

Climate Change, Challenges for Science and Society, and the IPCC (Intergovernmental Panel on Climate Change)

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**Thanks to the Belgian Federal Science Policy Office (BELSPO)
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Climate Services and IPCC

- « Climate Services provide climate information in a way that assists decision making » (GFCS web site)
- The first climate service is the IPCC itself!

Why the IPCC (Intergovernmental Panel on Climate Change)?

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 (adaptation & mitigation).

WMO=World Meteorological Organization

UNEP= United Nations Environment Programme

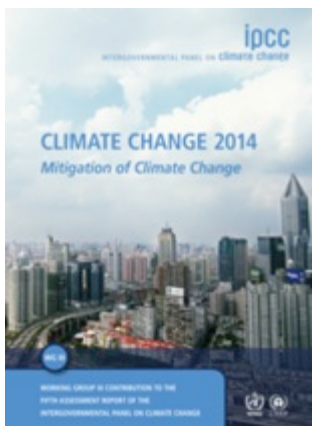




What is happening in the climate system?



What are the risks?



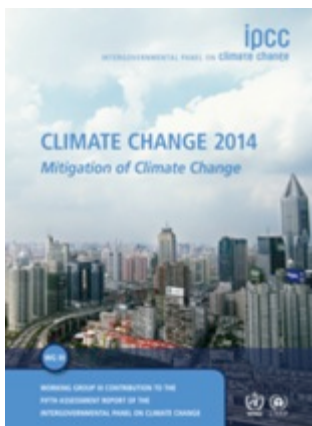
What can be done?



WG I (Physical science basis): 209 lead authors, 2014 pages, 54.677 review comments



WG II (Impacts, Adaptation and Vulnerability): 243 lead authors, 30 chapters, 50.492 review comments

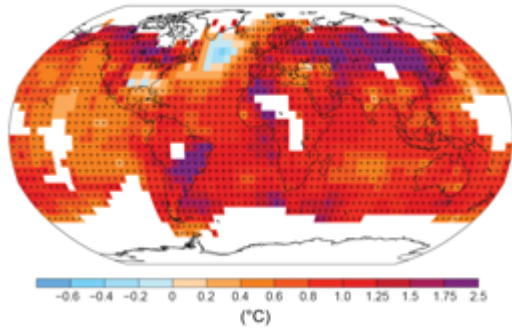


WG III (Mitigation of Climate Change): 235 coordinating and lead authors, 2000 pages, 38.315 review comments

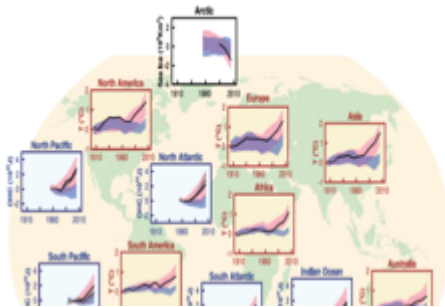


What is happening in the climate system?

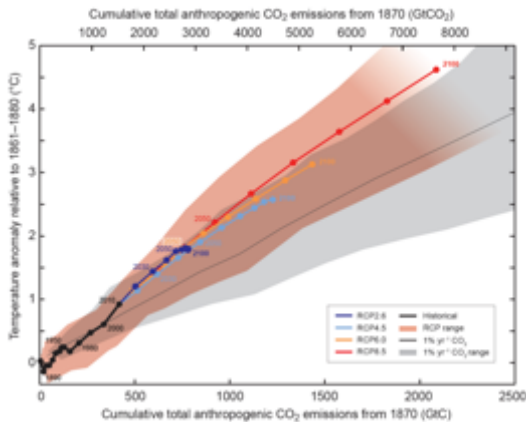
Observed change in surface temperature 1901–2012



Warming of the climate system is unequivocal, [...]



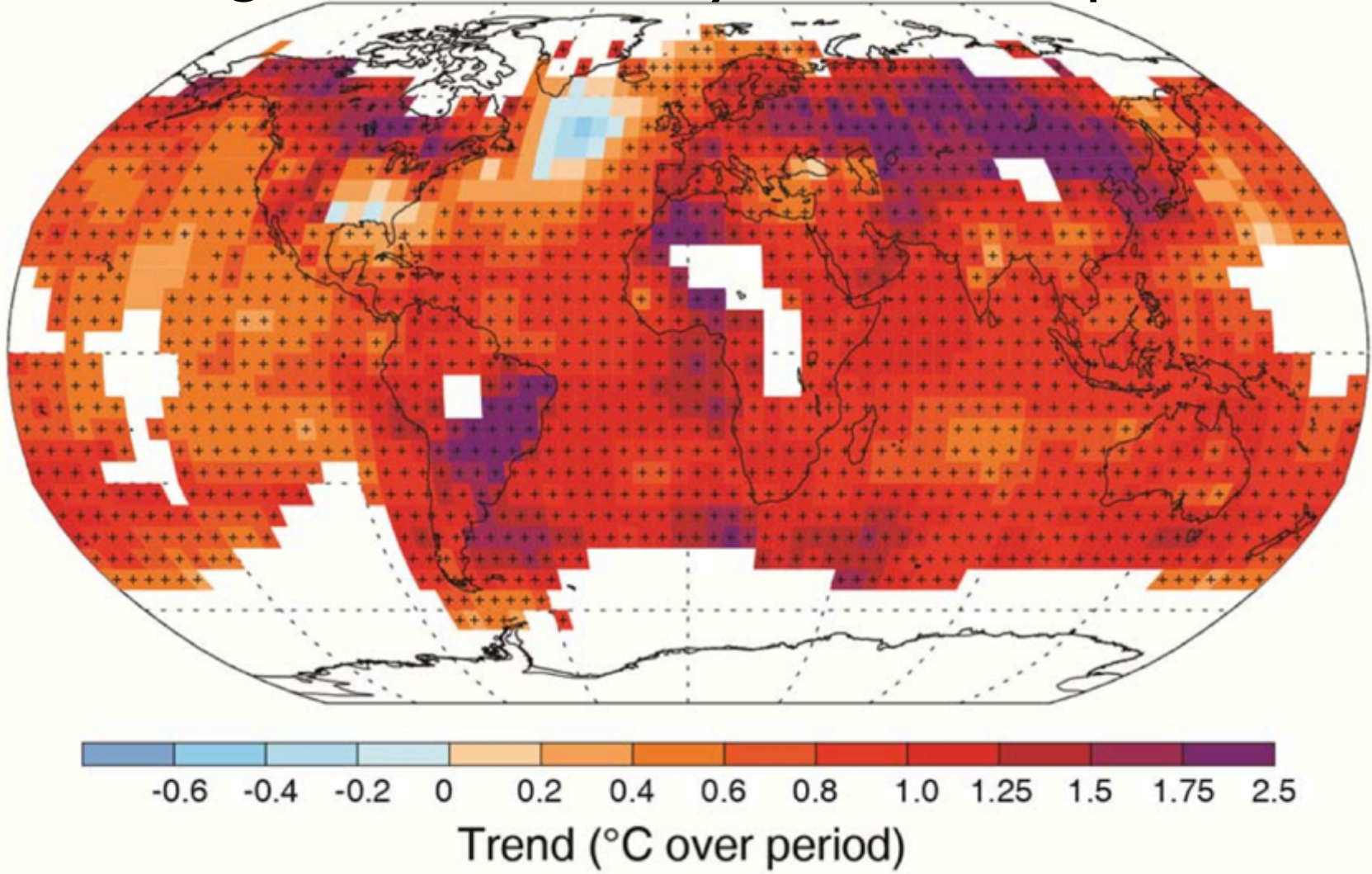
Human influence on the climate system is clear.



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

Change in average surface temperature 1901-2012

Warming in the climate system is unequivocal



Plateau Glacier (1961) (Alaska)



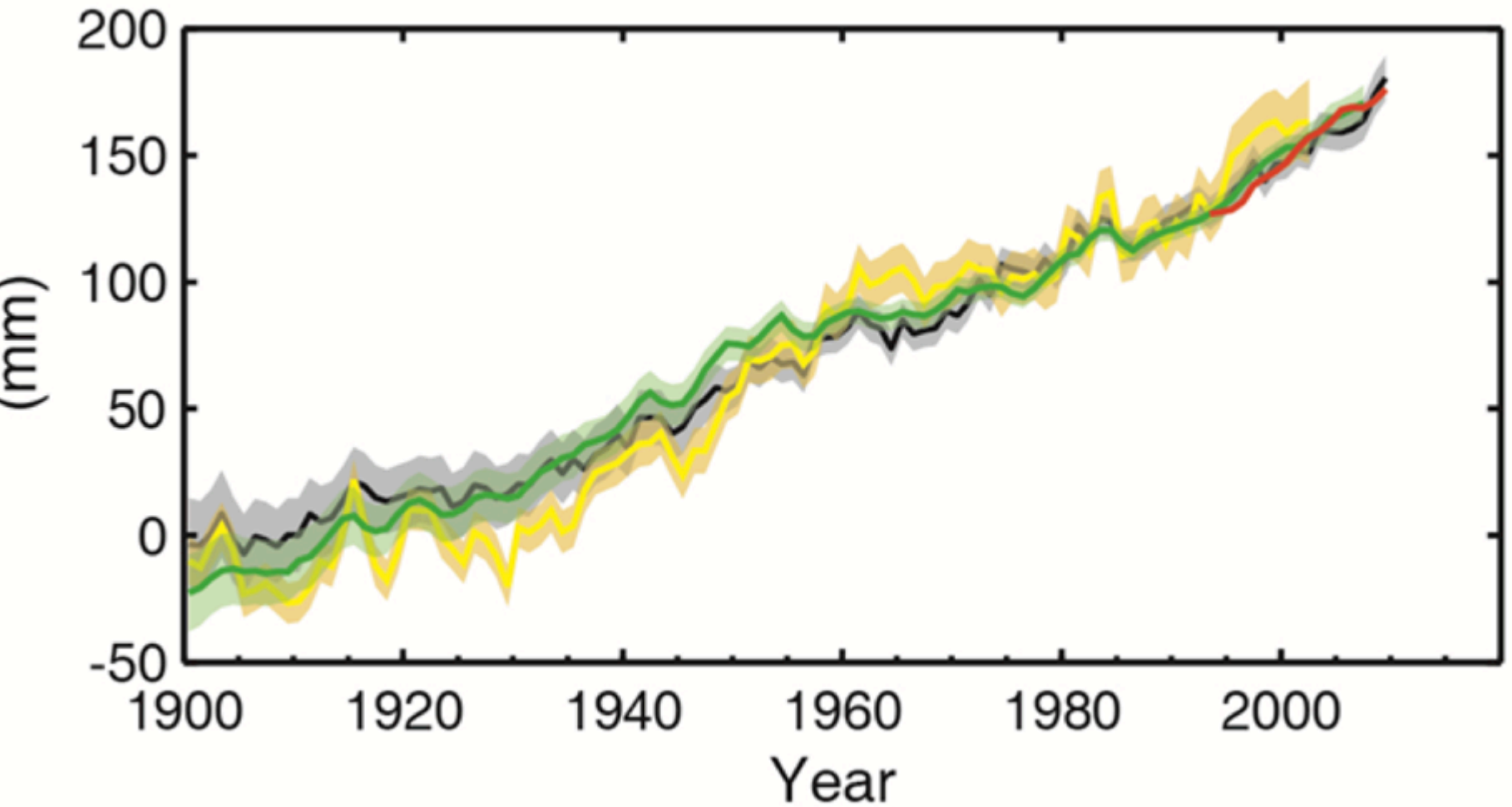
http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Plateau Glacier (2003) (Alaska)

