

Le Sommet Climat de Paris: échec ou succès ? Bilan et perspectives

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Thanks to the Belgian Federal Science Policy Office (BELSPO) and the Ministry of Foreign Affairs, and to my team at the Université catholique de Louvain for their support

Plan

- Un accord hi-sto-rique!
- Un accord tout-à-fait insuffisant
- Y a du boulot !

Plan

- Un accord hi-sto-rique !

Paris Agreement

- Article 2:
 - ◆ (...) to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:
 - ▶ Holding the increase in the global average temperature to **well below 2 °C** above pre-industrial levels and to **pursue efforts** to limit the temperature increase to **1.5 °C** above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;
 - ▶ **Increasing the ability to adapt** (...) and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production;
 - ▶ Making **finance flows consistent** with a pathway towards low greenhouse gas emissions and climate-resilient development

Paris Agreement

- Article 3:
 - ◆ As nationally determined contributions to the global response to climate change, **all Parties** are to undertake and communicate ambitious efforts (...) with the view to achieving the purpose of this Agreement as set out in Article 2.
The efforts of all Parties will represent **a progression over time**, while recognizing the **need to support developing country** Parties for the effective implementation of this Agreement.

Paris Agreement

- Article 4:
 - ♦ 1. (...) Parties aim to reach **global peaking** of greenhouse gas emissions **as soon as possible**, recognizing that **peaking will take longer for developing country Parties**,
 - ♦ and to undertake **rapid reductions thereafter in accordance with best available science**,
 - ♦ so as to achieve a **balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century**, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty
 - ♦ 3. **Each Party's successive nationally determined contribution will represent a progression(...)**

Paris Agreement

- Article 4 (cont.):
 - ✦ 4. Developed country Parties should continue taking the lead by undertaking economy-wide absolute emission reduction targets.
 - ✦ Developing country Parties should continue enhancing their mitigation efforts, and are encouraged to move over time towards economy-wide emission reduction or limitation targets in the light of different national circumstances.
 - ✦ **Each Party shall communicate a nationally determined contribution every five years**
 - ✦ Parties shall take into consideration in the implementation of this Agreement the **concerns of Parties with economies most affected by the impacts of response measures**, particularly developing country Parties.

Paris Agreement

- Article 5:
 - ◆ Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases (...) including forests.
 - ◆ Parties are encouraged to take action to implement and support (...) policy approaches and positive incentives for activities relating to reducing emissions from deforestation and forest degradation,
- Article 6
 - ◆ 4. A mechanism to contribute to the mitigation of greenhouse gas emissions and support sustainable development is hereby established under the authority and guidance of the Conference of the Parties (...) for use by Parties on a voluntary basis.



Paris Agreement

- Article 7
 - ◆ Parties hereby establish the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change
- Article 8
 - ◆ Parties recognize the importance of averting, minimizing and **addressing loss and damage** associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of **loss and damage**.

Plan

- Un accord tout-à-fait insuffisant

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 (adaptation & mitigation).

WMO=World Meteorological Organization

UNEP= United Nations Environment Programme

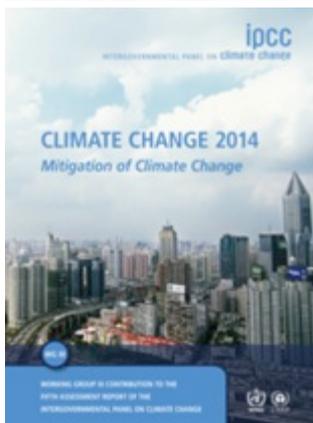




What is happening in the climate system?



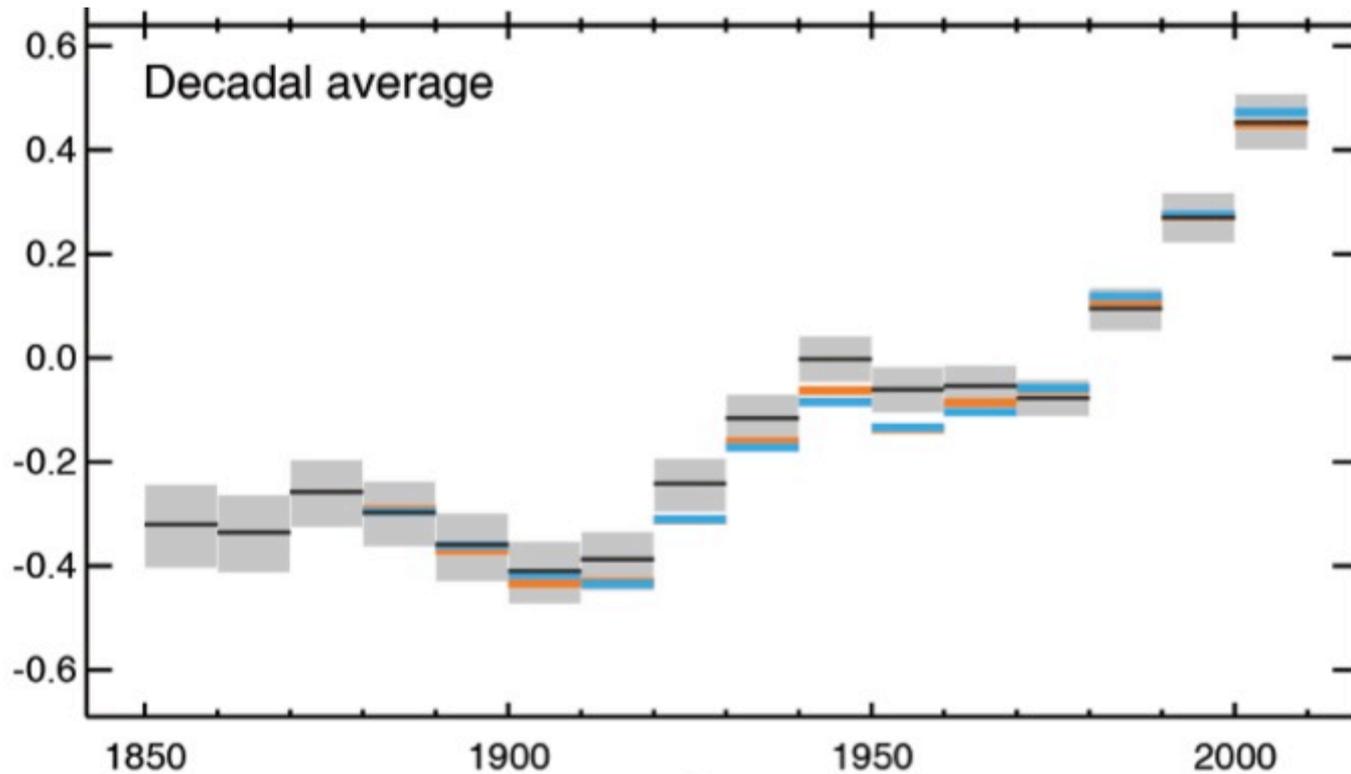
What are the risks?



What can be done?

Key messages from IPCC AR5

- **Human influence on the climate system is clear**
- **Continued emissions of greenhouse gases will increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems**
- **While climate change is a threat to sustainable development, there are many opportunities to integrate mitigation, adaptation, and the pursuit of other societal objectives**
- **Humanity has the means to limit climate change and build a more sustainable and resilient future**



(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*).

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

Plateau Glacier (1961) (Alaska)



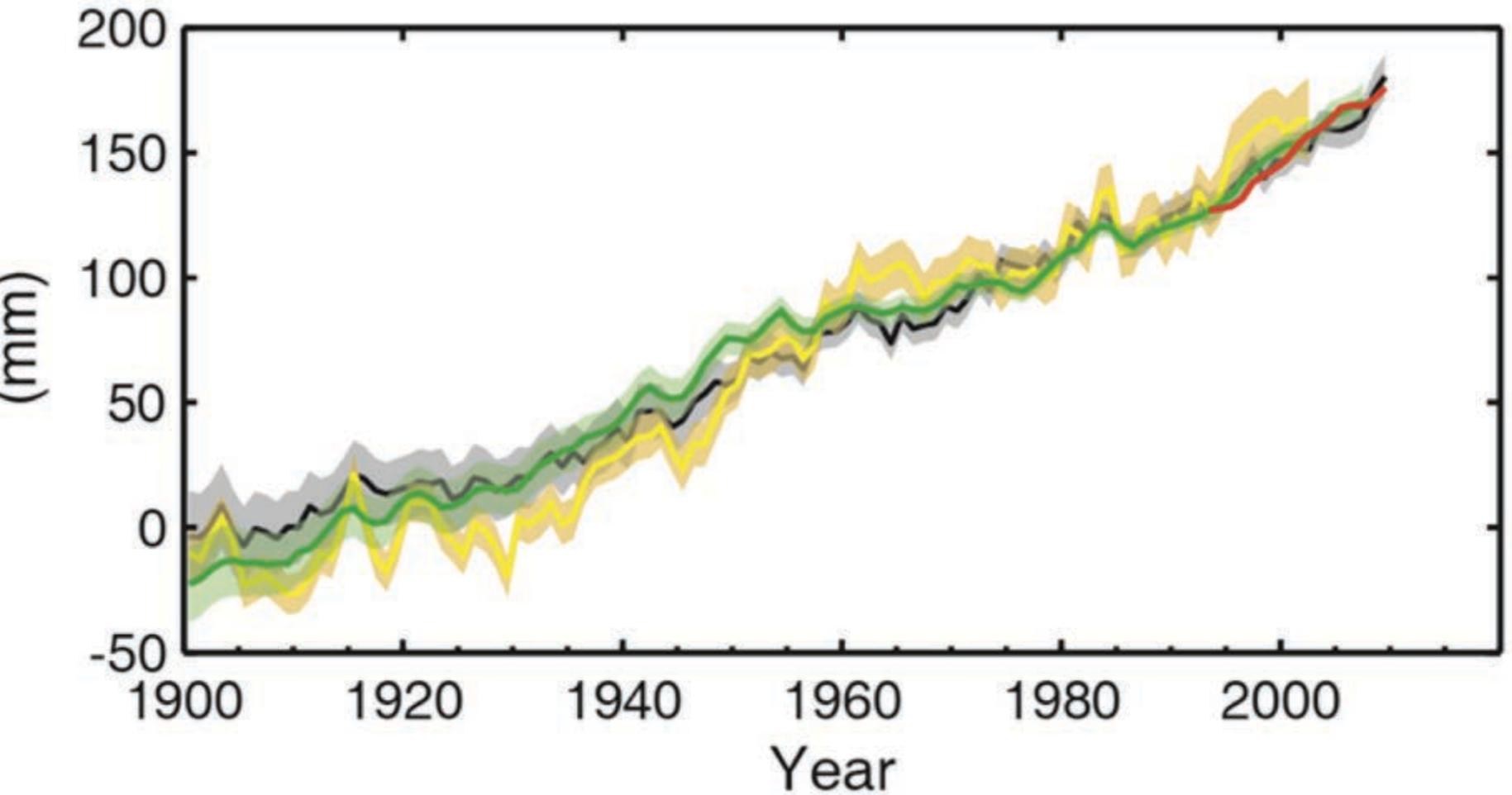
http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Plateau Glacier (2003) (Alaska)

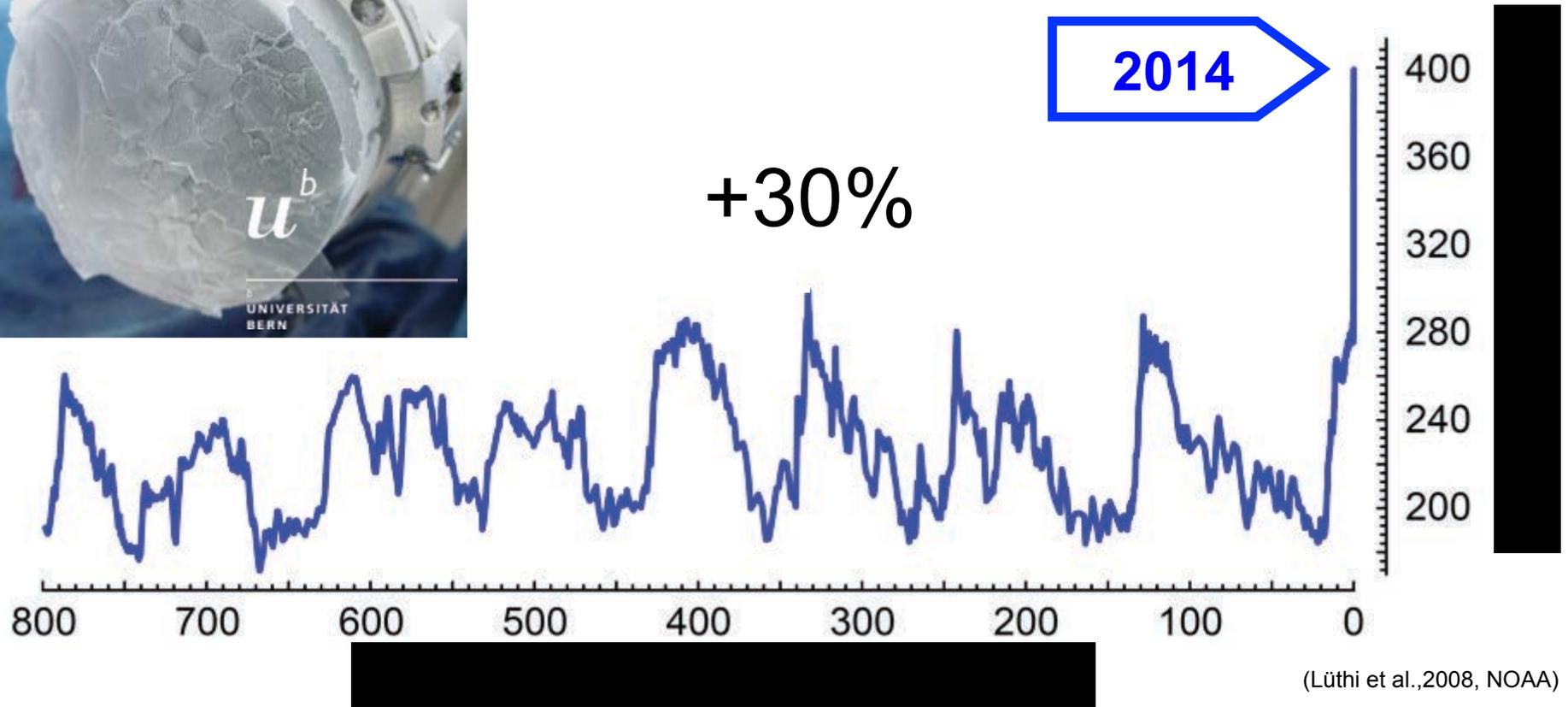


http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Change in average sea-level change



Atmospheric concentrations of CO₂



The concentrations of CO₂ have increased to levels unprecedented in at least the last 800,000 years.

