Climate Change 2013: The Physical Science Basis

Working Group I contribution to the IPCC Fifth Assessment Report

Philip Mote

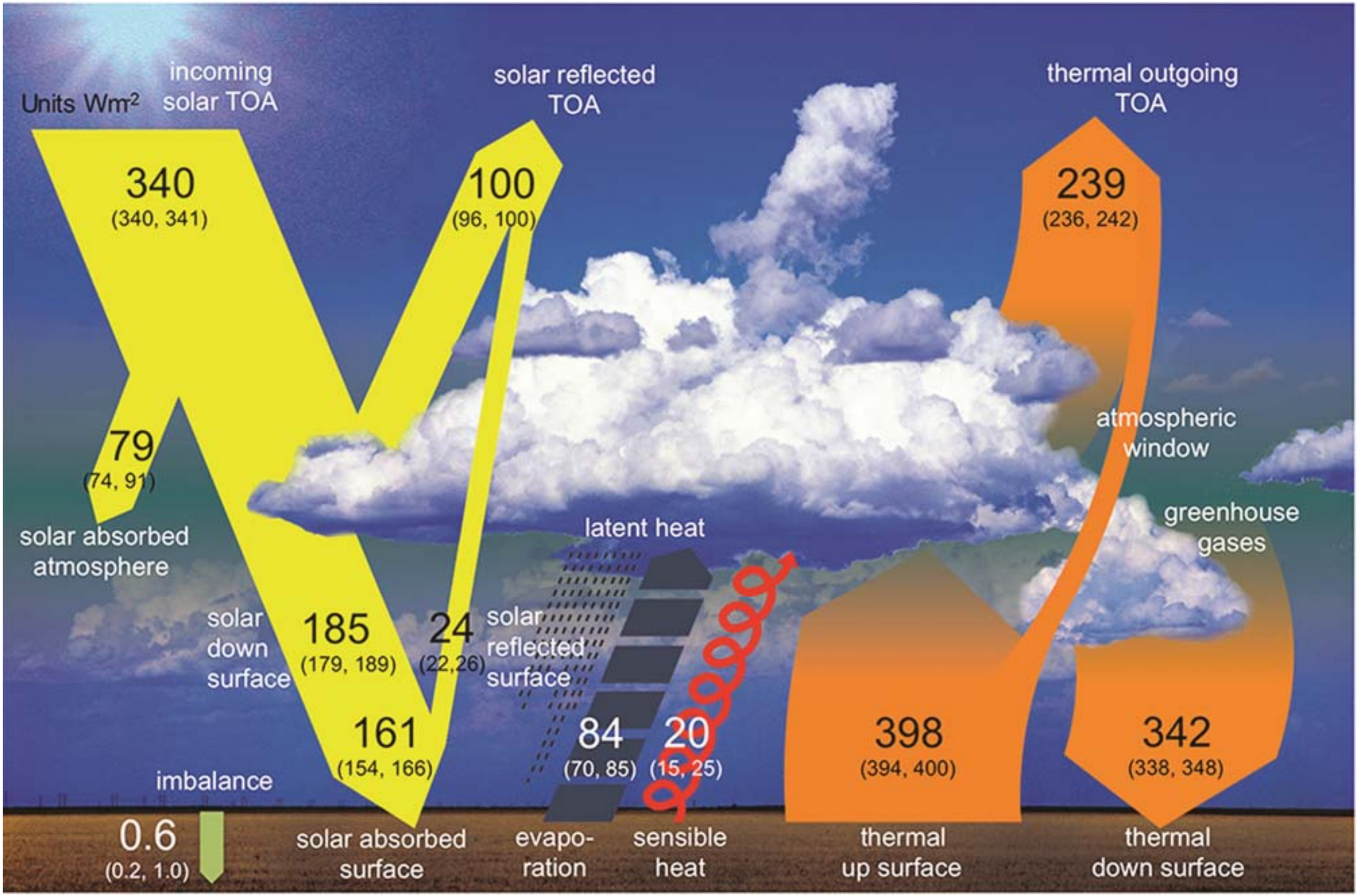
"Lead" Author, Chapter 4

NW RISA PI, Oregon State University

© Yann Arthus-Bertrand / Altitude

Outline

- 1 slide of climate science
- Background, scope, and processes of IPCC
- Summary of main results
- Observed changes in extremes
- the global warming 'hiatus'
- Changes in ENSO etc.

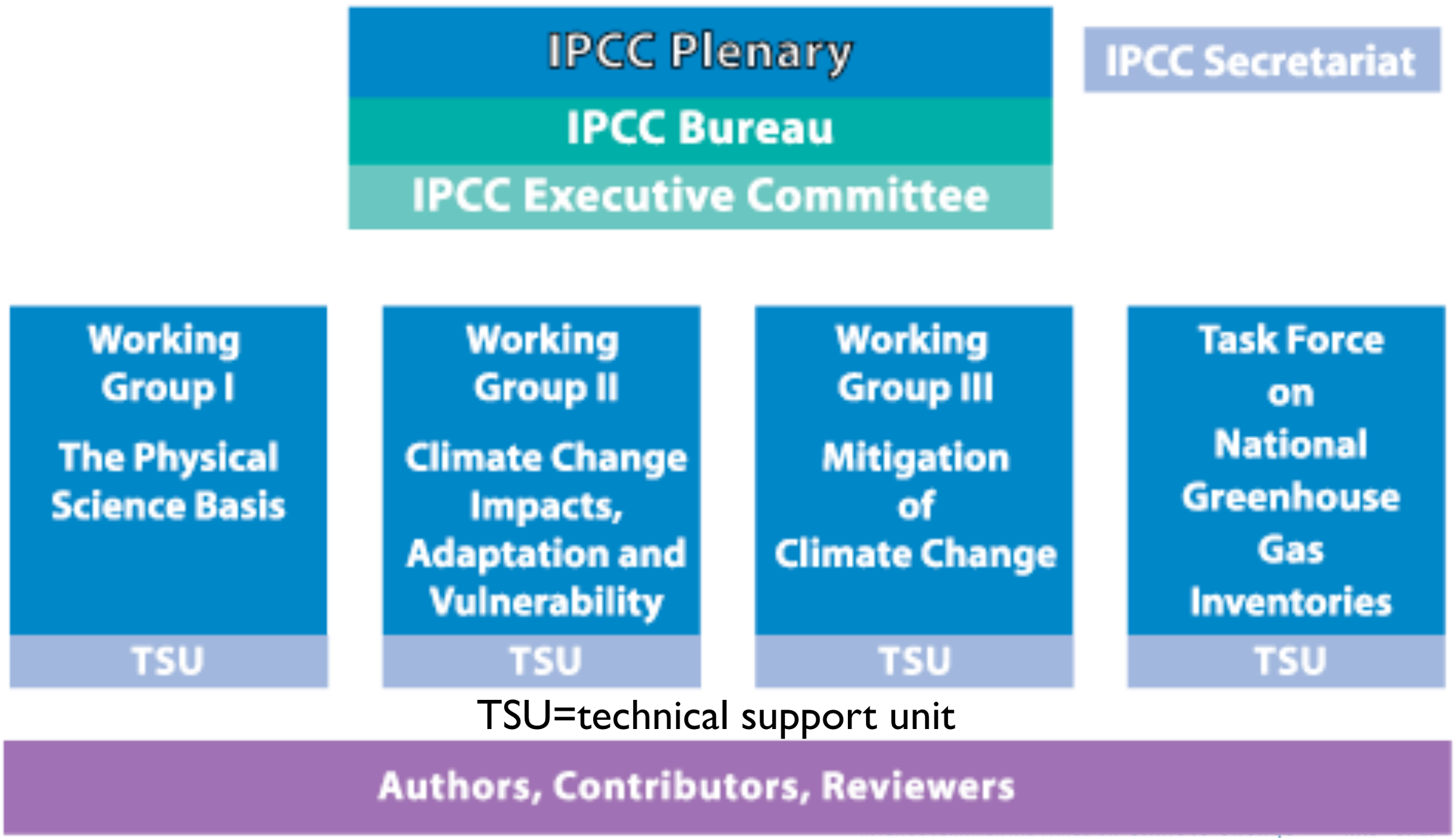


IPCC 2013 Fig 2.11

ipcc INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

IPCC structure



History

- Established in 1988 WMO-UNEP
- Major assessment reports 1990, 1996, 2001, 2007, 2013
- Numerous special reports

More

- Confidence (very low-low-medium-high-very high)
- Likelihood (quantitative): virtually certain ≥99%, very likely >90%, likely>66%, about as likely as not 33-66%, unlikely <33%, very unlikely <10%, exceptionally unlikely ≤1%.
- Definition of assessment
- Review process: total 54,677 comments