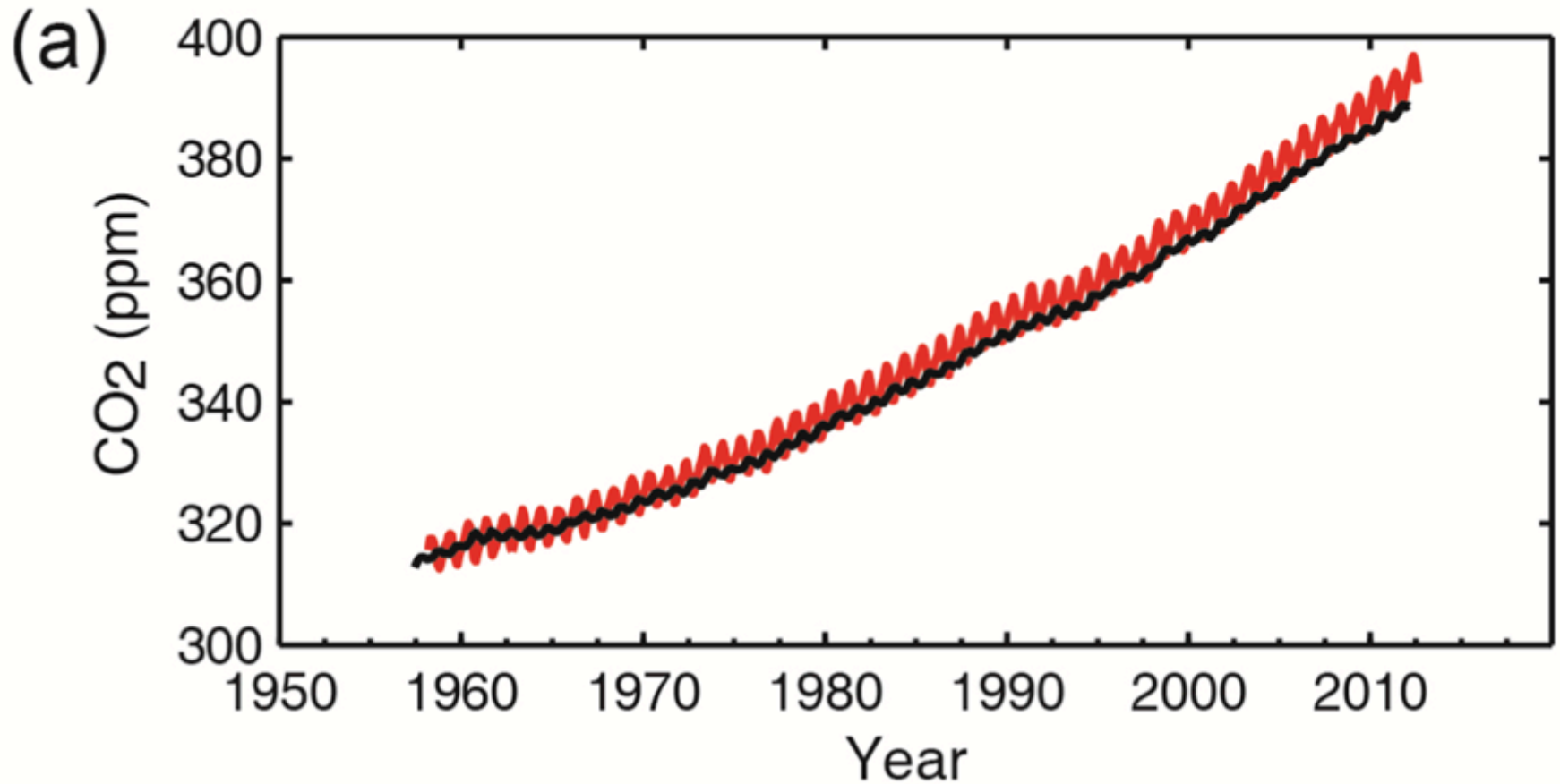


http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

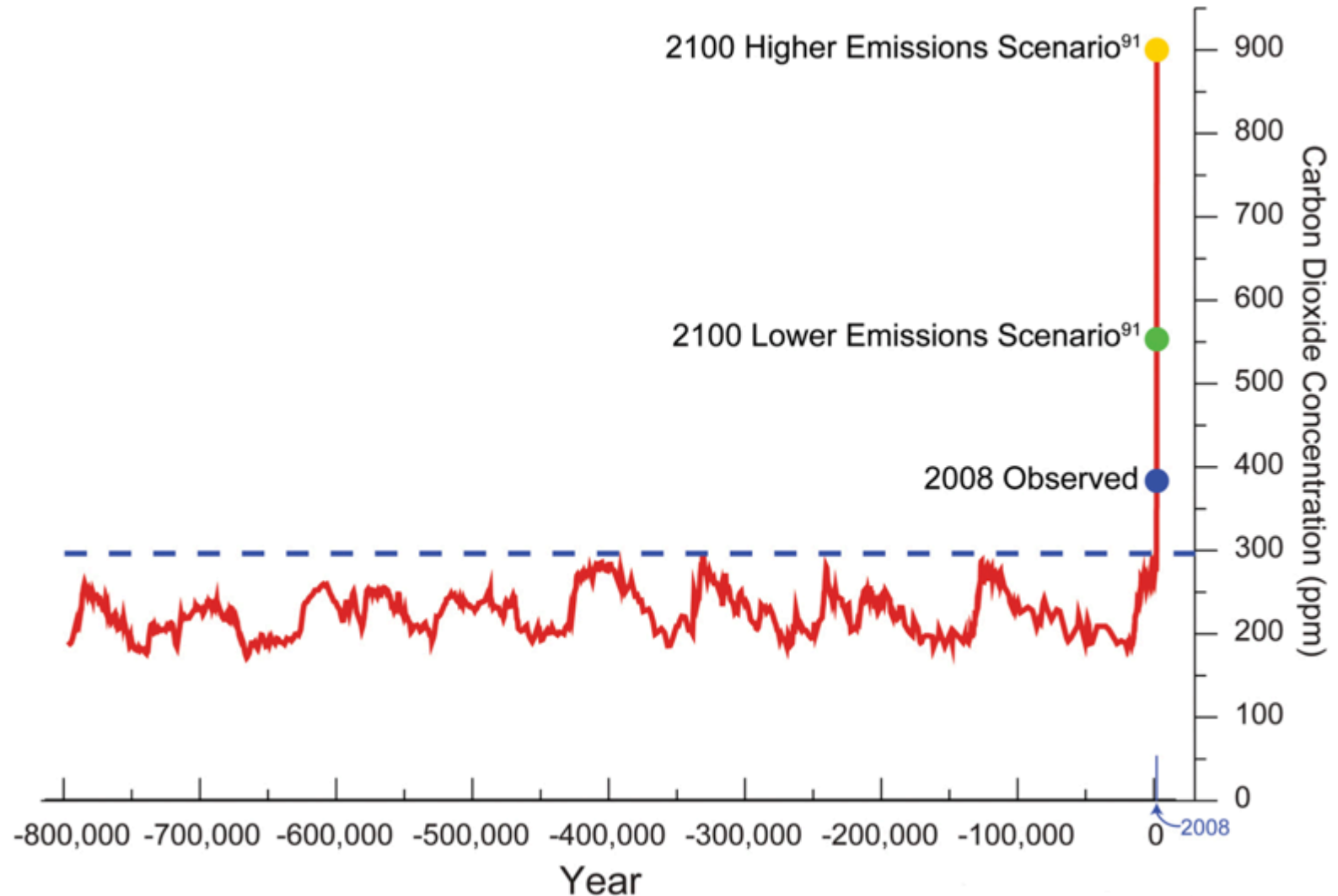
Change in average sea-level change



Atmospheric CO₂ concentration



Atmospheric CO₂ over the last 800,000 years



Lüthi *et al.*; Tans; IIASA²

A Progression of Understanding: Greater and Greater Certainty in Attribution

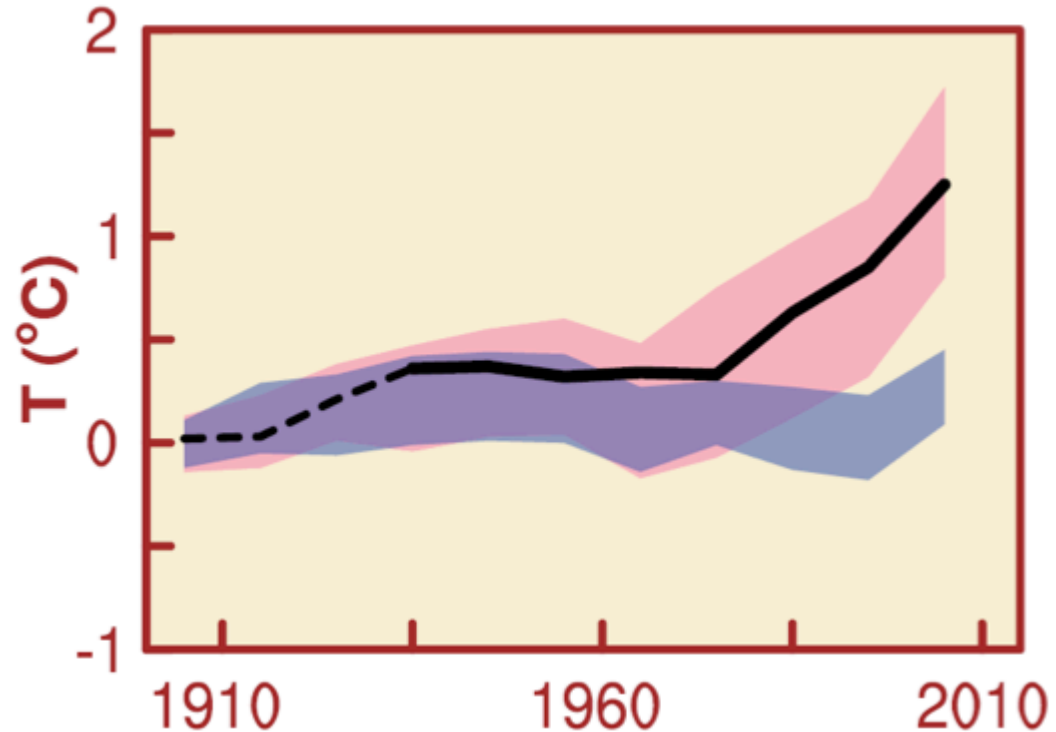
AR1 (1990):
“unequivocal detection
not likely for a decade”

AR2 (1995): “balance
of evidence suggests
discernible human
