

# ***Climate Change: What Must be Known***

**Jean-Pascal van Ypersele**

**(Université catholique de Louvain)**

**Former IPCC Vice-Chair (2008-2015)**

**Twitter: @JPvanYpersele**

**Expo-Sciences, Brussels, 29 April 2016**

**Thanks to the Belgian Federal Science Policy Office (BELSPO)  
and to my team at the Université catholique de Louvain for their support**

# 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





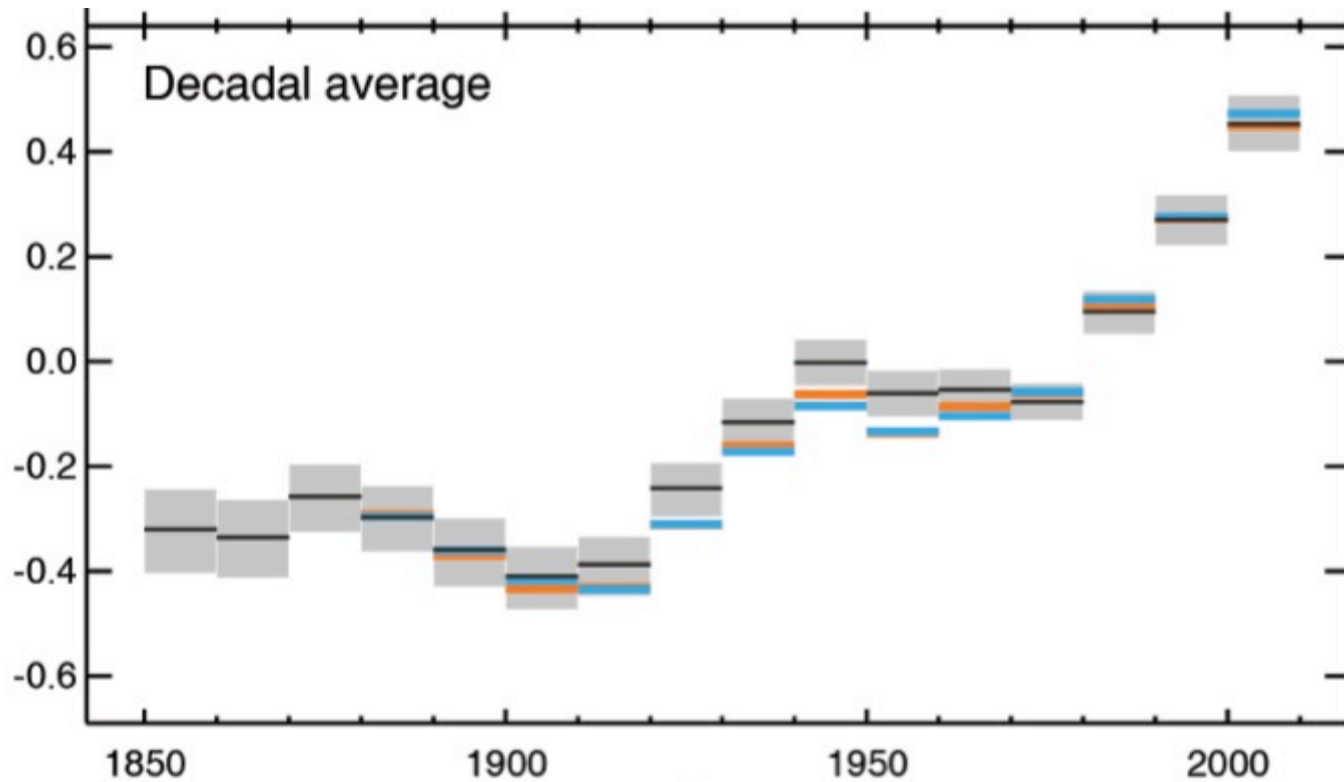
**What is happening in the climate system?**



**What are the risks?**



**What can be done?**



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

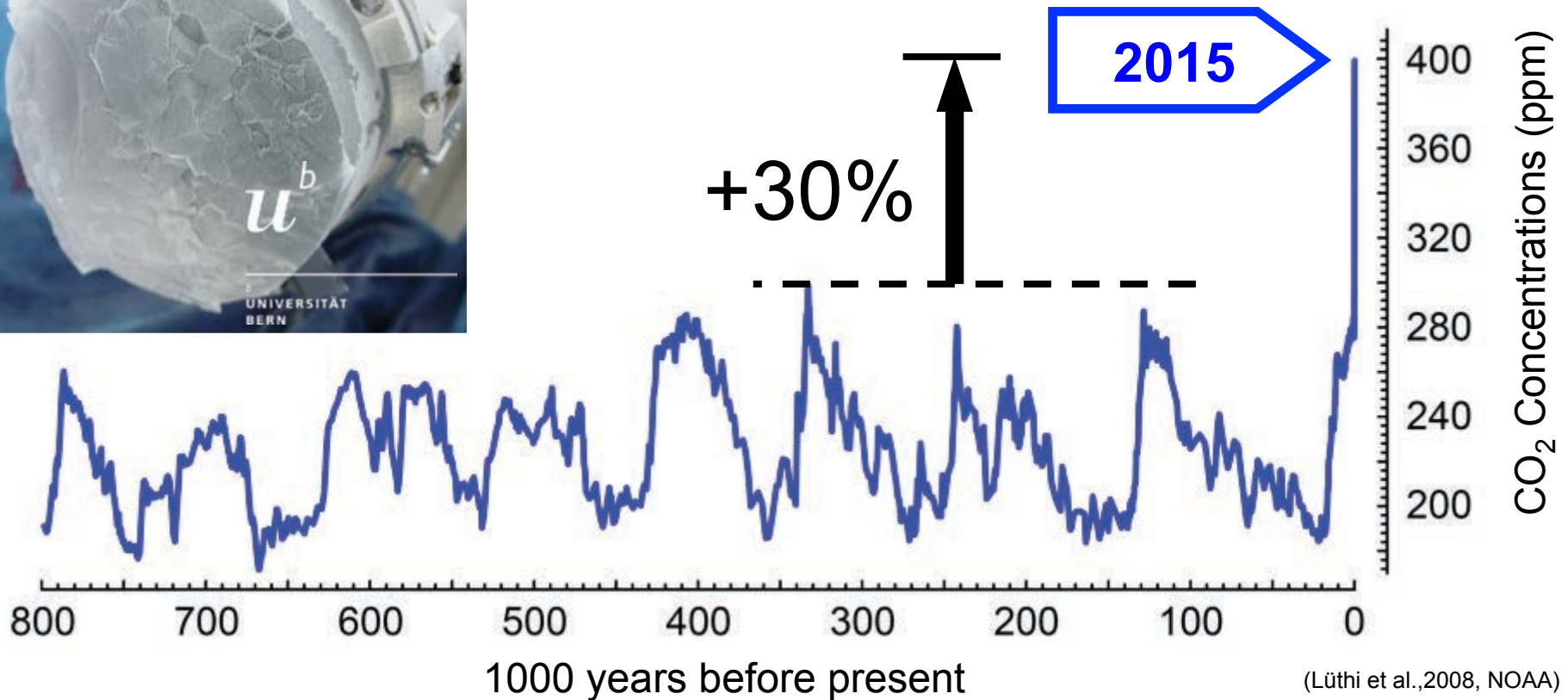
# Plateau Glacier (2003) (Alaska)



[http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm\\_ven=Email&cm\\_cat=ENVIRONMENT\\_us\\_share](http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share)