Working Group I Timeline

- November 2010: First lead author meeting
- March 2011: Zero order draft submitted
- Limited review
- July 2011: Second lead author meeting
- November 2011: First order draft submitted
- Comprehensive review
- April 2012: Third lead author meeting
- August 2012: Second order draft submitted
- Government review
- January 2013: Fourth lead author meeting
- March 2013: Cutoff for accepted papers
- May 2013: Final draft submitted
- September 2013: Plenary in Stockholm

ipcc INTERGOVERNMENTAL PANEL ON climate change WMO UNEP

WGI 4th lead authors meeting

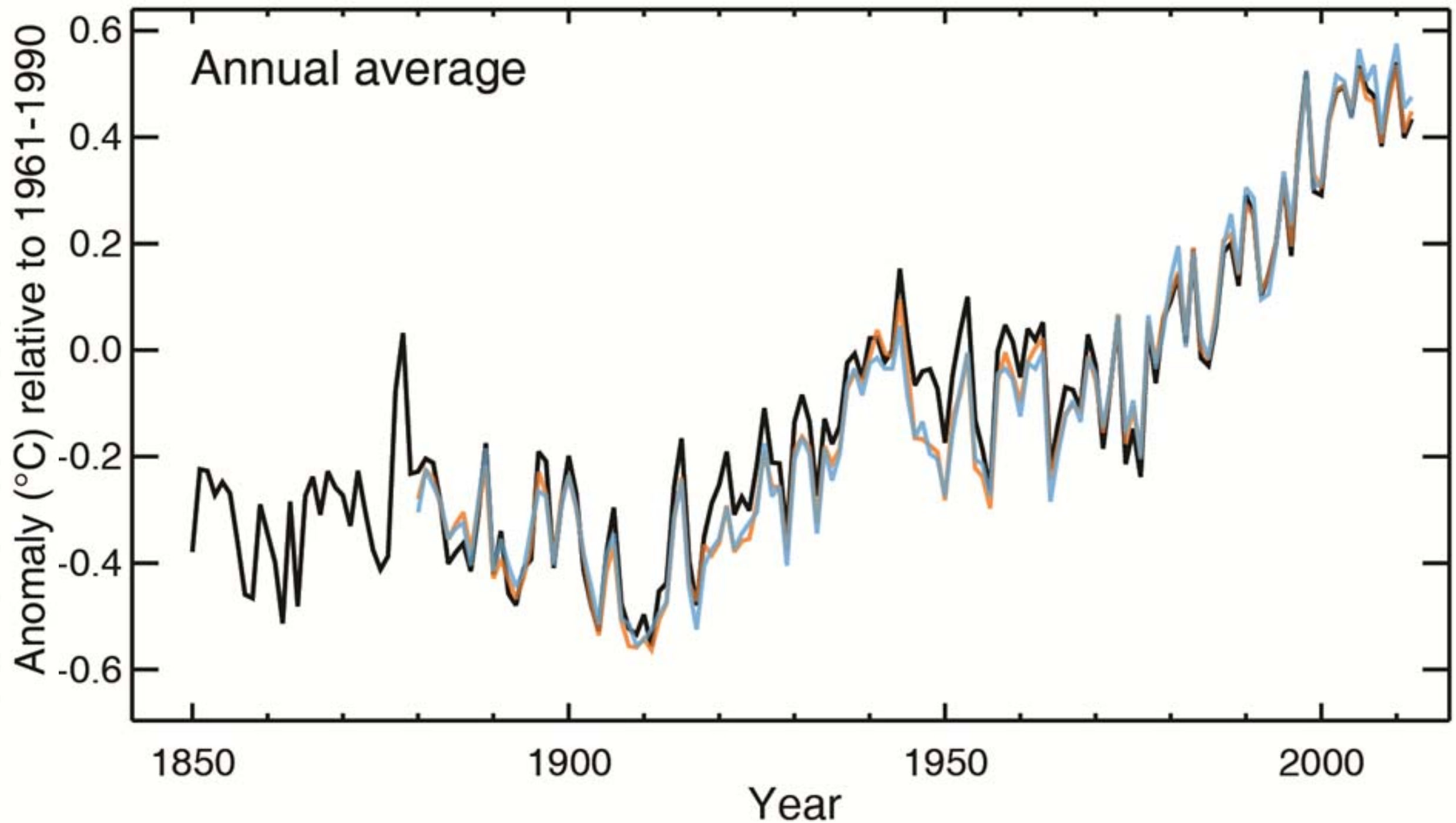
ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

Headline statements

Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented ...

The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen...

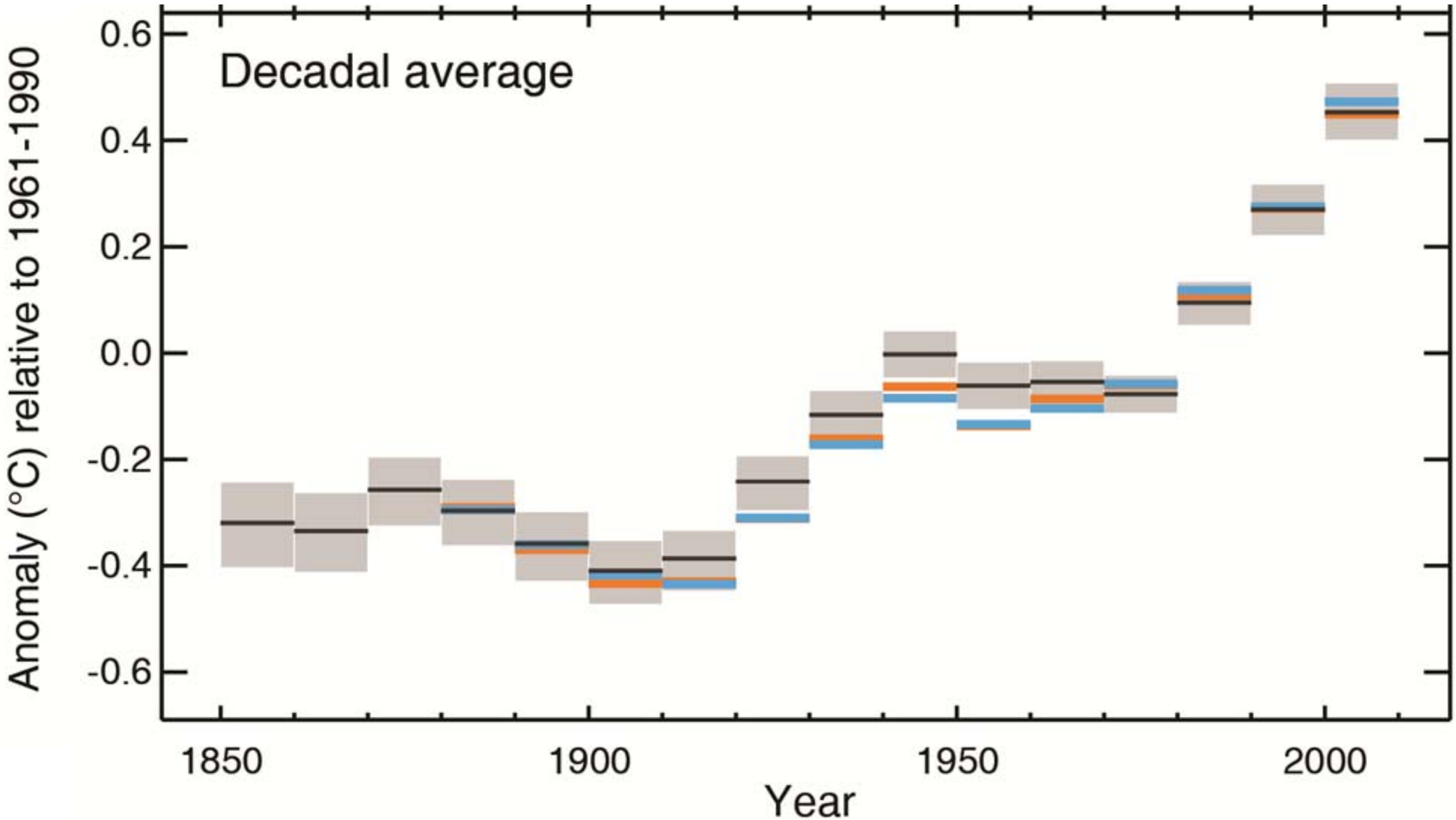
Observed globally averaged combined land and ocean surface temperature anomaly1850–2012