influence”

AR3 (2001): “most of
the warming of the
past 50 years is **likely**
(odds 2 out of 3) due
to human activities”

AR4 (2007): “most of
the warming is **very
likely** (odds 9 out of 10)
due to greenhouse
gases”

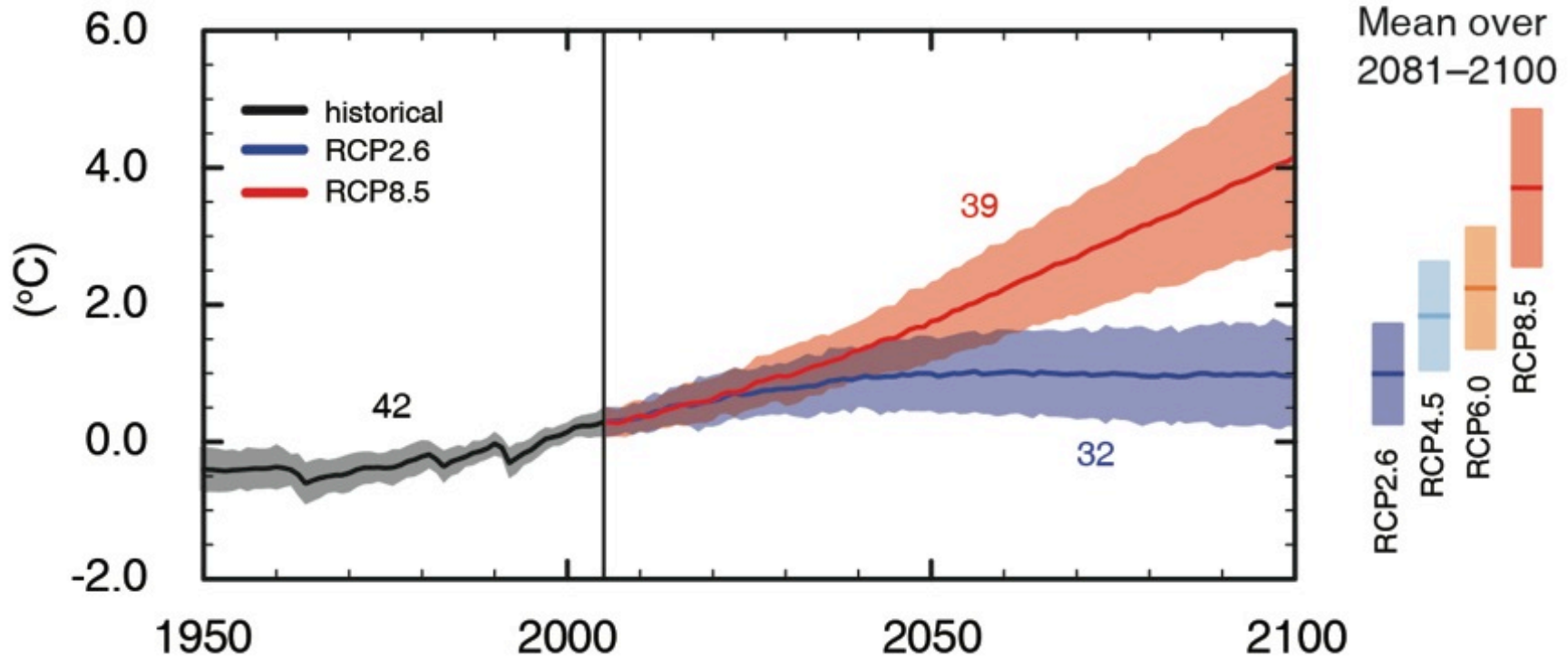
AR5 (2013) «It is **extremely likely**
(odds 95 out of 100) that human influence
has been the dominant cause... »



Blue zone: natural factors only

Pink zone: all factors

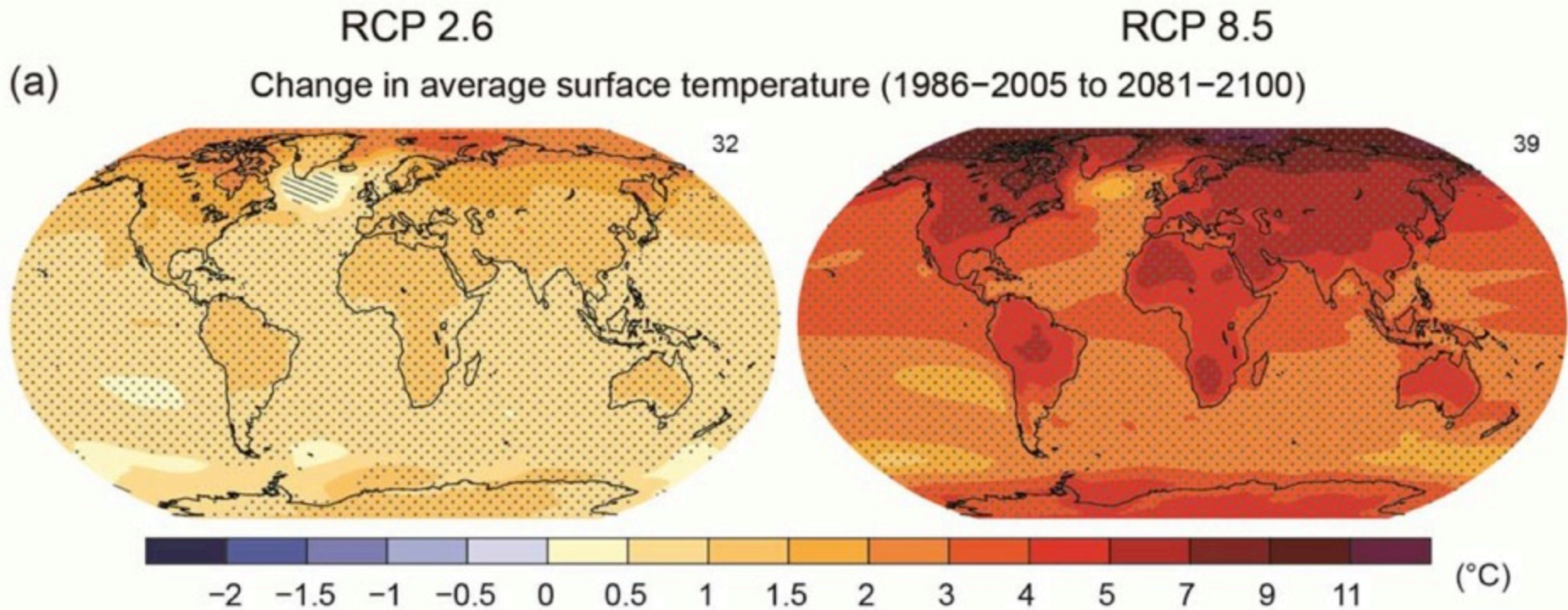
Global average surface temperature change