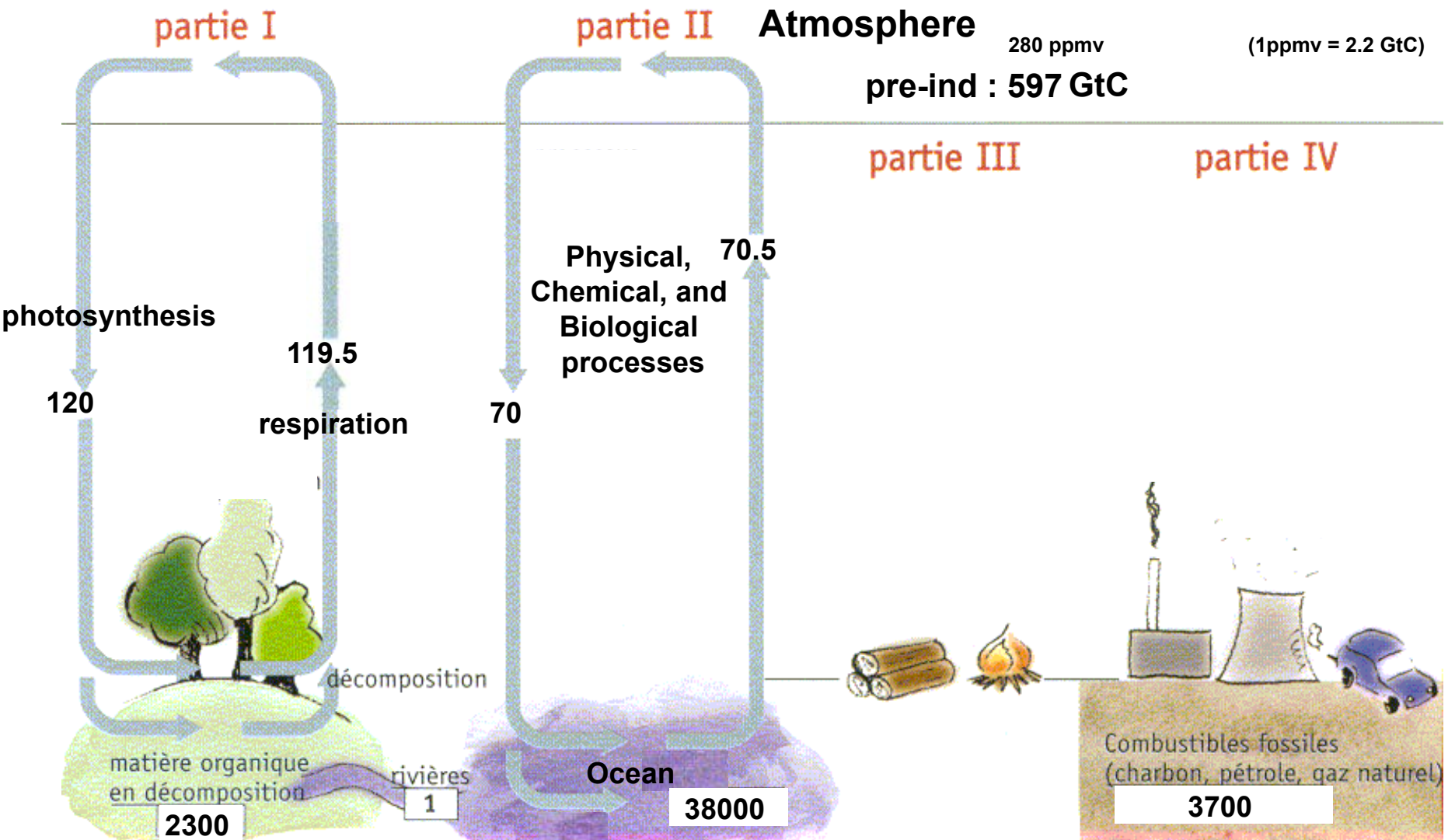
# Atmospheric concentrations of CO<sub>2</sub>



**The concentrations of CO<sub>2</sub> have increased to levels unprecedented in at least the last 800,000 years.**



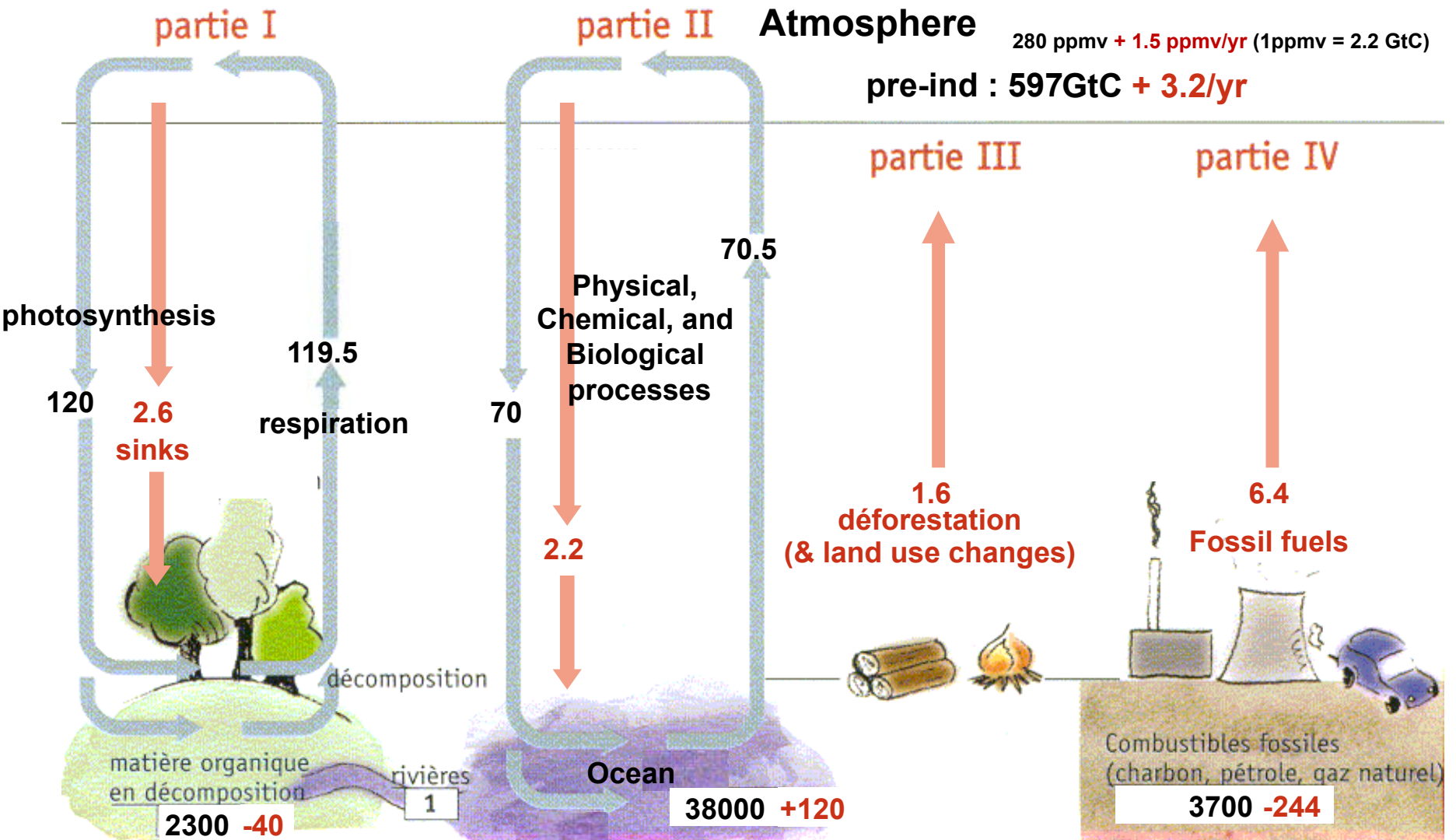
# Carbon cycle: unperturbed fluxes



Units: GtC (billions tons of carbon) or GtC/year (multiply by 3.7 to get GtCO<sub>2</sub>)

# Carbon cycle: perturbed by human activities

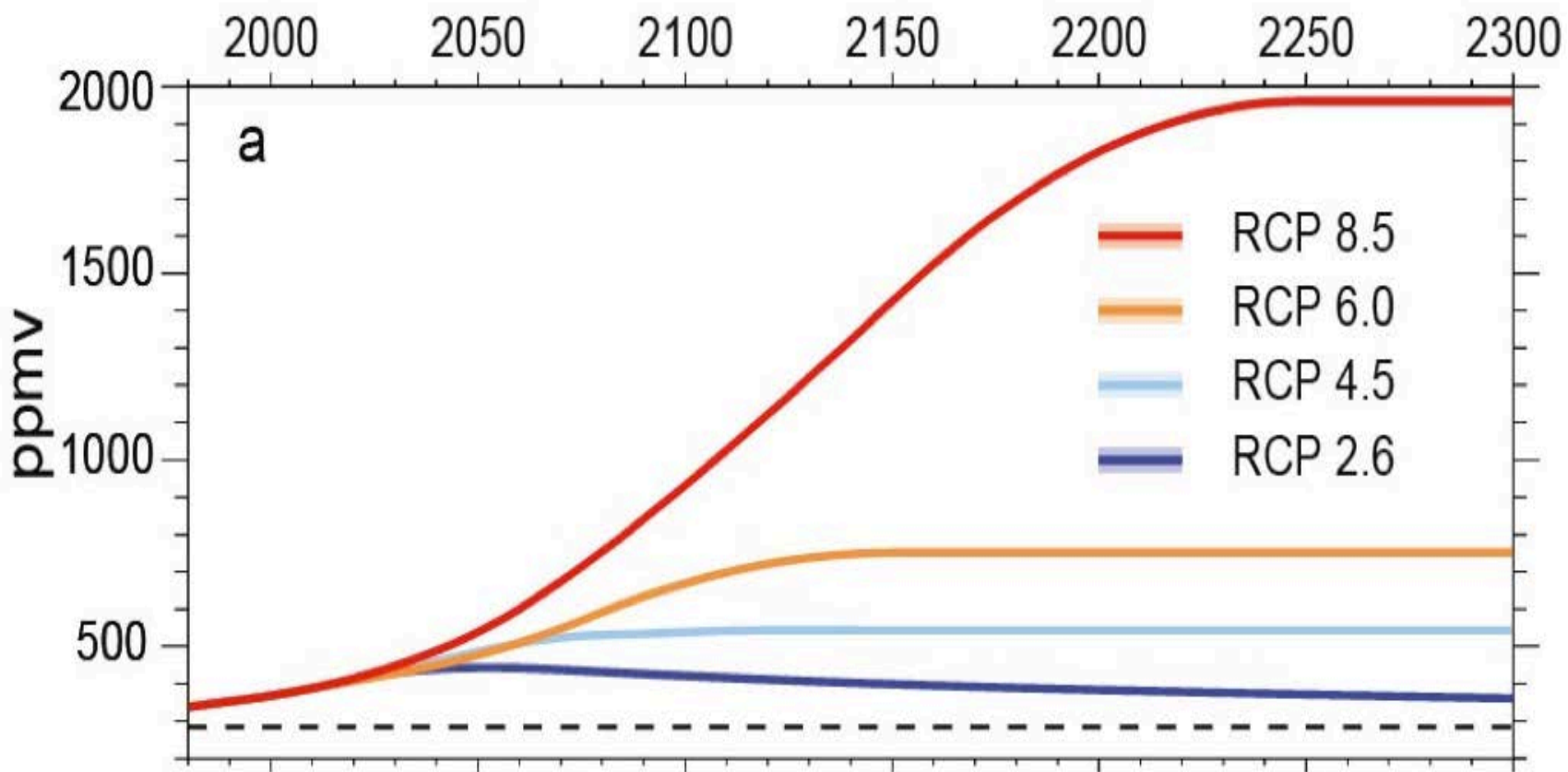
(numbers for the decade 1990-1999s, based on IPCC AR4)



