A few things a climate scientist would like to tell policymakers

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Outline

- IPCC = best source of information
- The climate change (CC) problem is real
- The problem is serious
- Deep emissions reductions are needed
- So is adaptation, particularly in developing countries
- Elements of solutions are at hand
- Technology is important, but not sufficient
- Change is affordable, and offers co-benefits
- The economic crisis could offer opportunities to tackle CC: orient the stimulus packages
- A deal in Copenhagen is essential

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2500+ SCIENTIFIC EXPERT REVIEWERS
800+ CONTRIBUTING AUTHORS AND
450+ LEAD AUTHORS FROM
130+ COUNTRIES
6 YEARS WORK
1 REPORT

2007

Bali action plan (december 2007)

- ***The Conference of the Parties*,**
- ***(…) Responding* to the findings of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change that warming of the climate system is unequivocal, and that delay in reducing emissions significantly constrains opportunities to achieve lower stabilization levels and increases the risk of more severe climate change impacts,**
- ***Recognizing* that deep cuts in global emissions will be required to achieve the ultimate objective of the Convention and emphasizing the urgency (NOTE 1) to address climate change as indicated in the Fourth Assessment Report of the IPCC,**
- **1. *Decides* to launch a comprehensive process to enable the full, effective and sustained implementation of the Convention through long-term cooperative action, now, up to and beyond 2012, in order to reach an agreed outcome and adopt a decision at its fifteenth session, by addressing, inter alia: …**
- **Note 1: Contribution of Working Group III to the Fourth Assessment Report of the IPCC, Technical Summary, pages 39 and 90, and Chapter 13, page 776.**

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What does IPCC tell us about climate science?

- WG1: climatology

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Key points from the WG1 IPCC AR4 Report

- Warming of the climate system is unequivocal
- Very high confidence that net effect of human activities since 1750 = warming
- Last 50 years likely to be highest temperature in at least last 1300 yrs
- Most of this warming is very likely (90%) due to increase in human greenhouse gases
- Without emission reduction policies, global temperature could increase by 1.1 to 6.4°C, or even higher in 2100 compared to 1990
- Sea level could increase by 18 to 59 cm, or more, by 2100
- Frequency/intensity of several extreme phenomena due to increase (ex: heat waves, droughts, floods, …)

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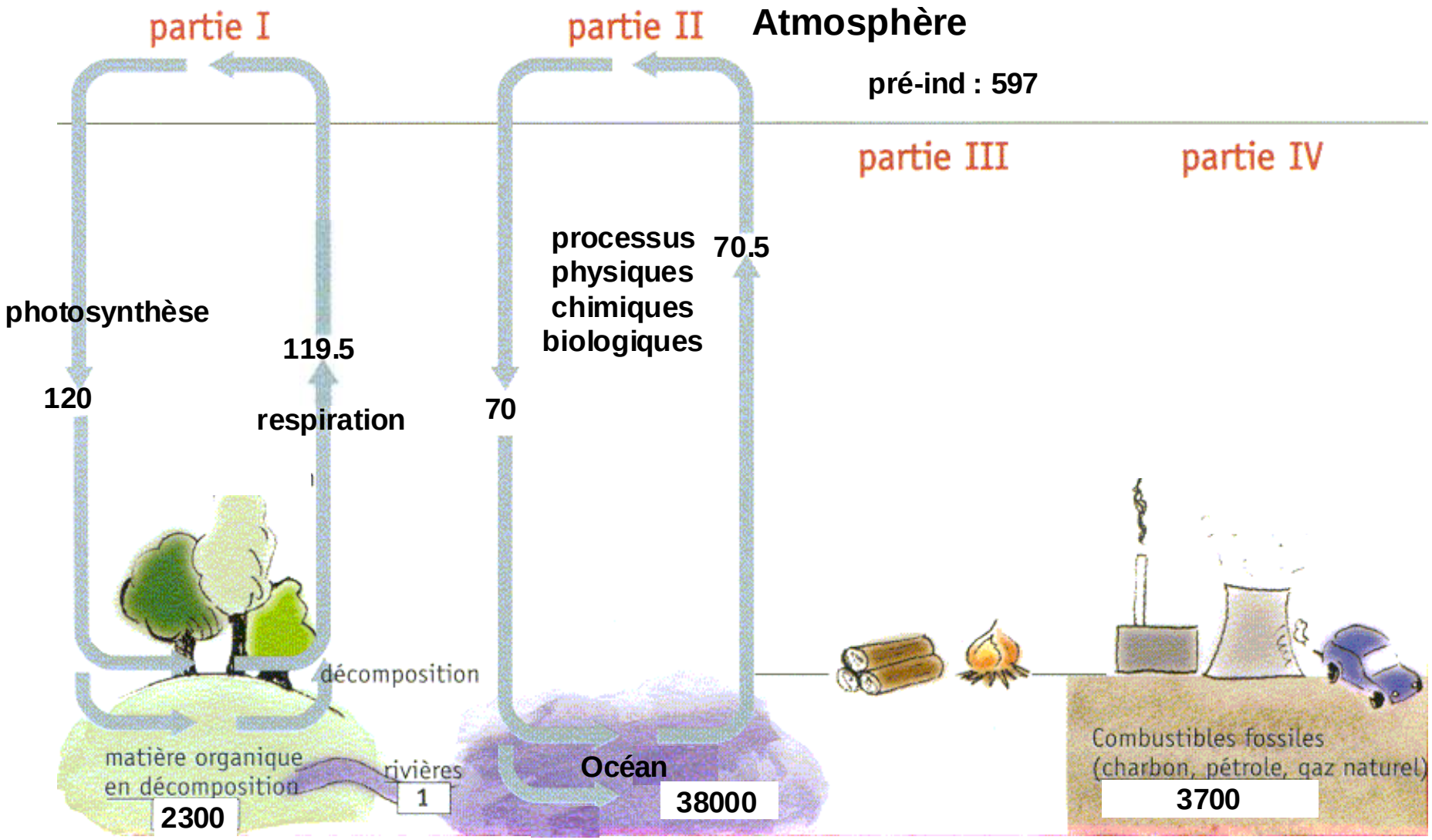
Cycle du carbone



