

Climate change and IPCC: Why they matter for both Mitigation and Adaptation

Jean-Pascal van Ypersele

Université catholique de Louvain

IPCC Vice-chair

Knowledge for Climate Midterm Assessment, Amsterdam,

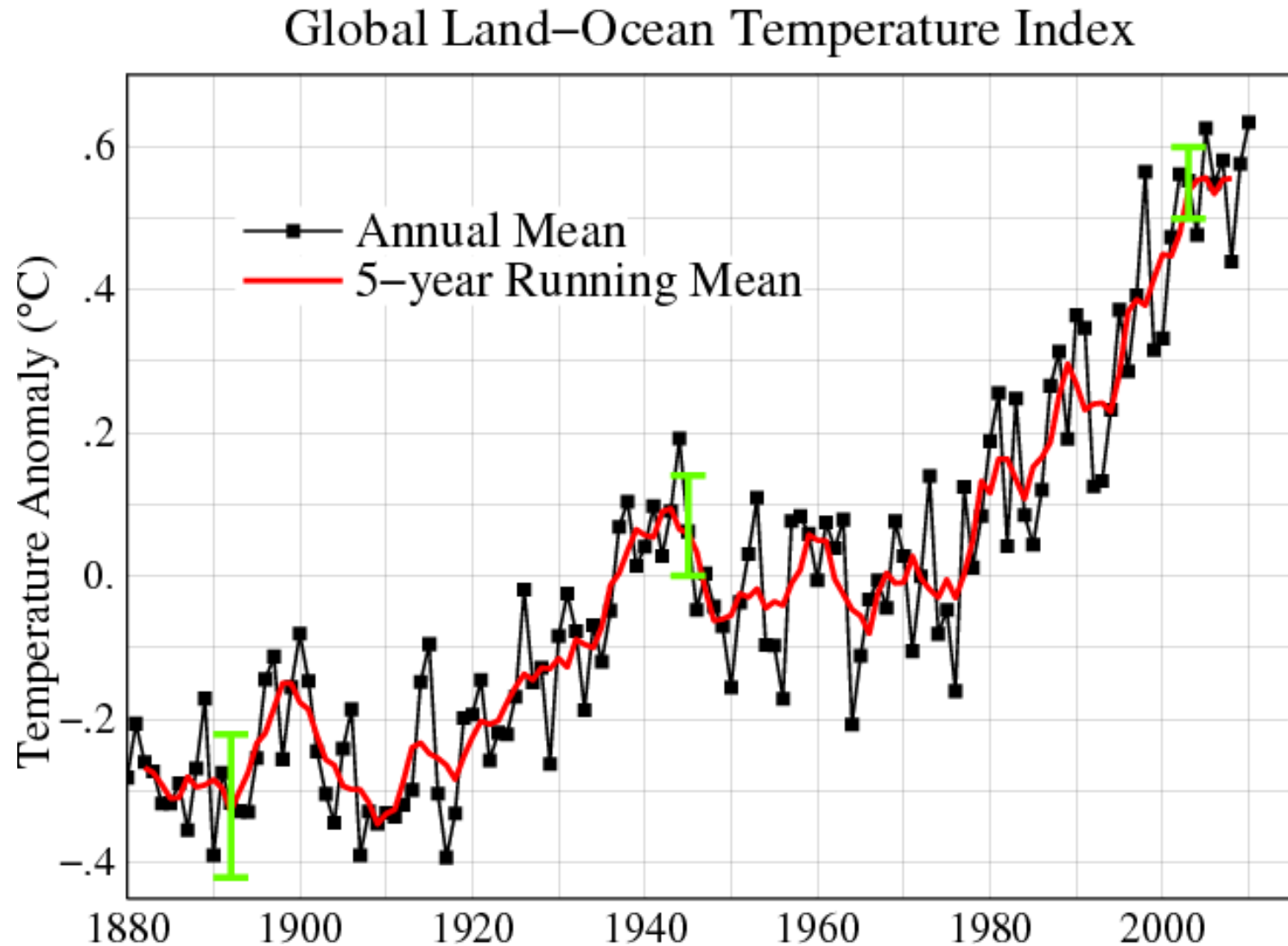
4 October 2012

Thanks to the Belgian Science Policy Office for its support,
and Philippe Marbaix and Bruna Gaino for their help

ipcc
INTERGOVERNMENTAL PANEL ON climate change

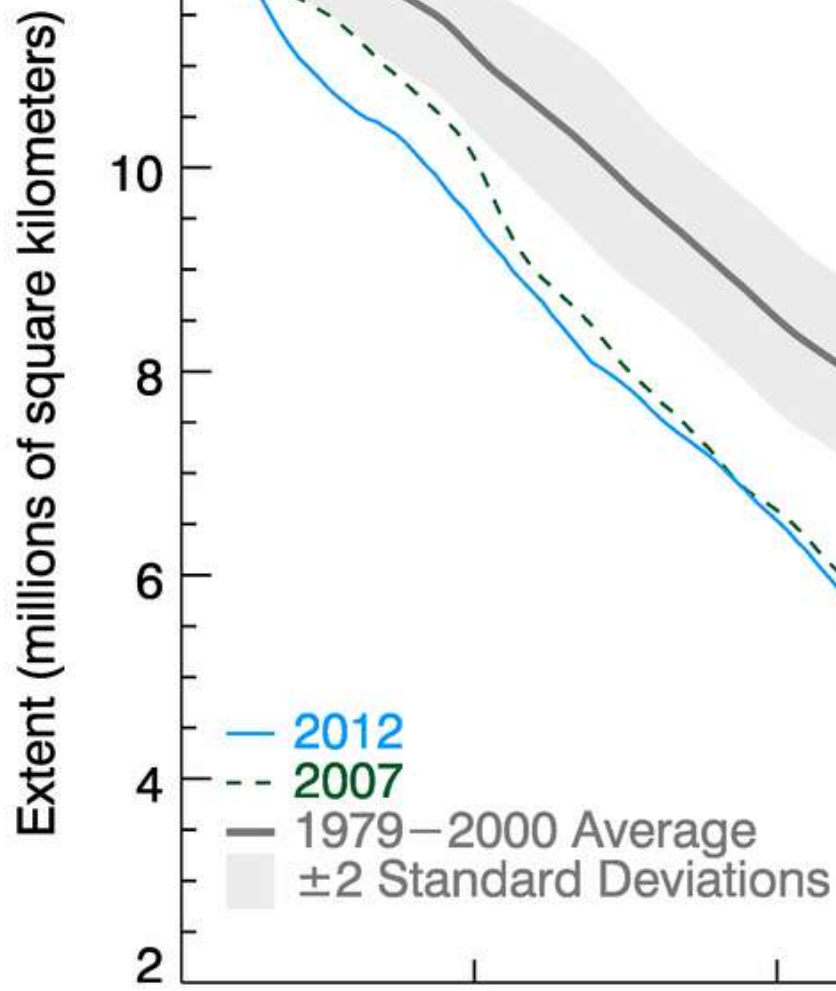


Warming has not « stopped »: Global (land & ocean) mean surface temperature change from NASA GISS until 2010