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

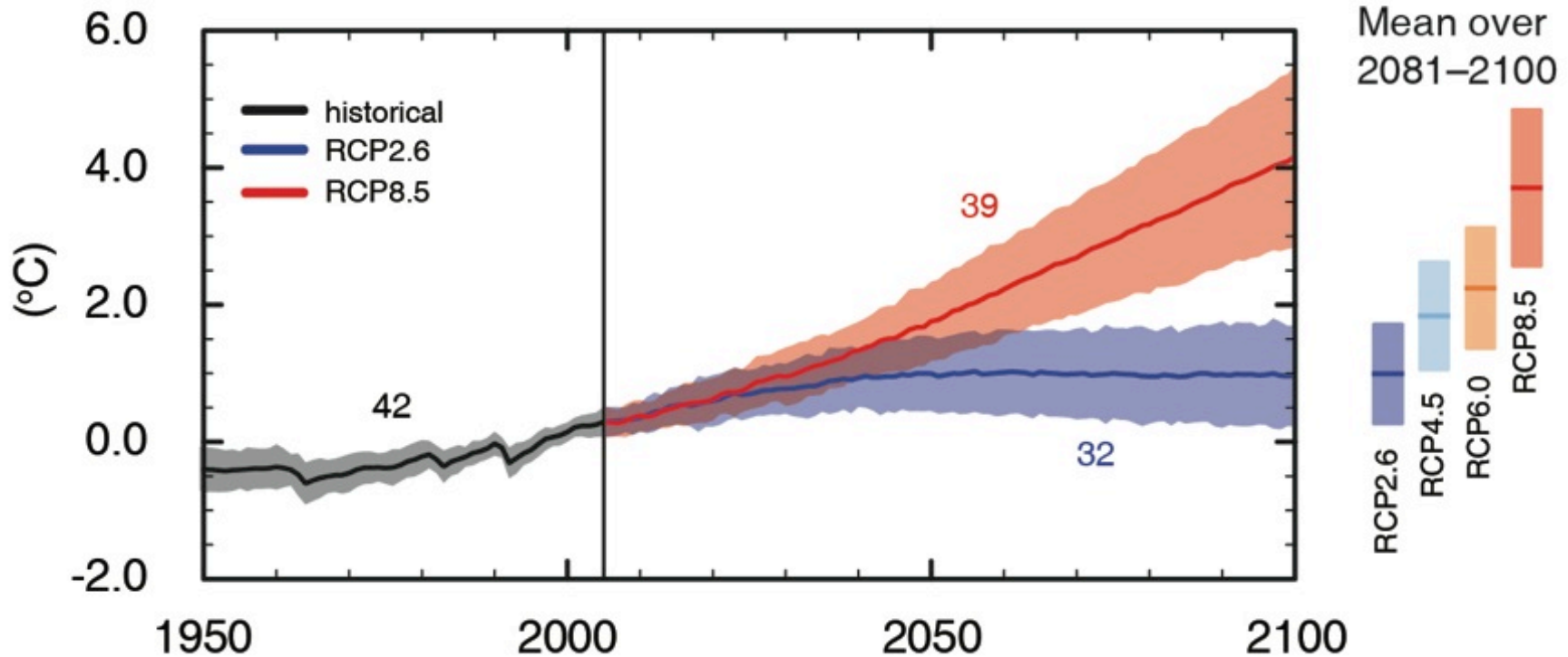
Stocks!

# RCP Scenarios: Atmospheric CO<sub>2</sub> concentration



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

## Global average surface temperature change



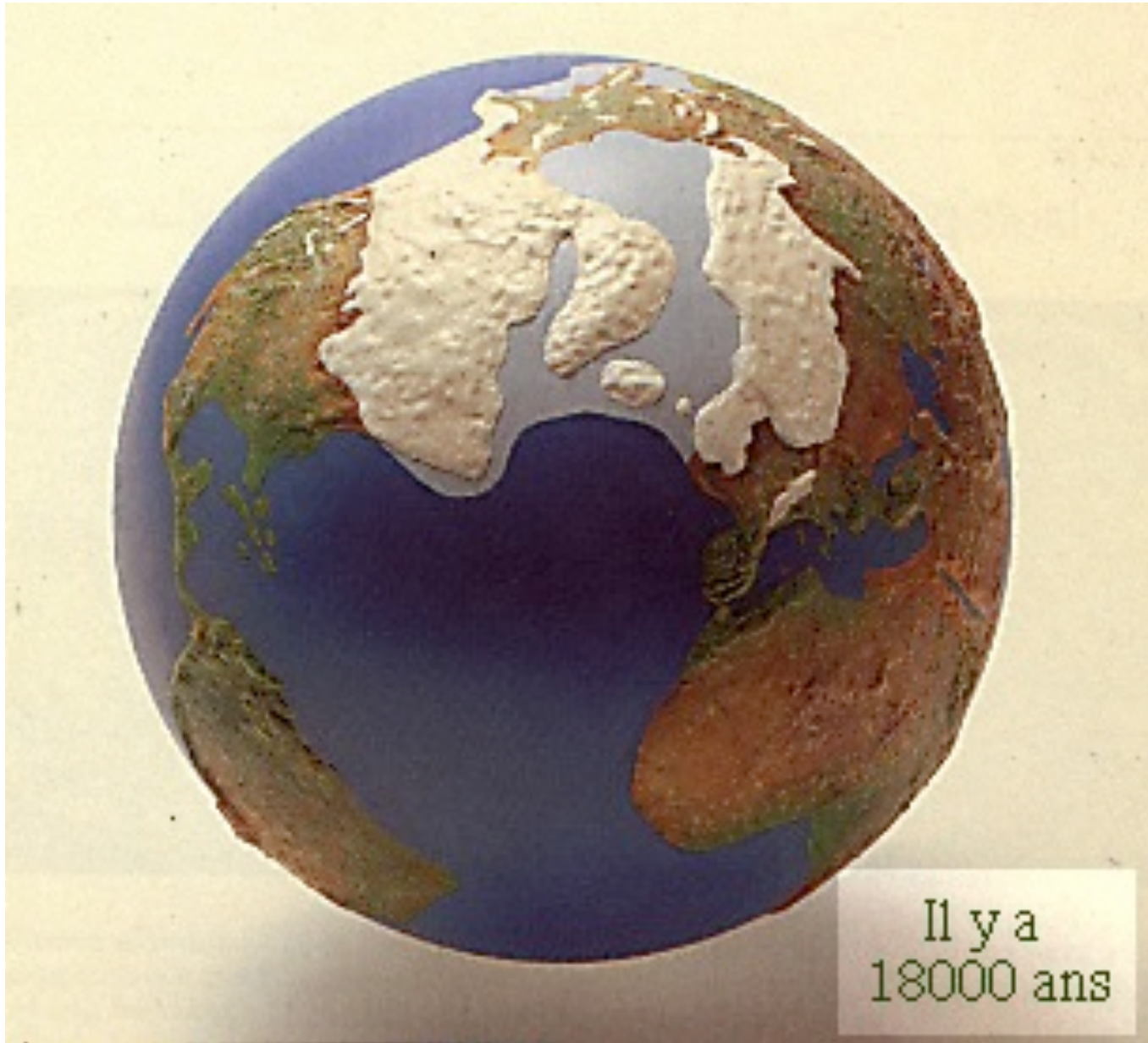
(IPCC 2013, Fig. SPM.7a)