IPCC AR5 Working Group I
Climate Change 2013: The Physical Science Basis

IPCC 2013 SPM Fig 1

INTERGOVERNMENTAL PANEL ON climate change

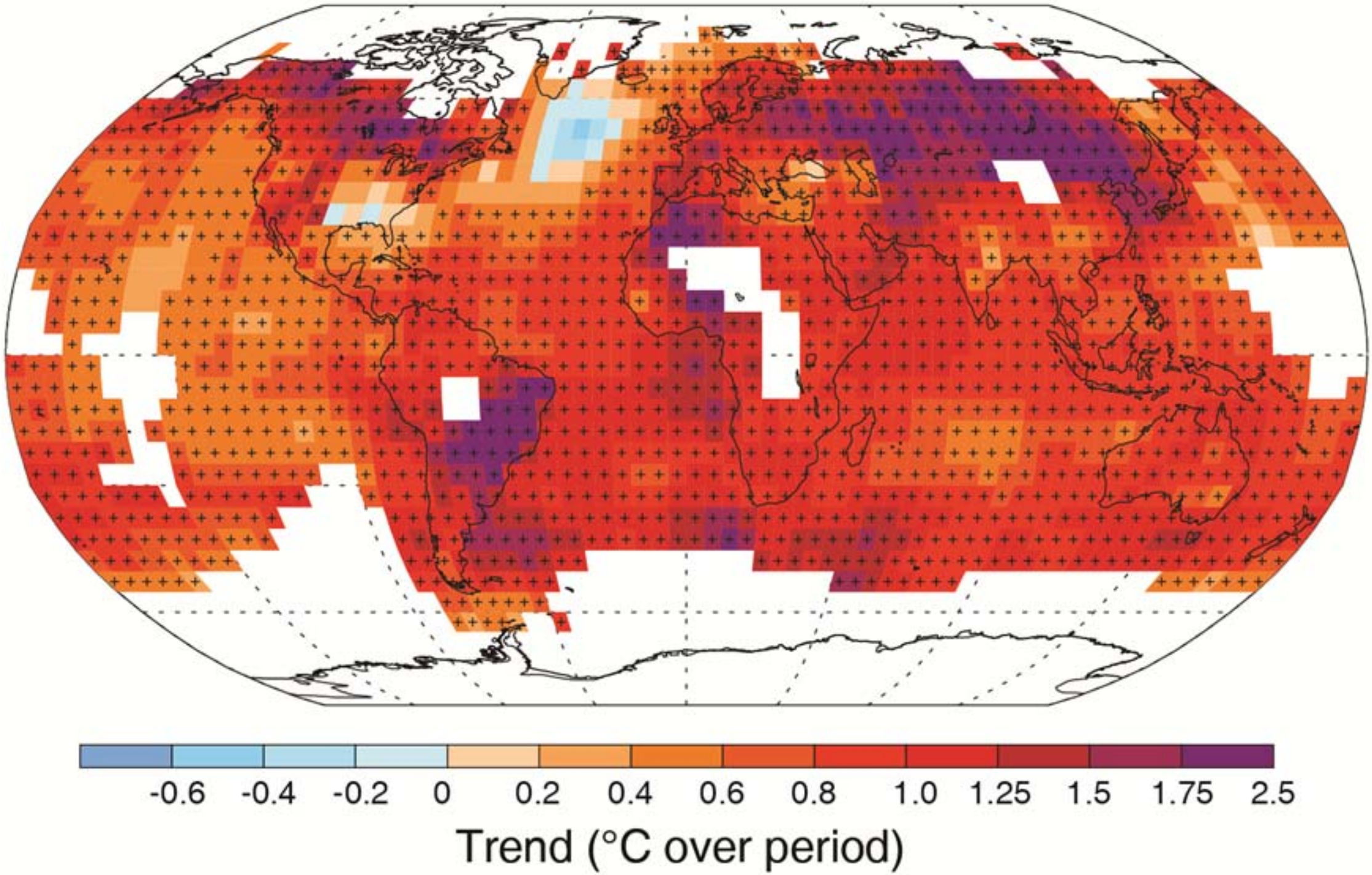


IPCC AR5 Working Group I
Climate Change 2013: The Physical Science Basis

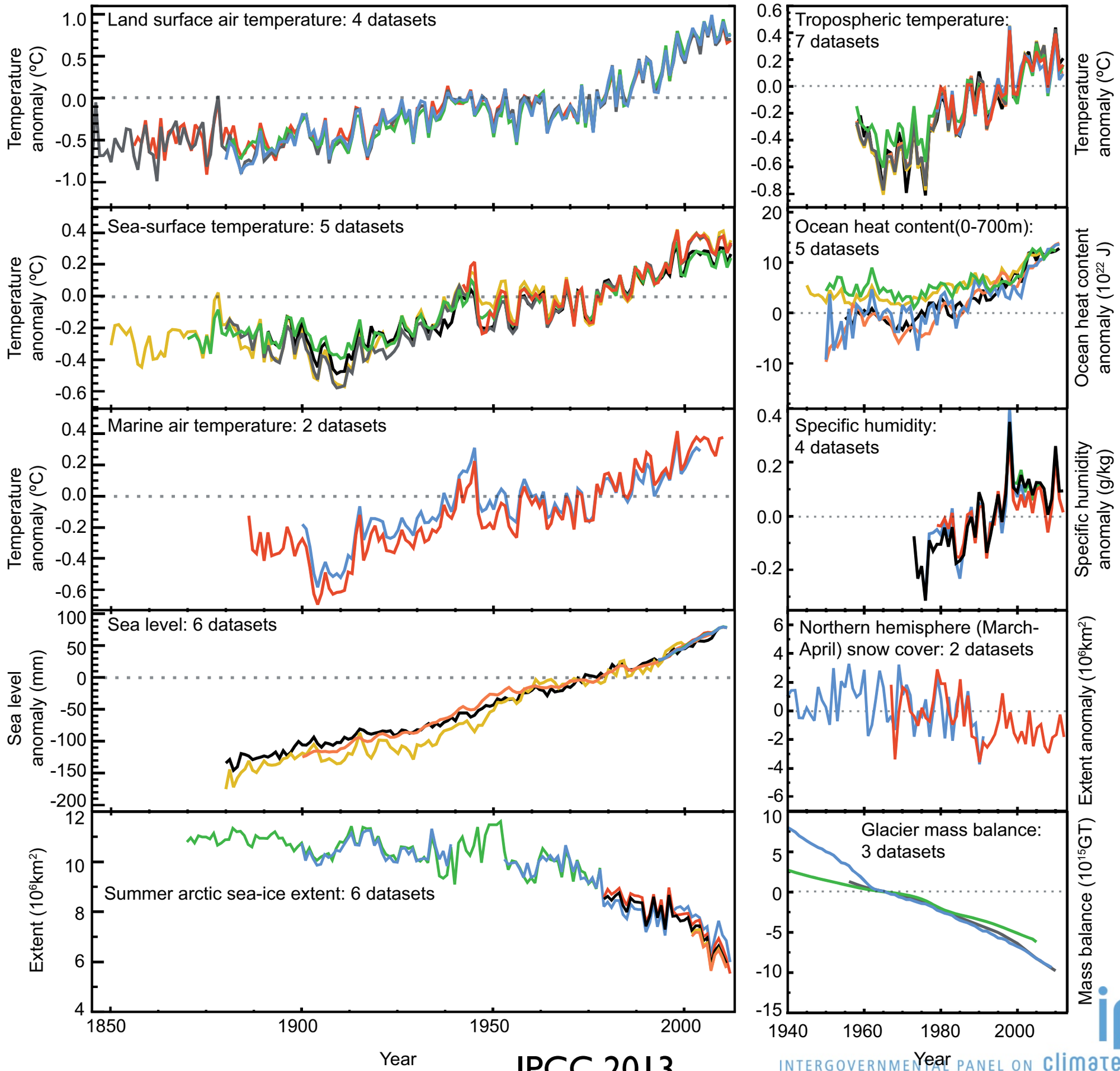
IPCC 2013 SPM Fig 1

ipcc INTERGOVERNMENTAL PANEL ON climate change

Observed change in average surface temperature 1901–2012



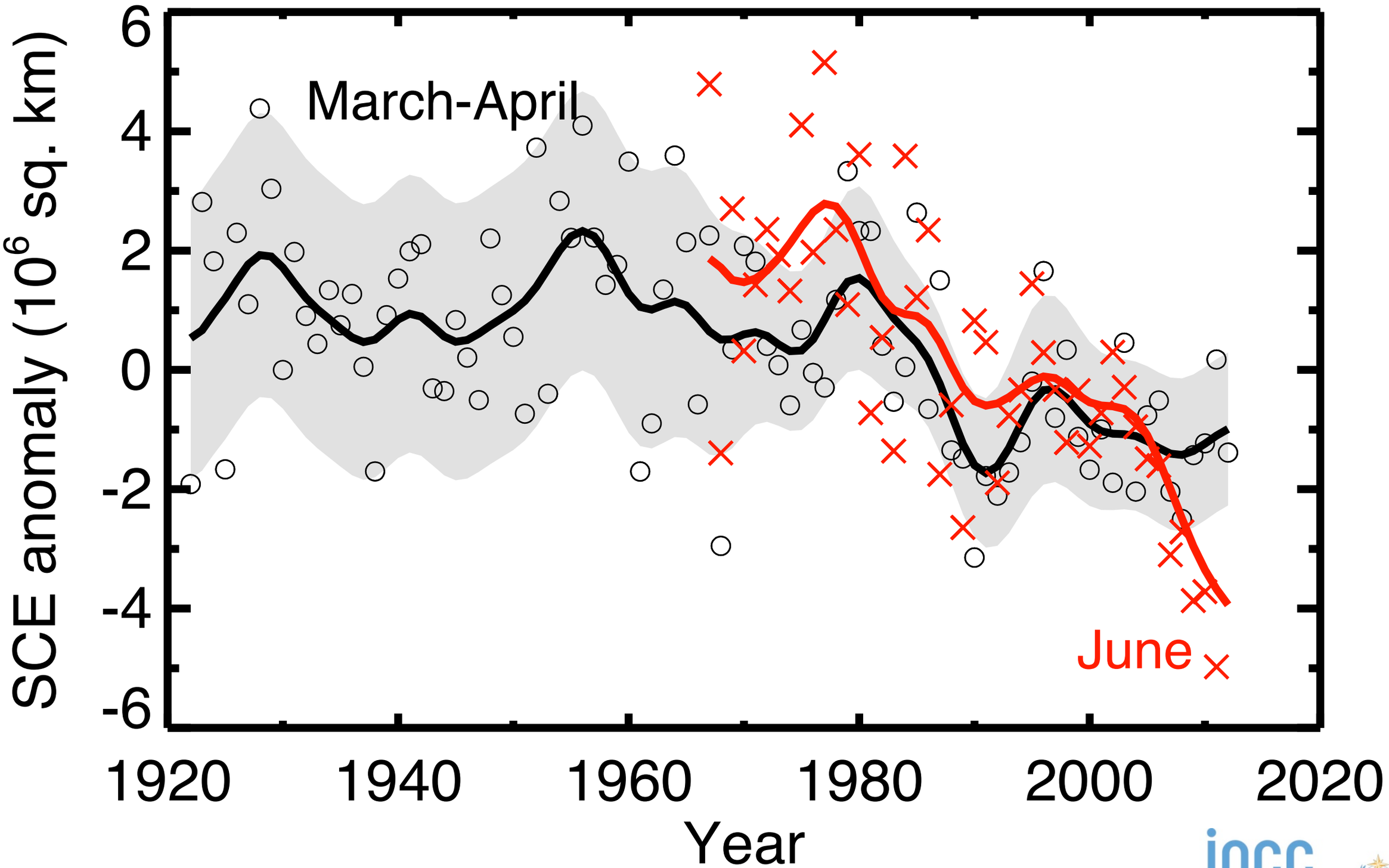
IPCC 2013 SPM Fig 1



IPCC 2013

ipcc INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

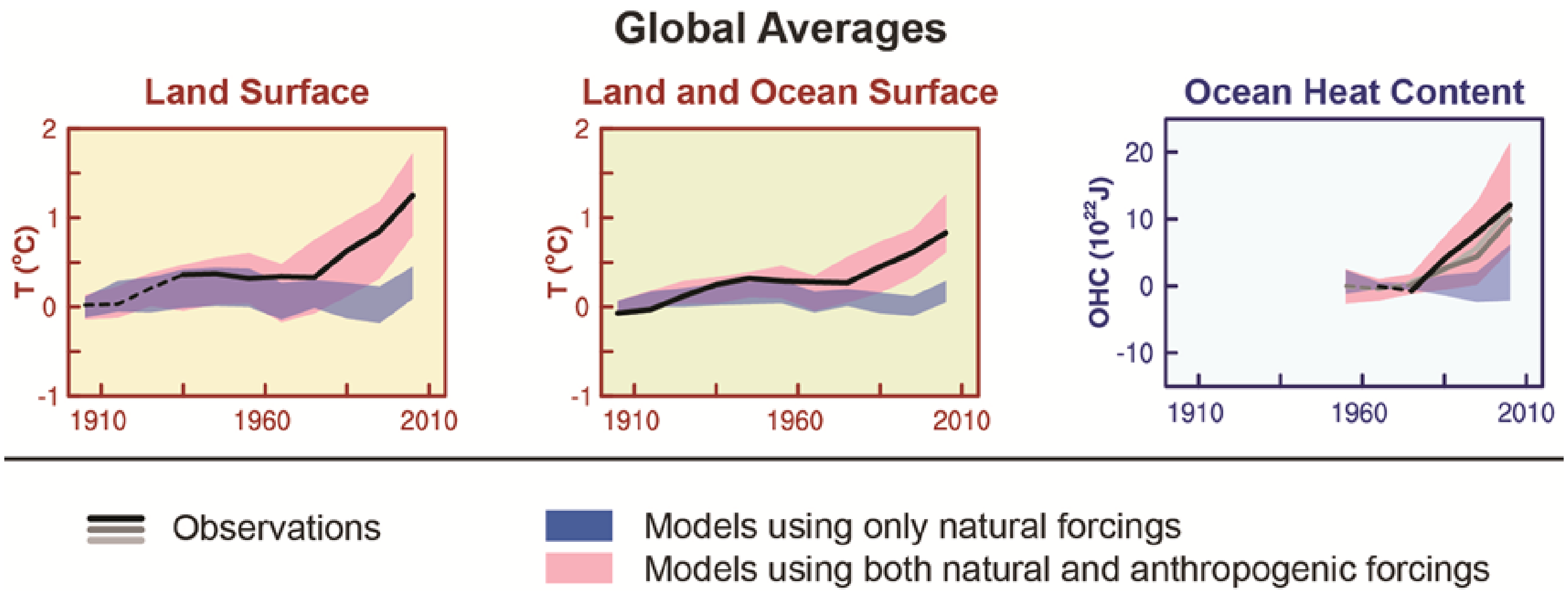


