

Climate Change: the IPCC view



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Credits: many slides borrowed with gratitude from IPCC
colleagues: R. Christ, RK Pachauri, S. Solomon, J. Palutikof,
J. Stone...

Climate Broadcasters Network-Europe (CBN-E), Geneva, 1-9-2009

⌘ The IPCC

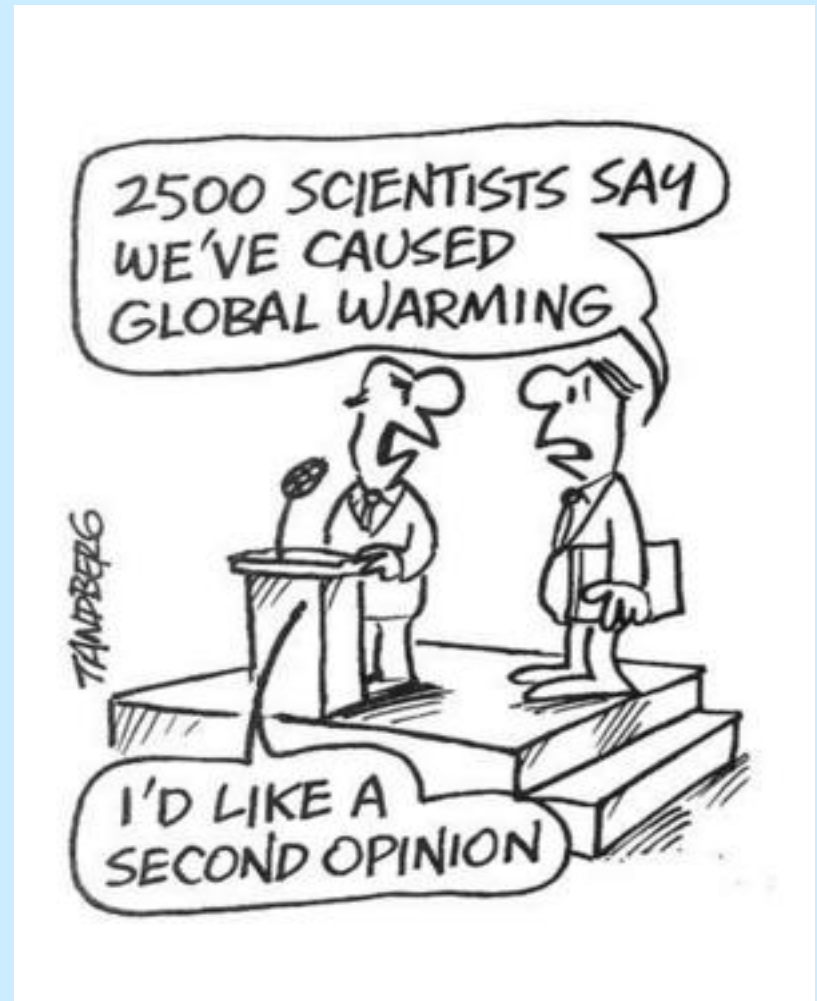
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Why the IPCC ?

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.




Role of IPCC

"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."

(source: www.ipcc.ch)



**IPCC Reports are
policy-relevant,
NOT
policy-prescriptive**



IPCC Working Groups & Task Force

Working Group I - "The Physical Science Basis"

Working Group II - "Impacts, Adaptation and Vulnerability"

Working Group III - "Mitigation of Climate Change"

Task Force on National Greenhouse Gas Inventories

(source: www.ipcc.ch)

The evolving perspective - IPCC Assessments

FAR

Climate impacts
Efficiency

SAR

Climate impacts
Efficiency
Equity

TAR

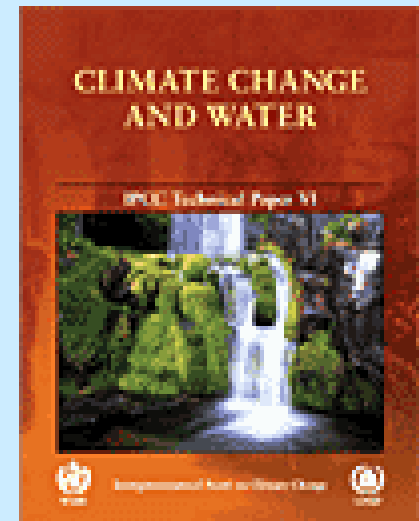
Climate impacts
Efficiency
Equity
Sustainable Development

AR4

Climate impacts
Efficiency
Equity
Sustainable development
Regional focus
Socio economic impacts

IPCC Products

- **Assessment reports** provide a comprehensive picture of the present state of understanding of climate change (1990 – 1995 – 2001 – 2007).
- **Special reports** address and assess a specific issue (e.g. Ozone layer, Land use, Technology transfer)
- **Methodology reports** provide methodologies for national greenhouse gas inventories and are used by Parties to the UNFCCC to prepare their national communications
- **Technical papers** focus on a specific topic drawing material from other IPCC reports



IPCC writing cycle (4 years, 1250 authors, 2500 expert reviewers)



- ⌘ 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*



⌘ Latest science

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Key messages from the IPCC WG1 Report (1)



⌘ Certain:

- ☑ Emissions resulting from **human activities** are **substantially increasing** the atmospheric concentrations of the **greenhouse gases**: CO₂, CH₄, CFC, and N₂O

⌘ Calculated **with confidence**:

- ☑ Under the business as usual scenario, **temperature will increase by about 3°C by 2100** (uncertainty range: 2 to 5°C), and **sea level will increase by 60 cm** (uncertainty range: 30 to 100 cm)

Key messages from the IPCC WG1 Report (2)



- ⌘ With an increase in the mean temperature, **episodes of high temperature** will most likely become **more frequent**
- ⌘ Rapid changes in climate will change the composition of ecosystems; **some species** will be unable to adapt fast enough and **will become extinct**.
- ⌘ Long-lived gases (**CO₂**, N₂O and CFCs) **would require immediate reduction** in emissions from human activities **of over 60% to stabilise their concentration at today's levels**.

Oops...

