Climate change and public transport: a few messages inspired by IPCC

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What is the IPCC?

- **IPCC : Intergovernmental Panel on Climate Change (GIEC in French)**
- **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**
- **Web : http://www.ipcc.ch**

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IPCC writing cycle (4 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*

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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 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
- Frequency/intensity of several extreme phenomena due to increase (ex: heat waves, droughts, floods, …)

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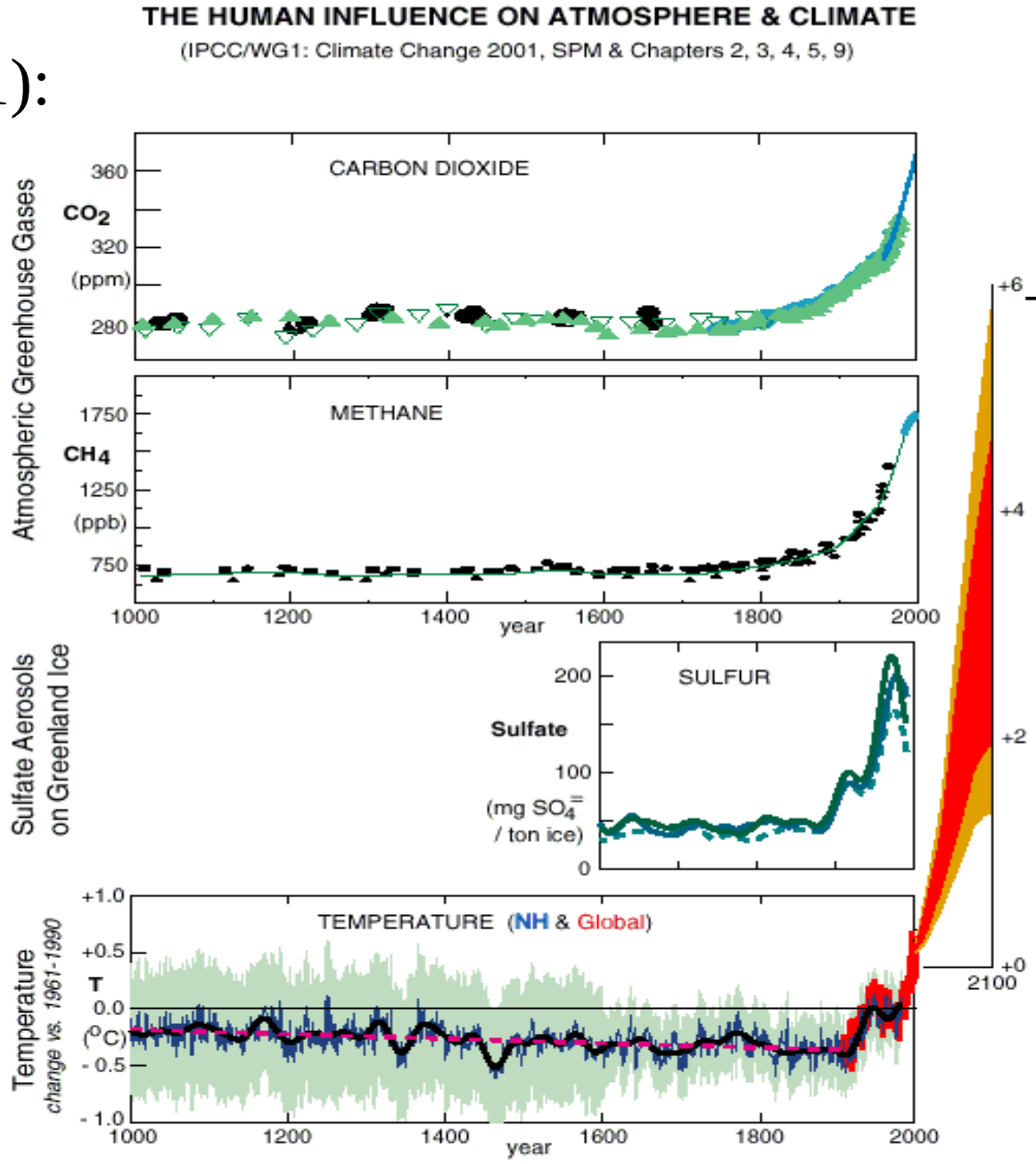
IPCC

TAR (2001):



AR4:

+6.4 C

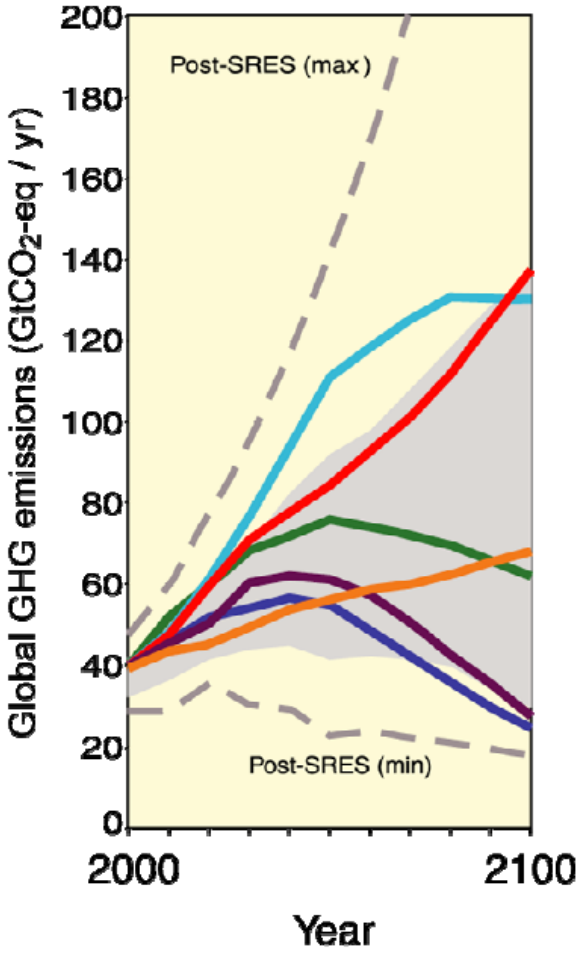
+5.8 C

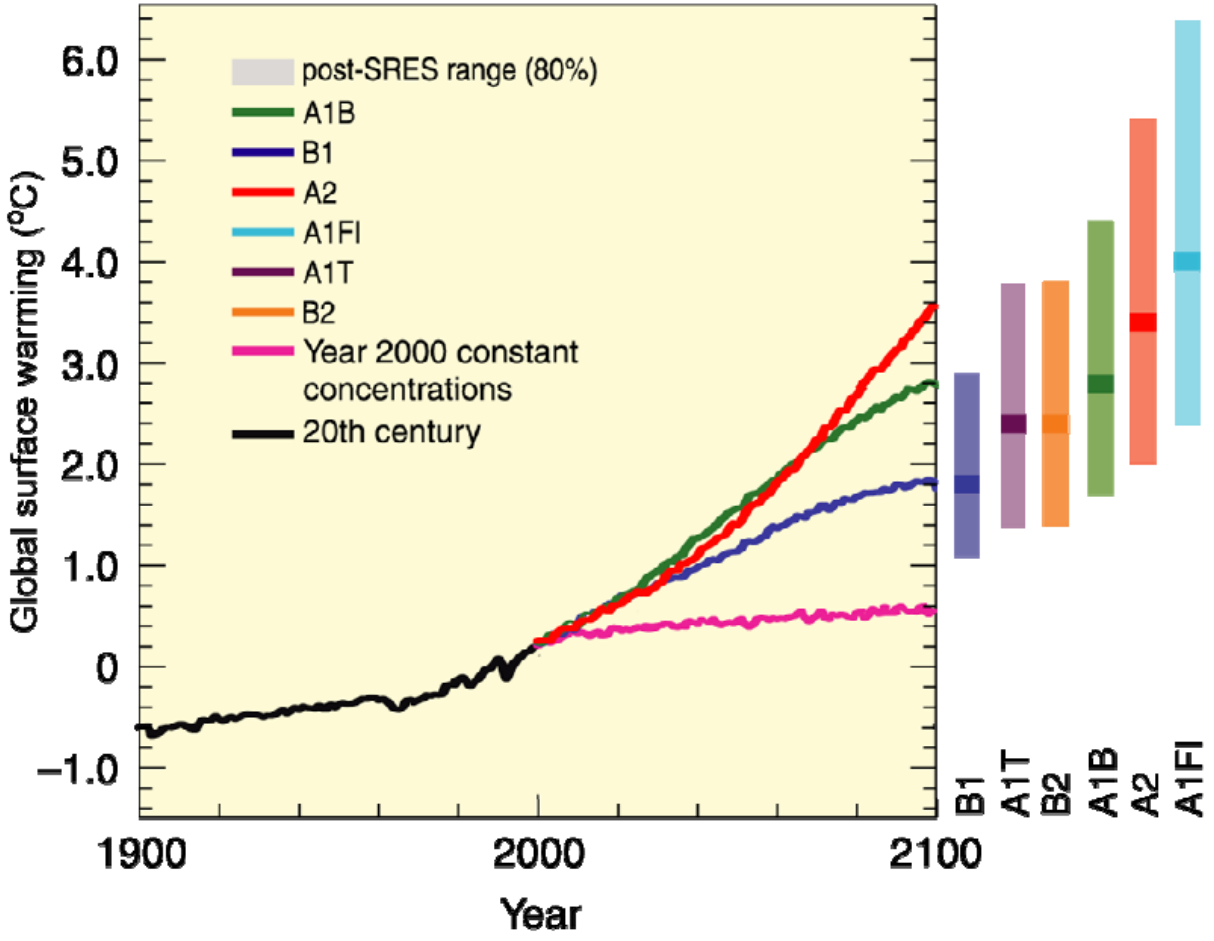
+1.4 C

+1.1 C

Source: IPCC, AR4 (2007)

Climate projections without mitigation





NB: écart par rapport à la moyenne 1980-1999

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What does IPCC tell us about impacts and adaptation?

- WG2: Impacts, Vulnerability, and adaptation

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More heavy precipitation and more droughts….