Source: NASA GIS

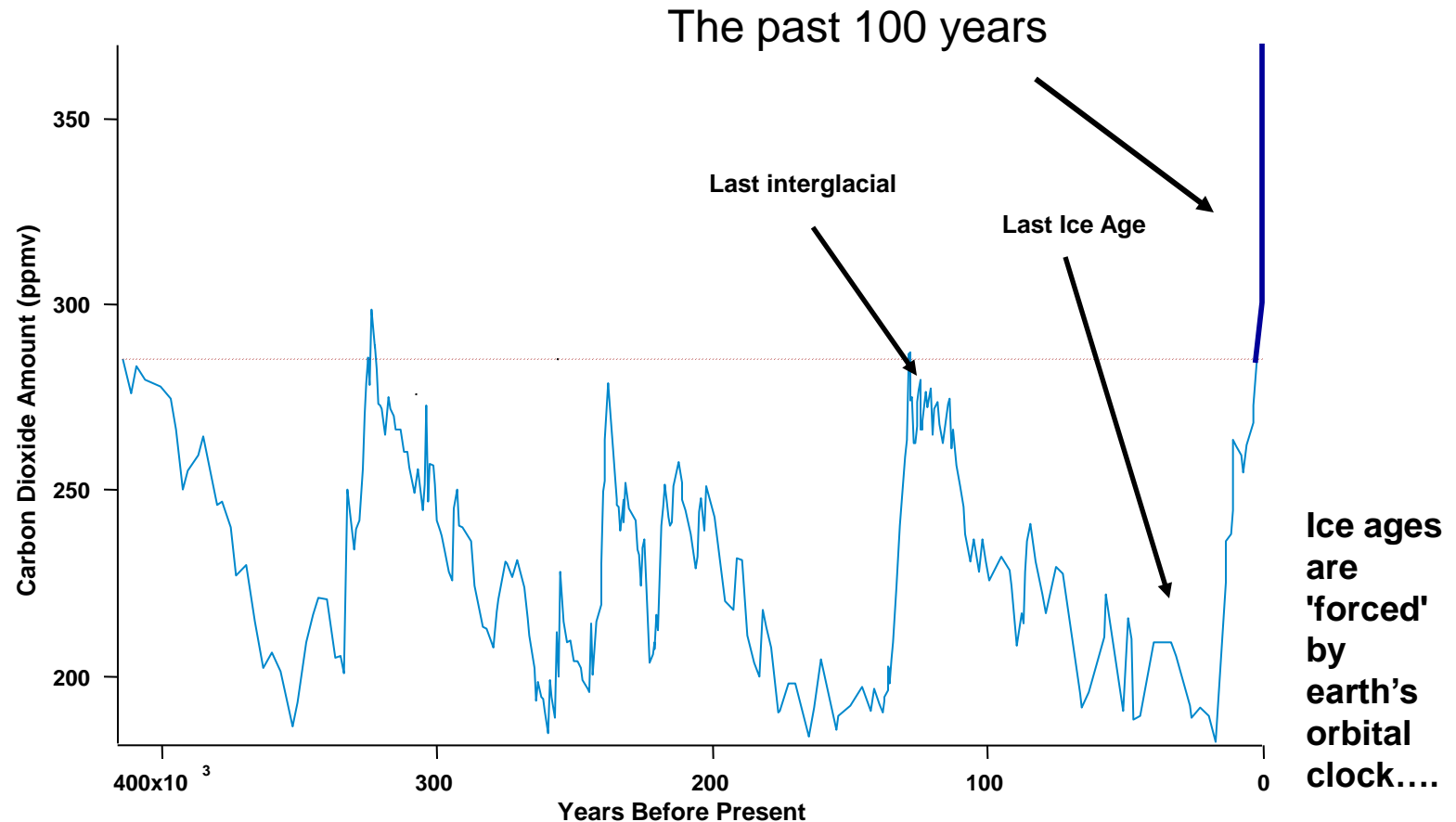
Arctic Sea Ice Extent (Area of ocean with at least 15% sea ice)



National Snow and Ice Data Center, Boulder CO

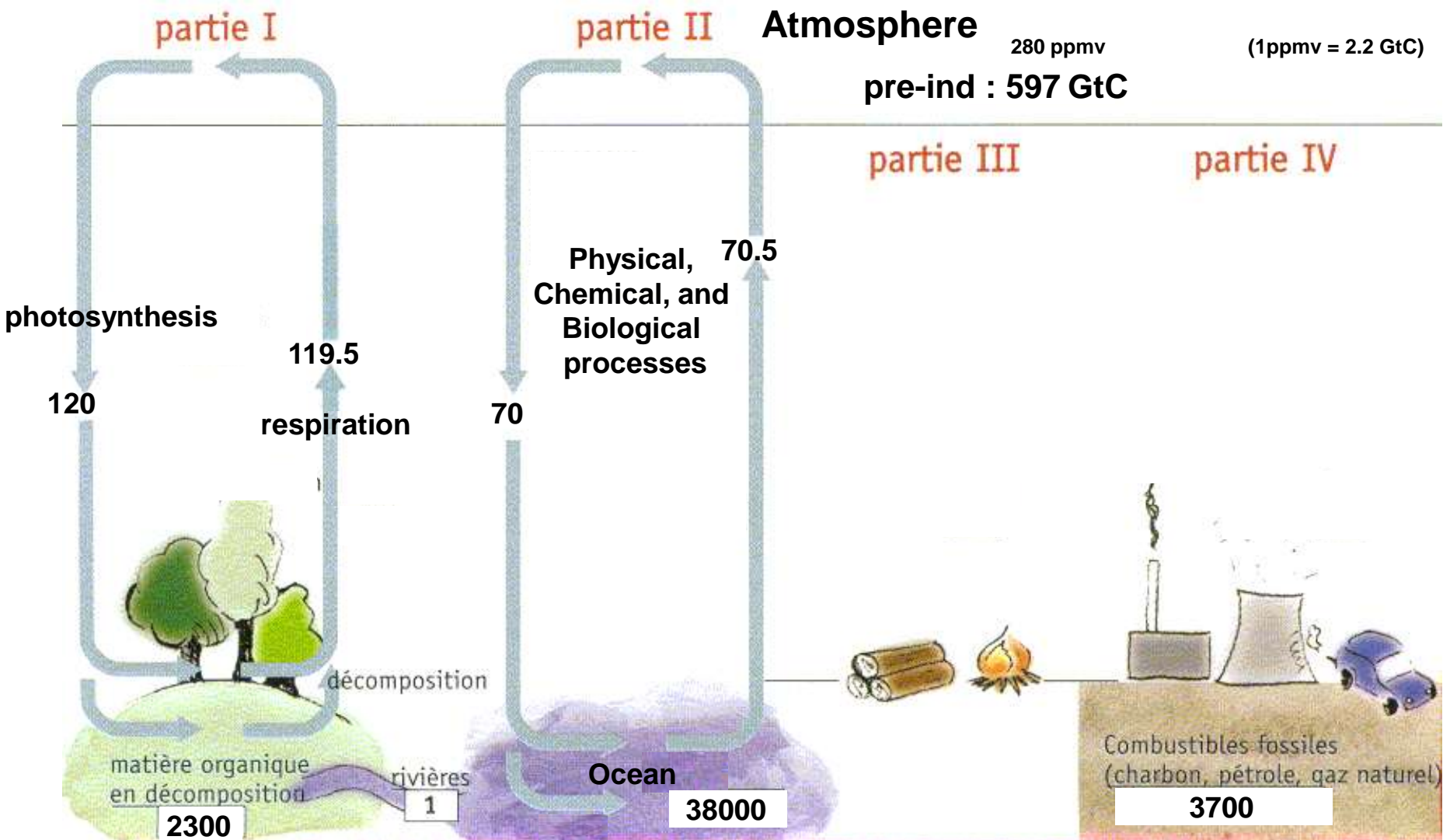
12 Sep 2012

Some information about carbon dioxide changes through four past ice ages (from ice cores), and in the modern era (from global data)



It is well established that there is more carbon dioxide in the atmosphere today than there has been in at least 650,000 years. (Figure by S. Solomon)

