

The Challenge of Climate Change: Also an Opportunity

Jean-Pascal van Ypersele

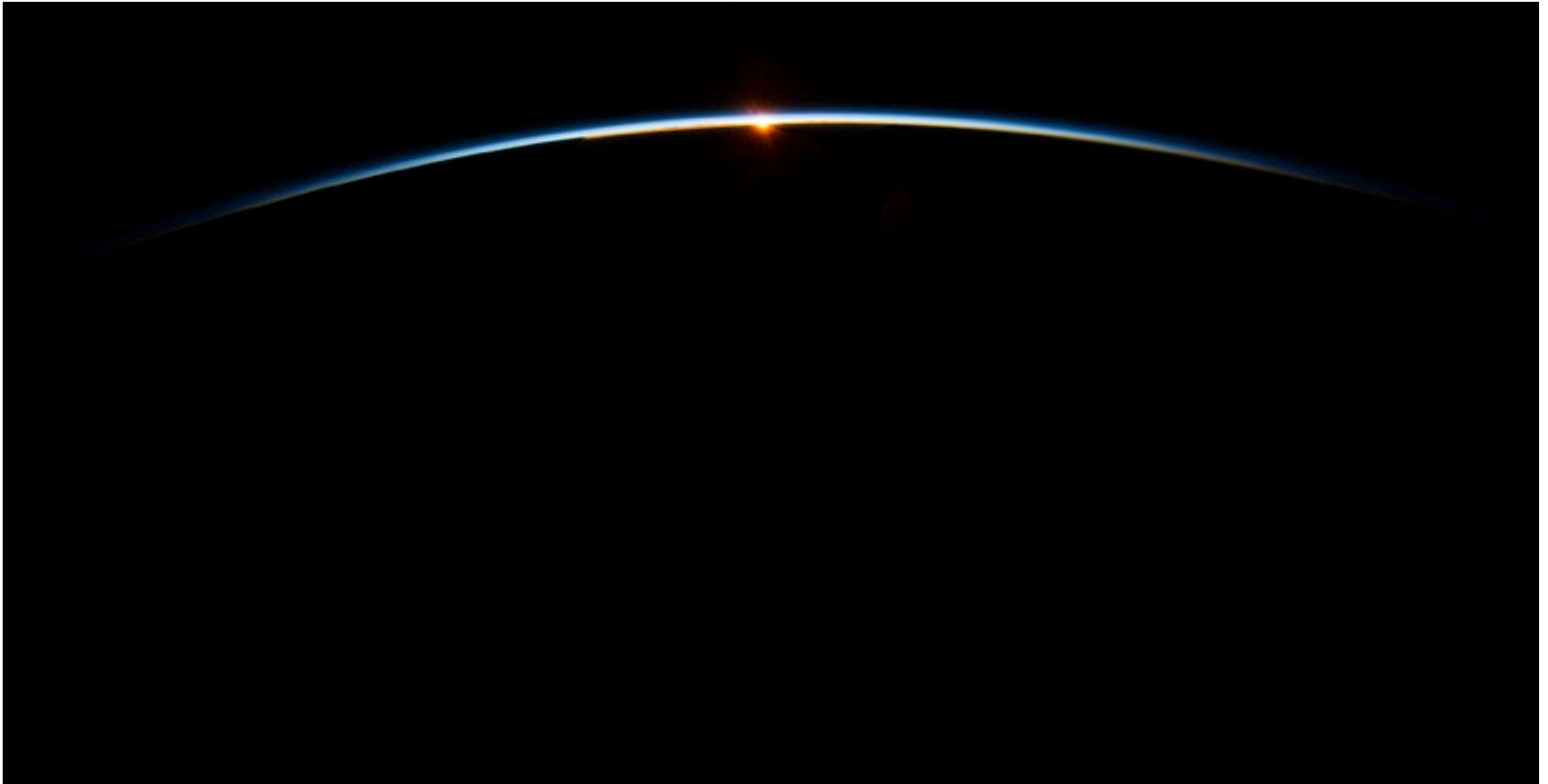
**(Université catholique de Louvain, Belgium)
Former IPCC Vice-Chair (2008--2015)**

Twitter: @JPvanYpersele

**25^e anniversaire de RDC Environnement, Bruxelles,
20 November 2017**

**Thanks to the Walloon Government (funding the Walloon Platform for IPCC)
and to my team at the Université catholique de Louvain for their support**

Our atmosphere is thin and fragile (as seen by ISS crew on 31 July 2013)



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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

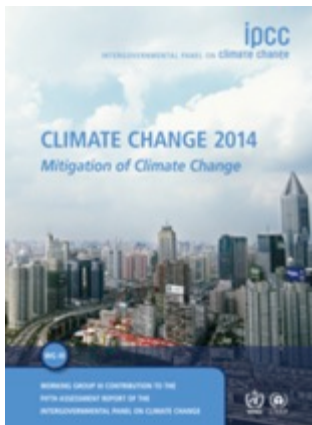




What is happening in the climate system?



What are the risks?

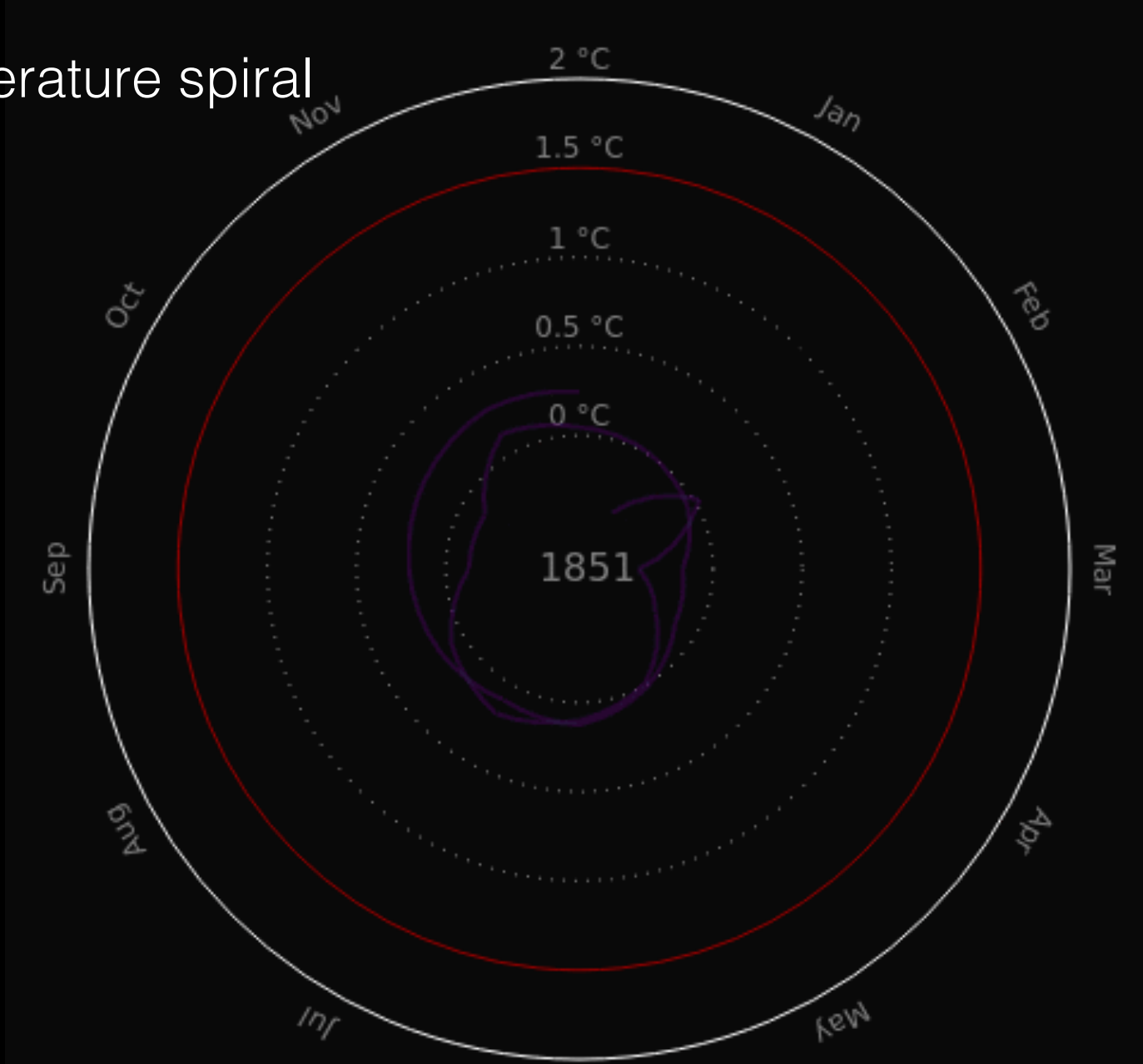


What can be done?

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**

Temperature spiral



Global Mean Temperature in °C relative to 1850 – 1900

Graph: Ed Hawkins (Climate Lab Book) – Data: HadCRUT4 global temperature dataset

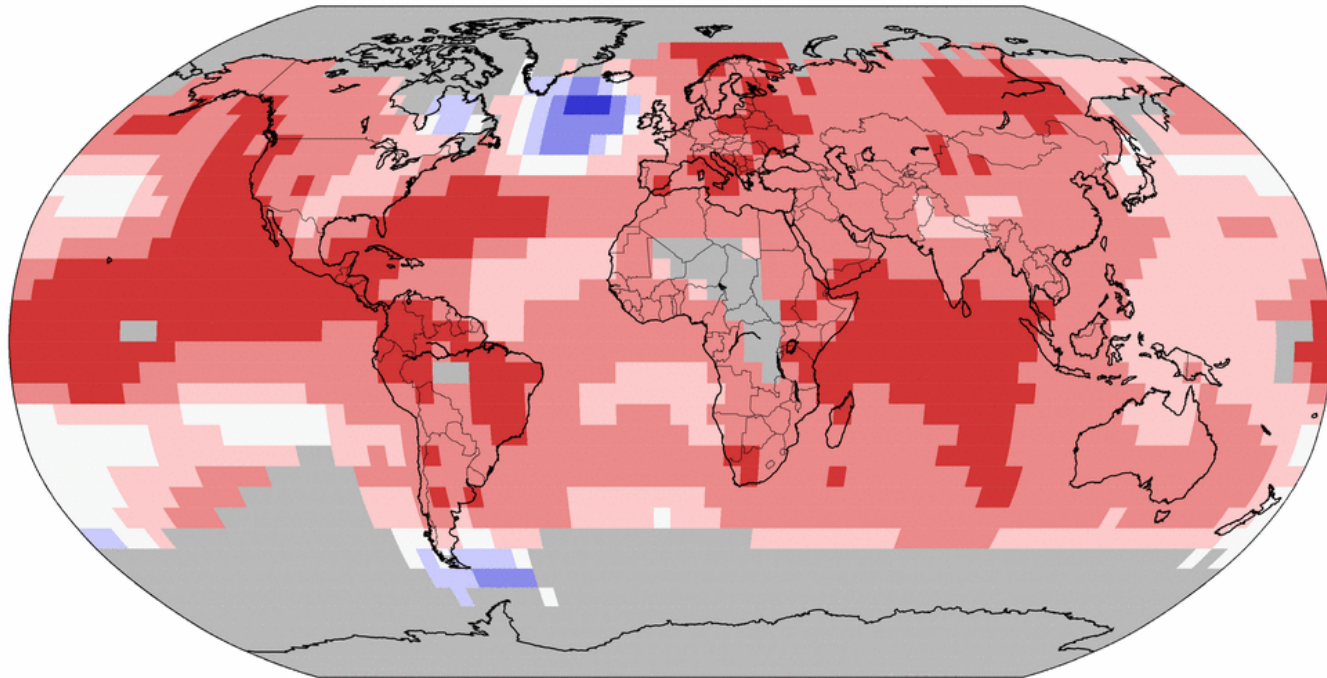
Available on <http://openclimatedata.net/climate-spirals/temperature>

2014, 2015, 2016= warmest years since 1880

Land & Ocean Temperature Percentiles Jan–Dec 2015

NOAA's National Centers for Environmental Information

Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0




Record
Coldest


Much
Cooler than
Average


Cooler than
Average


Near
Average


Warmer than
Average


Much
Warmer than
Average


Record
Warmest



Wed Jan 13 12:15:02 EST 2016

Plateau Glacier (1961) (Alaska)