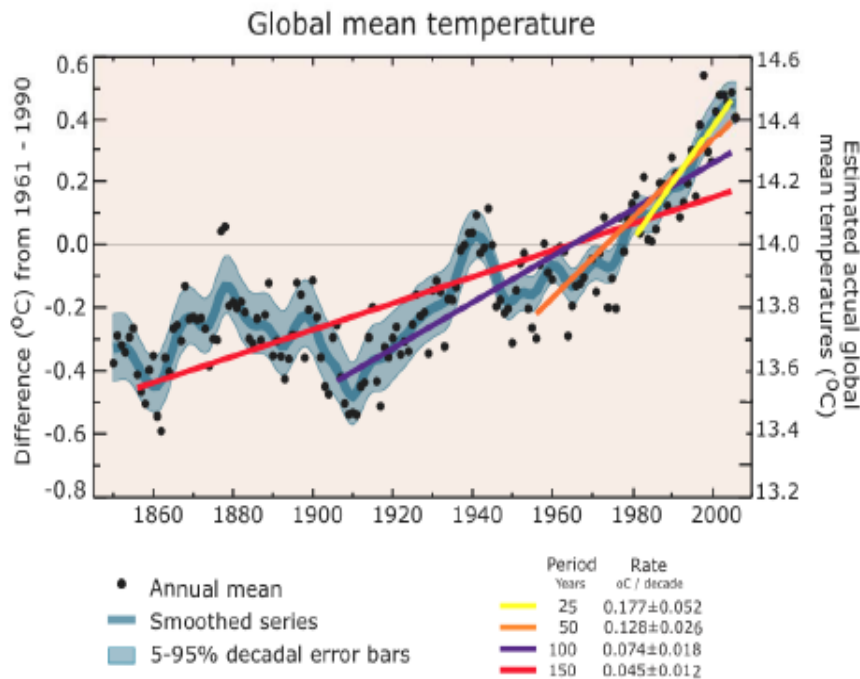


⌘... this was from the IPCC **first** assessment report, published 19 years ago (1990)

⌘Was anybody really listening?

⌘ Some Highlights of the IPCC Working Group I, II, and III

Twenty Years after the birth of IPCC:



Source: IPCC WGI AR4

- The science is now well established.
- The political engagement is stronger.
- Climate change is more than an environmental issue
- The warming continues

A Progression of Understanding: Greater and Greater Certainty in Attribution

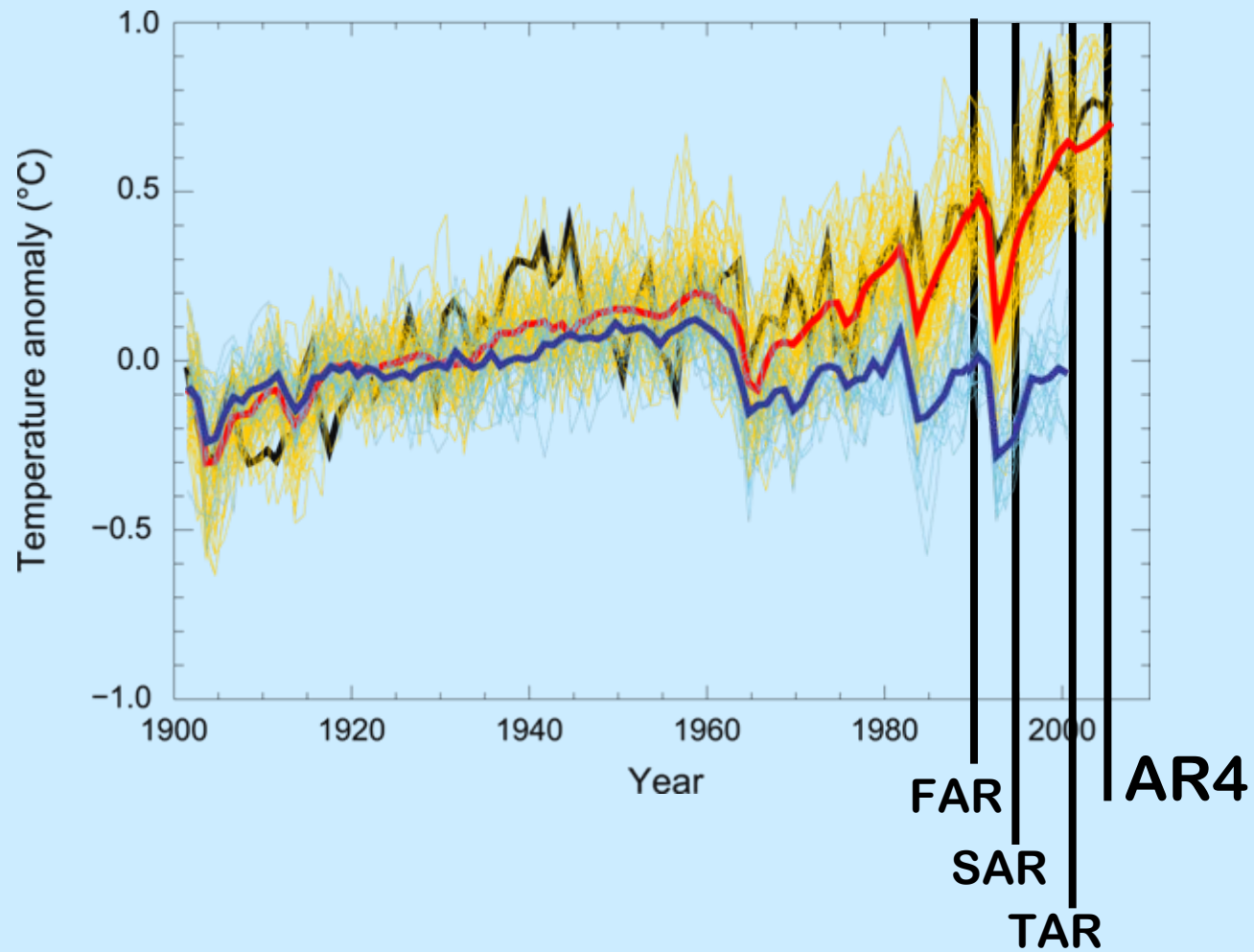
FAR (1990):