IPCC 2013 Fig 4.19

INTERGOVERNMENTAL PANEL ON climate change

Headline statements

Human influence on the climate system is clear... [and] has been **detected** in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes. ... It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century.

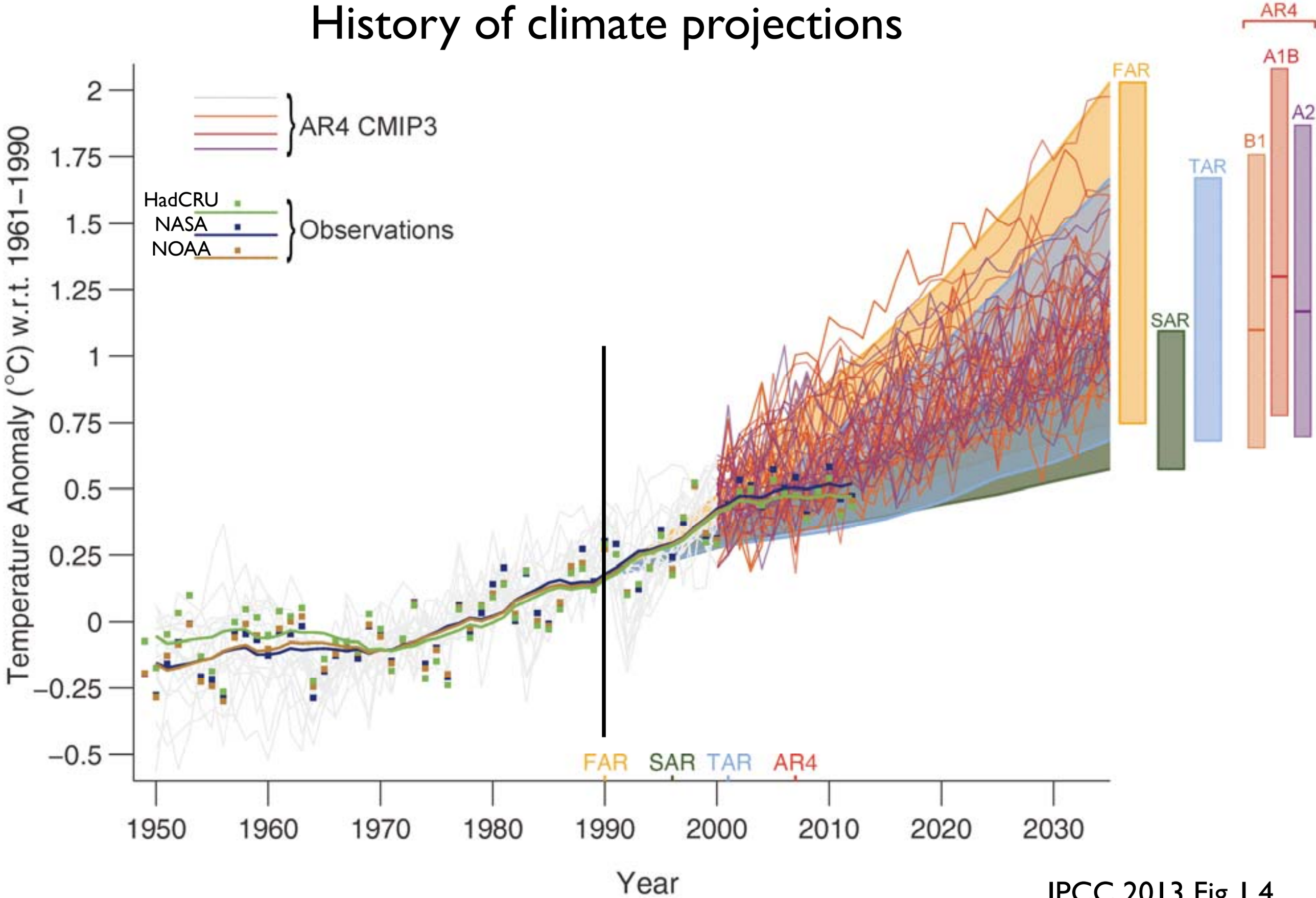


IPCC 2013 SPM Fig 6

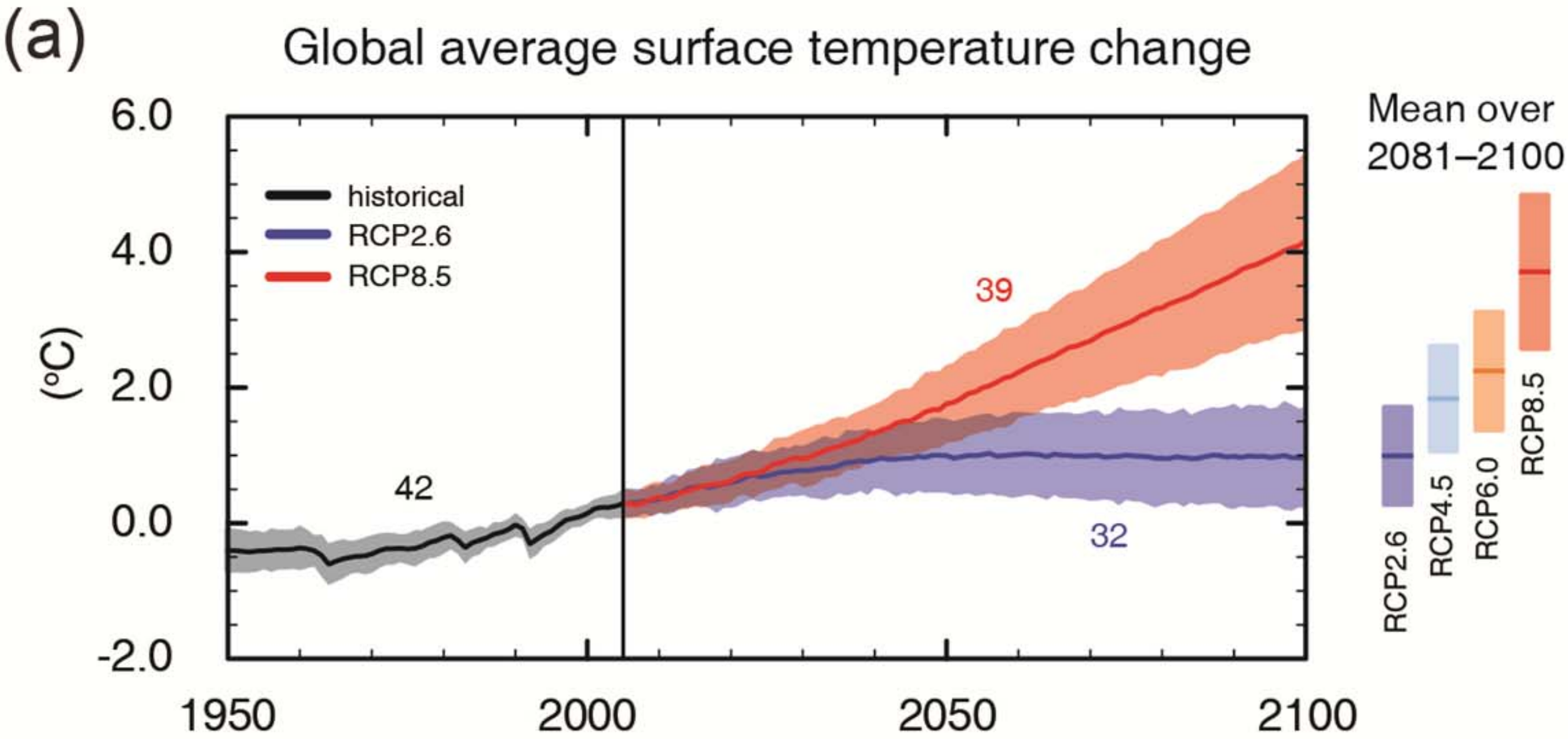
Headline statements

Global surface temperature change for the end of the 21st century is *likely* to exceed 1.5°C relative to 1850 to 1900 for all RCP scenarios except RCP2.6.