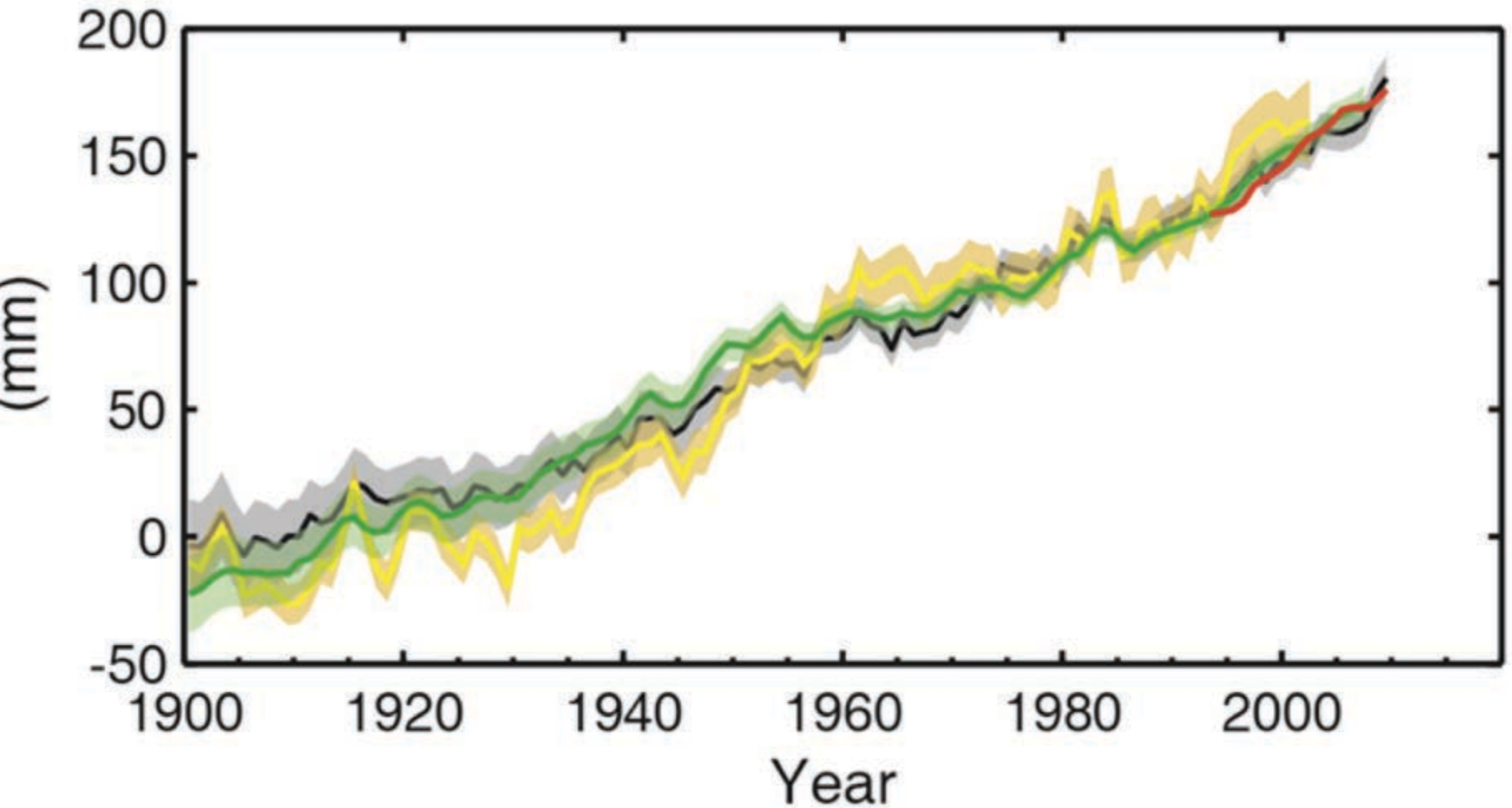
http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Plateau Glacier (2003) (Alaska)

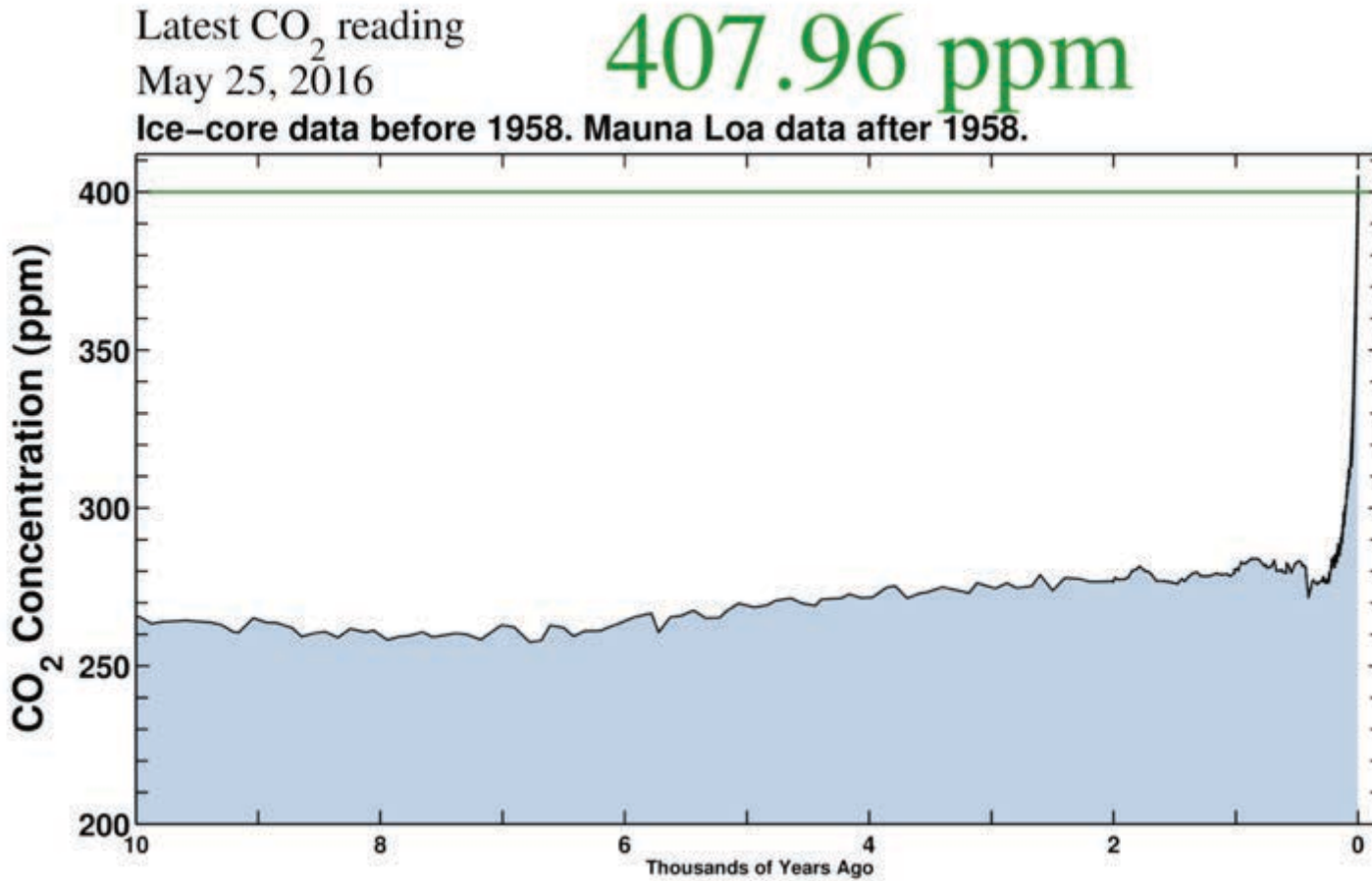


http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Change in average sea-level change

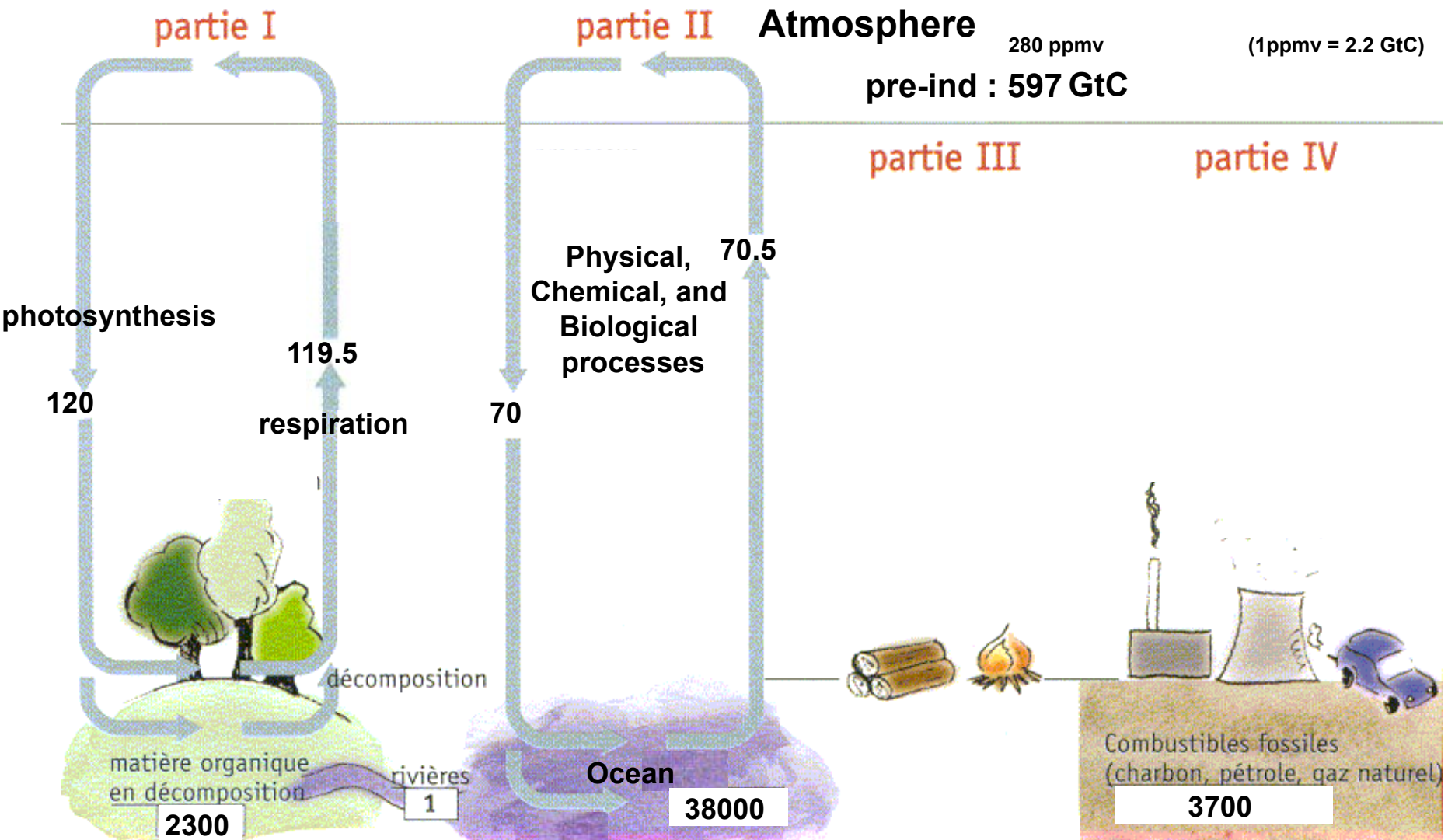


CO₂ Concentration, 25 May 2016 (Keeling curve)