**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**



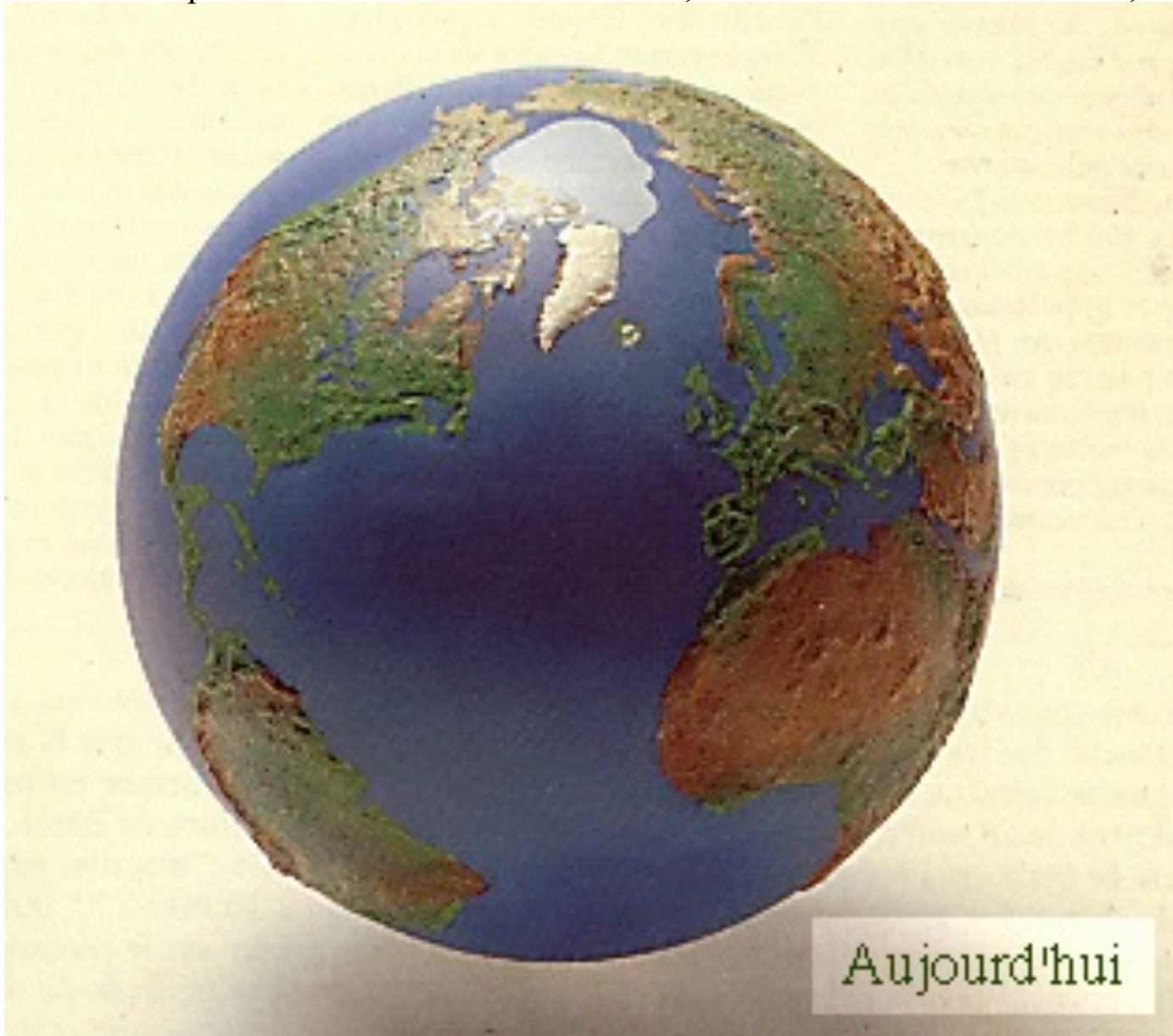
# 18-20000 years ago (Last Glacial Maximum)