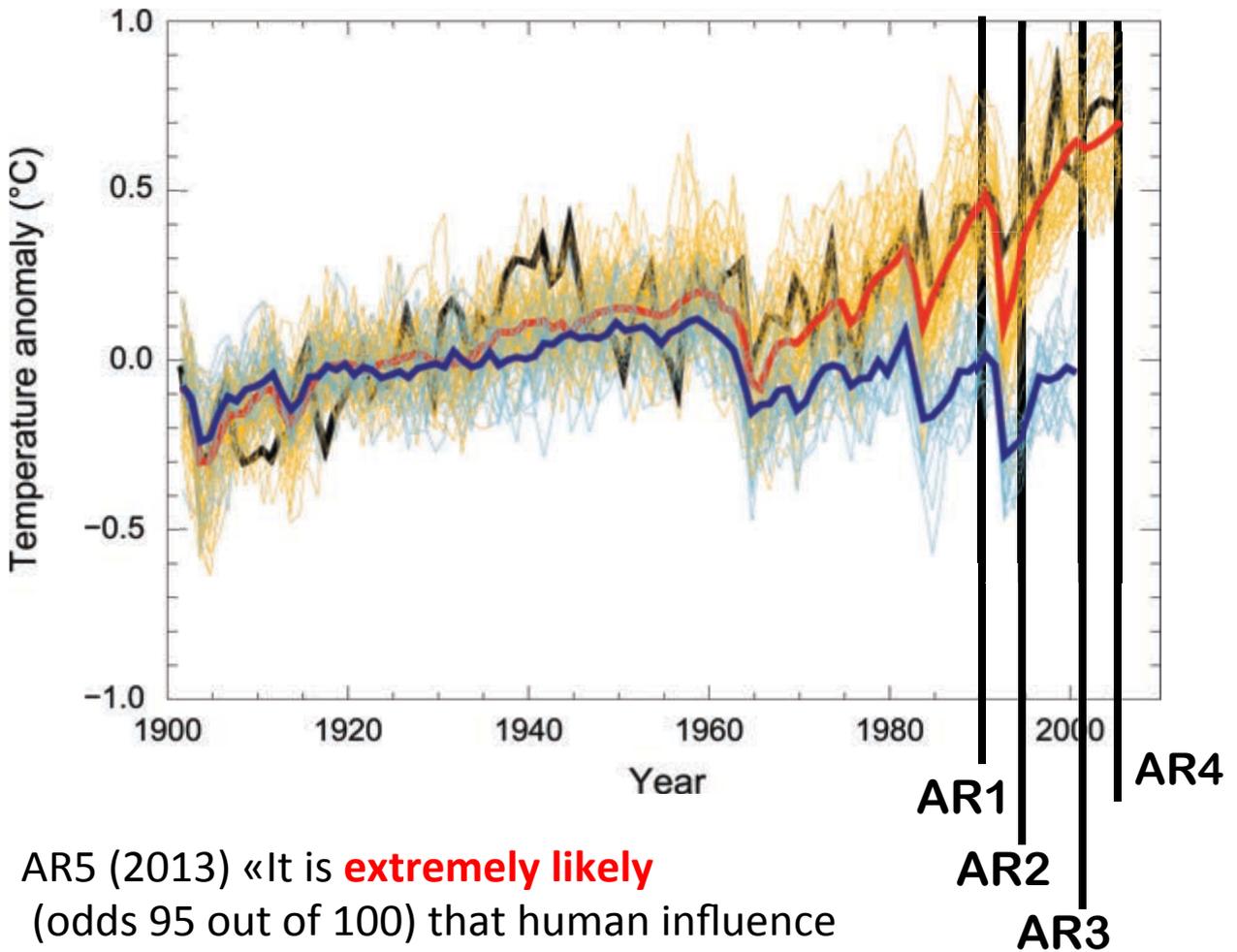
A Progression of Understanding: Greater and Greater Certainty in Attribution

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

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

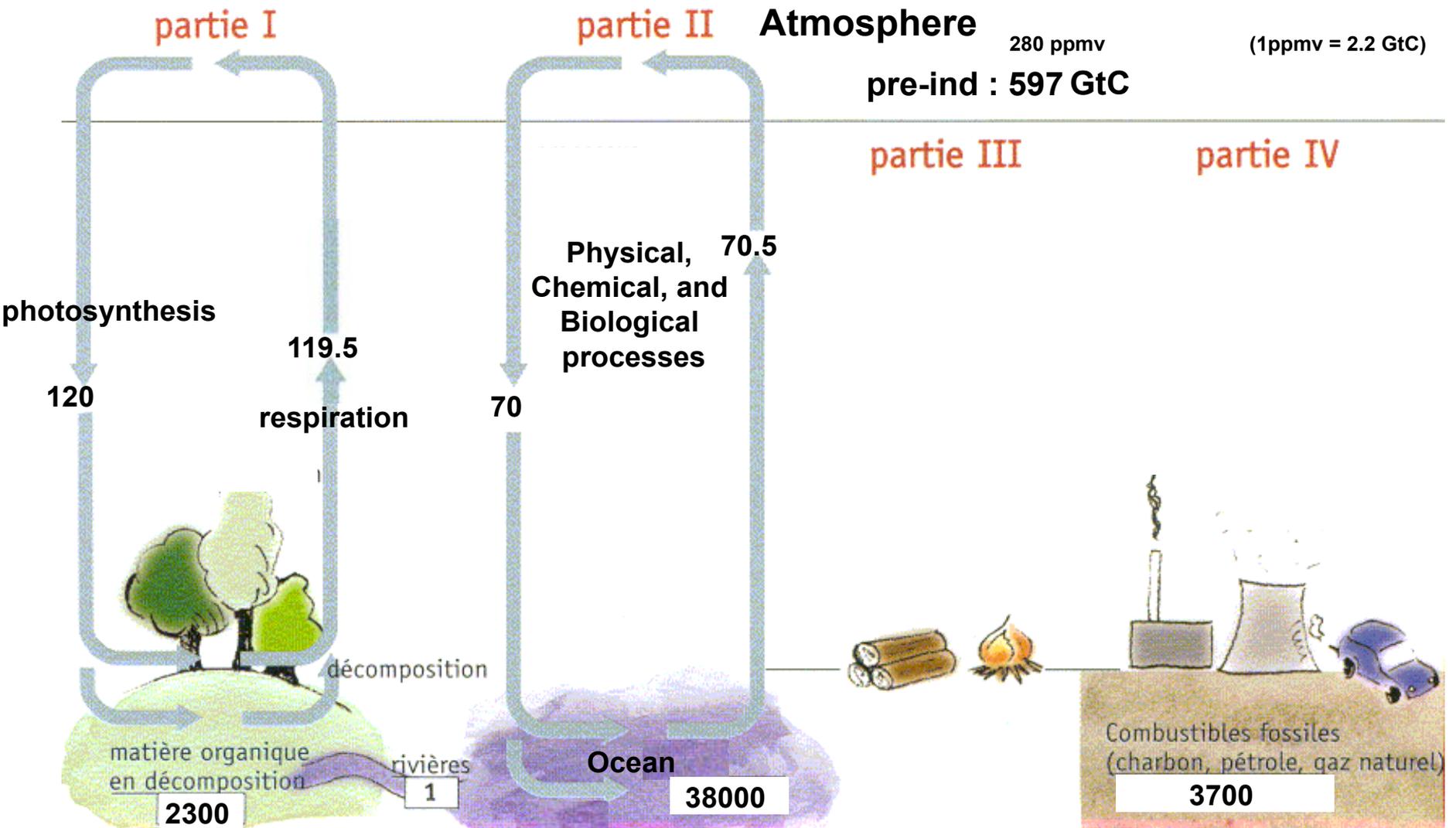
AR3 (2001): “most of
the warming of the
past 50 years is **likely**
(odds 2 out of 3) due
to human activities”

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... »

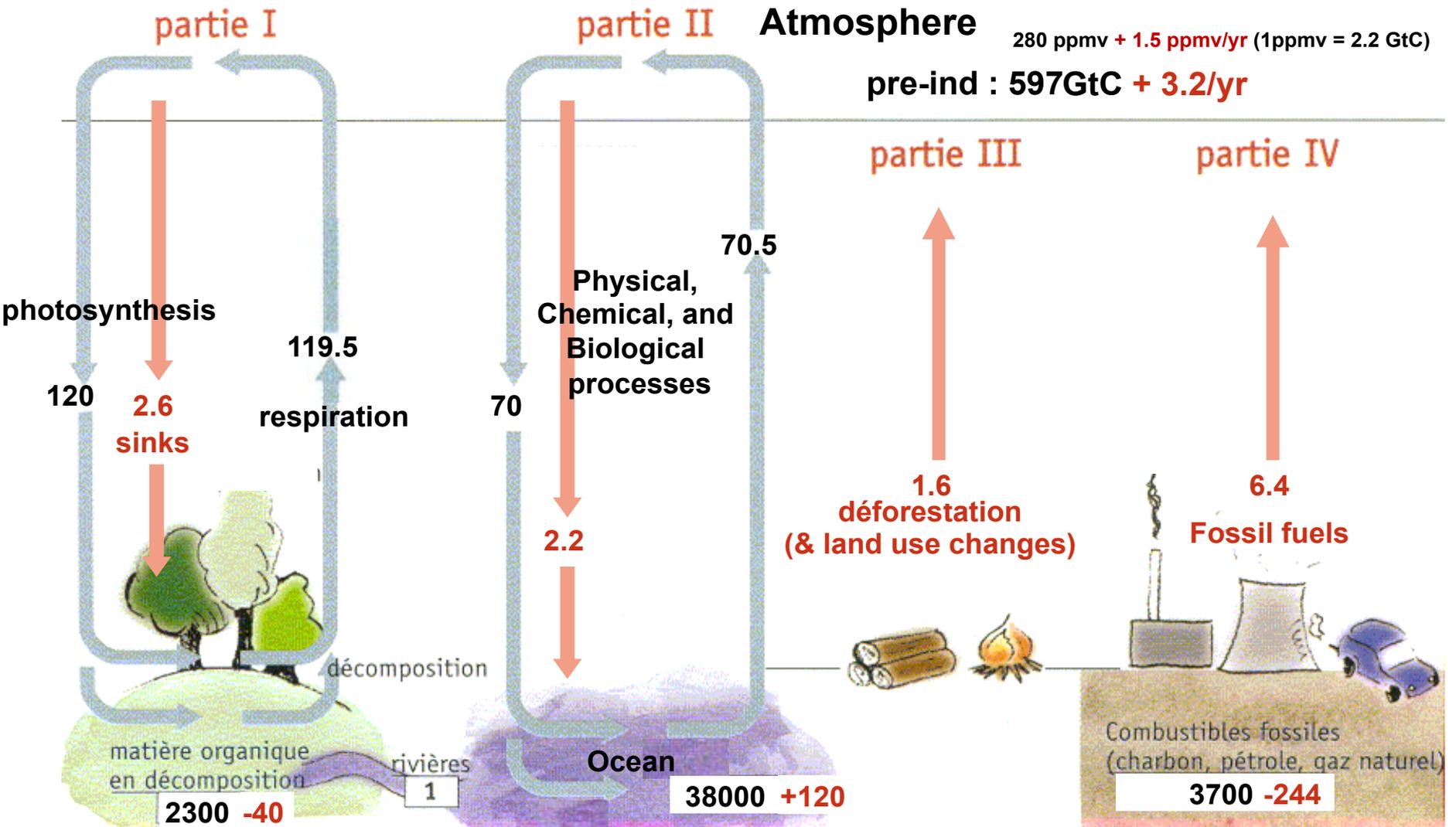
Carbon cycle: unperturbed fluxes



Units: GtC (billions tons of carbon) or GtC/year (multiply by 3.7 to get GtCO₂)

Carbon cycle: perturbed by human activities

(numbers for the decade 1990-1999s, based on IPCC AR4)

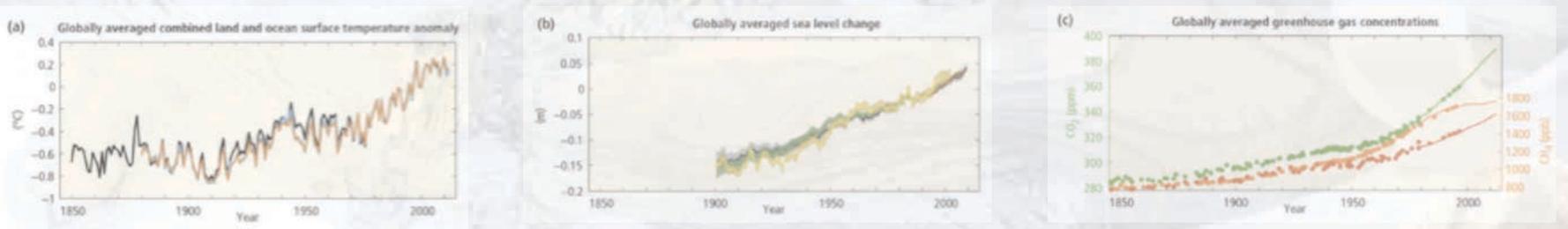


Units: GtC (billions tons of carbon) or GtC/year

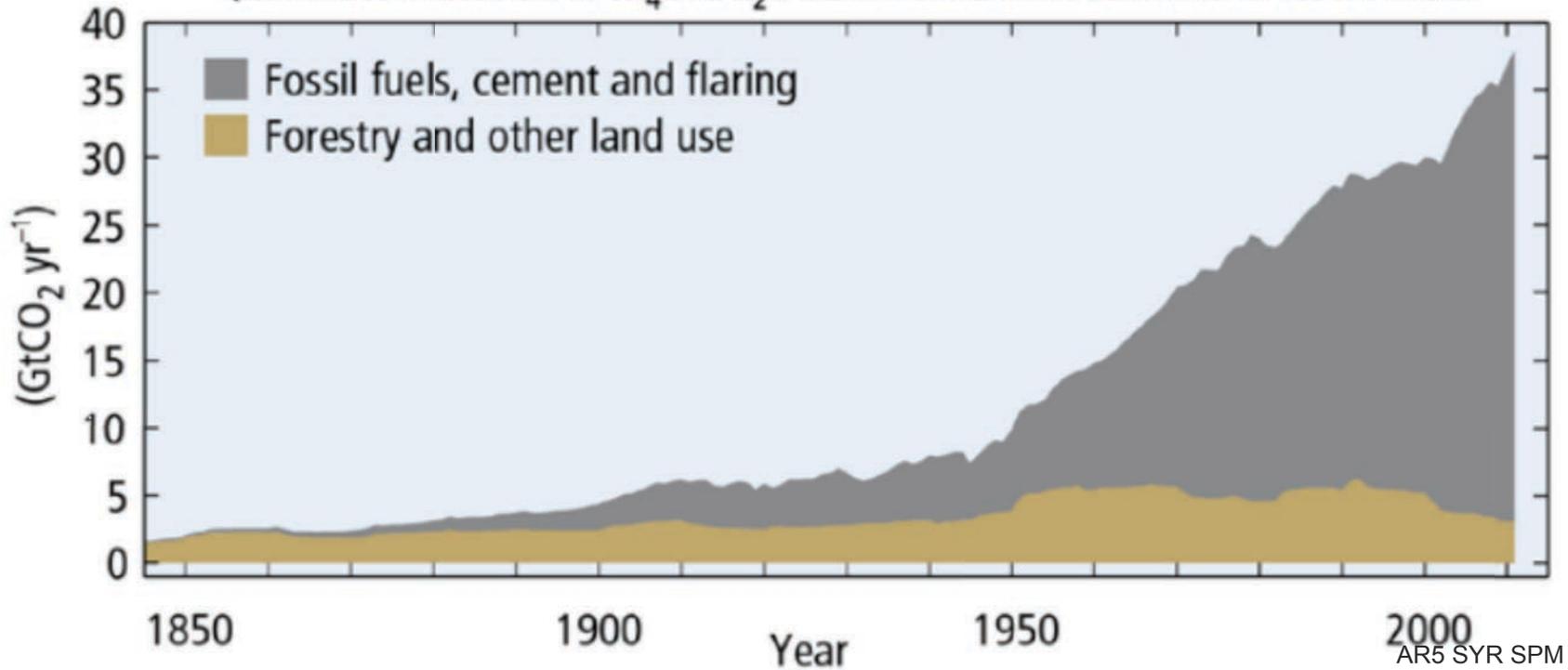
Stocks!