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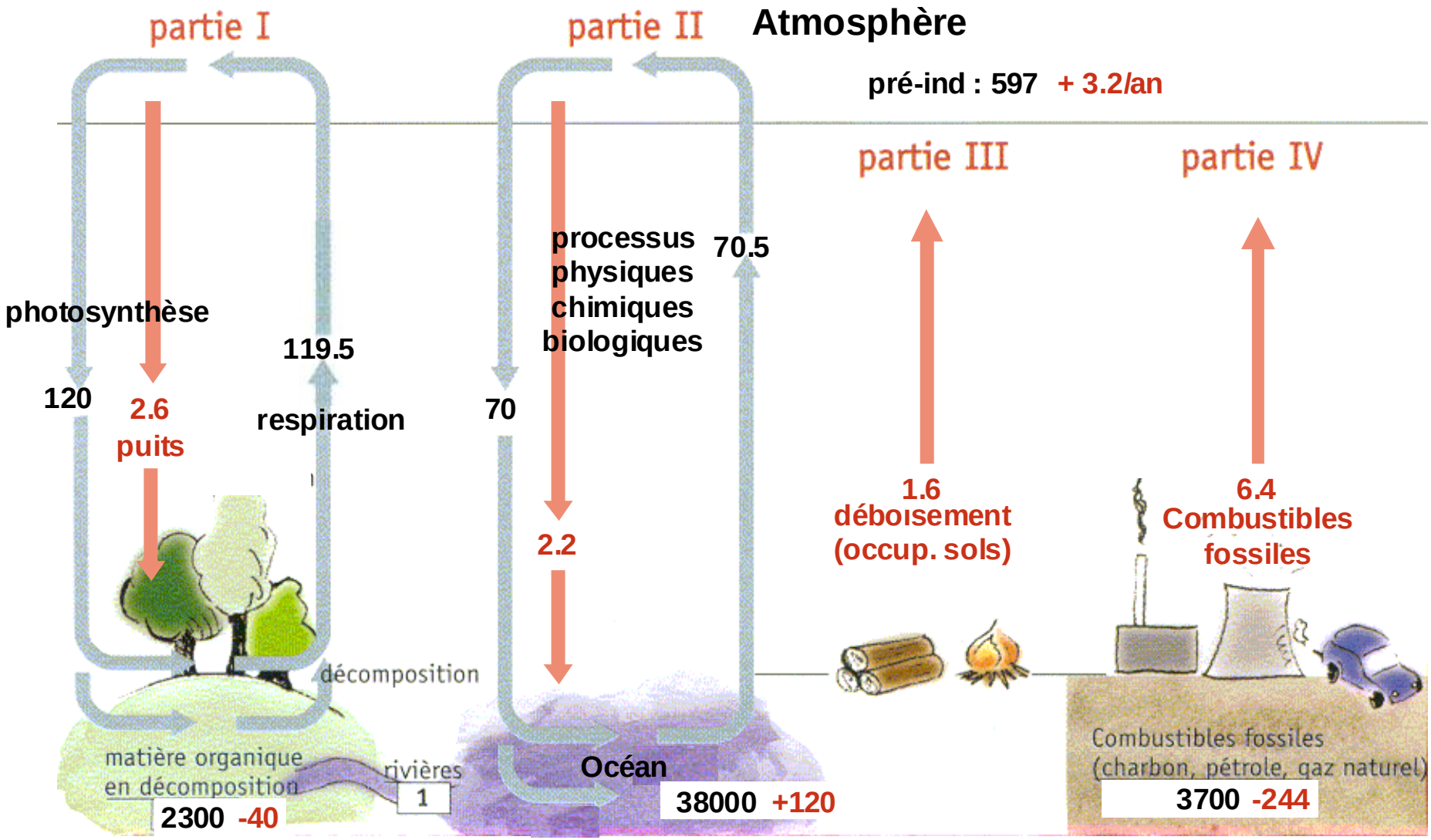
Unités: GtC (milliards de tonnes de carbone) ou GtC/an

Cycle du carbone



Unités: GtC (milliards de tonnes de carbone) ou GtC/an

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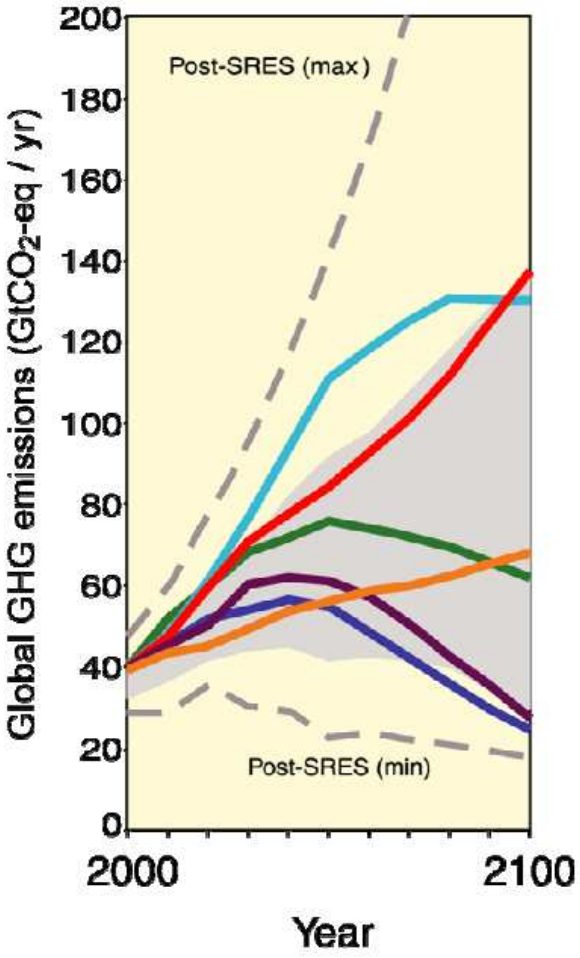
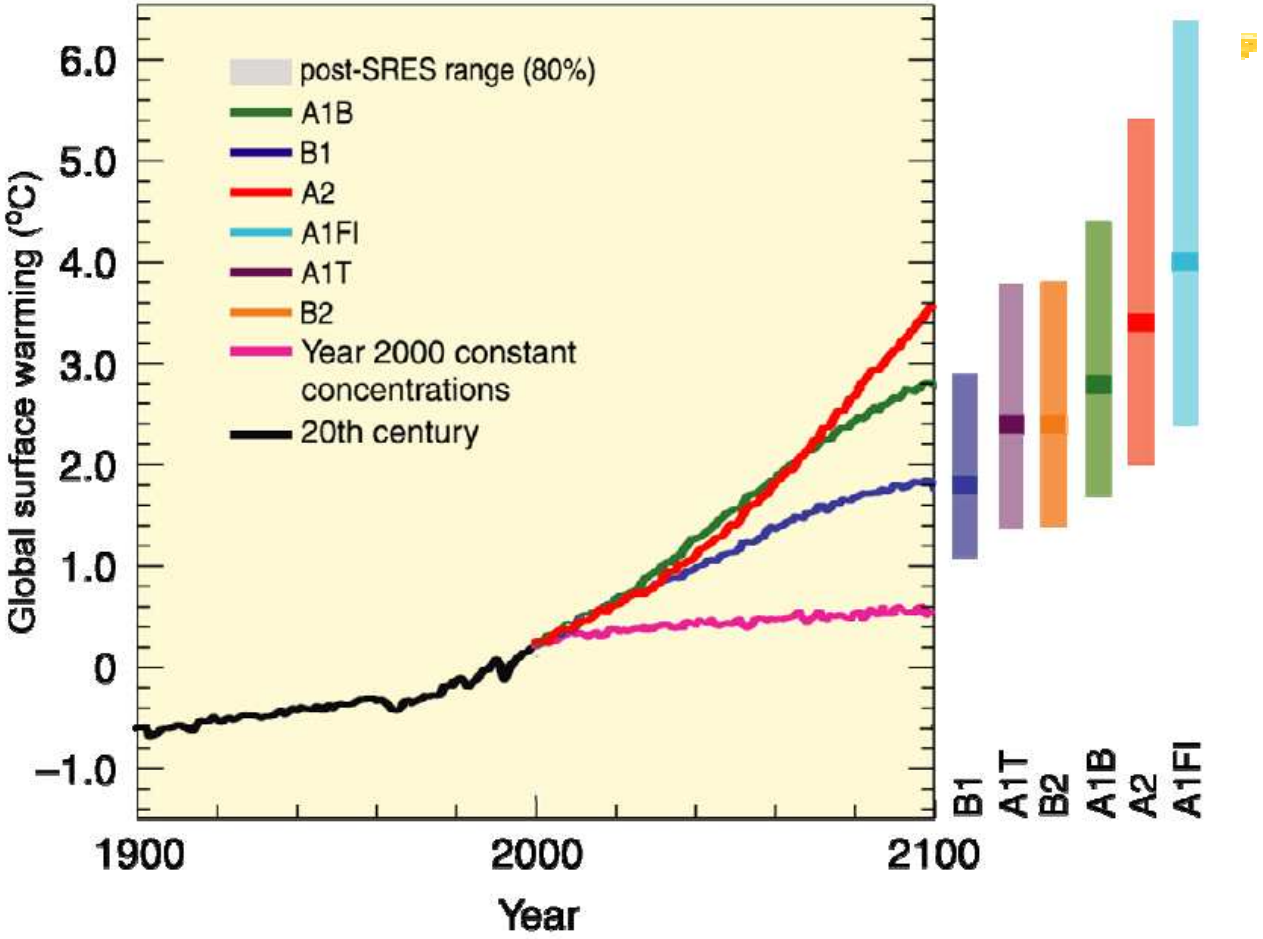
Source: IPCC, AR4 (2007)