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

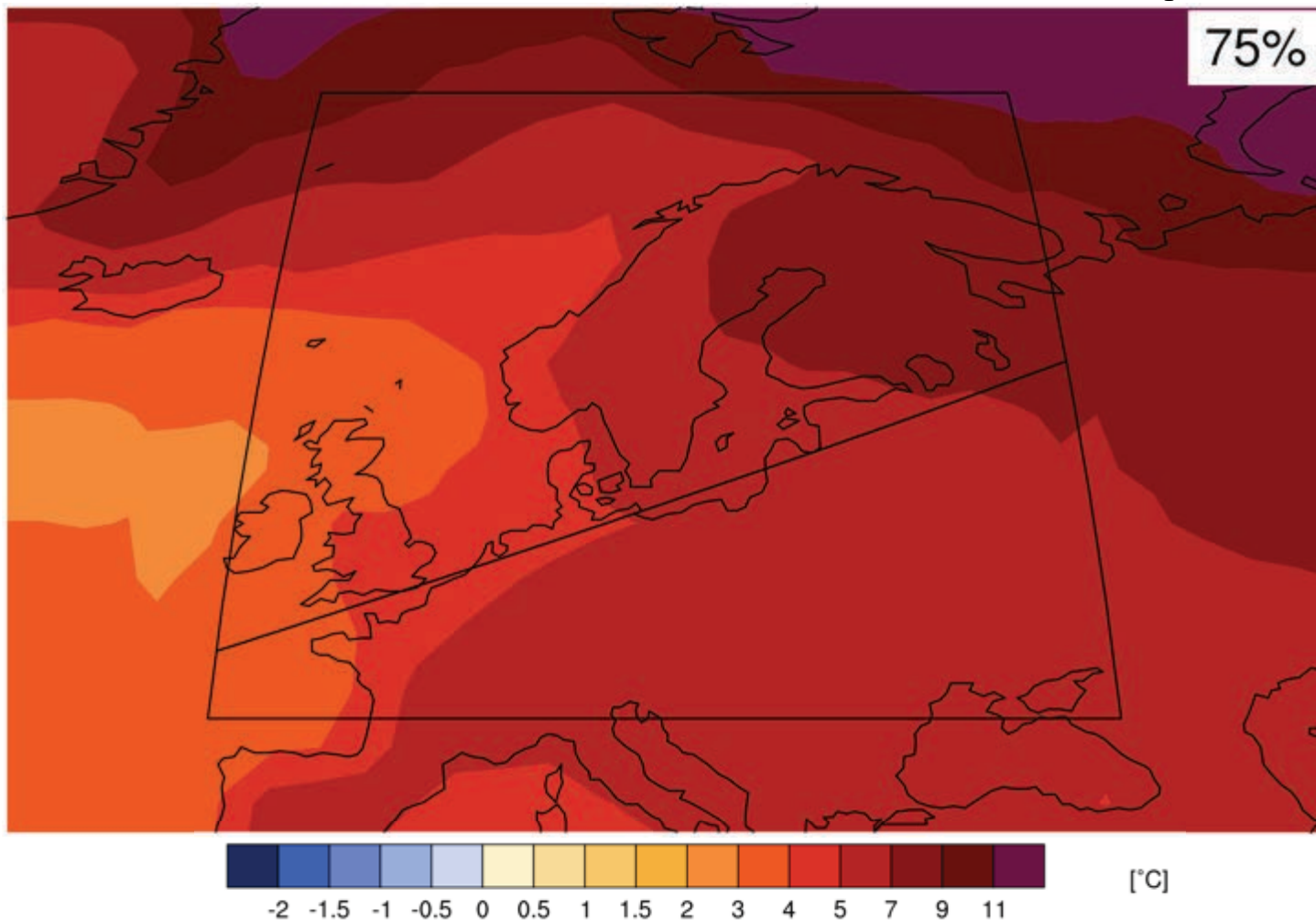


# Today, with +4-5°C globally

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

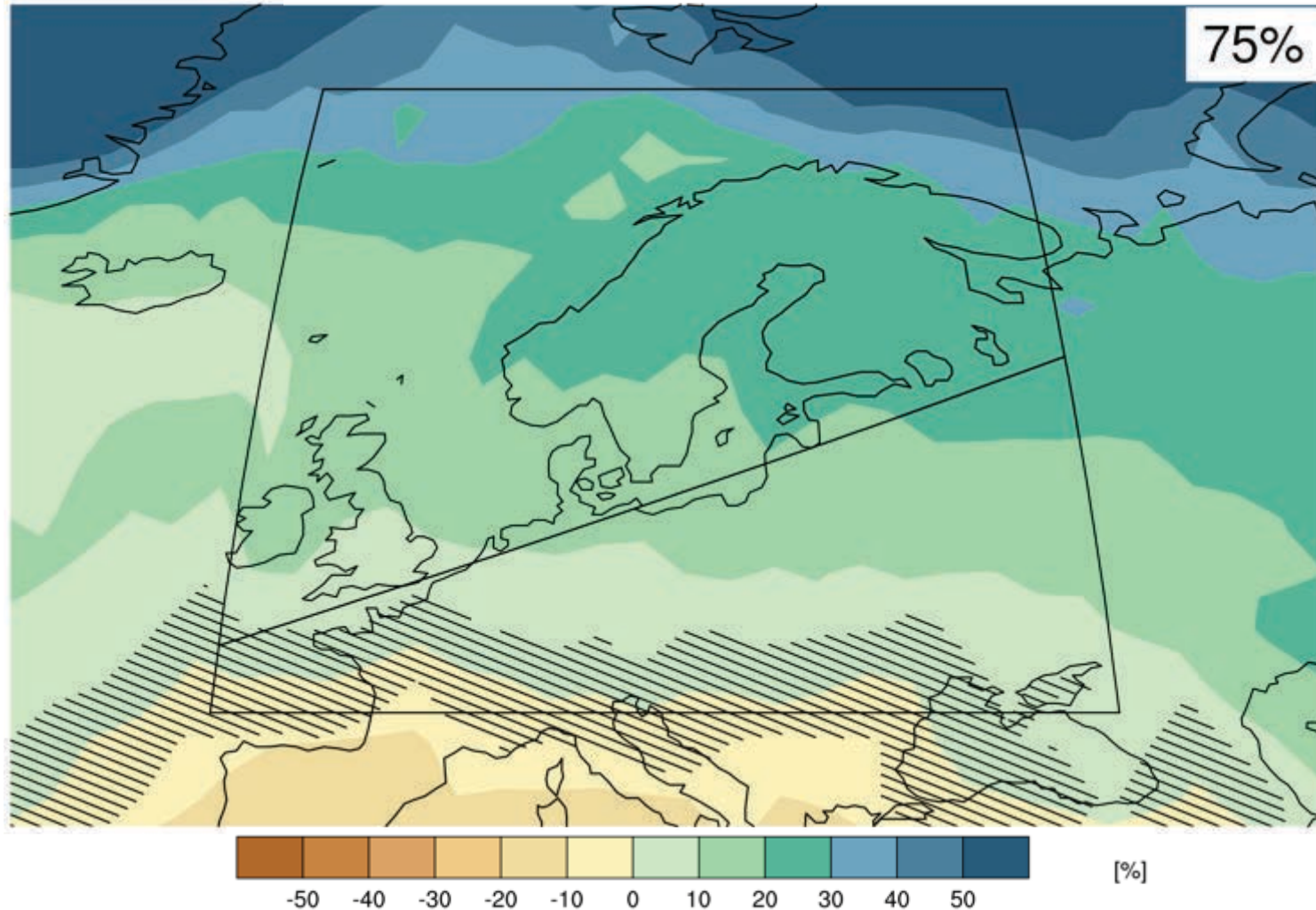


# North Europe - Map of temperature changes: 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)

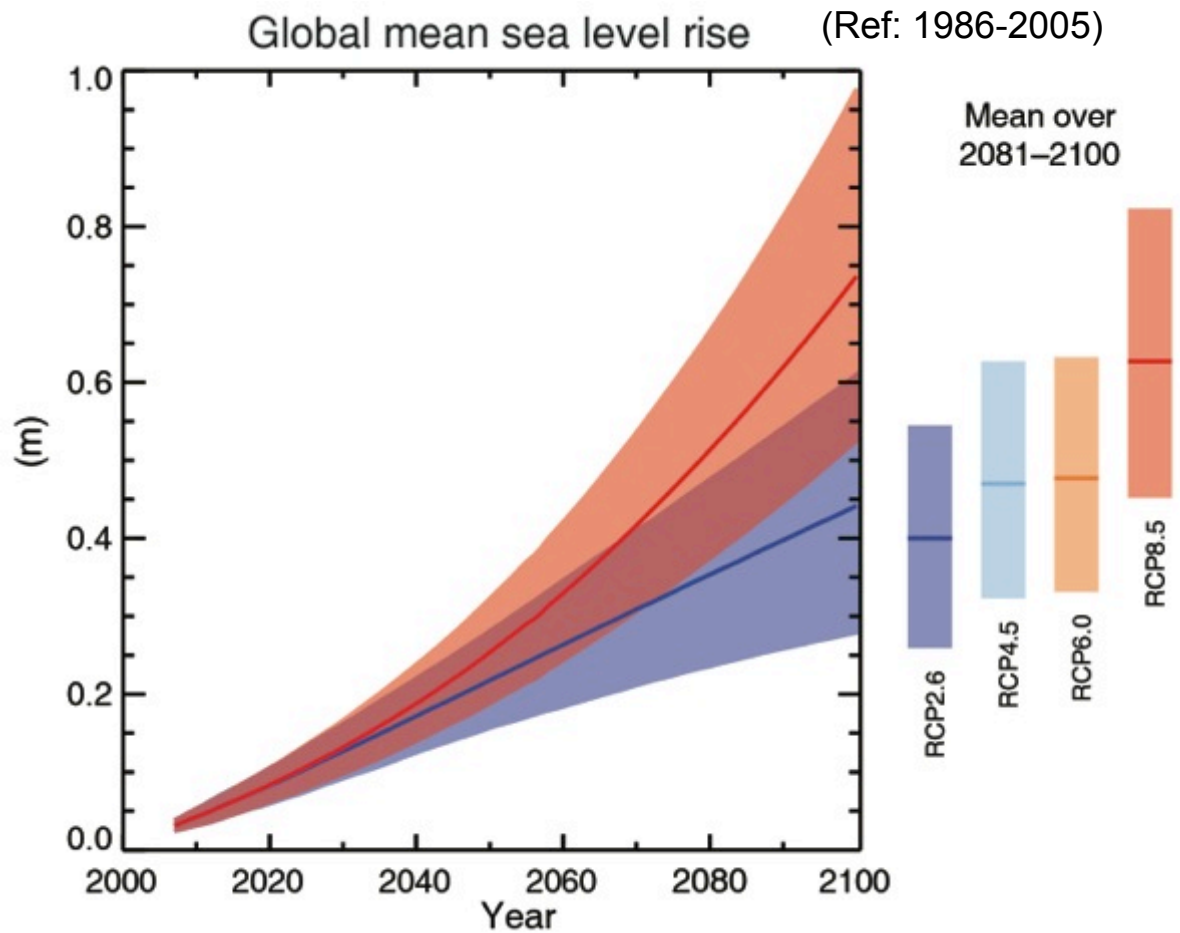




# North Europe - Map of precipitation changes in 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)







(IPCC 2013, Fig. SPM.9)

Sea level due to continue to increase

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



(Time 2001)