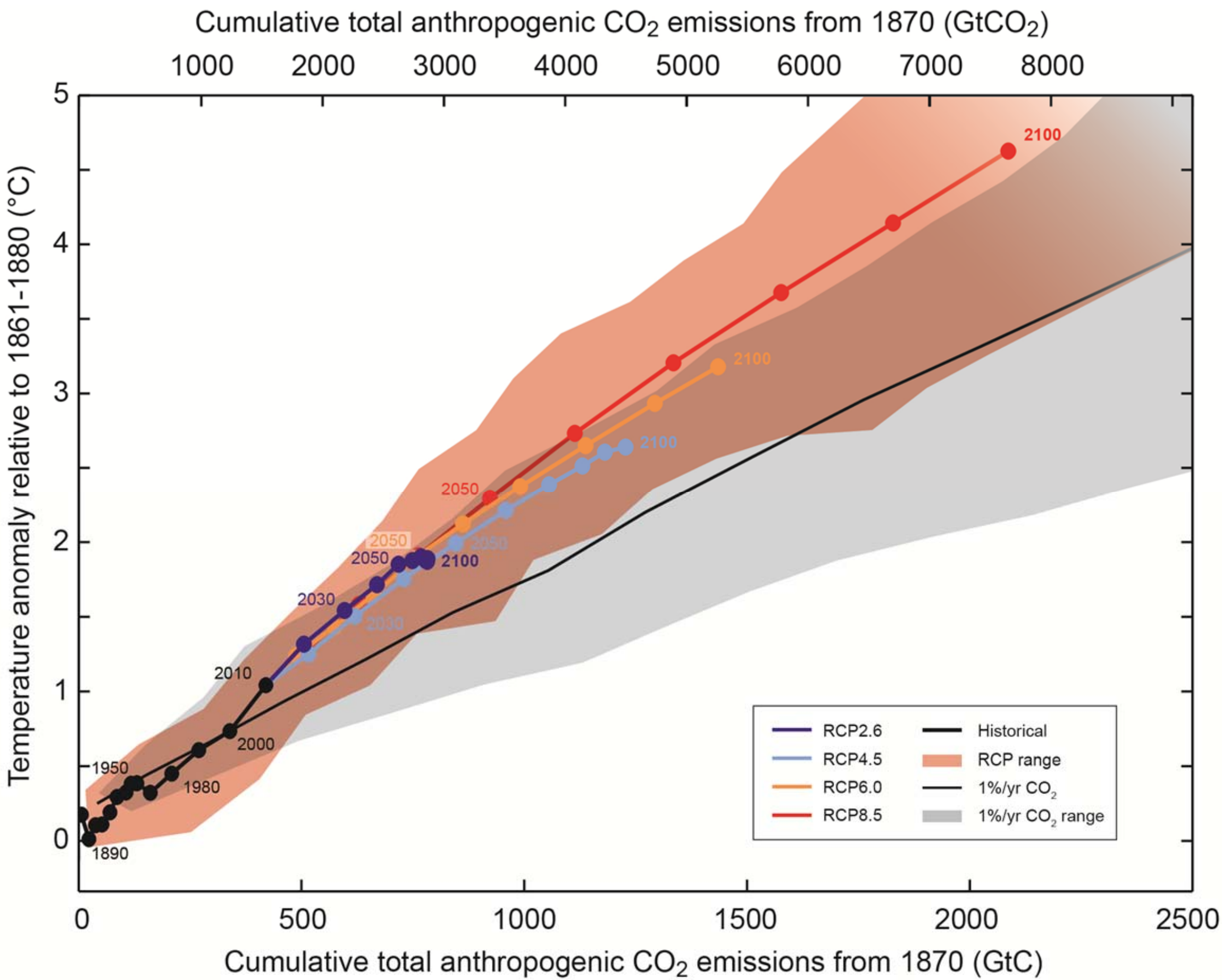
History of climate projections



IPCC 2013 Fig 1.4



IPCC 2013 SPM Fig 7

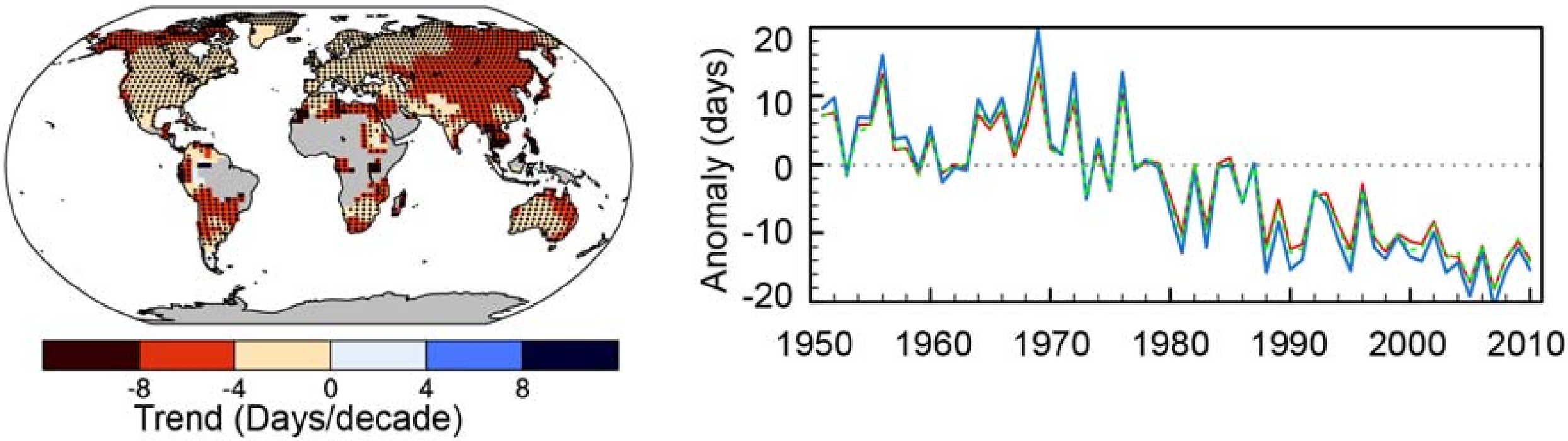


IPCC 2013 SPM Fig 10

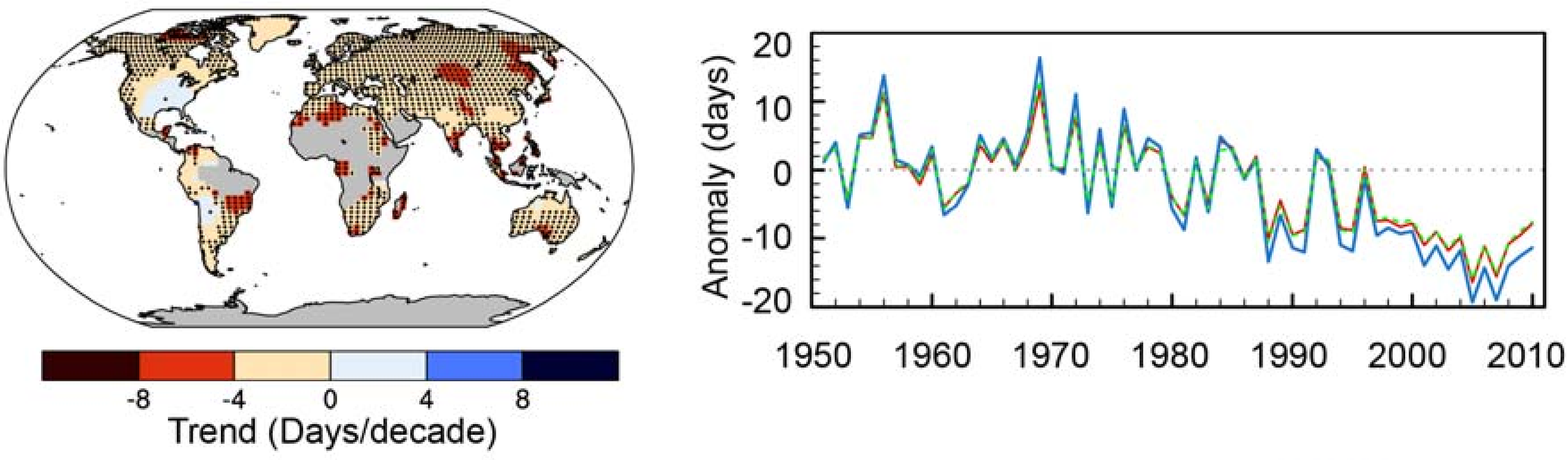
Outline

- 1 slide of climate science
- Background, scope, and processes of IPCC
- Summary of main results
- Observed changes in extremes
- the global warming 'hiatus'
- Changes in ENSO etc.