The carbon cycle is policy-relevant

- CO₂ accumulates in the atmosphere as long as human emissions are larger than the natural absorption capacity**
- Historical emissions from developed countries therefore matter for a long time**
- As warming is function of cumulated emissions, the carbon « space » is narrowing fast (to stay under 1.5 or 2°C warming)**



(d) Global anthropogenic CO₂ emissions
 Quantitative information of CH₄ and N₂O emission time series from 1850 to 1970 is limited



AR5 SYR SPM

Sources of emissions

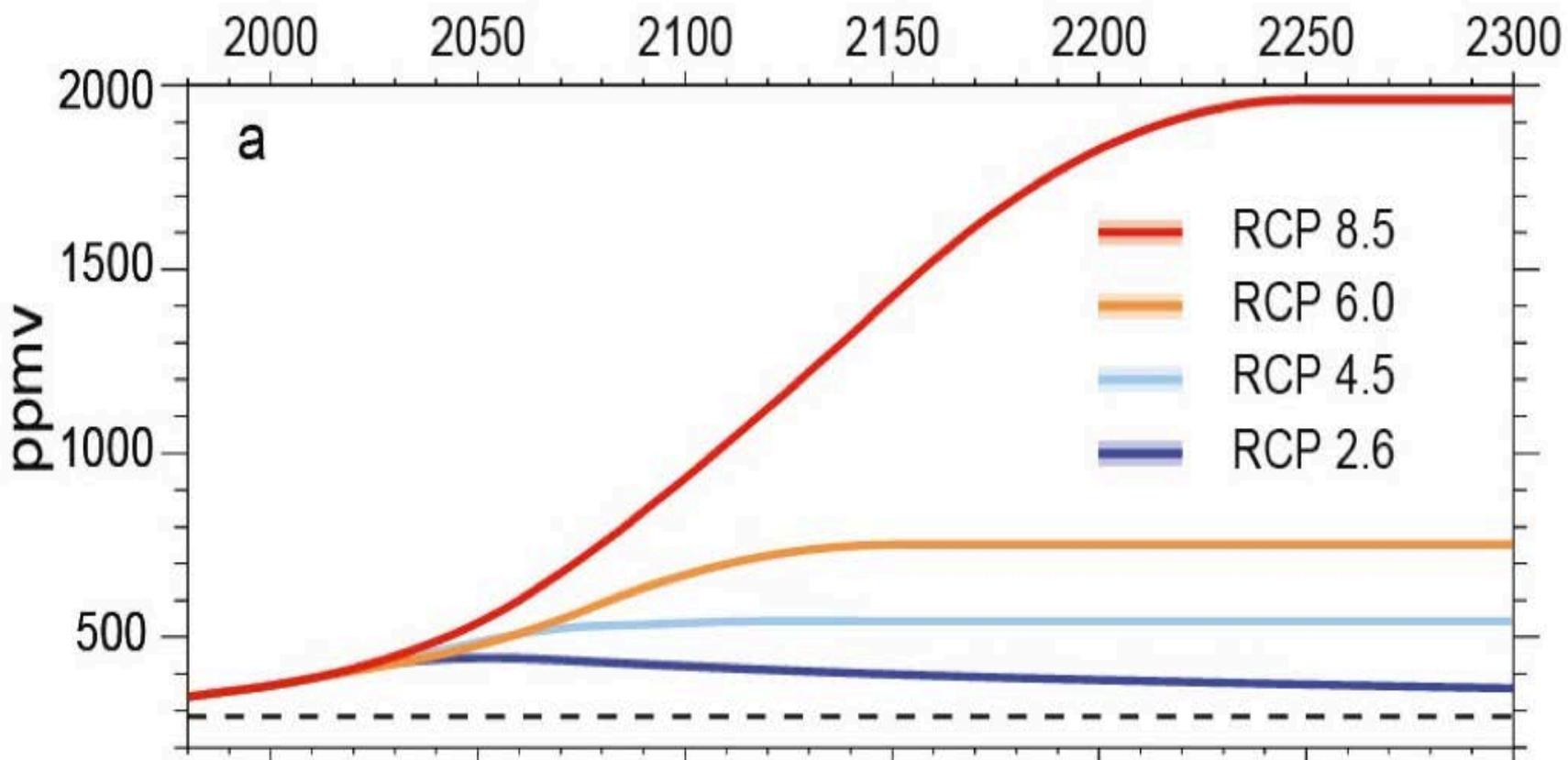
Energy production remains the primary driver of GHG emissions



2010 GHG emissions

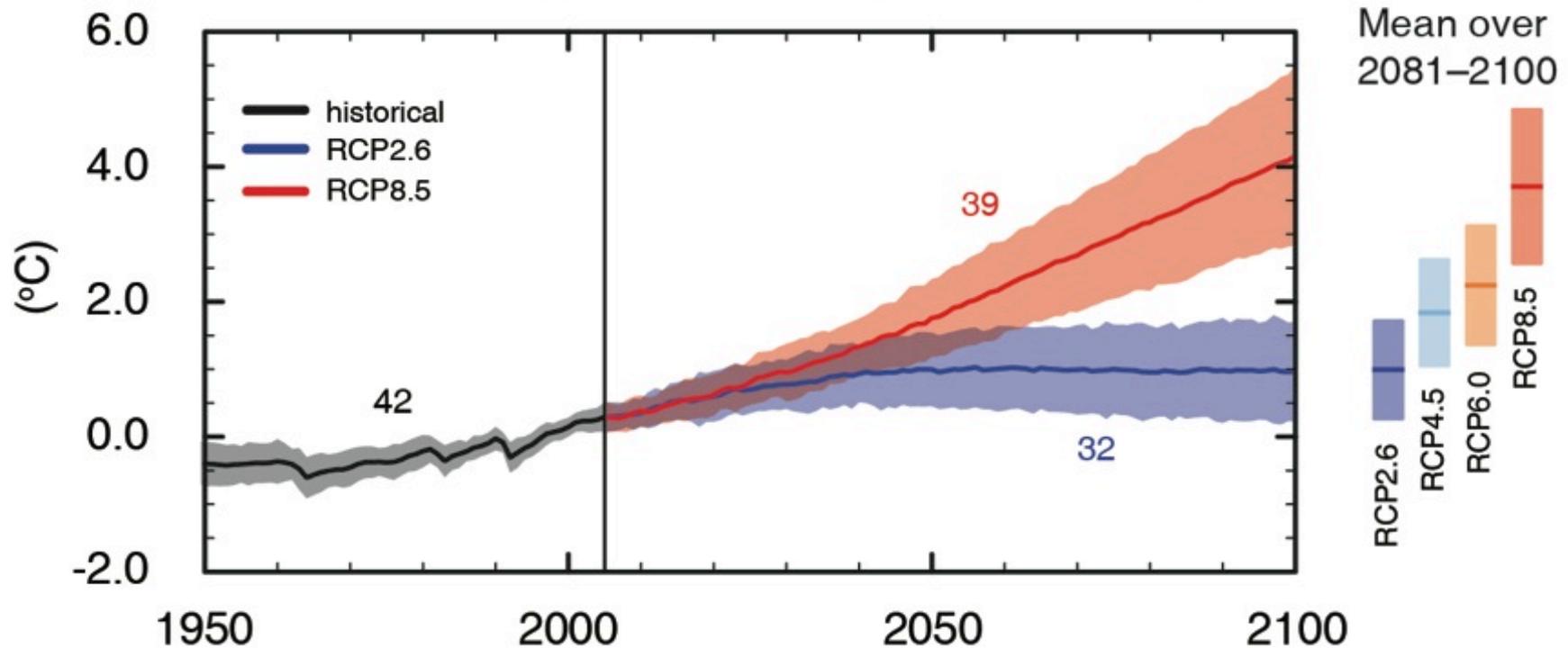
AR5 WGIII SPM

RCP Scenarios: Atmospheric CO₂ concentration



Three stabilisation scenarios: RCP 2.6 to 6
One Business-as-usual scenario: RCP 8.5

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

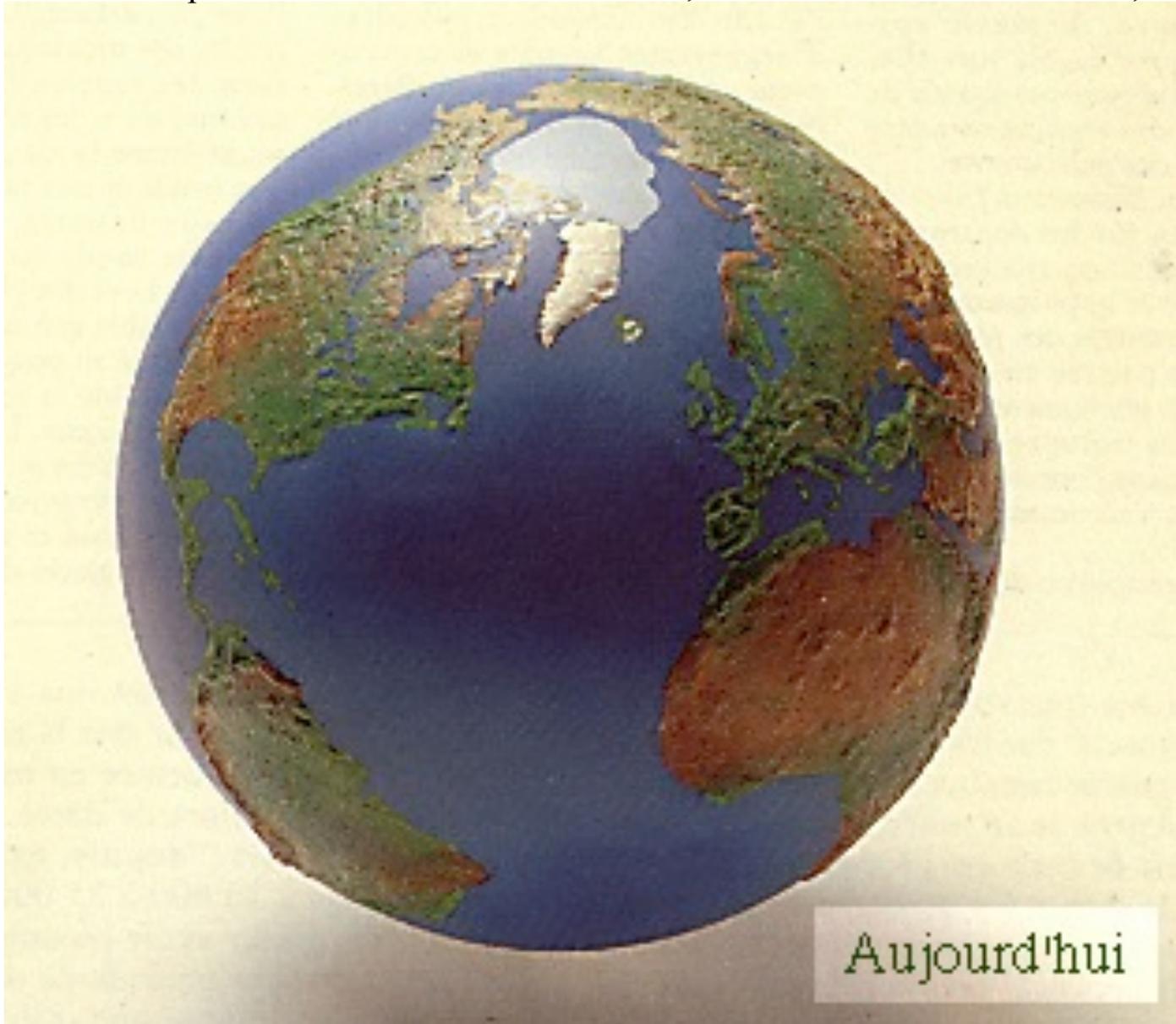
18-20000 years ago (Last Glacial Maximum)