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



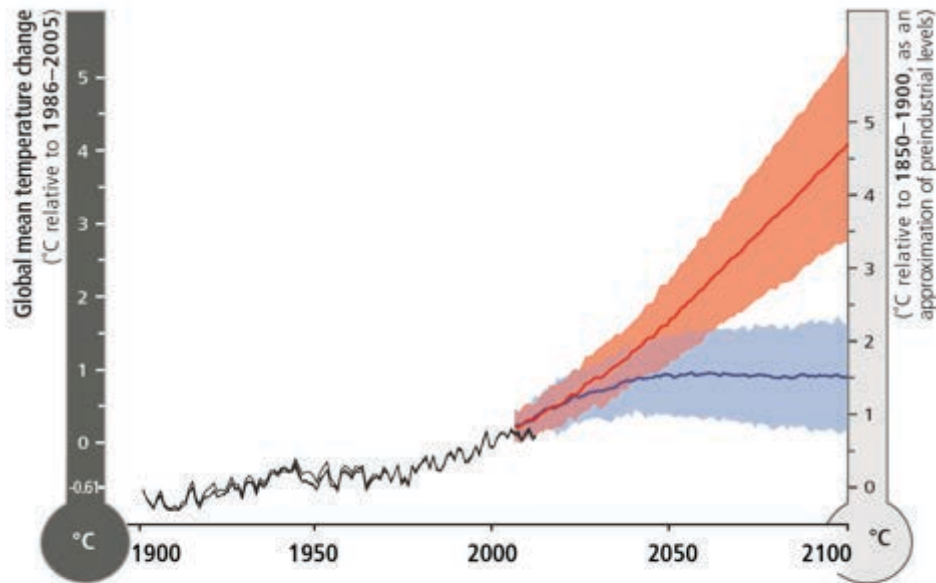


# Flood risk adaptation in Bangladesh (example): cyclone shelters, awareness raising, forecasting and warning

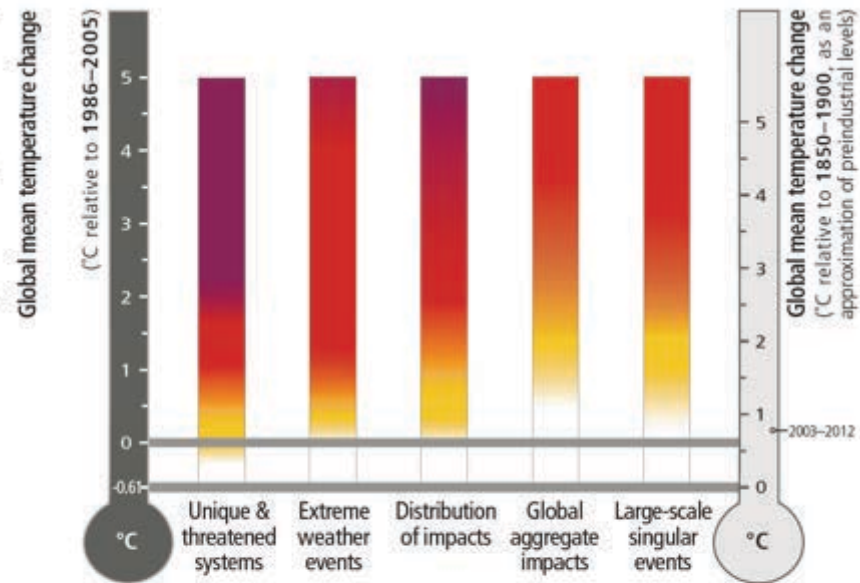


photo: Dr Thorsten Klose/German Red Cross (2010), evaluation of the Community Based Disaster Preparedness Programme run by the Red Cross in 1996-2002





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



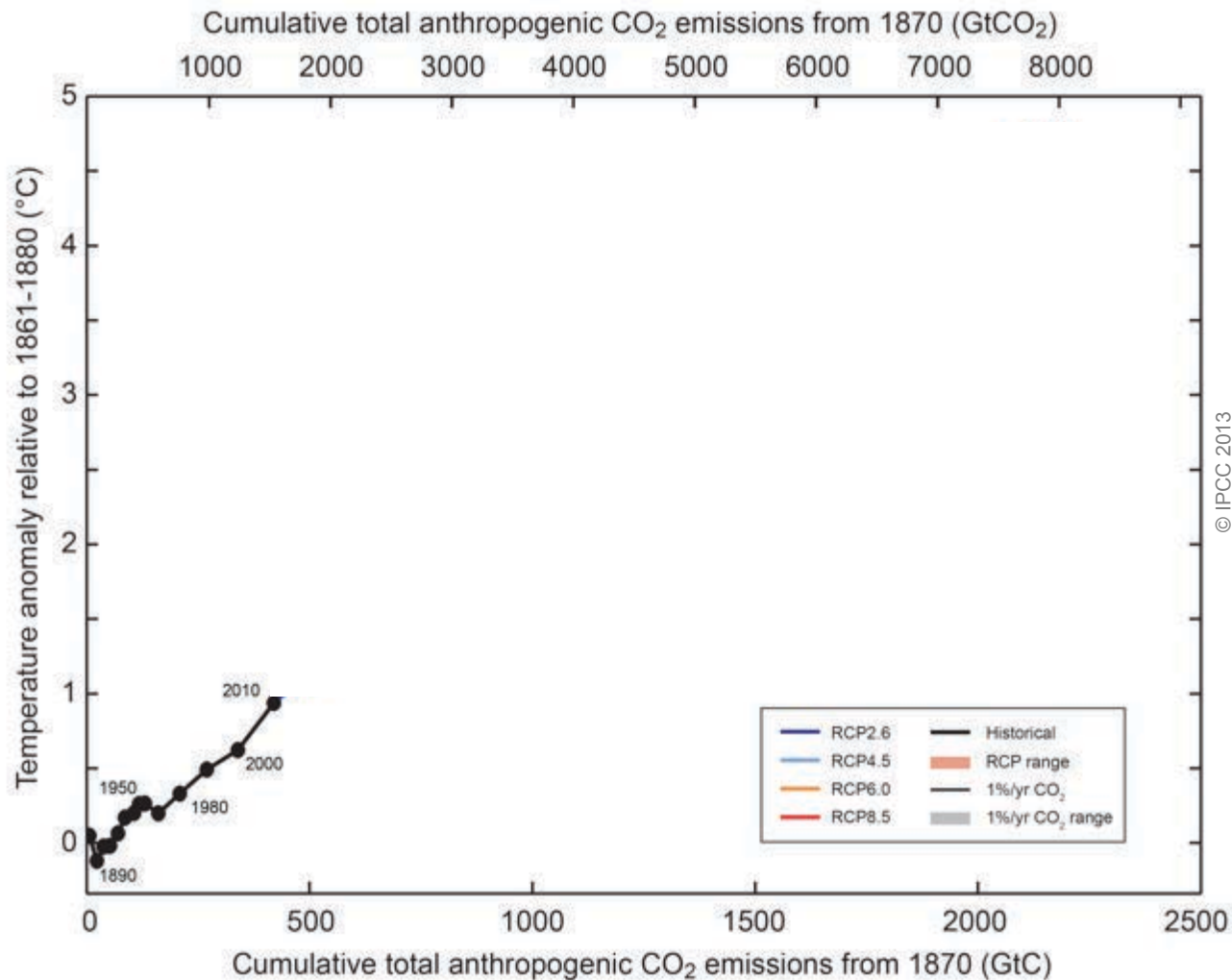


Fig. SPM.10

Cumulative emissions of CO<sub>2</sub> largely determine global mean surface warming by the late 21st century and beyond.