Climate projections without mitigation





NB: écart par rapport à la moyenne 1980-1999

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Projected globally averaged surface warming and sea level rise at the end of the 21st century (IPCC WG1 AR4)

	Temperature Change (°C at 2090-2099 relative to 1980-1999) [a]		Sea Level Rise (m at 2090-2099 relative to 1980-1999)
Case	Best estimate	*Likely* range	Model-based range excluding future rapid dynamical changes in ice flow
Constant Year 2000 concentrations [c]	0.6	0.3 – 0.9	NA
B1 scenario	1.8	1.1 – 2.9	0.18 – 0.38
A1T scenario	2.4	1.4 – 3.8	0.20 – 0.45
B2 scenario	2.4	1.4 – 3.8	0.20 – 0.43
A1B scenario	2.8	1.7 – 4.4	0.21 – 0.48
A2 scenario	3.4	2.0 – 5.4	0.23 – 0.51
A1FI scenario	4.0	2.4 – 6.4	0.26 – 0.59

NB: add 0.5°C to get pre-industrial reference

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What does IPCC tell us about impacts and adaptation?

- WG2: Impacts, Vulnerability, and adaptation

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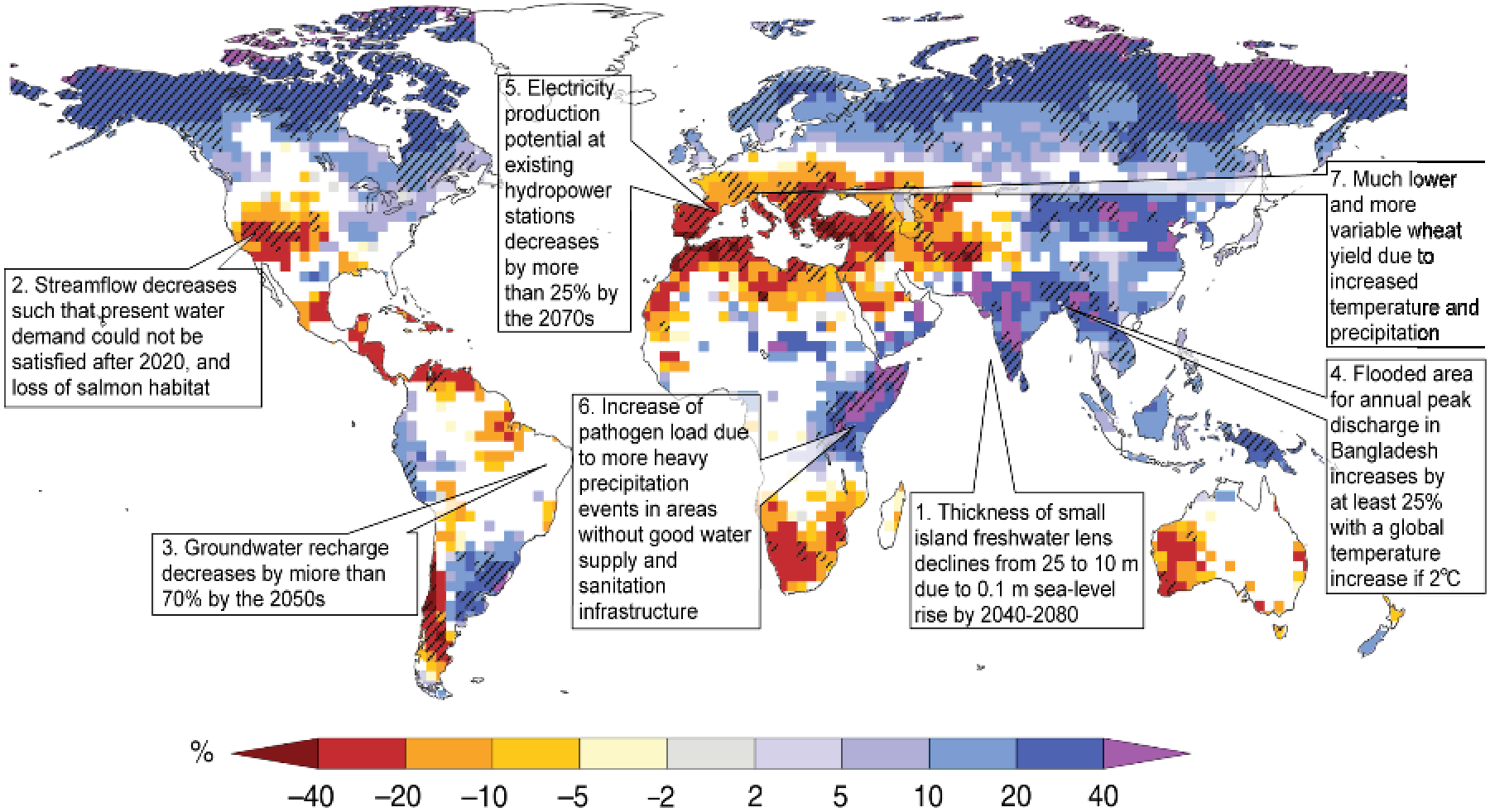
Water at the end of the 21st century for SRES A1B



