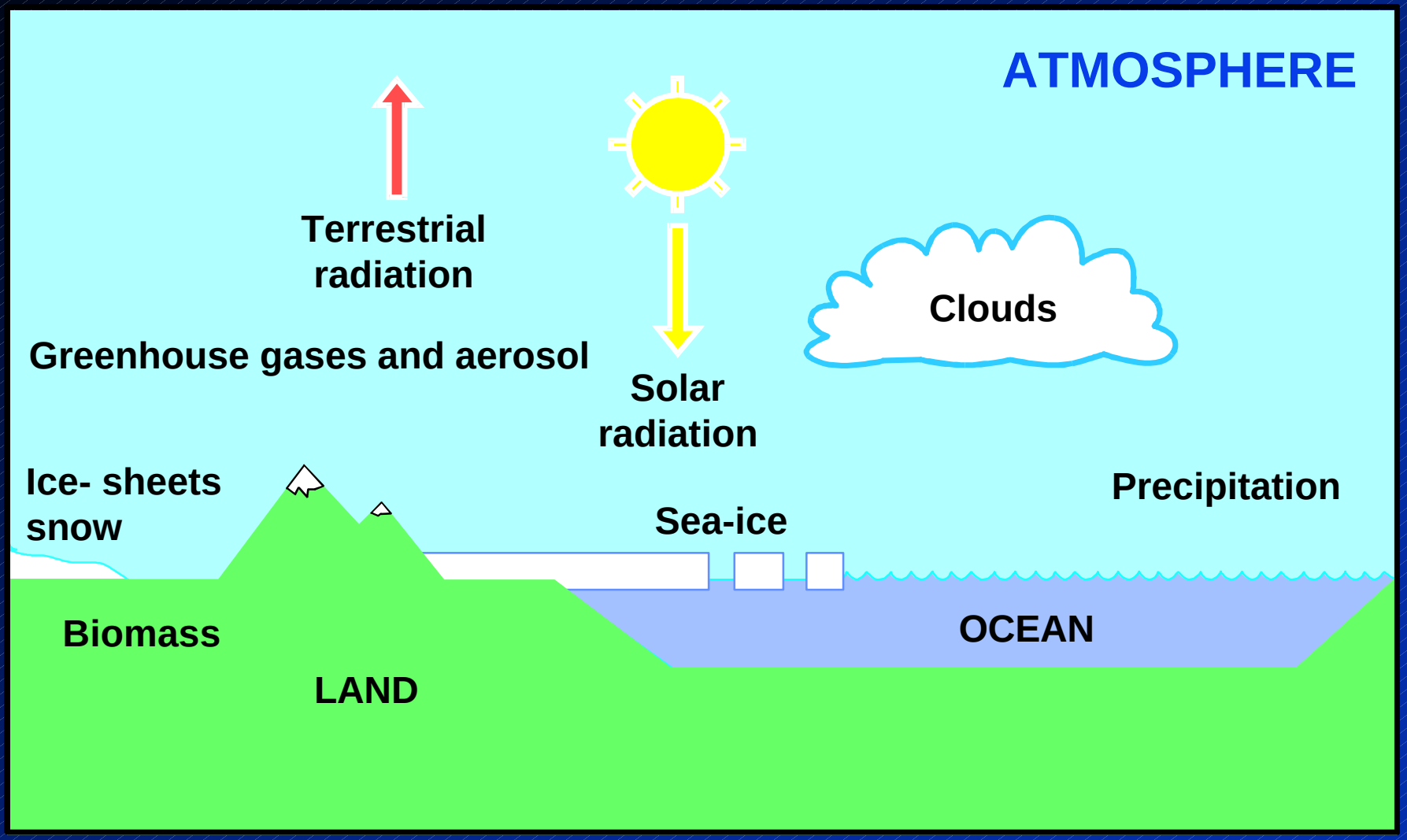
THE CLIMATE SYSTEM



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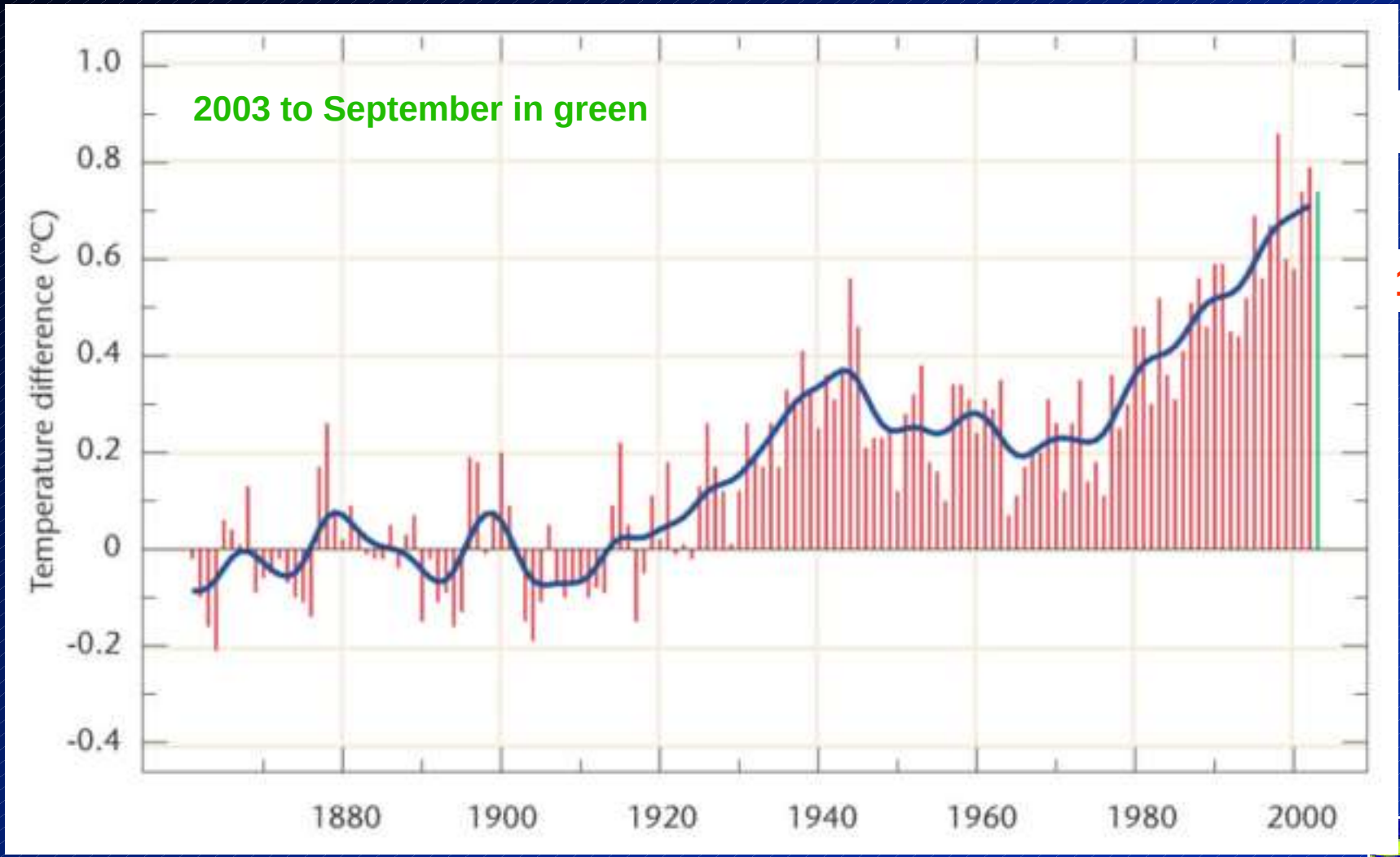
GLOBAL SURFACE TEMPERATURES 1861-2002



1.5°F

1.0°F

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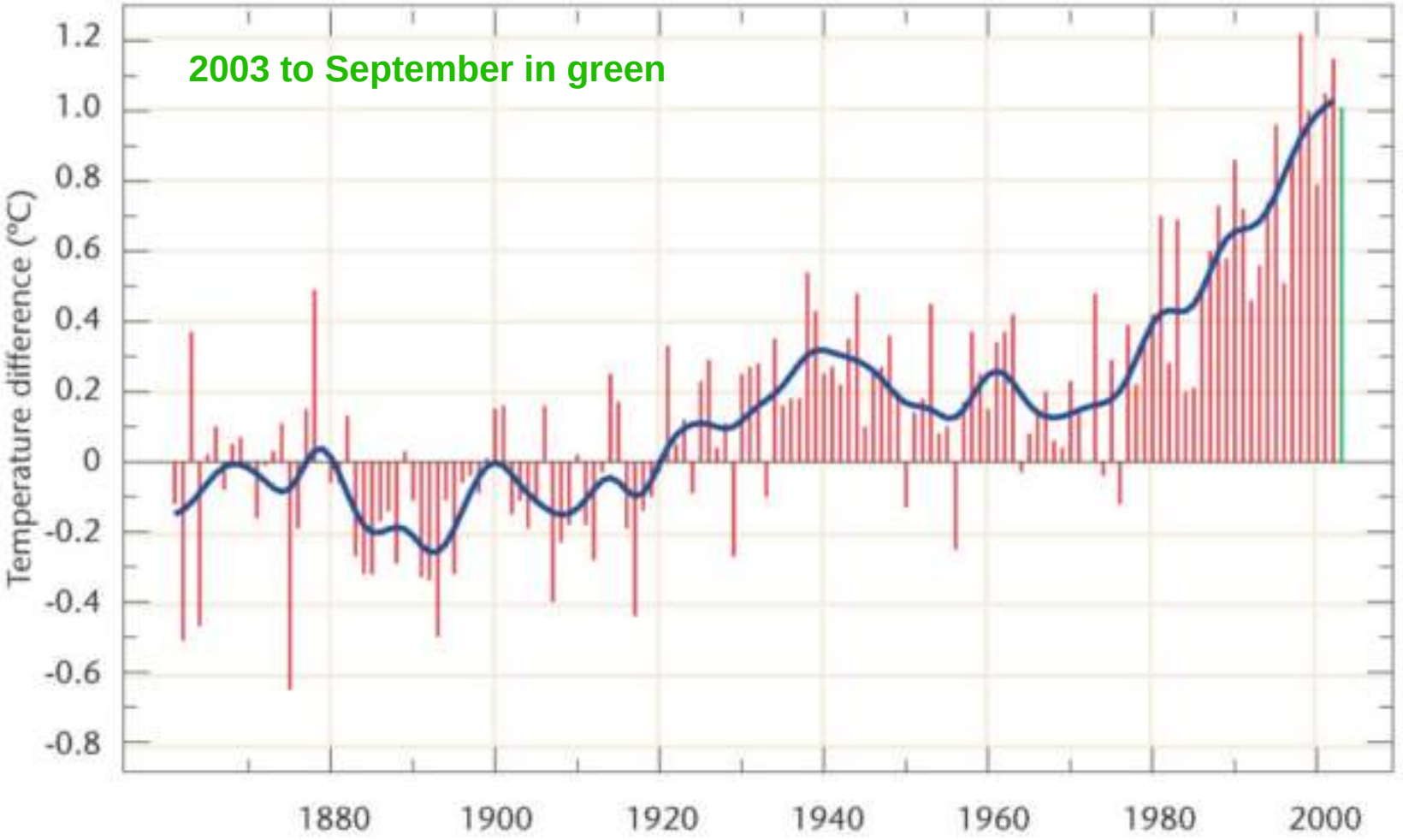
GLOBAL SURFACE TEMPERATURES OVER LAND 1861-2002