“unequivocal detection not likely for a decade”

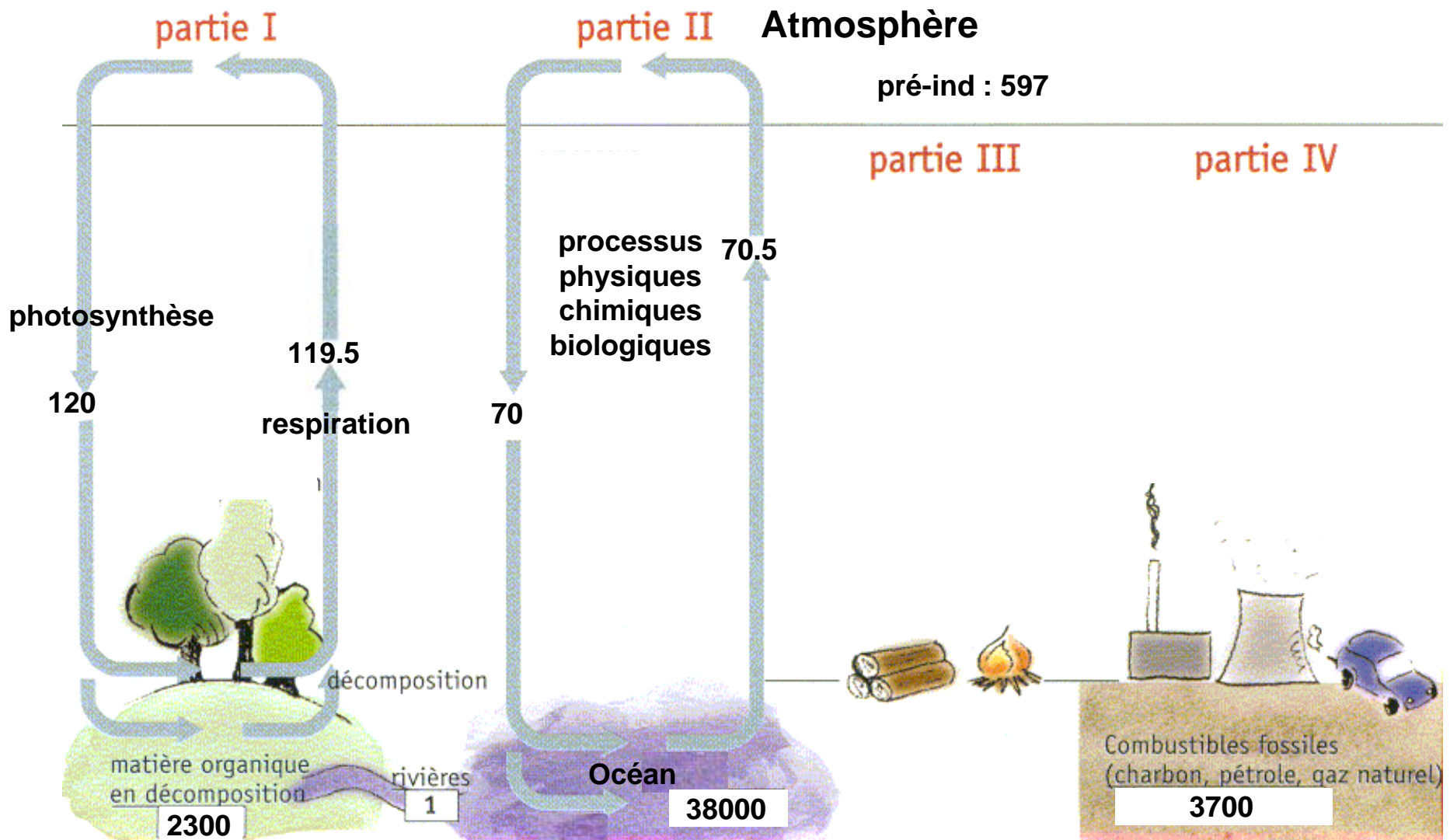
SAR (1995): “balance of evidence suggests discernible human influence”

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

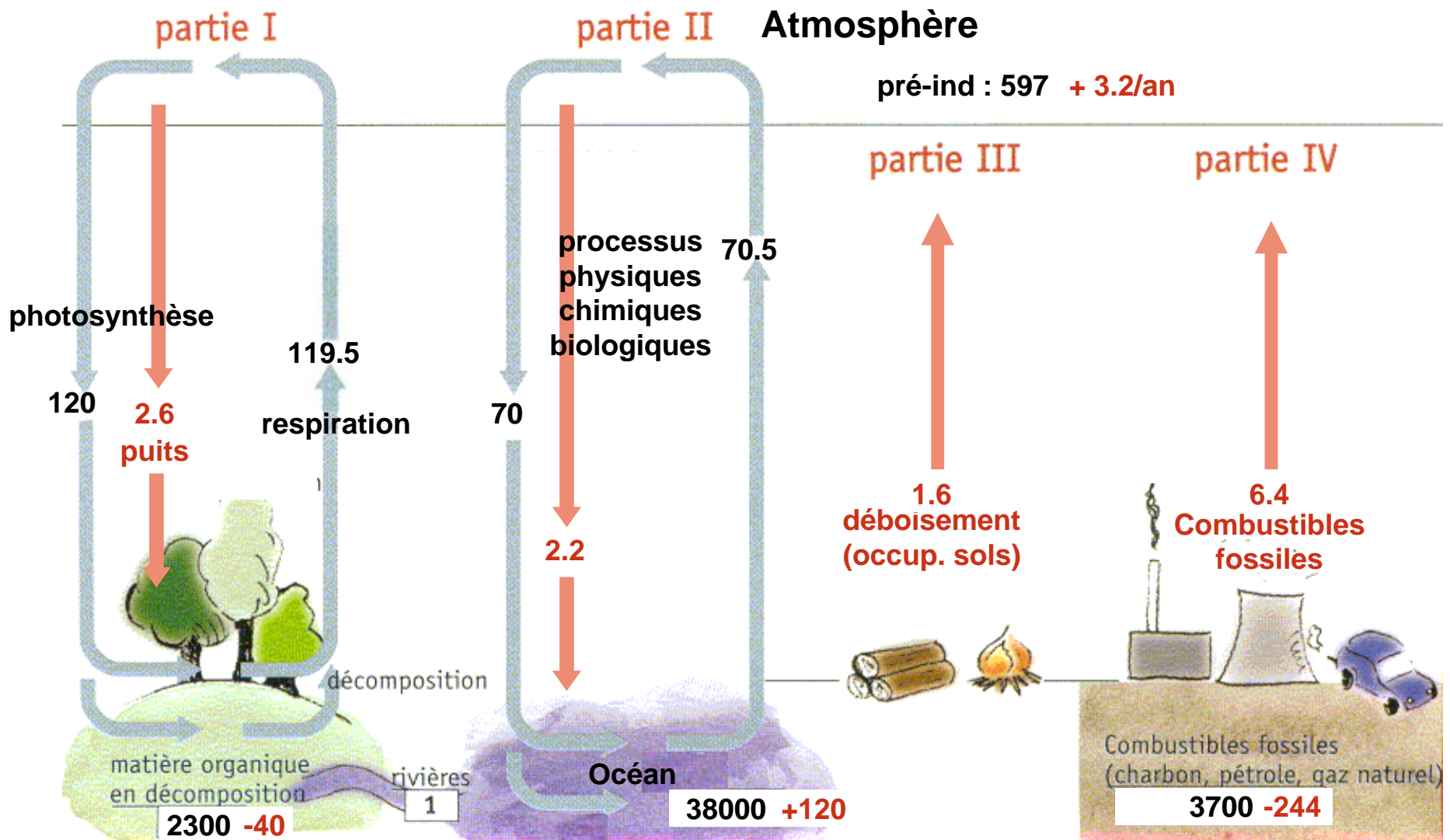
AR4 (2007): “most of the warming is very likely (odds 9 out of 10) due to greenhouse gases”