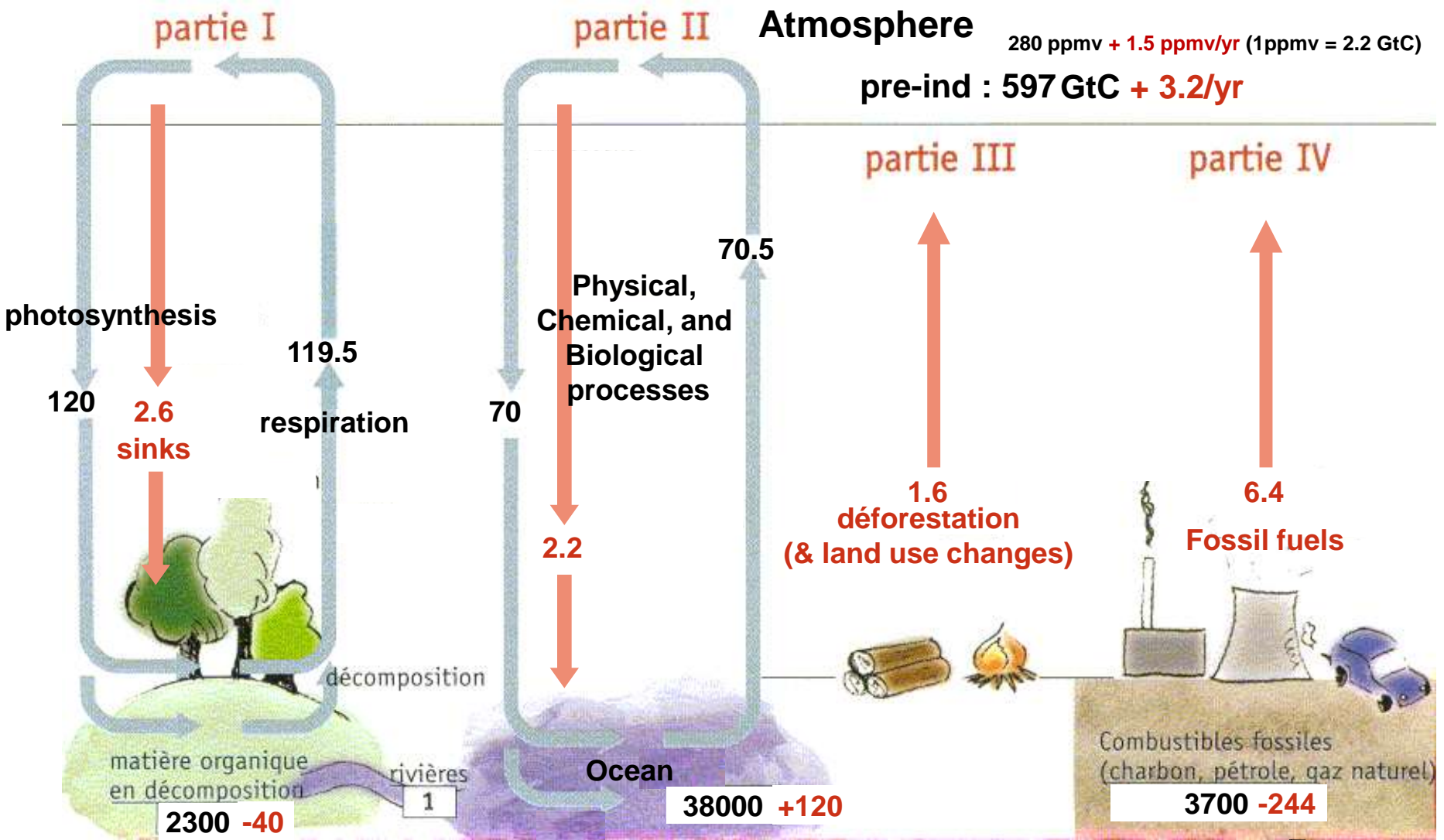
Carbon cycle: unperturbed fluxes



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)

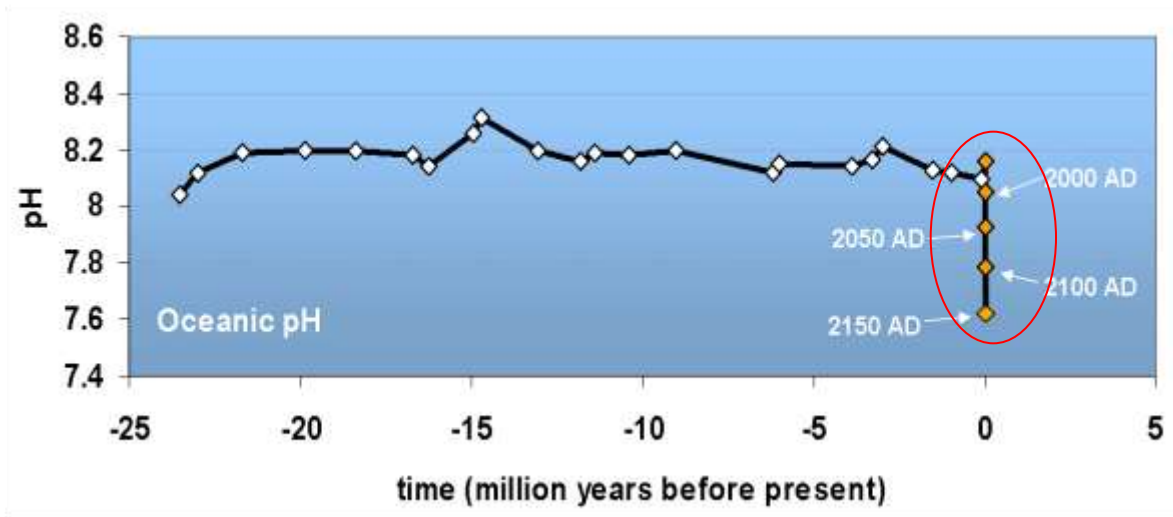


Units: GtC (billions tons of carbon) or GtC/year

Stocks!

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

A Progression of Understanding: Greater and Greater Certainty in Attribution

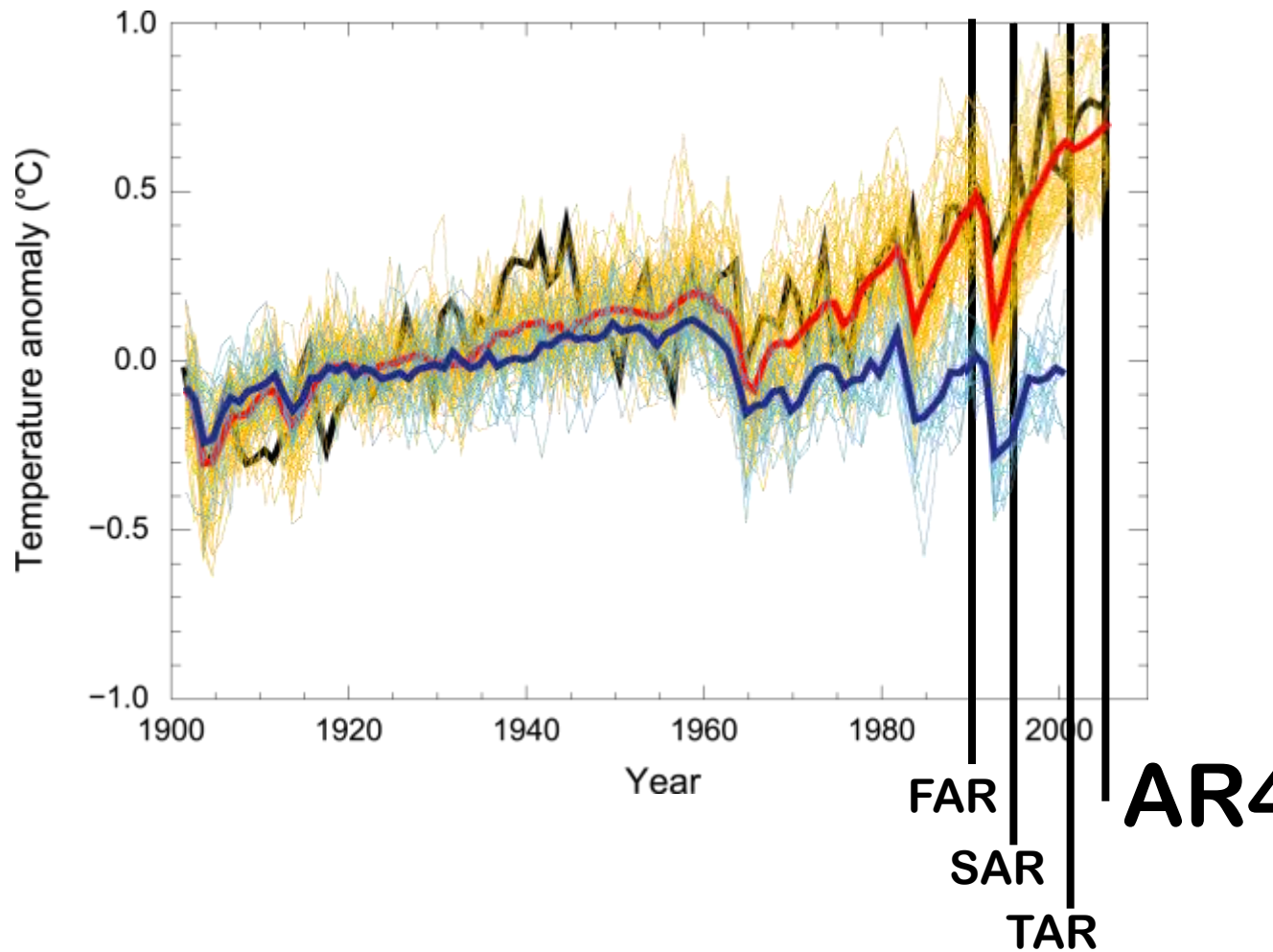
FAR (1990):
“unequivocal detection
not likely for a decade”

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

TAR (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”

