Climate Change as a Global Challenge
The IPCC 5th Assessment Report (AR5)

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UfM Conference, Athens, 12 May 2014

Thanks to the Belgian Federal Science Policy Office (BELSPO) for its support

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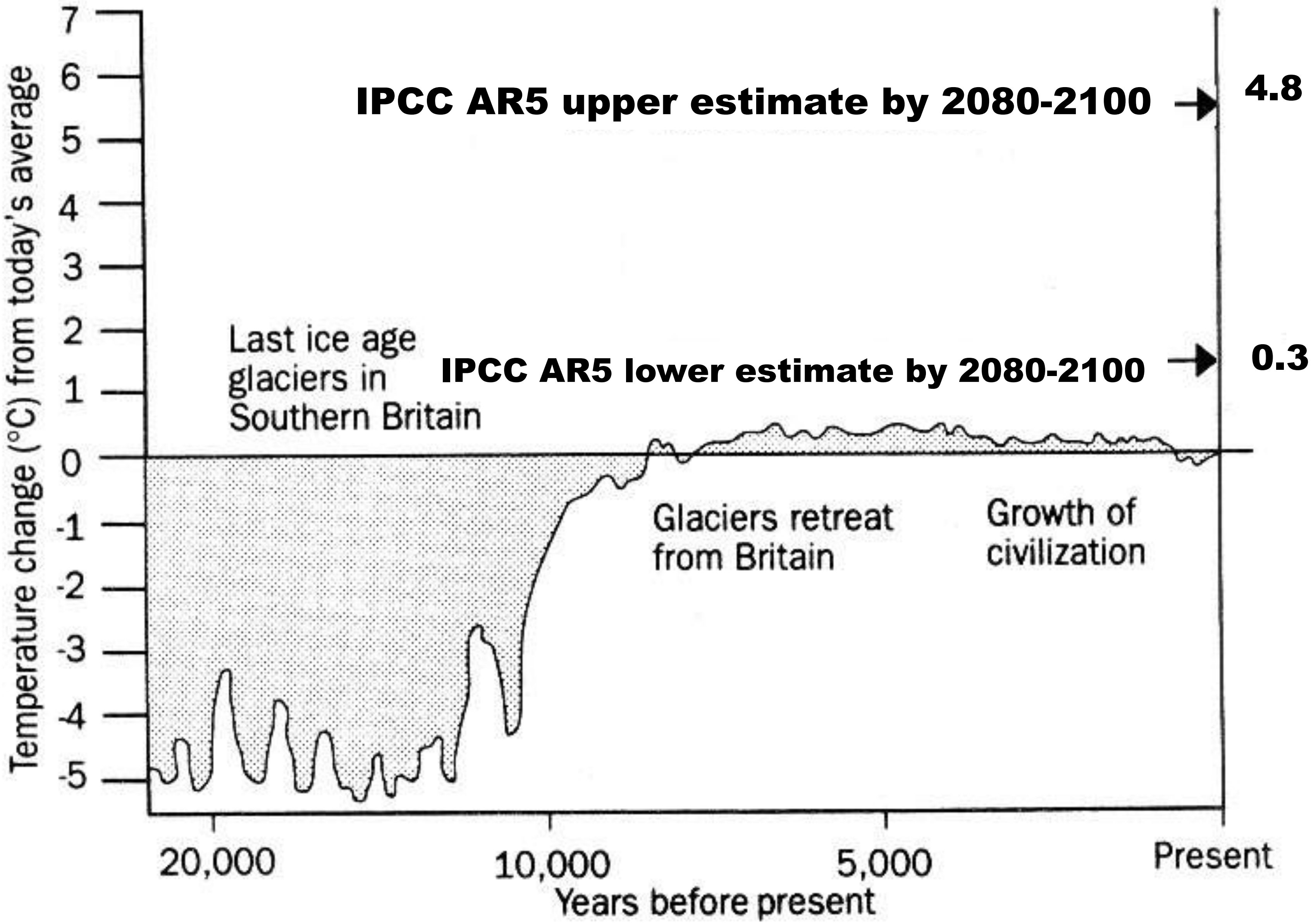
WMO UNEP

The Parthenon, built more than 2400 years ago…



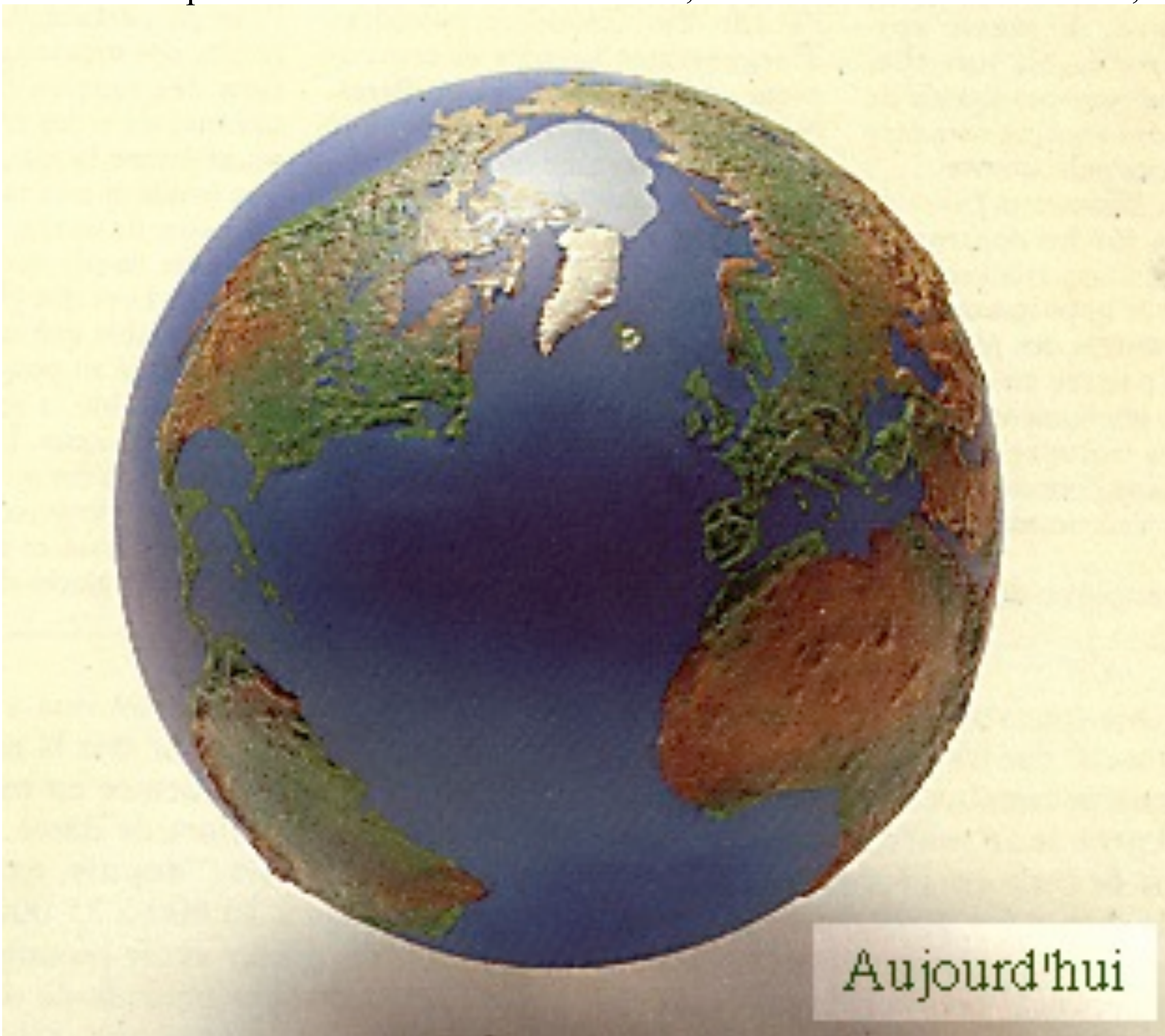
Adapted from: International Geosphere Biosphere Programme Report no.6, Global Changes of the Past, July1988

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.



Why the IPCC (Intergovernmental Panel on Climate Change)?