Cycle du carbone



Cycle du carbone



TAR (2001):

THE HUMAN INFLUENCE ON ATMOSPHERE & CLIMATE

(IPCC/WG1: Climate Change 2001, SPM & Chapters 2, 3, 4, 5, 9)

AR4:

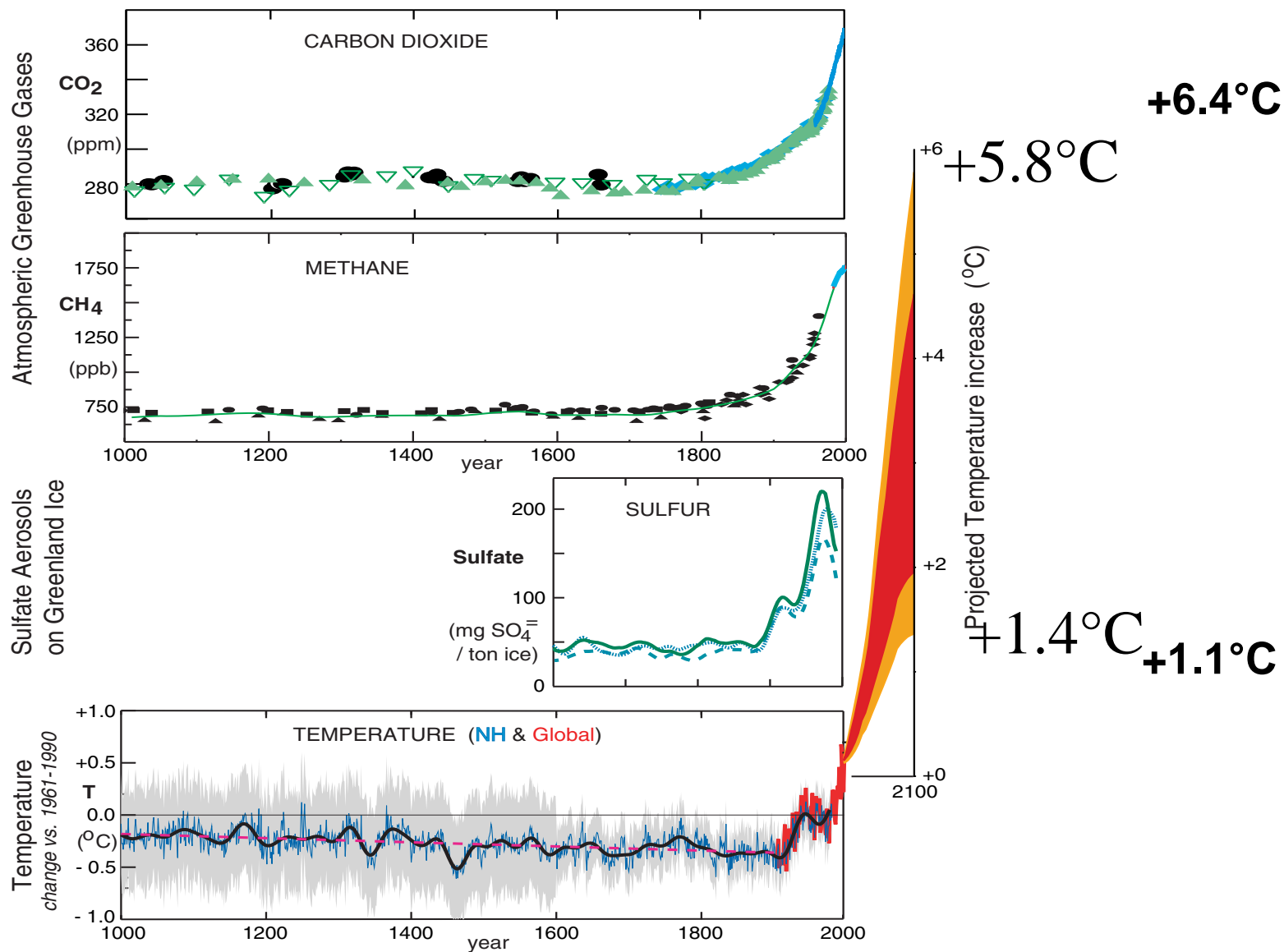
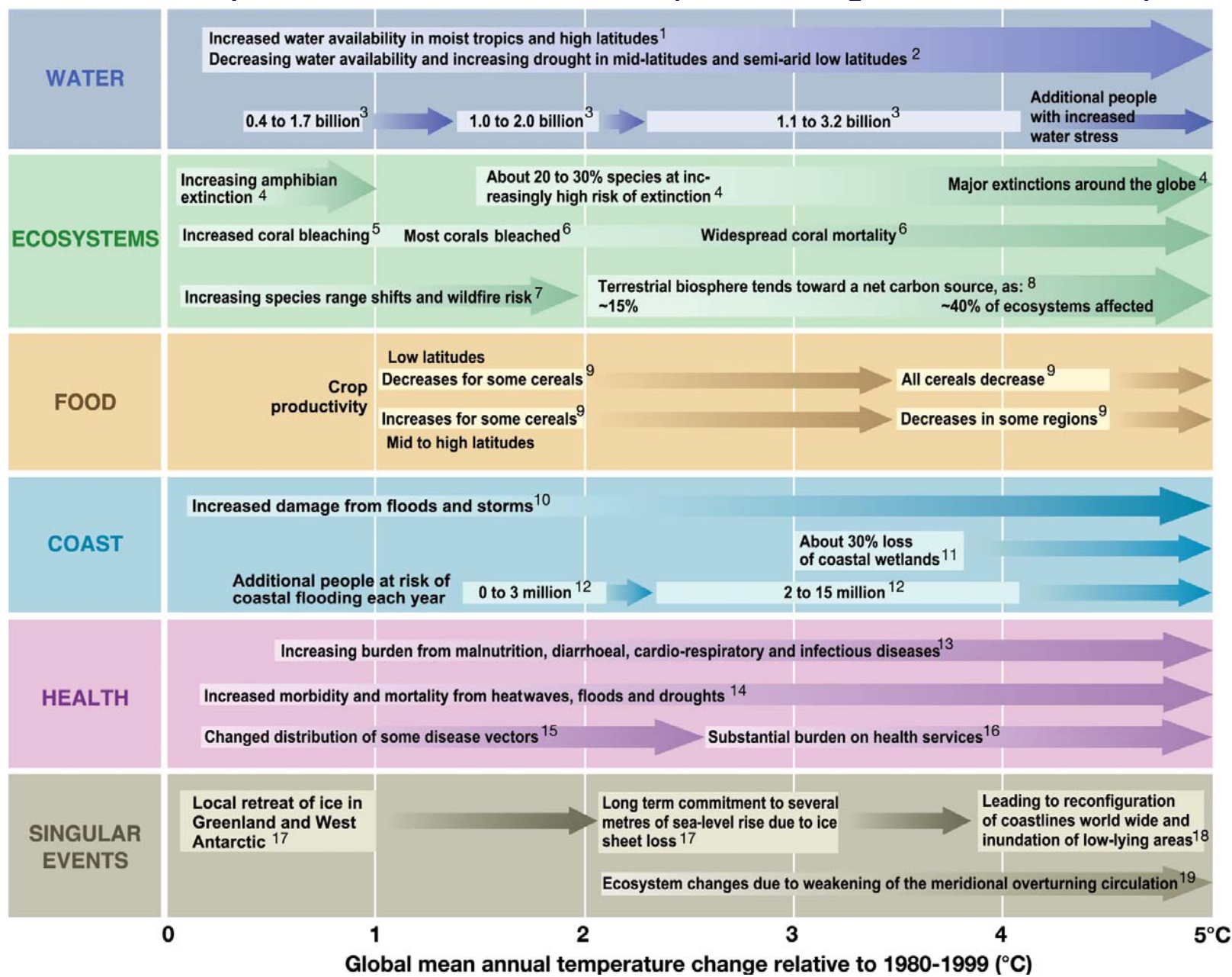