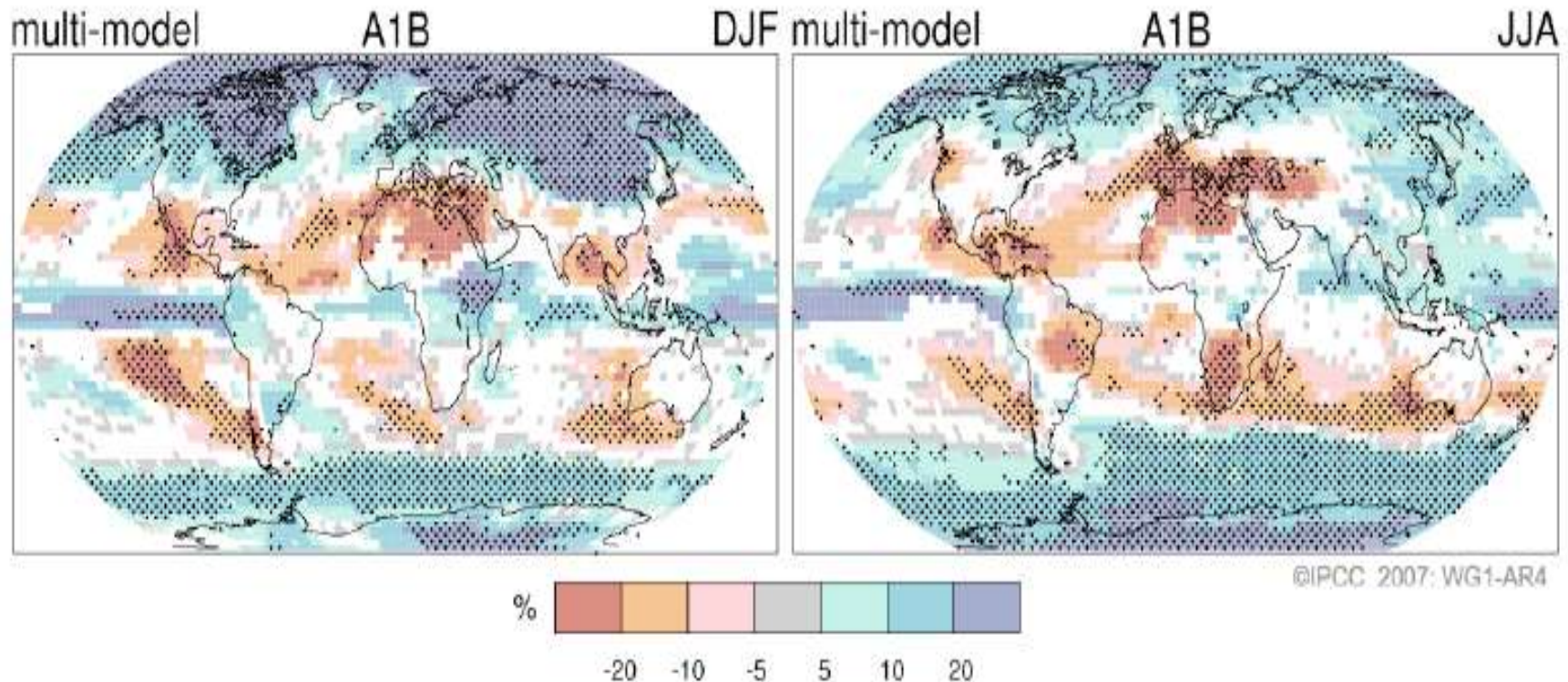
(Slide from Sir John Houghton, based on AR4)



Key conclusion from the last IPCC report (2007):

- **Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations**

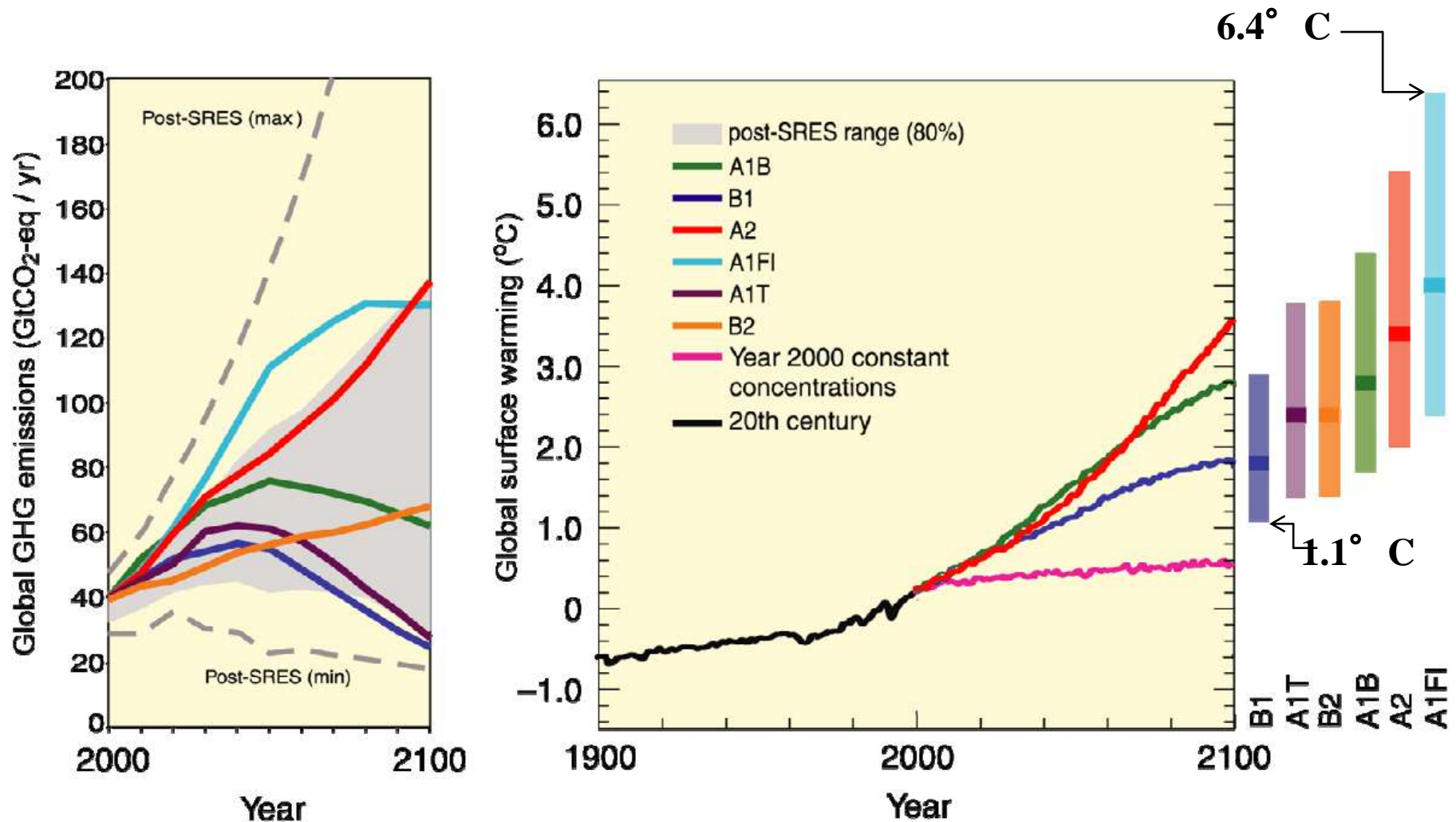
Regionale spreiding: neerslag



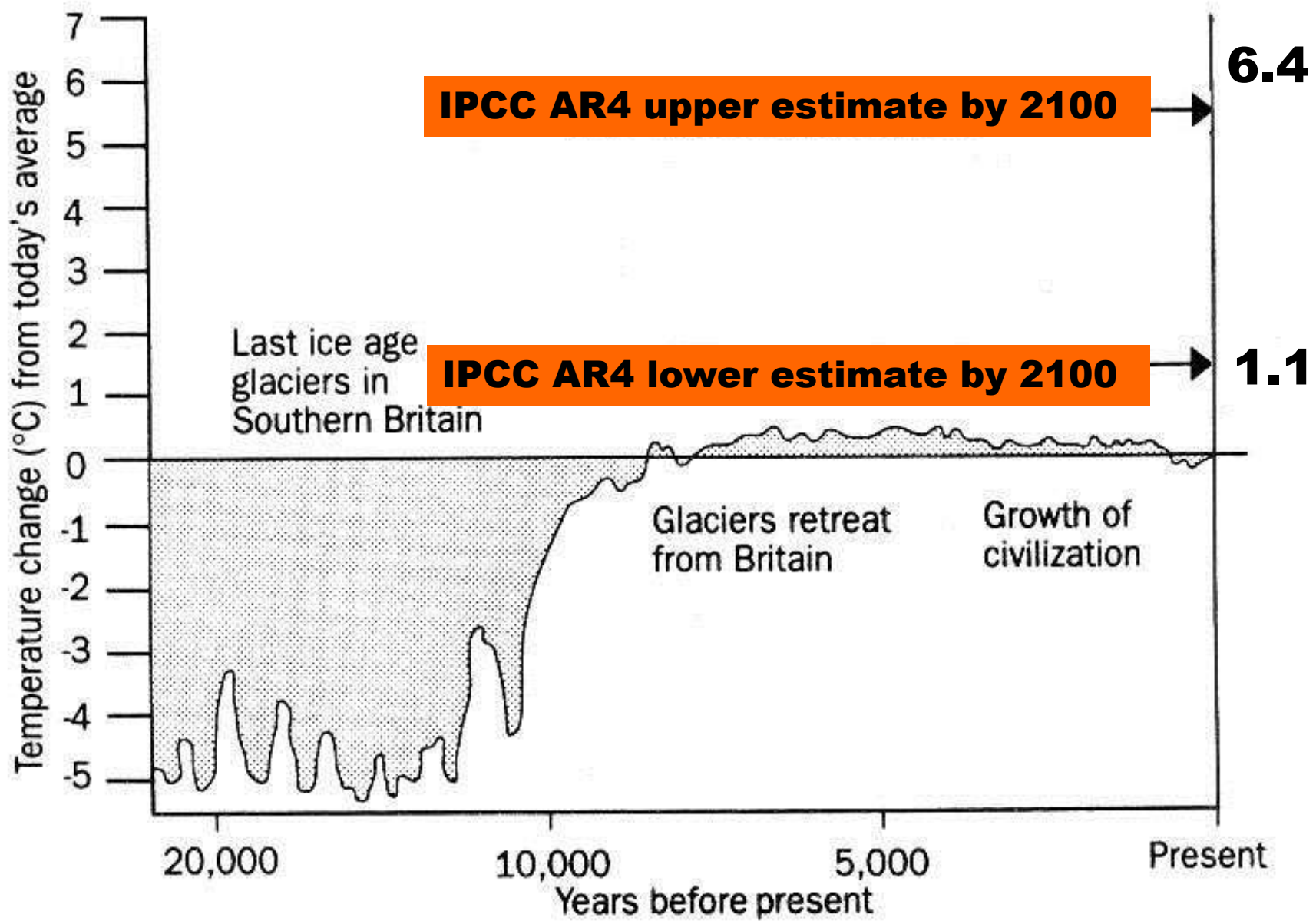
Gestippelde regio's: meer dan 90% akkoord ivm de richting van de verandering.