Source: scripps.ucsd.edu/programs/keelingcurve/

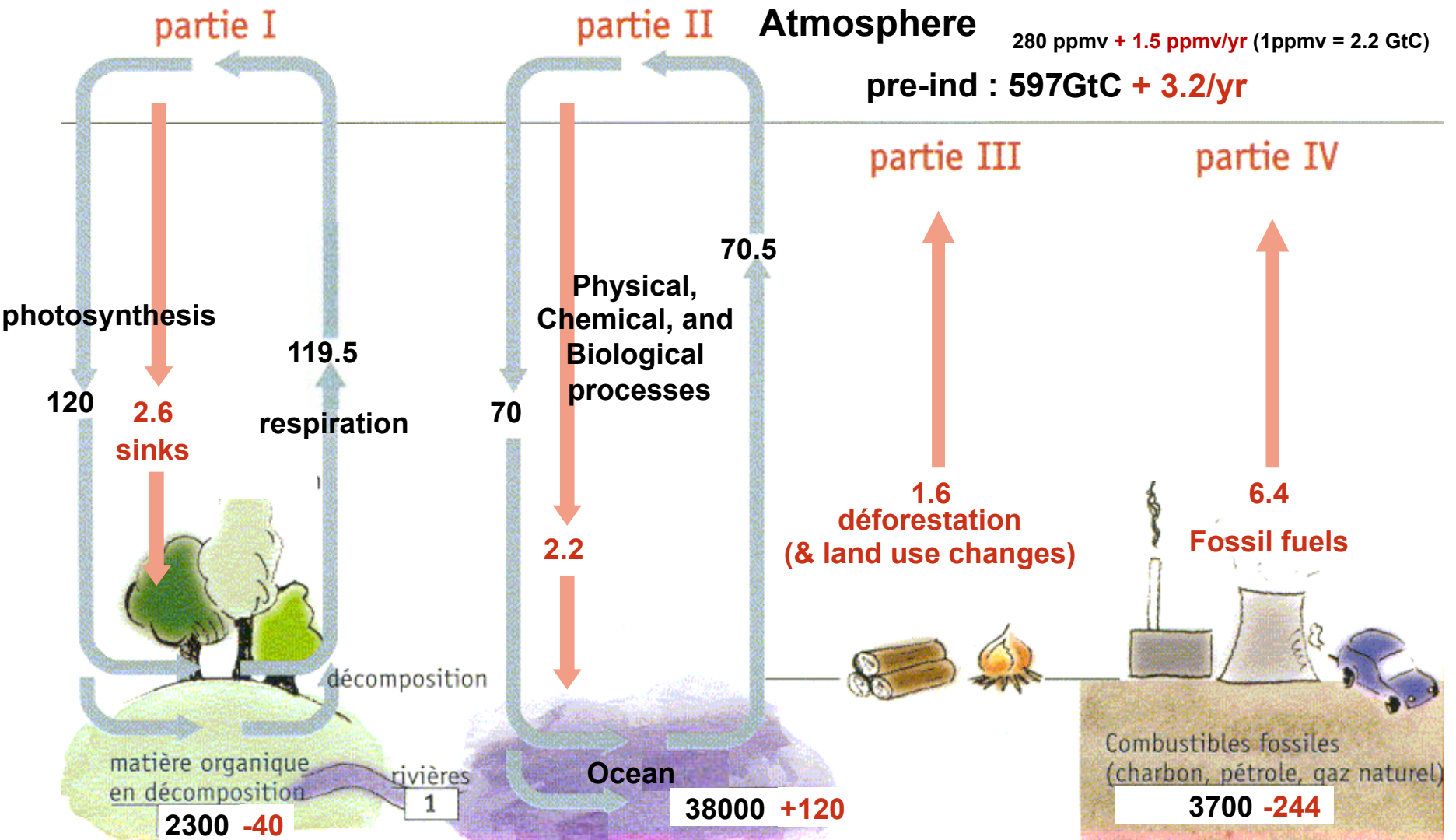
Carbon cycle: unperturbed fluxes



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!

A Progression of Understanding: Greater and Greater Certainty in Attribution

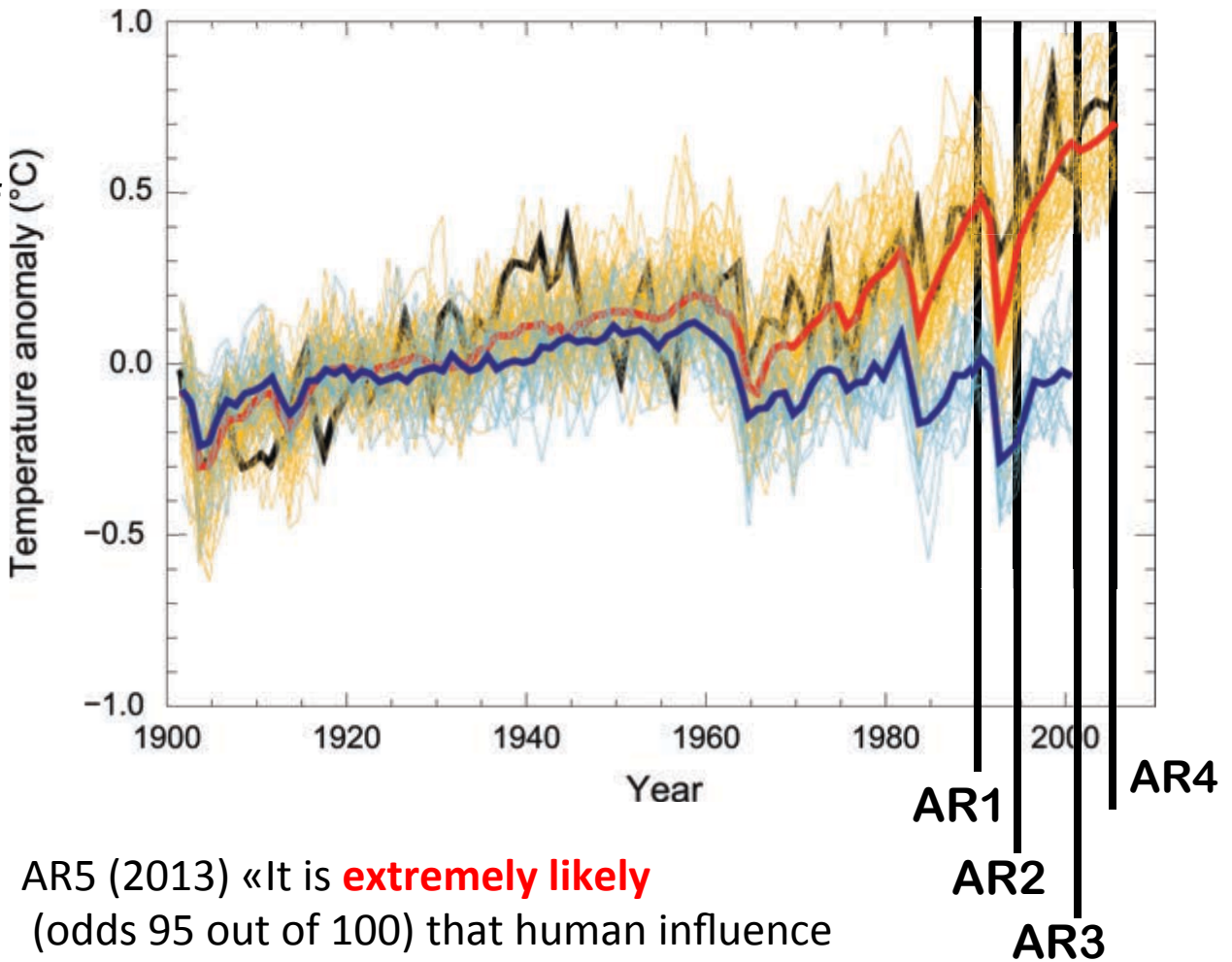
AR1 (1990):

“unequivocal detection not likely for a decade”

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

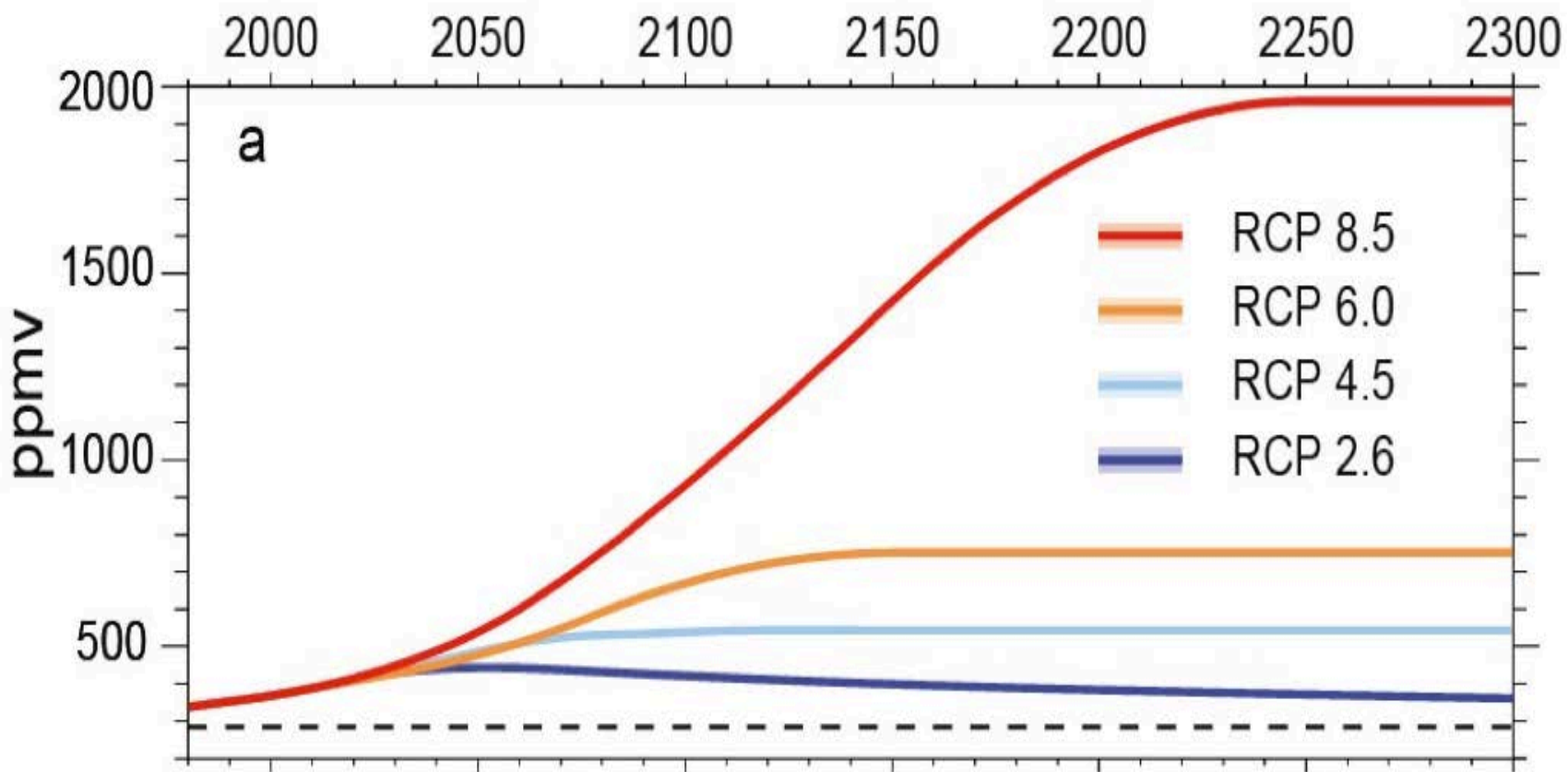
AR3 (2001): “most of the warming of the past 50 years is **likely** (odds 2 out of 3) due to human activities”