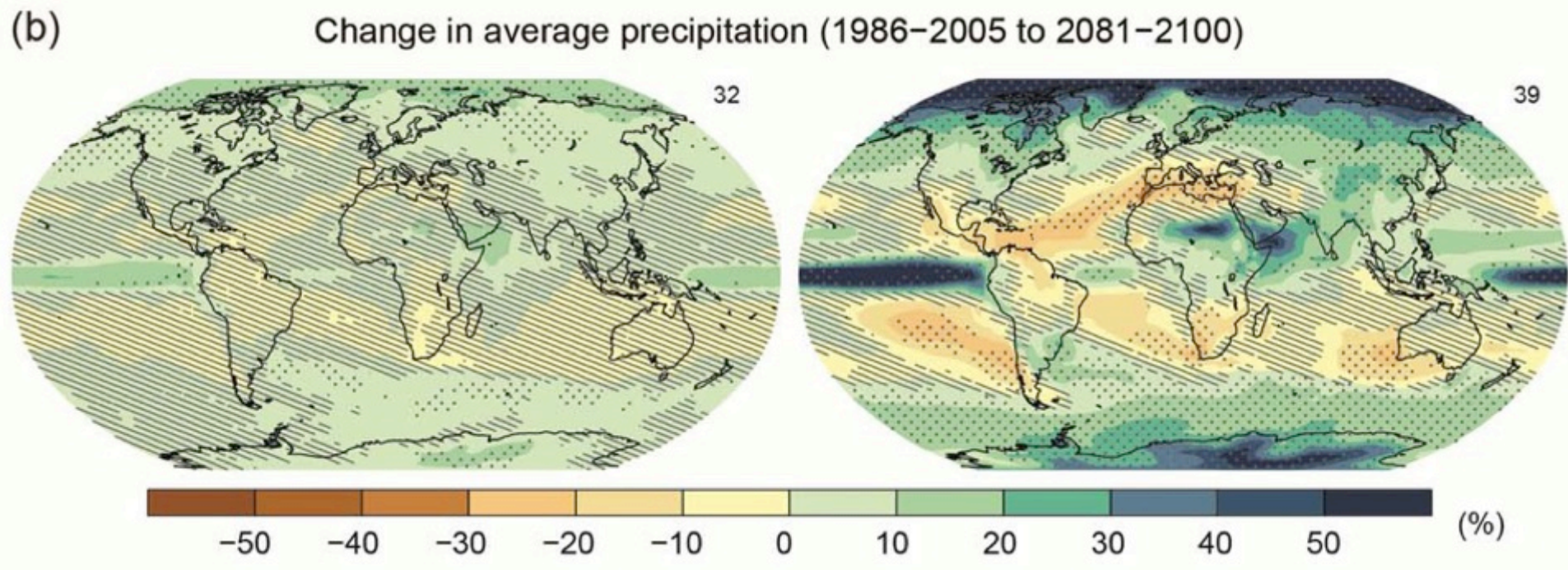
(IPCC 2013, Fig. SPM.7a)

Only the lowest (RCP2.6) scenario maintains the global surface temperature increase above the pre-industrial level to less than 2°C with at least 66% probability

Surface temperature projections



Projected Change in Precipitation



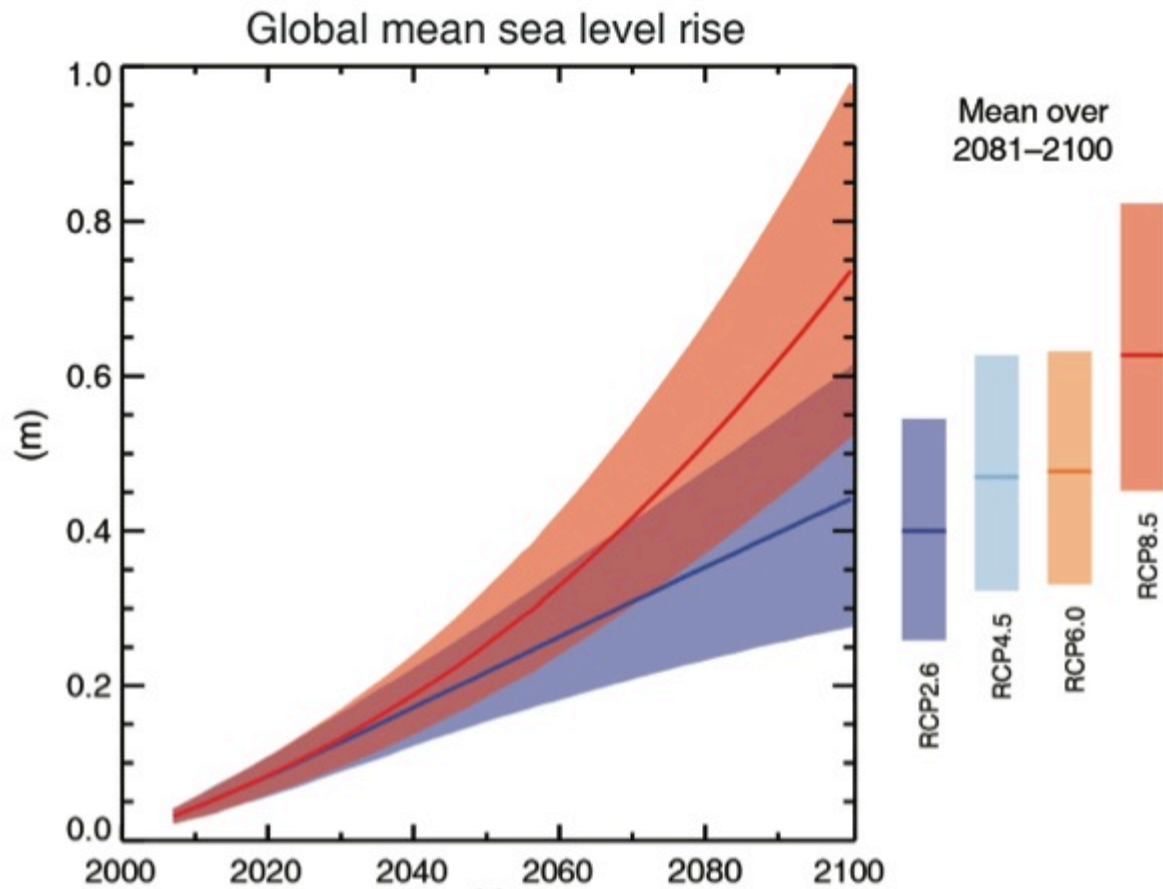


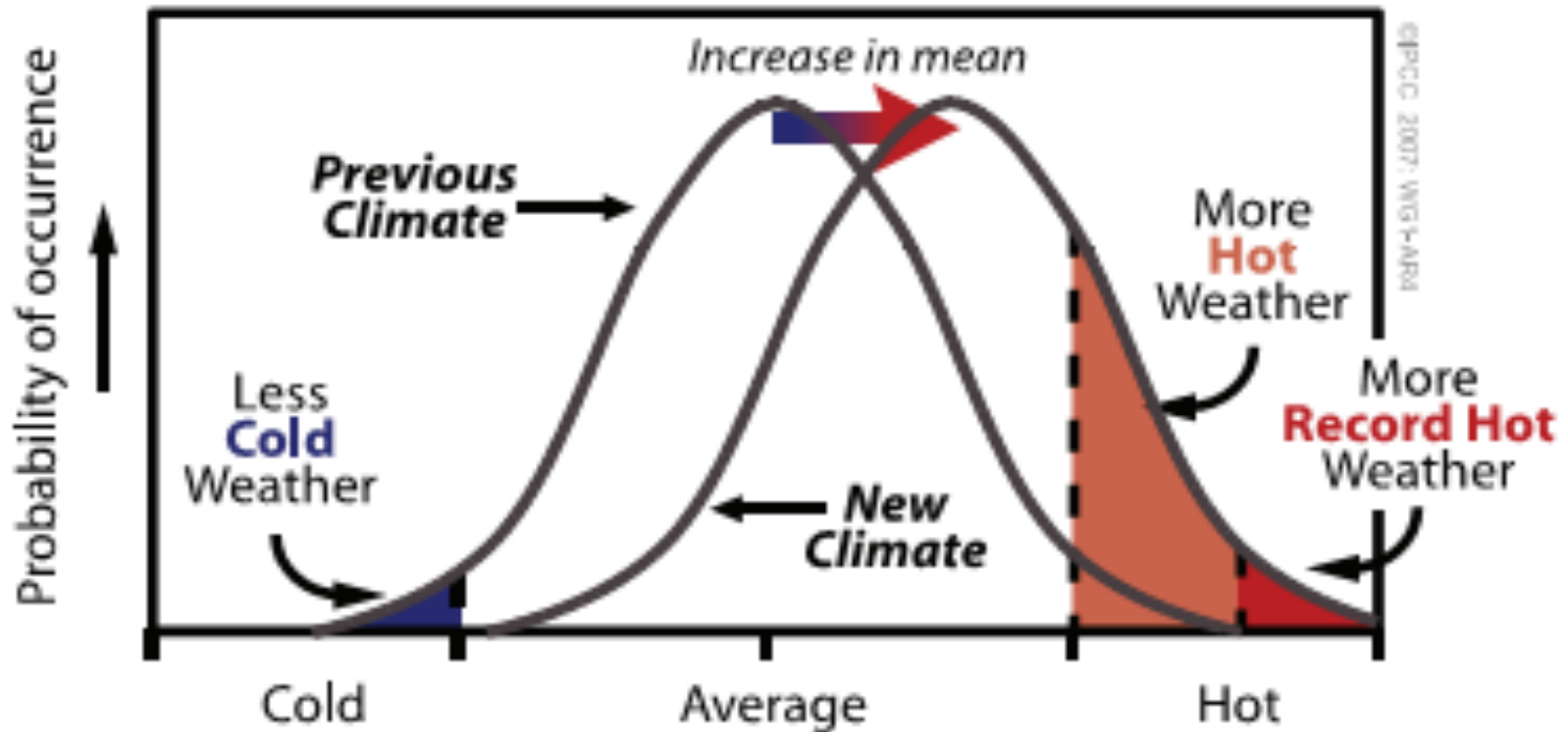
Fig. SPM.9

RCP2.6 (2081-2100), *likely* range: 26 to 55 cm

RCP8.5 (in 2100), *likely* range: 52 to 98 cm

(Reference level: 1986-2005)

Changes in average produce changes in probability of extremes



Box TS.5, Figure 1. Schematic showing the effect on extreme temperatures when the mean temperature increases, for a normal temperature distribution.