Witte regio's: geen overeenstemming tussen de modellen (<66% in dezelfde richting).

Climate projections without mitigation

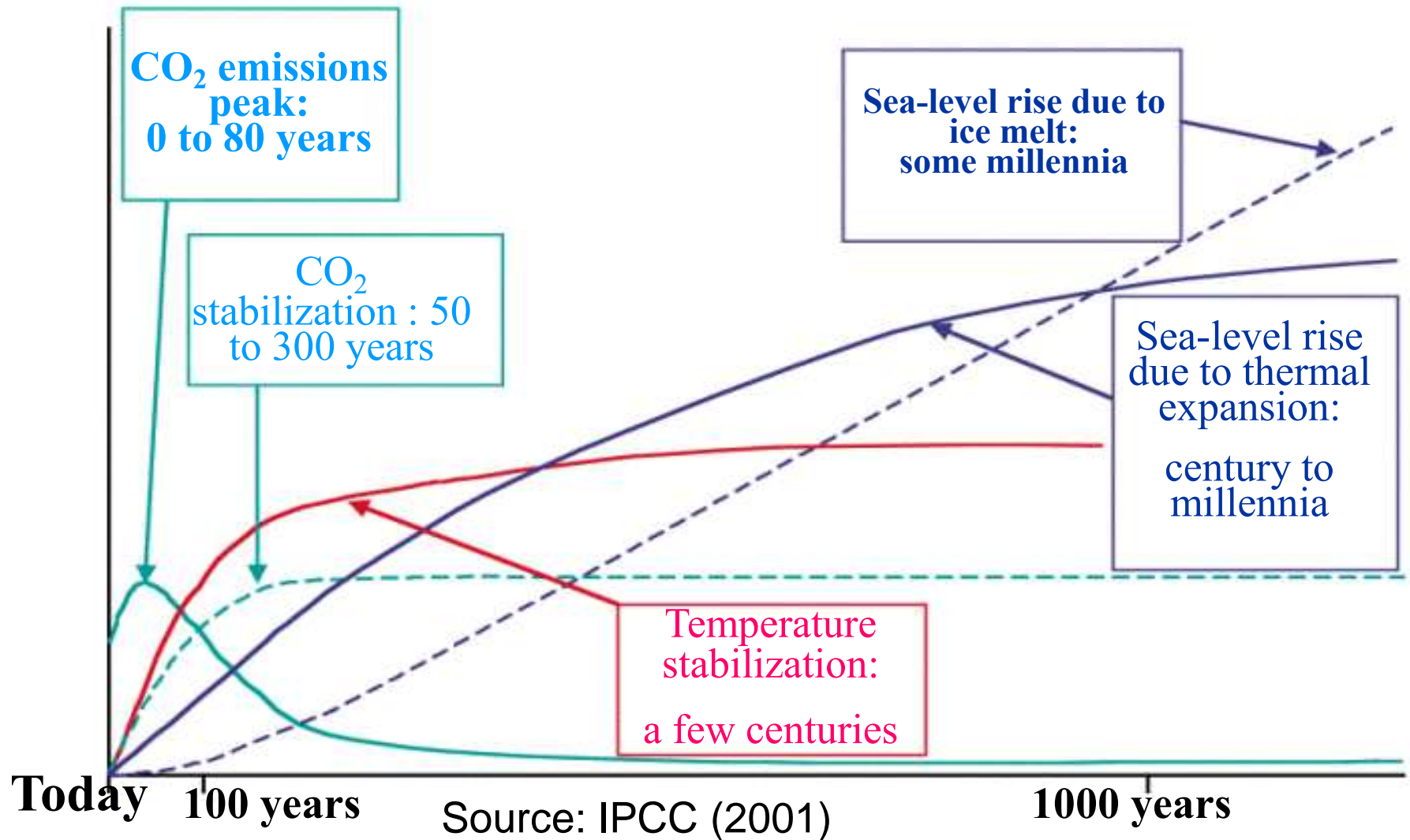


NB: departure from the 1980-1999 average



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

Significant inertia exists in the climate system



**AR4: 20% - 30% of
plants and animals