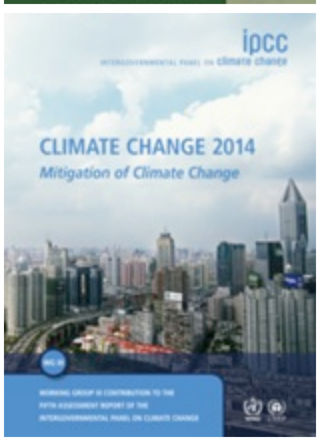
Established by WMO and UNEP in 1988

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)

Received the Nobel Peace Prize in 2007

WMO=World Meteorological Organization
UNEP= United Nations Environment Programme



What is happening in the climate system?

What are the risks?

What can be done?

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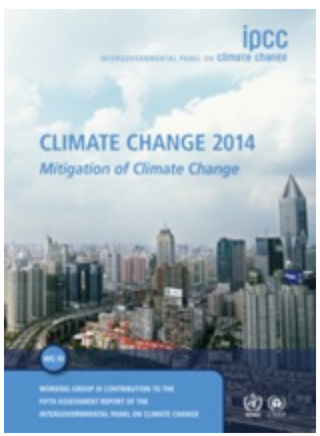

WG I (Physical science basis): 209 lead authors, 2014 pages, 54.677 review comments

WG II (Impacts, Adaptation, and Vulnerability): 243 lead authors, 2500 pages, 50.492 review comments

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

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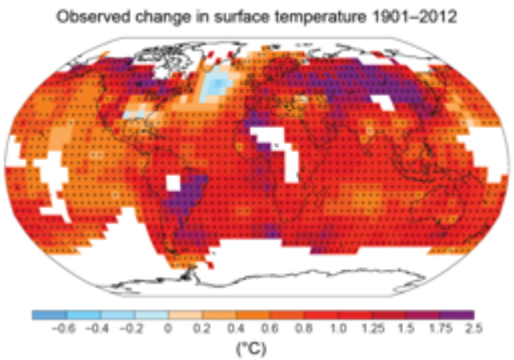
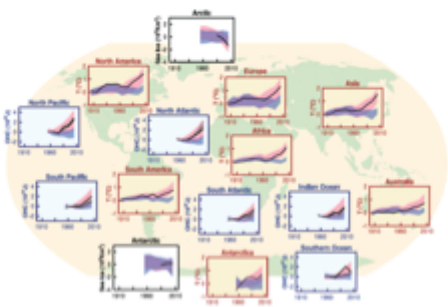
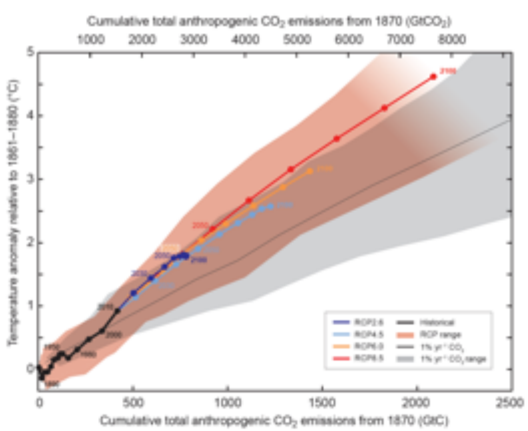
What is happening in the climate system?







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.

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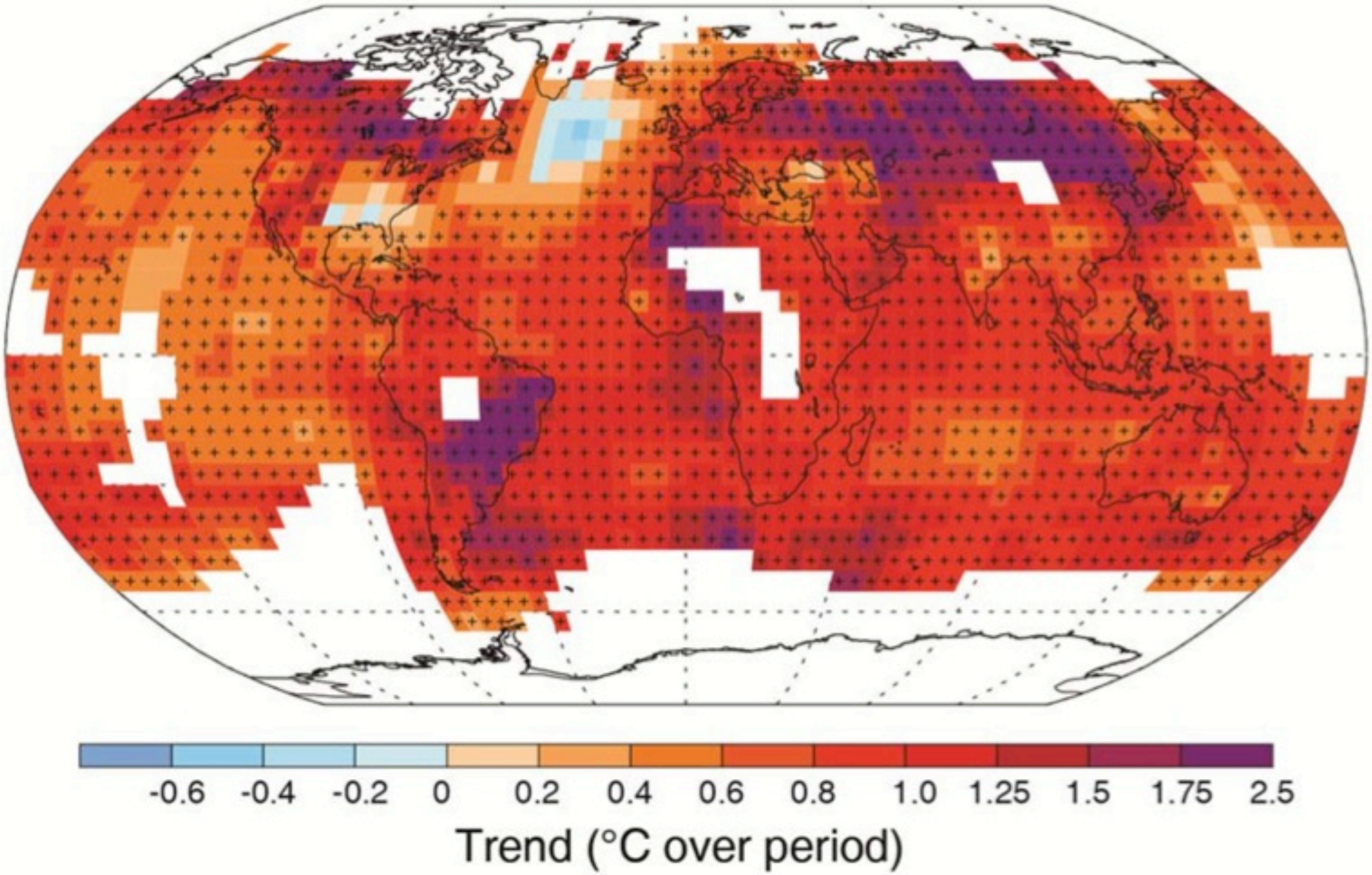
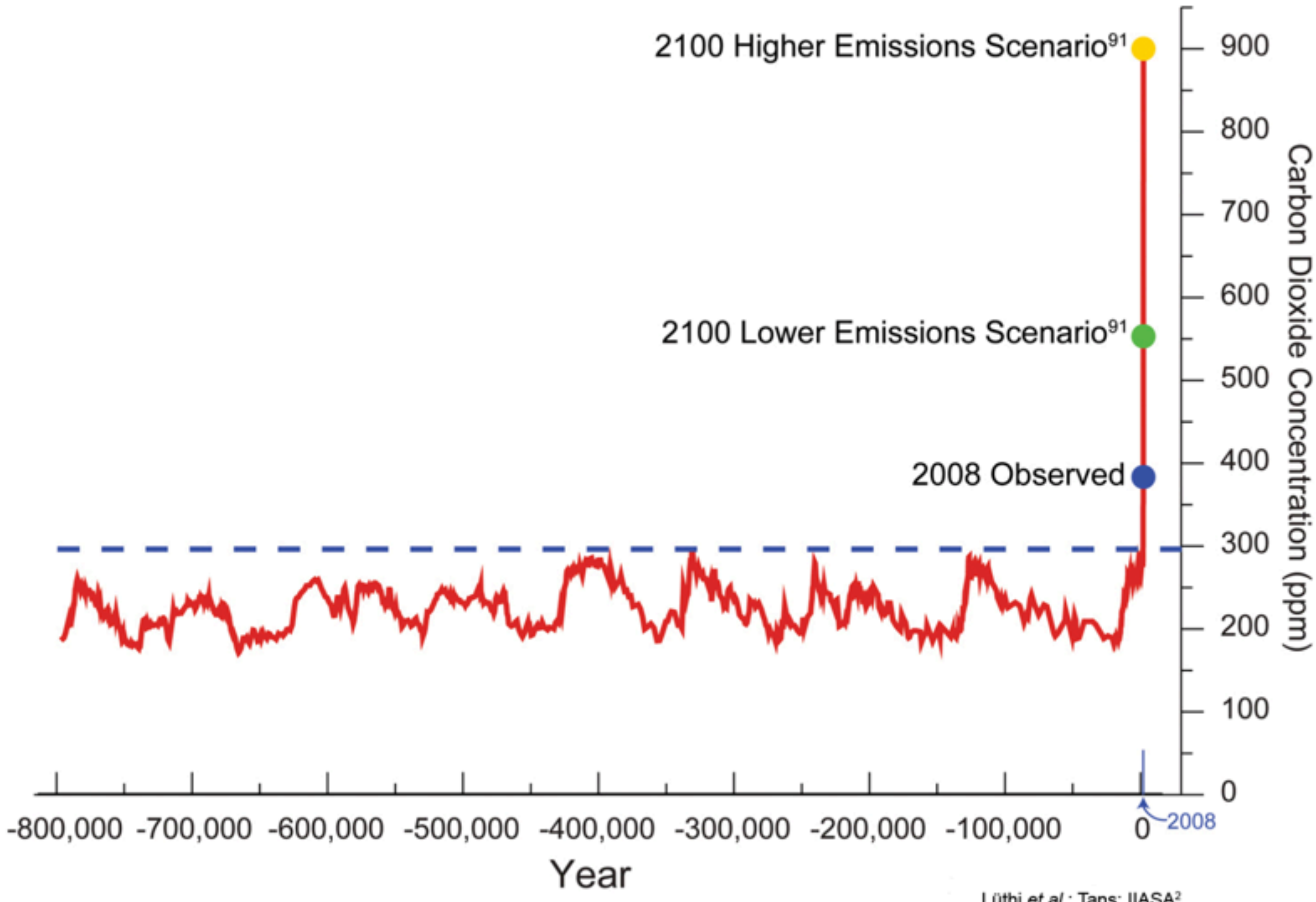
Evolution de la température moyenne en surface 1901-2012: +0.89°C