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

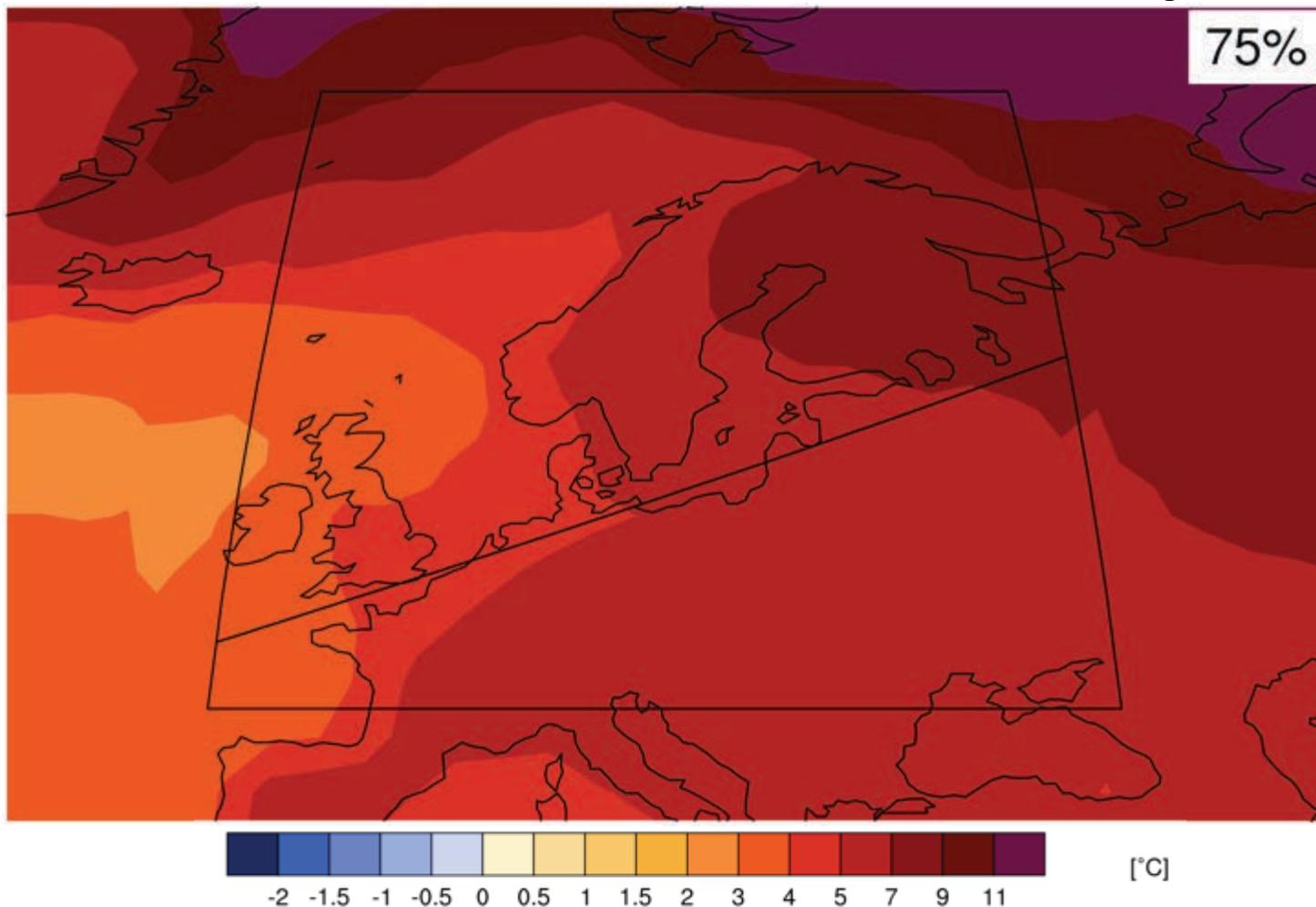


Today, with +4-5°C globally

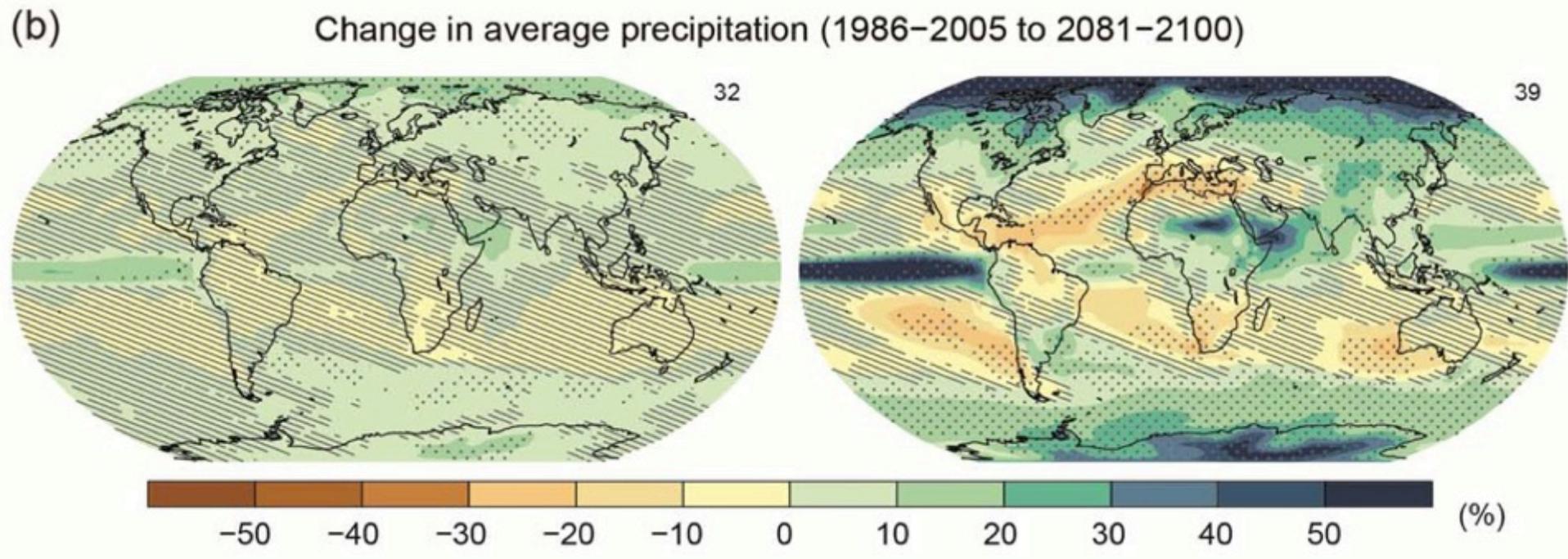
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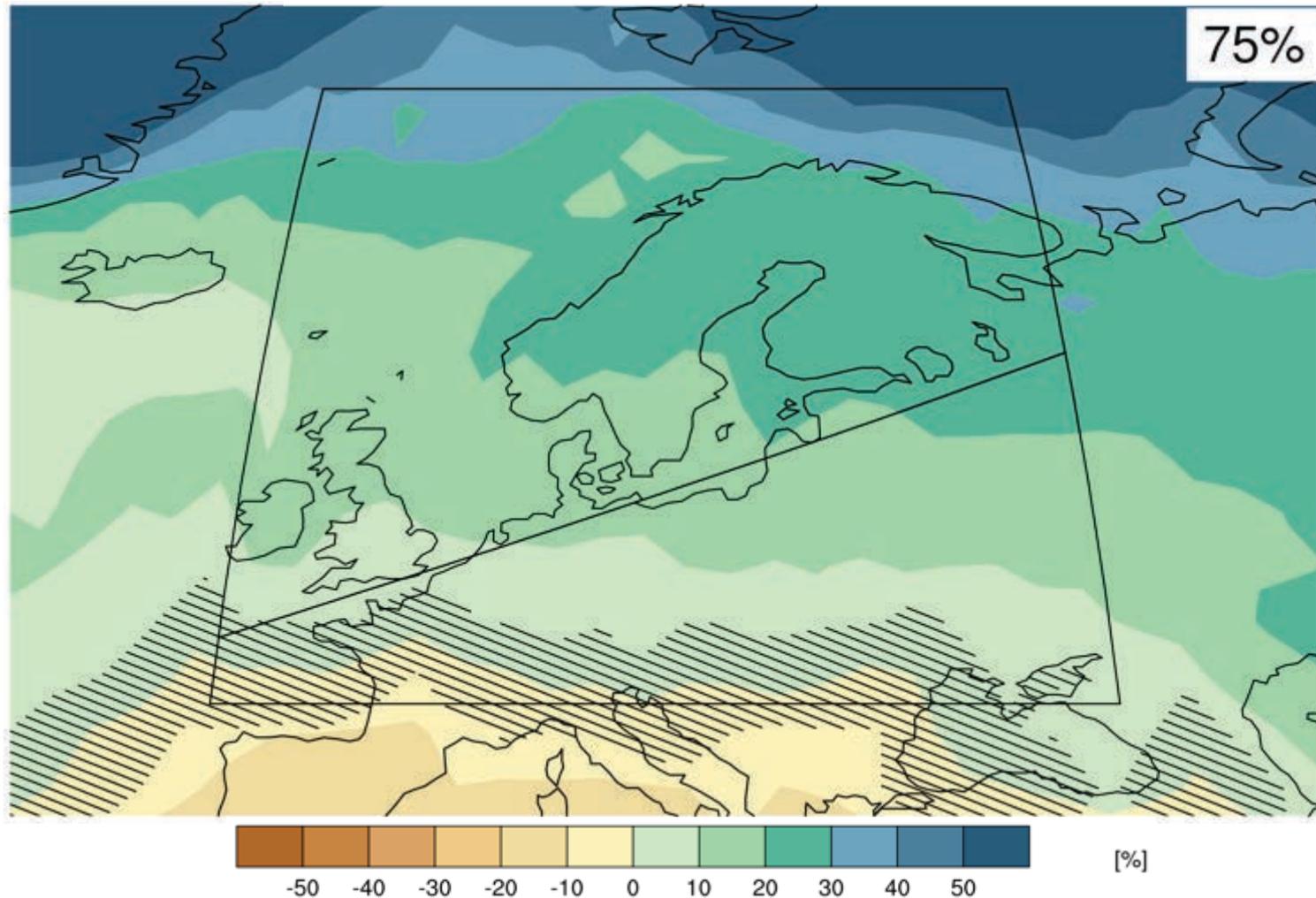
North Europe - Map of temperature changes: 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)

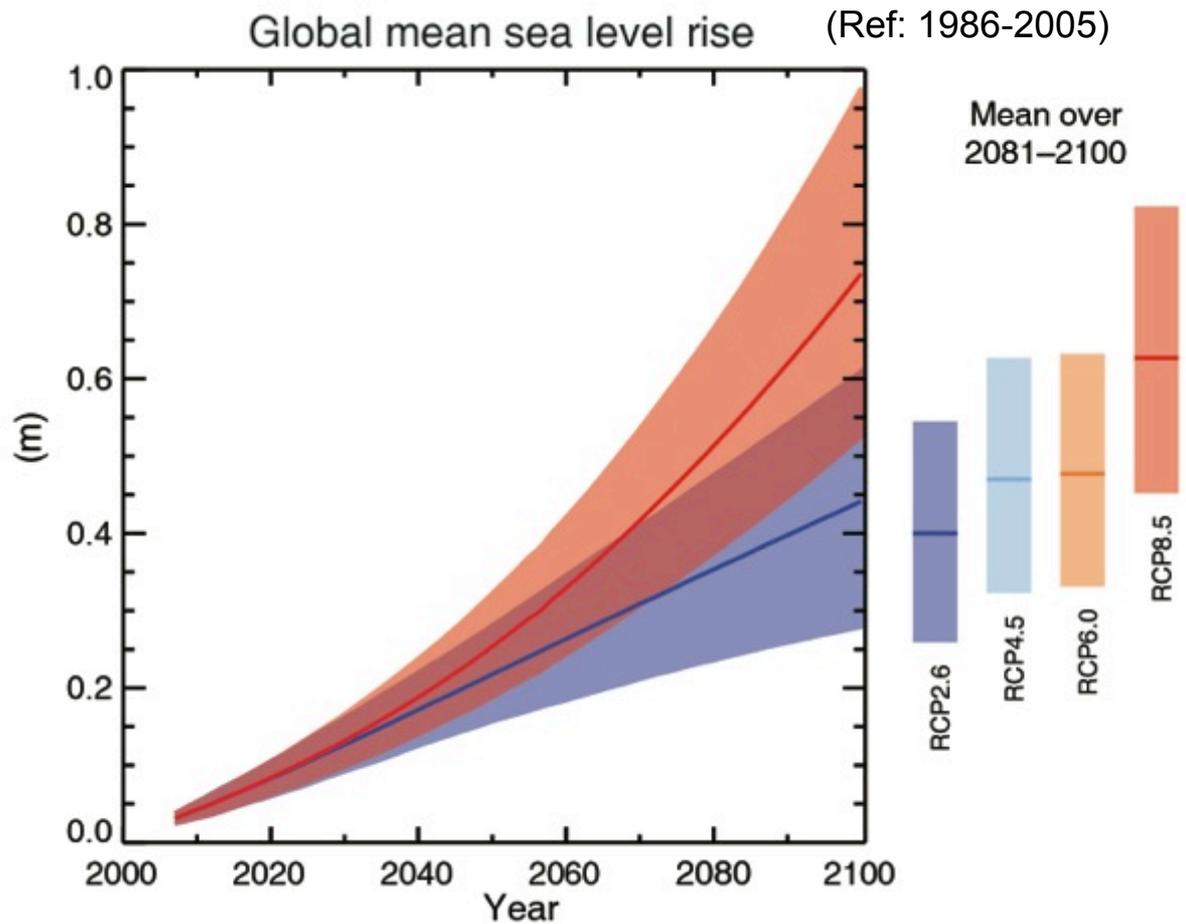


Annual rainfall projections



North Europe - Map of precipitation changes in 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)





(IPCC 2013, Fig. SPM.9)