species likely at
“increased risk of
extinction”**

**if ΔT 2°C - 3°C (above
pre-industrial temperature)**

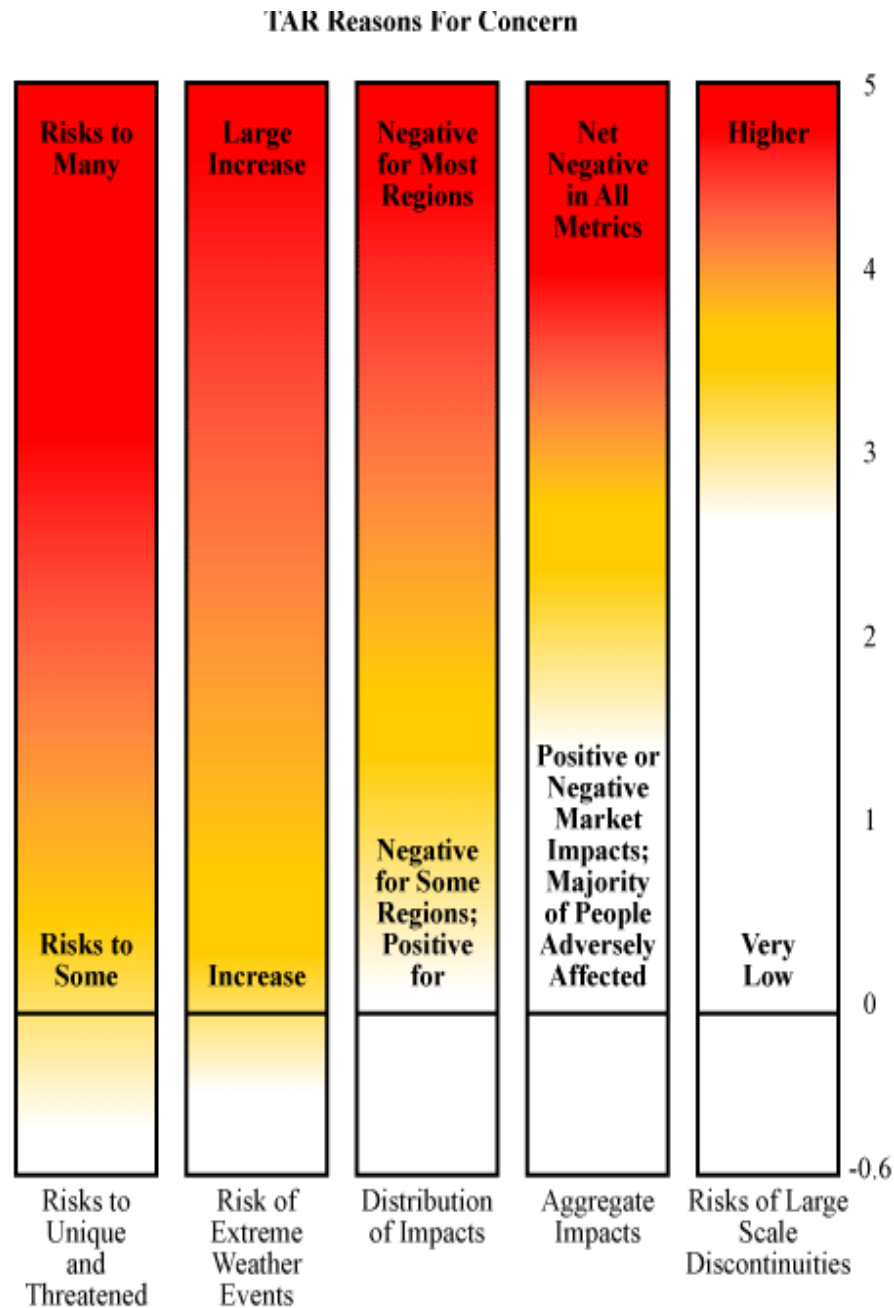


WMO

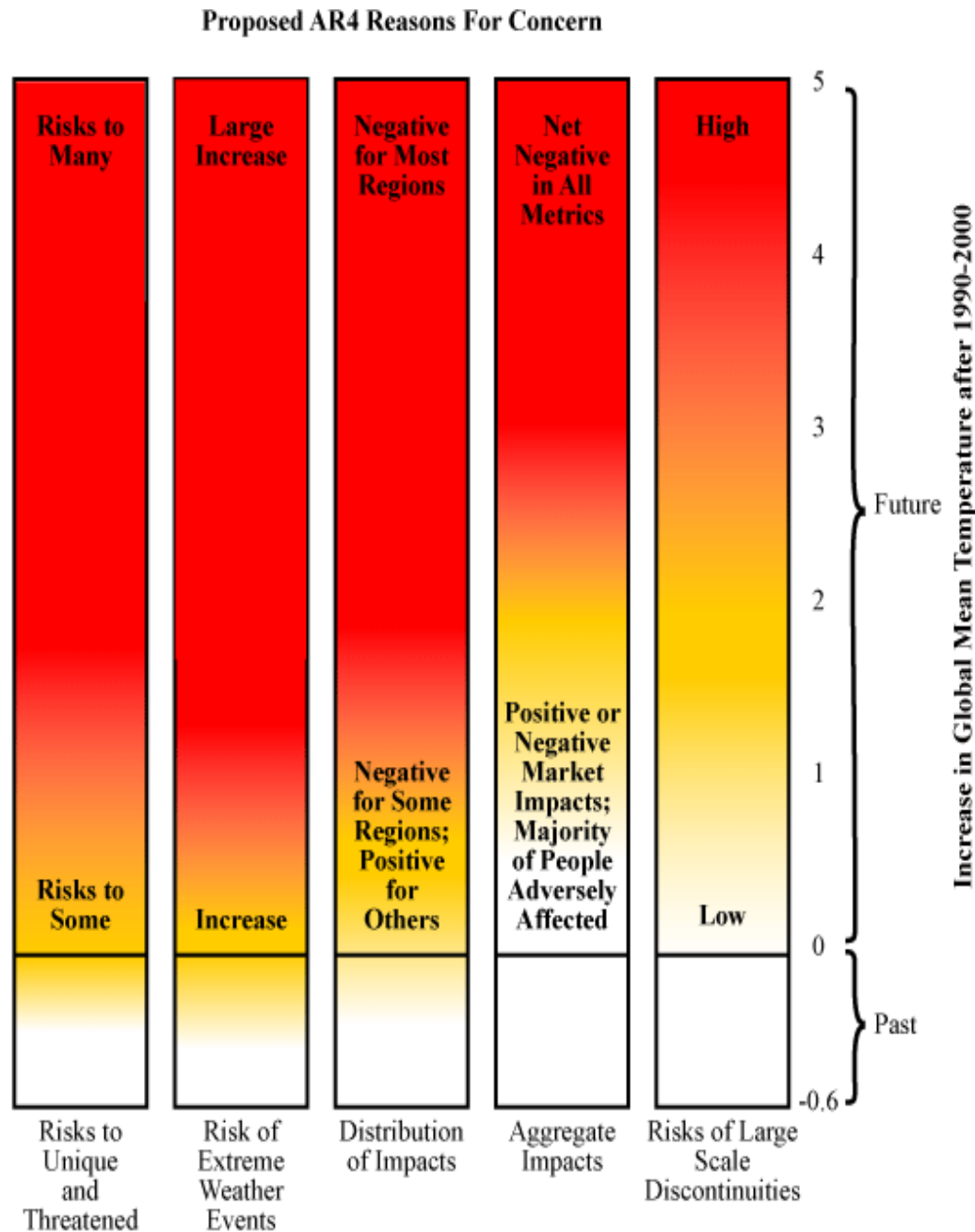


UNEP

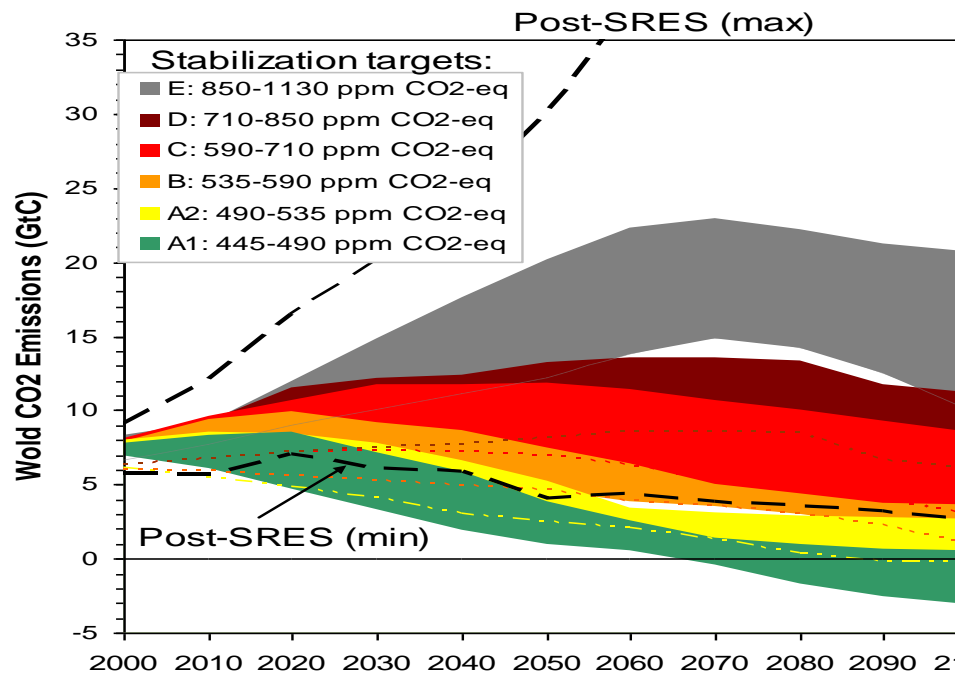
IPCC TAR, 2001



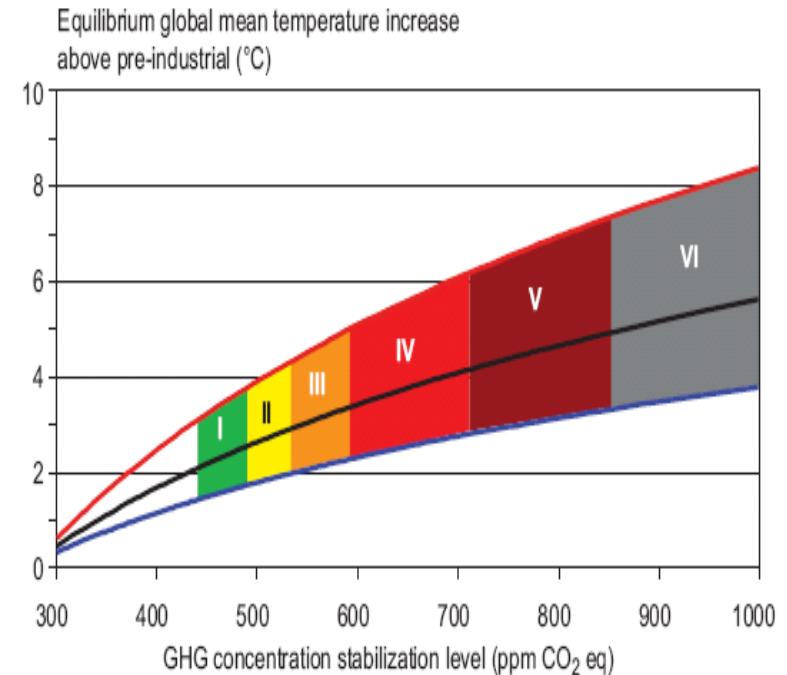
**Smith et
al, 2009,
PNAS,
based on
IPCC AR4,
2007**