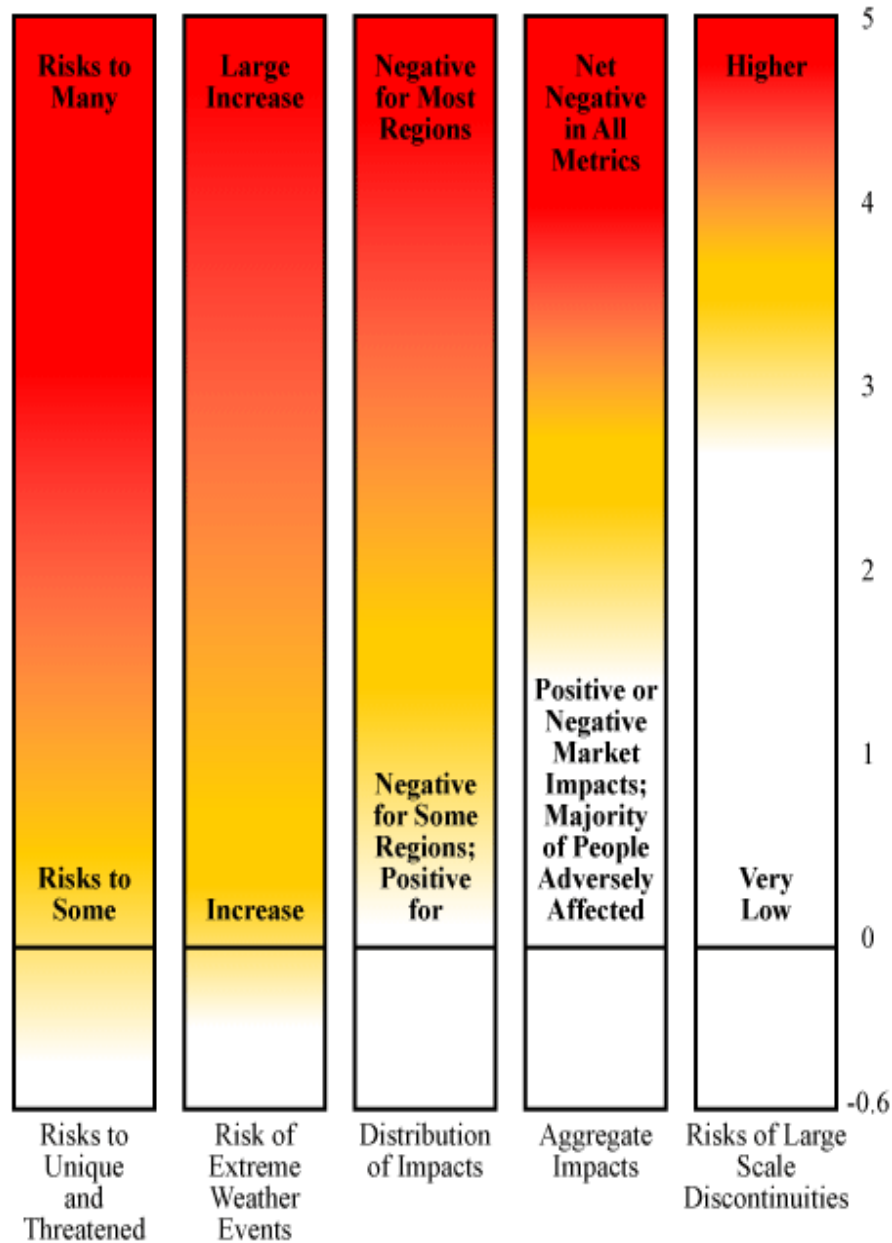
Table TS.3. (lower) Examples of global impacts projected for changes in climate (and sea level and atmospheric CO₂ where relevant)