2.0°F

1.0°F

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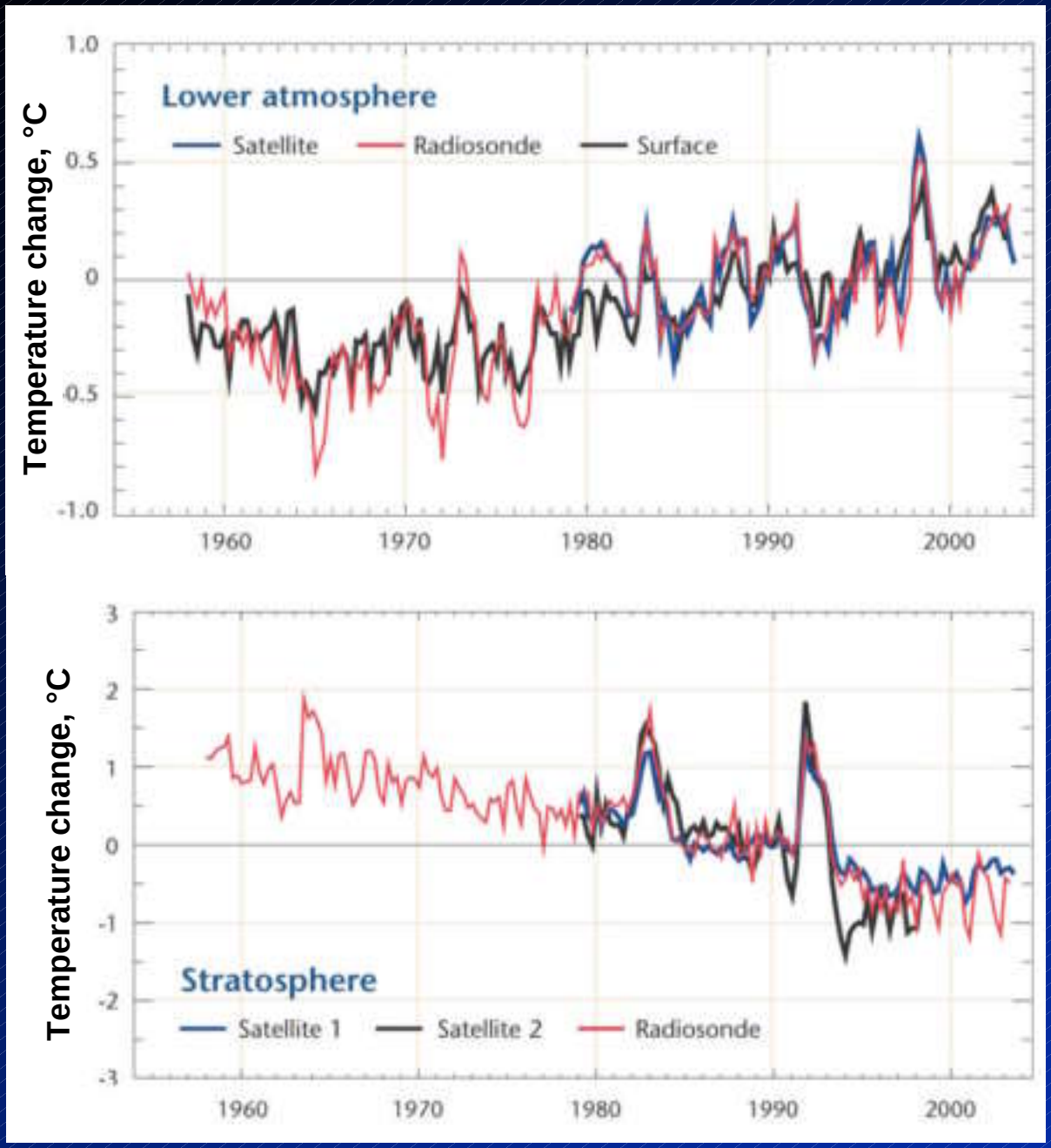
TROPOSPHERIC AND STRATOSPHERIC TEMPERATURES 1958-2002



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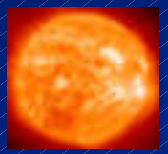
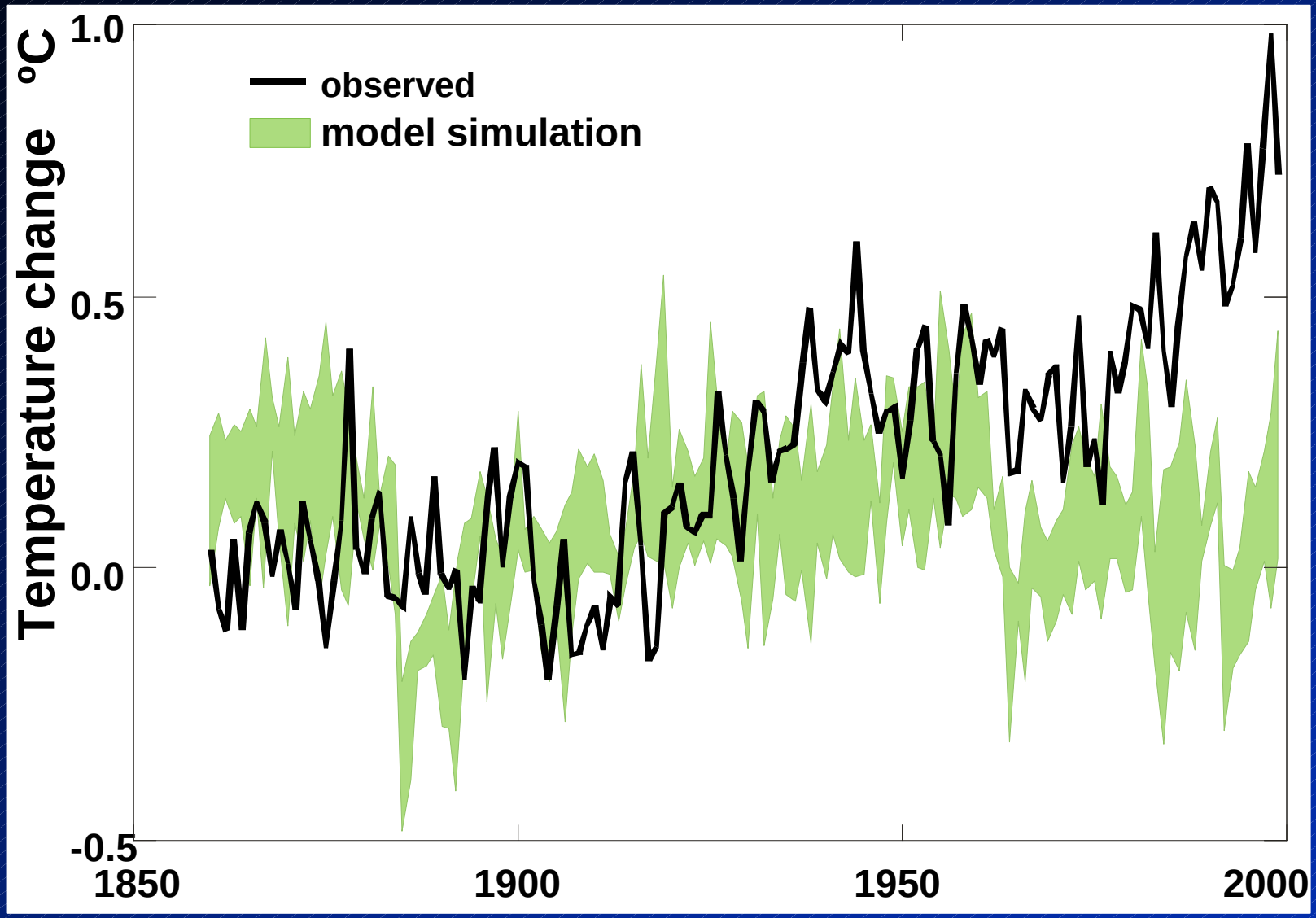
Possible causes of recent climate change

- Natural internal climate variability (“chaos”)
- Natural factors that force change
  - orbit of the earth around the sun
  - energy output of the sun 
  - volcanic particles in the stratosphere (“dust”) 
- Man-made factors that force change 
  - greenhouse gases (CO2, methane….)
  - small particles (cooling effect of sulphates, etc)

OBSERVED AND SIMULATED CHANGE

calculated using only natural factors



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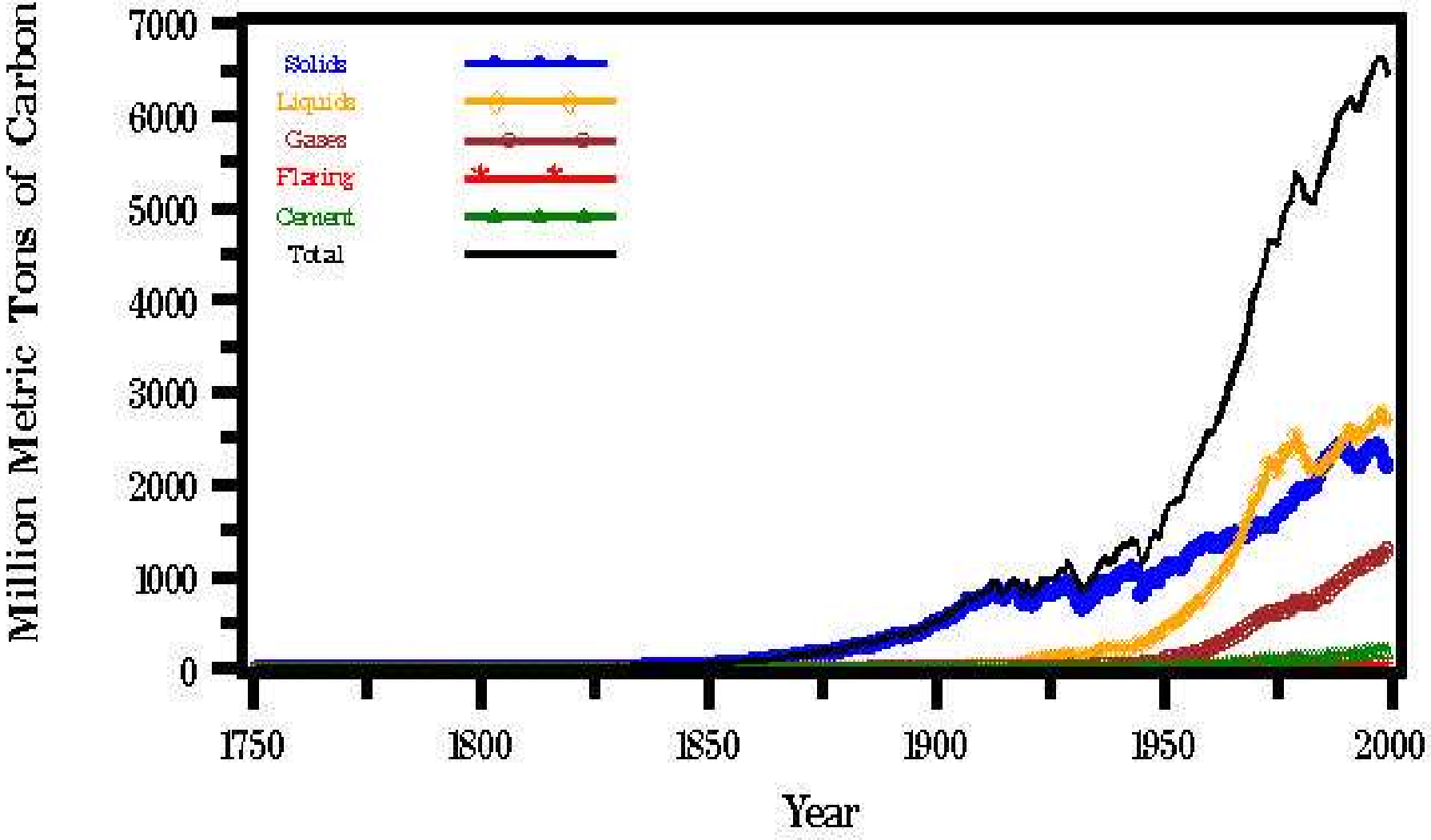
MAN-MADE CO2 EMISSIONS