TP Figure 3.4: Ensemble mean change of annual runoff, in percent, between present (1980-1999) and 2090-2099 for the SRES A1B emissions scenario (based on Milly et al., 2005).

WMO

UNEP

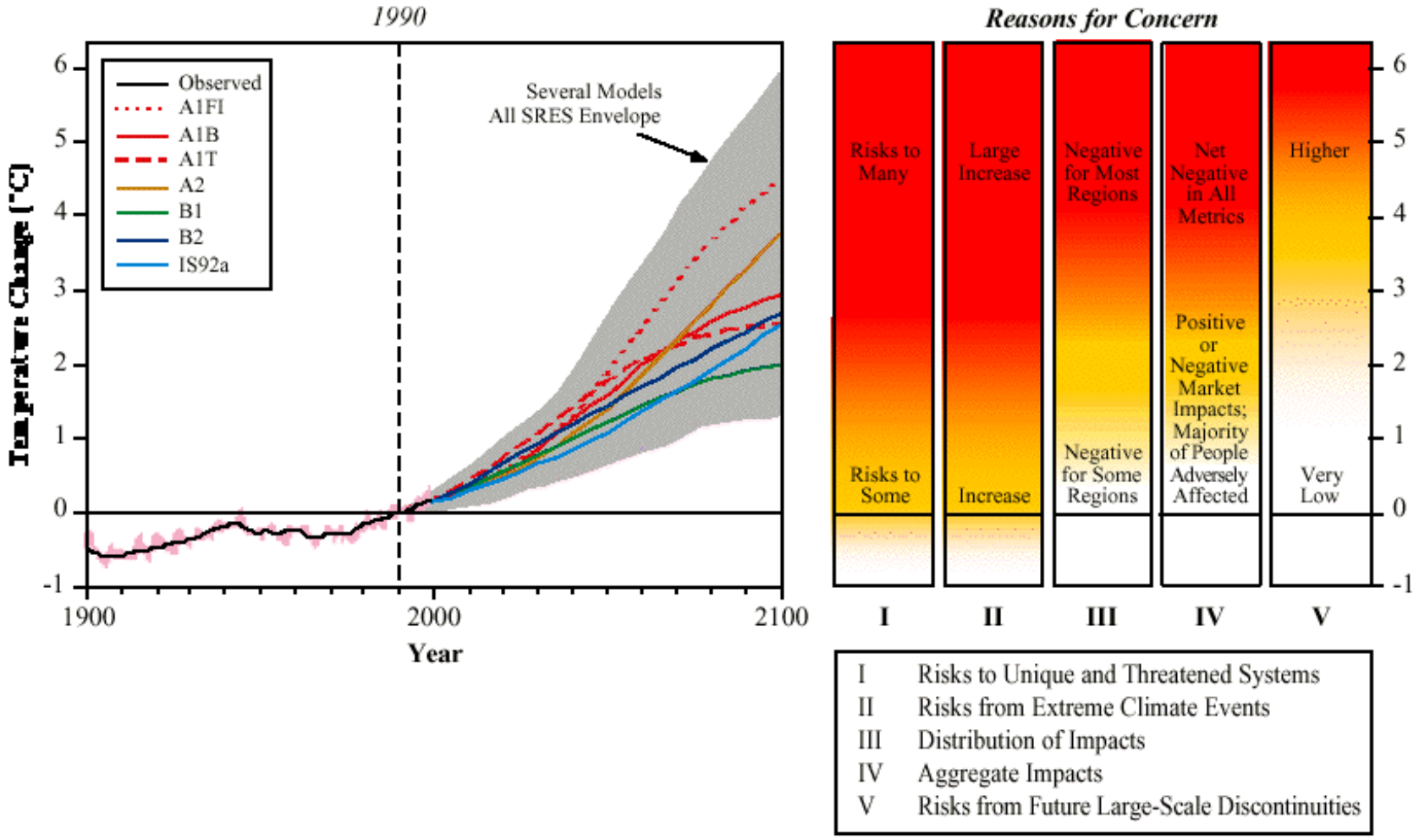
20% - 30% of plants and animals species at increased risk of extinction

if ΔT 1.5°C - 2.5°C (above 1990 temperature)