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



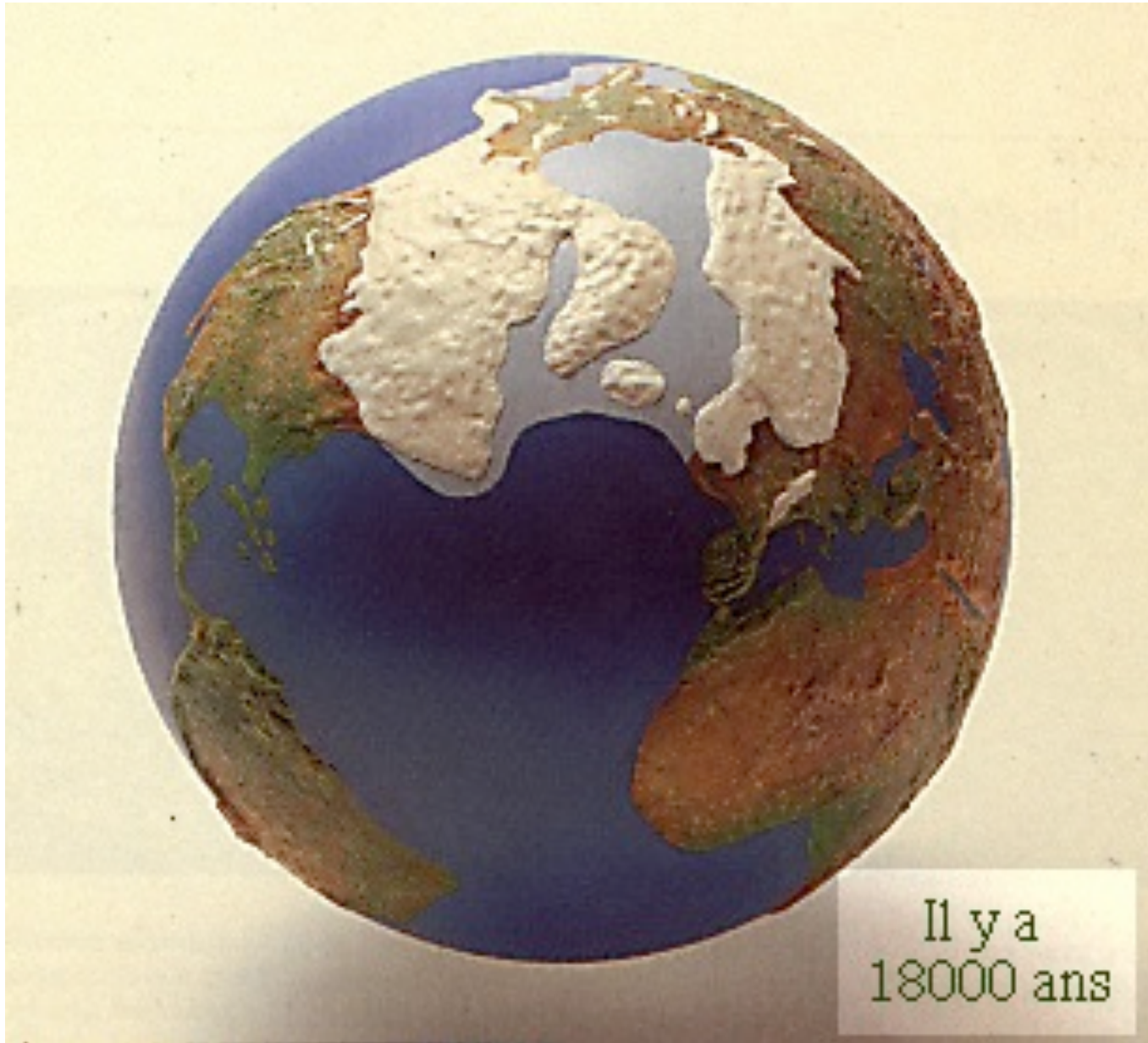
There is evidence that anthropogenic influences, including increasing atmospheric greenhouse gas concentrations, have changed these extremes



What are the risks?

18-20000 years ago (Last Glacial Maximum)

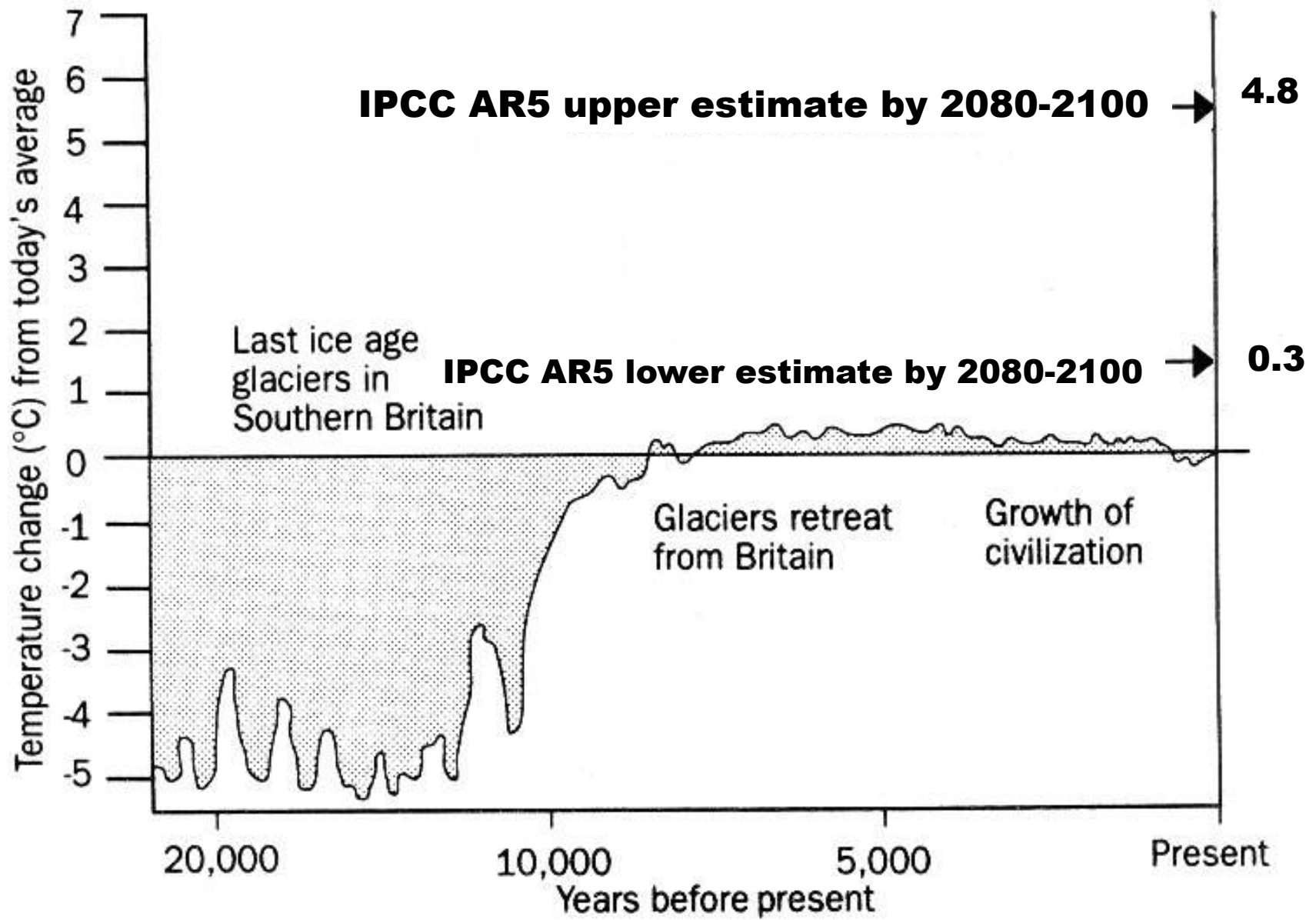
With permission from Dr. S. Jousaume, in « Climat d'hier à demain », CNRS éditions.



Today, with +4-5°C globally

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





Adapted from: International Geosphere Biosphere Programme Report no.6,
Global Changes of the Past, July 1988

(A)



Confidence in attribution to climate change

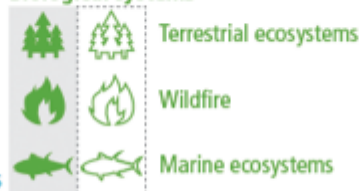


Observed impacts attributed to climate change for

Physical systems



Biological systems



Human and managed systems



Regional-scale impacts

Outlined symbols = Minor contribution of climate change
Filled symbols = Major contribution of climate change

An underwater photograph of a coral reef. The water is a deep, dark green. In the foreground, there is a large, dense field of coral. The coral is mostly brown and yellow, indicating significant bleaching. A single, prominent, healthy-looking coral colony is visible in the center, showing a light green and white color. The background shows more coral structures extending into the distance.

WIDESPREAD OBSERVED IMPACTS

A CHANGING WORLD



RISKS OF
CLIMATE CHANGE
INCREASE
WITH CONTINUED
HIGH EMISSIONS

Effects on Nile delta: 10 M people above 1m



(Time 2001)