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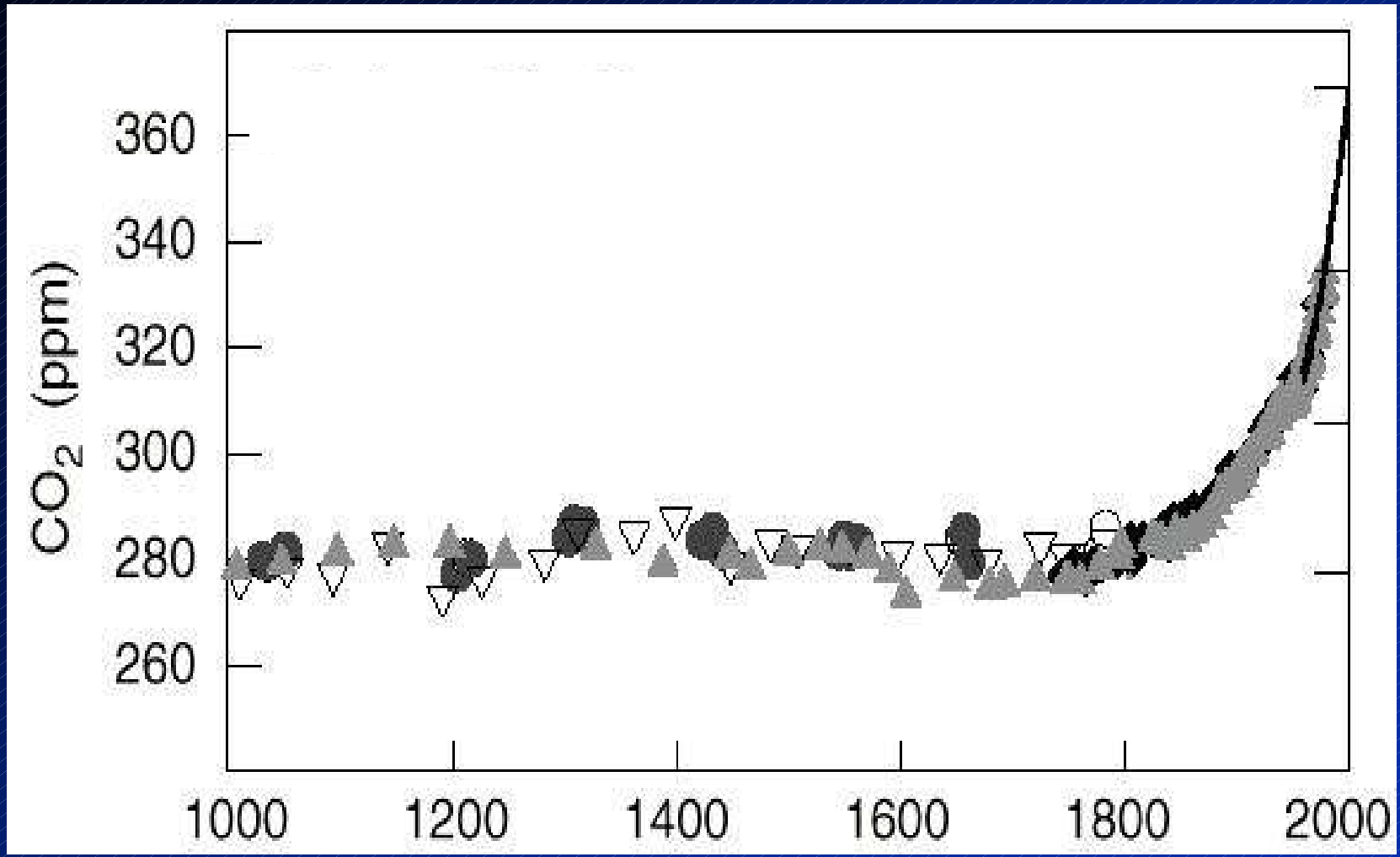
Carbon Dioxide in the Atmosphere
has risen by over 30% due to human activities



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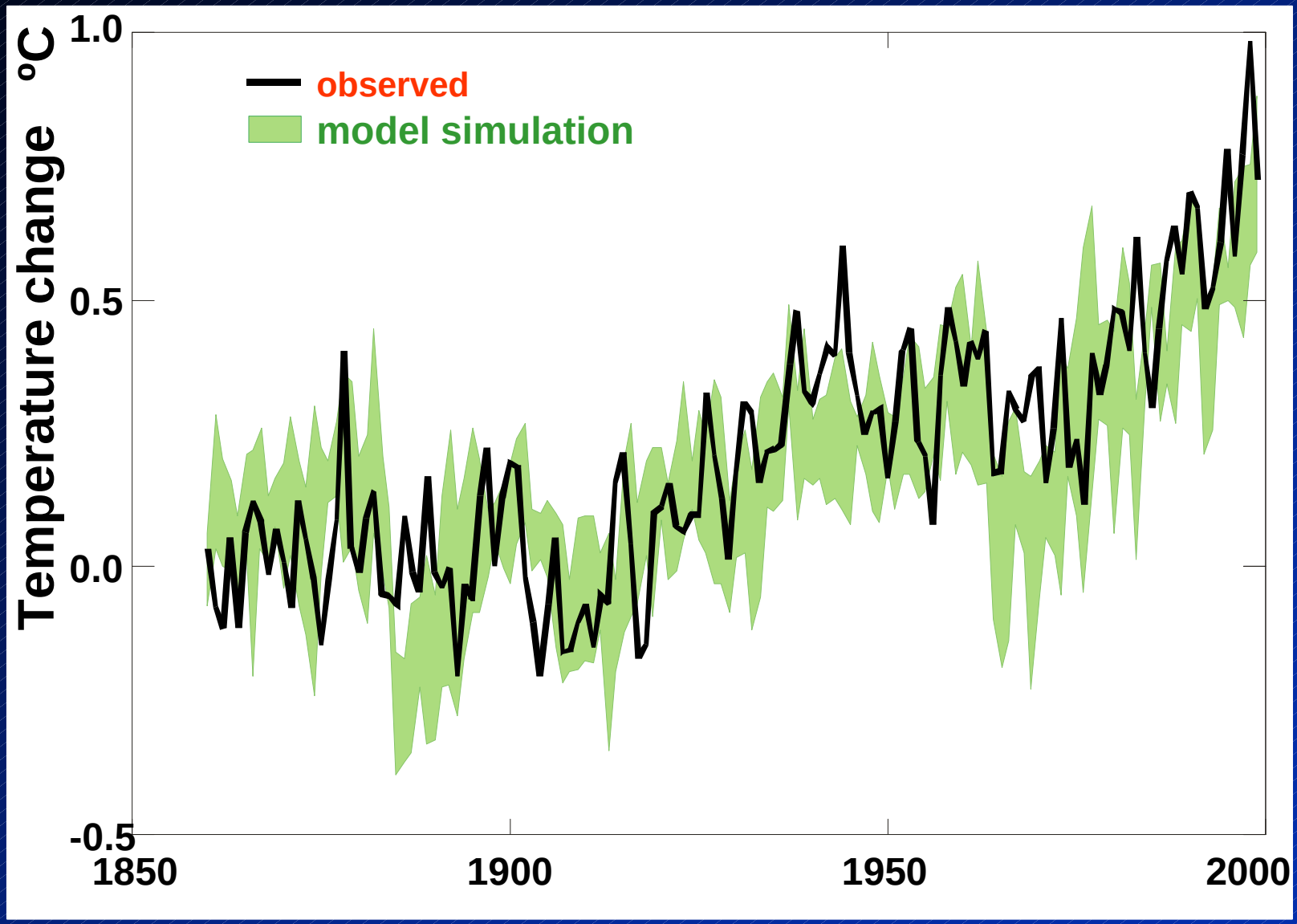
Observed and simulated climate change
from natural AND Man-made factors



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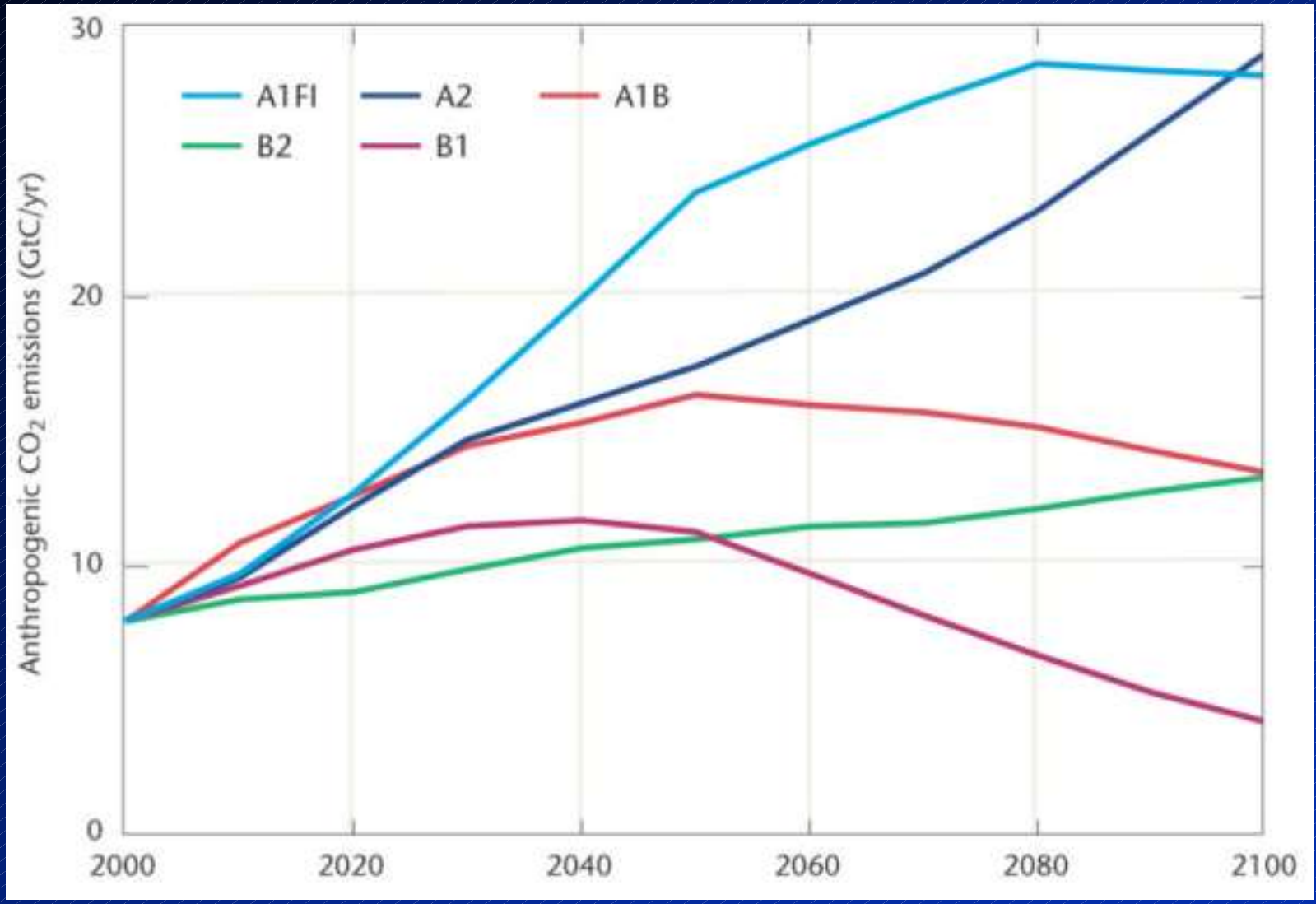
MAN-MADE CO2 EMISSIONS (Gt/yr) IN THE IPCC SRES SCENARIOS