(a) Cold Nights



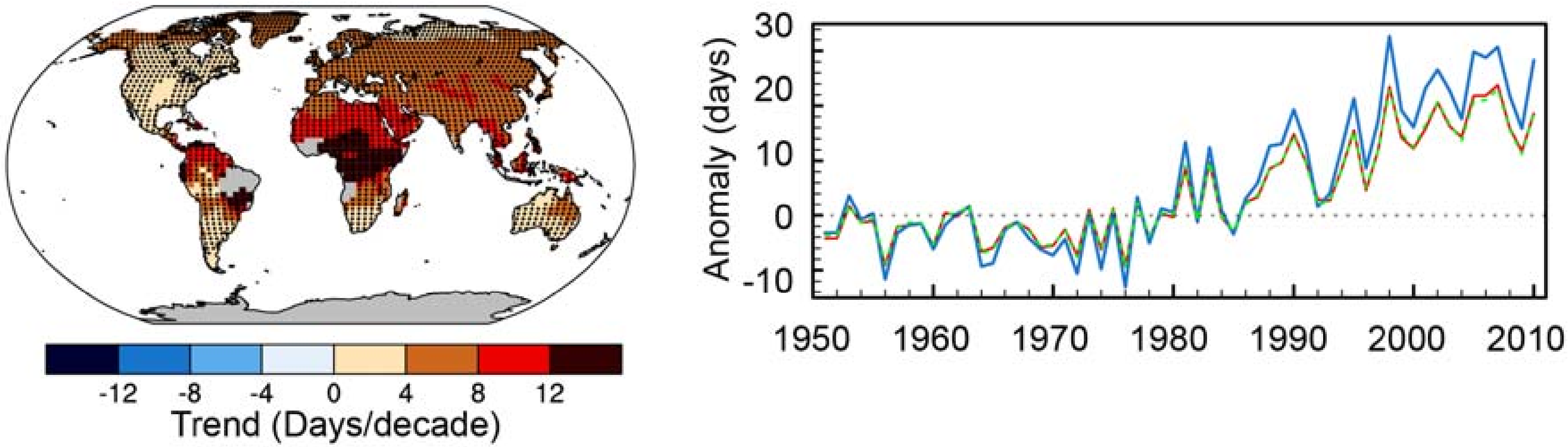
(b) Cold Days



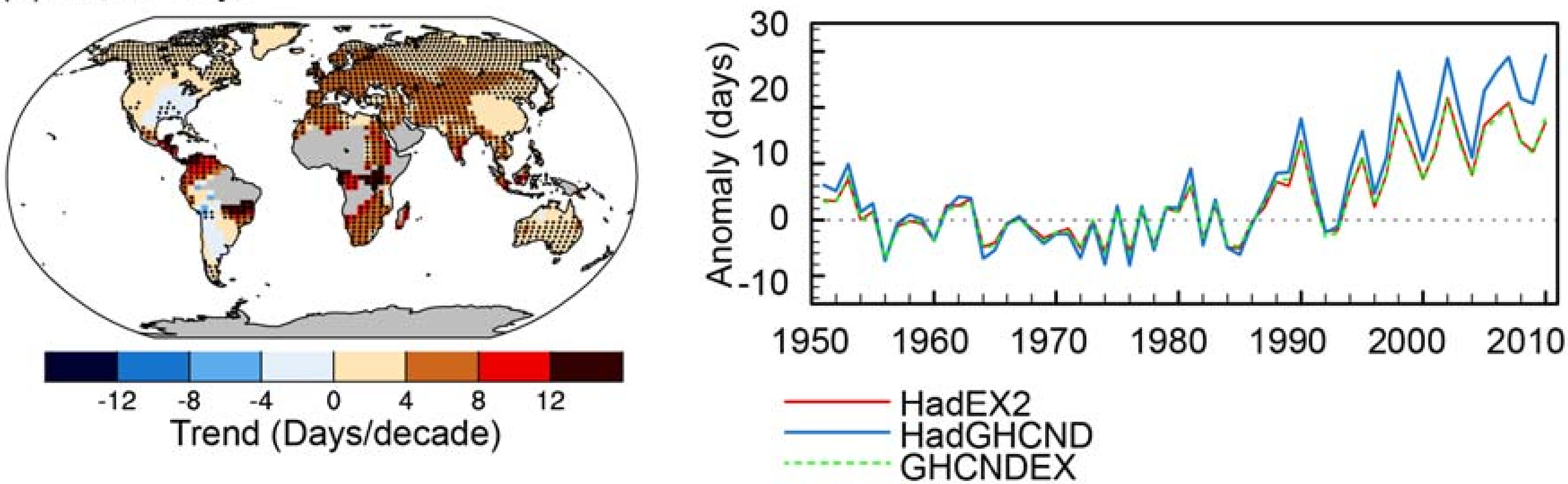
IPCC 2013 Fig 2.32

INTERGOVERNMENTAL PANEL ON climate change

(c) Warm Nights



(d) Warm Days



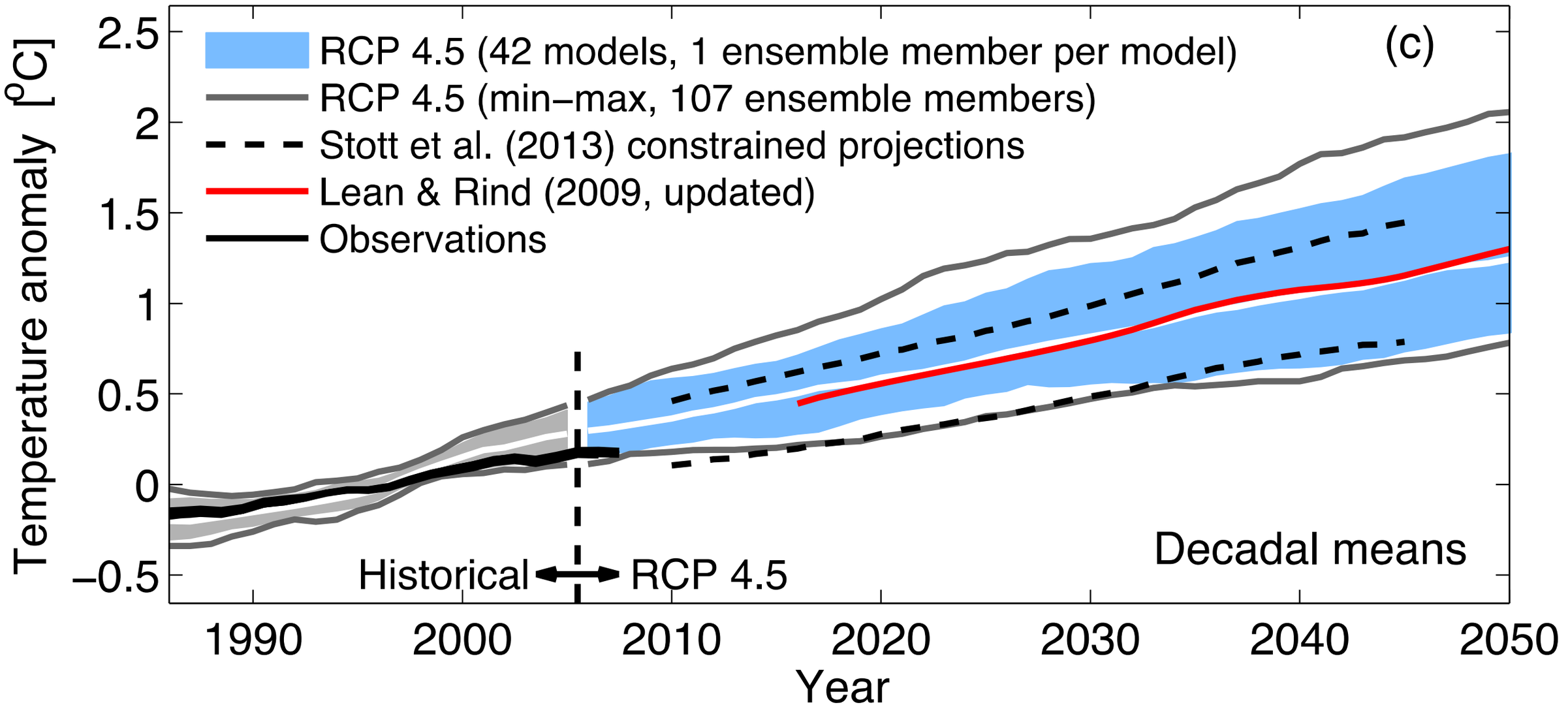
IPCC 2013 Fig 2.32

INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

The ‘Hiatus’

- Depends on starting point: 1998 very warm
- 1998-2012 still positive: 0.04°C
- Consistent with internal variability, observed radiative forcing, increased ocean heat flux

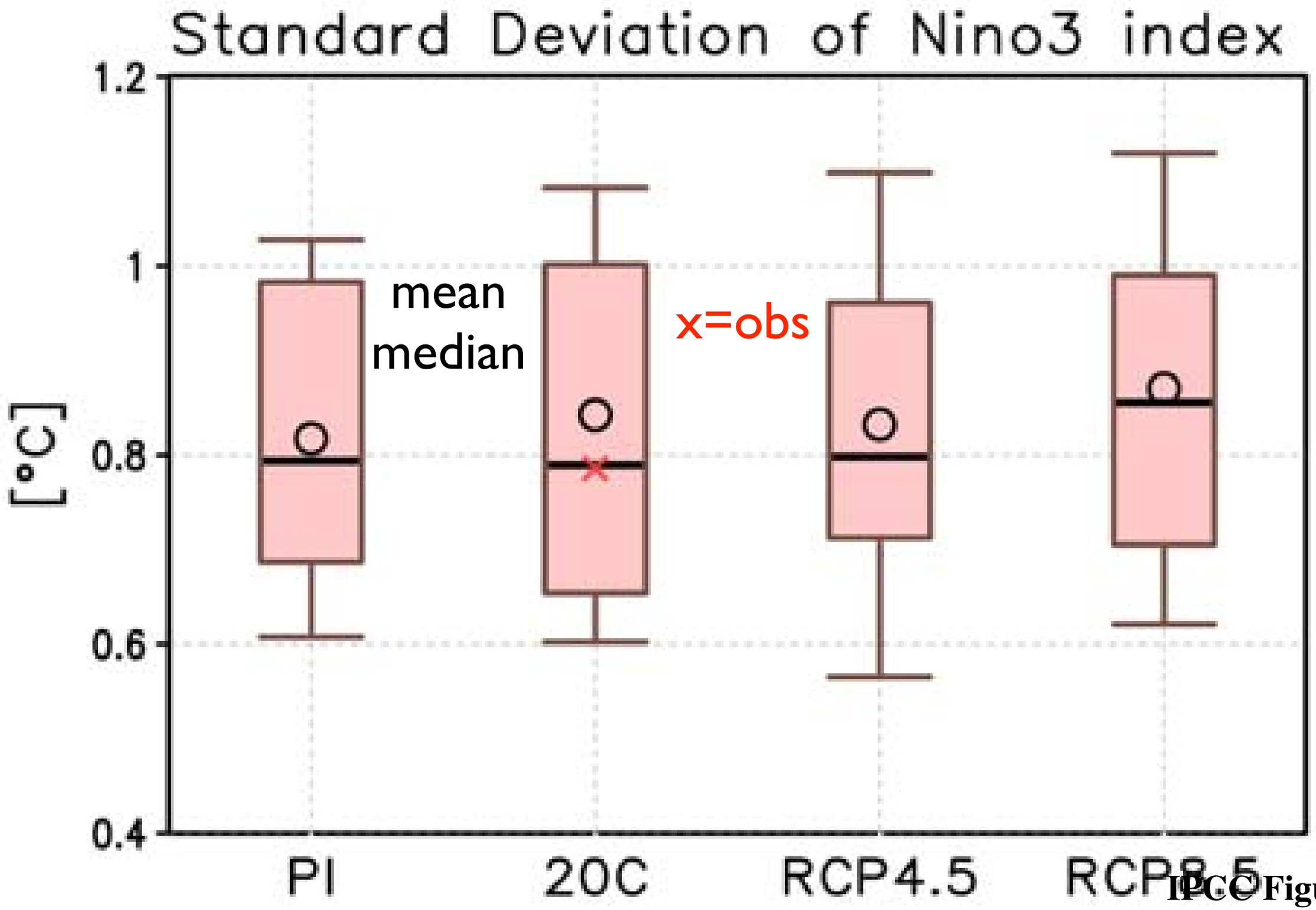
Box TS.3



IPCC 2013 Fig 11.9

INTERGOVERNMENTAL PANEL ON climate change

will ENSO change?