(IPCC 2013, Fig. SPM.1b)

Le réchauffement du système climatique est sans équivoque

Atmospheric CO_2 over the last 800000 years



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

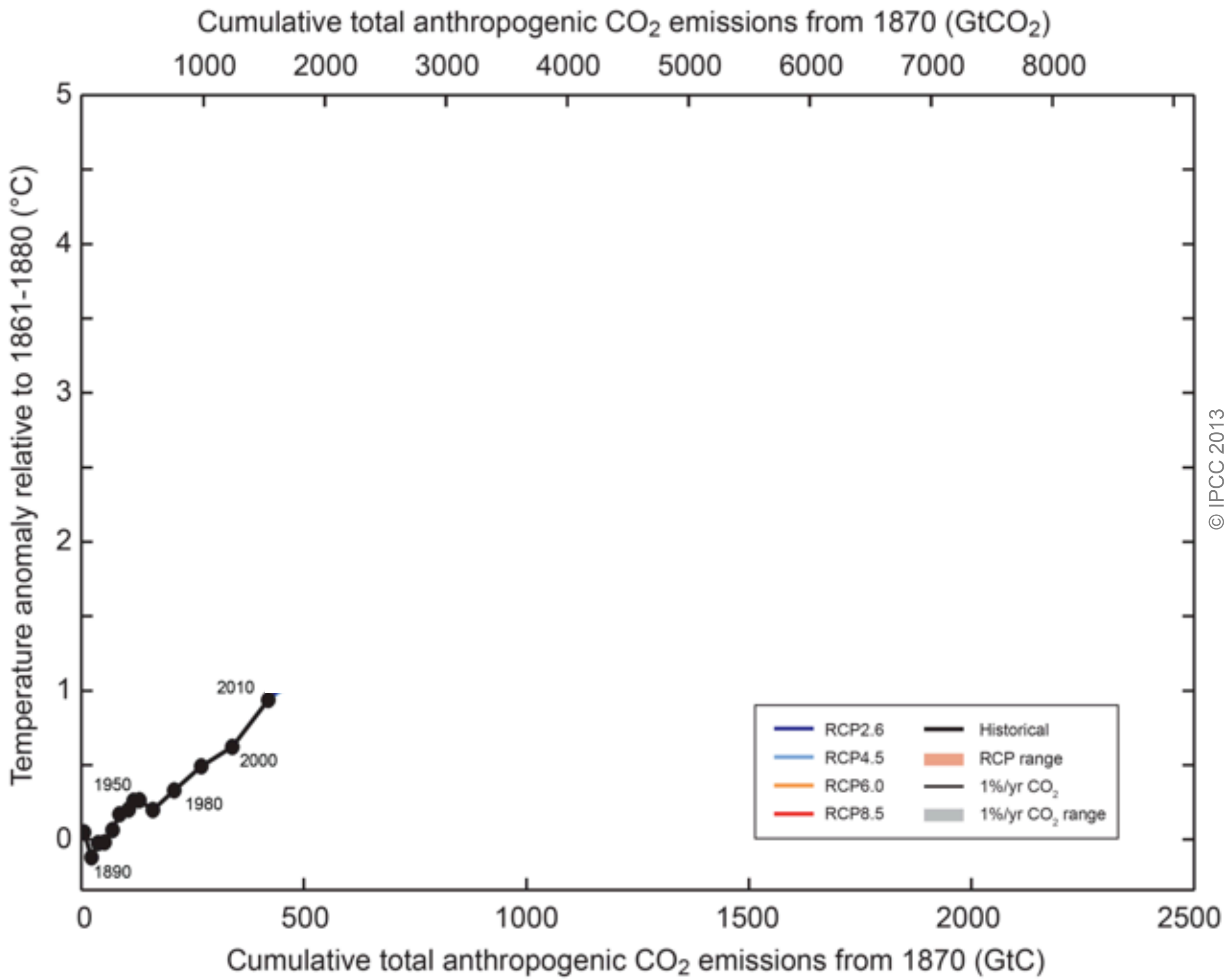


Fig. SPM.10

Cumulative emissions of CO_2 largely determine global mean surface warming by the late 21st century and beyond.