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



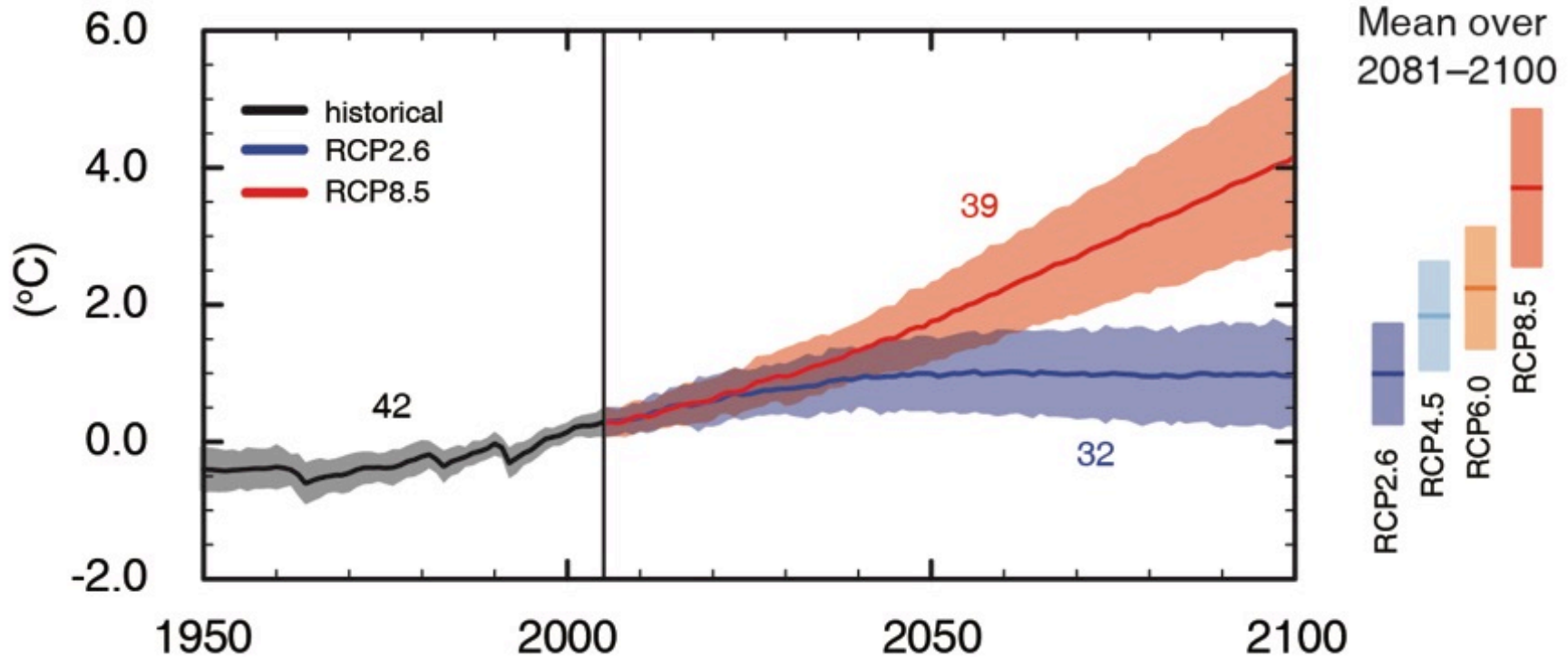
AR5 (2013) «It is **extremely likely** (odds 95 out of 100) that human influence has been the dominant cause... »

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

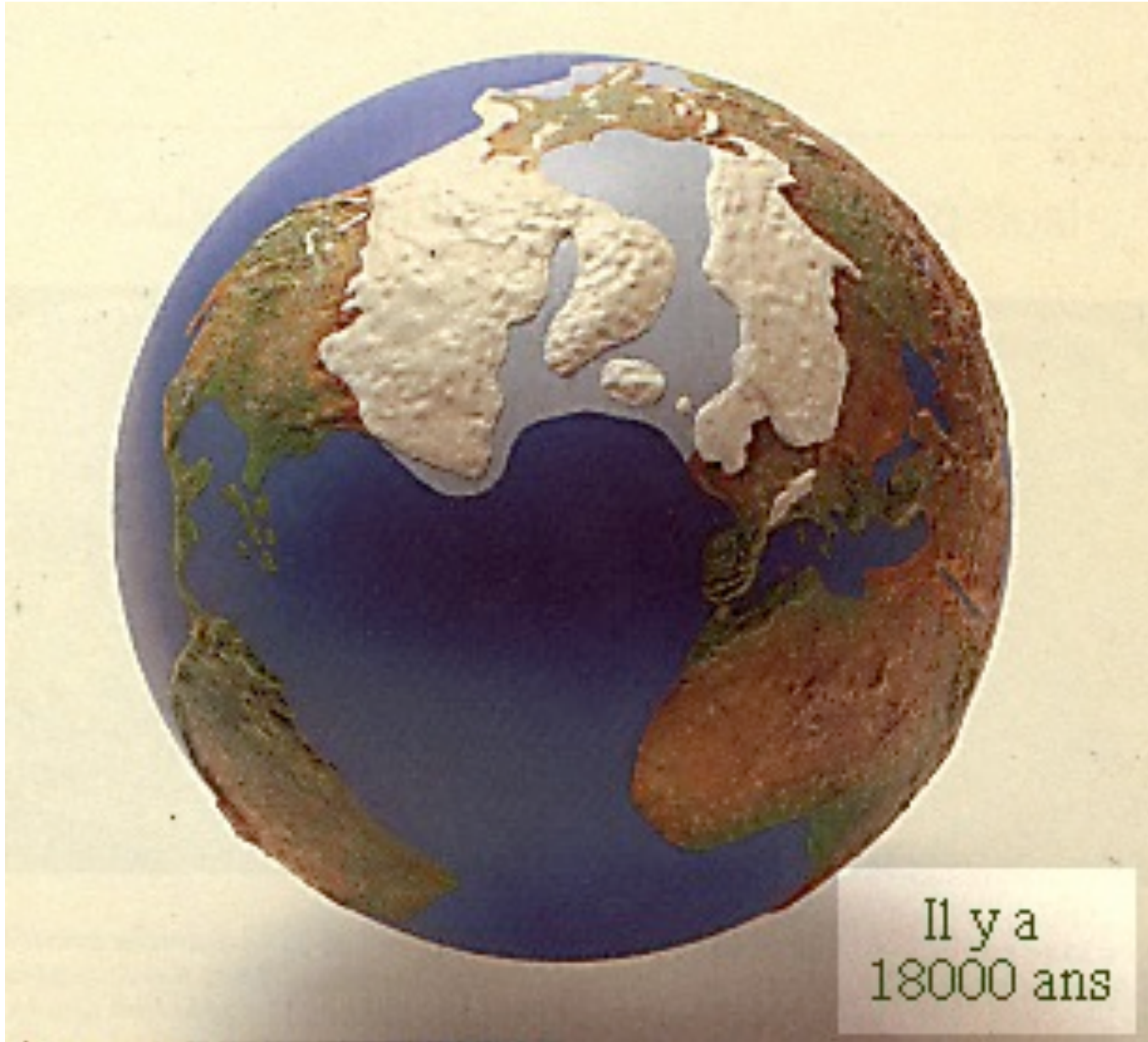


(IPCC 2013, Fig. SPM.7a)

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. Joussaume, in « Climat d'hier à demain », CNRS éditions.

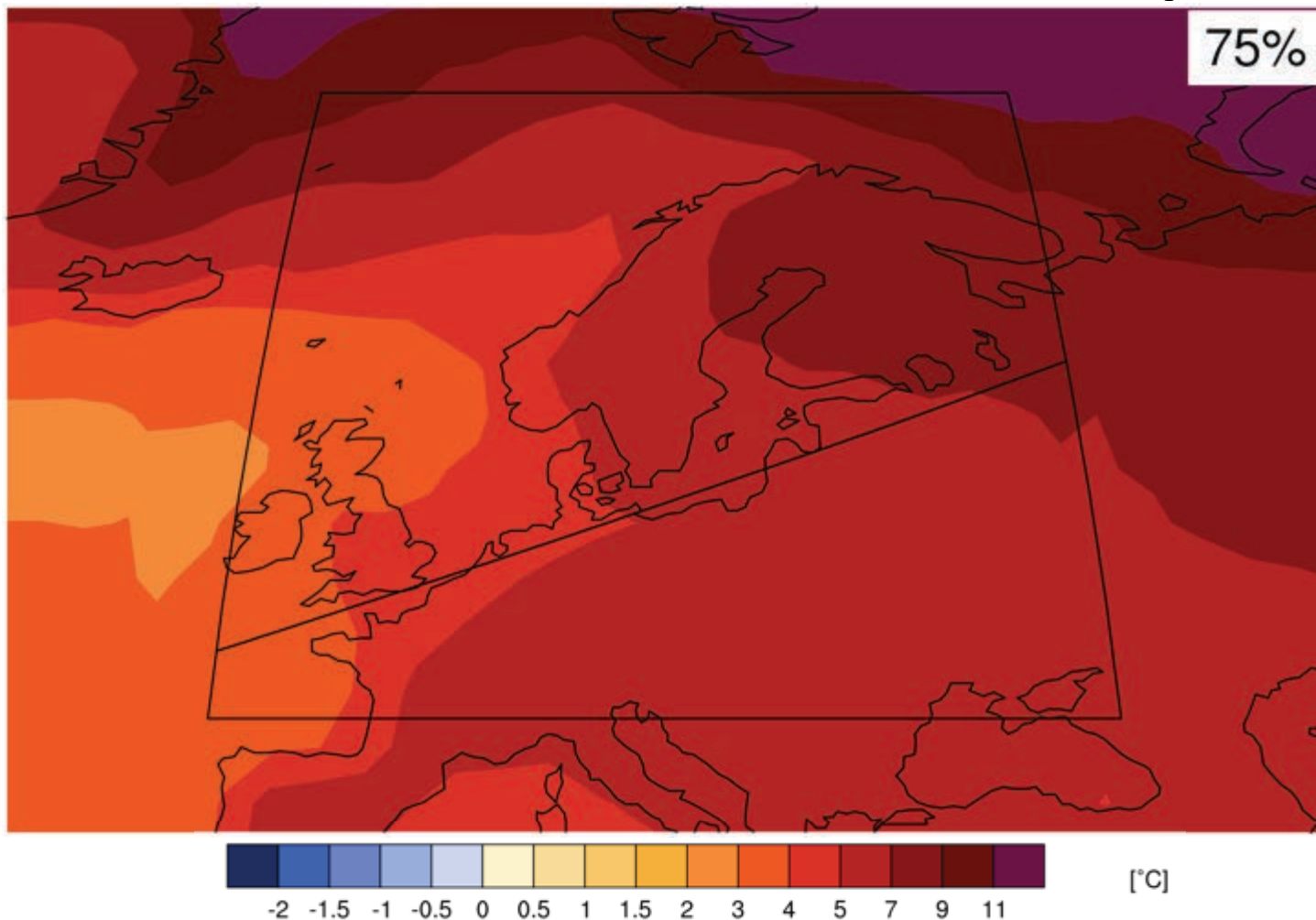


Today, with +4-5°C globally

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



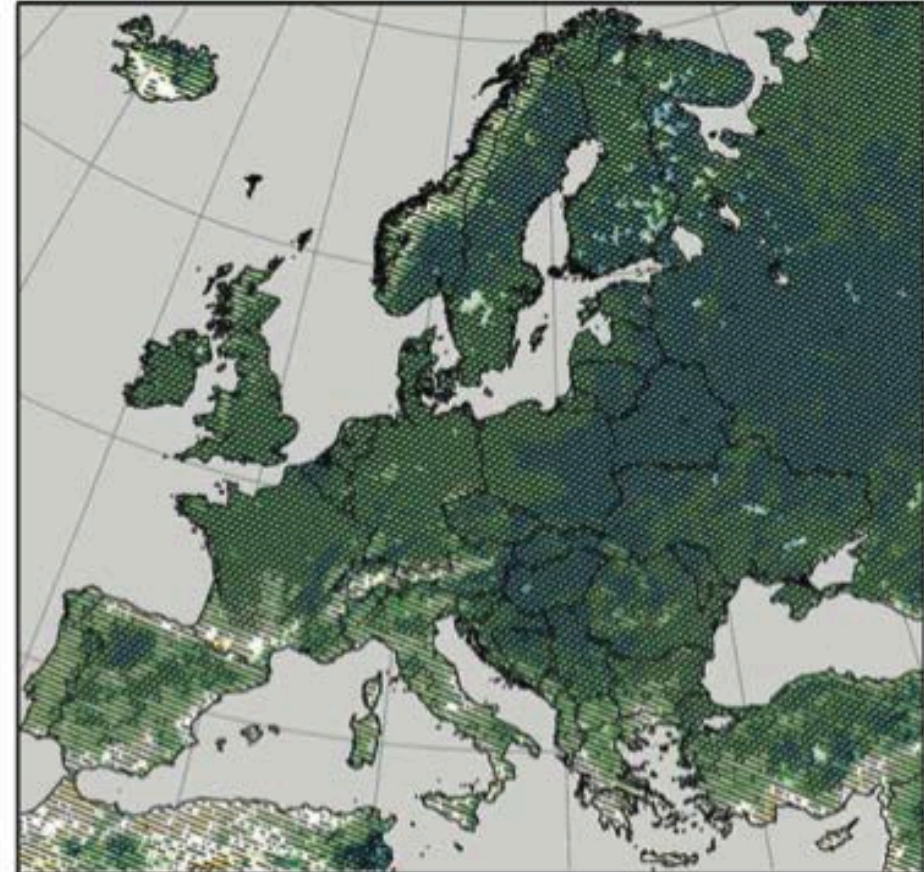
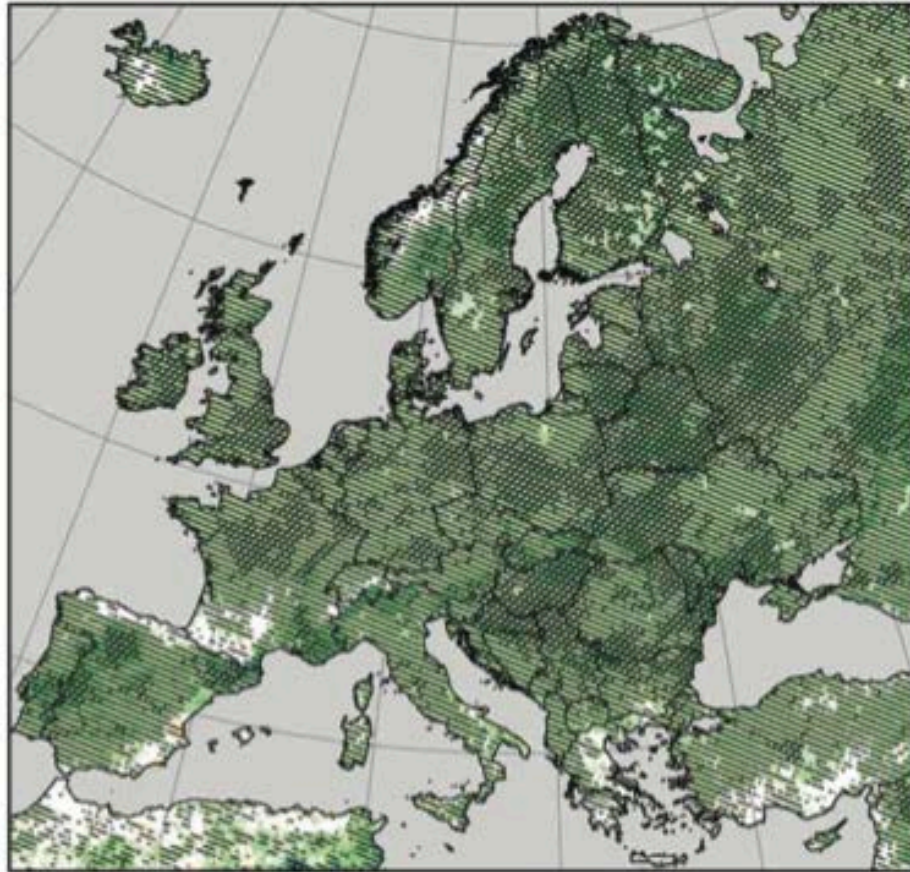
North Europe - Map of temperature changes: 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)