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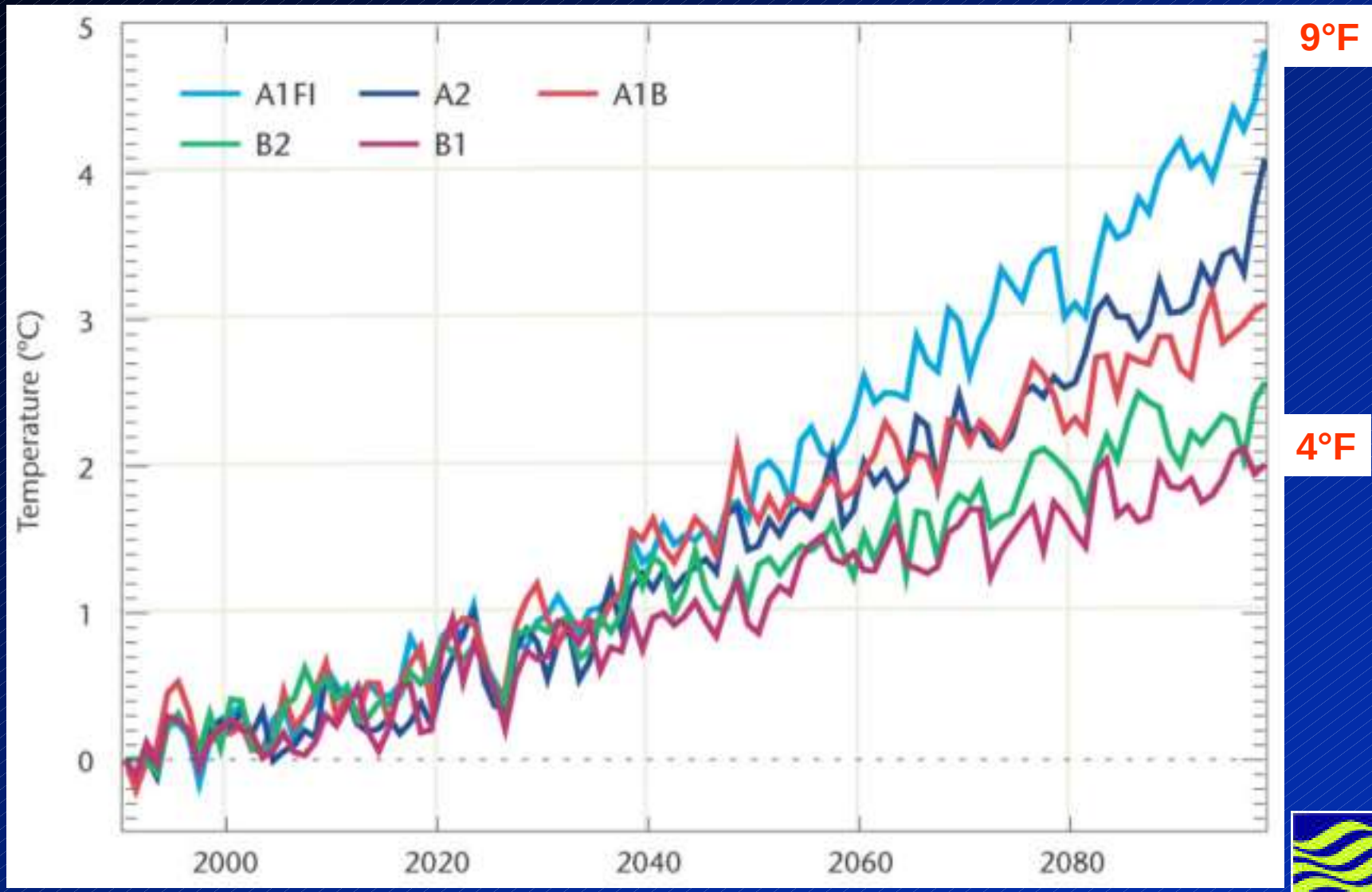
GLOBAL TEMPERATURE RISE
from 5 IPCC SRES emissions scenarios



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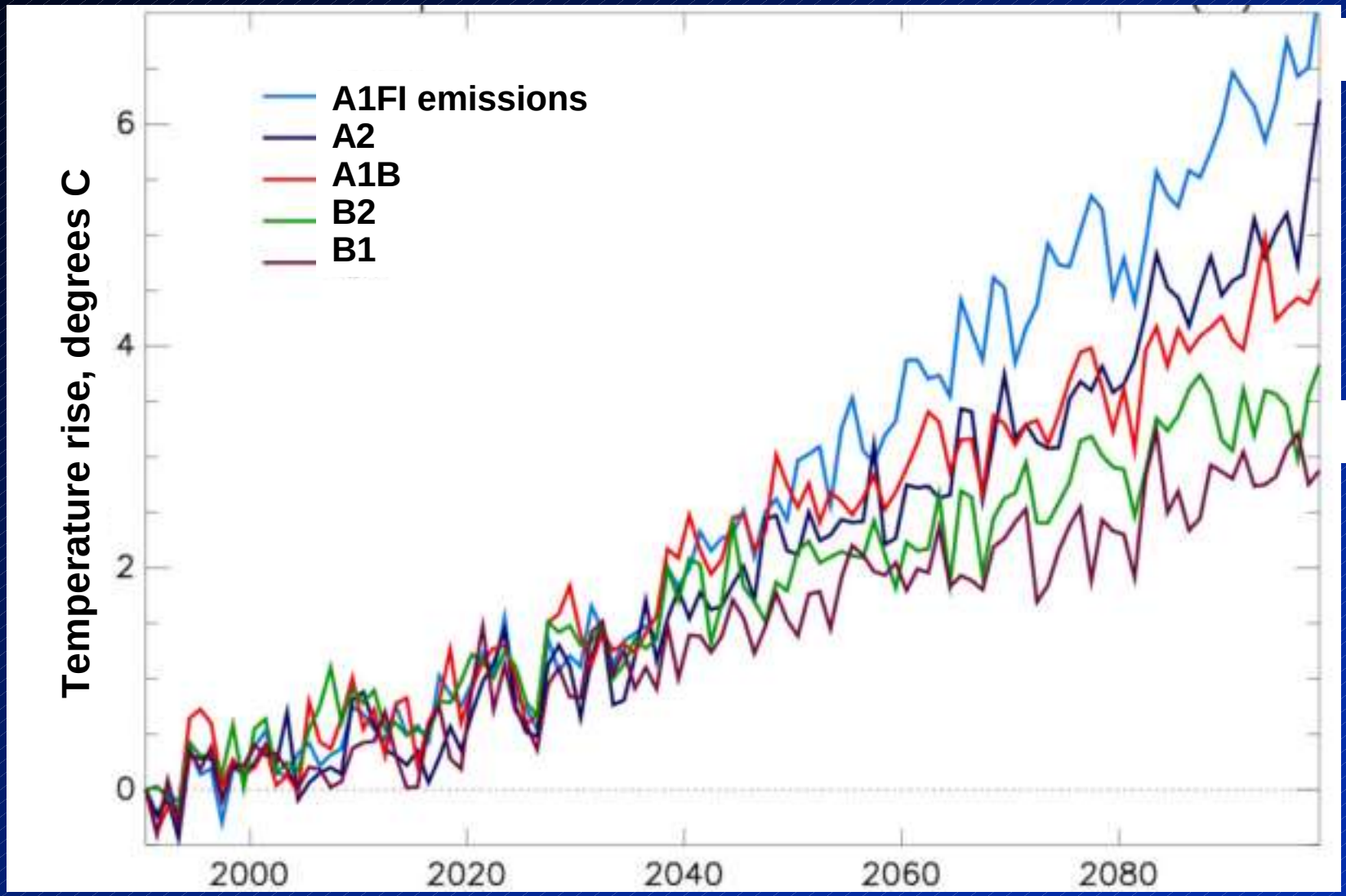
GLOBAL TEMPERATURE RISE OVER LAND from 5 IPCC SRES emissions scenarios



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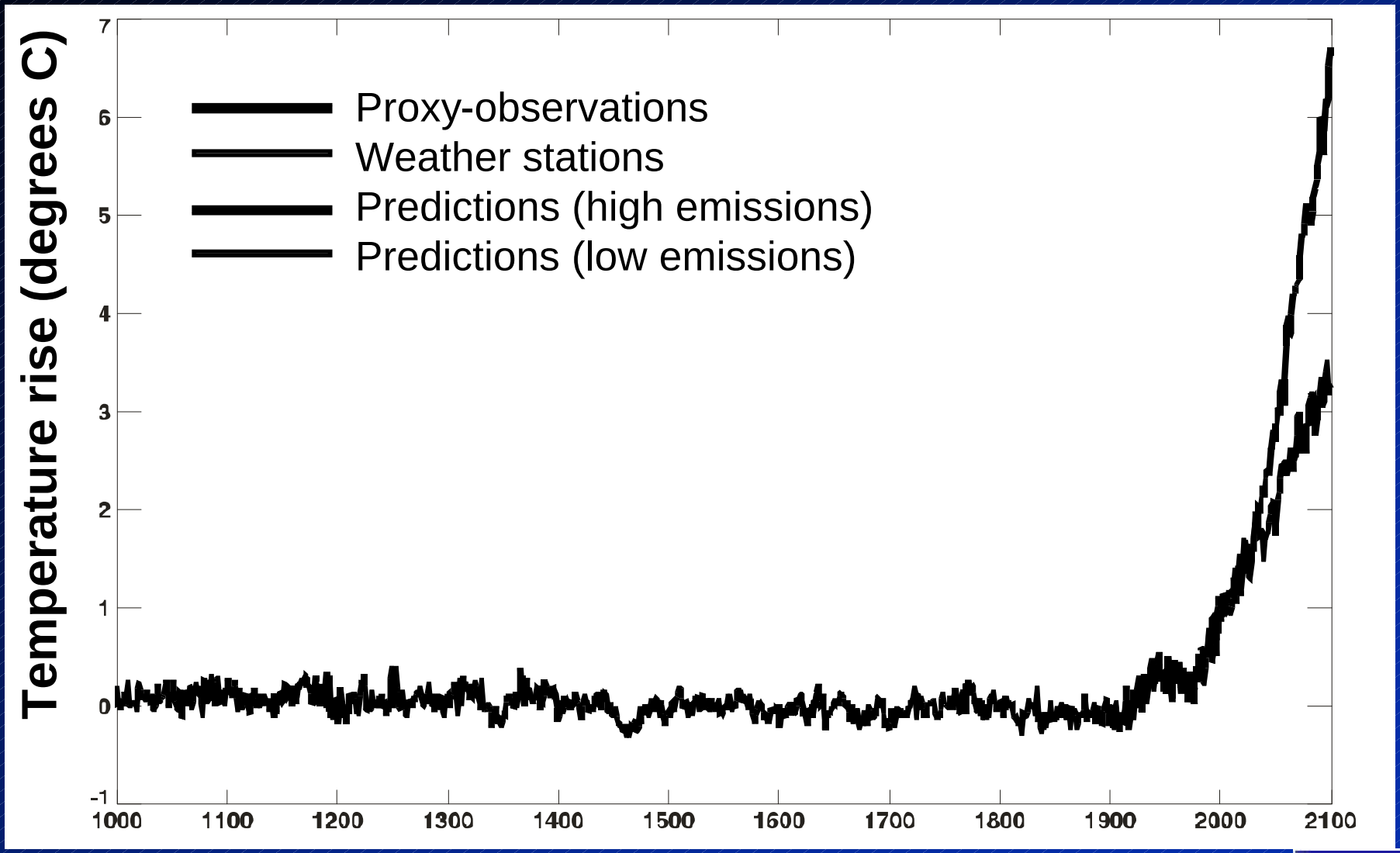
N HEMISPHERE TEMPERATURE 1000 - 2100