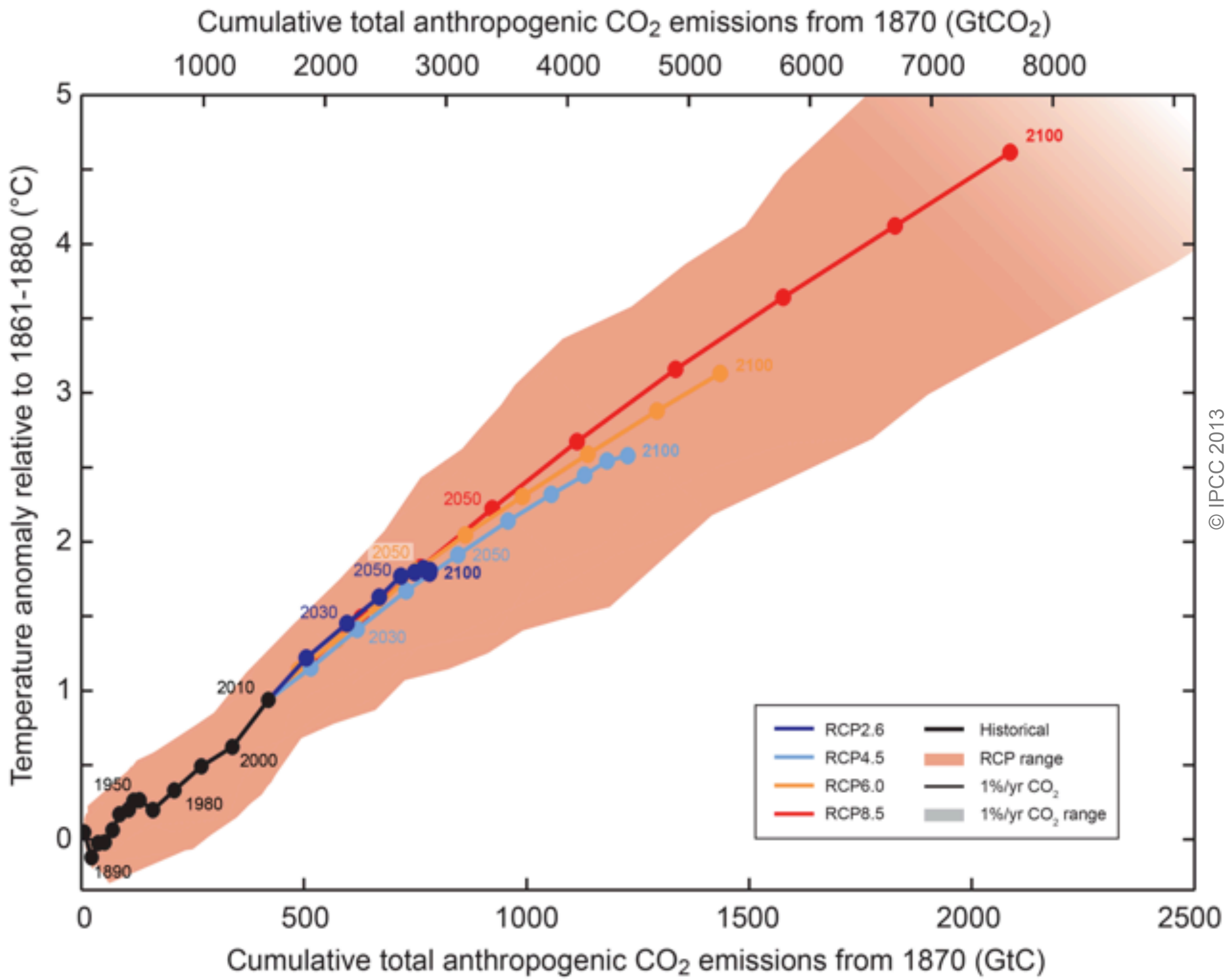
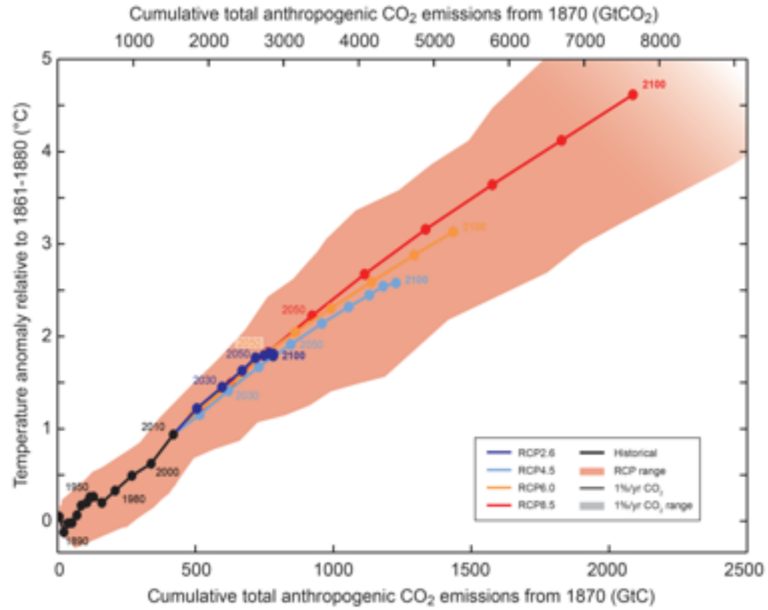


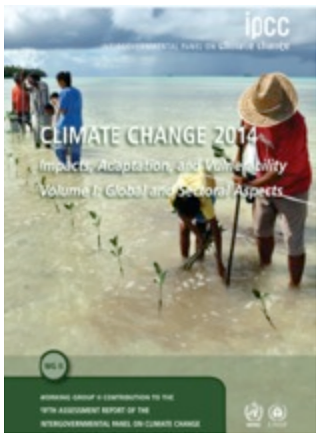
Fig. SPM.10

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

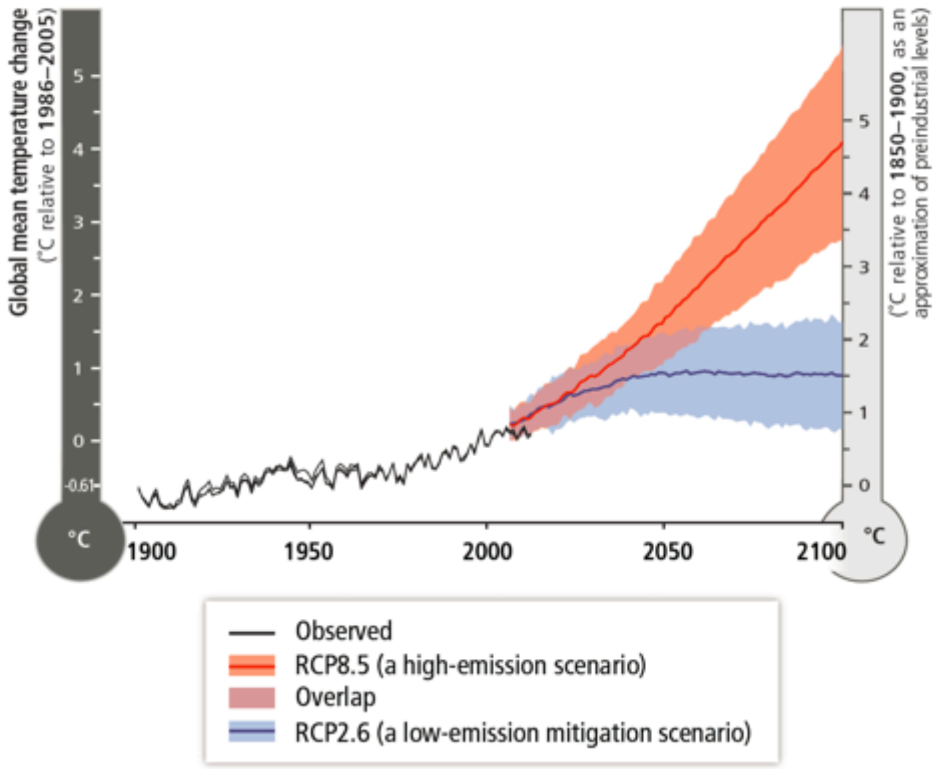


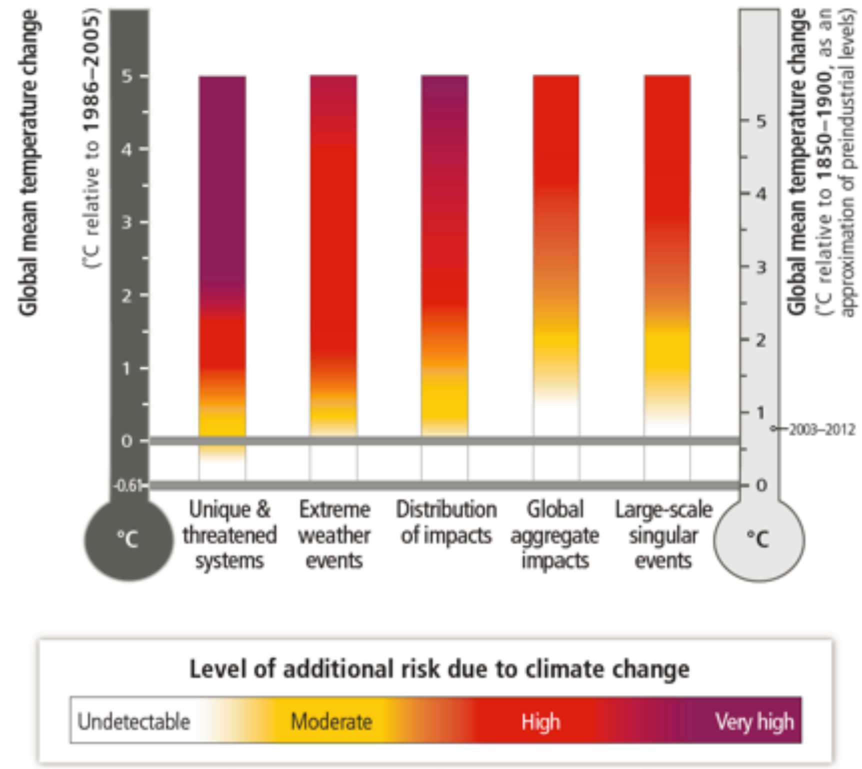
Limiting warming to *likely* less than 2°C since 1861-1880 requires cumulative CO_2 emissions to stay below 1000 GtC. Until 2011, over 50% of this amount has been emitted.