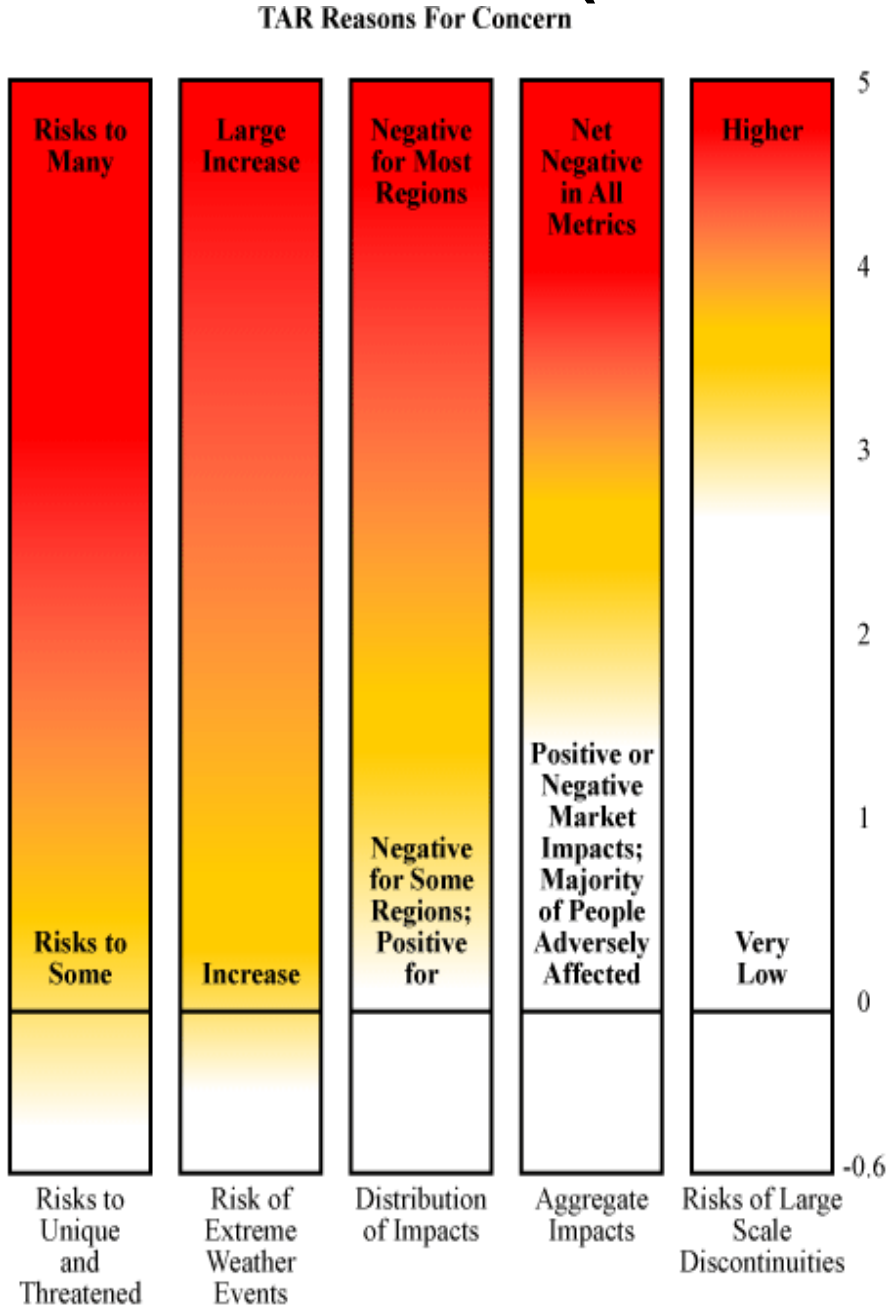
WMO

UNEP

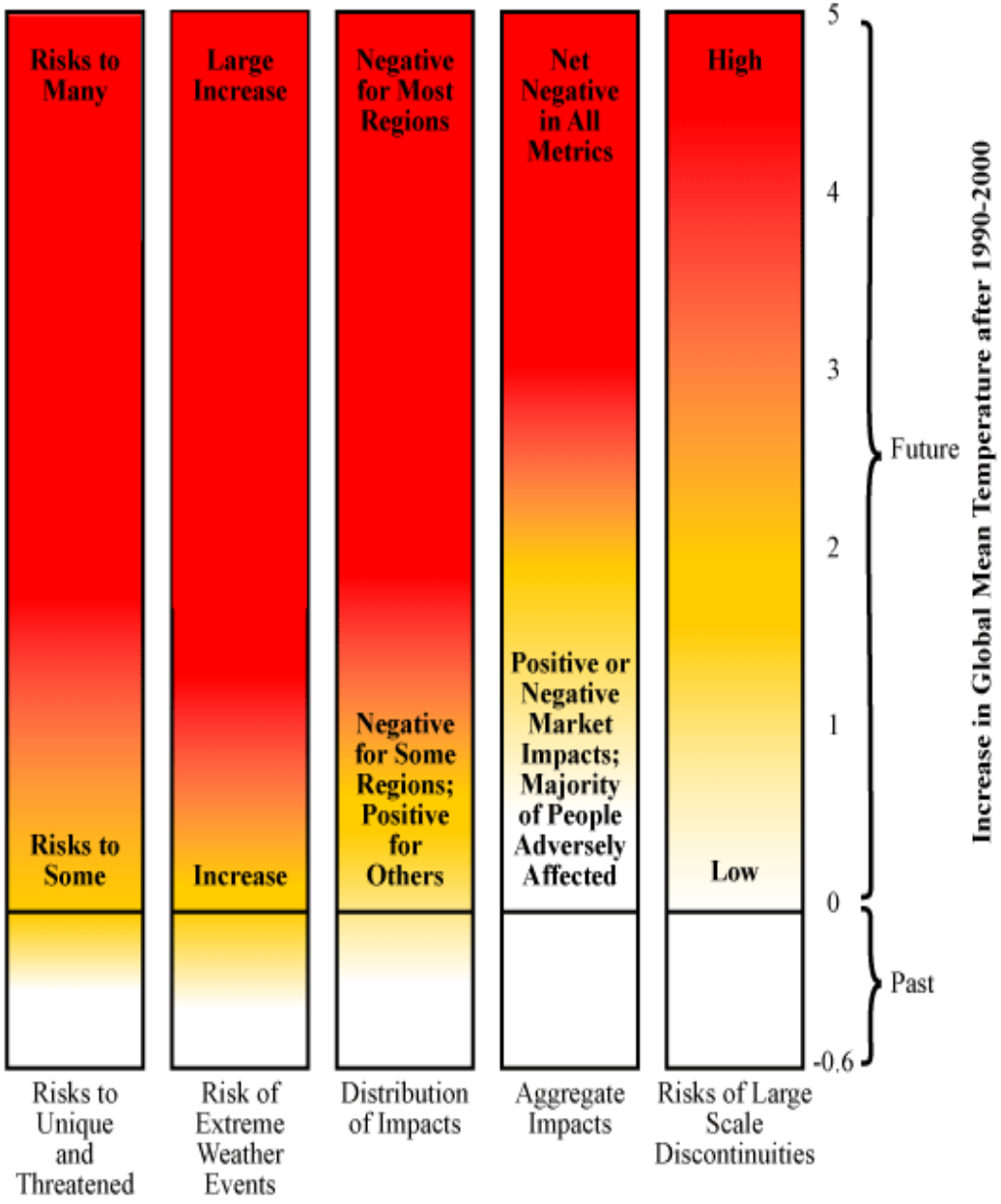
IPCC 2001:


1990
Several Models
All SRES Envelope
Observed
A1FI
A1B
A1T
A2
B1
B2
IS92a
Temperature Change (°C)
6
5
4
3
2
1
0
-1
1900
2000
2100
Year
Reasons for Concern
Risks to Many
Risks to Some
Large Increase
Increase
Negative for Most Regions
Negative for Some Regions
Net Negative in All Metrics
Positive or Negative Market Impacts; Majority of People Adversely Affected
Higher
Very Low
I
II
III
IV
V
I Risks to Unique and Threatened Systems
II Risks from Extreme Climate Events
III Distribution of Impacts
IV Aggregate Impacts
V Risks from Future Large-Scale Discontinuities

Reasons for concern (TAR-2001)



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



What does IPCC tell us on mitigation?