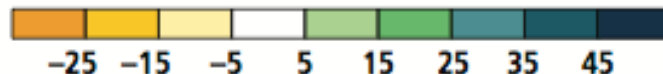
DJF seasonal changes in heavy precipitation (%), 2071-2100 compared to 1971-2000

RCP4.5

RCP8.5



Seasonal changes in heavy
precipitation in percent



//// Significant change

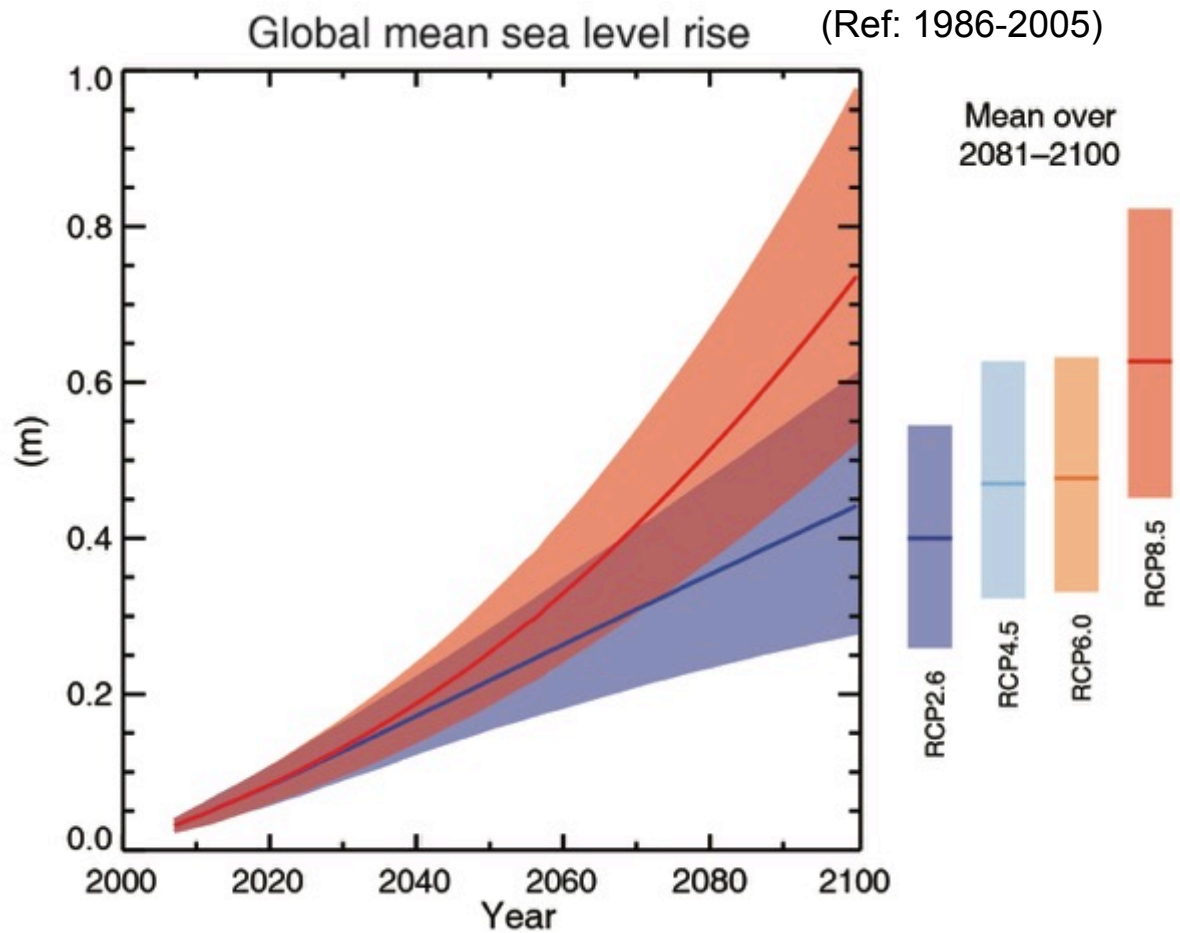
\\\\ Robust change

In Germany, many residents weren't prepared for the mass flooding as the rain pelted down (May 2016)



In Puerto Rico, Hurricane Maria created the worst humanitarian crisis in the US for decades





(IPCC 2013, Fig. SPM.9)

Sea level due to continue to increase

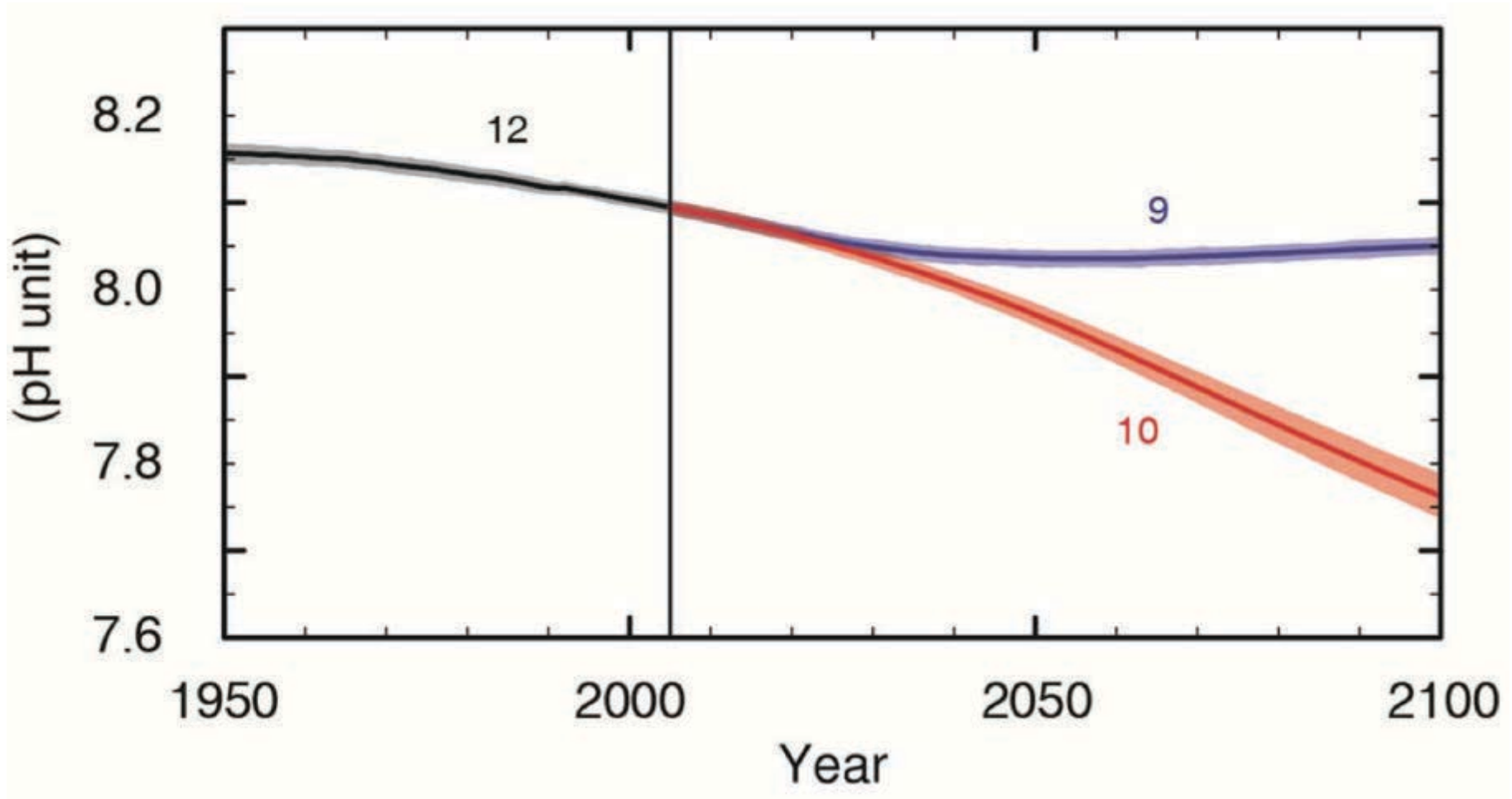
Effets sur le Delta du Nil, où vivent plus de 10 millions de personnes à moins d'1 m d'altitude



(Time 2001)

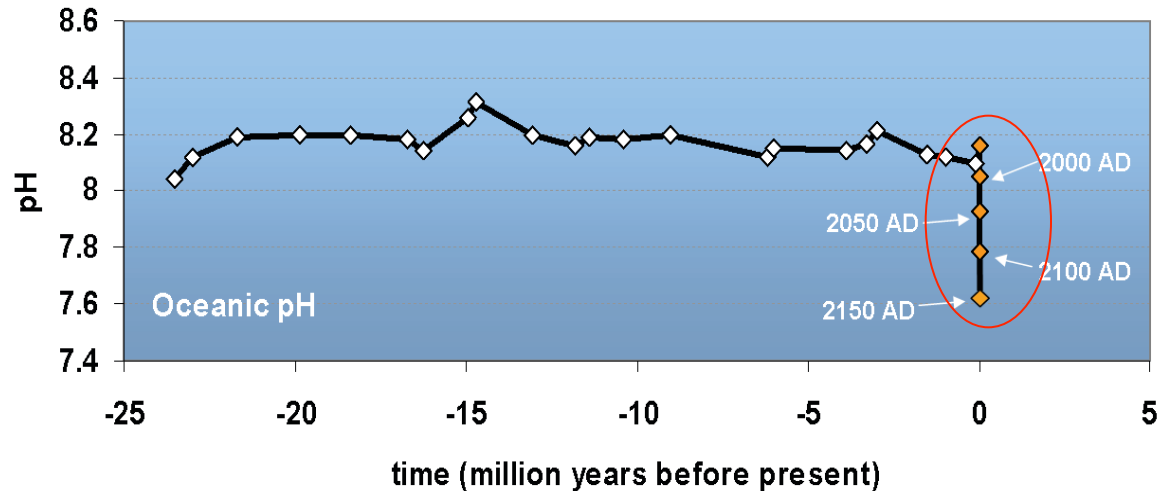
Global ocean surface pH (projections)