Accounting for other forcings, the upper amount of cumulative CO_2 emissions is 800 GtC; over 60% have been emitted by 2011.



What are the risks?





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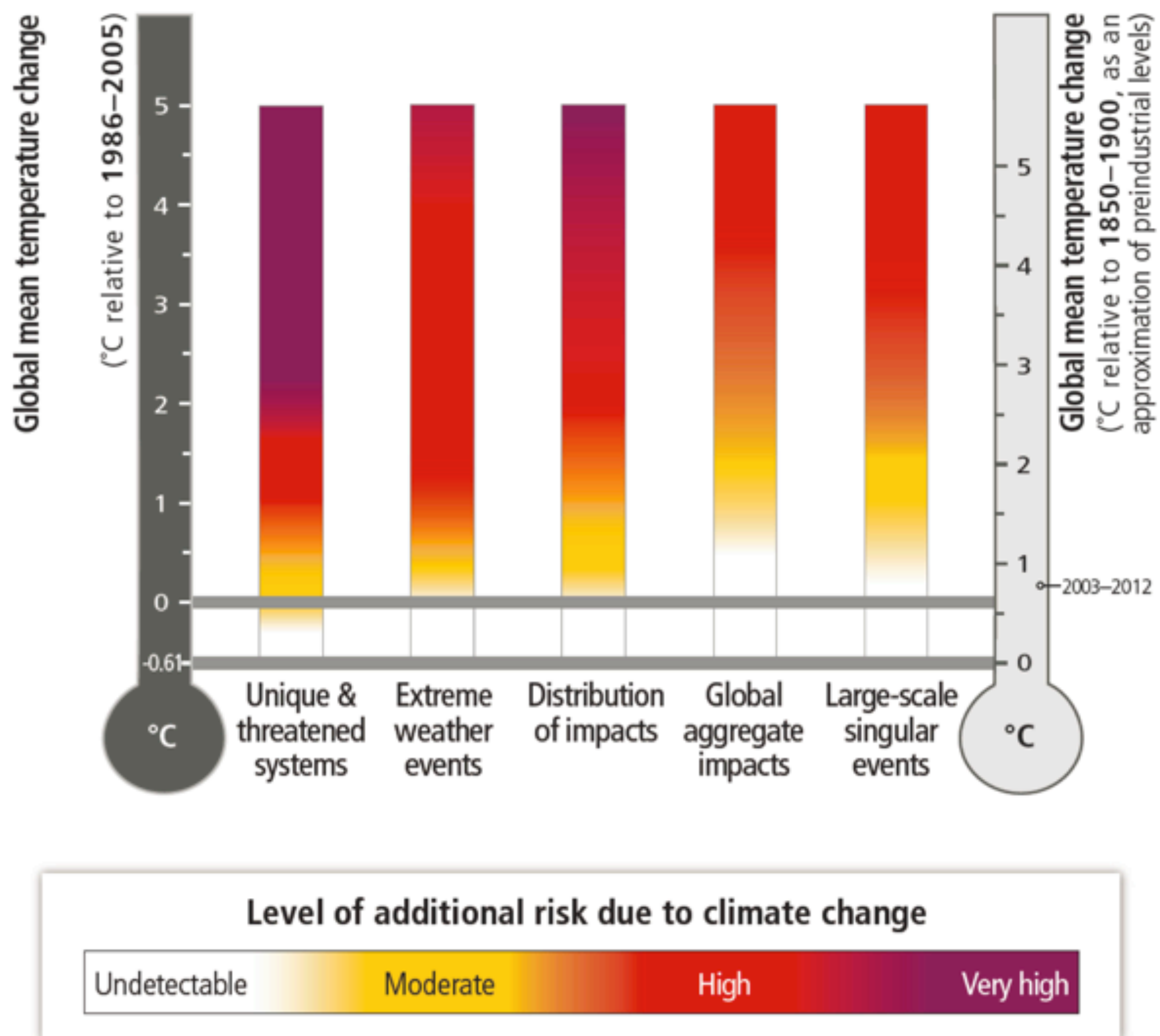
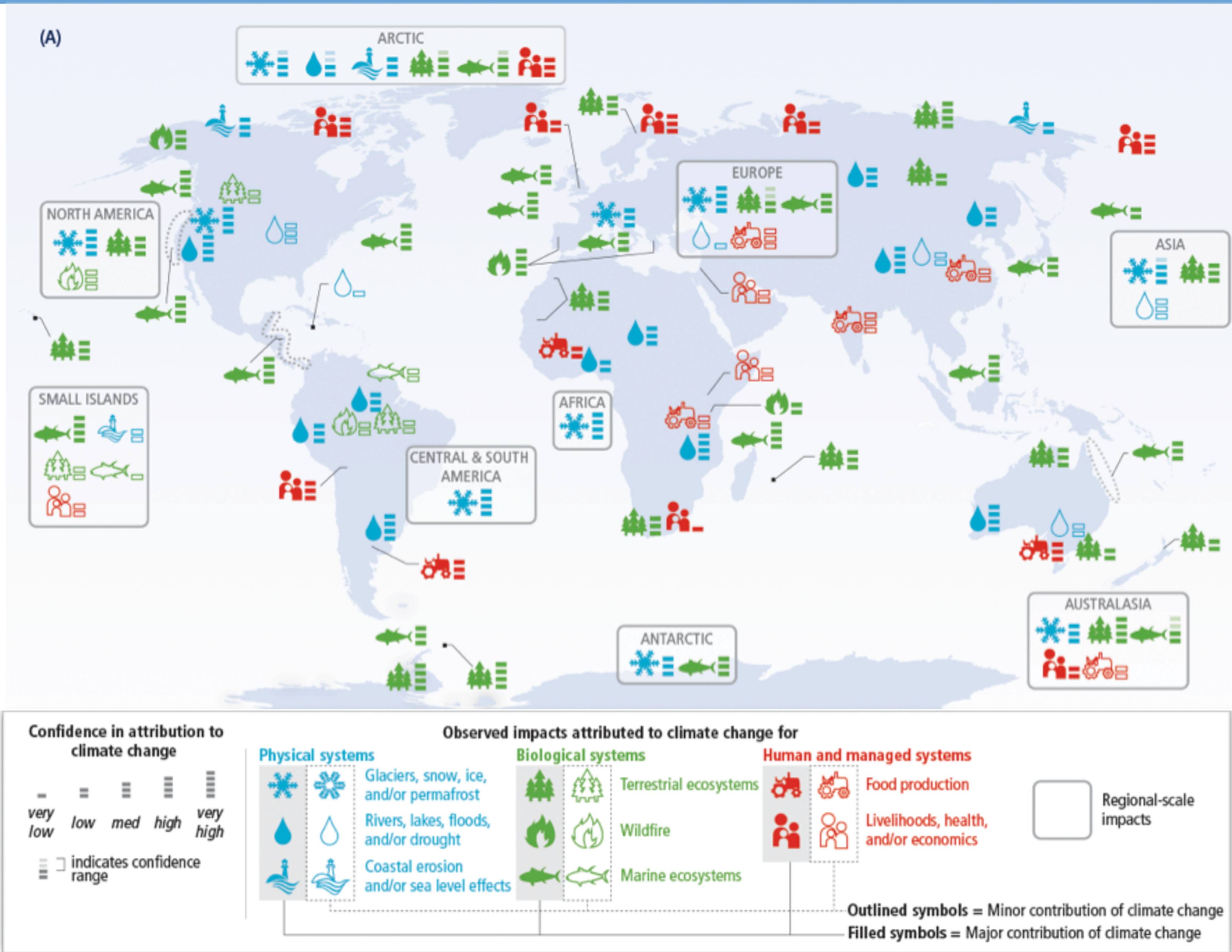