- WG3: Mitigation

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Stabilisation levels and equilibrium global mean temperatures

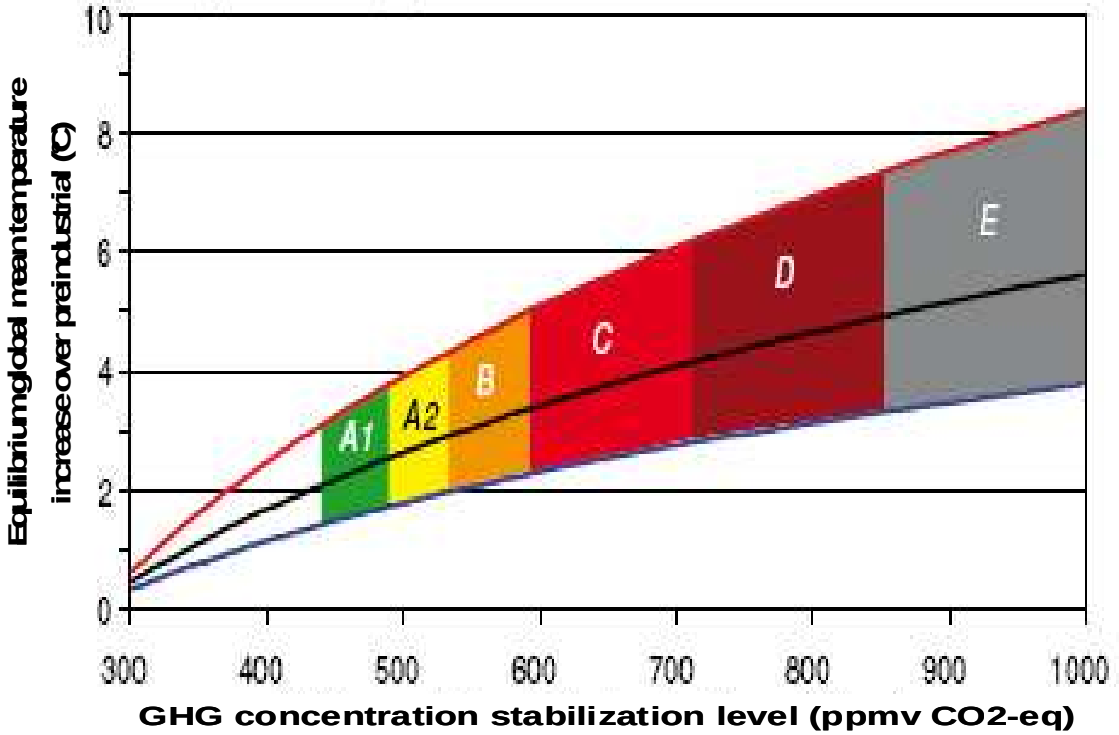
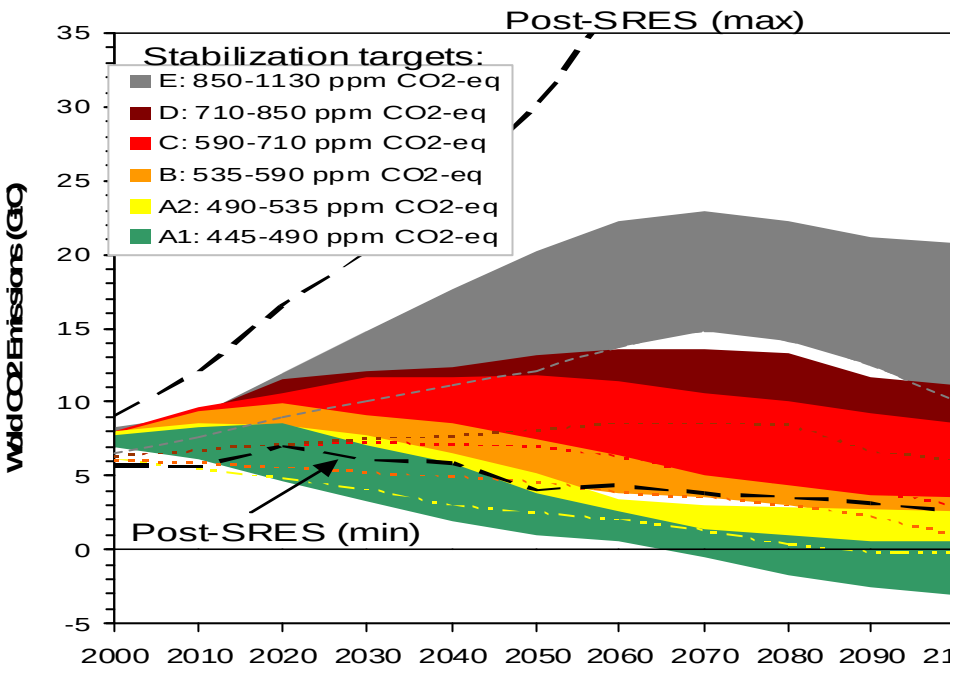
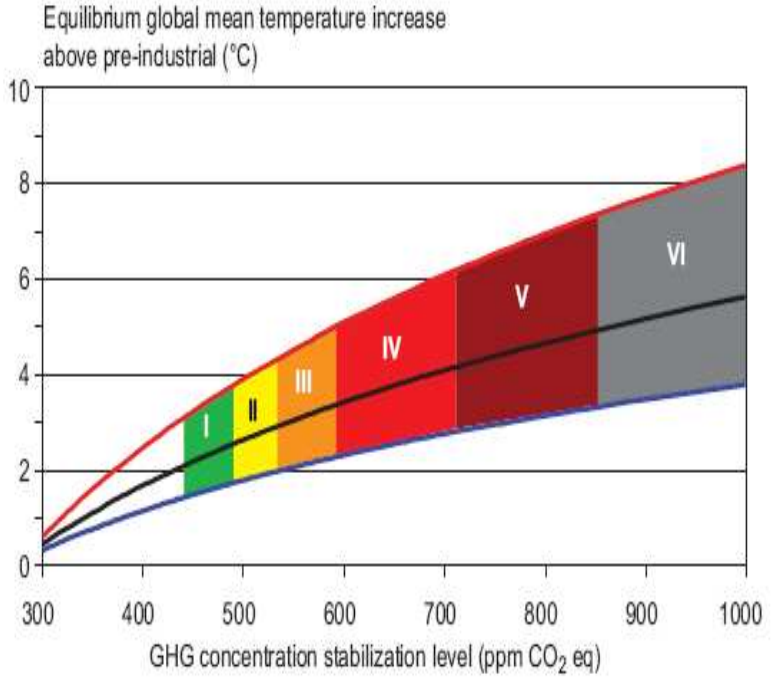