Ocean Acidification, for RCP 8.5 (orange) & RCP2.6 (blue)



Oceans are Acidifying Fast

Changes in pH over the last 25 million years



“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

Coral reefs are dying



American Samoa (from www.globalcoralbleaching.org)

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

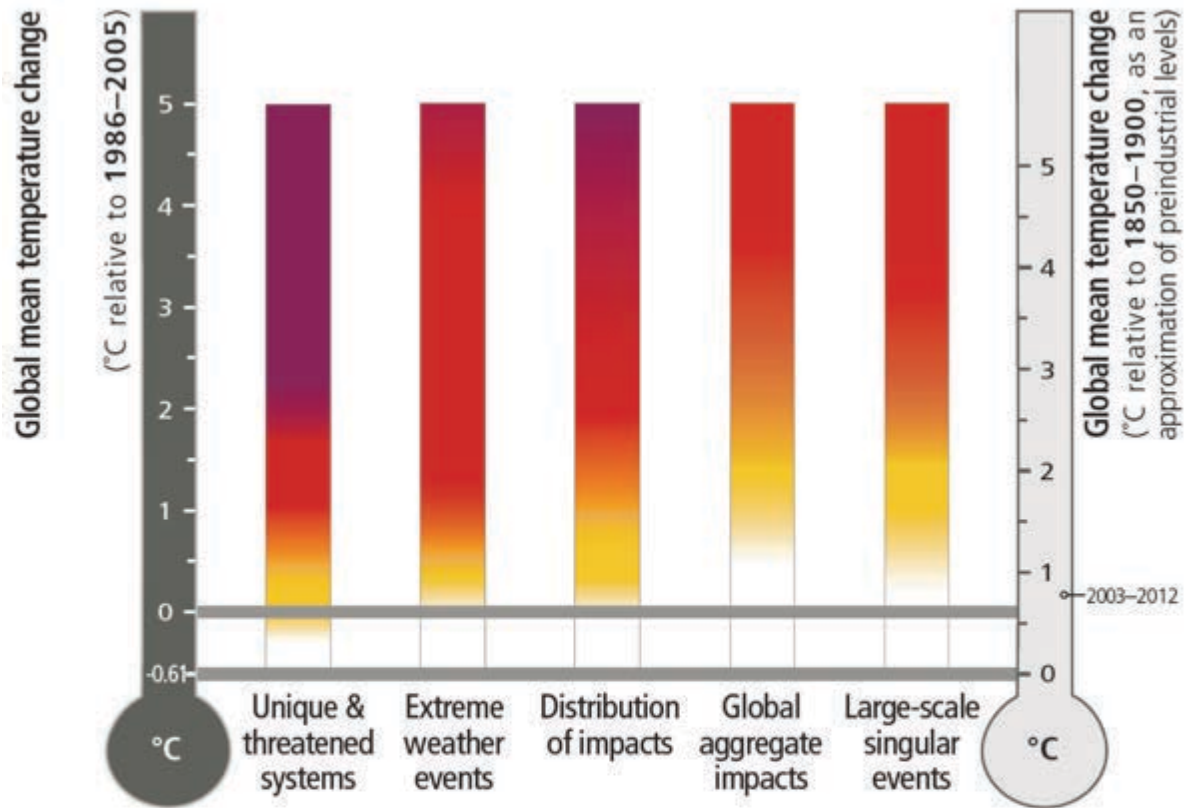


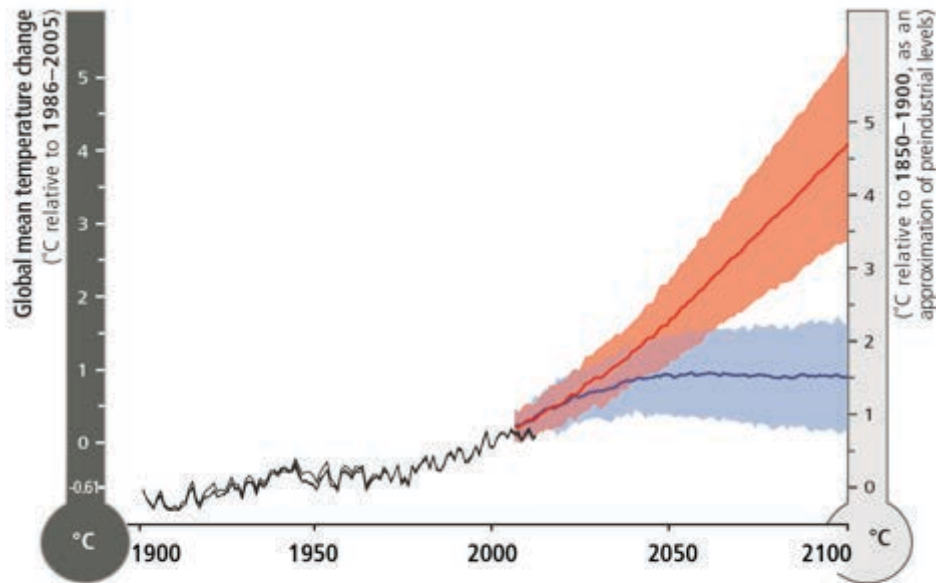
Coastal flooding

AR5 WGII SPM

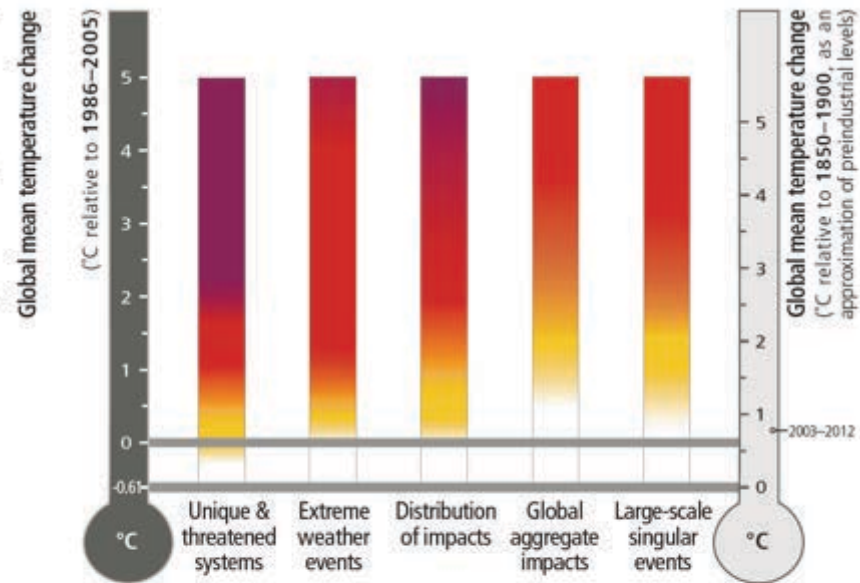
Risk = Hazard x Vulnerability x Exposure (Katrina flood victim, New Orleans, 2005)

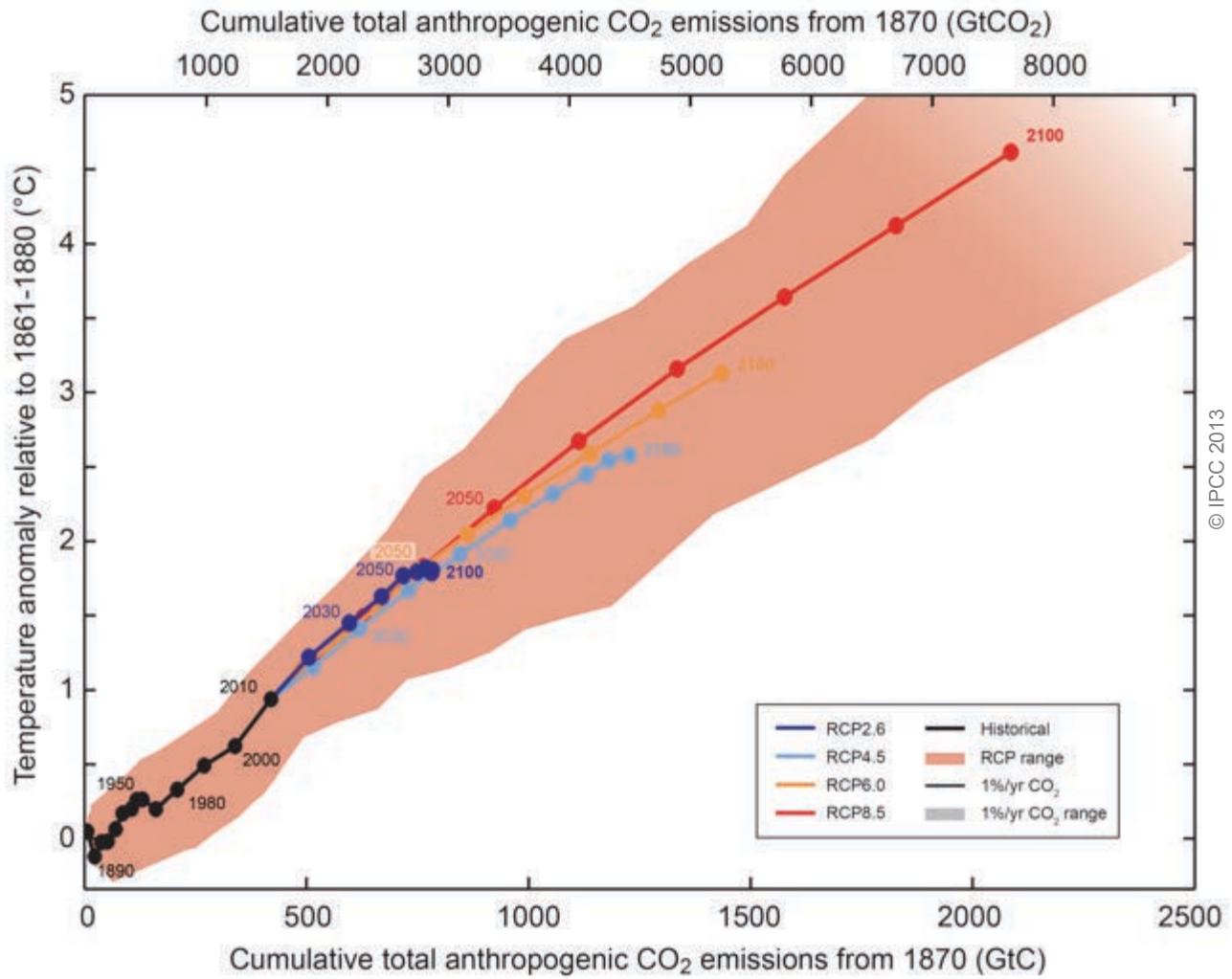






- Observed
- RCP8.5 (a high-emission scenario)
- Overlap
- RCP2.6 (a low-emission mitigation scenario)