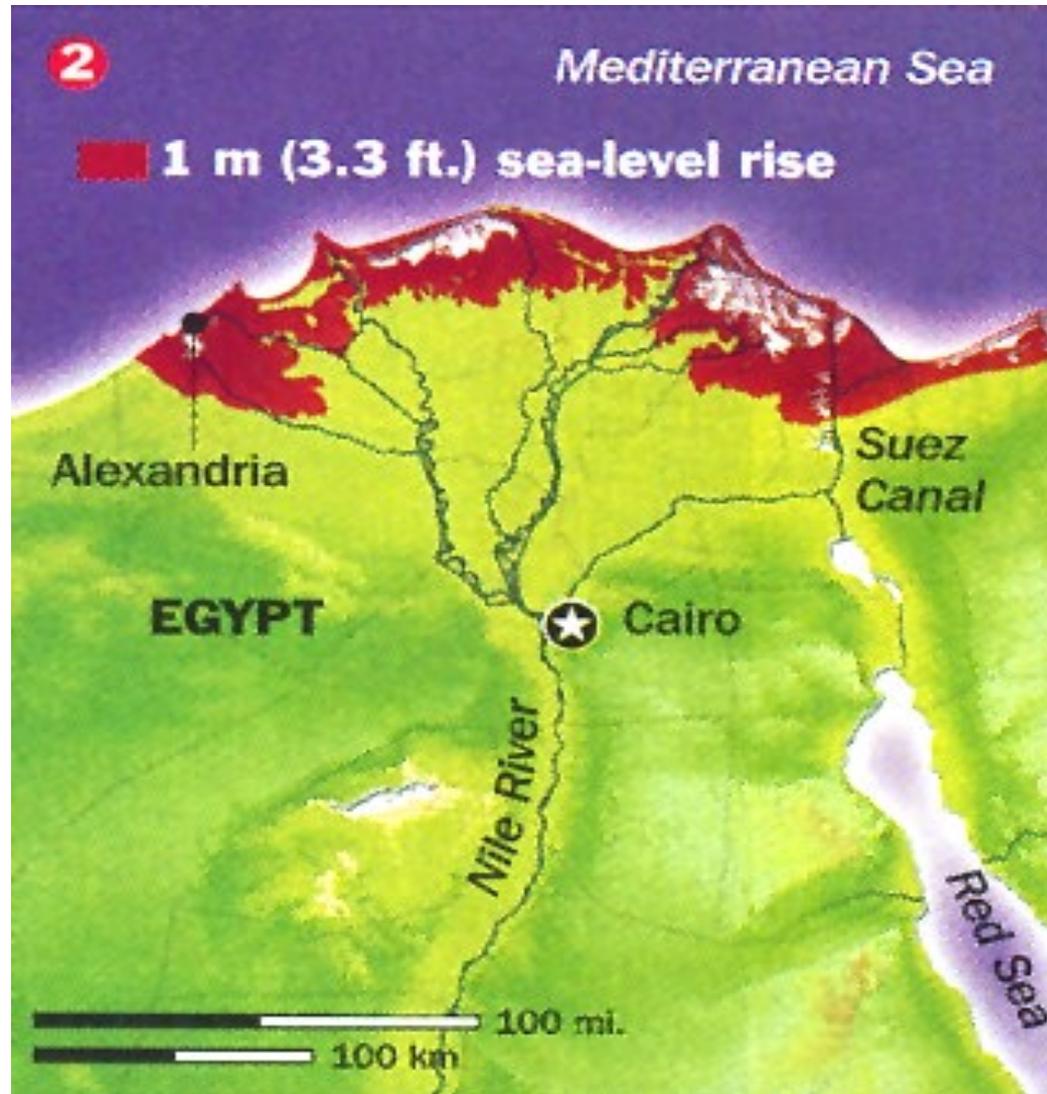
Sea level due to continue to increase

**With 1 metre sea-level rise: 63000 ha below sea-level in Belgium (likely in 22nd century, not impossible in 21st century)
(NB: flooded area depends on protection)**



Source: J.P. van Ypersele et P. Marbaix (2004) See www.climate.be/impacts

Effets sur le Delta du Nil, où vivent plus de 10 millions de personnes à moins d'1 m d'altitude



(Time 2001)

Impacts are already underway

- **Tropics to the poles**
- **On all continents and in the ocean**
- **Affecting rich and poor countries (but the poor are more vulnerable everywhere)**



AR5 WGII SPM

Potential Impacts of Climate Change



Food and water shortages



Increased displacement of people



Increased poverty



Coastal flooding

AR5 WGII SPM



ADAPTATION IS ALREADY OCCURRING

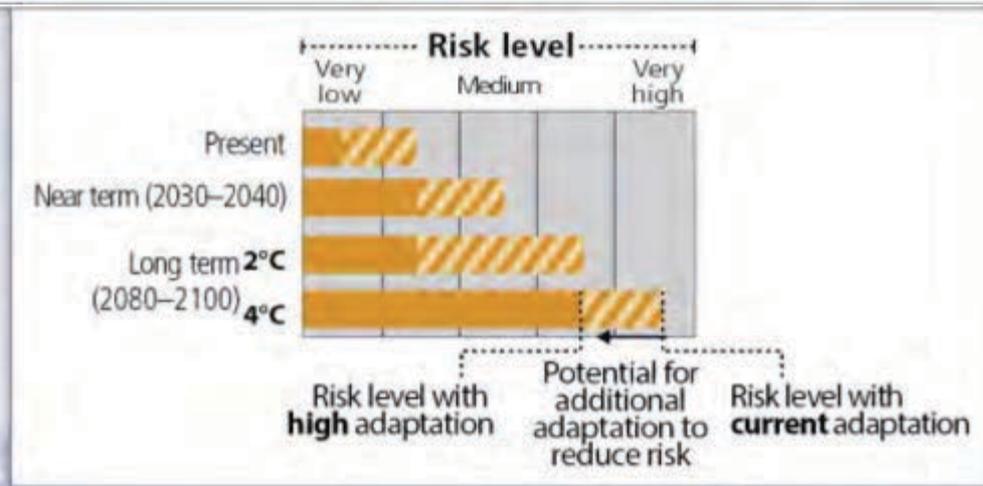
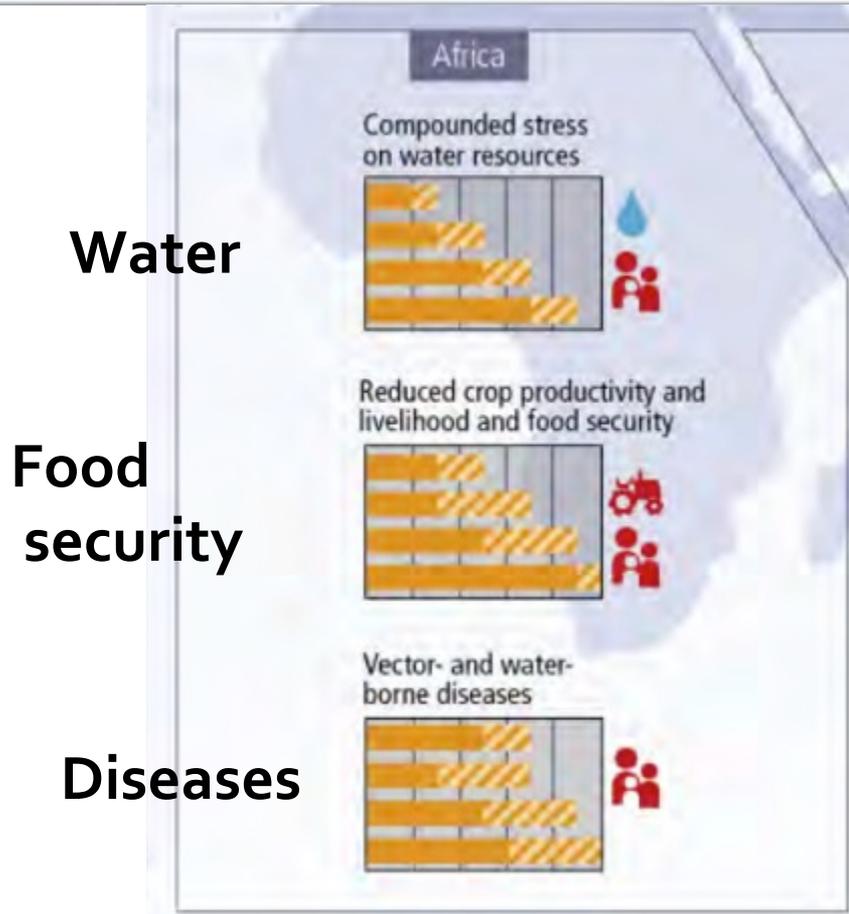
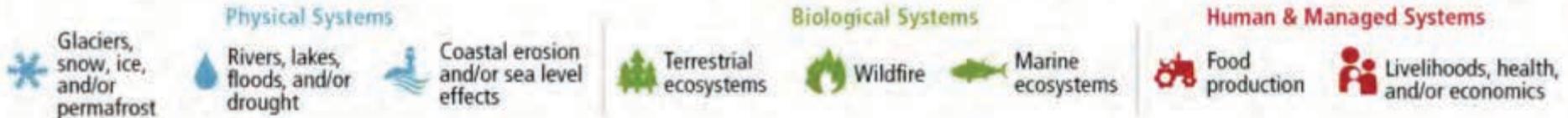
Flood risk adaptation in Bangladesh (example): cyclone shelters, awareness raising, forecasting and warning



photo: Dr Thorsten Klose/German Red Cross (2010), evaluation of the Community Based Disaster Preparedness Programme run by the Red Cross in 1996-2002

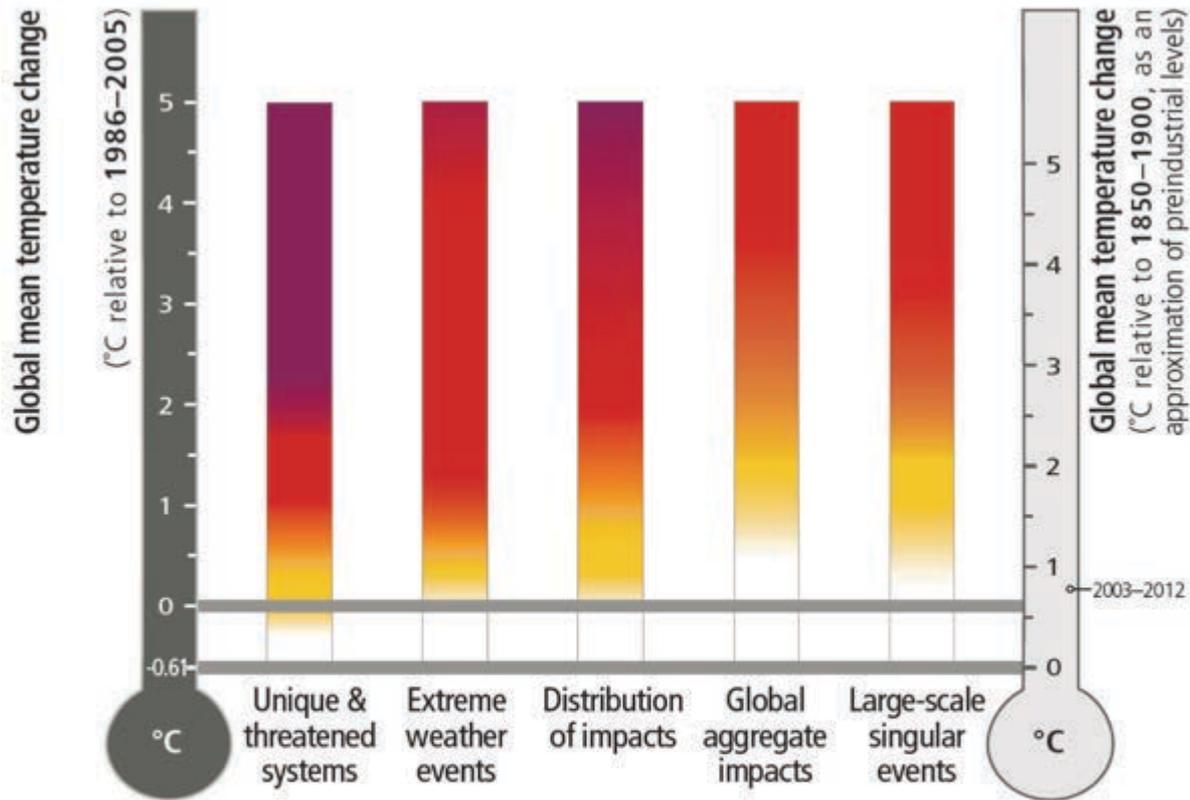
Regional key risks and risk reduction through adaptation