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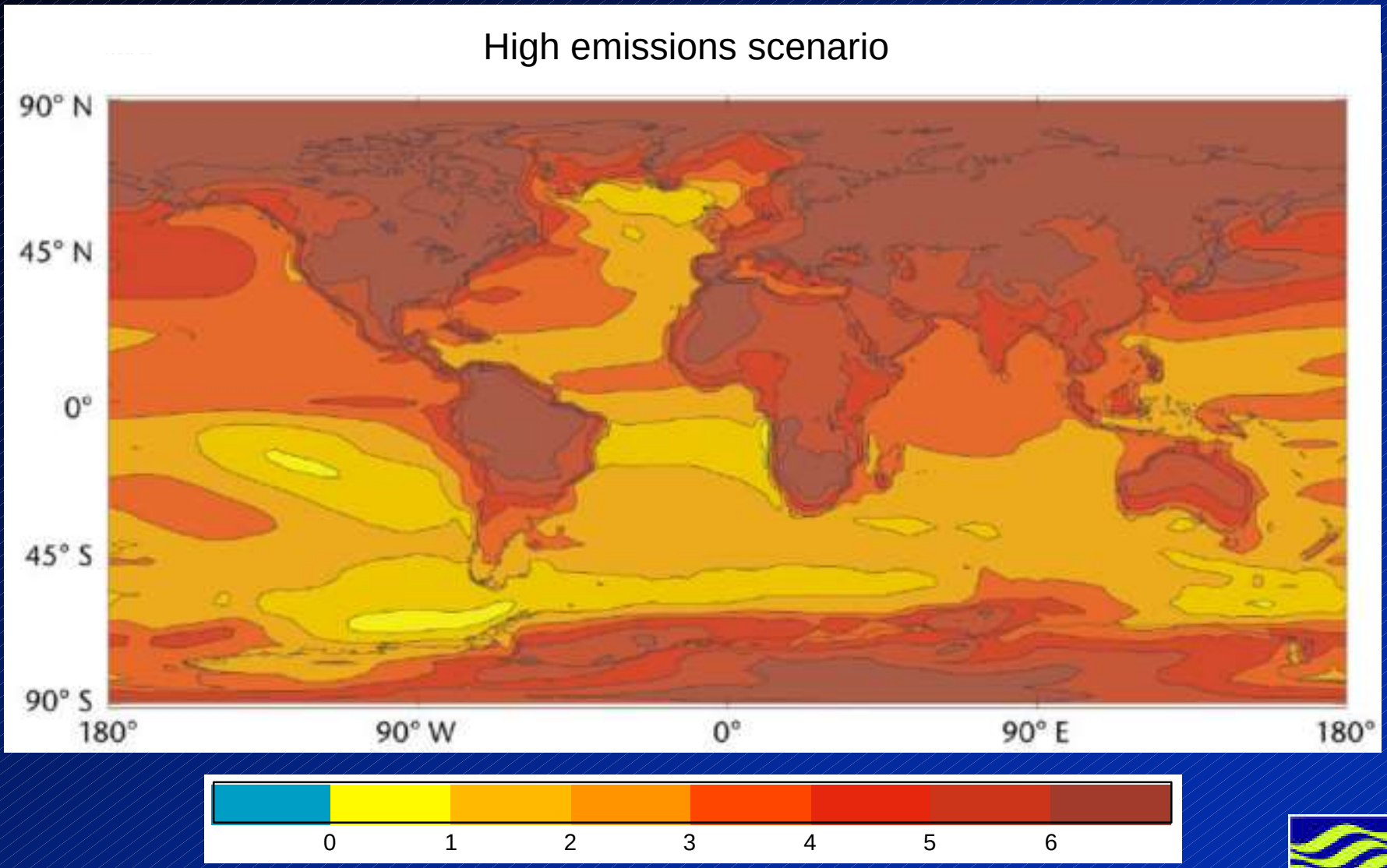
PATTERN OF ANNUAL TEMPERATURE CHANGES
2080s relative to present day

High emissions scenario



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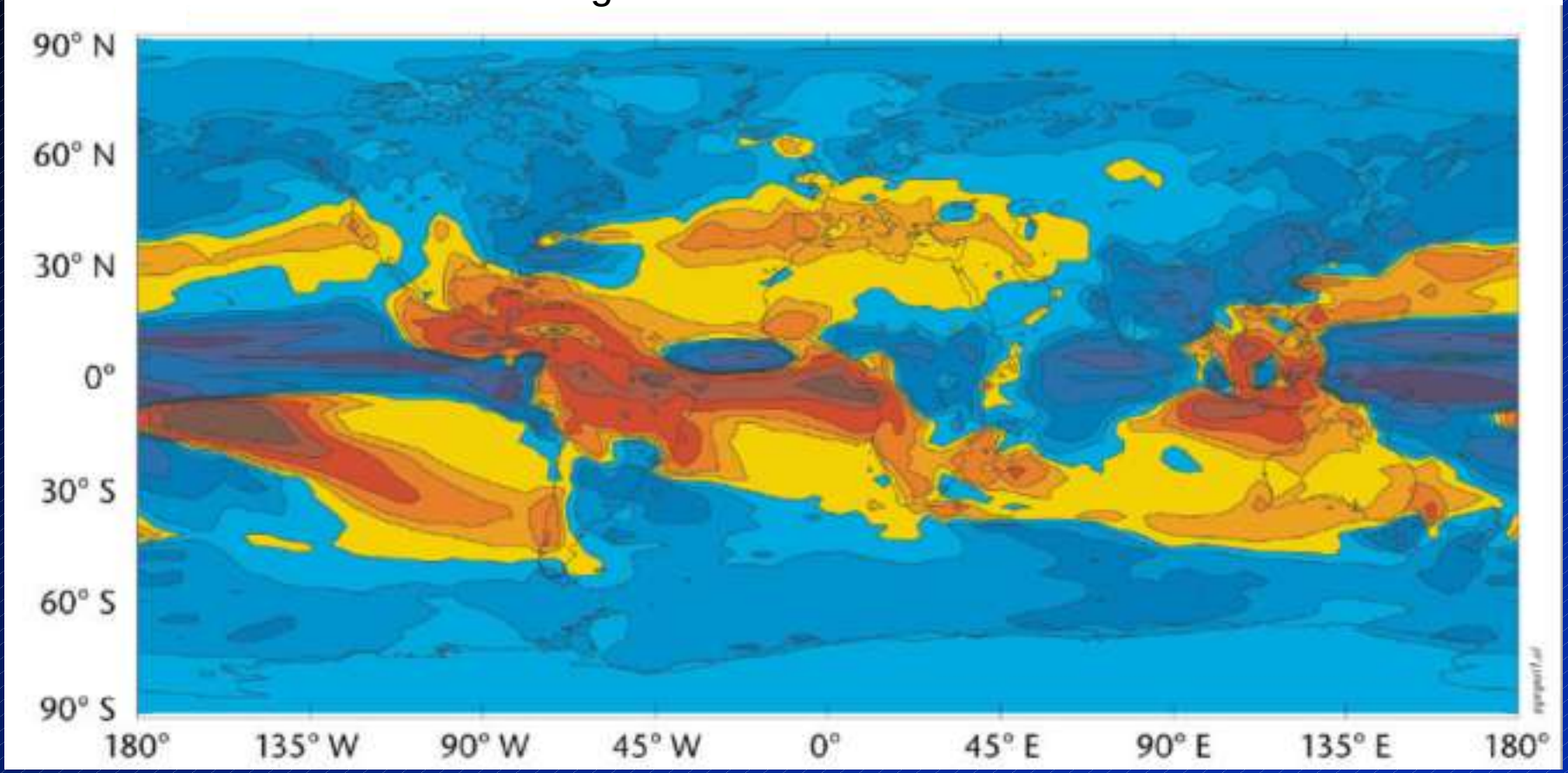
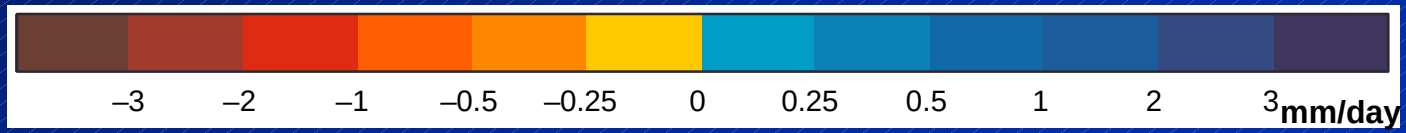
PATTERN OF ANNUAL PRECIPITATION CHANGES
2080s relative to present day

High emissions scenario





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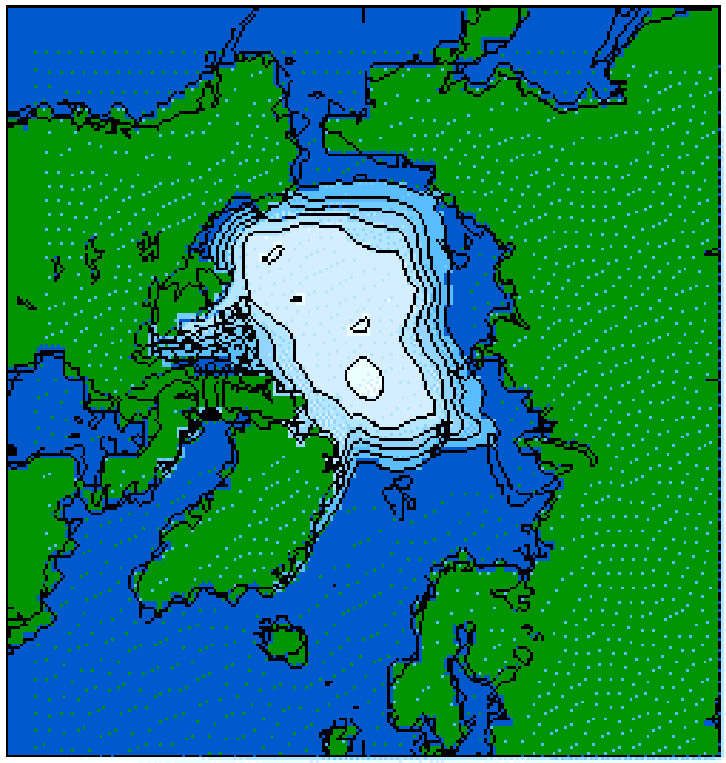
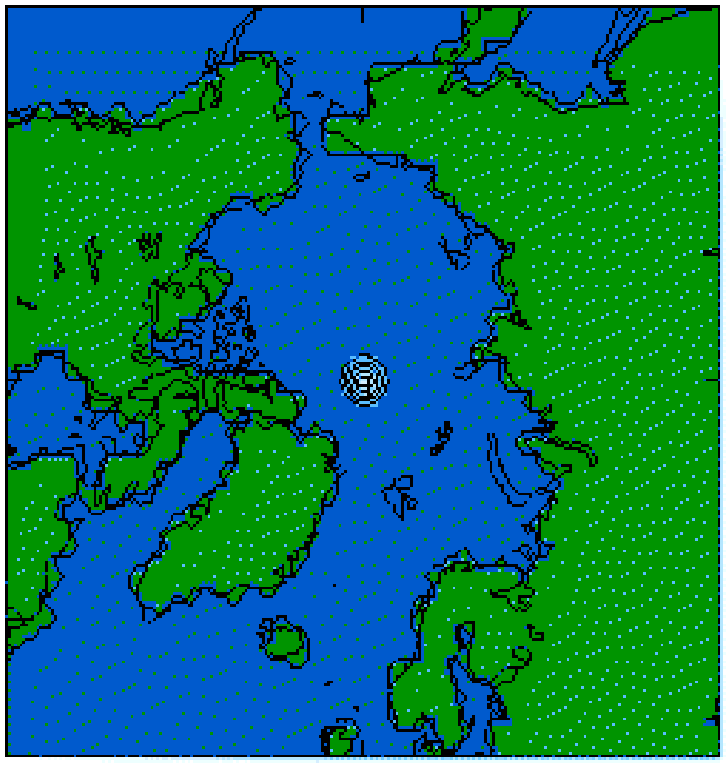
Extent of arctic summer sea-ice



