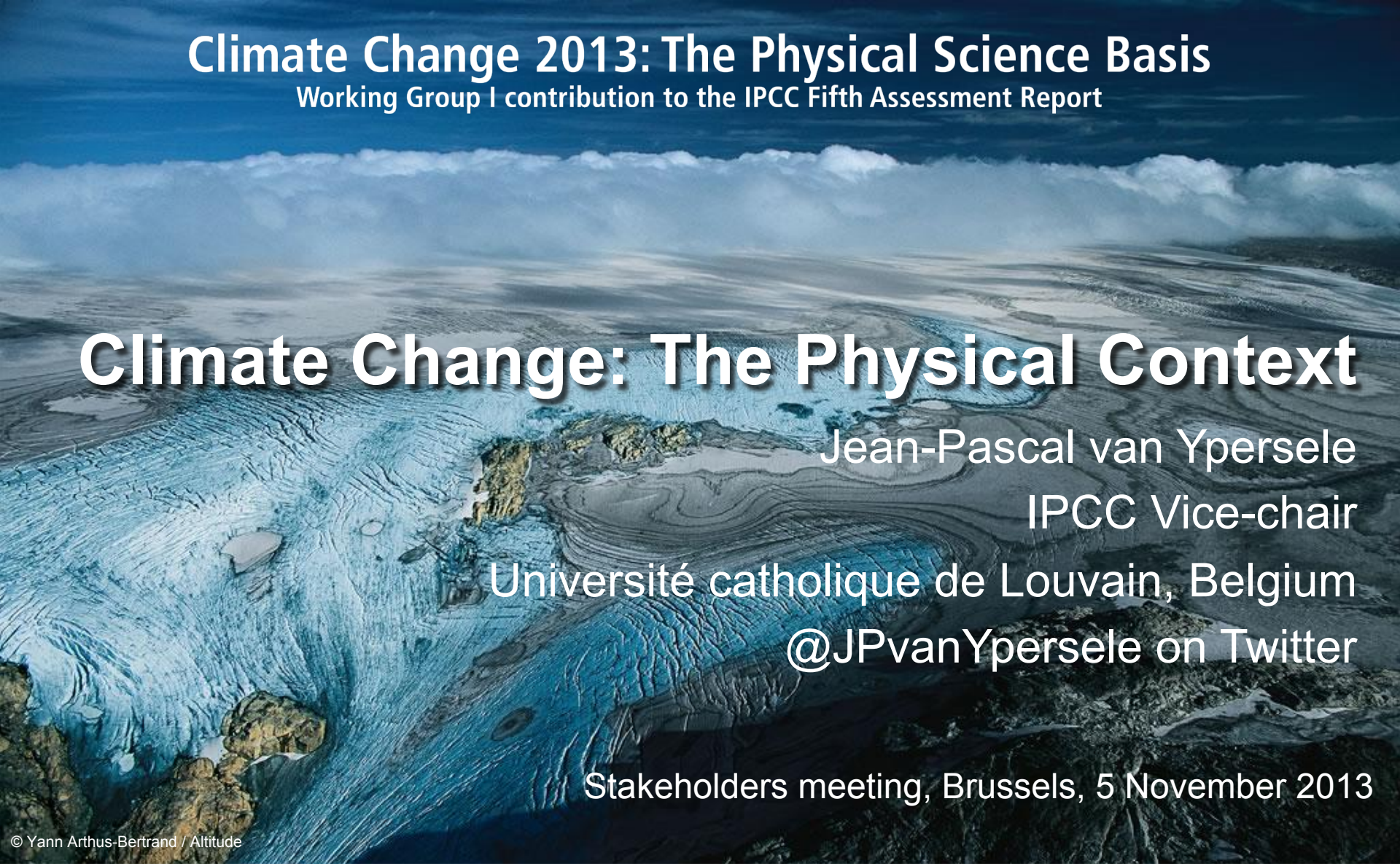

Climate Change 2013: The Physical Science Basis

Working Group I contribution to the IPCC Fifth Assessment Report

Climate Change: The Physical Context

Jean-Pascal van Ypersele
IPCC Vice-chair
Université catholique de Louvain, Belgium
@JPvanYpersele on Twitter

Stakeholders meeting, Brussels, 5 November 2013

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Thanks to the Belgian Federal Science Policy Office for their support,
to IPCC WGI for some of the slides, and to Dr Philippe Marbaix & Dr Bruna Gaino for their help

Why the IPCC ?

Established by WMO and UNEP in 1988

to provide policy-makers with an objective source of information about

- causes of climate change,
- potential environmental and socio-economic impacts,
- possible response options.