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

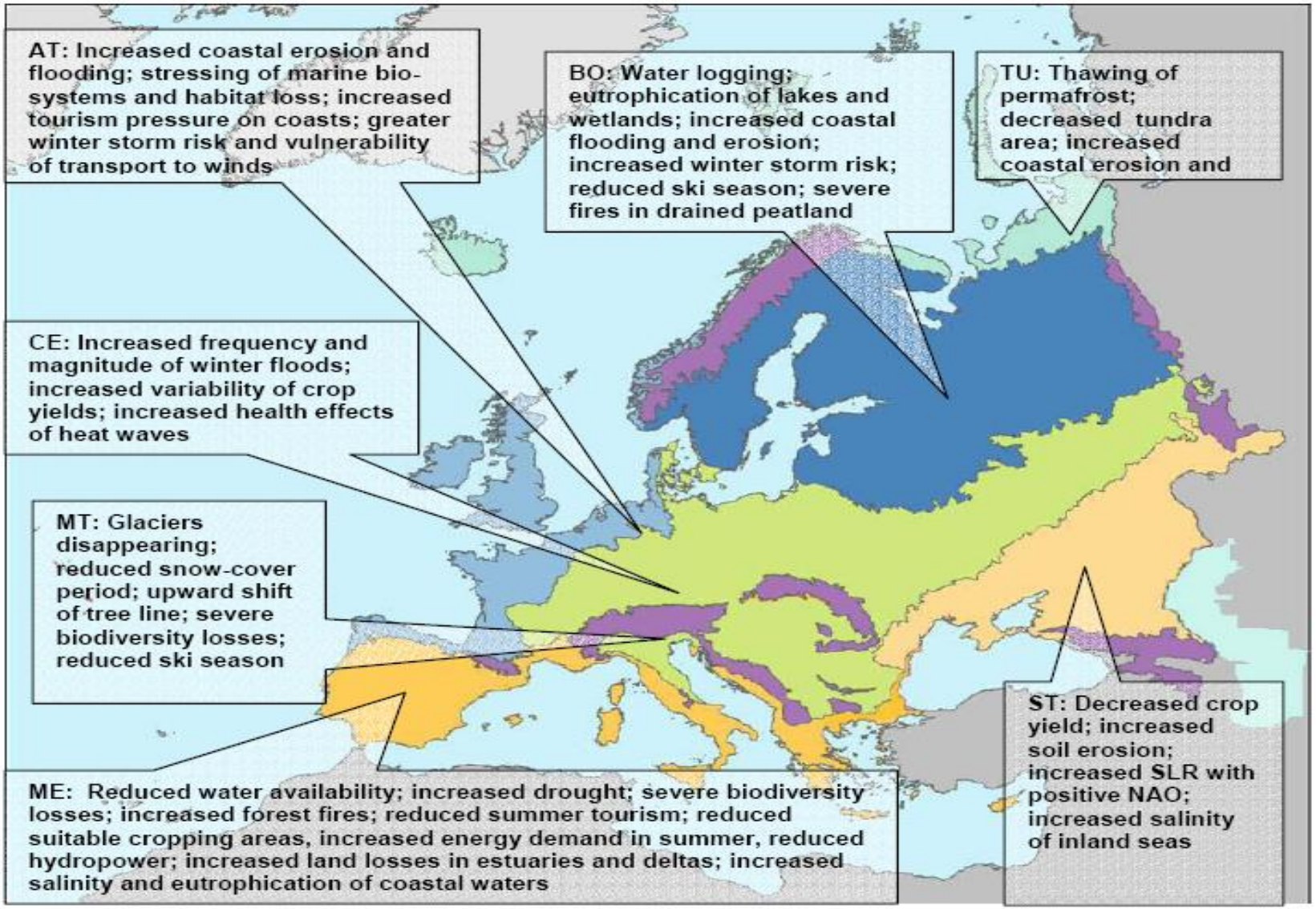


Figure 12.3: *Key vulnerabilities of European systems and sectors to climate change during the 21st century for the main biogeographic regions of Europe (EEA 2004a): TU (Tundra, pale turquoise); BO (Boreal, dark blue); AT (Atlantic, light blue); CE (Central, green [includes the Pannonian Region]); MT (Mountains, purple); ME (Mediterranean, orange [includes the Black Sea region]); ST (Steppe, cream); SLR (sea-level raise); NAO (North Atlantic Oscillation).*

Effects on Nile delta: 10 M people above 1m

(Time 2001)

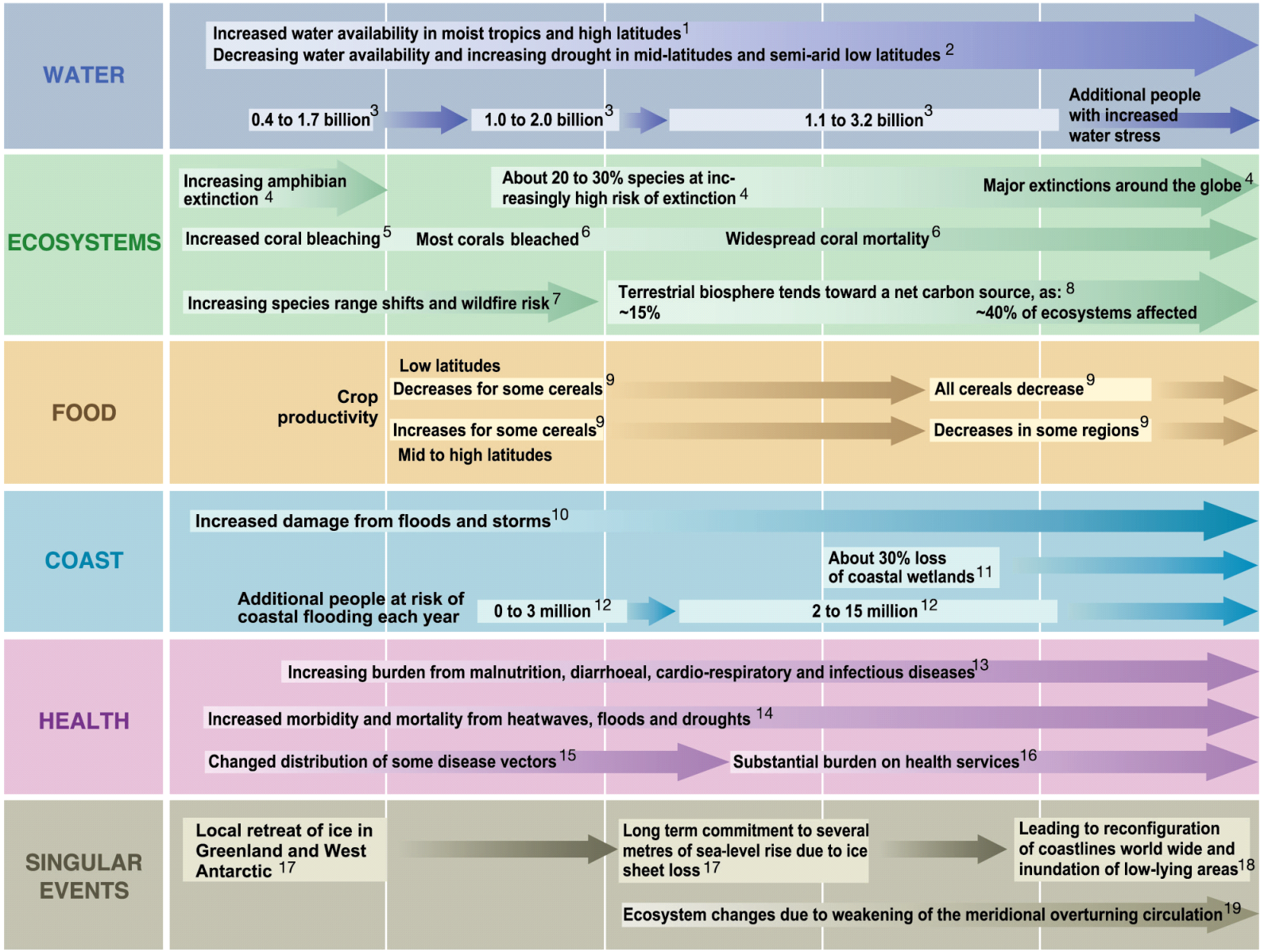
With 8 metre sea-level rise: 3700 km^2 below sea-level in Belgium