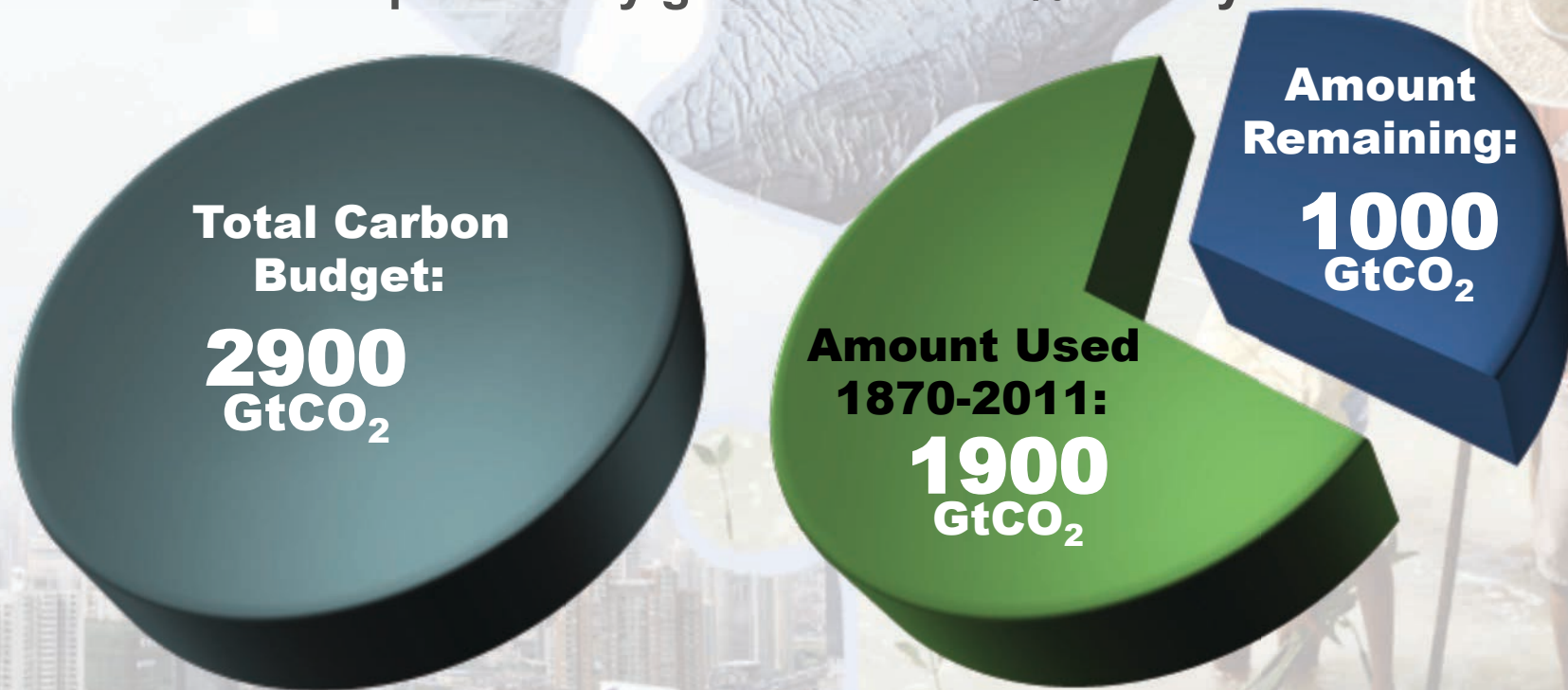
© IPCC 2013

Fig. SPM.10

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

The window for action is rapidly closing

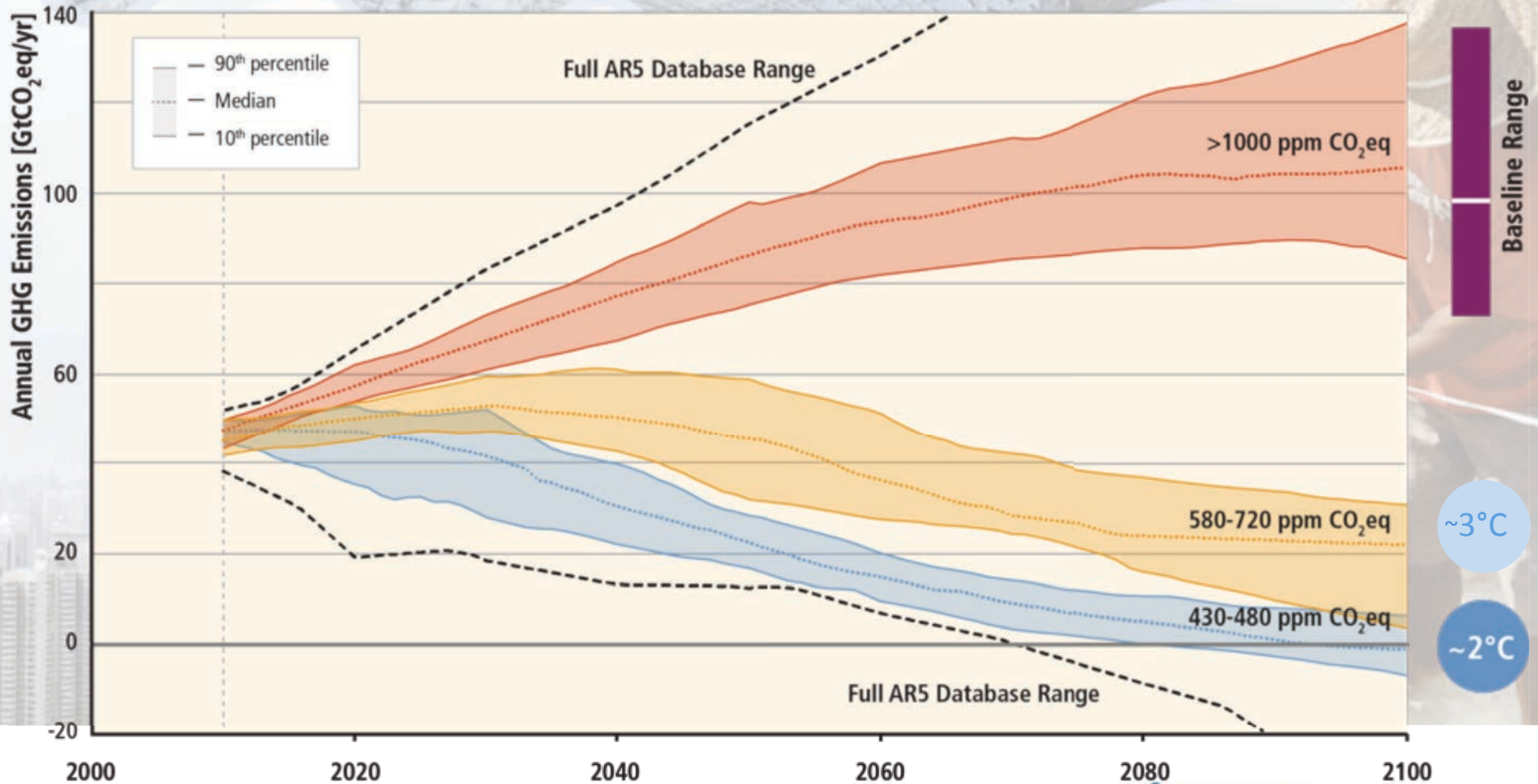
65% of the carbon budget compatible with a 2°C goal is already used
NB: this is with a probability greater than 66% to stay below 2°C



NB: Emissions in 2011: 38 GtCO₂/yr

AR5 WGI SPM

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



Based on Figure 6.7

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**

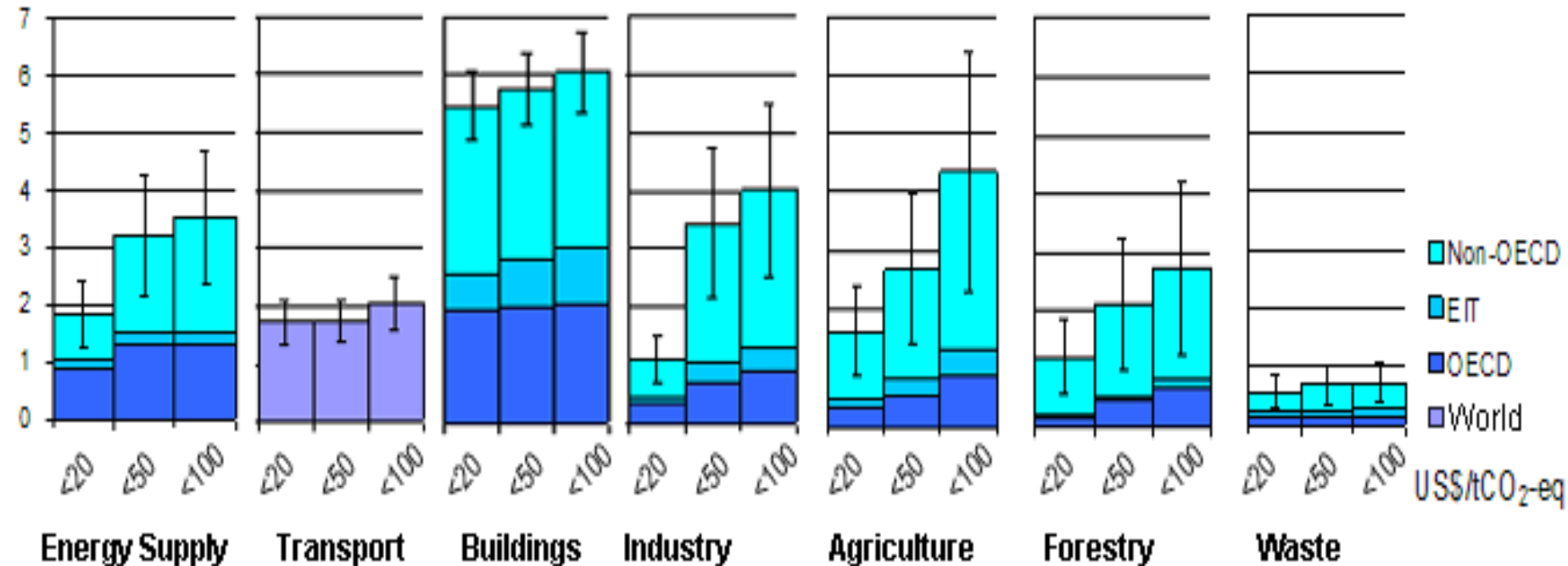


Lifestyle and behavioural changes

AR5 WGIII SPM

All sectors and regions have the potential to contribute by 2030

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



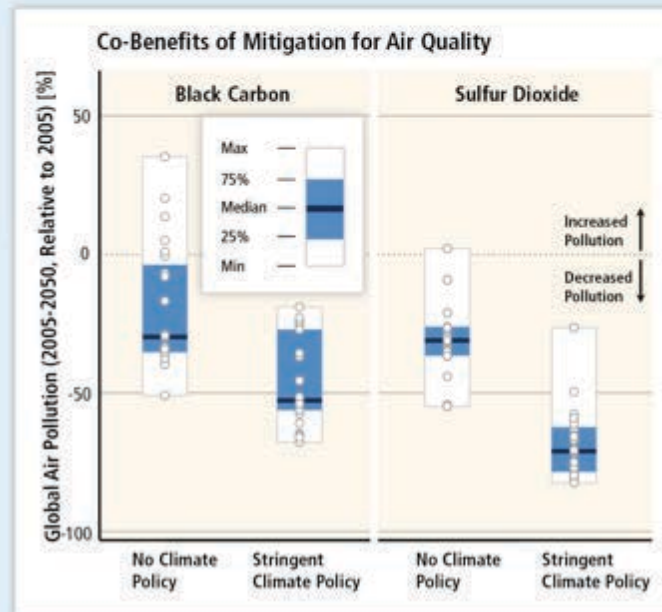
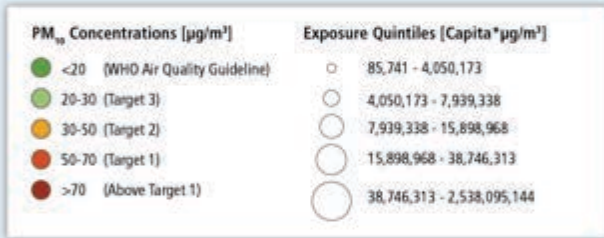
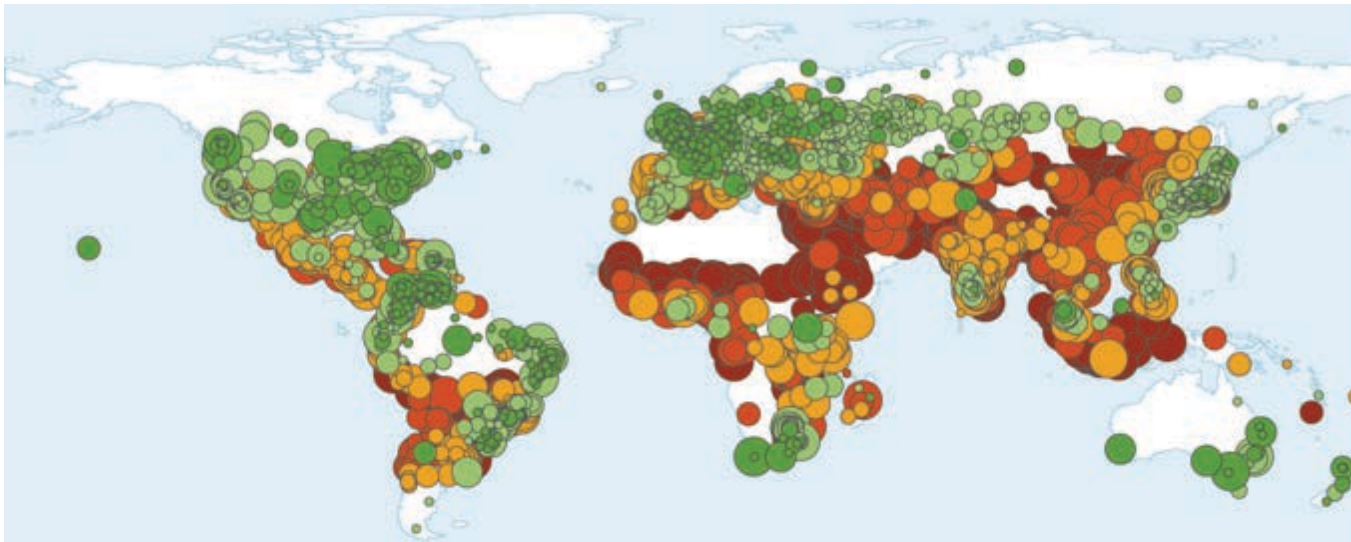
IPCC AR4 (2007)