AR5, WGII, Box SPM.1 Figure 1

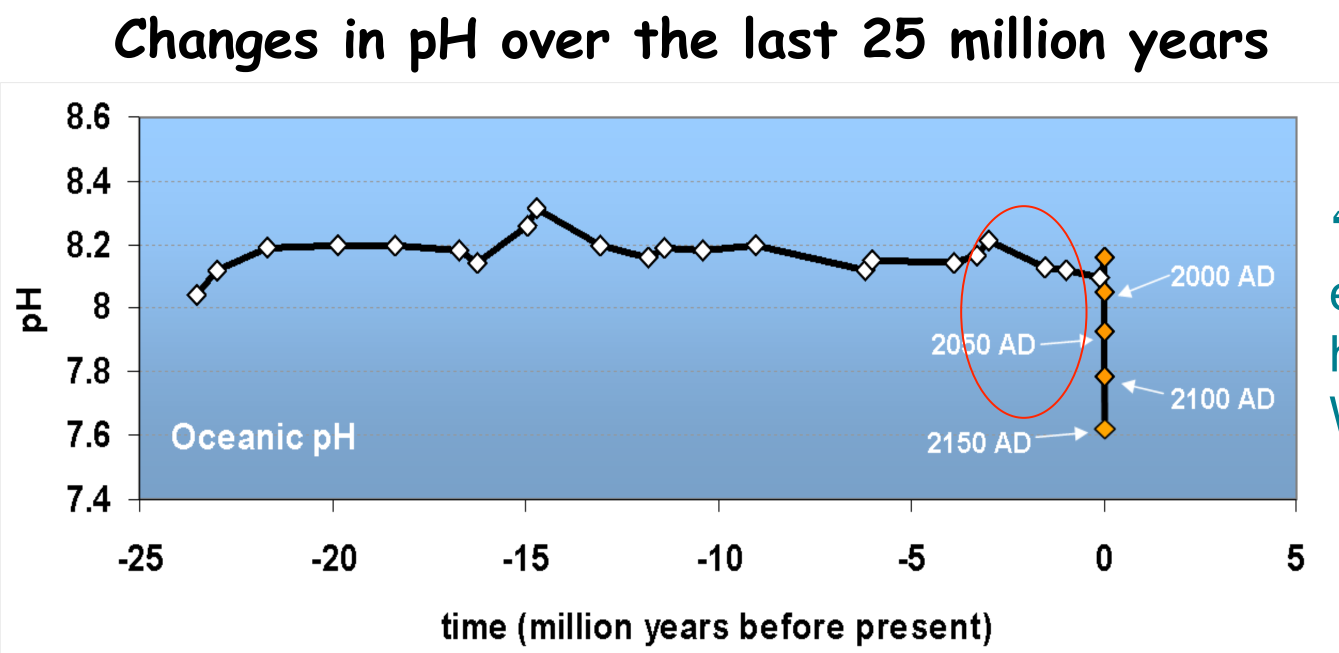


(A)
ARCTIC
NORTH AMERICA
EUROPE
ASIA
SMALL ISLANDS
AFRICA
CENTRAL & SOUTH AMERICA
ANTARCTIC
AUSTRALASIA
Confidence in attribution to climate change
very low
low
med
high
very high
indicates confidence range
Observed impacts attributed to climate change for
Physical systems
Glaciers, snow, ice, and/or permafrost
Rivers, lakes, floods, and/or drought
Coastal erosion and/or sea level effects
Biological systems
Terrestrial ecosystems
Wildfire
Marine ecosystems
Human and managed systems
Food production
Livelihoods, health, and/or economics
Regional-scale impacts
Outlined symbols = Minor contribution of climate change
Filled symbols = Major contribution of climate change

Effects on Nile delta: > 10 M people only 1 m above sea level

(Time 2001)

Oceans are Acidifying Fast (because of CO_2 emissions)



"Today is a rare event in the history of the World"

- It is happening now, at a speed and to a level not experienced by marine organisms for about 60 million years

- Mass extinctions linked to previous ocean acidification events

- Takes 10,000's of years to recover

Turley et al. 2006

Slide courtesy of Carol Turley, PML


RISKS OF
CLIMATE CHANGE
INCREASE
WITH CONTINUED
HIGH EMISSIONS
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IPCC AR5 WGII:

Without adaptation, local temperature increases of 1°C or more above preindustrial levels are projected to negatively impact yields for the major crops (wheat, rice, and maize) in tropical and temperate regions, although individual locations may benefit (medium confidence).

Chapter 23 (Europe): Climate change is likely to (…) decrease yields in Southern Europe [*high confidence*]

Irrigation

Climate change will increase irrigation needs [*high confidence*] but future irrigation will be constrained by reduced runoff, demand from other sectors, and by economic costs

By 2050s, irrigation will **not be sufficient to prevent damage from heat waves** to crops in some sub-regions [*medium confidence*].

System costs will increase under all climate scenarios [*high confidence*]

Integrated management of water, also across countries' boundaries, is needed to address future competing demands between agriculture, energy, conservation and human settlements

Slide courtesy of Daniela Jacob

What can be done?