WMO=World Meteorological Organization

UNEP= United Nations Environment Programme

Key SPM Messages

19 Headlines

on less than 2 Pages

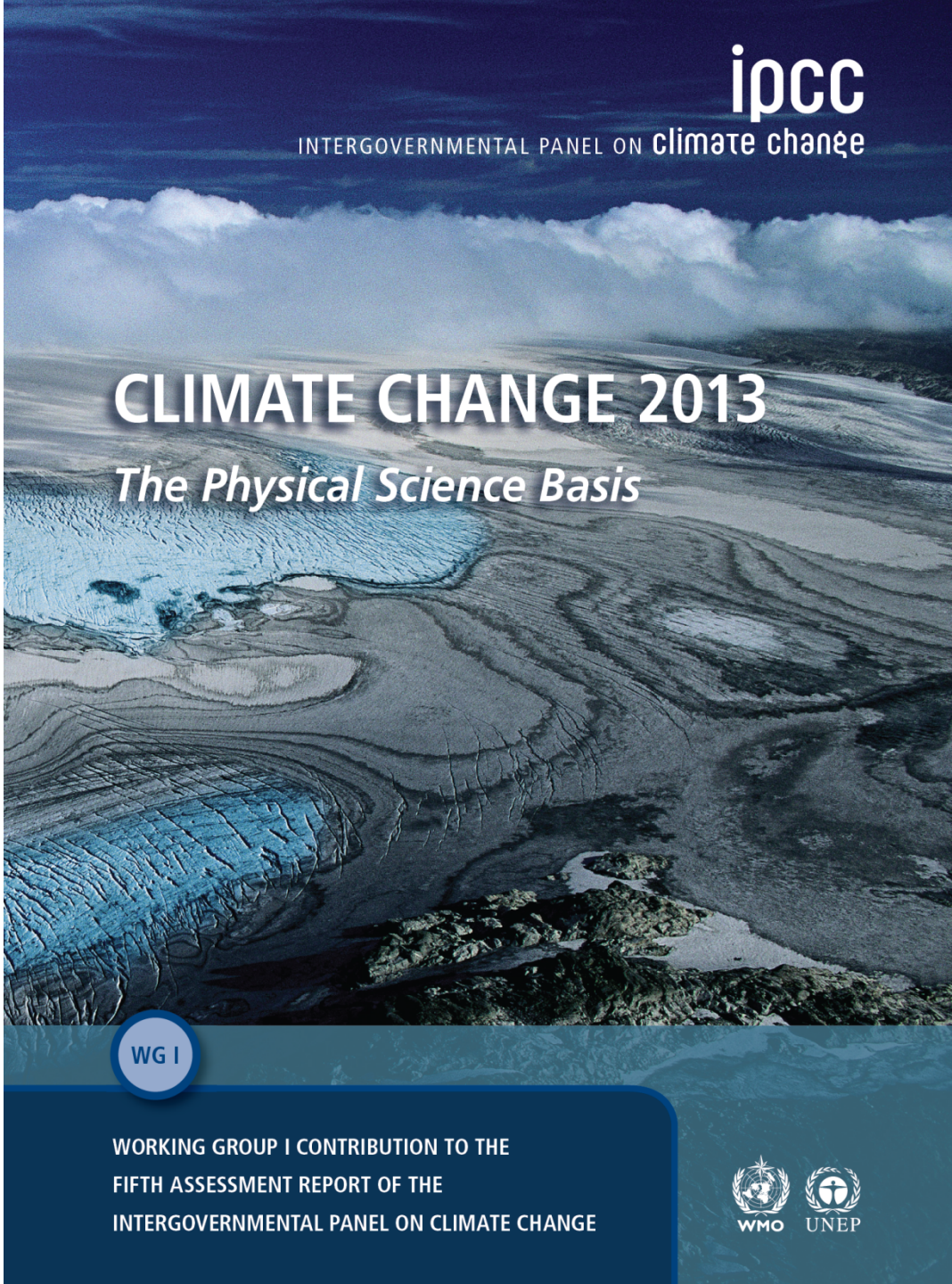
Summary for Policymakers
~14,000 Words

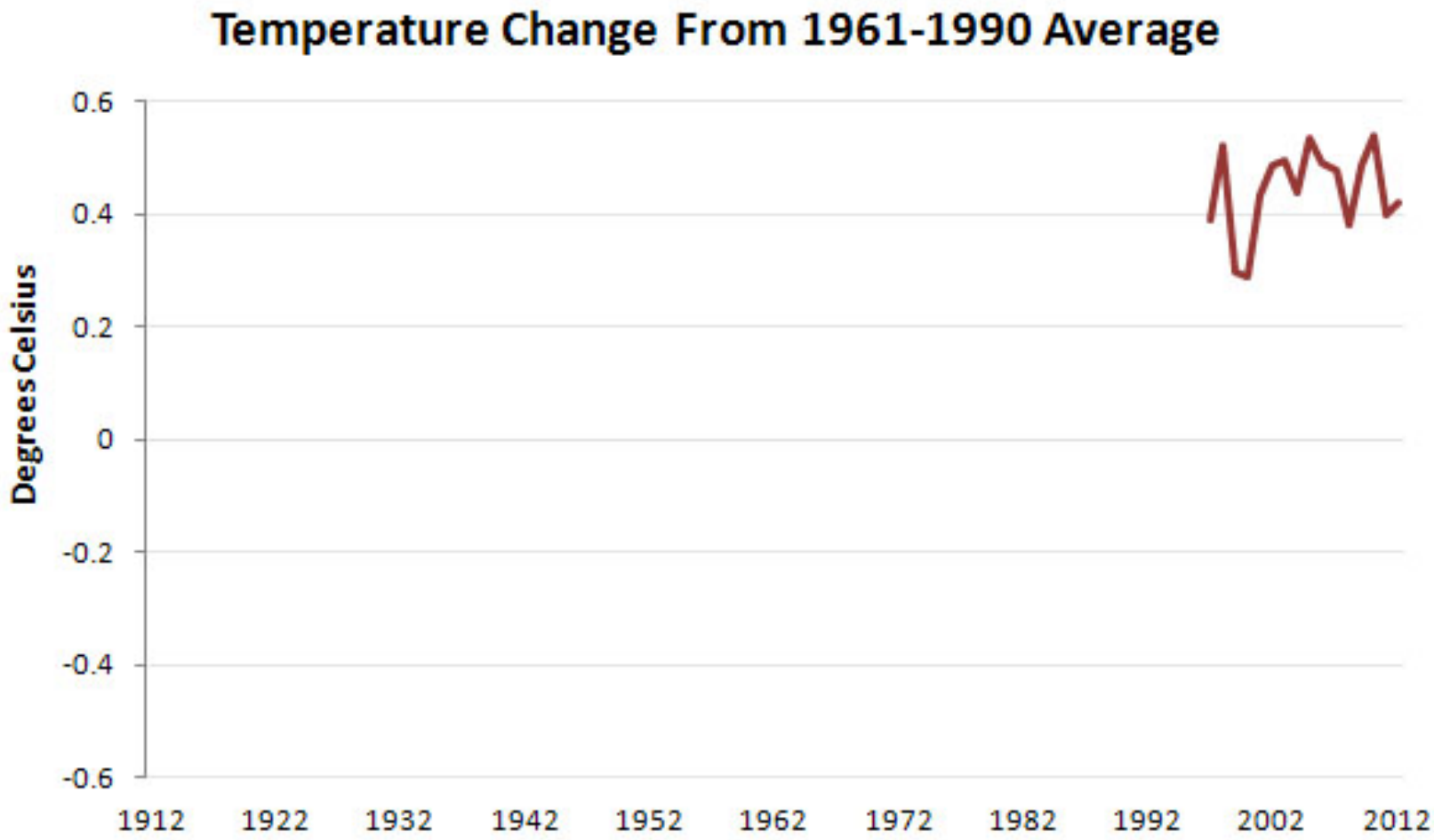
14 Chapters
Atlas of Regional Projections

54,677 Review Comments
by 1089 Experts

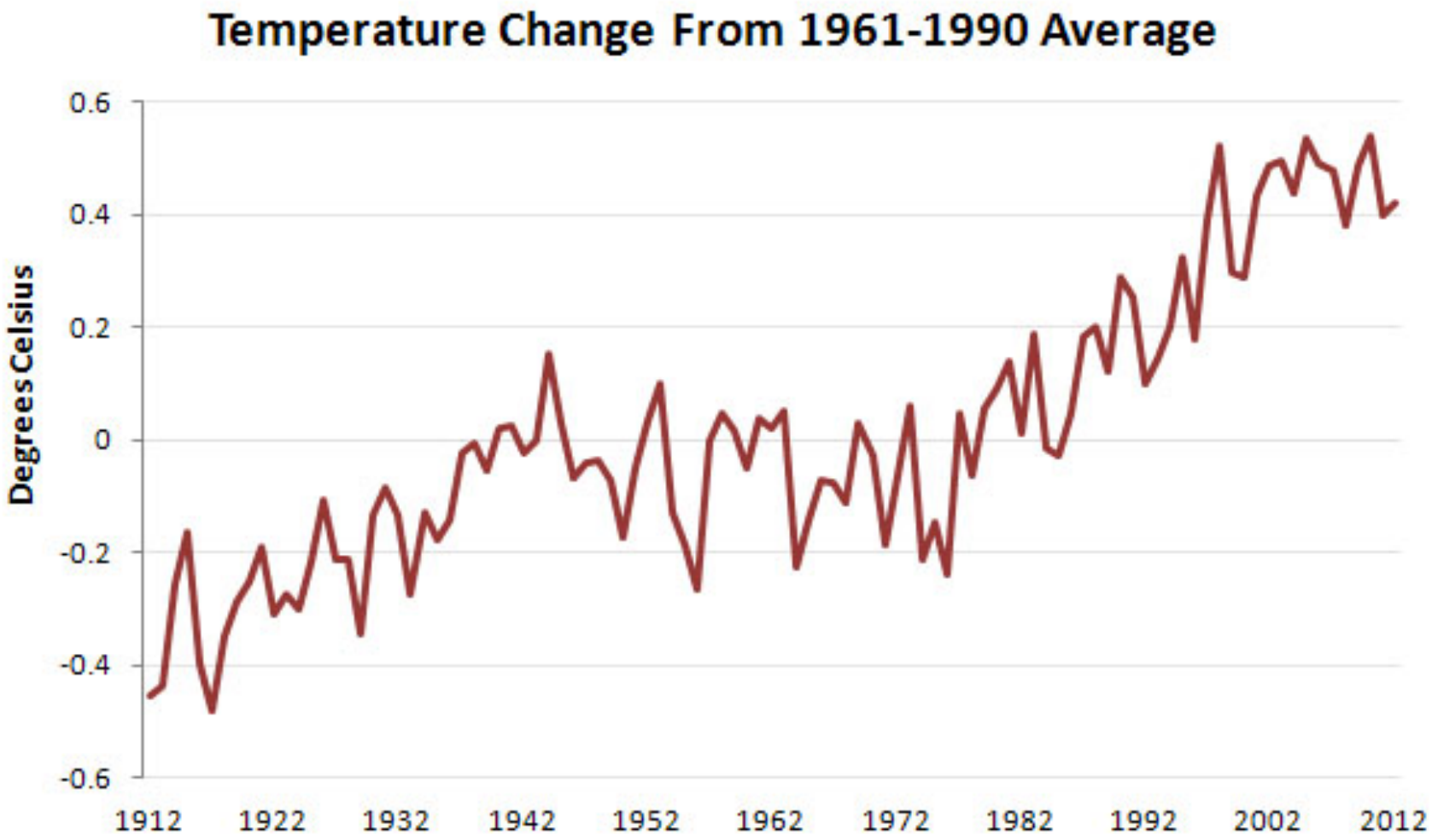
2010: 259 Authors Selected

2009: WGI Outline Approved



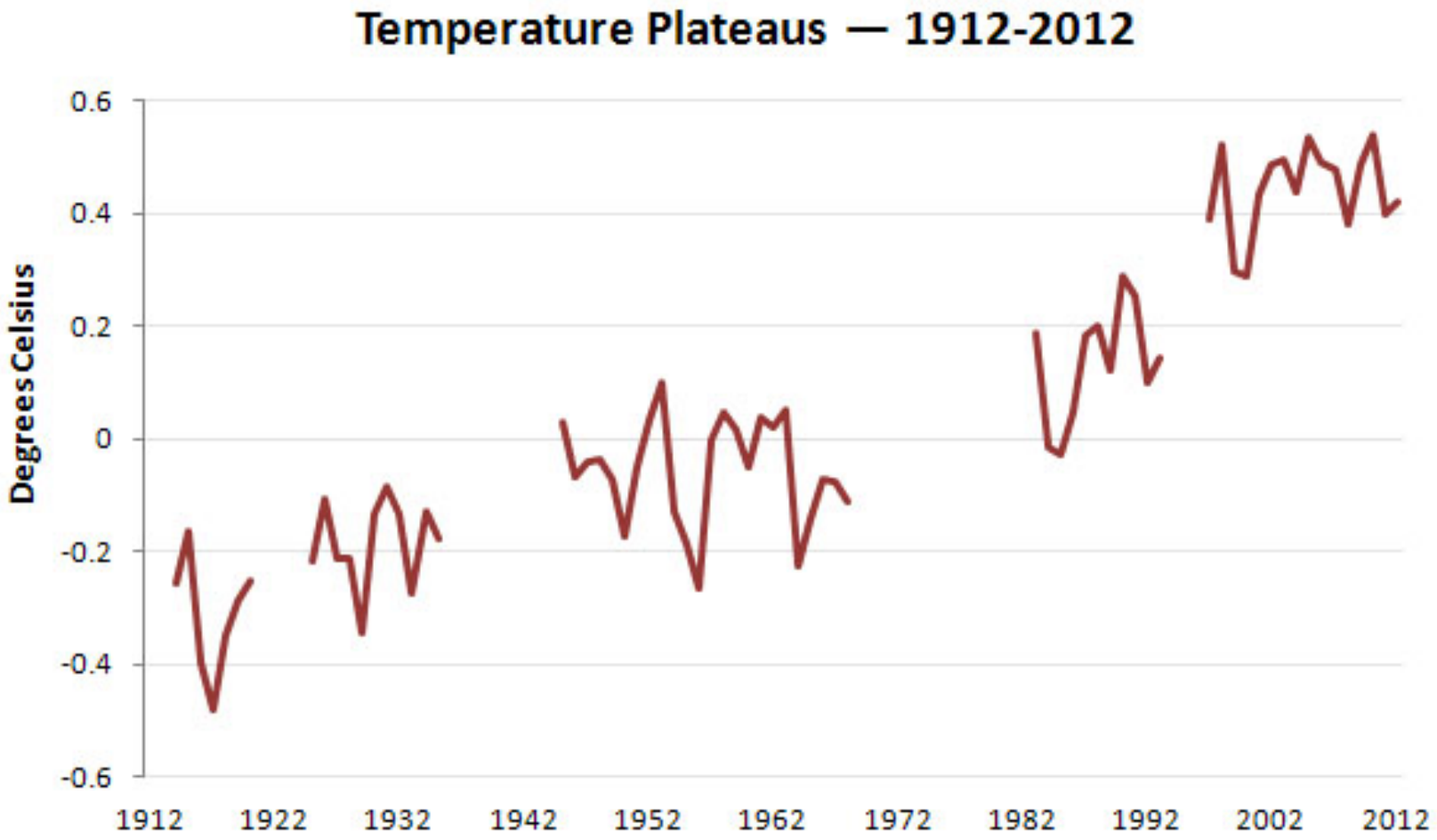


http://www.motherjones.com/kevin-drum/2012/10/lying-statistics-global-warming-edition



http://www.motherjones.com/kevin-drum/2012/10/lying-statistics-global-warming-edition