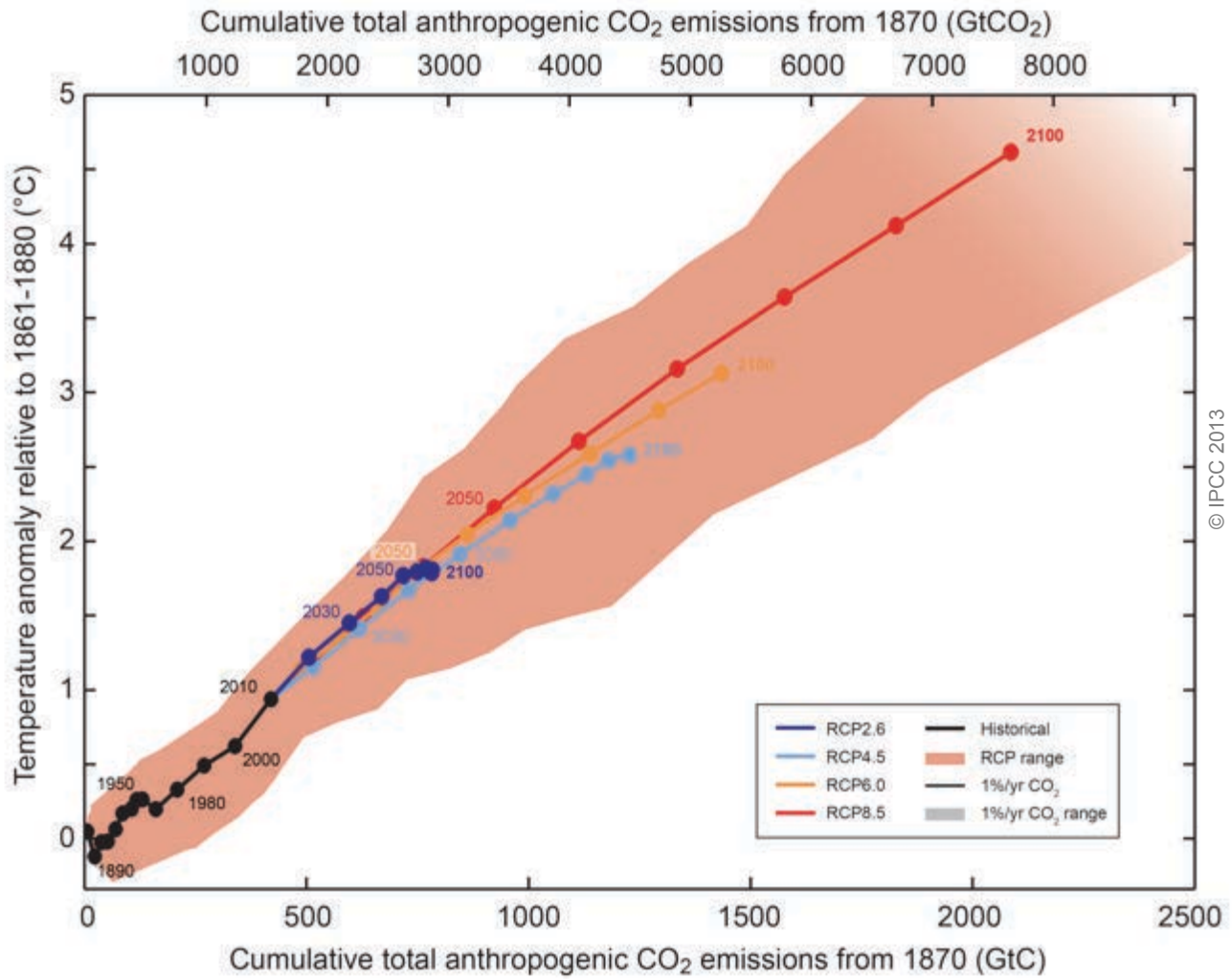


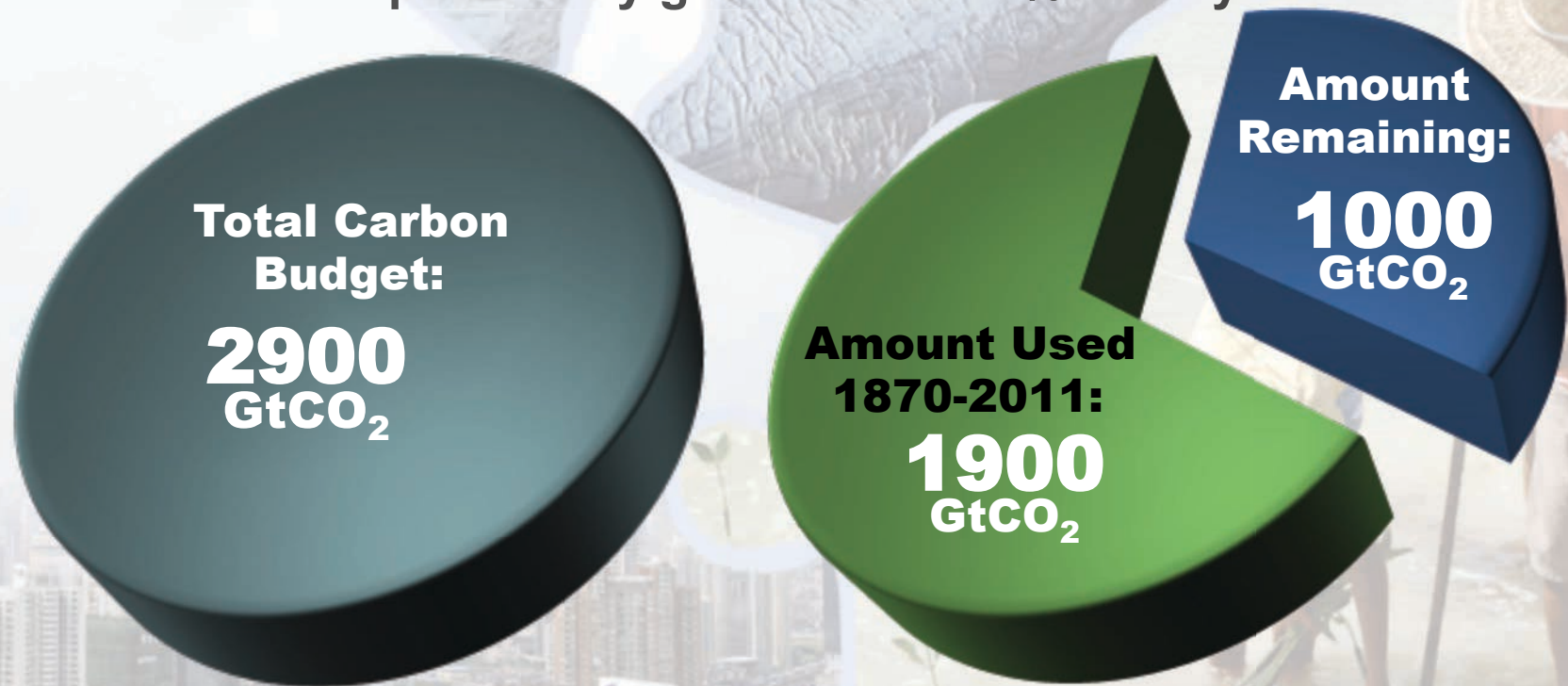
Fig. SPM.10

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



# The window for action is rapidly closing

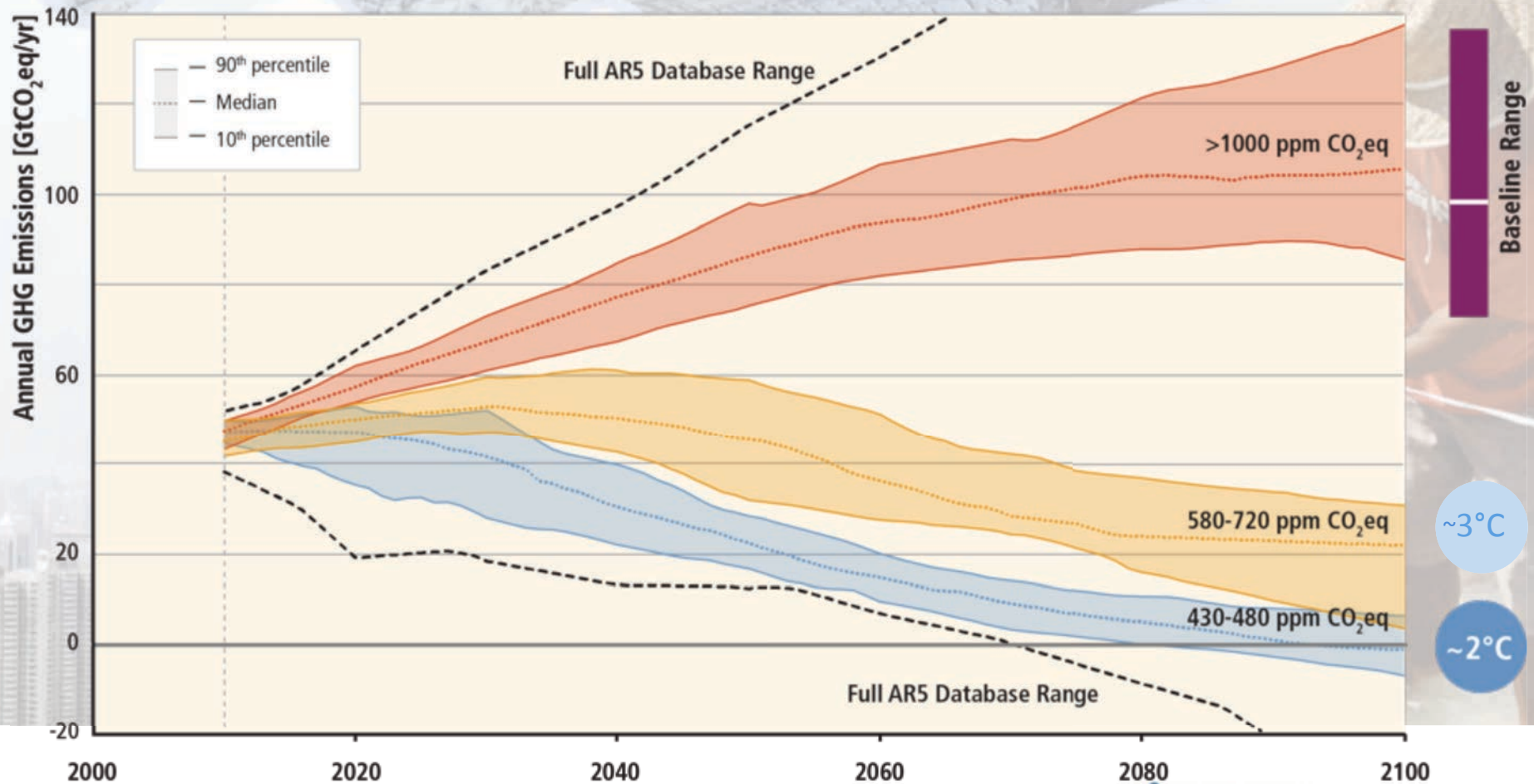
65% of the carbon budget compatible with a 2°C goal is already used  
NB: this is with a probability greater than 66% to stay below 2°C