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**



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

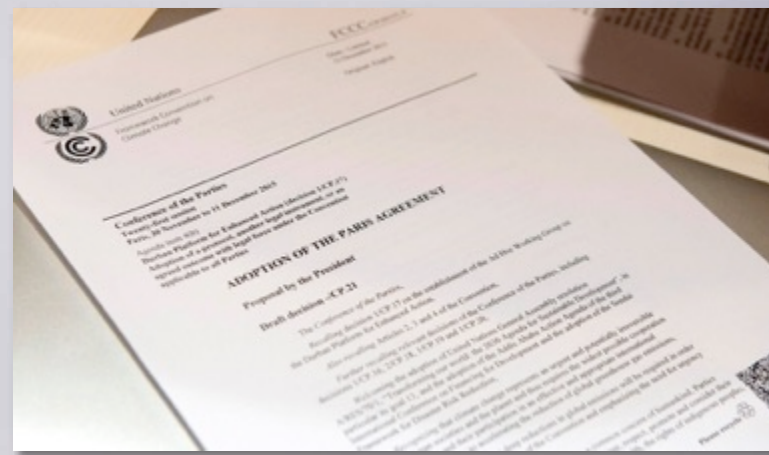
If well designed, measures to prevent climate change could offer so many opportunities:

- Co-benefits in reduced pollution, health improvement, employment, gender equality, food security, reduced poverty, energy independence...**
- Opportunities to shift the tax burden away from labour and implement sustainable development**
- Opportunities to integrate research results in a useful, policy-relevant way, across disciplines (including social sciences)**

Sur les Changements Climatiques 2015

COP21/CMP11

Paris, France



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

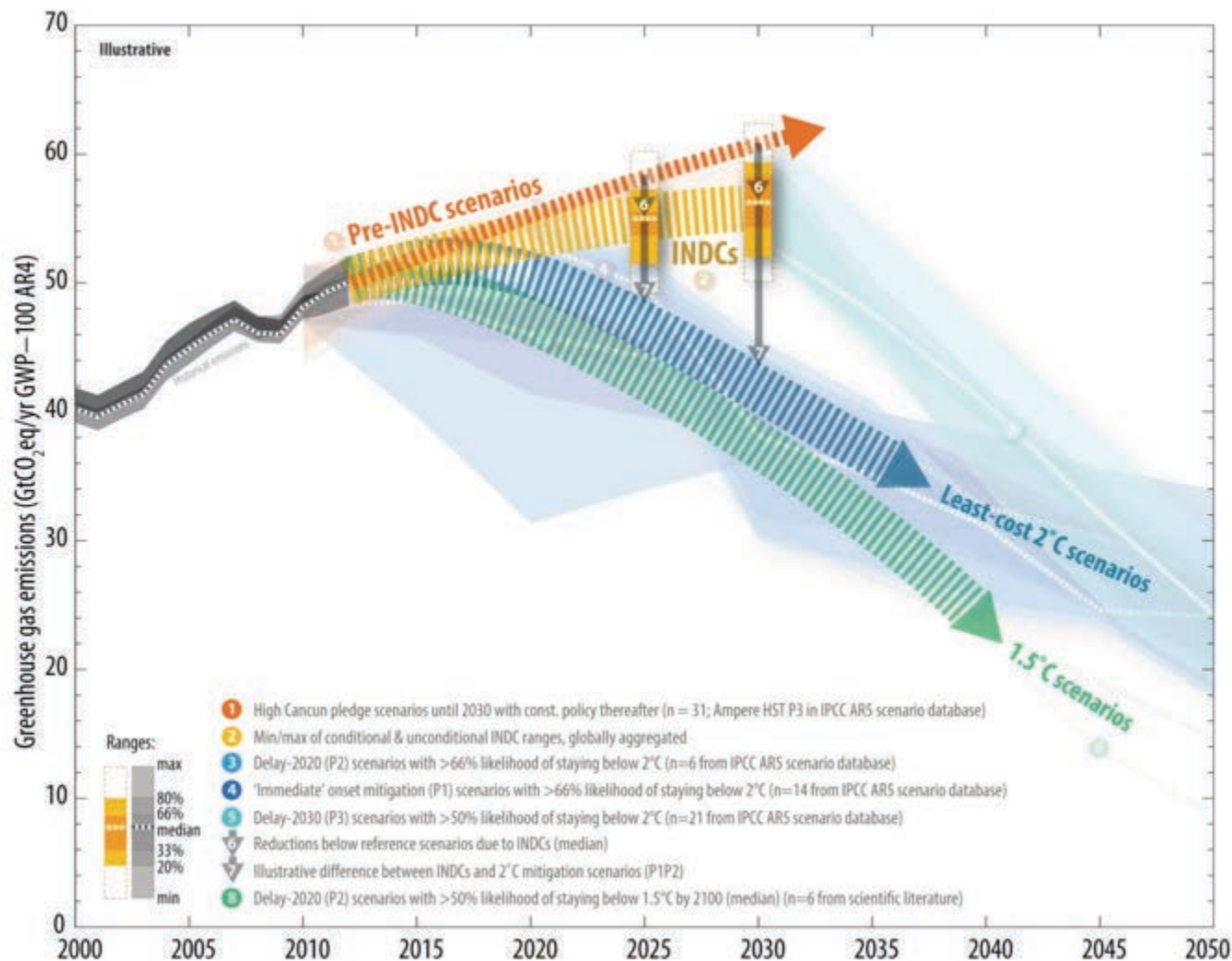
- Article 4:
 - ◆ 1. (...) Parties aim to reach **global peaking** of greenhouse gas emissions **as soon as possible**, recognizing that **peaking will take longer for developing country Parties**,
 - ◆ and to undertake **rapid reductions thereafter in accordance with best available science**,
 - ◆ so 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(...)**

“Getting 196 Countries To Agree On Climate Change Was The Easy Part. Now comes the real work.”

(C. Figueres, World Economic Forum 2016, Davos)



Comparison of global emission levels in 2025 and 2030 resulting from the implementation of the intended nationally determined contributions



La COP23 à Bonn, présidée par Fidji



La COP23 à Bonn, présidée par Fidji: Timoci, 12 ans, s'adresse aux Chefs d'Etat et de gouvernement



La COP23 à Bonn, présidée par Fidji



COP23 in Bonn, chaired by Fiji

- **Fiji has done the job it was given to do, which is to advance the implementation guidelines of the Paris Agreement and prepare for more ambitious action through the Talanoa Dialogue of 2018.**
- Countries will need to finalise the implementation guidelines at COP24 in Poland next year.

COP23 in Bonn, chaired by Fiji

- The **Talanoa Dialogue** agreed in Bonn establishes an inclusive and participatory process to allow Parties, as well as non-party stakeholders, to share stories and showcase best practices **to urgently raise ambition** - including pre-2020 action - **in nationally-determined contributions (NDCs)**.

COP23 in Bonn, chaired by Fiji

- The Gender Action Plan and Indigenous Peoples Platform** agreed in Bonn will help ensure that those who are traditionally marginalised have a strong voice in the climate change negotiations and are empowered to become actors of change.

COP23 in Bonn, chaired by Fiji

-Under Fiji's Presidency, more funding for **climate adaptation** was secured and an important next step was taken to ensure that the Adaptation Fund shall serve the Paris Agreement. A **global partnership** was launched to provide millions of climate-vulnerable people the world over with **affordable access to insurance**.

COP23 in Bonn, chaired by Fiji

Through the **Ocean Pathway Partnership**, Fiji has launched a major new initiative to strengthen the link between climate change action and the health of the ocean, including in the UN Climate Change process, as well as in national climate action plans.

A historic agreement on agriculture will help nations reduce emissions for the sector that is the second biggest emitter after energy, as well as help promote the sector's resilience to the effects of climate change.



SUSTAINABLE DEVELOPMENT GOALS



Walking the talk...

- Energy audit of our home
- Strong external insulation (wood fibre)
- Ultra-efficient windows
- Airtightness inspecting + heat-recovery mechanical ventilation
- Oil furnace replaced by geothermal heat pump principally fed with PV pannels
- Non-tropical wood
- Small, used electric car
- Electric bicycles

Trying to be coherent (external insulation)



J'essaye d'être cohérent...



Conclusions (1/2)

The challenge is huge: transform the world in a few decades so that the whole world activities are decarbonized, while poverty and hunger are eliminated in a few decades

Addressing it open so many opportunities, for research in all disciplines and accross disciplines and for integrating results of this research in meaningful actions by all: governments, cities, businesses, NGOs, and citizens.

It opens also economic opportunities, and opportunities to address in a synergistic manner other societal goals, such as the 17 Sustainable Development Goals.

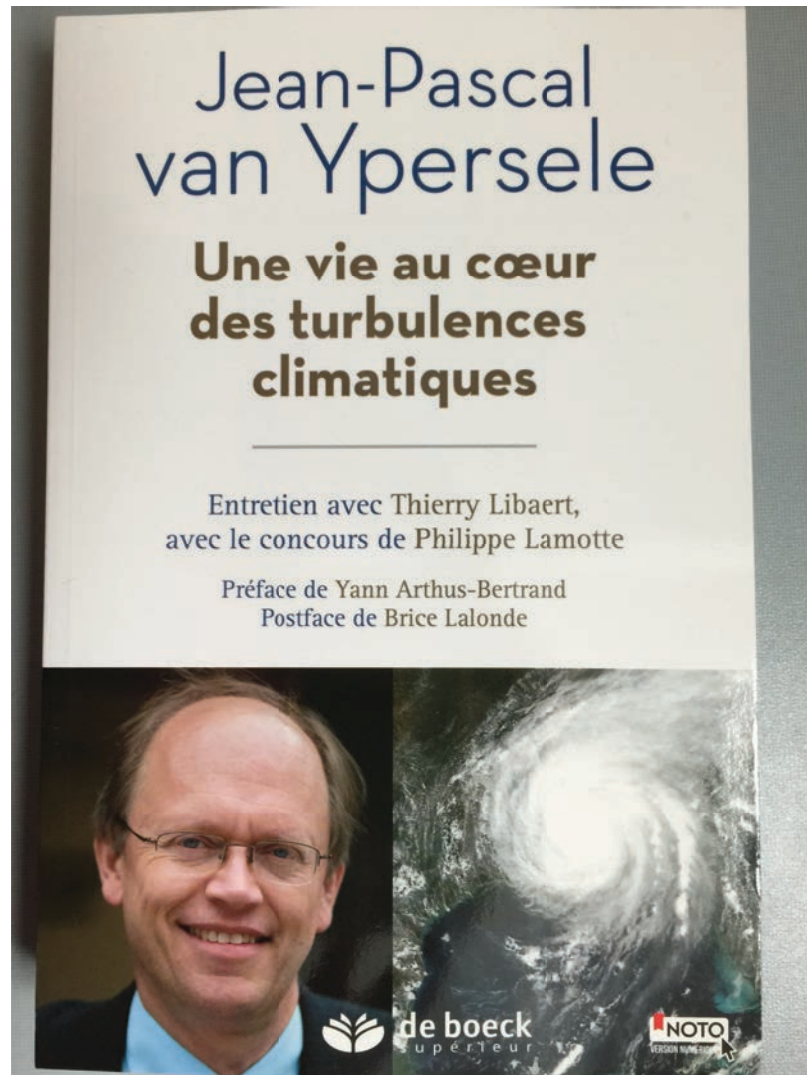
Conclusions (2/2)

Last but not least, addressing this challenge, together, will allow us to look our children and grand children into their eyes when they will ask us how we contributed to avoiding the announced environmental collapse.

Buddhist saying: Courage is the gateway to happiness

In a nutshell: Yes we can !

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octobre 2015
Broché: 16 euros
E-book: 13 euros**



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**