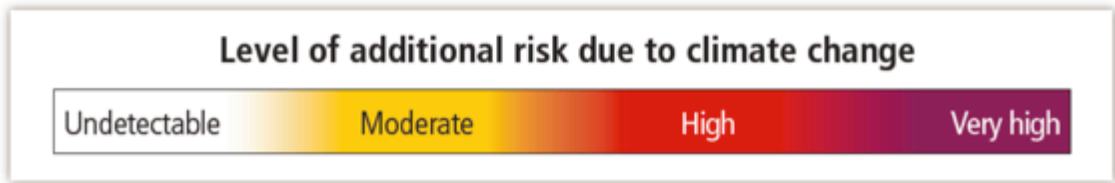
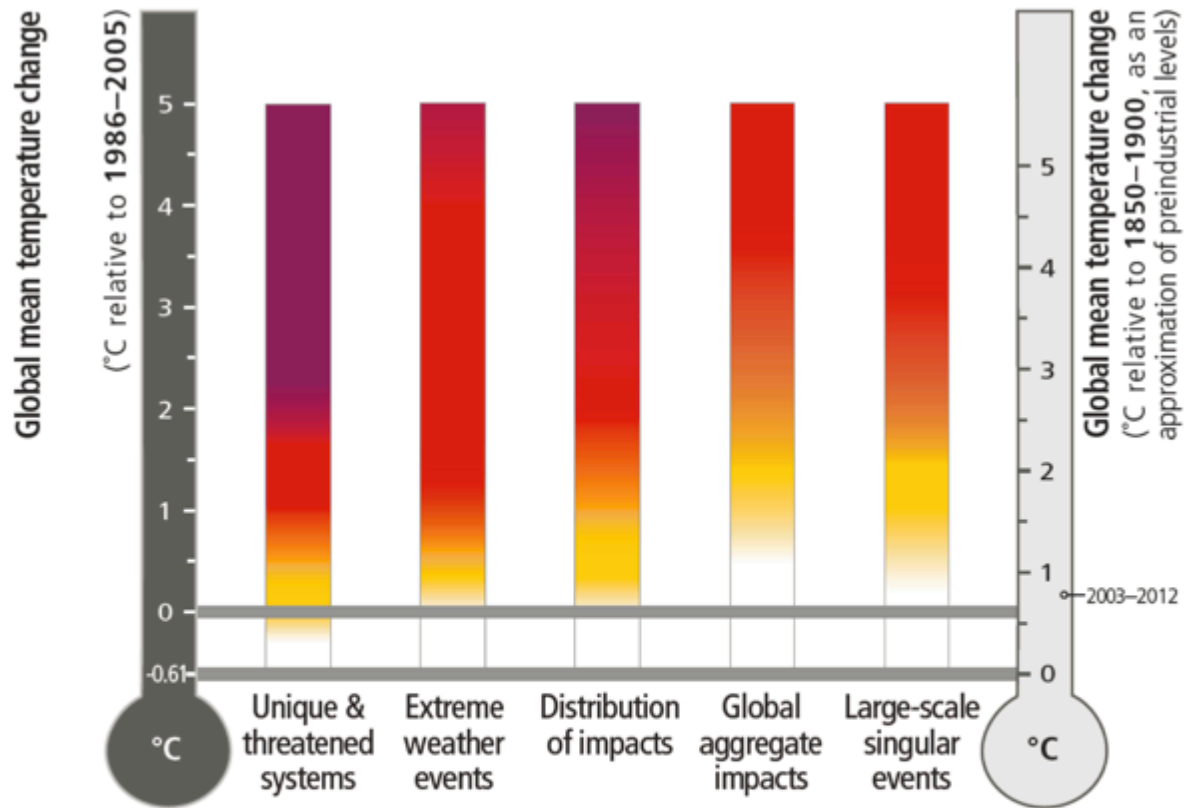
Risk = Hazard x Vulnerability x Exposure (Katrina flood victim)

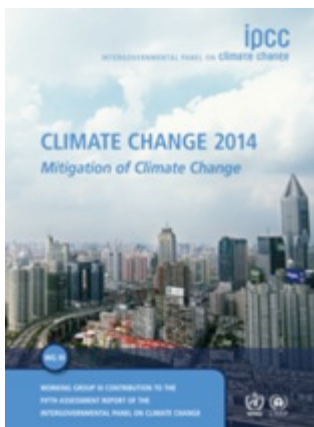




INCREASING MAGNITUDES
OF WARMING INCREASE
THE LIKELIHOOD OF

**SEVERE AND
PERVASIVE IMPACTS**





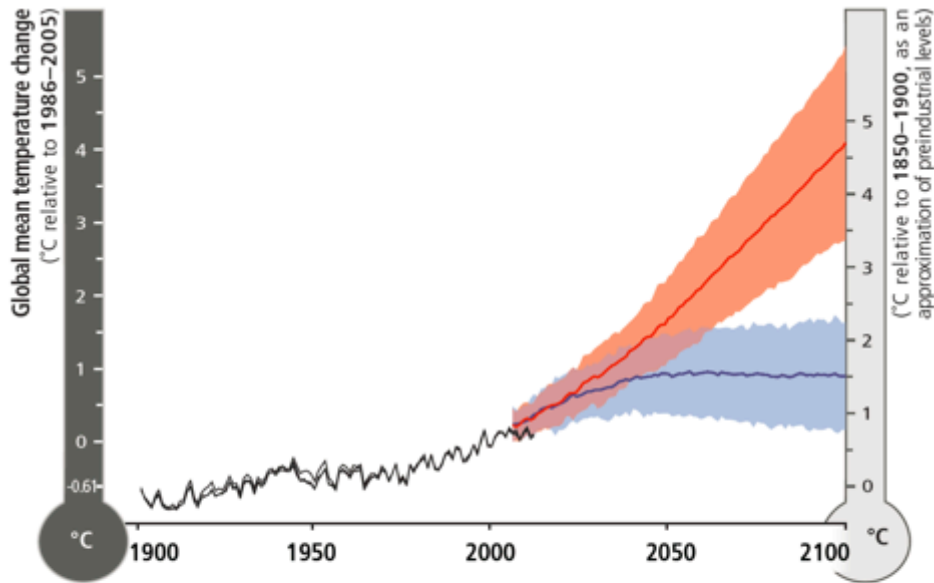
What can be done?



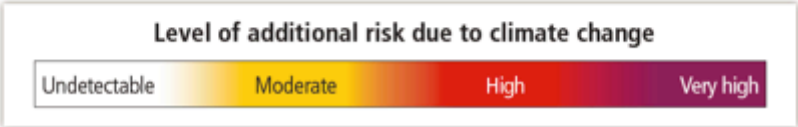
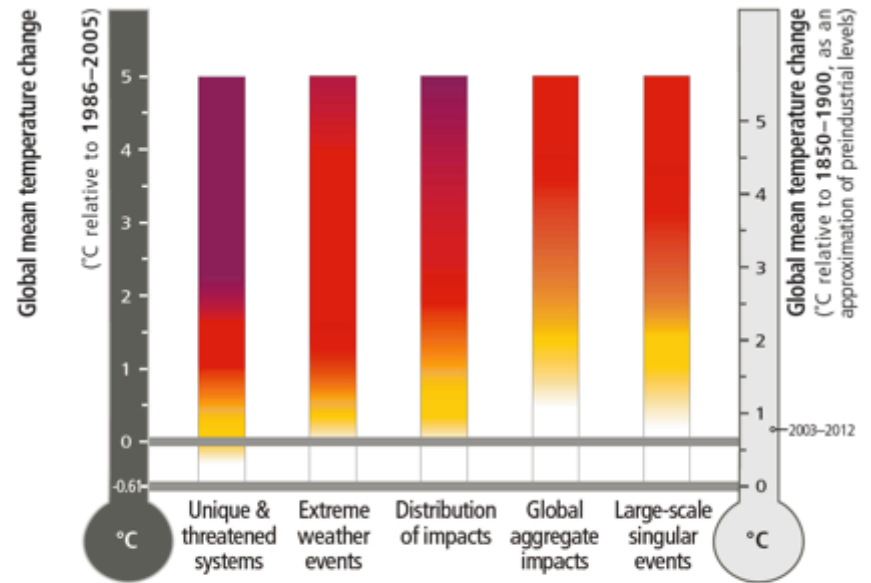
ADAPTATION IS ALREADY OCCURRING