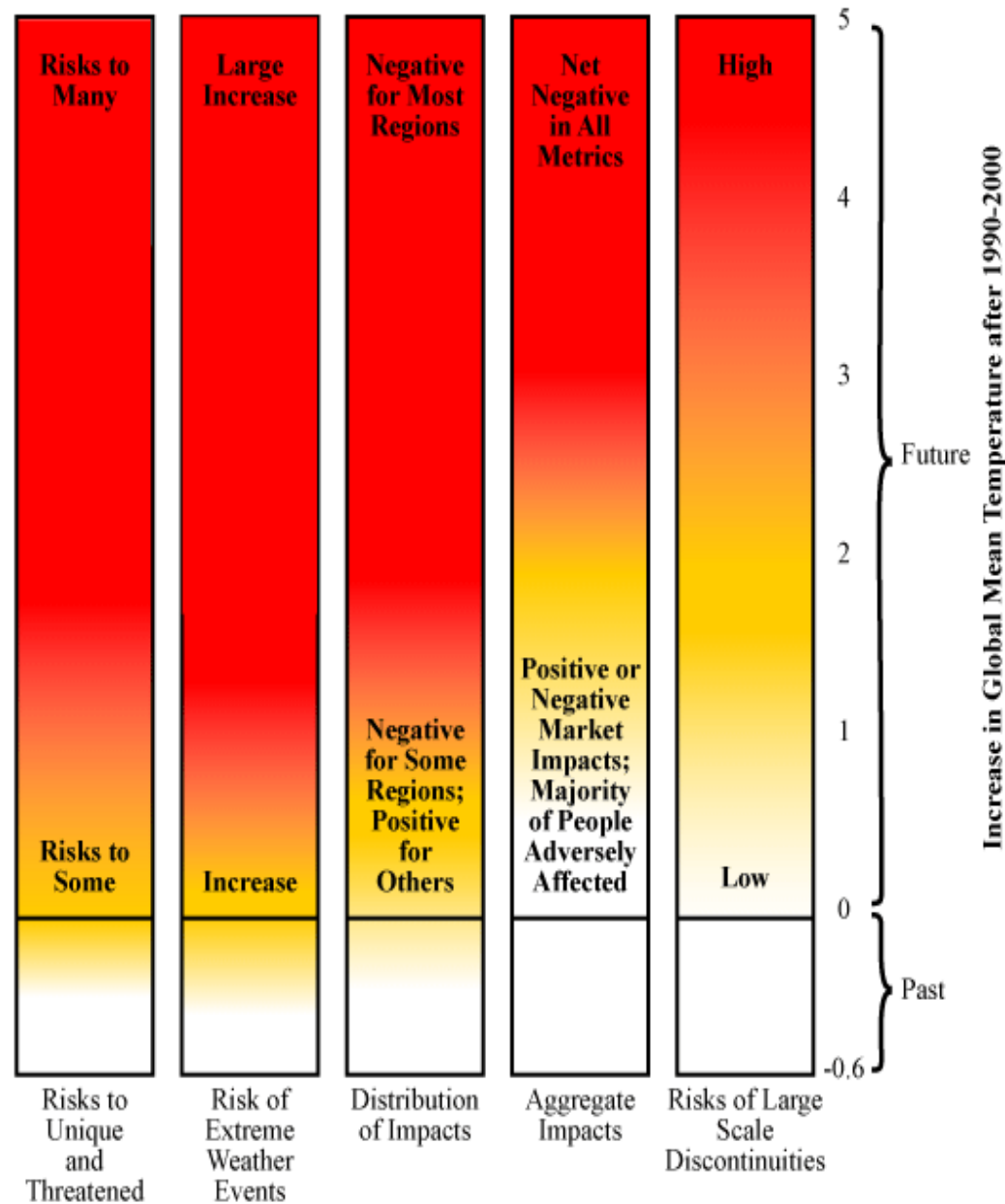
Source: IPCC WGII AR4

Reasons for concern (TAR-2001)

TAR Reasons For Concern



Reasons for concern (Smith et al, 2009, PNAS, based on AR4-2007)