IPCC Figure 14.14

Conclusions

- "Warming of the climate system is unequivocal"
- "...human influence has been the dominant cause of the observed warming..."

Climate Change 2013: The Physical Science Basis

Working Group I contribution to the IPCC Fifth Assessment Report

Further Information

www.climatechange2013.org

© Yann Arthus-Bertrand / Altitude

IPCC AR5 Working Group I
Climate Change 2013: The Physical Science Basis

ipcc
INTERGOVERNMENTAL PANEL ON climate change

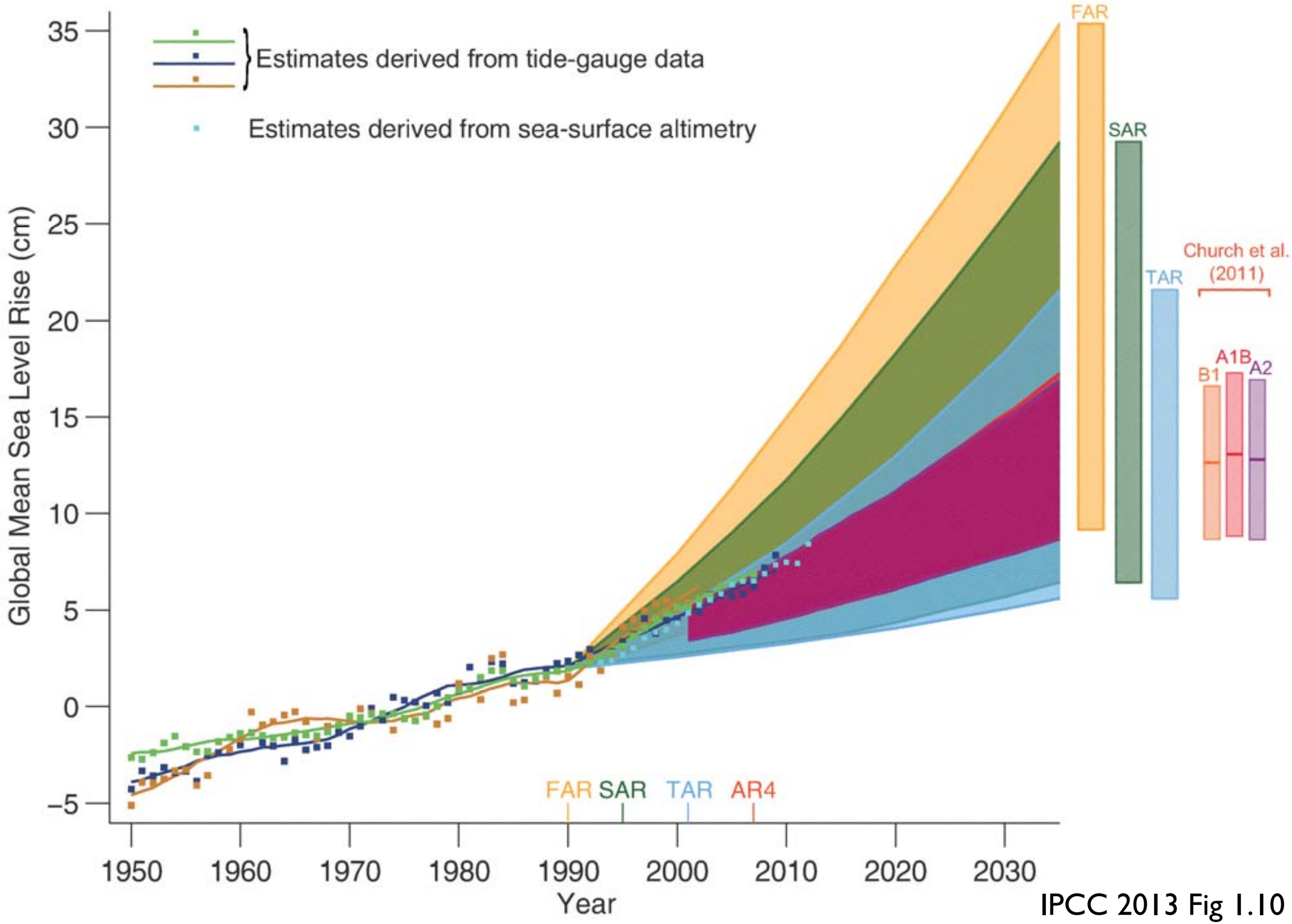
WMO UNEP

Warming

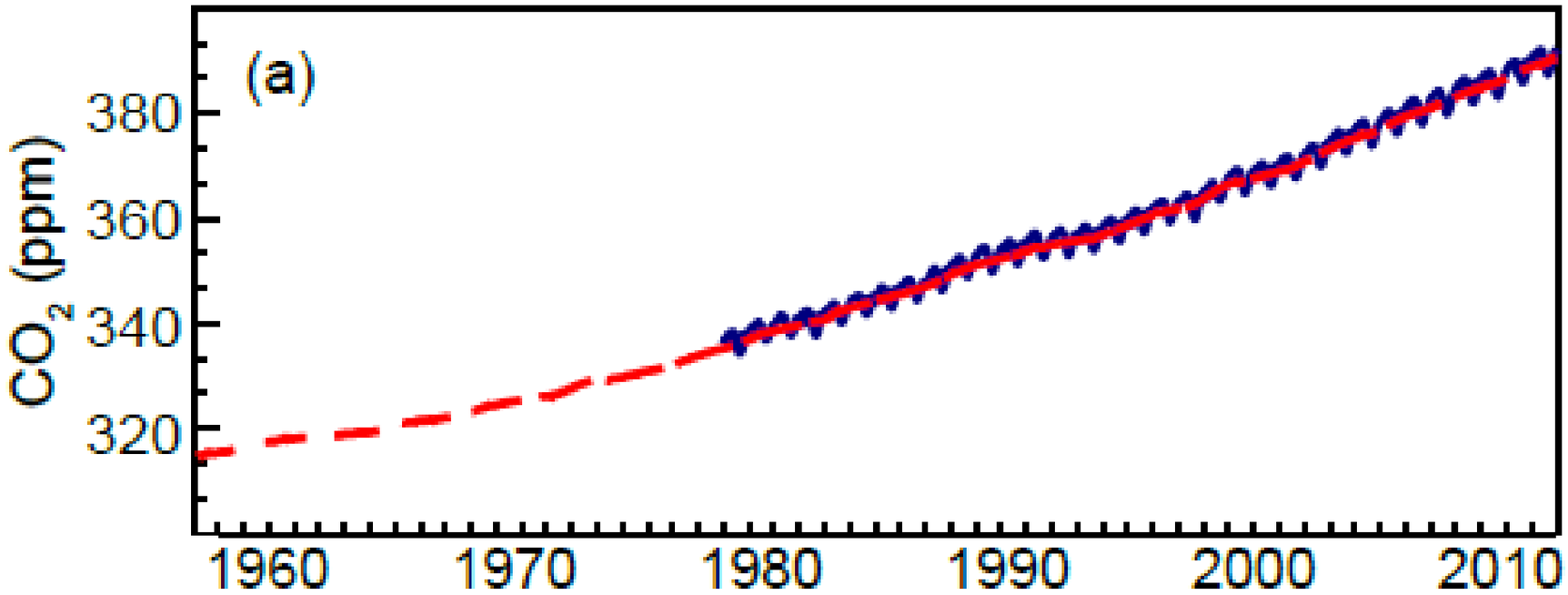
- FAR: Global mean surface air temperature has increased by 0.3°C to 0.6°C over the last 100 years
- SAR: Global mean surface temperature has increased by between about 0.3 and 0.6°C since the late 19th century
- TAR: An increasing body of observations gives a collective picture of a warming world and other changes in the climate system…Over the 20th century the increase has been 0.6°C
- AR4: Warming of the climate system is unequivocal…The updated 100-year linear trend (1906 to 2005) [is] 0.74°C [0.56°C to 0.92°C]
- AR5: Warming of the climate system is unequivocal…The globally averaged linear trend [is] 0.85 [0.65 to 1.06] °C over the period 1880 to 2012, when multiple independently produced datasets exist