Lying With Statistics, Global Warming Edition



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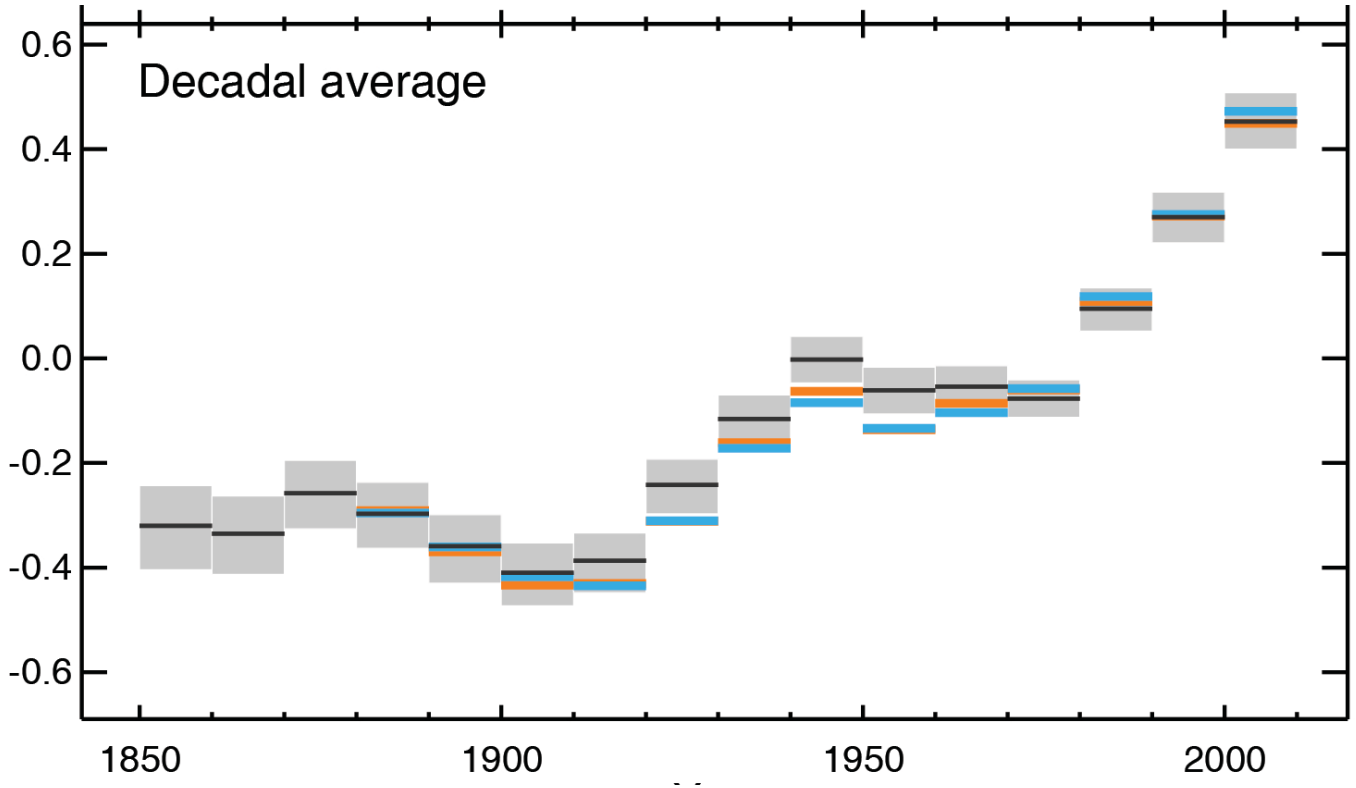


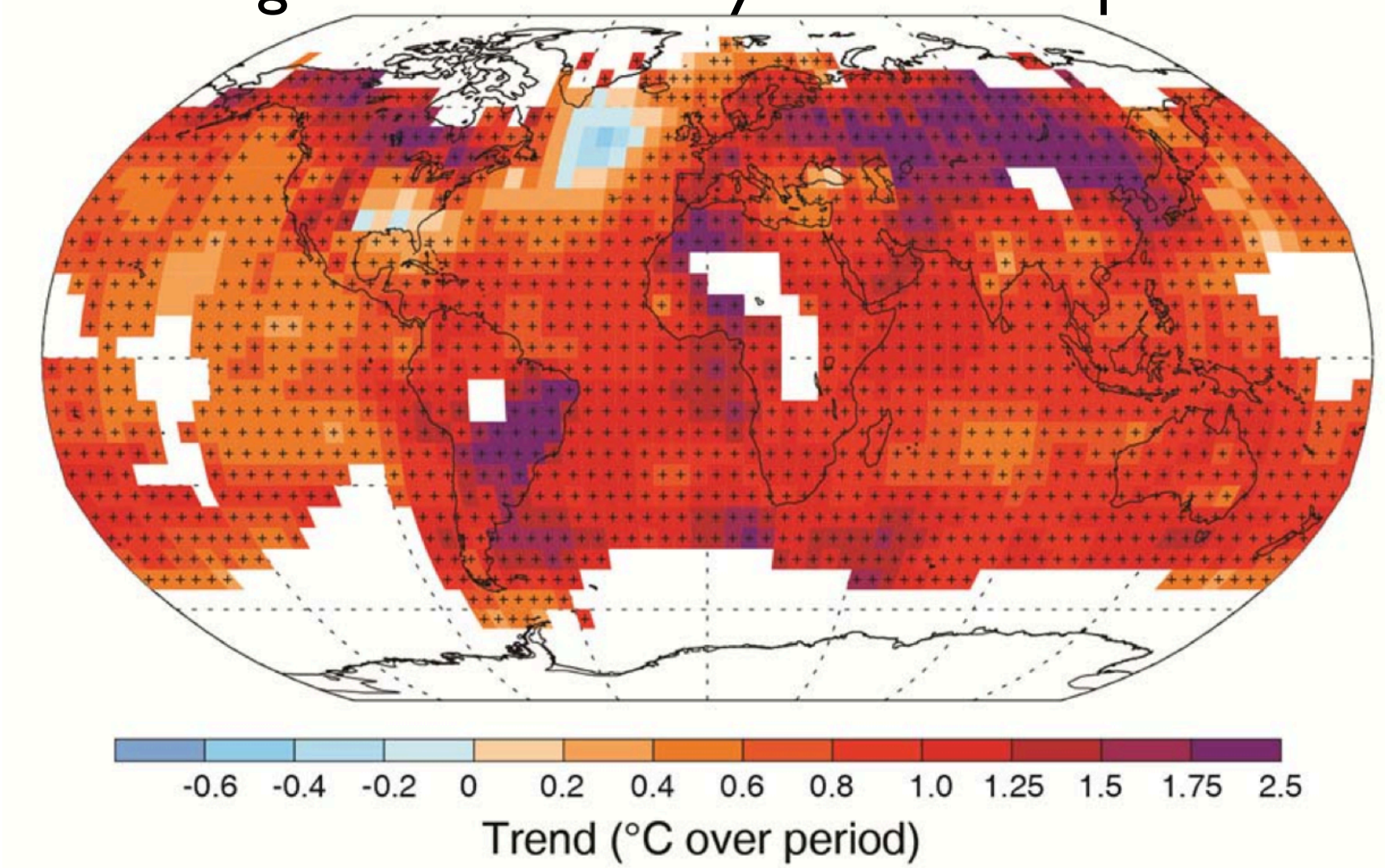
(IPCC 2013, Fig. SPM.1a)

Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850.

In the Northern Hemisphere, 1983–2012 was *likely* the warmest 30-year period of the last 1400 years (*medium confidence*).

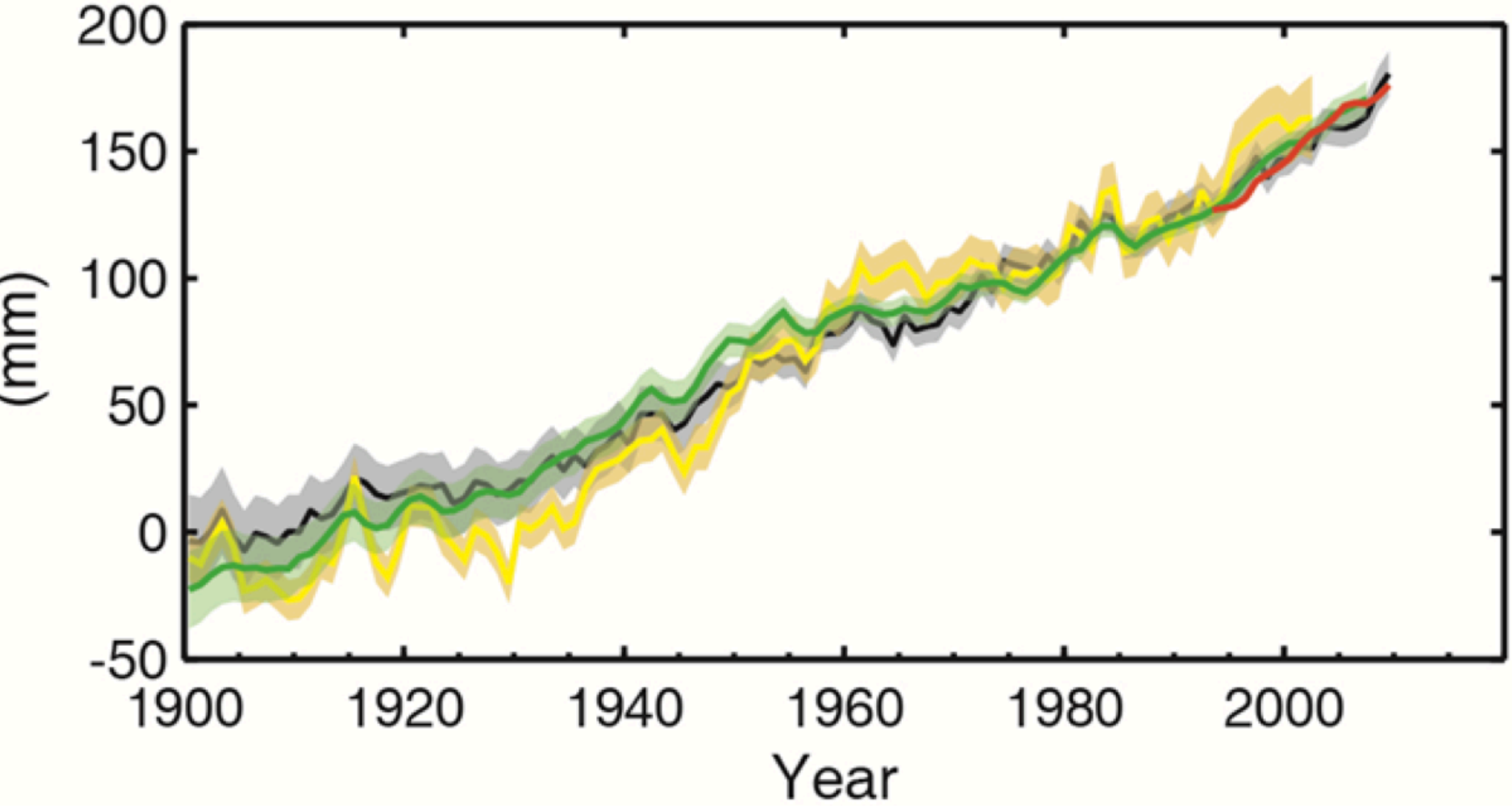
Change in average surface temperature 1901-2012