The lower the stabilisation level the earlier global emissions have to go down



Multigas and CO₂ only studies combined



IPCC AR4 (2007)

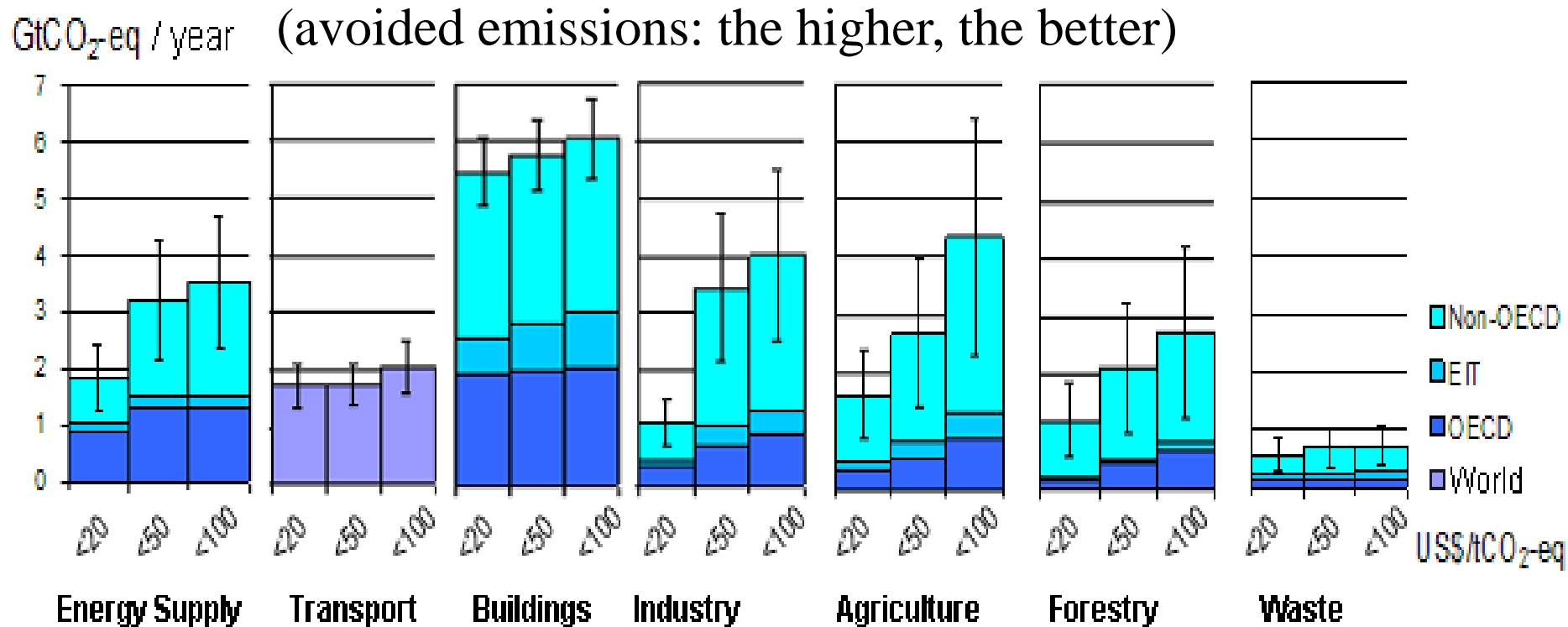
Long term mitigation (after 2030)

- The lower the stabilization level, the more quickly emissions would need to peak and to decline thereafter
- Mitigation efforts over the next two to three decades will have a large impact on opportunities to achieve lower stabilization levels

IPCC AR4 (2007)

Stab level (ppm CO ₂ -eq)	Global Mean temp. increase at equilibrium (°C)	Year CO ₂ needs to peak	Reduction in 2050 compared to 2000
445 – 490	2.0 – 2.4	2000 - 2015	-85 to -50
490 – 535	2.4 – 2.8	2000 - 2020	-60 to -30
535 – 590	2.8 – 3.2	2010 - 2030	-30 to +5
590 – 710	3.2 – 4.0	2020 - 2060	+10 to +60
710 – 855	4.0 – 4.9	2050 - 2080	+25 to +85
855 – 1130	4.9 – 6.1	2060 - 2090	+90 to +140

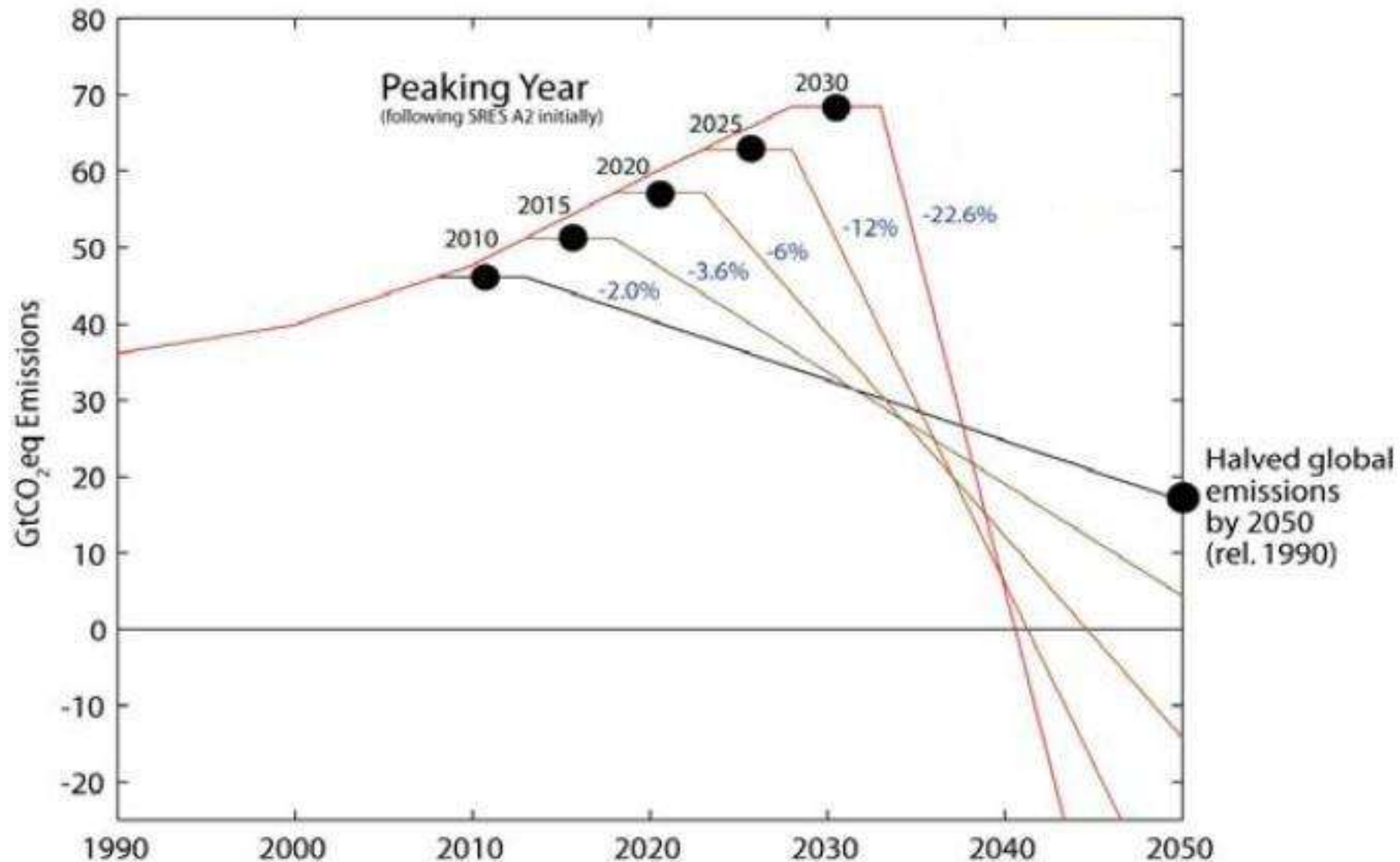
All sectors and regions have the potential to contribute by 2030



IPCC AR4 (2007)