Present Day

0 0.15 0.3 0.45 0.6 0.75 0.9



2080s

0 0.15 0.3 0.45 0.6 0.75 0.9

High emissions

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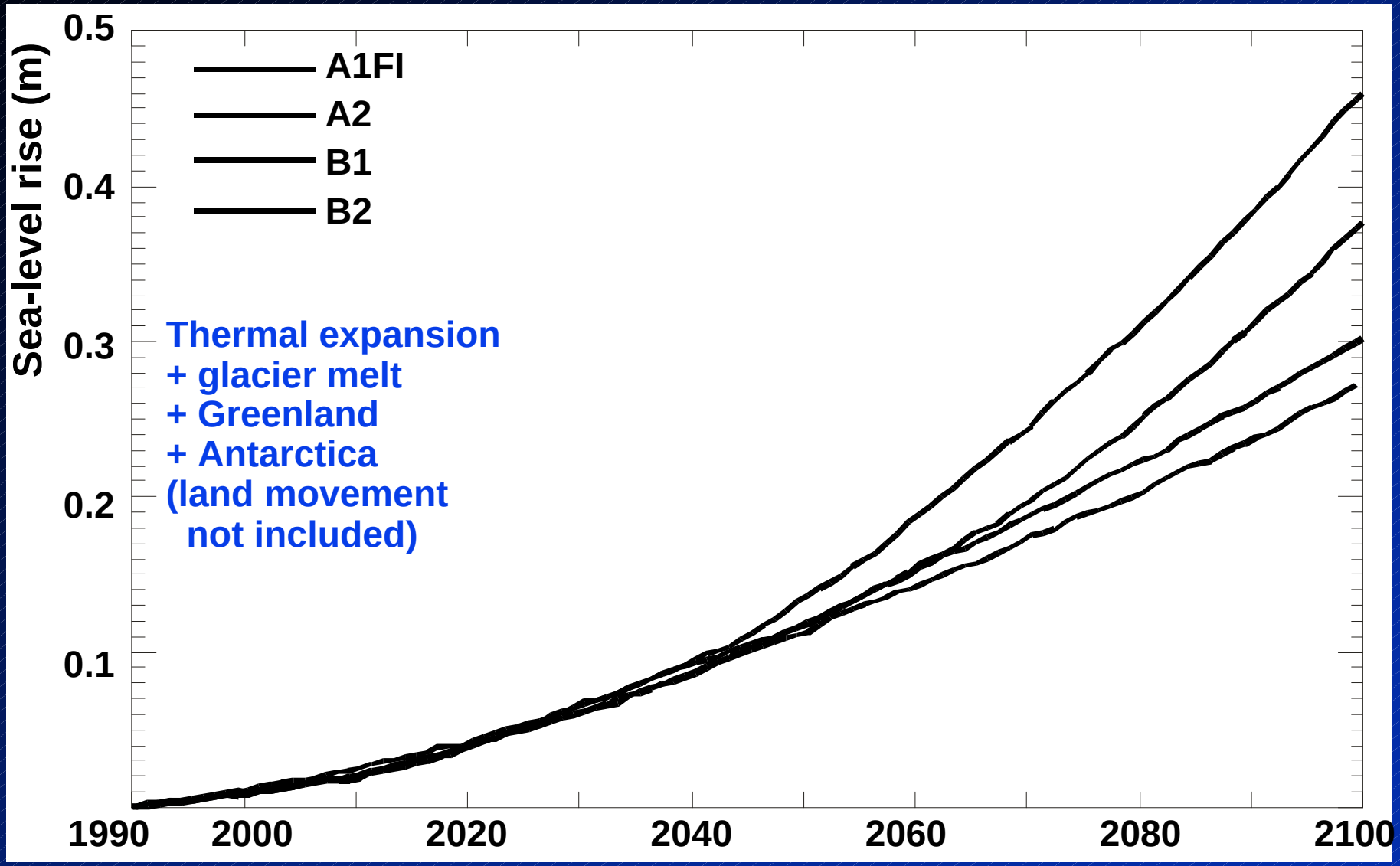
GLOBAL SEA LEVEL RISE



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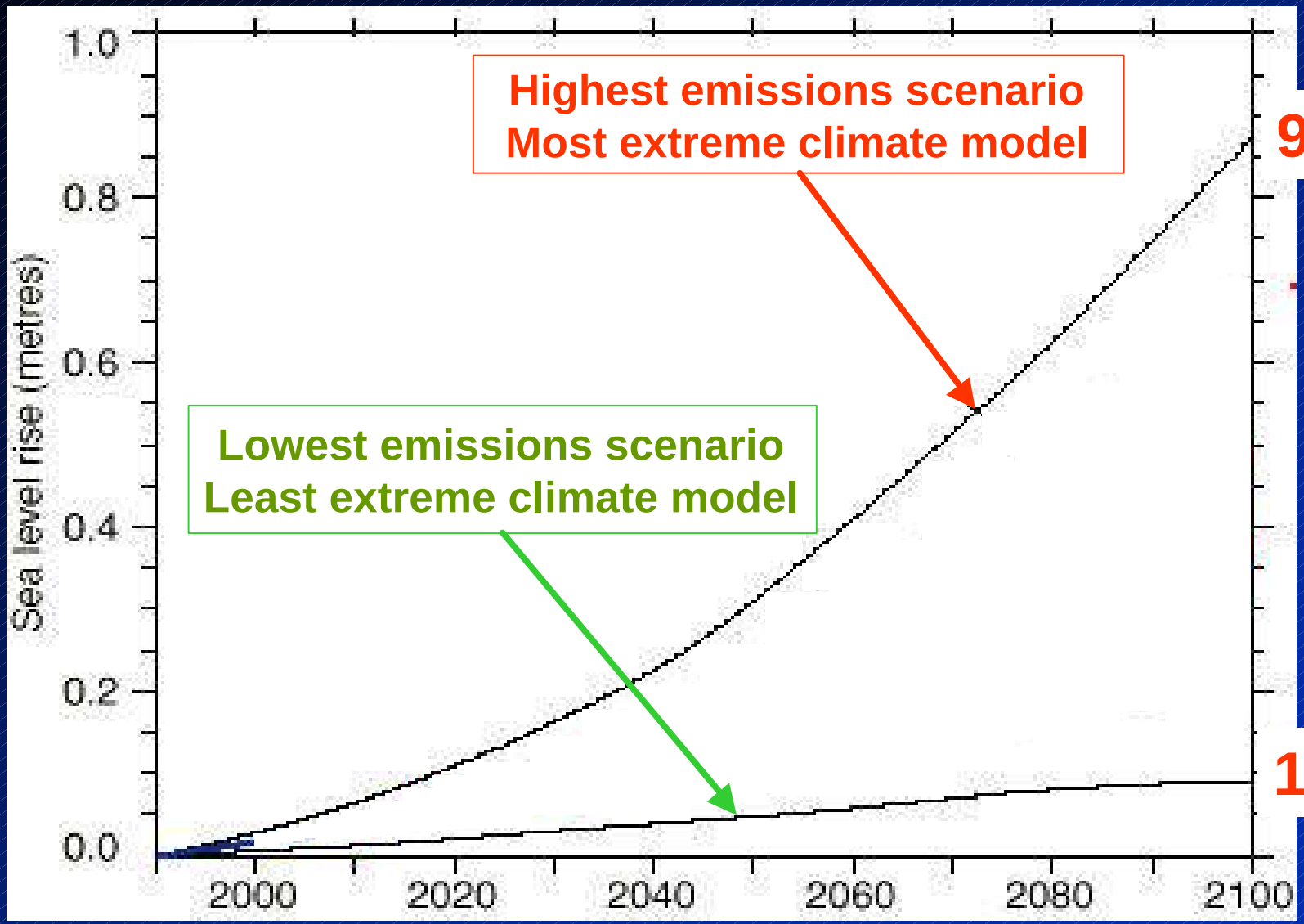
GLOBAL SEA LEVEL RISE
from all emissions and models



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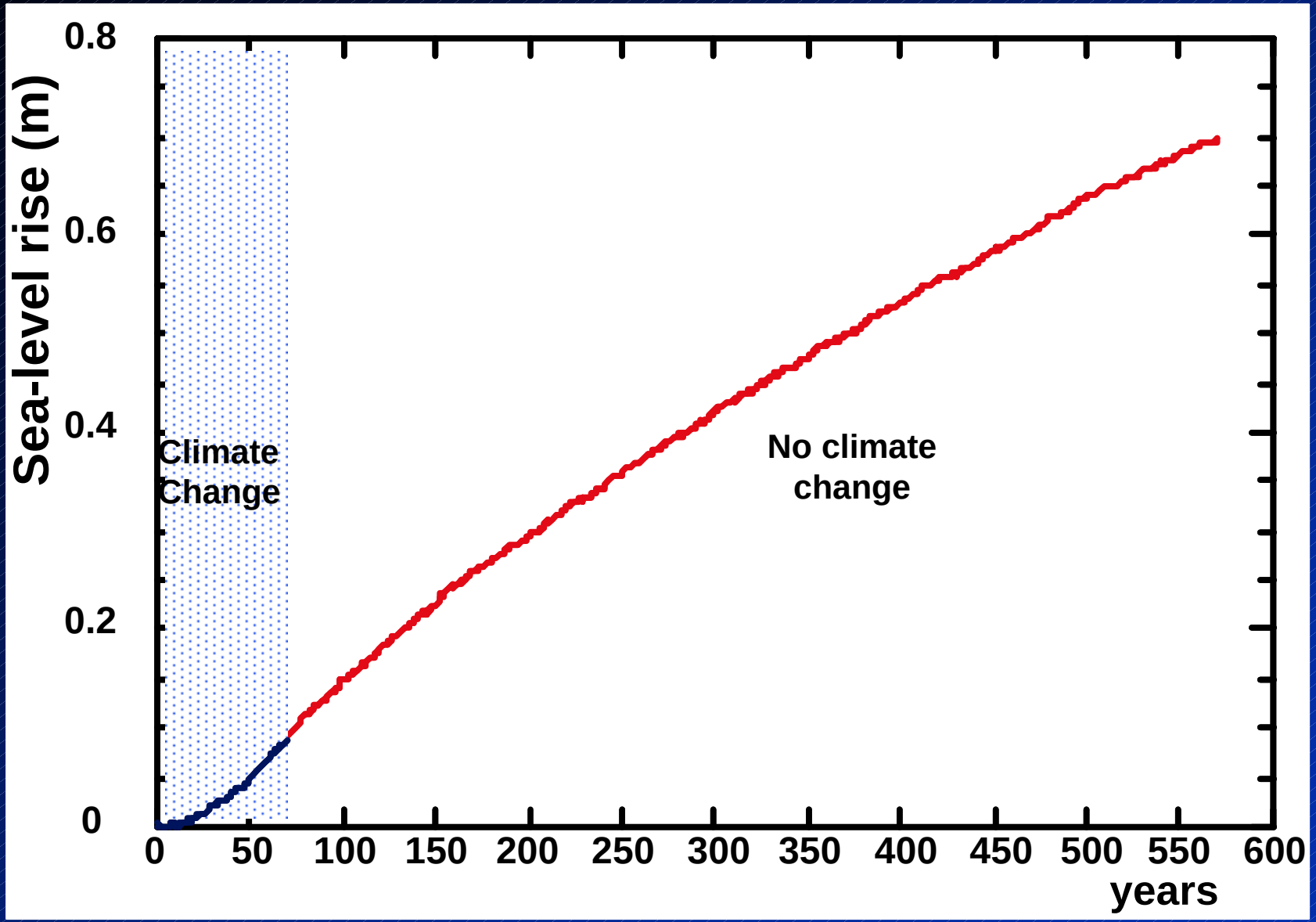
SEA LEVEL RISE COMMITTMENT