Representative key risks for each region for

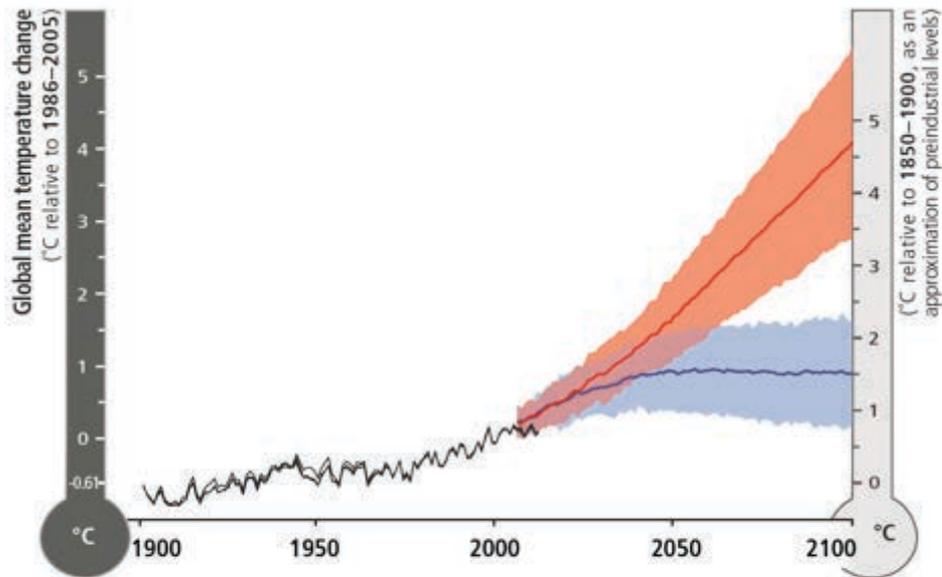




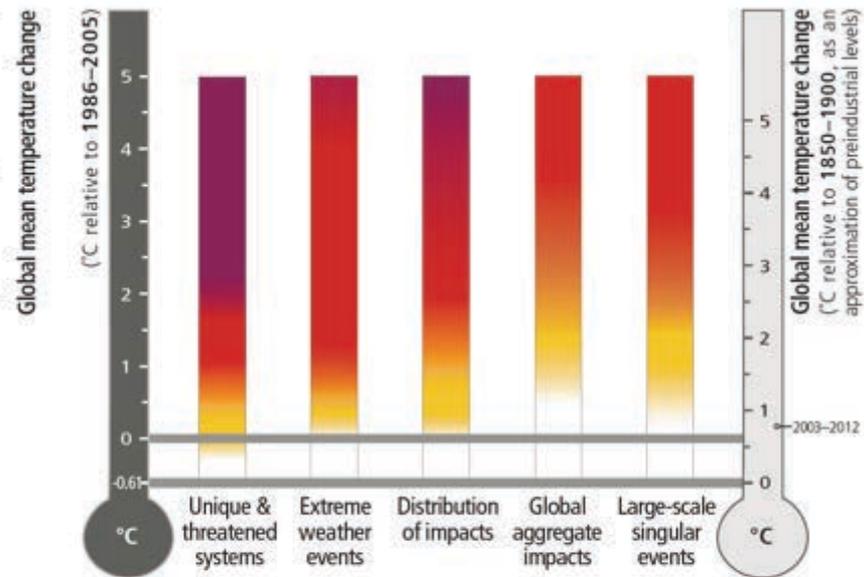
RISKS OF
CLIMATE CHANGE
INCREASE
WITH CONTINUED
HIGH EMISSIONS

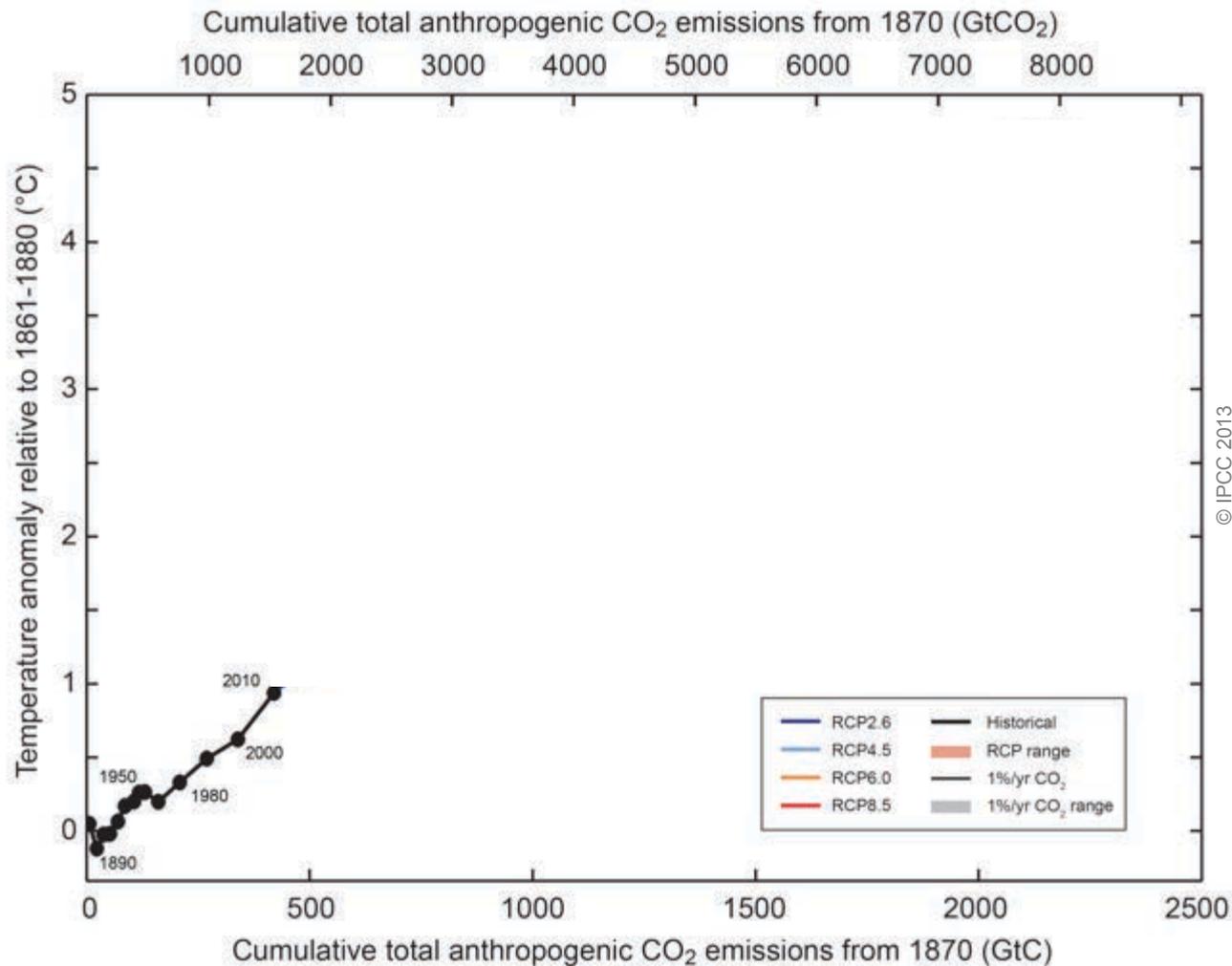


AR5, WGII, Box SPM.1 Figure 1



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





© IPCC 2013

Fig. SPM.10

Cumulative emissions of CO₂ largely determine global mean surface warming by the late 21st century and beyond.

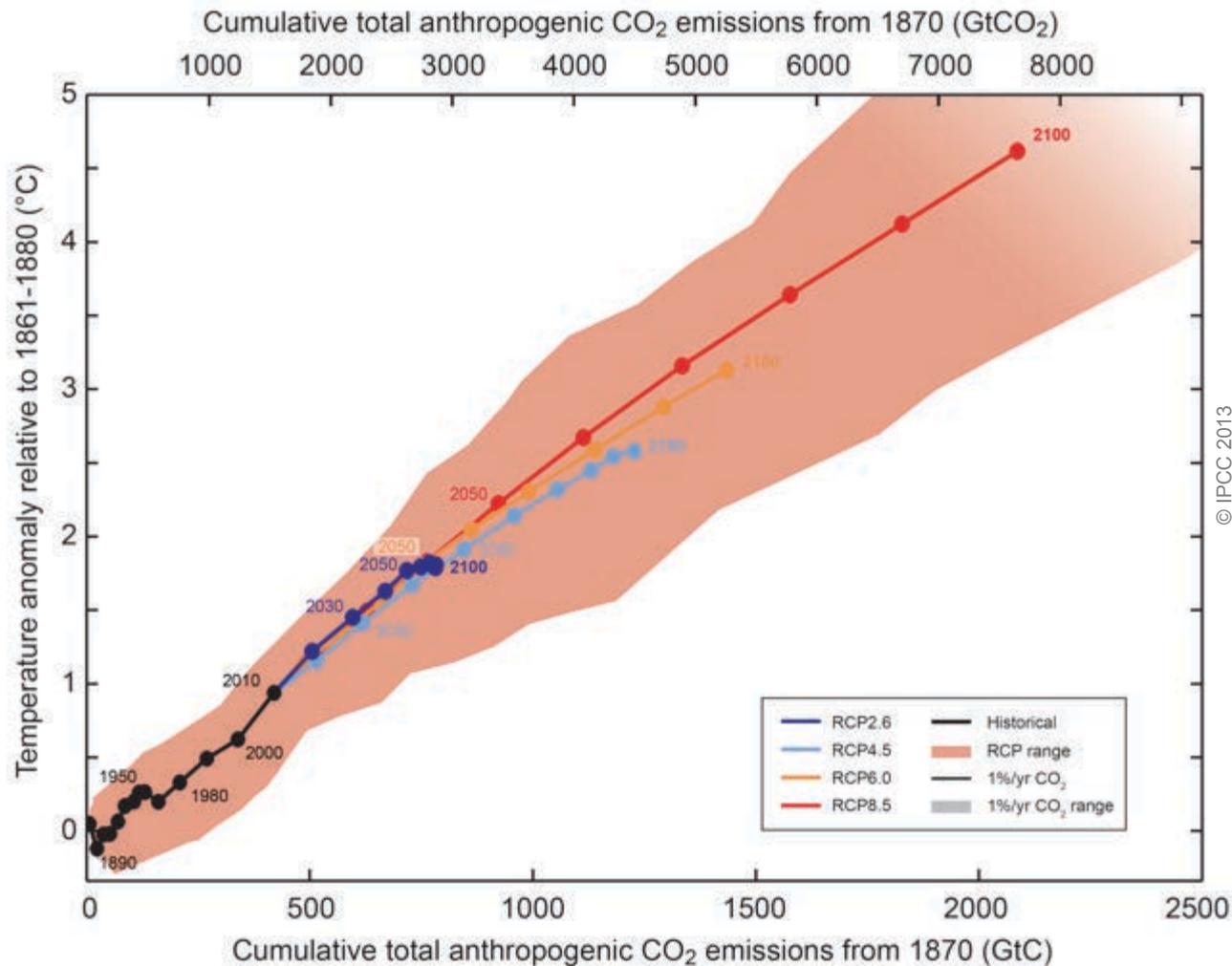
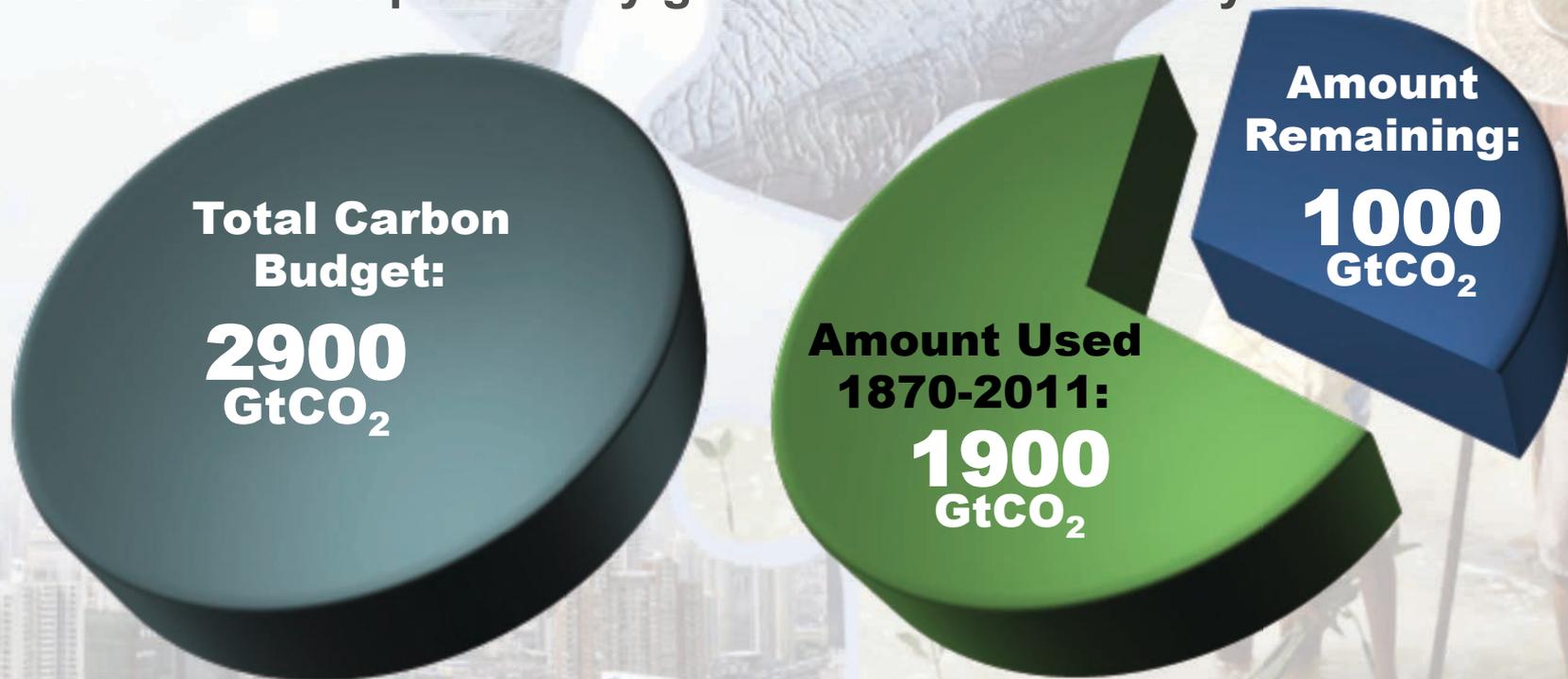


Fig. SPM.10

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

The window for action is rapidly closing

65% of the carbon budget compatible with a 2°C goal is already used
NB: this is with a probability greater than 66% to stay below 2°C



NB: Emissions in 2011: 38 GtCO₂/yr

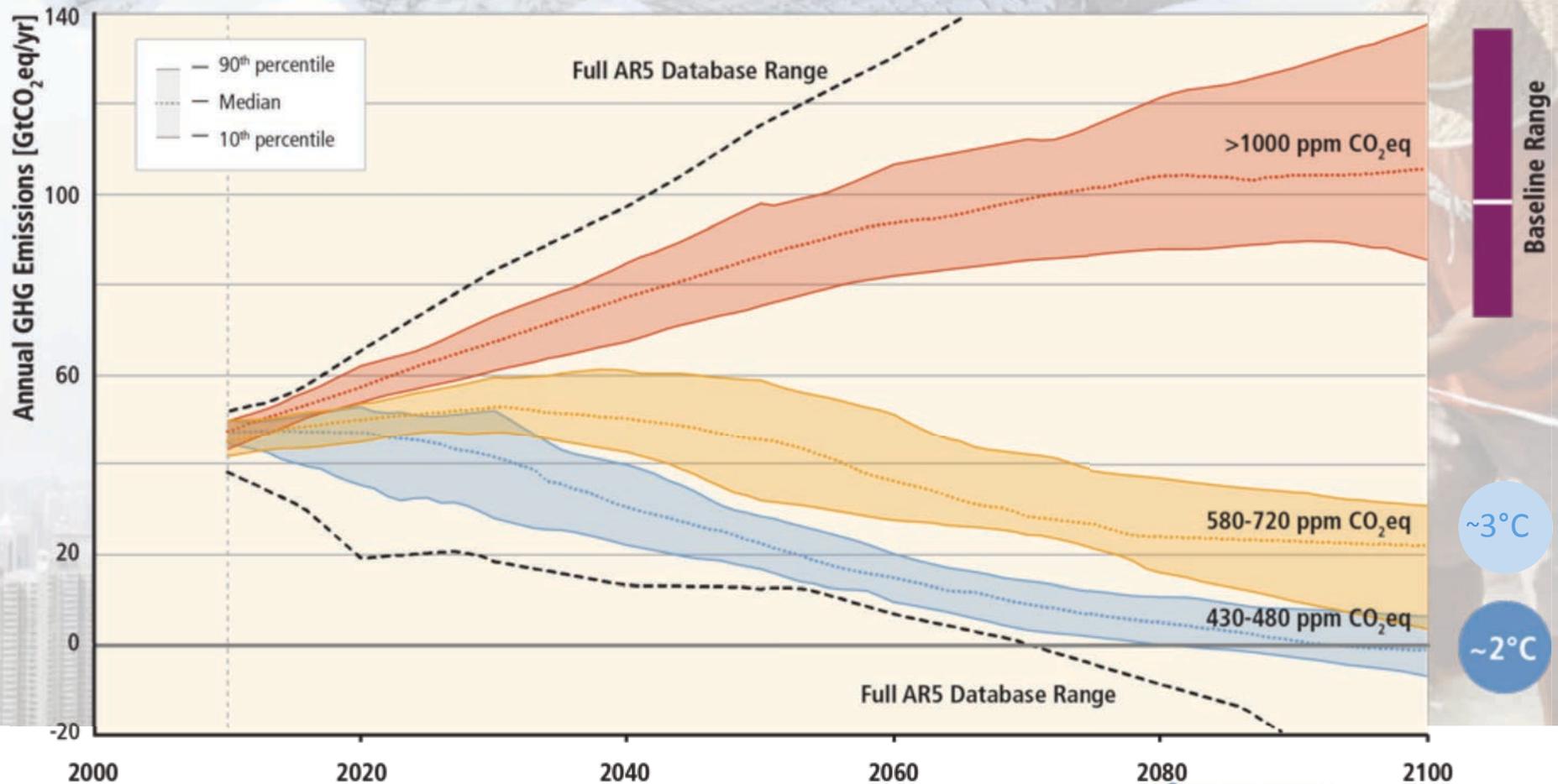
AR5 WGI SPM

Historical Responsibility

International cooperation on climate change involves ethical considerations, including equitable effort-sharing.