Warming in the climate system is unequivocal



AR5 WGI SPM - Approved version / subject to final copyedit

Change in average sea-level change



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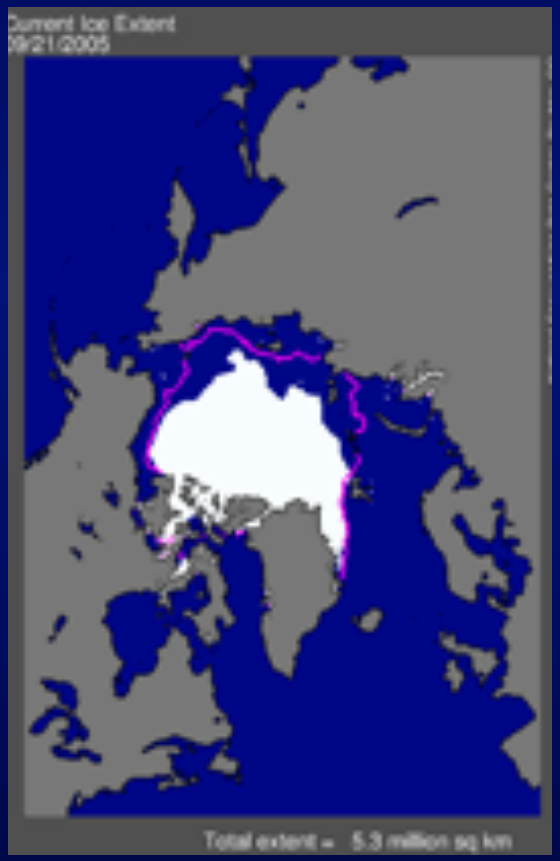
Extension of the Arctic ice cap

September 1979

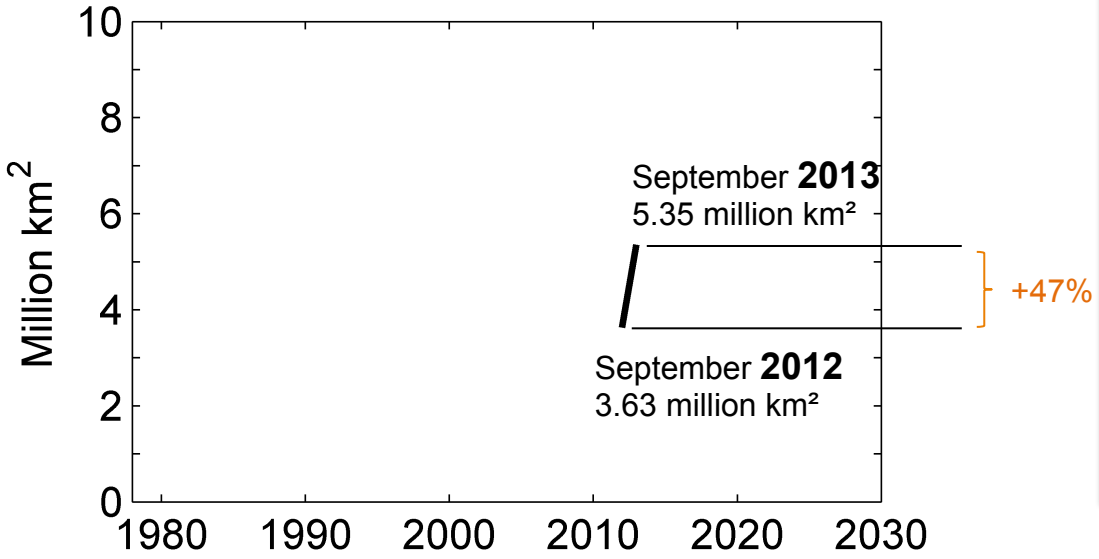
September 2005



September 2007

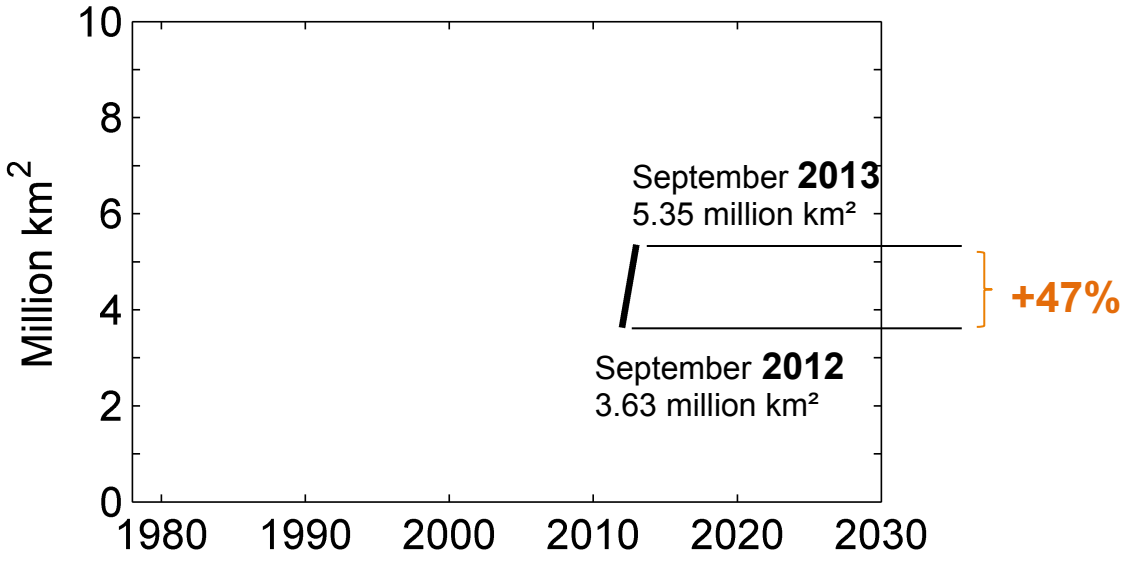
The pink line indicates the average ice cap extension since 1979

Observed Arctic September sea ice extent



Credit: F. Massonnet, UCL, 2013
Sea ice extent data: www.nsidc.org

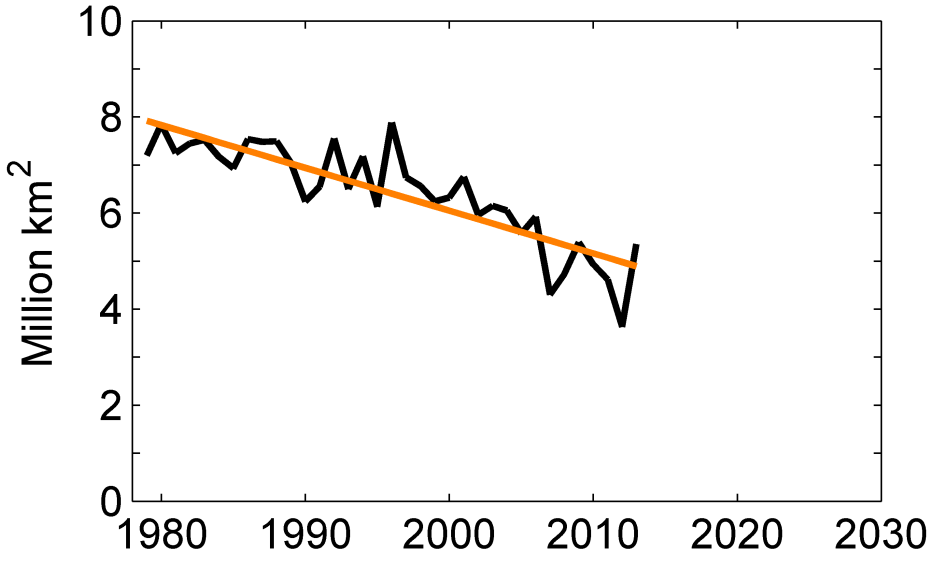
Observed Arctic September sea ice extent



Cherry-picking analysis

-« **Arctic sea ice cover is rebounding** »

-« **Climate is cooling** »