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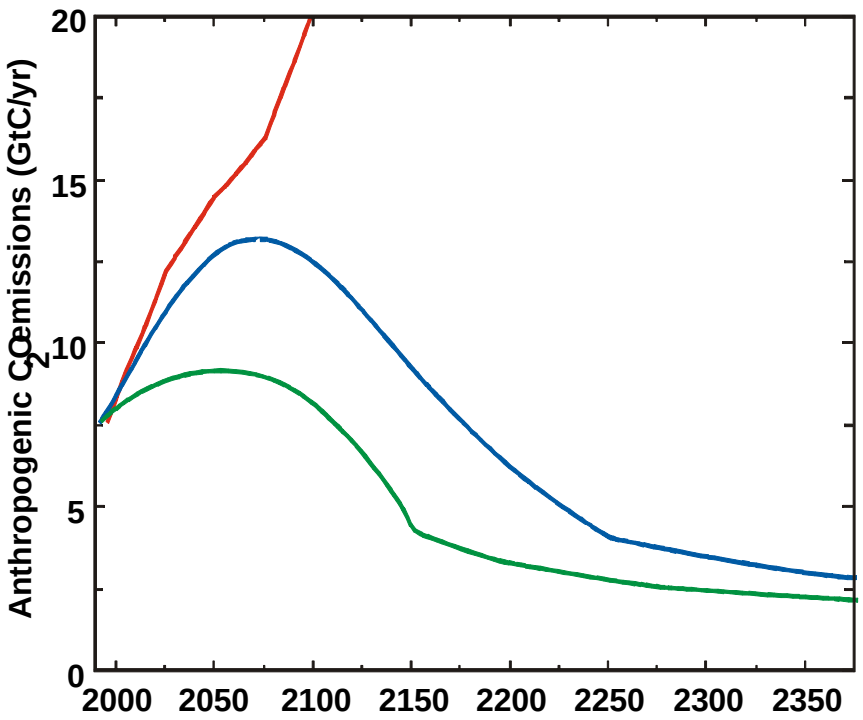
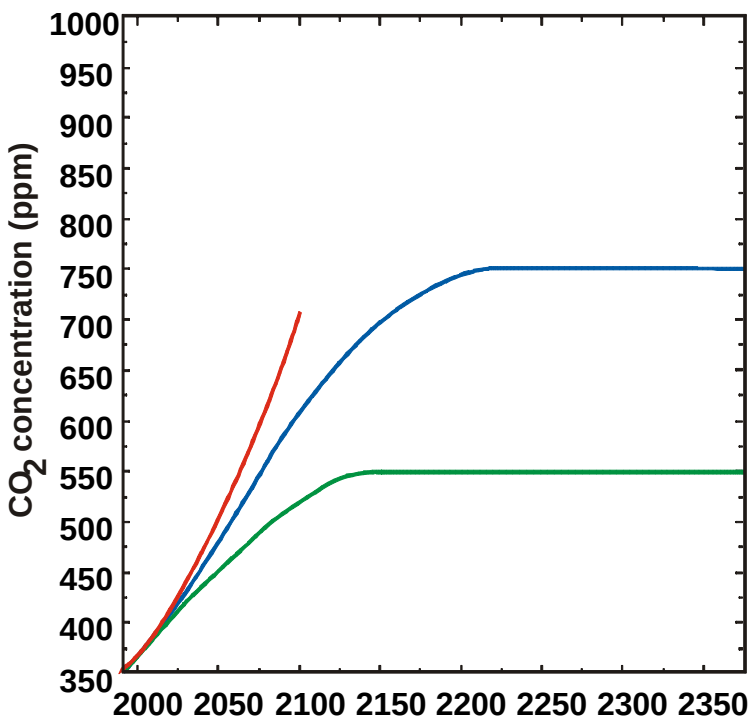
UN Framework Convention on Climate Change

- “The ultimate objective of this Convention is…stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system…”
- Research currently underway to decide what concentration constitutes a “dangerous level”
- Negotiations would then have to agree the common but differentiated contributions to achieving this stabilisation level, and by when.

EMISSIONS AND CONCENTRATIONS OF CO_2

from unmitigated emissions and possible emission pathways to stabilisation at 550ppm and 750ppm





Unmitigated emissions | 750 ppm stabilisation | 550 ppm stabilisation

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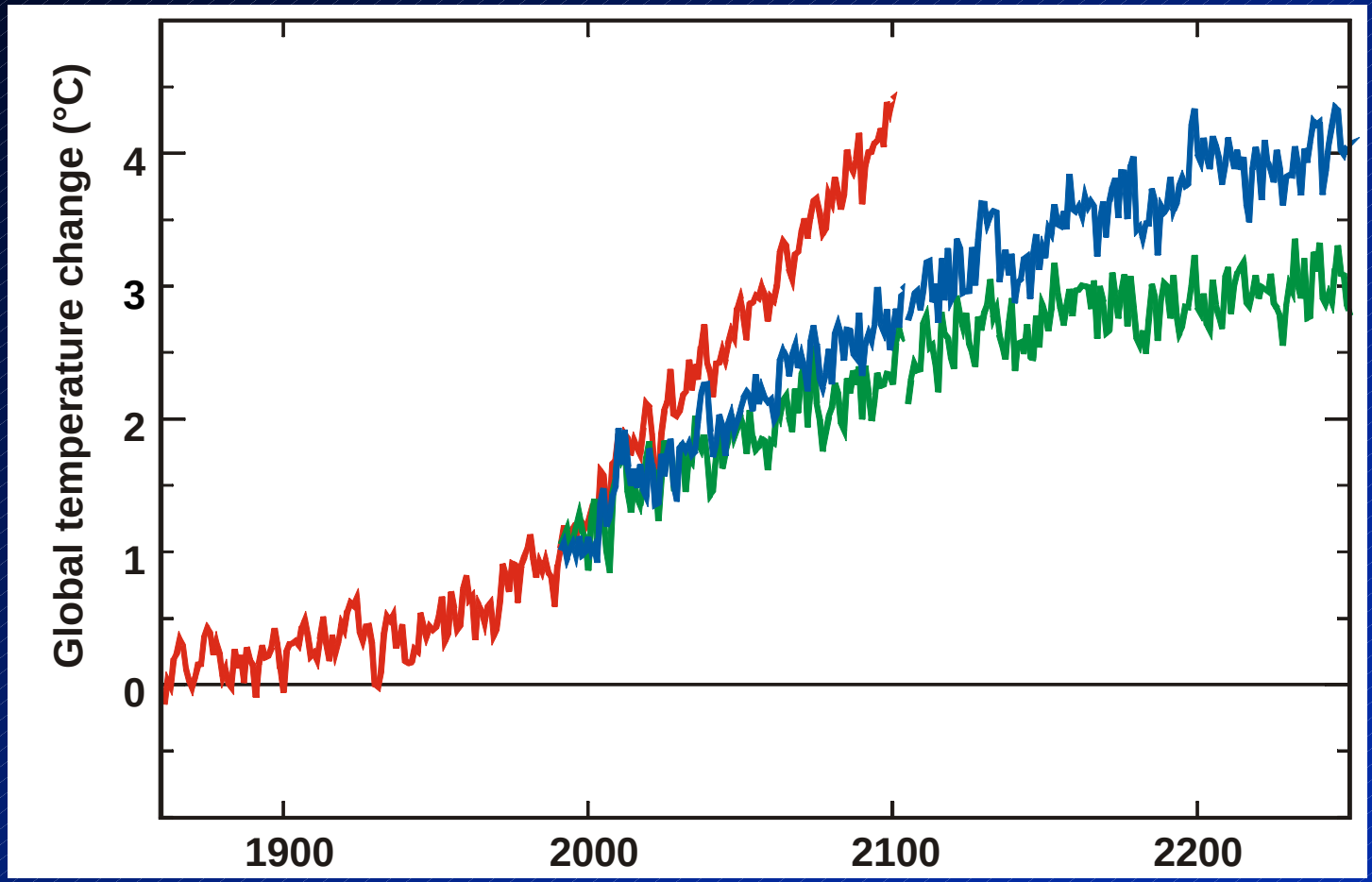
GLOBAL AVERAGE TEMPERATURE RISE

from unmitigated and stabilising emission scenarios



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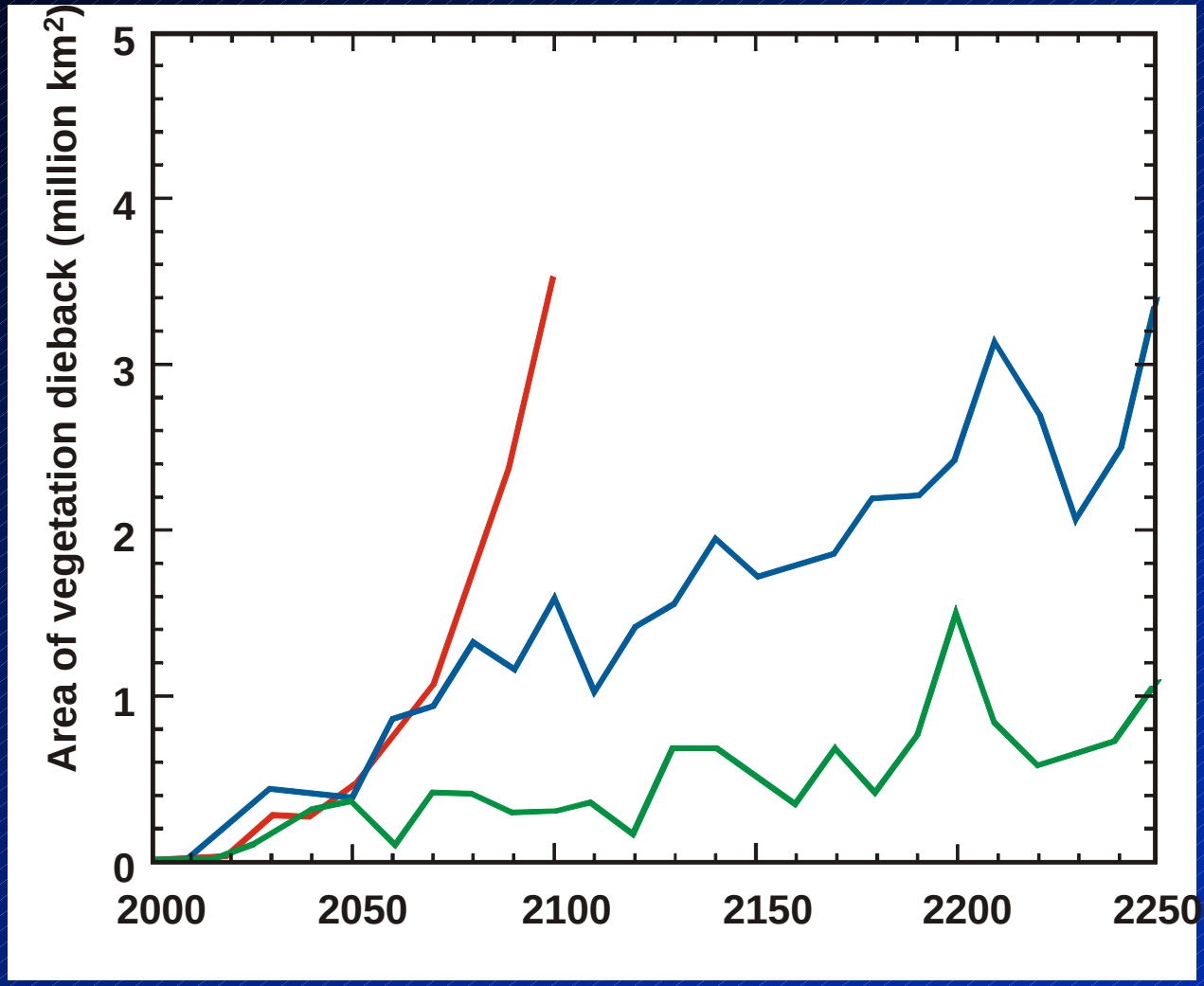
AREA OF VEGETATION DIEBACK