These questions include how much overall mitigation is needed to avoid **'dangerous interference with the climate system'**, how the effort or **cost of mitigating climate change should be shared among countries** and between the present and future, how to account for such factors as **historical responsibility for GHG emissions**, and how to choose among alternative policies for mitigation and adaptation. Ethical issues of well-being, **justice**, fairness, and rights are all involved. Ethical analysis can identify the different ethical principles that underlie different viewpoints, and distinguish correct from incorrect ethical reasoning.

Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.

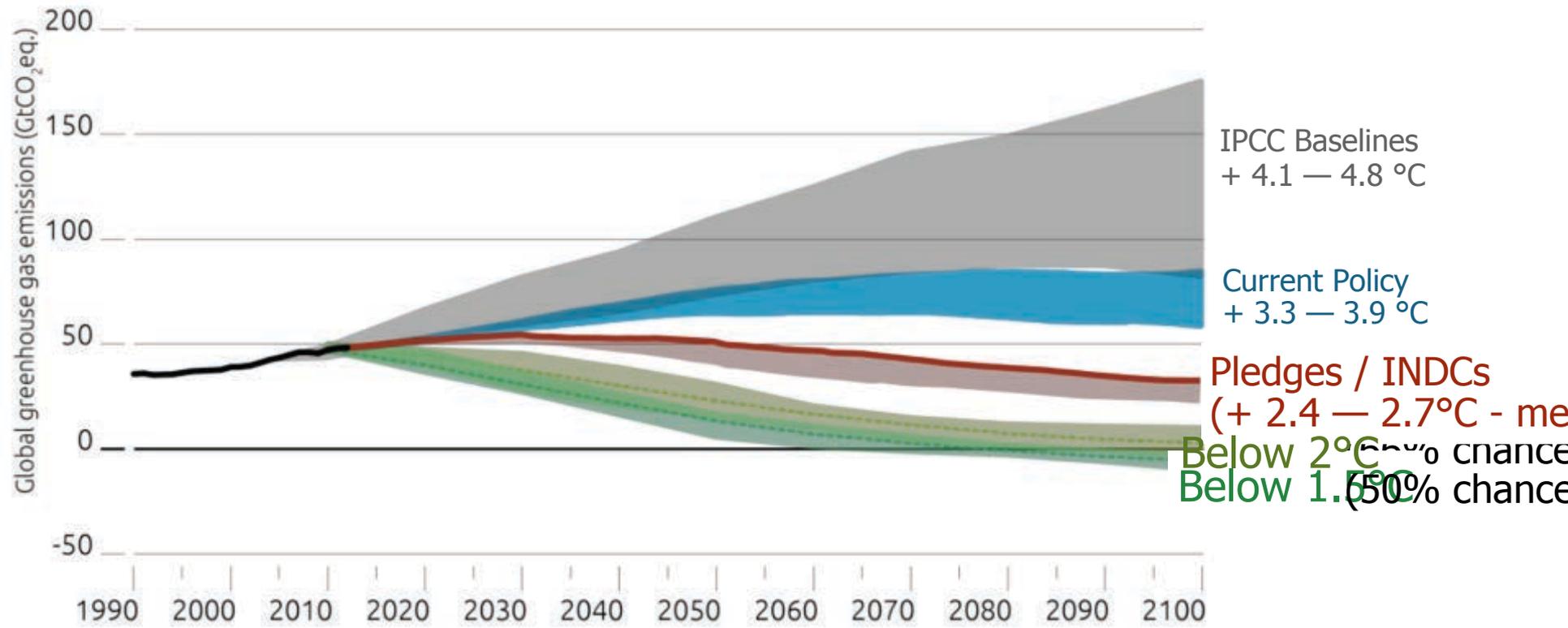


Based on Figure 6.7

Intended Nationally Determined Contributions

(INDCs)

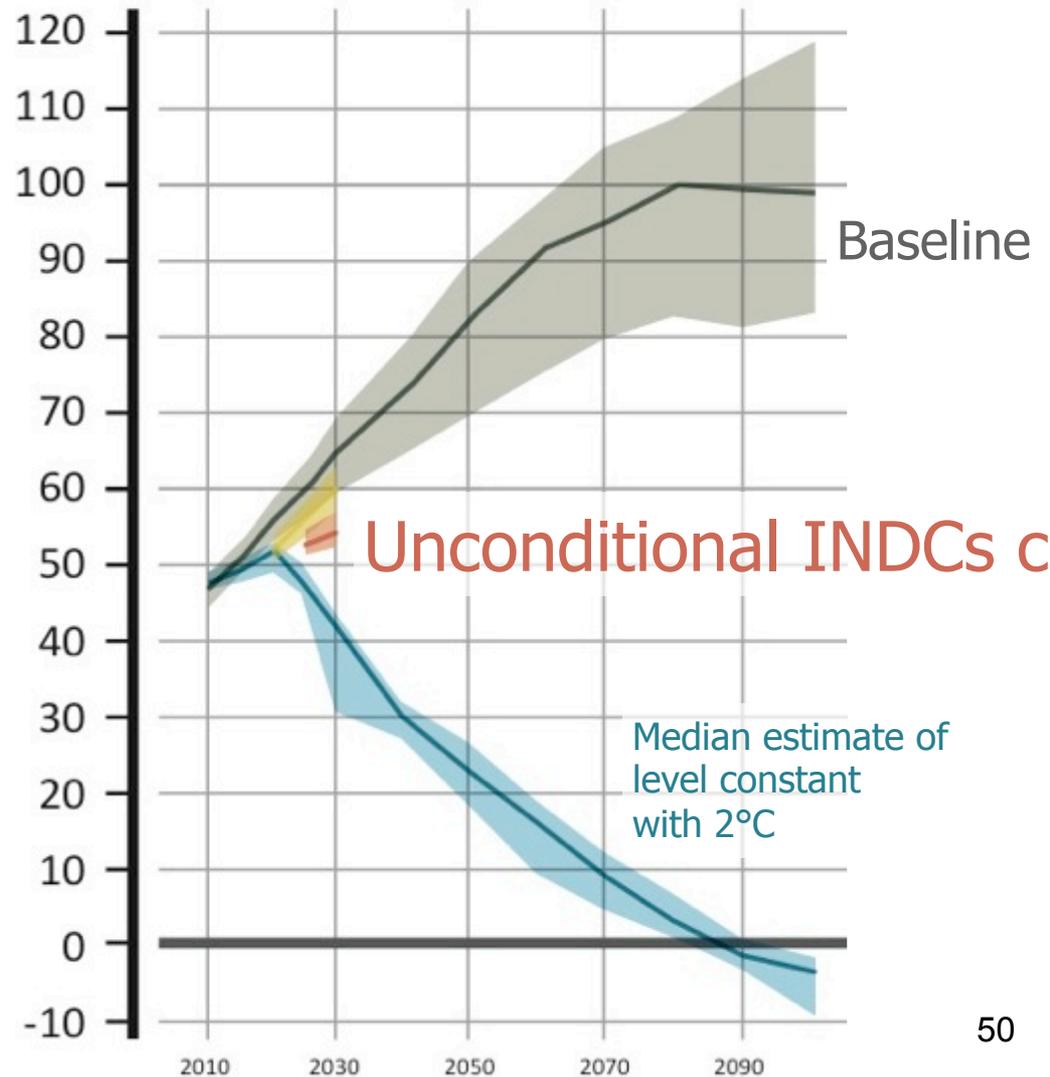
- Analysis from climateactiontracker.org (december 2015)



Intended Nationally Determined Contributions (INDCs)

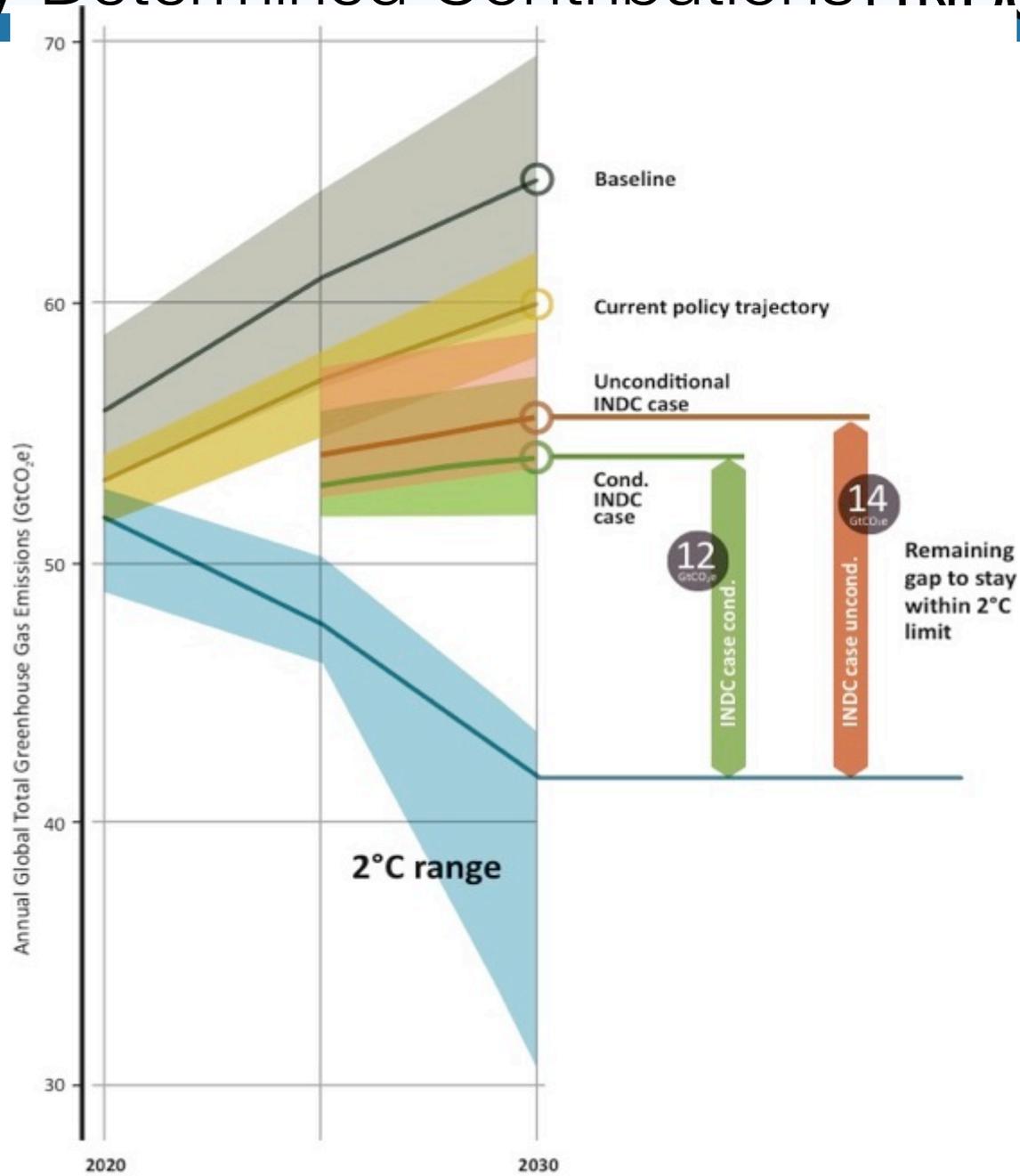
- UN emissions gap report

Annual Global Total Greenhouse Gas Emissions (GtCO₂e)

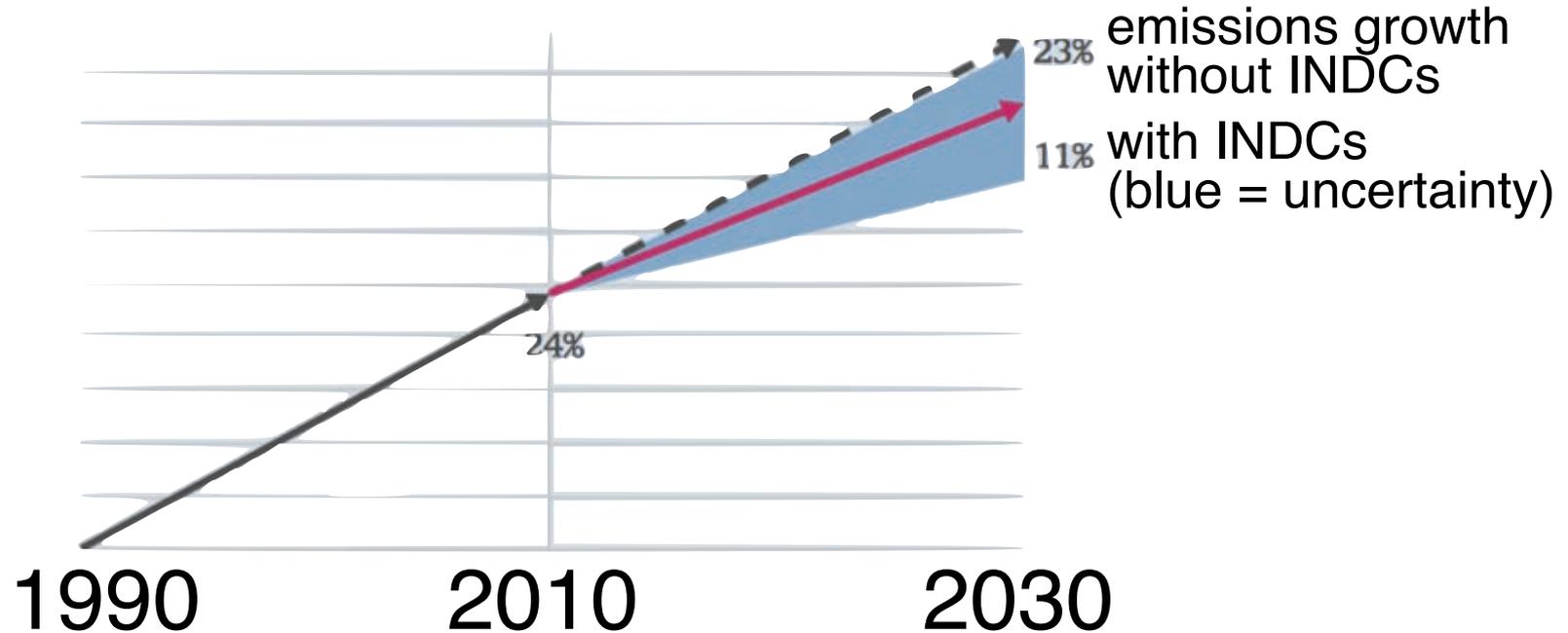


Intended Nationally Determined Contributions (INDCs)

- UN emissions gap report
- a « gap » of
 - ♦ 12 GtCO₂e if conditions set by some countries are met,
 - ♦ 14 GtCO₂e without those conditional contributions



INDCs: UNFCCC's Synthesis Report



- Slow down of emissions growth due to INDCs:
 - ♦ With the INDCs, emissions are expected to equal ~54% by 2025 and 75% by 2050 of the « carbon budget » since 2011 that would be consistent with 66% chances of $< 2^{\circ}\text{C}$

Source : UNFCCC, octob
http://unfccc.int/focus/indc_portal/item

Plan

- Y a du boulot !