Scientific approach: the full view

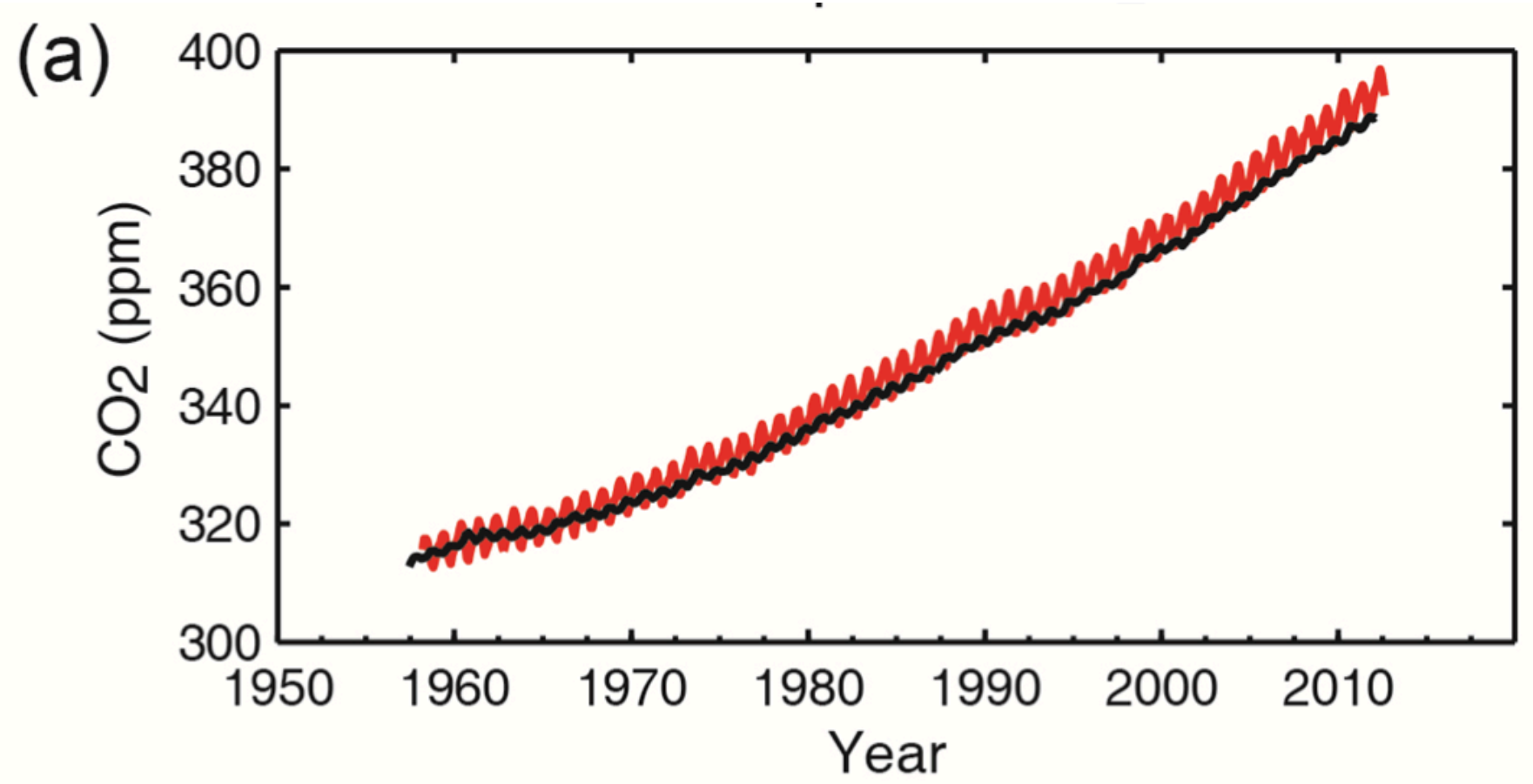
-**Variability of September sea ice extent at the interannual time scale is important**

-**Significant negative trend over record period (1979-2013): −0.89 million km²/ decade**

-**September 2013 sea ice extent is 6th lowest on record and 16.5% below 1979-2013 average**

Credit: F. Massonnet, UCL, 2013
Sea ice extent data: www.nsidc.org

Atmospheric CO_2 concentration



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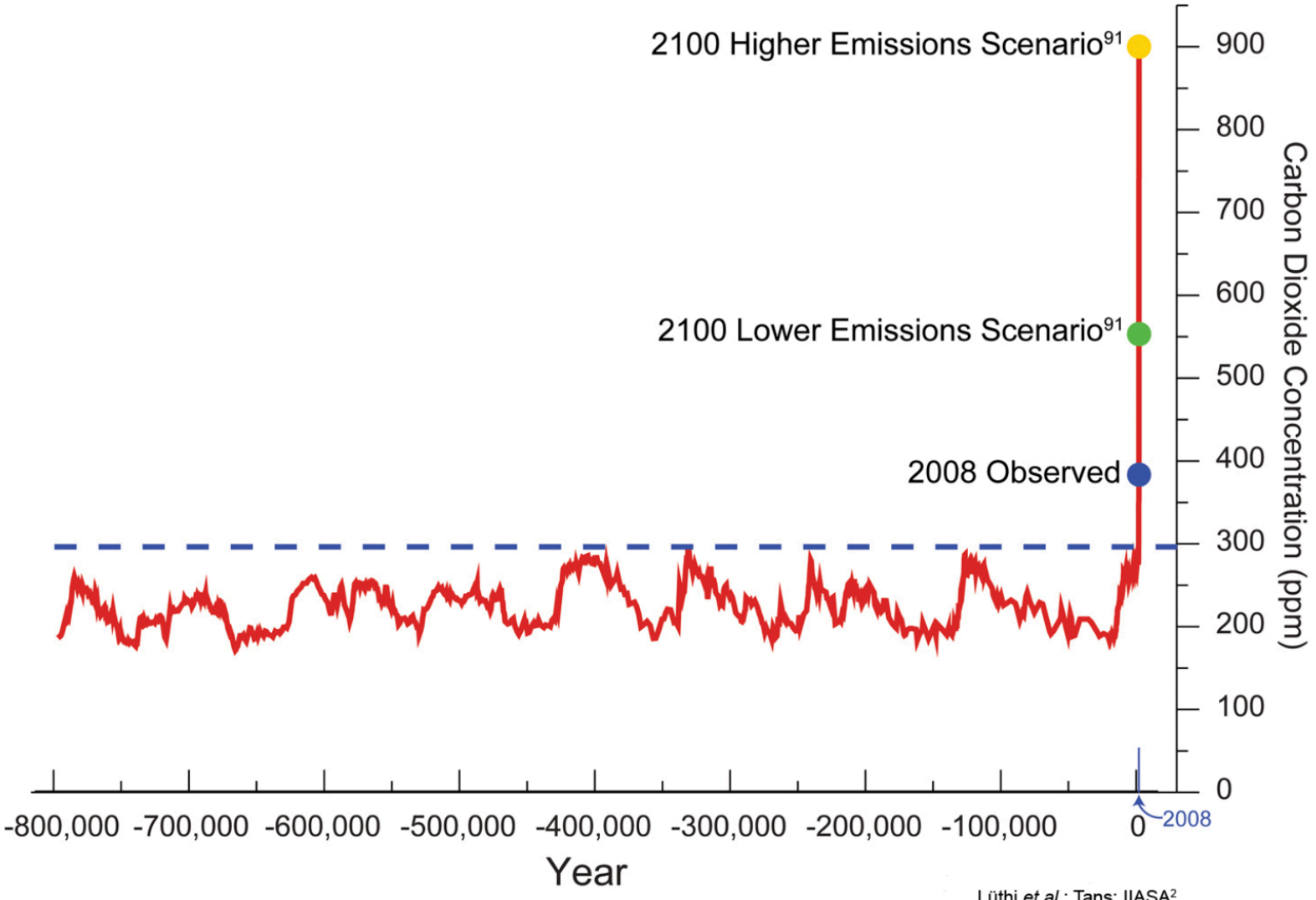
Atmospheric CO_2 over the last 800000 years



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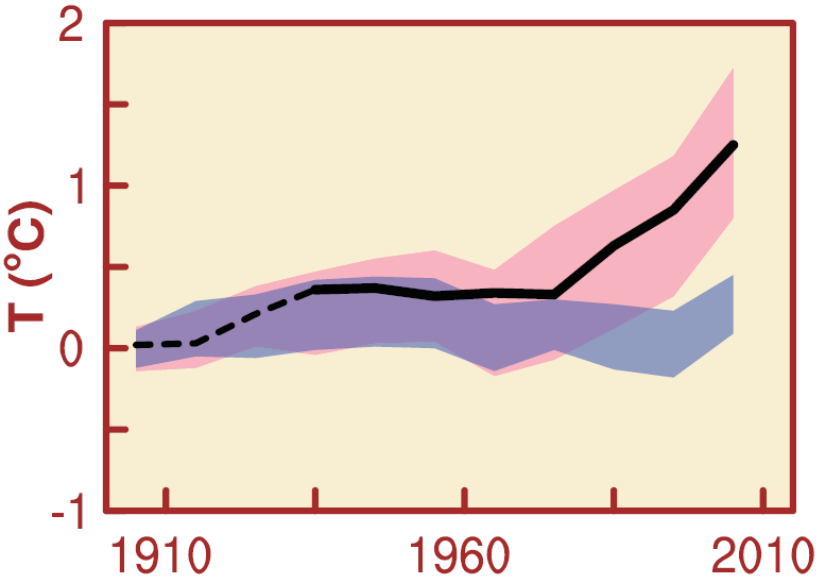
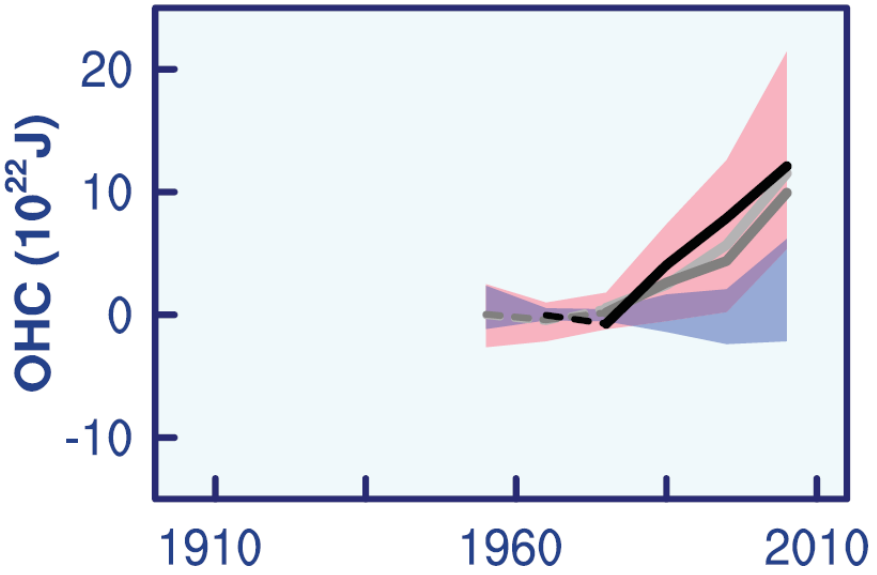
U.S. Global Change Research Program:Lüthi *et al.*; Tans; IIASA2