With CEH Edinburgh

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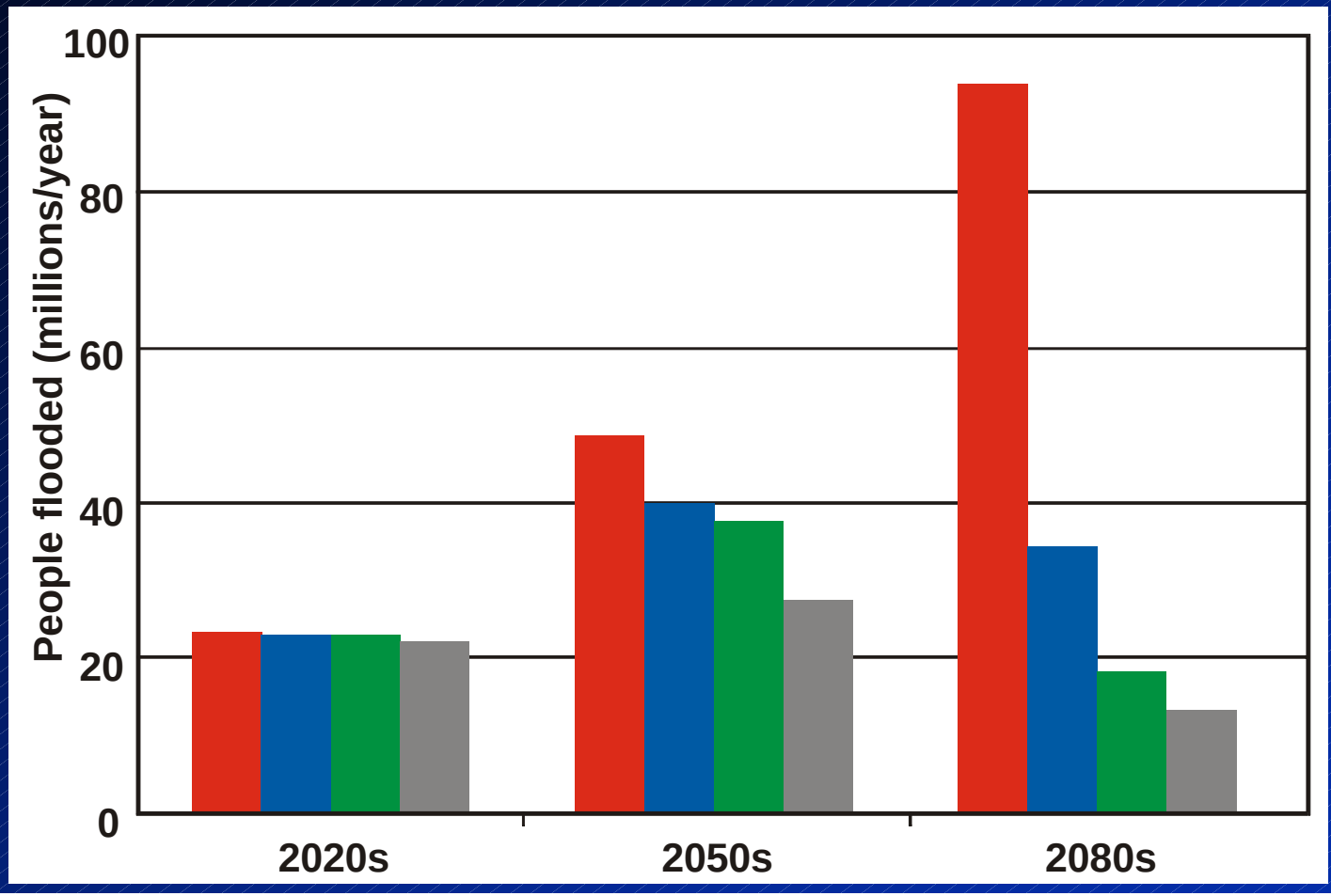
ANNUAL NUMBER OF PEOPLE FLOODED

with no climate change and under three emissions scenarios



With Univ Middlesex

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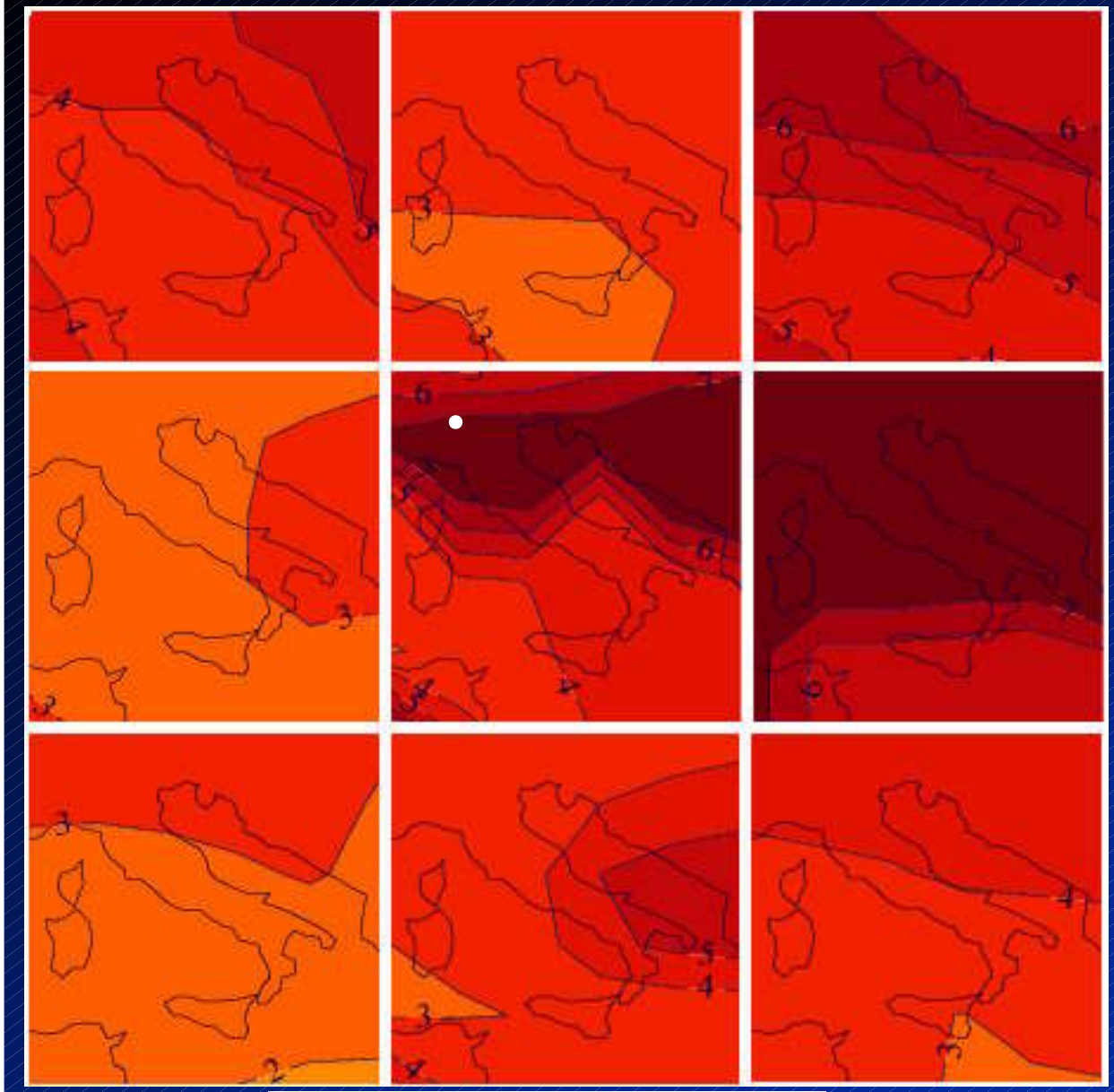
Certainties, uncertainties, probabilities

- The natural greenhouse effect already warms us by 30°C
- Man's activities increased CO_2 & other greenhouse gases
- More greenhouse gases will warm us further
- The earth has warmed by about 0.7°C over last 100y

- Most of the last 50y warming is likely due to Man's activities
- Global warming by 2100 is projected to be 1.4 – 5.8°C
- Uncertainties at local scale are greater
- Probabilistic predictions will replace the current range of deterministic predictions



SUMMER TEMPERATURE RISE OVER ITALY by 2080s due to SRES A2 emissions PREDICTED BY NINE CLIMATE MODELS

0 1 2 3 4 5 6 7°C

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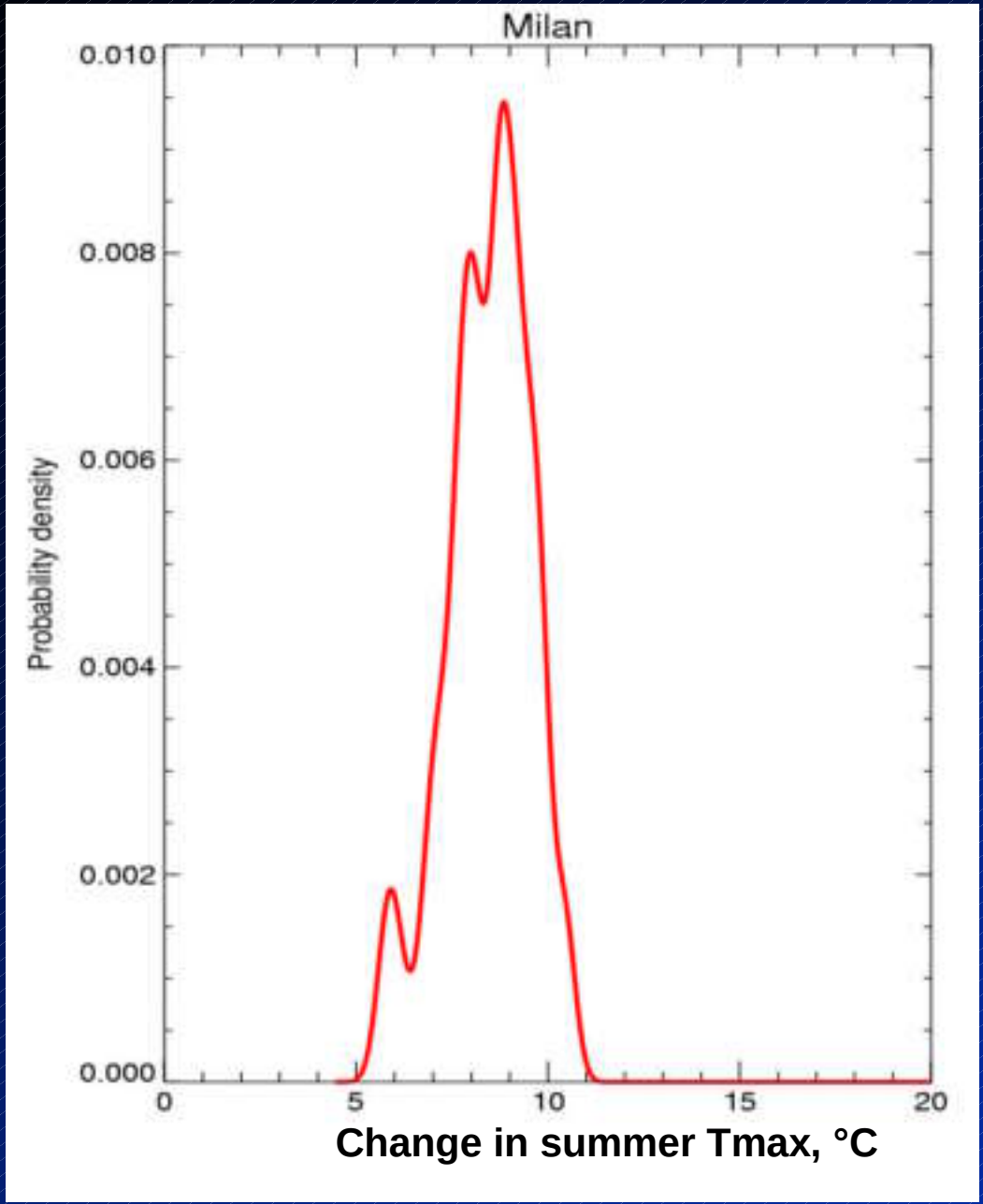

PROBABILITY OF CHANGE IN SUMMER DAILY MAXIMUM TEMPERATURE IN MILAN

by the 2080s under SRES A2

Dave Sexton
53-member
HadSM3

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SUMMARY

- Warming of 1°C over land since C19; 2002 ranked #3
- Likely that most of the recent warming is Man-made
- Predictions of global warming 1.4 – 5.8°C by 2100
- Uncertainty mainly due to understanding & modelling
- Probabilistic predictions are required for adaptation; work in hand