***Figure SPM 8**: Stabilization scenario categories as reported in Figure SPM.7 (coloured bands) and their relationship to equilibrium global mean temperature change above pre-industrial, using (i) "best estimate" climate sensitivity of 3 ℃ (black line in middle of shaded area), (ii) upper bound of likely range of climate sensitivity of 4.5 ℃ (red line at top of shaded area) (iii) lower bound of likely range of climate sensitivity of 2 ℃ (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

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

Stab level (ppm CO2-eq)	Global Mean temp. increase at equilibrium (°C)	Year CO2 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

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

- **Chapter 13, page 776:**

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
A-450 ppm CO_2-eq[b]	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
B-550 ppm CO_2-eq	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
C-650 ppm CO_2-eq	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 CO_2-eq assume a (temporary) overshoot of about 50 ppm (See Den Elzen and Meinshausen, 2006).

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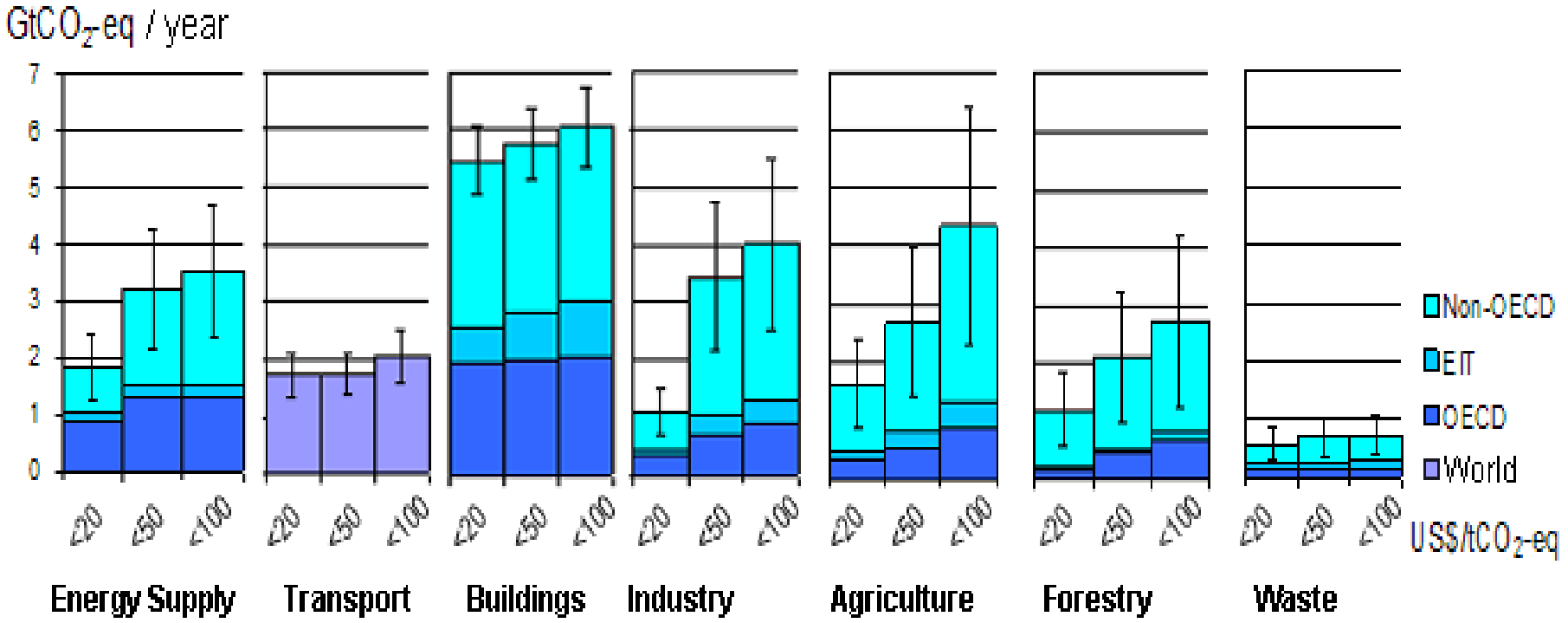
All sectors and regions have the potential to contribute by 2030



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

How can emissions be reduced?

Sector	**(Selected) Key mitigation technologies and practices currently commercially available.**
Transport	More fuel efficient vehicles; hybrid vehicles; biofuels; modal shifts from road transport to rail and **public transport systems**; cycling**,** walking; **land-use planning**
Buildings	Efficient lighting; efficient appliances and airco; improved insulation ; solar heating and cooling; alternatives for fluorinated gases in insulation and aplliances

Examples of policies which have shown good results (IPCC 2007)