ADAPTATION IS
ALREADY OCCURRING
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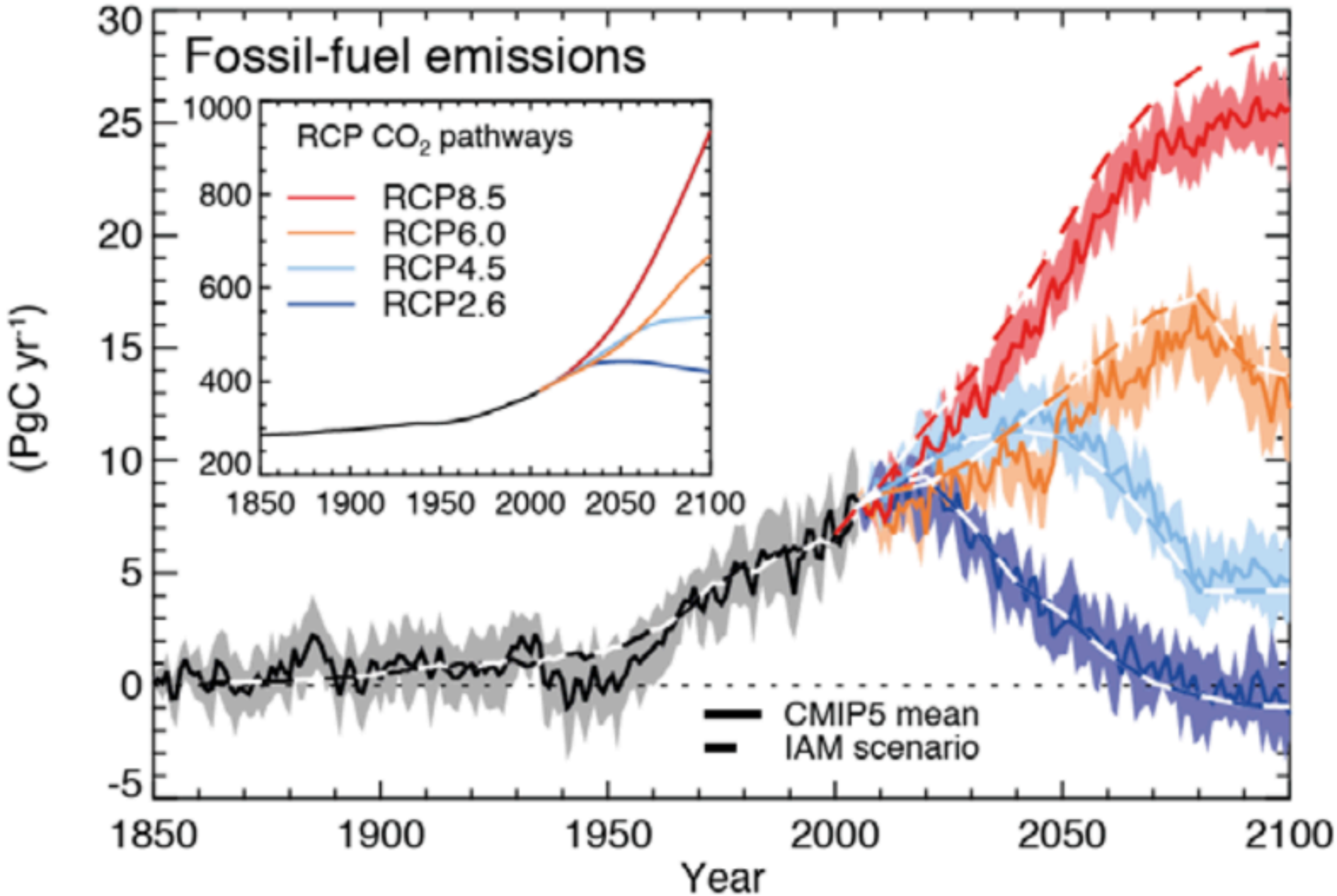
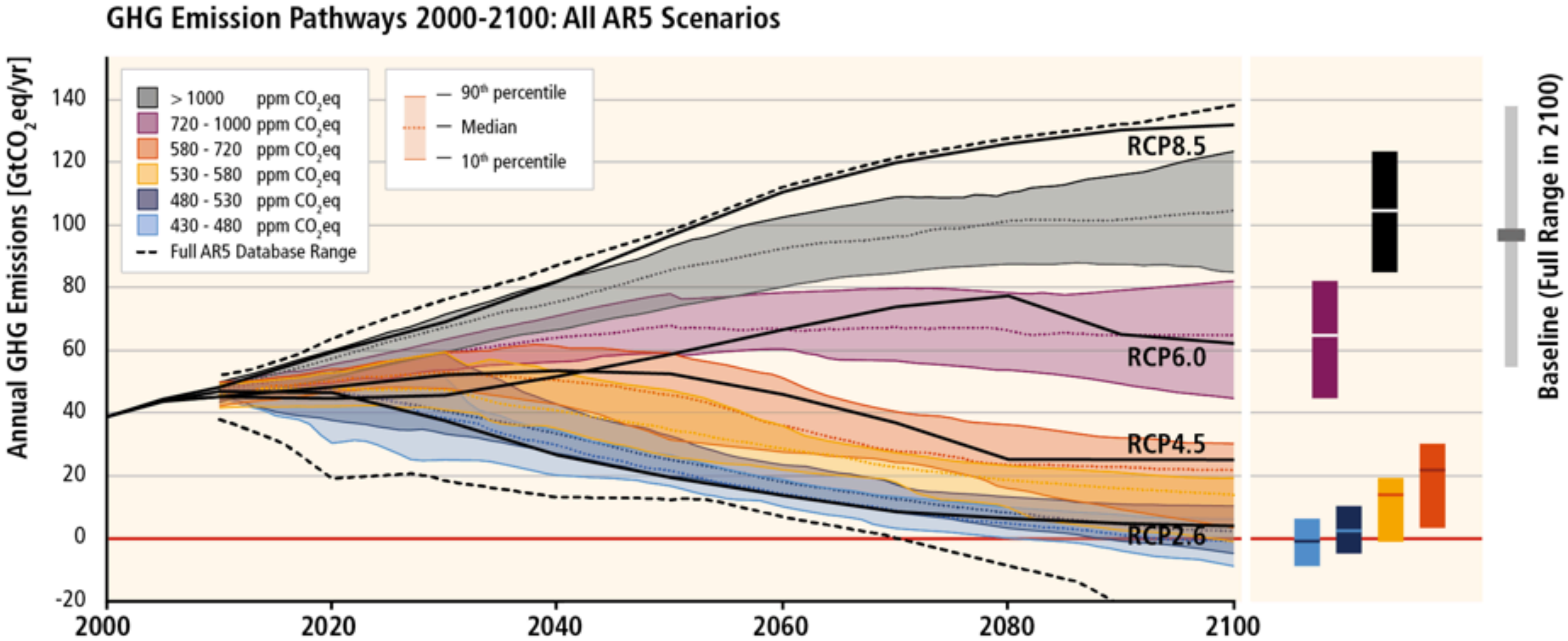
Compatible fossil fuel emissions simulated by the CMIP5 models for the four RCP scenarios



AR5 WGI TS – Fig TS 19

Without more mitigation, global mean surface temperature might increase by 3.7° to 4.8°C over the 21st century.



Can temperature rise still be kept below 1.5 or 2°C (over the 21st century) compared to pre-industrial ?

- **Many scenario studies confirm that it is technically and economically feasible to keep the warming below 2°C, with more than 66% probability ("likely chance").** This would imply limiting atmospheric concentrations to 450 ppm CO_2-eq by 2100.
- **Such scenarios** for an above 66% chance of staying below 2°C **imply reducing by 40 to 70% global GHG emissions compared to 2010 by mid-century, and reach zero or negative emissions by 2100.**

Can temperature rise still be kept below 1.5 or 2°C (over the 21st century) compared to pre-industrial ?

- **These scenarios are characterized by rapid improvements of energy efficiency and a near quadrupling of the share of low-carbon energy supply (renewables, nuclear, fossil and bioenergy with CCS), so that it reaches 60% by 2050.**

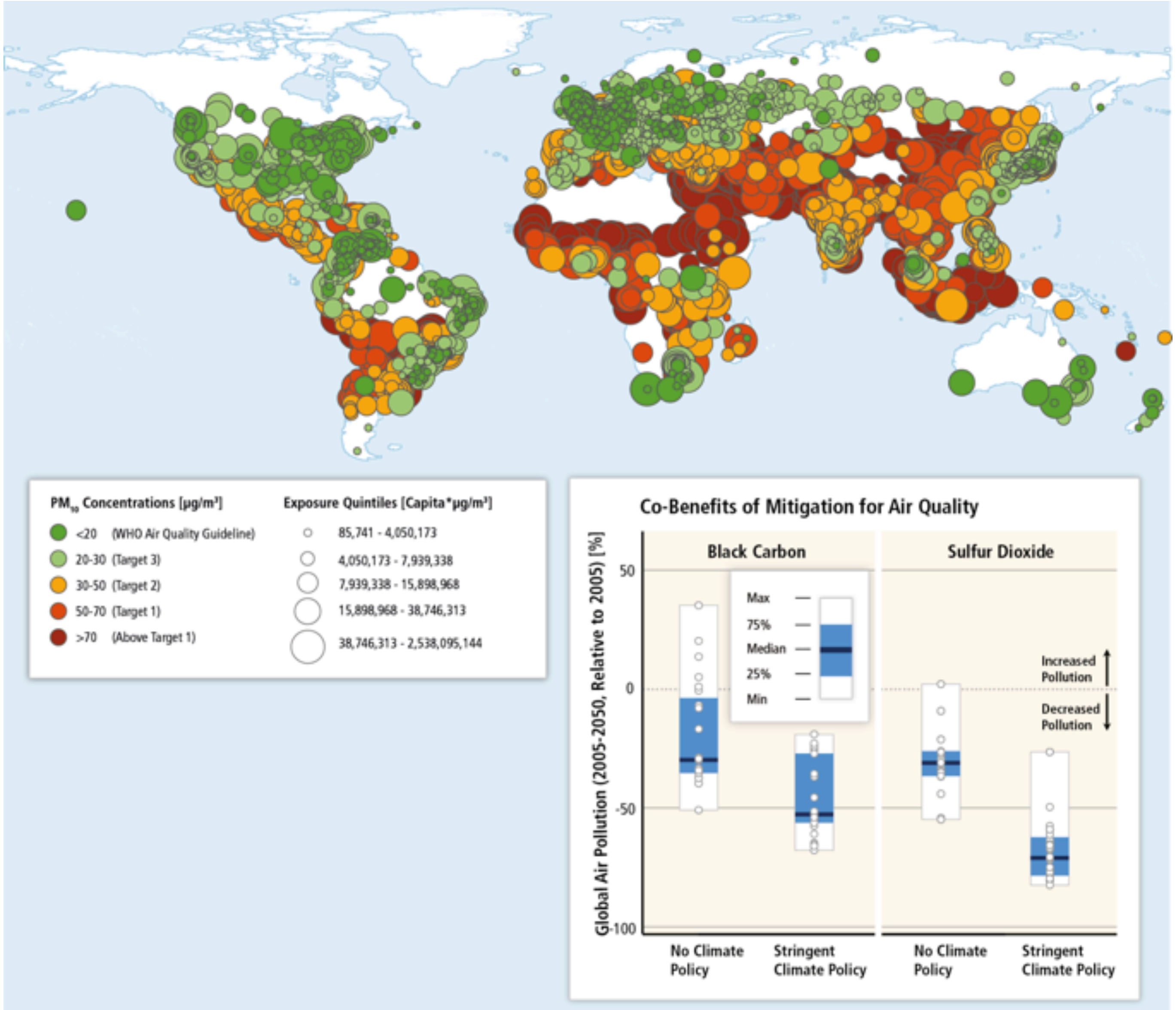
- **Keeping global temperature increase below 1.5°C would require even lower atmospheric concentrations (<430 ppm CO_2eq) to have a little more than 50% chance.** There are not many scenario studies available that can deliver such results, **requiring even faster reductions** in the medium term, indicating how difficult this is.