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 CO₂-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 CO₂eq) 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.**

Mitigation Measures



More efficient use of energy



Greater use of low-carbon and no-carbon energy

- Many of these technologies exist today
- But worldwide investment in **research** in support of GHG mitigation is small...



Improved carbon sinks

- **Reduced deforestation** and improved forest management and planting of new forests
- **Bio-energy with carbon capture and storage**



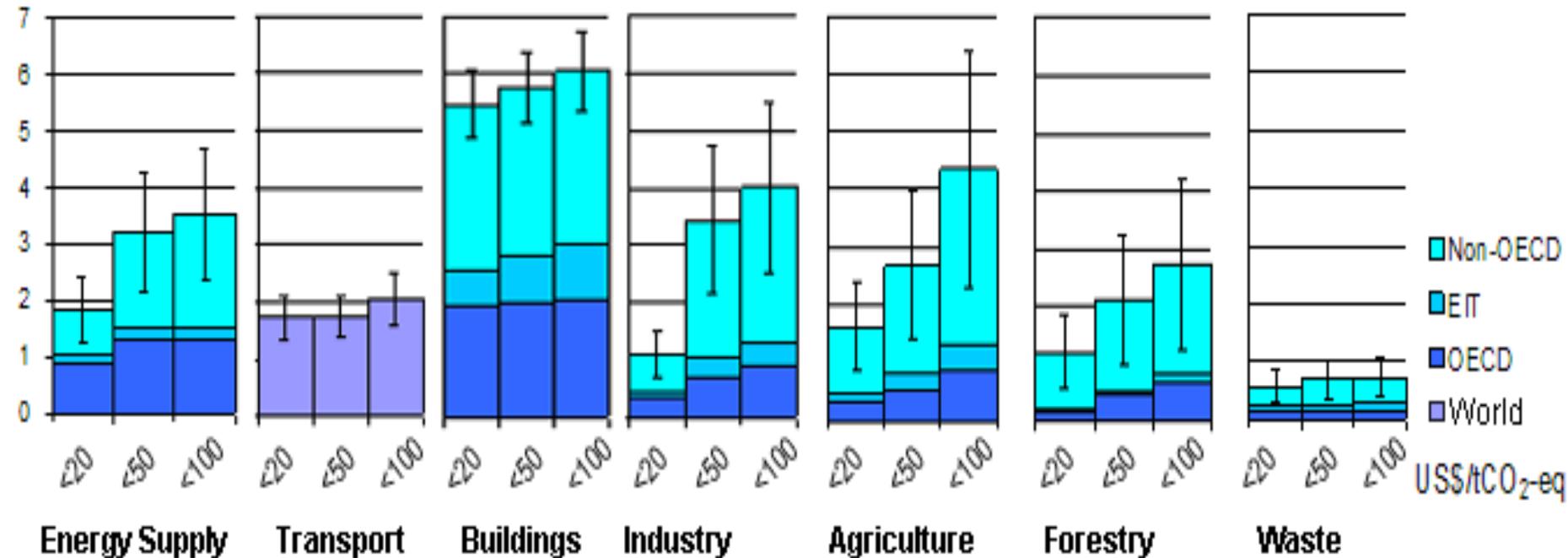
Lifestyle and behavioural changes

AR5 WGIII SPM

- **Mitigation requires major technological and institutional changes including the upscaling of low- and zero carbon energy (quadrupling from 2010 to 2050 for the scenario limiting warming below 2°C)**

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.

- **Substantial reductions in emissions would require large changes in investment patterns e.g., from 2010 to 2029, in billions US dollars/year:**

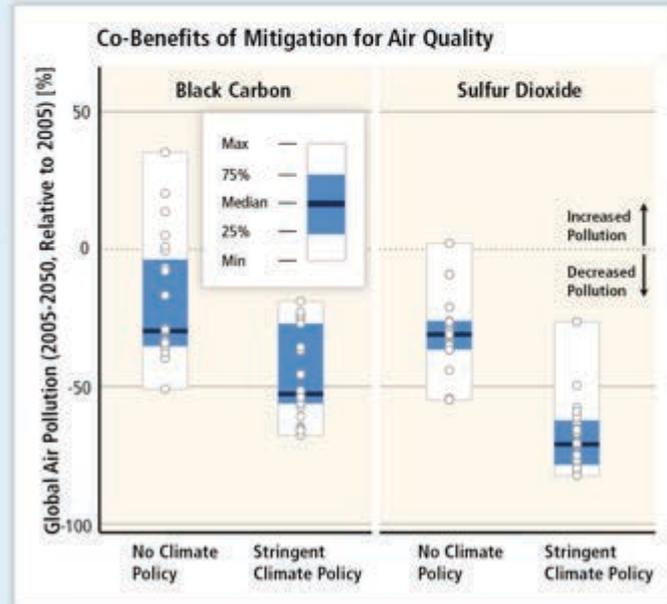
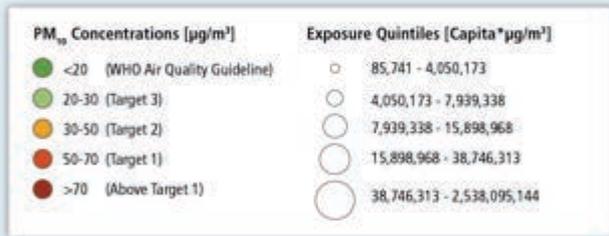
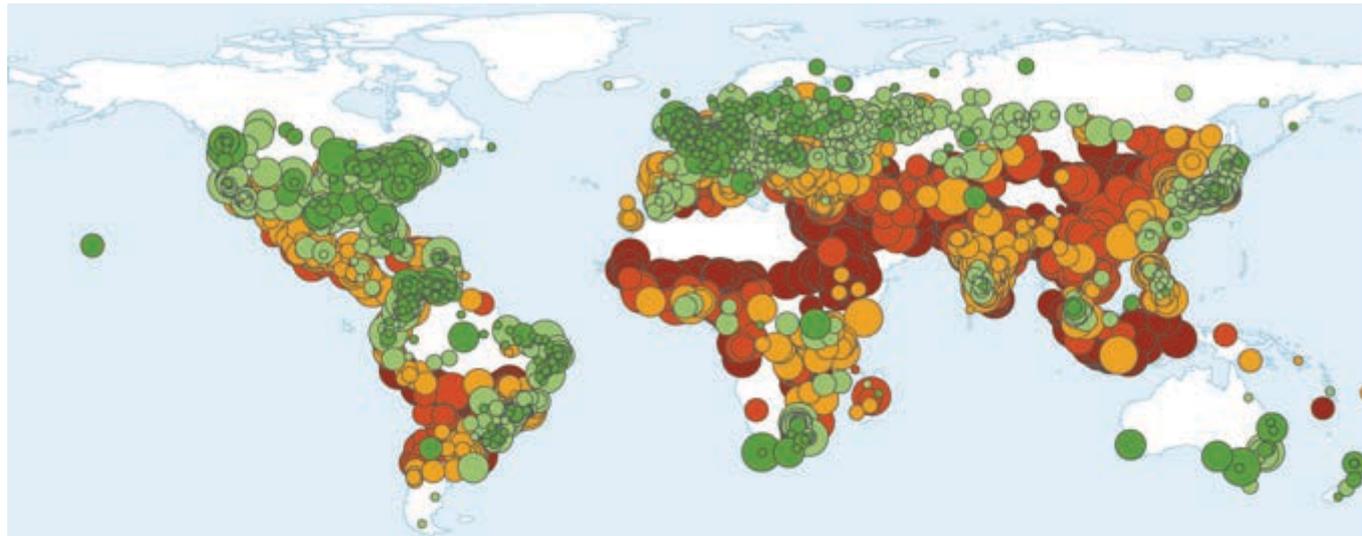
(mean numbers rounded, IPCC AR5 WGIII Fig SPM 9)

- **energy efficiency: +330**
- **renewables: + 90**
- **power plants w/ CCS: + 40**
- **nuclear: + 40**
- **power plants w/o CCS: - 60**
- **fossil fuel extraction: - 120**

An aerial photograph of a city, likely Hong Kong, showing a dense urban landscape with numerous high-rise buildings and a complex multi-level highway interchange in the foreground. The image is overlaid with a semi-transparent blue filter.

Delaying additional mitigation to 2030 will substantially increase the challenges associated with limiting warming over the 21st century to below 2°C relative to pre-industrial levels.

NB: Ambition *before* 2020 is essential as well (lock-in & entrainment effects)

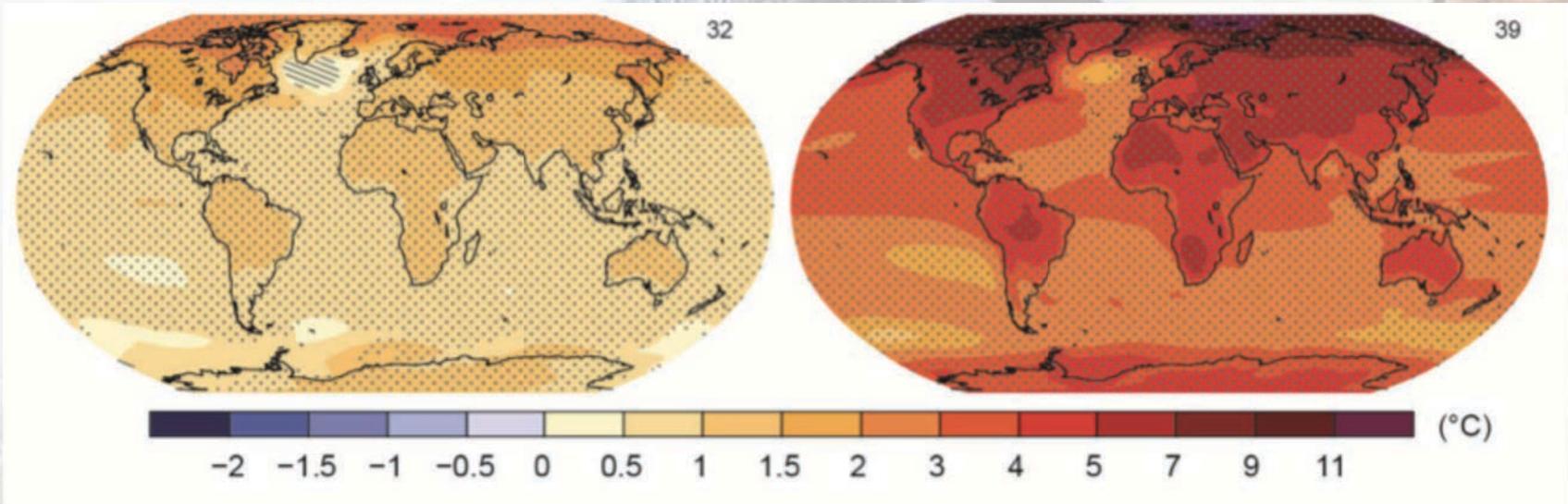


Mitigation can result in large co-benefits for human health and other societal goals.

The Choices Humanity Makes Will Create Different Outcomes (and affect prospects for effective adaptation)

With substantial mitigation

Without additional mitigation



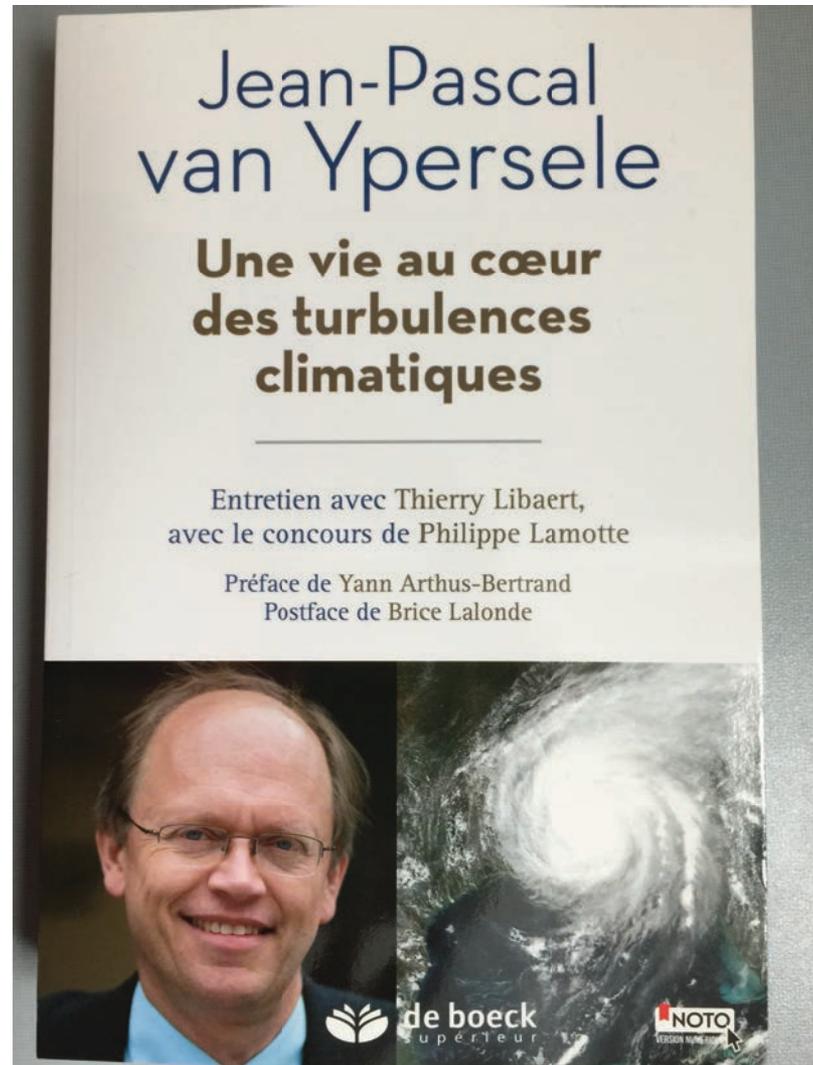
Change in average surface temperature (1986–2005 to 2081–2100)

AR5 WGI SPM

The Hidden IPCC Message:

- **If it's possible and not enough happens, what is lacking?**
- ***Political will, at the appropriate scale***

**Publié chez De Boeck
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E-book: 13 euros**





**Pier Vellinga, 2011:
Hoezo
klimaatverandering ,
Feiten, fabels en open
vragen, Uitgeverij
Balans.**

Useful links:

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