**NB: Emissions in 2011: 38 GtCO<sub>2</sub>/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

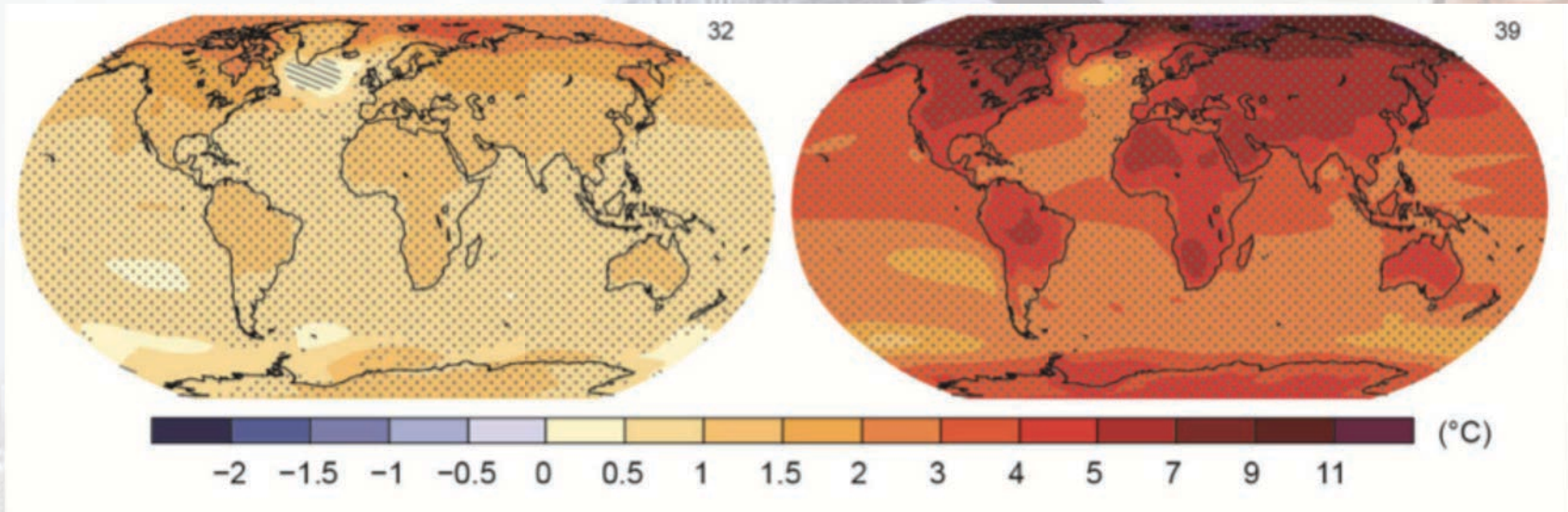
AR5 WGIII SPM



# 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

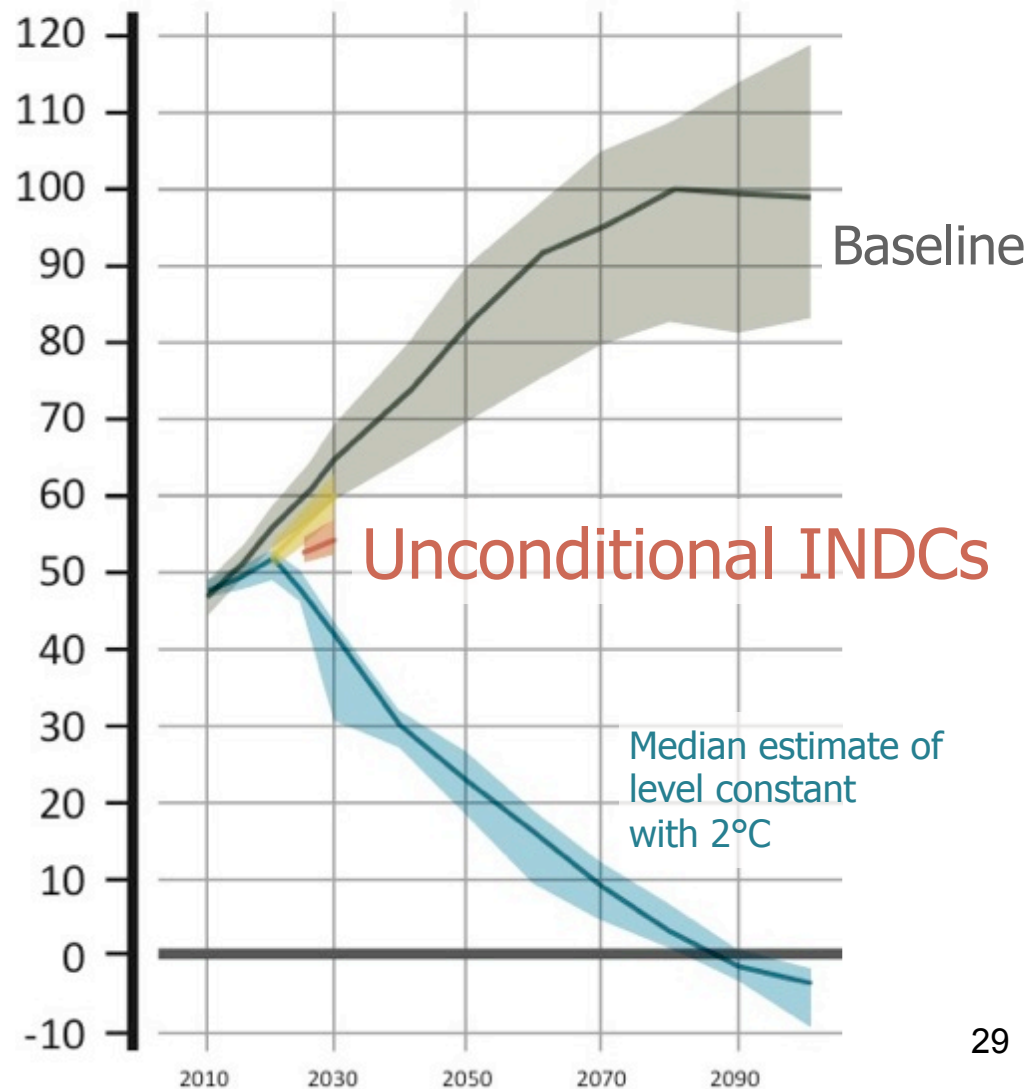
# **The Hidden IPCC Message:**

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

# Intended Nationally Determined Contributions (INDCs)

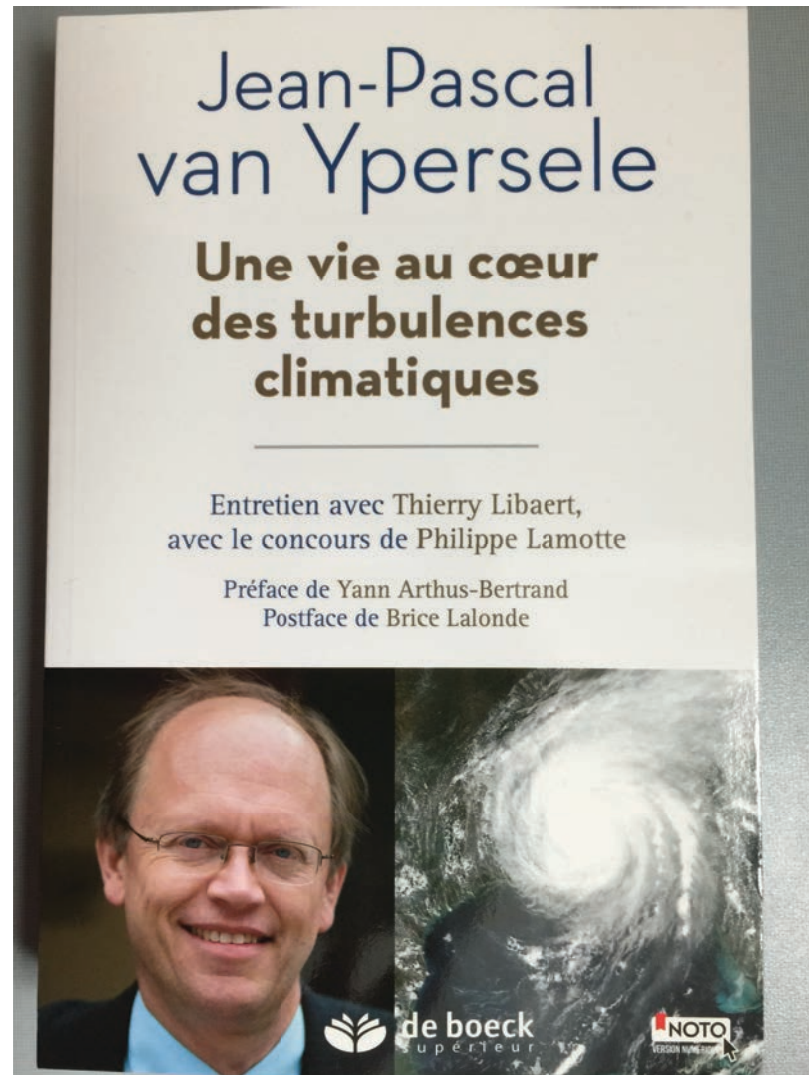
- INDCs = national plans announced before COP21
- Source: UN emissions gap report

Annual Global Total Greenhouse Gas Emissions (GtCO<sub>2</sub>e)





Publié chez De Boeck  
supérieur,  
octobre 2015



# Useful links:

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