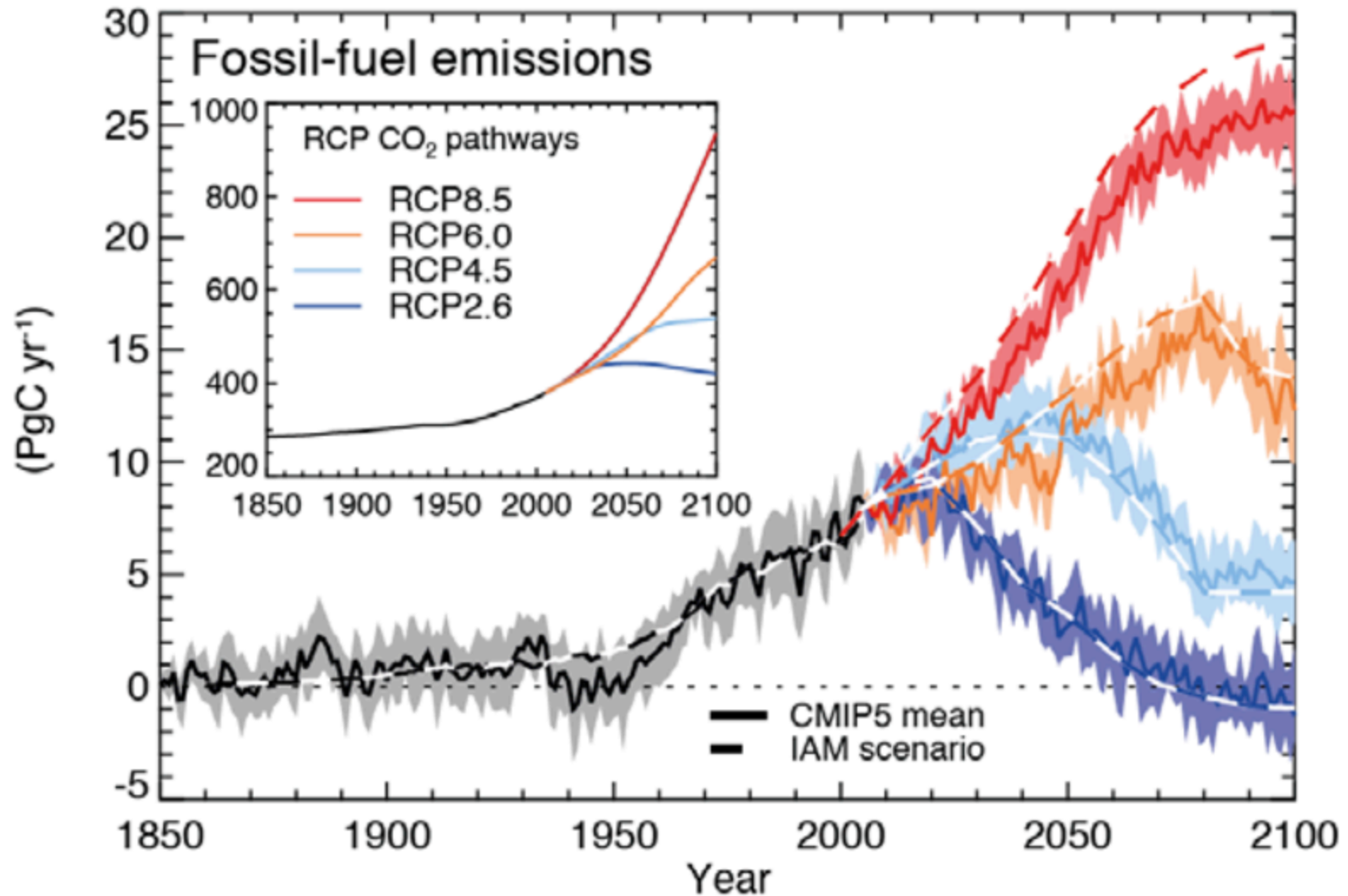
**ADAPTATION IS
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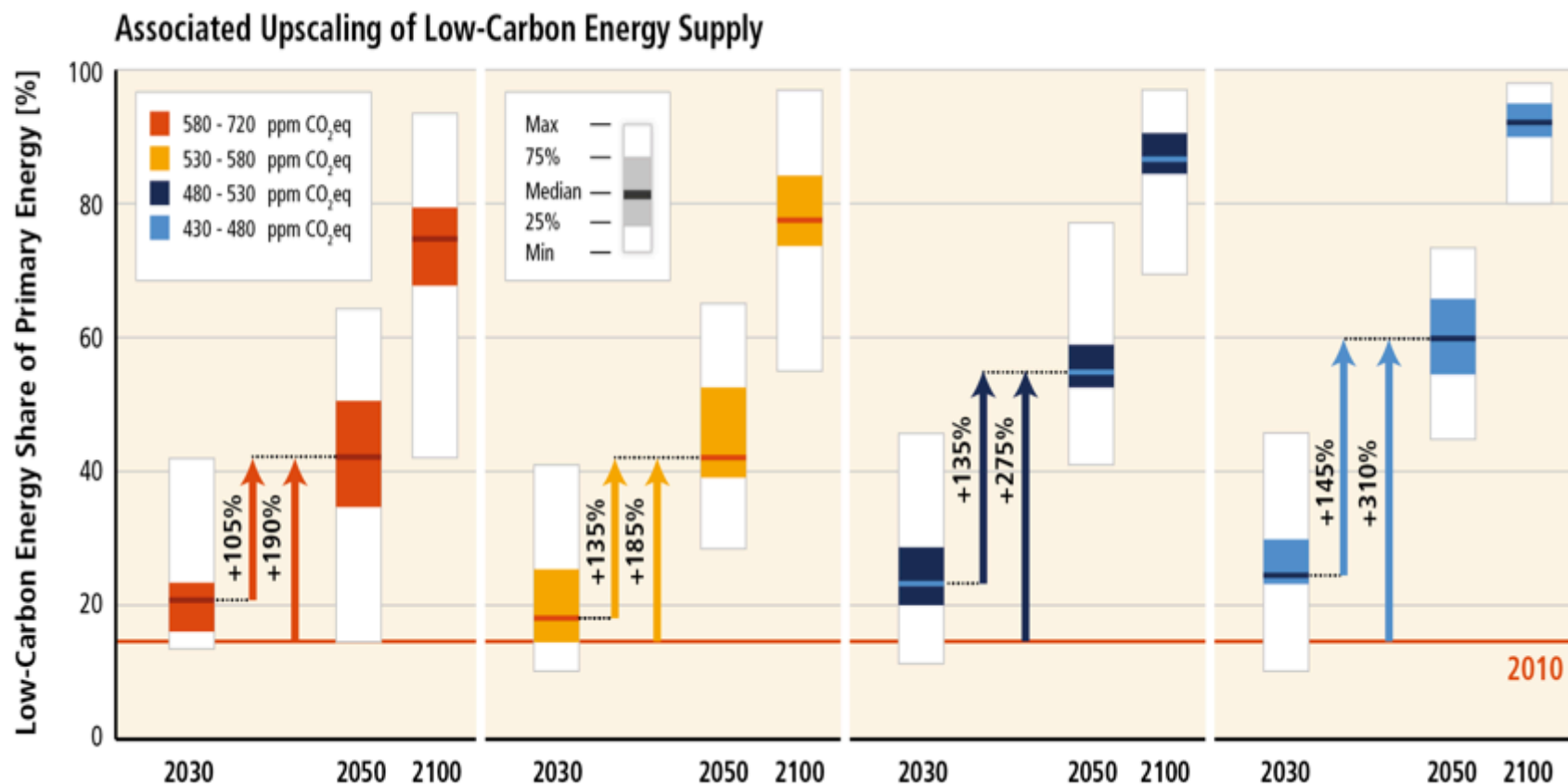
- Observed
- RCP8.5 (a high-emission scenario)
- Overlap
- RCP2.6 (a low-emission mitigation scenario)



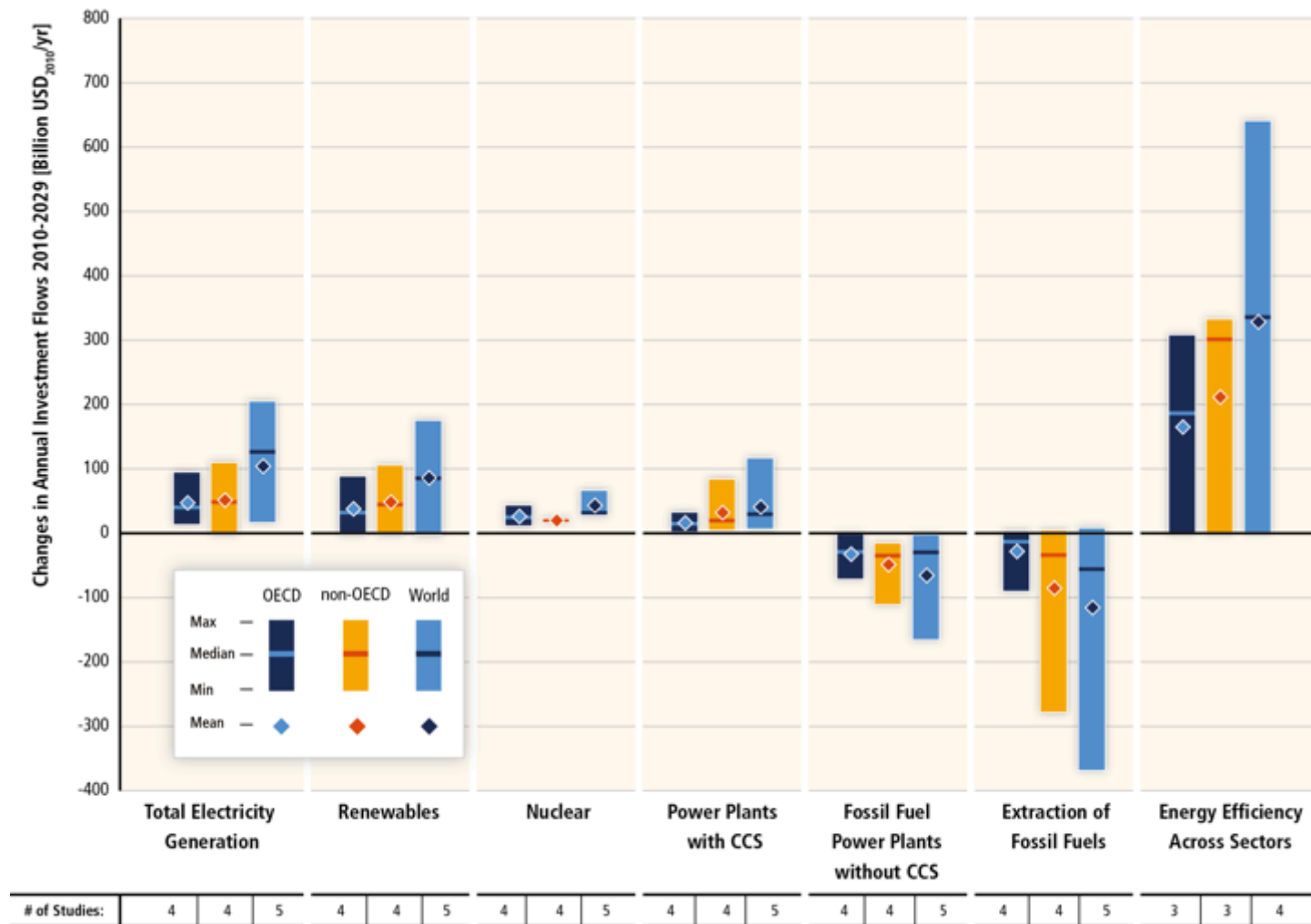
Compatible fossil fuel emissions simulated by the CMIP5 models for the four RCP scenarios



Mitigation requires major technological and institutional changes including the upscaling of low- and zero carbon energy



Substantial reductions in emissions would require large changes in investment patterns.