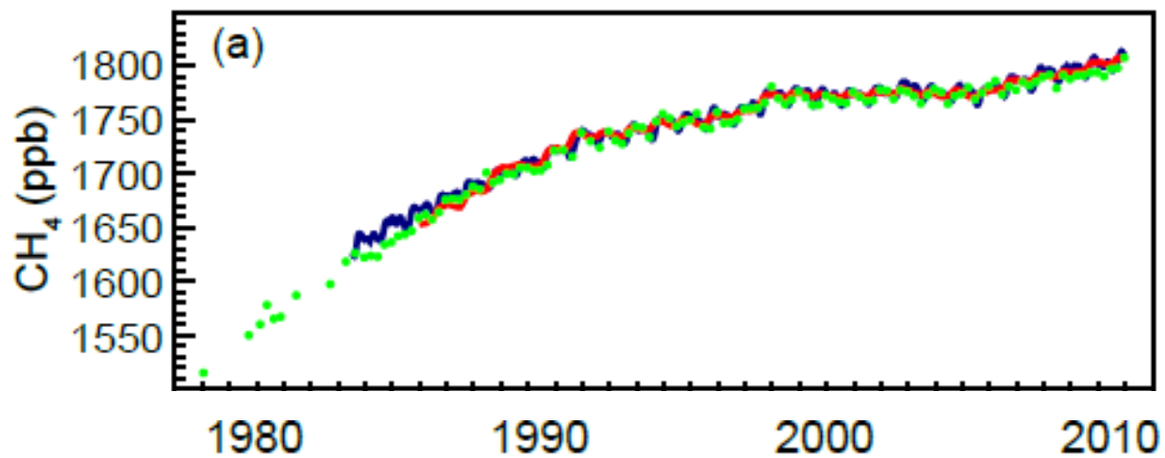
Attribution

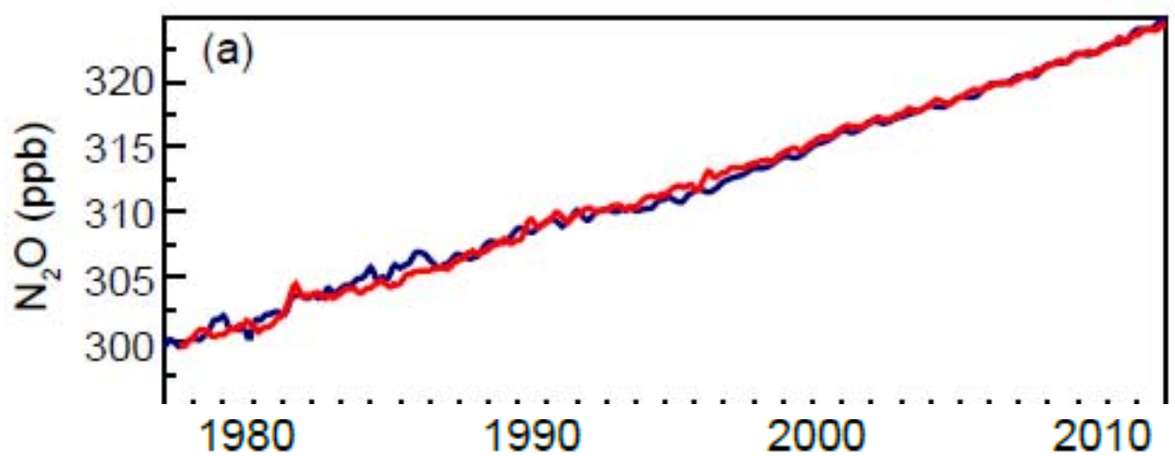
- FAR: The size of this warming is **broadly consistent** with predictions of climate models, but it is also of the same magnitude as natural climate variability.
- SAR: The **balance of evidence** suggests a discernible human influence on global climate.
- TAR: There is new and **stronger** evidence that most of the warming observed over the last 50 years is attributable to human activities
- AR4: **Most** of the observed increase in global average temperatures since the mid-20th century **is *likely*** due to the observed increase in [GHG] concentrations.
- AR5: Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise… It is ***extremely likely*** that human influence has been the **dominant** cause of the observed warming since the mid-20th century.



IPCC 2013 Fig 1.10



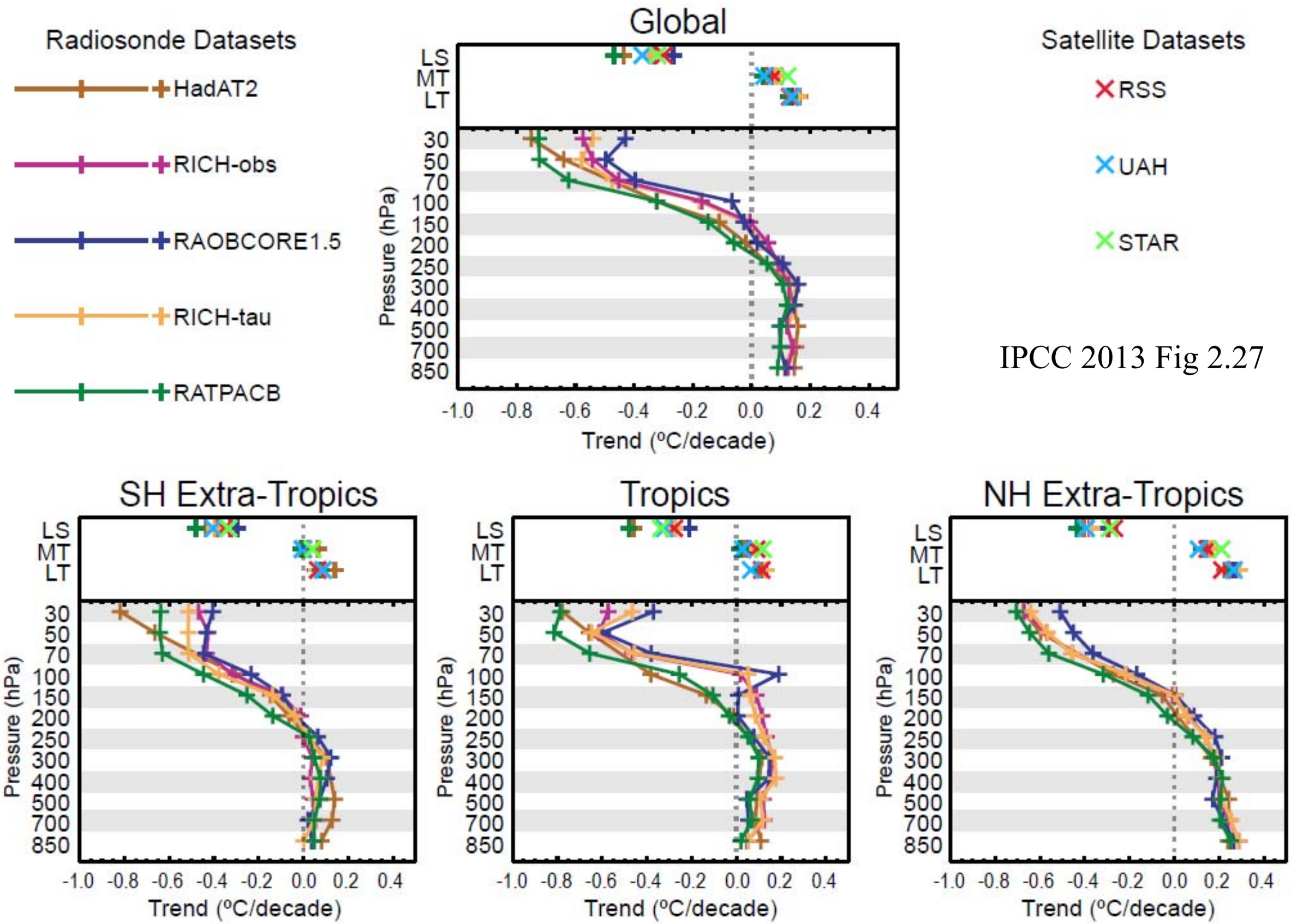




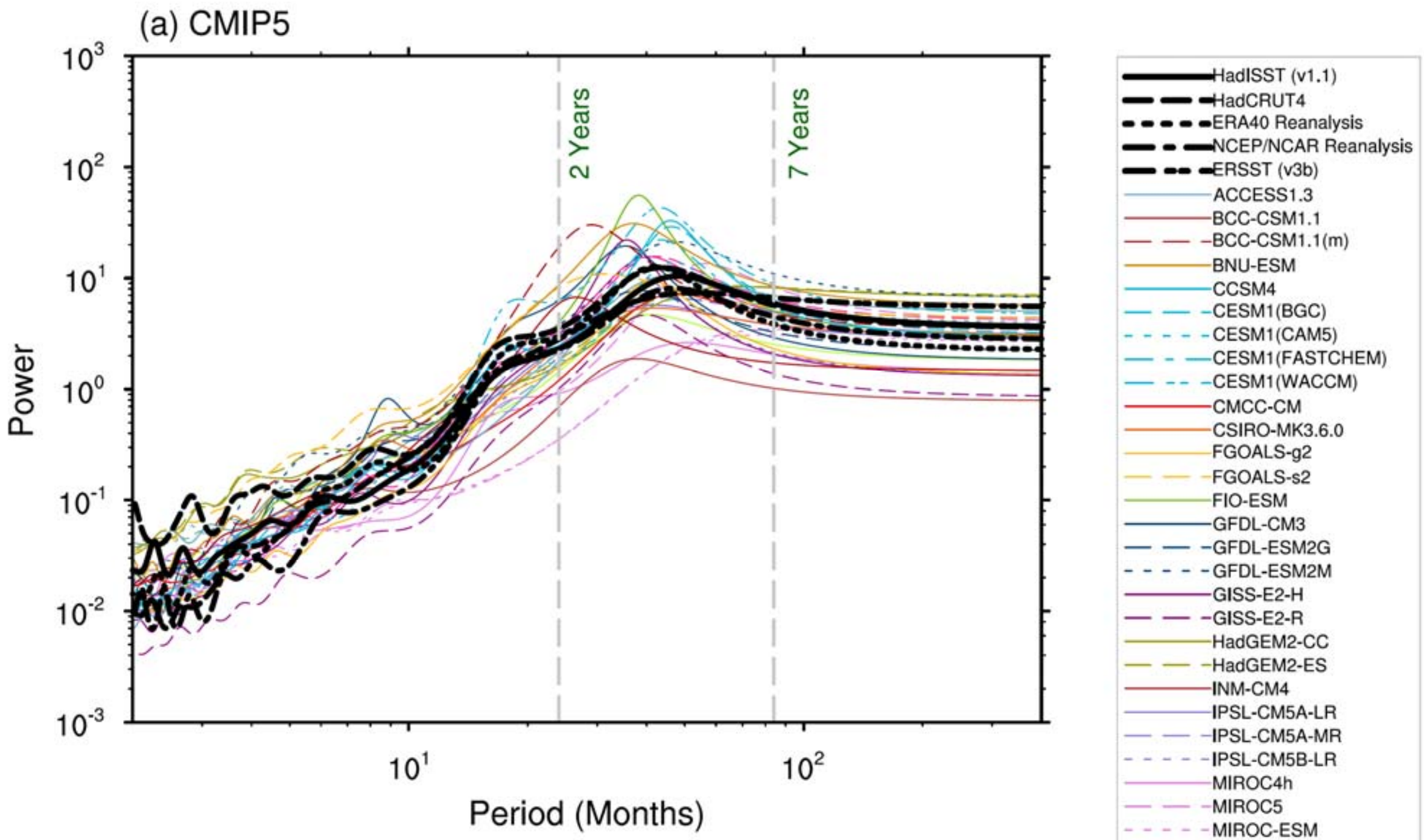
IPCC 2013 Figs 2.1, 2.2, 2.3

ipcc INTERGOVERNMENTAL PANEL ON climate change WMO UNEP

Upper air temp trends 1979-2012



IPCC 2013 Fig 2.27



IPCC 2013 Fig 9.35

ipcc INTERGOVERNMENTAL PANEL ON climate change WMO UNEP