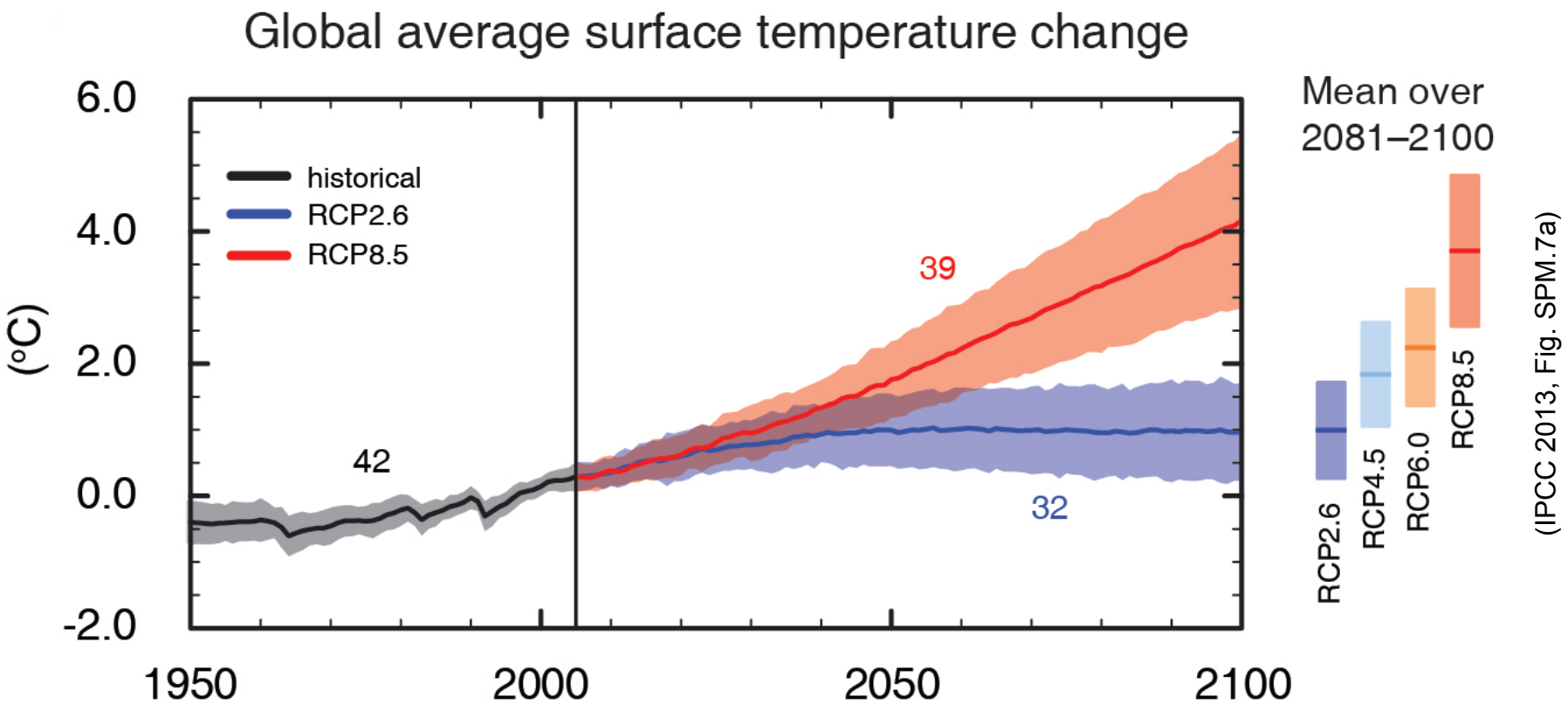
UNEP





(IPCC 2013, Fig. SPM.6)

Human influence on the climate system is clear



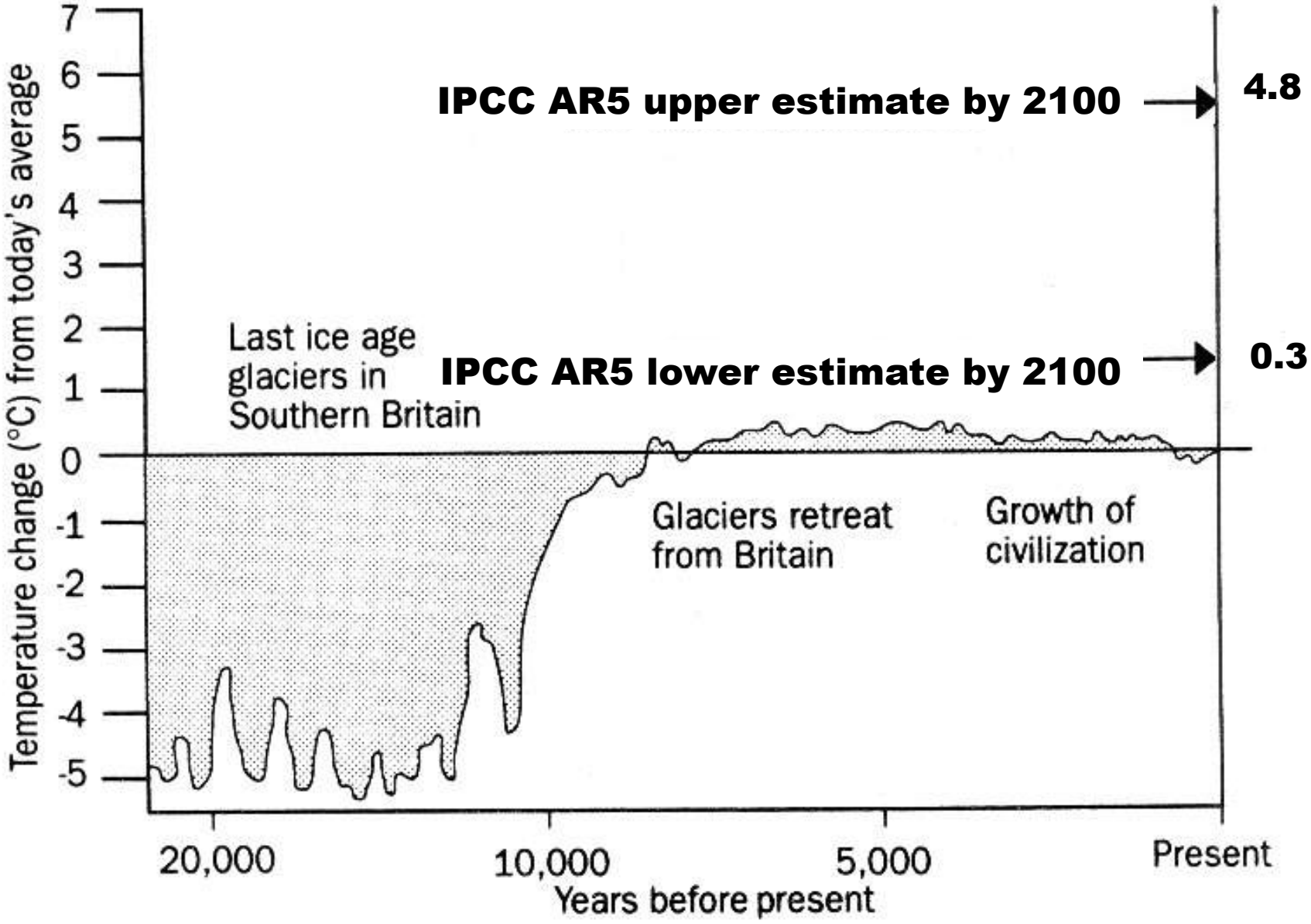
Global surface temperature change for the end of the 21st century is *likely* to exceed 1.5°C relative to 1850 for all scenarios

Global mean surface temperature change projections

(Increase over 21st century, from 1986-2005 to 2081-2100)

	mean	likely range
RCP2.6	1.0	0.3 to 1.7
RCP4.5	1.8	1.1 to 2.6
RCP6	2.2	1.4 to 3.1
RCP8.5	3.7	2.6 to 4.8

(°C)



Adapted from: International Geosphere Biosphere Programme Report no.6, Global Changes of the Past, July1988

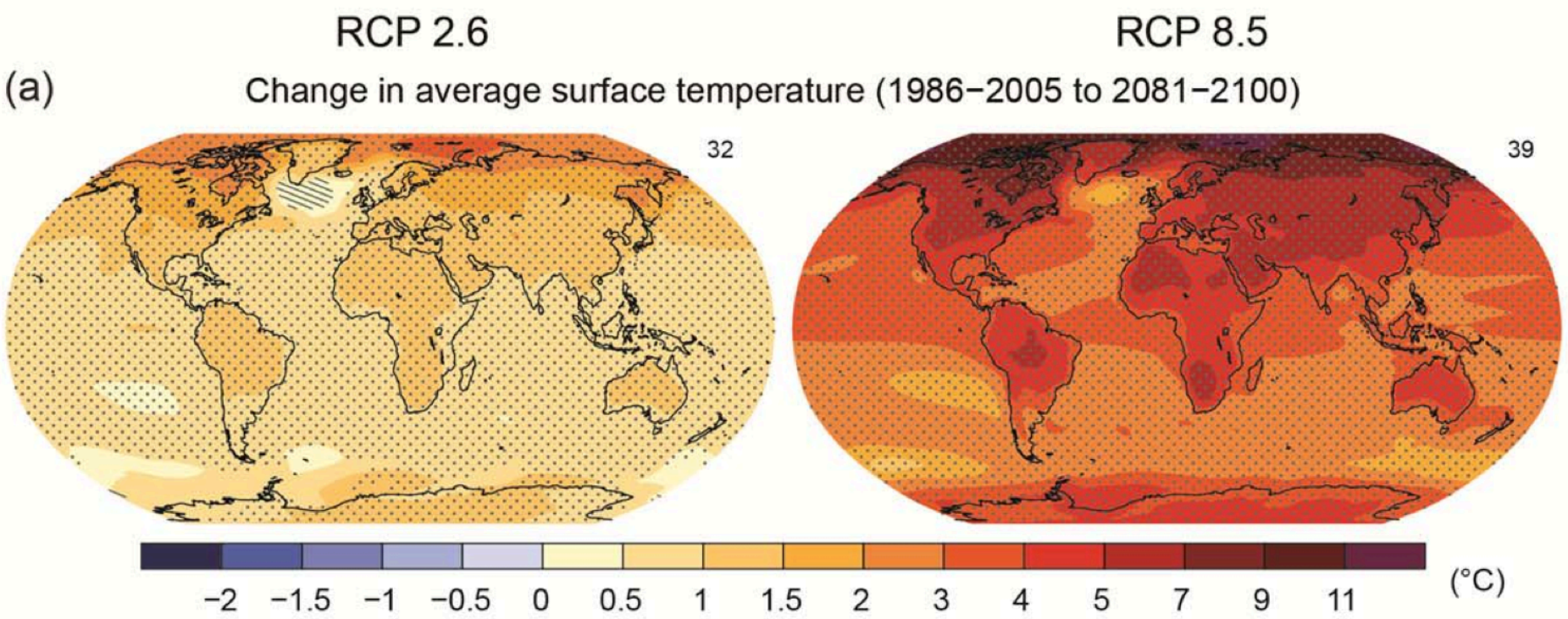
18-20000 years ago (Last Glacial Maximum)

With permission from Dr. S. Joussaume, in « Climat d'hier à demain », CNRS éditions.