Stabilisation levels and equilibrium global mean temperatures

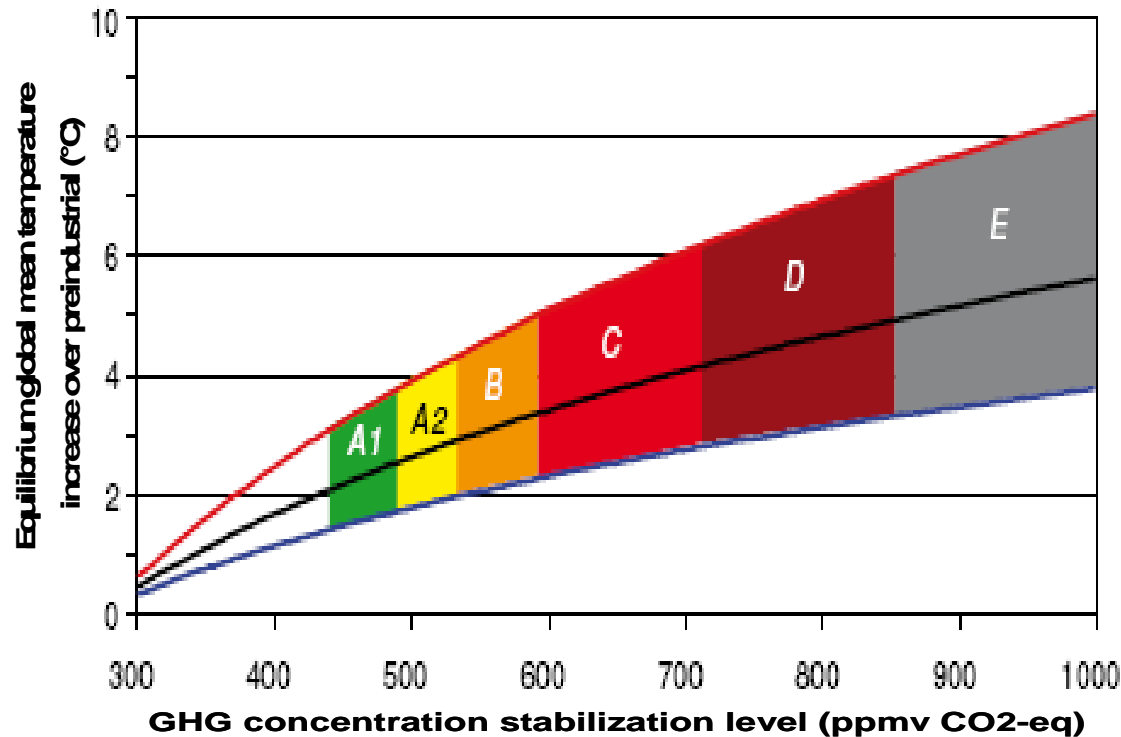
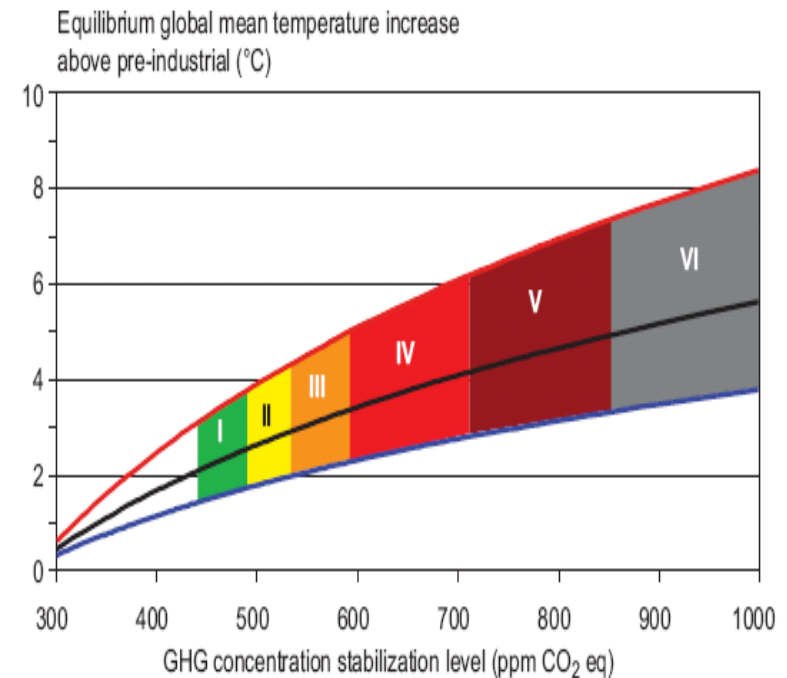
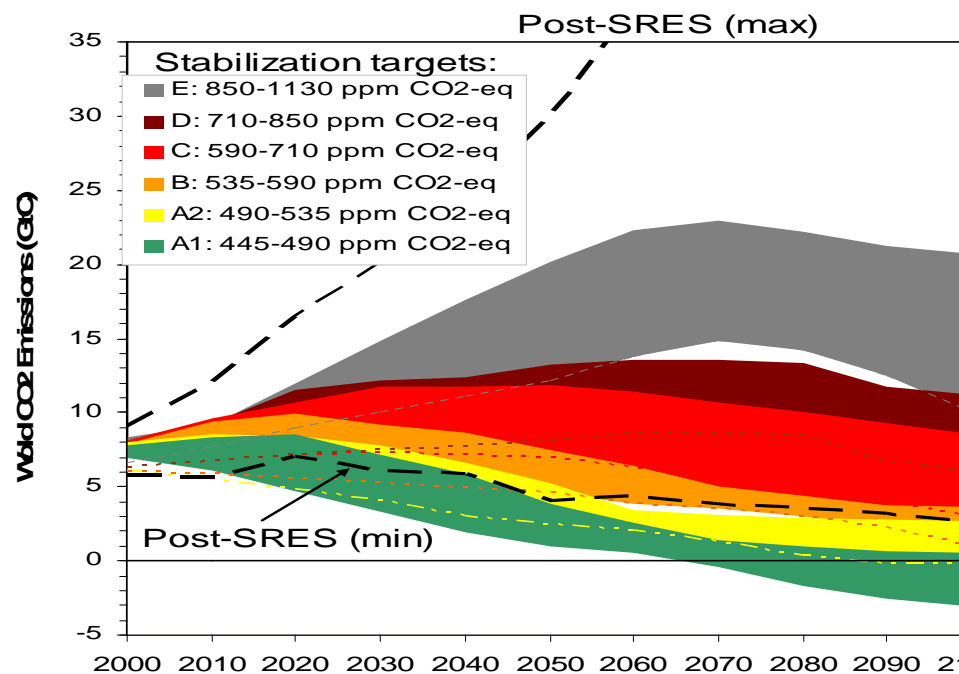


Figure SPM 8: Stabilization scenario categories as reported in Figure SPM.7 (coloured bands) and their relationship to equilibrium global mean temperature change above pre-industrial, using (i) “best estimate” climate sensitivity of 3 °C (black line in middle of shaded area), (ii) upper bound of likely range of climate sensitivity of 4.5 °C (red line at top of shaded area) (iii) lower bound of likely range of climate sensitivity of 2 °C (blue line at bottom of shaded area). Coloured shading shows the concentration bands for stabilization of greenhouse gases in the atmosphere corresponding to the stabilization scenario categories. The data are drawn from AR4 WGI, Chapter 10.8.