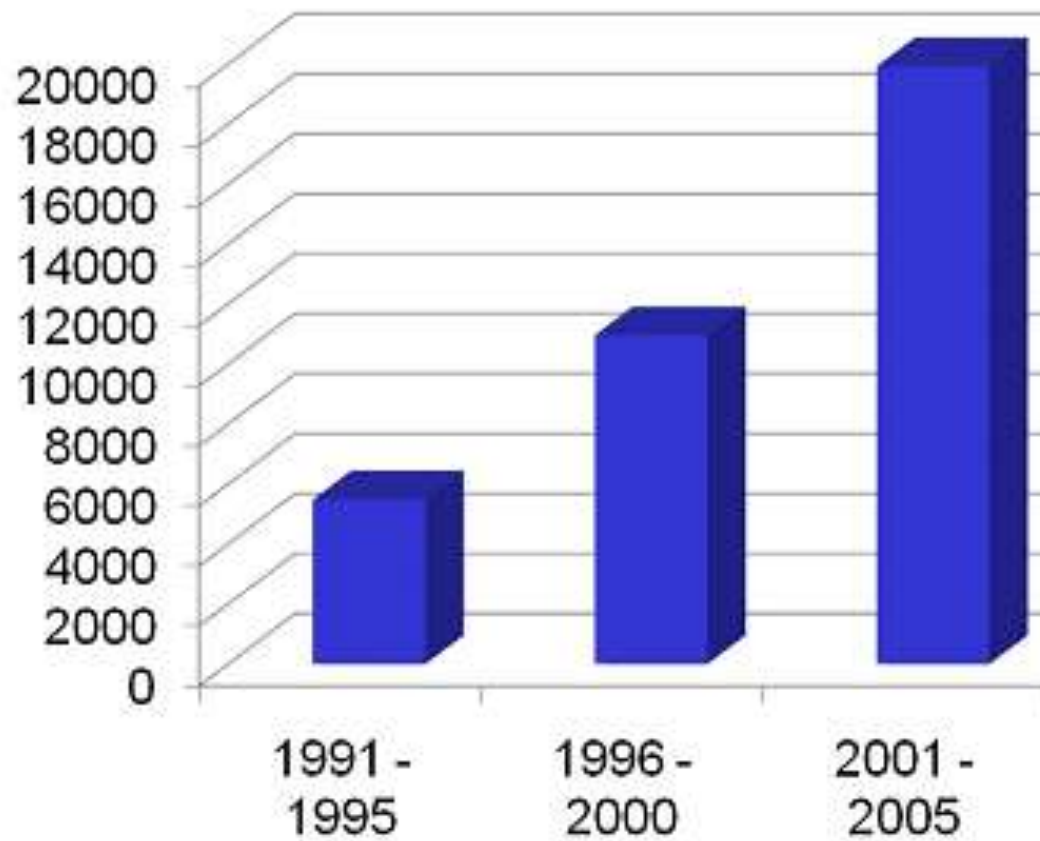
Note: estimates do not include non-technical options, such as lifestyle changes.

The more we wait, the more difficult it will be



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

Number of papers published on climate change



Key points on IPCC

- **IPCC: built for quality scientific assessment**
- **How it works**
- **Policy-relevant (PR) but not policy-prescriptive**
- **An example of (sometimes misunderstood) IPCC PR information: that related to the ultimate objective of the Climate Convention (2° C or 1.5° C stabilization target)**
- **A few words on AR5**

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.



What is the IPCC (GIEC in French) ?

- **IPCC** : Intergovernmental Panel on Climate Change
- Created by World Meteorological Organisation (WMO) & United Nations Environment Programme (UNEP) in 1988
- **Mandate** : assess the science of climate change, impacts and adaptation, mitigation options
- Publishes consensus reports (1990, 1996, 2001, 2007)
(Cambridge University Press)
Advises Climate Change Convention
- Nobel Peace prize (2007)

Role of IPCC (Intergovernmental Panel on Climate Change)

"The IPCC does not carry out research nor does it monitor climate related data or other relevant parameters. It bases its assessment mainly on peer reviewed and published scientific/technical literature."

NB: IPCC Reports are policy-relevant,
NOT policy-prescriptive

IPCC Structure

- **3 Working Groups, 1 Task Force**
- WG 1: Physical basis for climate change
- WG 2: Impacts, adaptation & vulnerability
- WG 3: Mitigation (emission reductions)
- TF: Emission inventories (methodologies)

IPCC writing cycle (5 years, 2500 scientists)

- ⌘ Plenary decides table of content of reports
- ⌘ Bureau appoints world-class scientists as authors, based on publication record
- ⌘ Authors assess all scientific literature
- ⌘ *Draft* – Expert **review** (+ Review editors)
- ⌘ *Draft 2 (+ Draft 1 Summary for Policy Makers (SPM))* – Combined expert/government **review**
- ⌘ *Draft 3 (+ Draft 2 SPM)* – Government **review** of SPM
- ⌘ Approval Plenary (interaction authors – governments) – *SPM and full report*
- ⌘ ***NB: the scientists have the last word!***

The IPCC Fourth Assessment Report (2007)

+130 countries

around 450 lead authors

around 800 contributing authors

+2500 scientific expert reviewers

+18000 peer-reviewed publications cited

+90000 comments from experts and Governments

The assessments carried out by the IPCC have influenced global action on an unprecedented scale

- ✓ First Assessment Report (1990) had a major impact in defining the content of the **UNFCCC**
- ✓ The Second Assessment Report (1996) was largely influential in defining the provisions of the **Kyoto Protocol**
- ✓ The Third Assessment Report (2001) focused attention on the **impacts** of climate change and the need for **adaptation**
- ✓ The Fourth Assessment Report (2007) is creating a strong basis for a **post-2012** agreement
- ✓ The Fifth Assessment Report (2013) ...

Nobel Peace Prize for 2007

- **Shared, in two equal parts, between the Intergovernmental Panel on Climate Change (IPCC) and Albert Arnold (Al) Gore Jr. for « *their efforts to build up and disseminate greater knowledge about manmade climate change, and to lay the foundations for the measures that are needed to counteract such change.* »**

UN Framework Convention on Climate Change Article 2 (*Ultimate objective*):

'...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

Such a level should be achieved within a time frame sufficient

- to allow ecosystems to adapt naturally to climate change,
- to ensure that food production is not threatened and
- to enable economic development to proceed in a sustainable manner.'

Emissions scenarios
(WGIII)

Critical climate change levels
(WG I, WGII, WGIII)

Key vulnerabilities
(WGI, WG II, WGIII)

Dangerous anthropogenic interference (or « How the IPCC is policy-relevant w/o being prescriptive »)

« The identification of potential key vulnerabilities is intended to provide guidance to decision-makers for identifying levels and rates of climate change that may be associated with 'dangerous anthropogenic interference' (DAI) with the climate system, in the terminology of the UNFCCC Article 2. **Ultimately, the determination of DAI** cannot be based on scientific arguments alone, but **involves other judgements informed by the state of scientific knowledge** »

- The IPCC ***never*** recommended a particular quantification of « dangerous anthropogenic interference », but the UNFCCC COP decided in Cancun (2010), based on the Copenhagen agreement, that the ultimate goal of the Convention would be interpreted as « 2°C » (with the possibility to review this goal (1.5°C ?) in 2015, i.e. the year following the AR5).

**AR5: we cannot speculate on content,
but...**

AR5 will be the best ever

- **Better integration of Mitigation and Adaptation**
- **Improved risk-management approach**
- **Evolving away from the non-mitigation SRES scenarios** (SRES= Special Report on Emission Scenarios, 2000)
- **Special effort to provide regional information when available**
- **Sustainable development & equity aspects**
- **More comprehensive treatment of economic aspects, and of cross-cutting issues**
- **Emerging issues handled (geo-engineering, ...)**
- **Better handling & communication of uncertainties**

Recent/Coming IPCC Products

- ***2011: Special report on Renewable Energy Sources and Climate Change Mitigation***
- ***2011: Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation***
- ***2013: AR5 WGI report (physical science)***
- ***2014: AR5 WGII (Impacts & Adaptation); WGIII (Mitigation), Synthesis Report***
- ***All available on www.ipcc.ch***

Final remarks on climate change science

- **What does climate knowledge mean for the urgency of mitigation and adaptation?**
 - **your work is of major importance for the world**
 - **implementation of your results will not be easy**
 - **the ivory tower time is gone, promote co-creation of knowledge instead**
 - **science-stakeholders (incl. policy) needs lubrication**
 - **scientific quality and integrity in presenting results is of major importance**

**IPCC is eager to continue
serving the climate and
sustainable development
process, with policy relevance,
without being policy-
prescriptive**

www.ipcc.ch

Useful links:



⌘ www.ipcc.ch : IPCC

⌘ www.climate.be/vanyp : my slides and other documents

⌘ www.skepticalscience.com: excellent responses to contrarians arguments