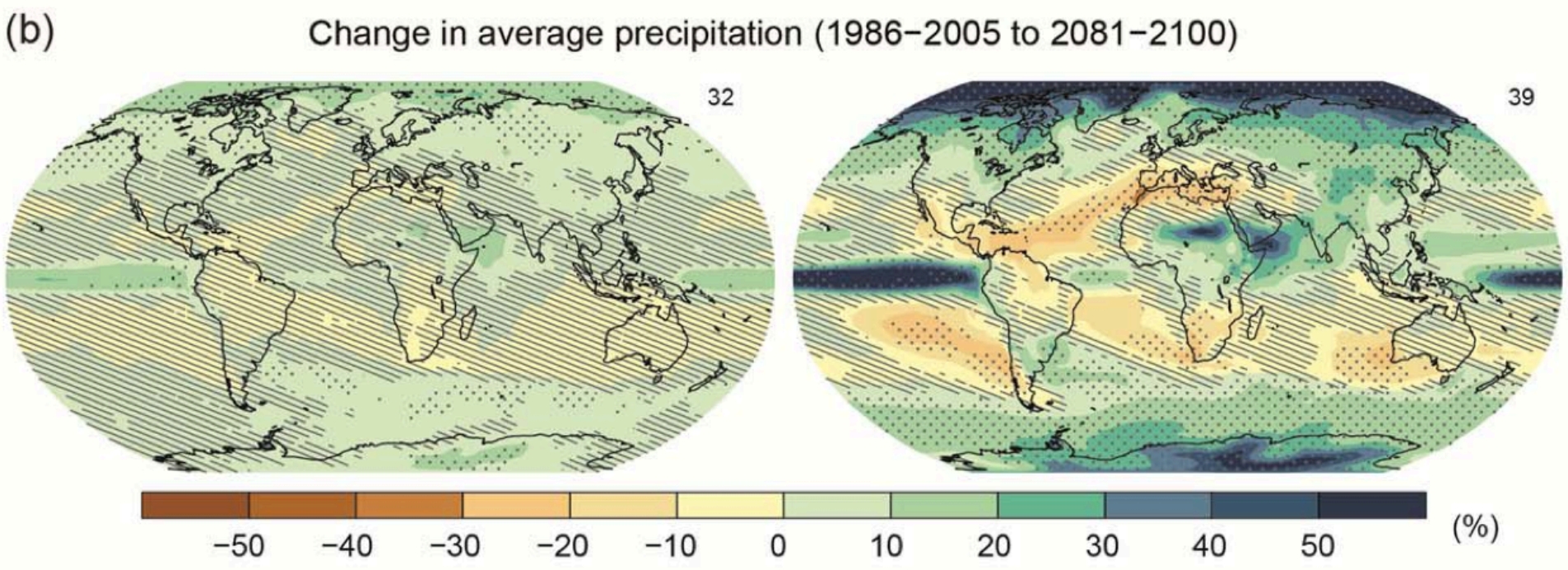
Today, with +4-5°C globally

With permission from Dr. S. Joussaume, in « Climat d'hier à demain », CNRS éditions.