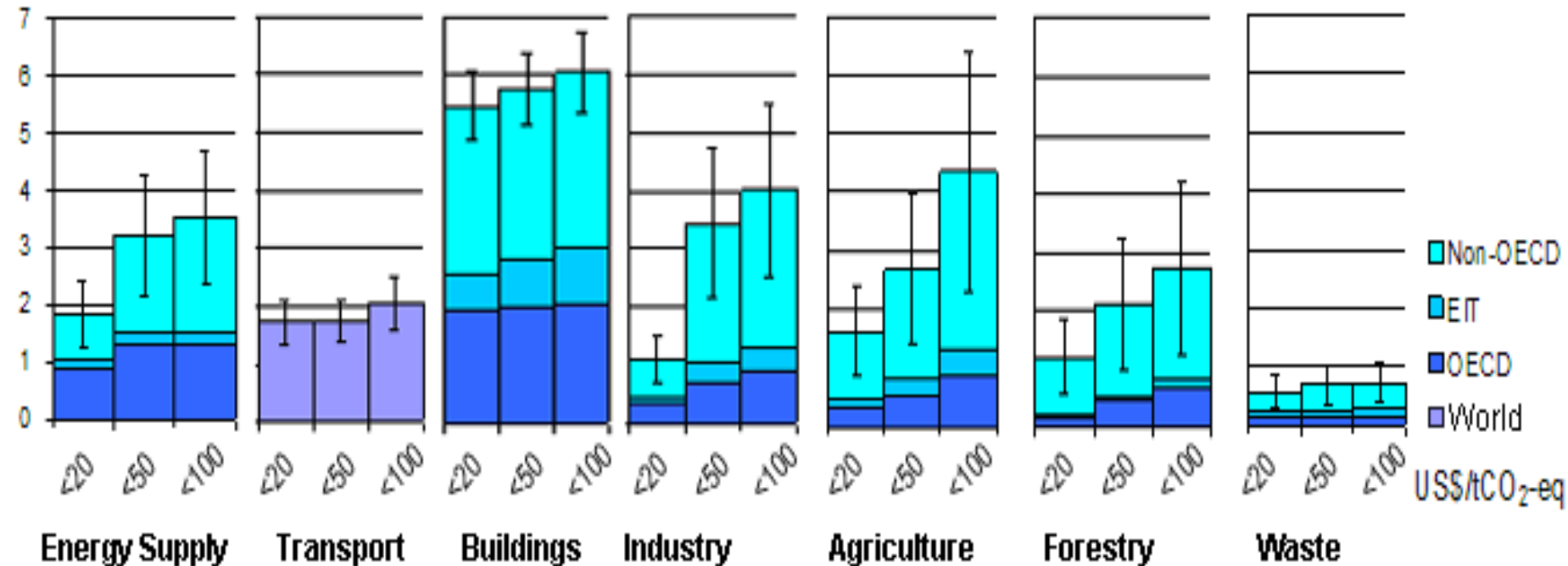


Other Challenges

- Fighting poverty / develop sustainably
- Powering the rise out of poverty (energy access)
- Access to clean water
- Food security
- Quality of environment (Air, water, soil,...)
- ...

All sectors and regions have the potential to contribute by 2030

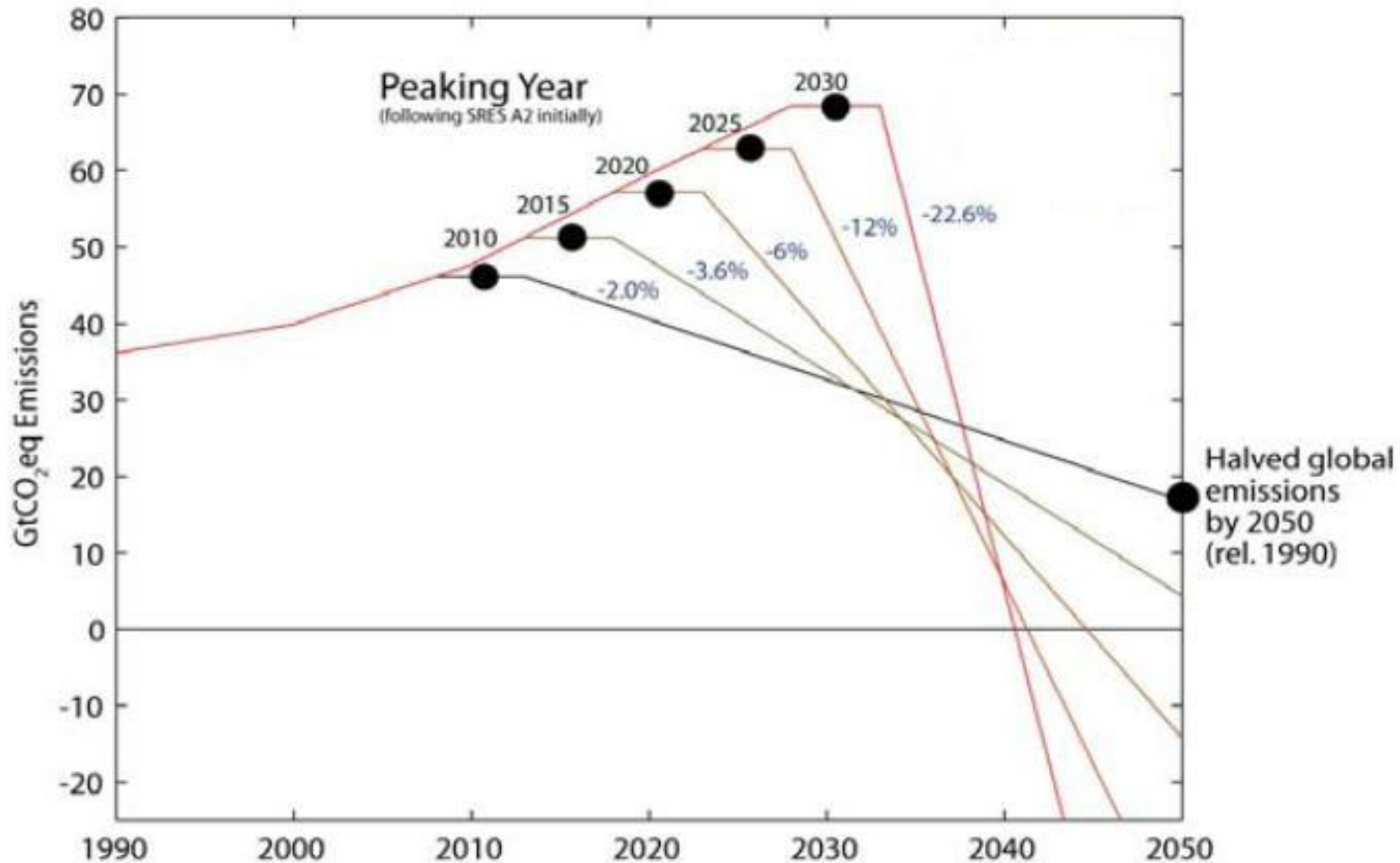
GtCO₂-eq / year (avoided emissions: the higher, the better)



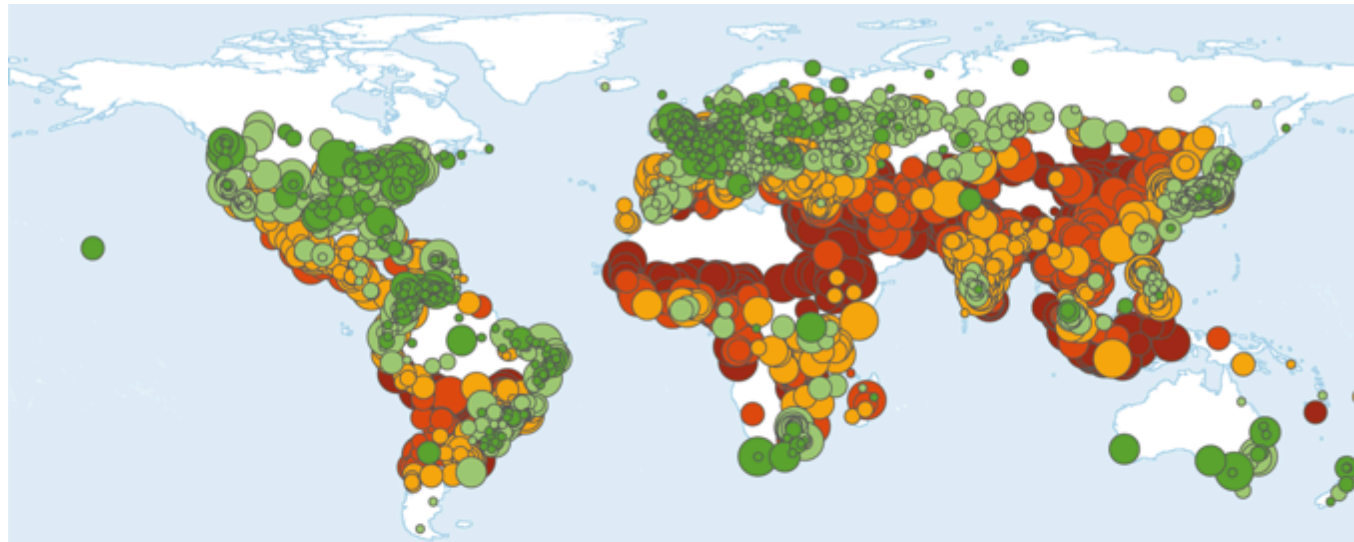
IPCC AR4 (2007)

Note: estimates do not include non-technical options, such as lifestyle changes.

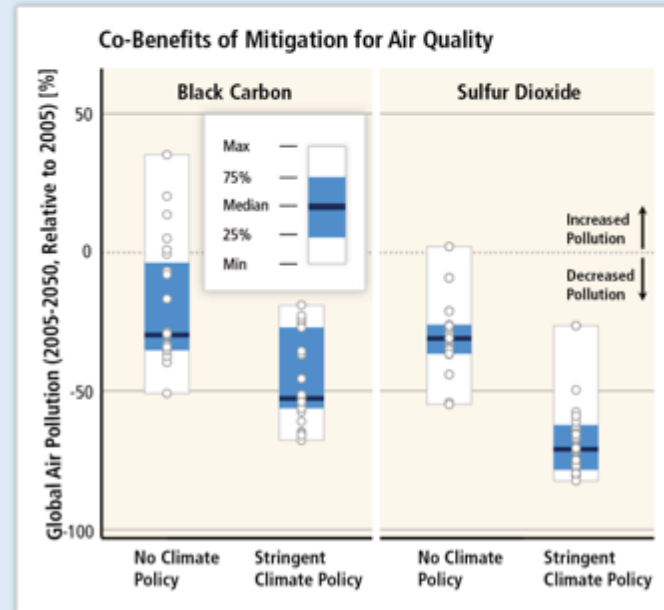
The more we wait, the more difficult it will be



Source: Meinshausen et al. - Nature, 30th April 2009



Mitigation can result in large co-benefits for human health and other societal goals.



Science has a lot to offer to understand better this un-named “Party” in the climate negotiations, with whom one *cannot* negotiate:

The Climate System, governed by the laws of Nature

The ICTP contribution to address these challenges is most welcome

Useful links:



- www.ipcc.ch : IPCC
- www.climate.be/vanyp : my slides and other documents
- www.skepticalscience.com: excellent responses to contrarians arguments
- **On Twitter: @JPvanYpersele**