Can temperature rise still be kept below 1.5 or 2°C (over the 21st century) compared to pre-industrial ?

- **Average global macro-economic costs of such reduction pathways that minimize costs over the century are modest compared to expected economic growth.** The assumptions used for this "ideal" cost-effective approach include mitigation action starting **immediately in all countries**, a **global carbon price** and **all key technologies available**. With those assumptions, the global macro-economic costs of a 2°C scenario are limited: an average annual reduction of consumption of about 0.04-0.14 percentage points (from a baseline increase of consumption of 1.6-3% per year).

Can temperature rise still be kept below 1.5 or 2°C (over the 21st century) compared to pre-industrial ?

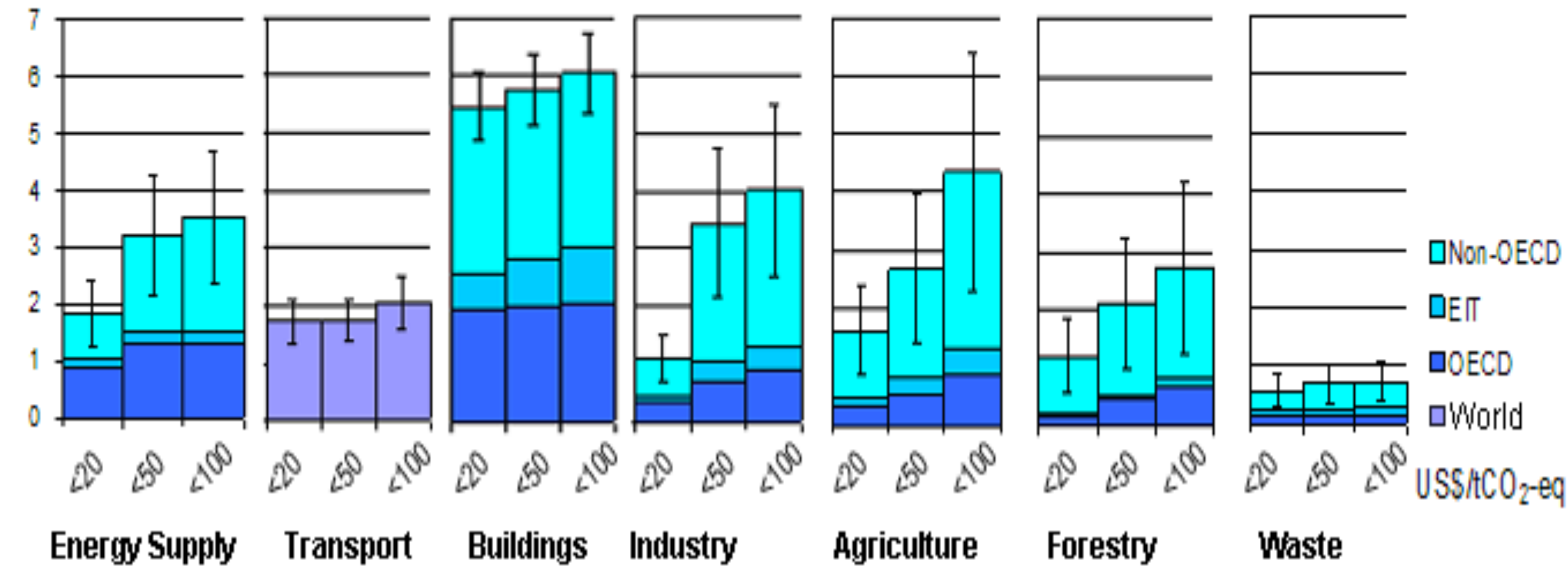
- There are also benefits from avoided climate change impacts and co-benefits in other areas, such as reduced health and ecosystem damages due to air pollution, improved energy security, food security, or employment. There is also a wide range of possible adverse side effects from climate policy that have not been well-quantified.



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

All sectors and regions have the potential to contribute by 2030

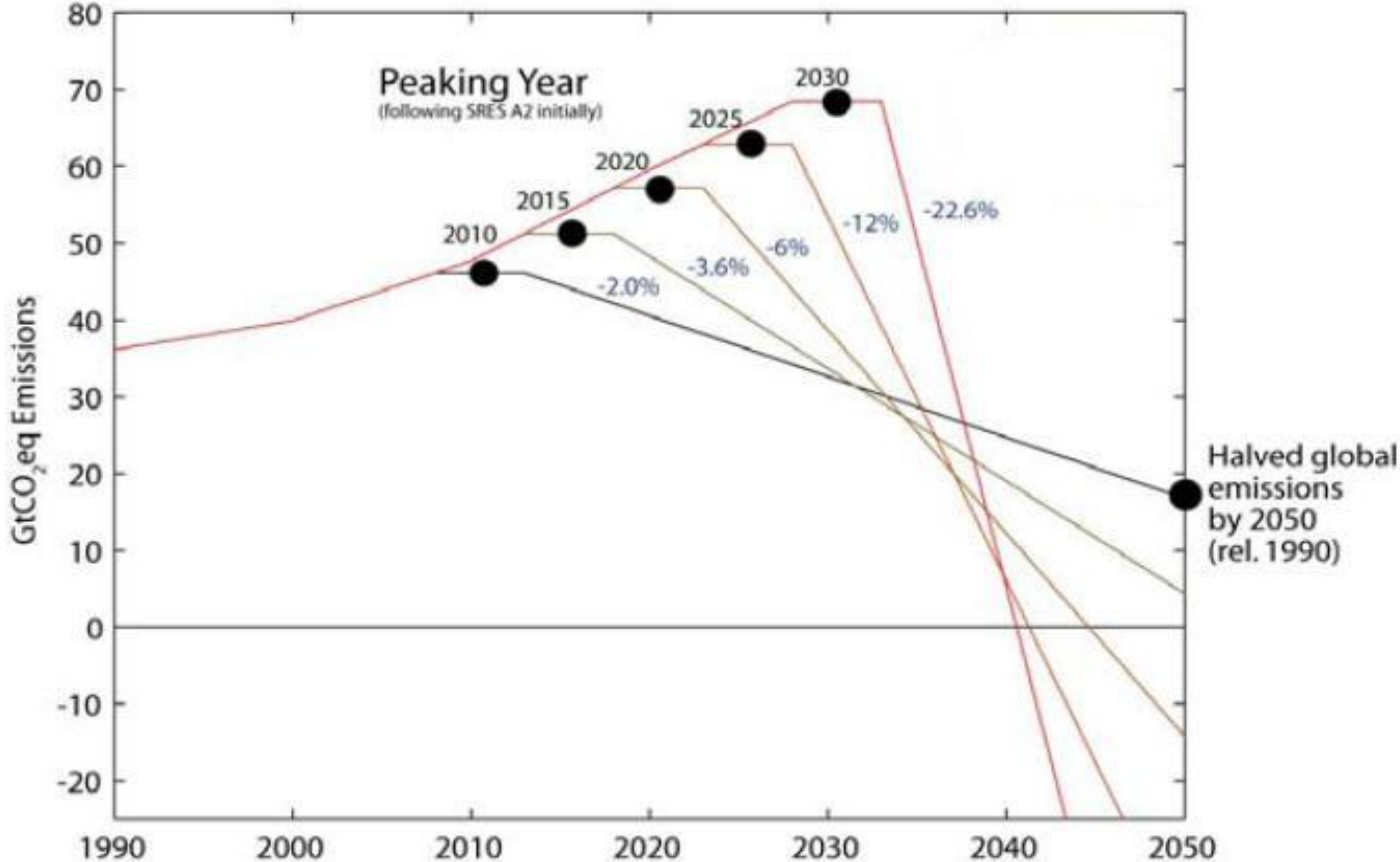
$GtCO_2$-eq / year (avoided emissions: the higher, the better)



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

“There is hope, modest hope”

(Co-chair WGIII Edenhofer)

Useful links:

- www.ipcc.ch : IPCC
- www.climate.be/vanyp : my slides and other documents
- **On Twitter: @JPvanYpersele**

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