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



Multigas and CO₂ only studies combined

Contribution of Working Group III to the Fourth Assessment Report of the IPCC,

- **Technical Summary, page 39:**

Table TS.2: Classification of recent (Post-Third Assessment Report) stabilization scenarios according to different stabilization targets and alternative stabilization metrics [Table 3.5].

Category	Additional radiative forcing (W/m ²)	CO ₂ concentration (ppm)	CO ₂ -eq concentration (ppm)	Global mean temperature increase above pre-industrial at equilibrium, using "best estimate" climate sensitivity ^{a), b)} (°C)	Peaking year for CO ₂ emissions ^{c)}	Change in global CO ₂ emissions in 2050 (% of 2000 emissions) ^{c)}	No. of assessed scenarios
I	2.5-3.0	350-400	445-490	2.0-2.4	2000 - 2015	-85 to -50	6
II	3.0-3.5	400-440	490-535	2.4-2.8	2000 - 2020	-60 to -30	18
III	3.5-4.0	440-485	535-590	2.8-3.2	2010 - 2030	-30 to +5	21
IV	4.0-5.0	485-570	590-710	3.2-4.0	2020 - 2060	+10 to +60	118
V	5.0-6.0	570-660	710-855	4.0-4.9	2050 - 2080	+25 to +85	9
VI	6.0-7.5	660-790	855-1130	4.9-6.1	2060 - 2090	+90 to +140	5
Total							177

Notes:

a) Note that global mean temperature at equilibrium is different from expected global mean temperatures in 2100 due to the inertia of the climate system.

b) The simple relationships $T_{eq} = T_{2\times CO_2} \times \ln([CO_2]/278)/\ln(2)$ and $\Delta Q = 5.35 \times \ln([CO_2]/278)$ are used. Non-linearities in the feedbacks (including e.g., ice cover and carbon cycle) may cause time dependence of the effective climate sensitivity, as well as leading to larger uncertainties for greater warming levels. The best-estimate climate sensitivity (3 °C) refers to the most likely value, that is, the mode of the climate sensitivity PDF consistent with the WGI assessment of climate sensitivity and drawn from additional consideration of Box 10.2, Figure 2, in the WGI AR4.

c) Ranges correspond to the 15th to 85th percentile of the Post-Third Assessment Report (TAR) scenario distribution. CO₂ emissions are shown, so multi-gas scenarios can be compared with CO₂-only scenarios.

Note that the classification needs to be used with care. Each category includes a range of studies going from the upper to the lower boundary. The classification of studies was done on the basis of the reported targets (thus including modelling uncertainties). In addition, the relationship that was used to relate different stabilization metrics is also subject to uncertainty (see Figure 3.16).

Contribution of Working Group III to the Fourth Assessment Report of the IPCC,

- Chapter 13, page 776: (cité en note de bas de page dans la “feuille de route de Bali)

Box 13.7 The range of the difference between emissions in 1990 and emission allowances in 2020/2050 for various GHG concentration levels for Annex I and non-Annex I countries as a group^a

Scenario category	Region	2020	2050
<i>A-450 ppm CO₂-eq^b</i>	Annex I	-25% to -40%	-80% to -95%
	Non-Annex I	Substantial deviation from baseline in Latin America, Middle East, East Asia and Centrally-Planned Asia	Substantial deviation from baseline in all regions
<i>B-550 ppm CO₂-eq</i>	Annex I	-10% to -30%	-40% to -90%
	Non-Annex I	Deviation from baseline in Latin America and Middle East, East Asia	Deviation from baseline in most regions, especially in Latin America and Middle East
<i>C-650 ppm CO₂-eq</i>	Annex I	0% to -25%	-30% to -80%
	Non-Annex I	Baseline	Deviation from baseline in Latin America and Middle East, East Asia

Notes:

- ^a The aggregate range is based on multiple approaches to apportion emissions between regions (contraction and convergence, multistage, Triptych and intensity targets, among others). Each approach makes different assumptions about the pathway, specific national efforts and other variables. Additional extreme cases – in which Annex I undertakes all reductions, or non-Annex I undertakes all reductions – are not included. The ranges presented here do not imply political feasibility, nor do the results reflect cost variances.
- ^b Only the studies aiming at stabilization at 450 ppm CO₂-eq assume a (temporary) overshoot of about 50 ppm (See Den Elzen and Meinshausen, 2006).

Some of the Challenges



- ⌘ **Improve policy-relevance, without becoming policy-prescriptive**
- ⌘ **Innovate to allow easier « updating »**
- ⌘ **Improve quality and readability**
- ⌘ **Provide elements of answer to difficult/new questions**
- ⌘ **Integrate Synthesis Report « design » in the scoping process from the start**
- ⌘ **Improve collaboration between WG**
- ⌘ **Improve developing countries participation**

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Coming IPCC Products

- ⌘ *2010: 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*

New accents in AR5

- ⌘ *Future changes in climate, impacts and socio economic conditions*
- ⌘ *based on new scenarios currently prepared by the scientific community*
- ⌘ *Focus on response measures in an integrated manner*
- ⌘ *Economics of vulnerability and adaptation*
- ⌘ *Regional changes in climate and its impacts*

Useful links:



⌘ www.ipcc.ch : IPCC

⌘ www.climate.be/vanyp : my slides and other documents, including the PNAS paper)

⌘ My e-mail: vanyp@climate.be