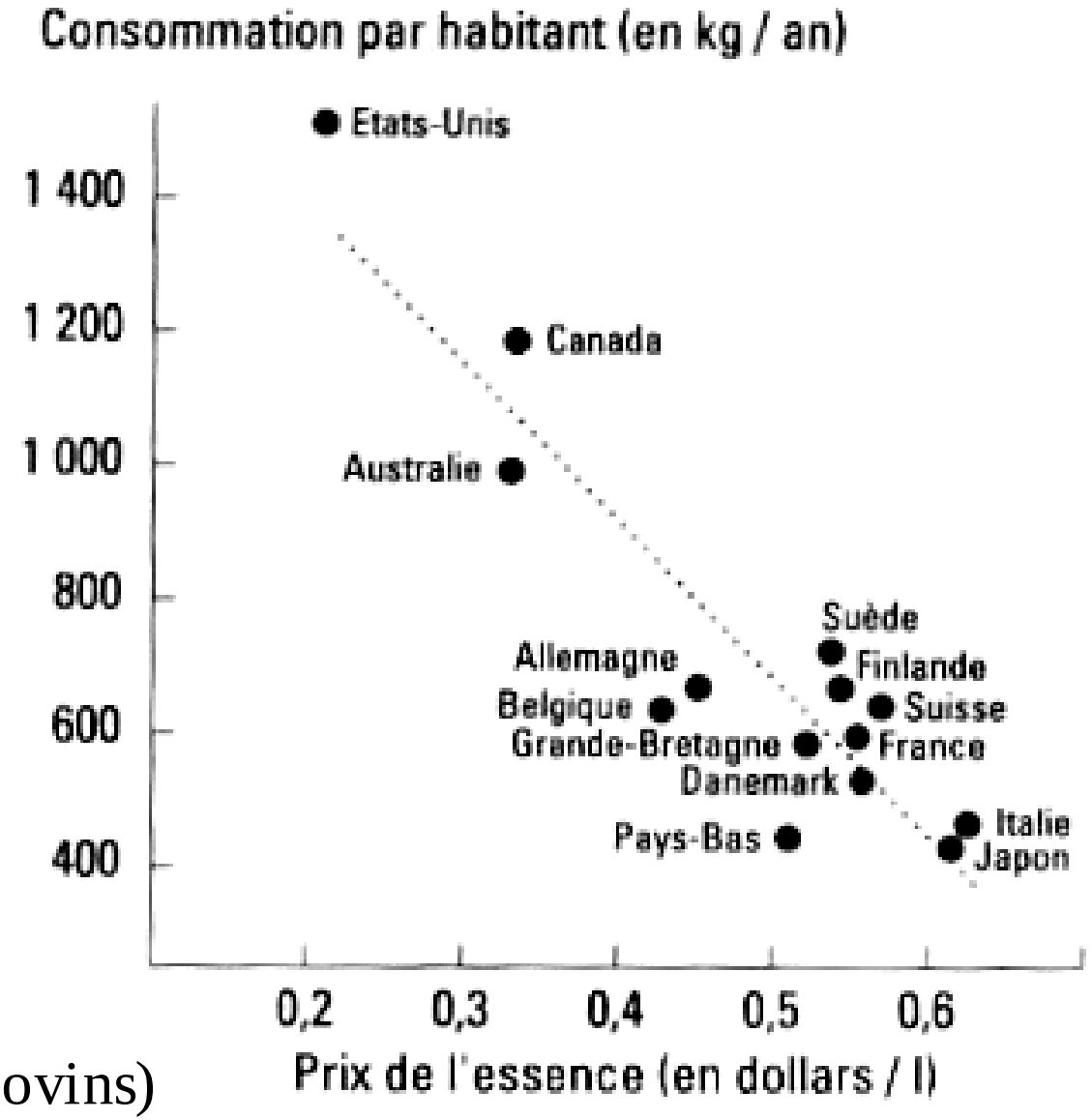
Sector	**Policies[1], measures and instruments shown to be environmentally effective**	**Key constraints or opportunities**
Transport	Mandatory fuel economy, biofuel blending and CO_2 standards for road transport	Partial coverage of vehicle fleet may limit effectiveness
	Taxes on vehicle purchase, registration, use and motor fuels, road and parking pricing	Effectiveness may drop with higher incomes
	Influence mobility needs through **land use regulations, and infrastructure planning**	Particularly appropriate for countries that are building up their transportation systems
	Investment in **attractive public transport facilities** and non-motorised forms of transport	

[1] Public RD&D investment in low emission technologies have proven to be effective in all sectors.

Changes in lifestyle and behaviour patterns can contribute to climate change mitigation

- Changes in occupant behaviour, cultural patterns and consumer choice in buildings.
- Reduction of car usage and efficient driving style, in relation to **urban planning and availability of public transport**
- Staff training, reward systems, regular feedback and documentation of existing practices in industrial organizations

Correlation fuel price/consumption



(Source: Lovins)

What are the macro-economic costs in **2030**?

Stabilization levels (ppm CO_2-eq)	Median GDP reduction [1] (%)	Range of GDP reduction [2] (%)	Reduction of average annual GDP growth rates [3] (percentage points)
590-710	0.2	-0.6 – 1.2	< 0.06
535-590	0.6	0.2 – 2.5	<0.1
445-535 [4]	Not available	< 3	< 0.12

[1] This is global GDP based market exchange rates.
[2] The median and the 10th and 90th percentile range of the analyzed data are given.
[3] The calculation of the reduction of the annual growth rate is based on the average reduction during the period till 2030 that would result in the indicated GDP decrease in 2030.
[4] The number of studies that report GDP results is relatively small and they generally use low baselines.

There are also co-benefits of mitigation

- Near–term health benefits from **reduced air pollution** may offset a substantial fraction of mitigation costs
- Mitigation can also be positive for: energy security, balance of trade improvement, provision of modern energy services to rural areas and employment

BUT

- Mitigation in one country or group of countries could lead to higher emissions elsewhere (“carbon leakage”) or effects on the economy (“spill-over effects”).

What is in store before Copenhagen?

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In the text that was on the table in Bangkok (October 2009) (FCCC/AWG-LCA/2009/INF.2):

- I.31 [To this end, [developed country parties]…, as a group, [shall][should][reduce their [domestic] GHG emissions][deeply cut their GHG emissions]: (a)[By at least 25-40][By 25-40] [By more than 25-40] [In the order of 30] [By at least 40] [By 45] [By at least 45]% from 1990 levels by [2017] [2020], through domestic and international efforts]…

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Conclusion

- **The Earth is heading towards a climate no human has ever known: we need to adapt**
- **Significant risks are assessed to be occurring for lower temp. increase than assessed earlier: adaptation (and money) is needed**
- **Adaptation has limits and costs: we need to prevent excessive warming (mitigation)**
- **Annex I reductions of 25-40% (1990-2020), and global emissions becoming NEGATIVE around 2070 deliver increase under 2°C only IF we are very lucky: the challenge is much bigger than assessed earlier**

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Conclusion

- We are heading towards strong constraints on GHG emissions, in all sectors, but we have to fight inertia, which is particularly large in infrastructure
- Coherence between different policies (energy, environment, trade, transport, industry, …) is essential, and offers many opportunities
- Urban and regional planning has a key role to play
- Costs can be limited, if there is much international collaboration
- Where there is a will, there is a way

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Web sites…

- www.ipcc.ch : IPCC full reports and SPM
- www.climate.be/jcm Interactive model (developed at UCL with support of Belgian Science Policy Office)
- www.climate.be/vanyp: my web page with many of my slides

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