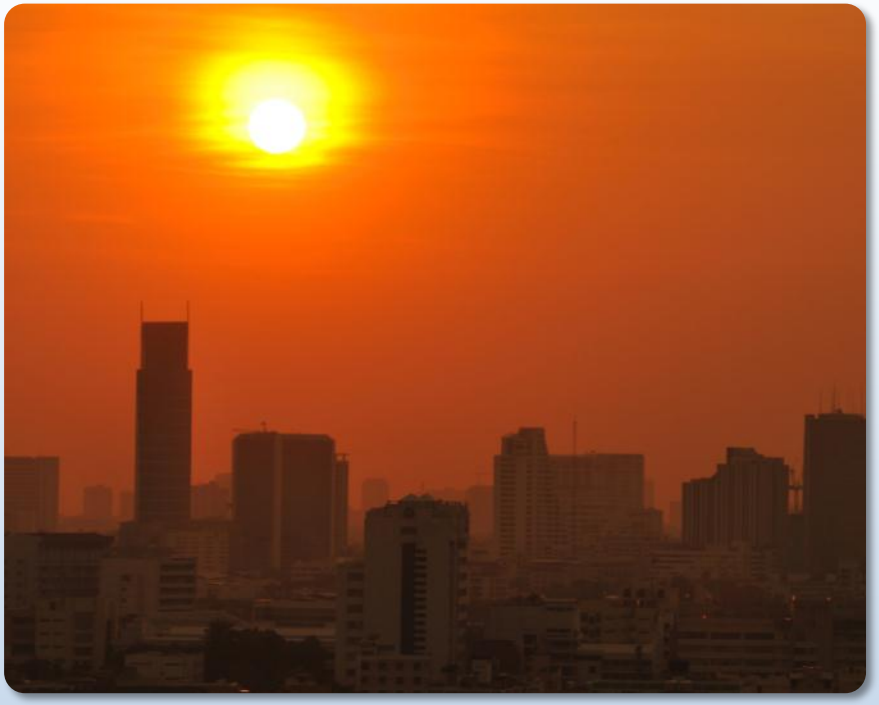
Surface temperature projections



Projected Change in Precipitation

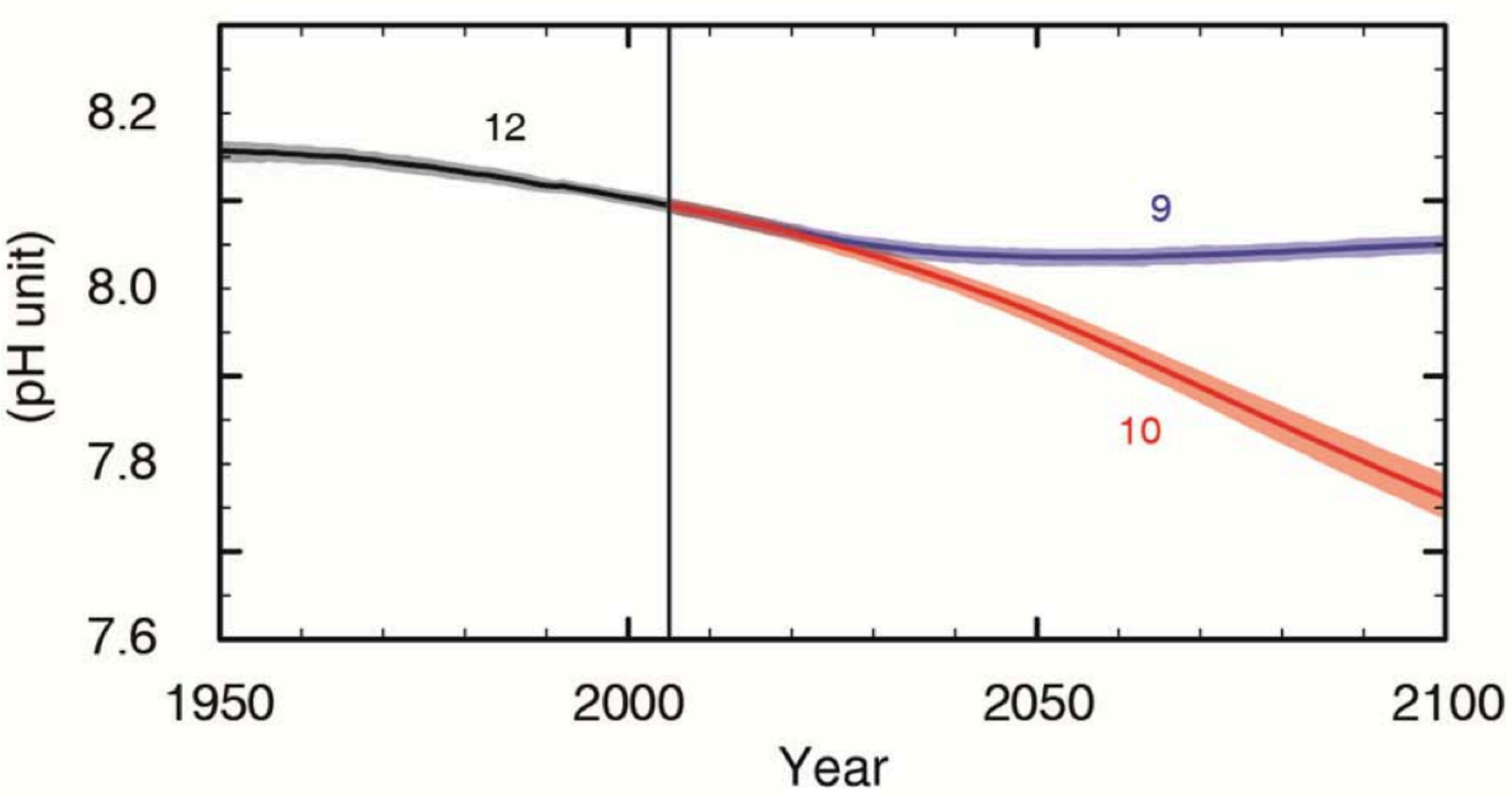


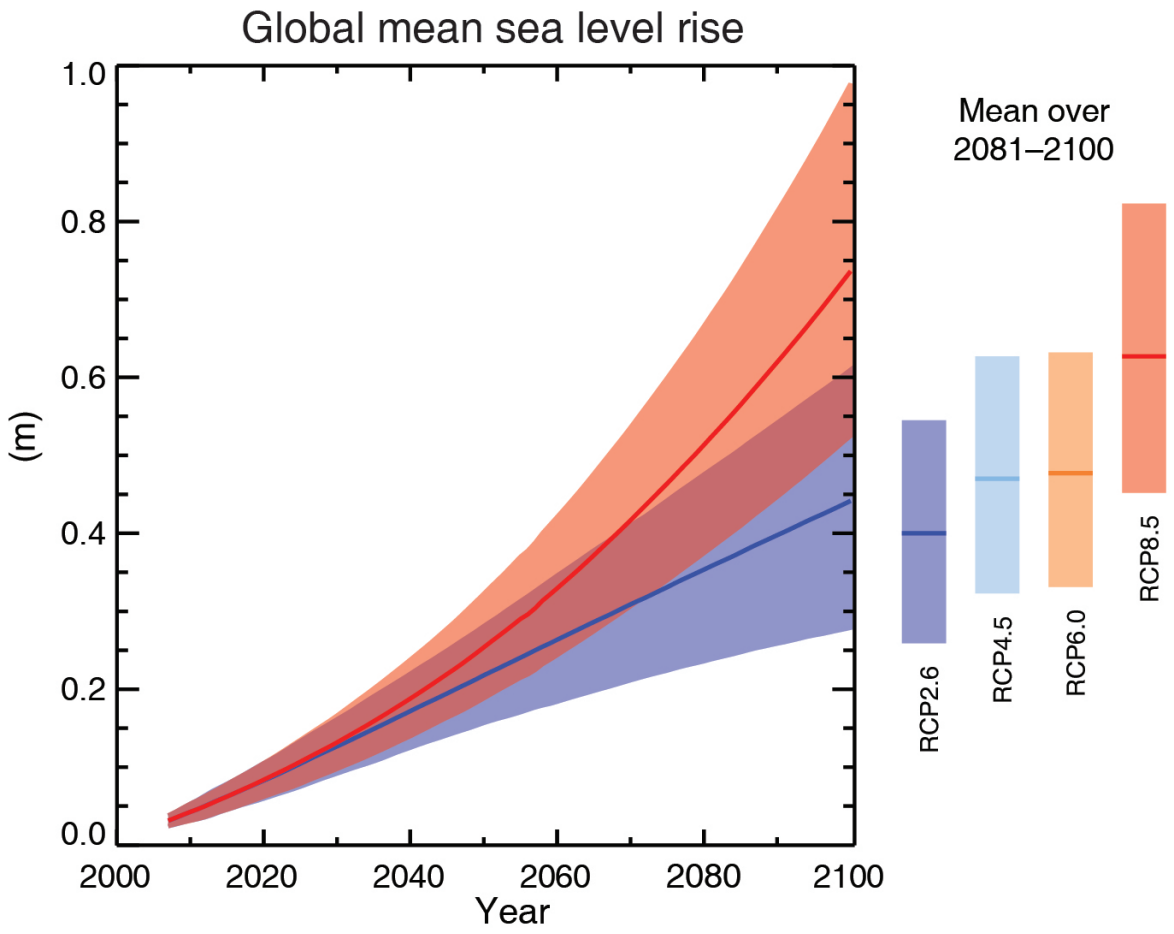
Since 1950, extreme hot days and heavy precipitation have become more common



There is evidence that anthropogenic influences, including increasing atmospheric greenhouse gas concentrations, have changed these extremes

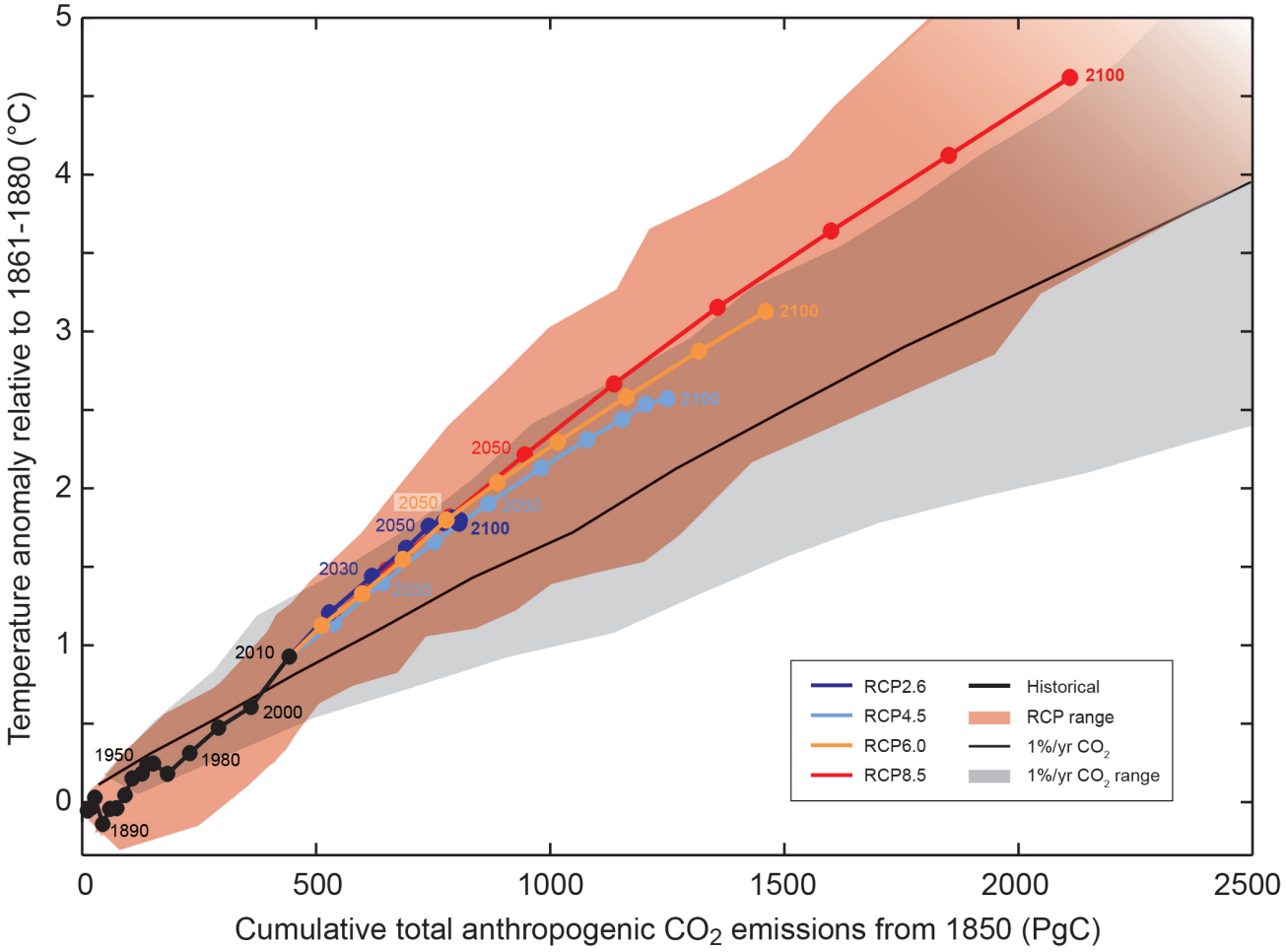
Ocean Acidification, for RCP 2.6 (orange) & RCP2.6 (blue)





(IPCC 2013, Fig. SPM.9)

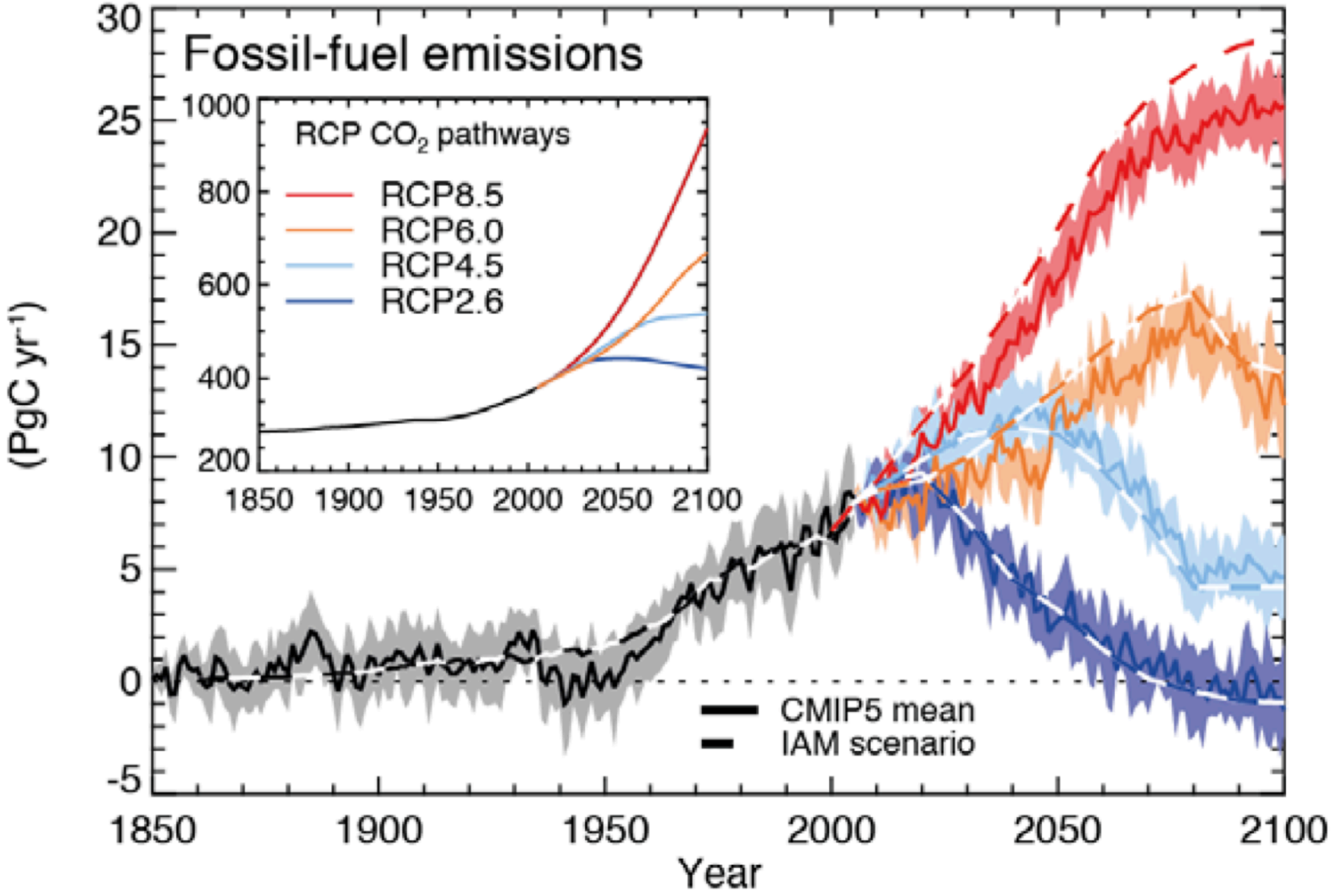
Global mean sea level will continue to rise during the 21st century



(IPCC 2013, Fig. SPM.10)

Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions

Compatible fossil fuel emissions simulated by the CMIP5 models for the four RCP scenarios



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Useful links:

- www.ipcc.ch : IPCC
- www.climatechange2013.org : IPCC WGI AR5
- www.climate.be/vanyp : my slides and other documents
- www.skepticalscience.com: excellent responses to contrarians arguments

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