(very possible in year 3000)

(NB: flooded area depends on protection)

Source: N. Dendoncker (Dépt de Géographie, UCL), J.P. van Ypersele et P. Marbaix (Dépt de Physique, UCL) (www.climate.be/impact)

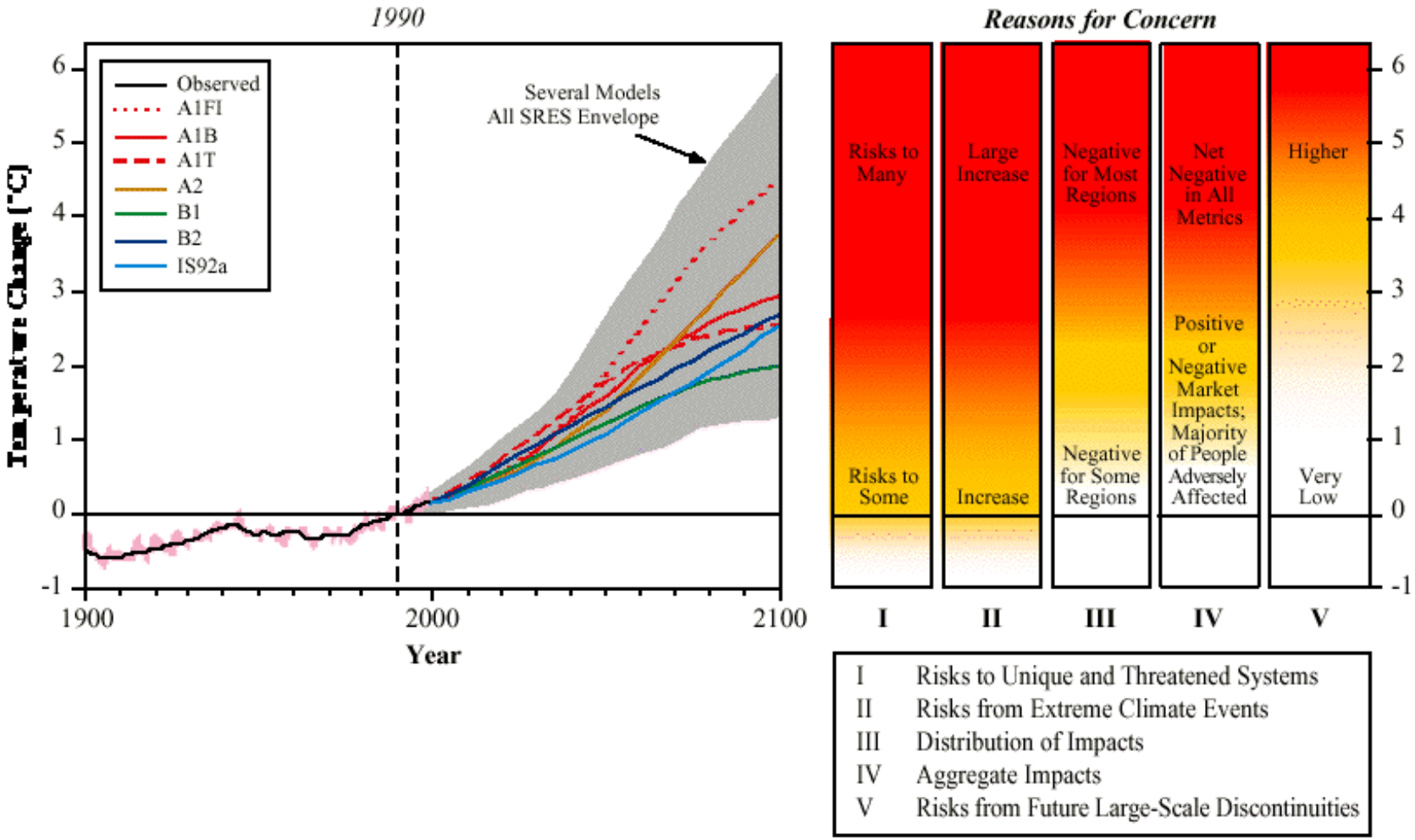
Table TS.3. (lower) Examples of global impacts projected for changes in climate (and sea level and atmospheric CO_2 where relevant)



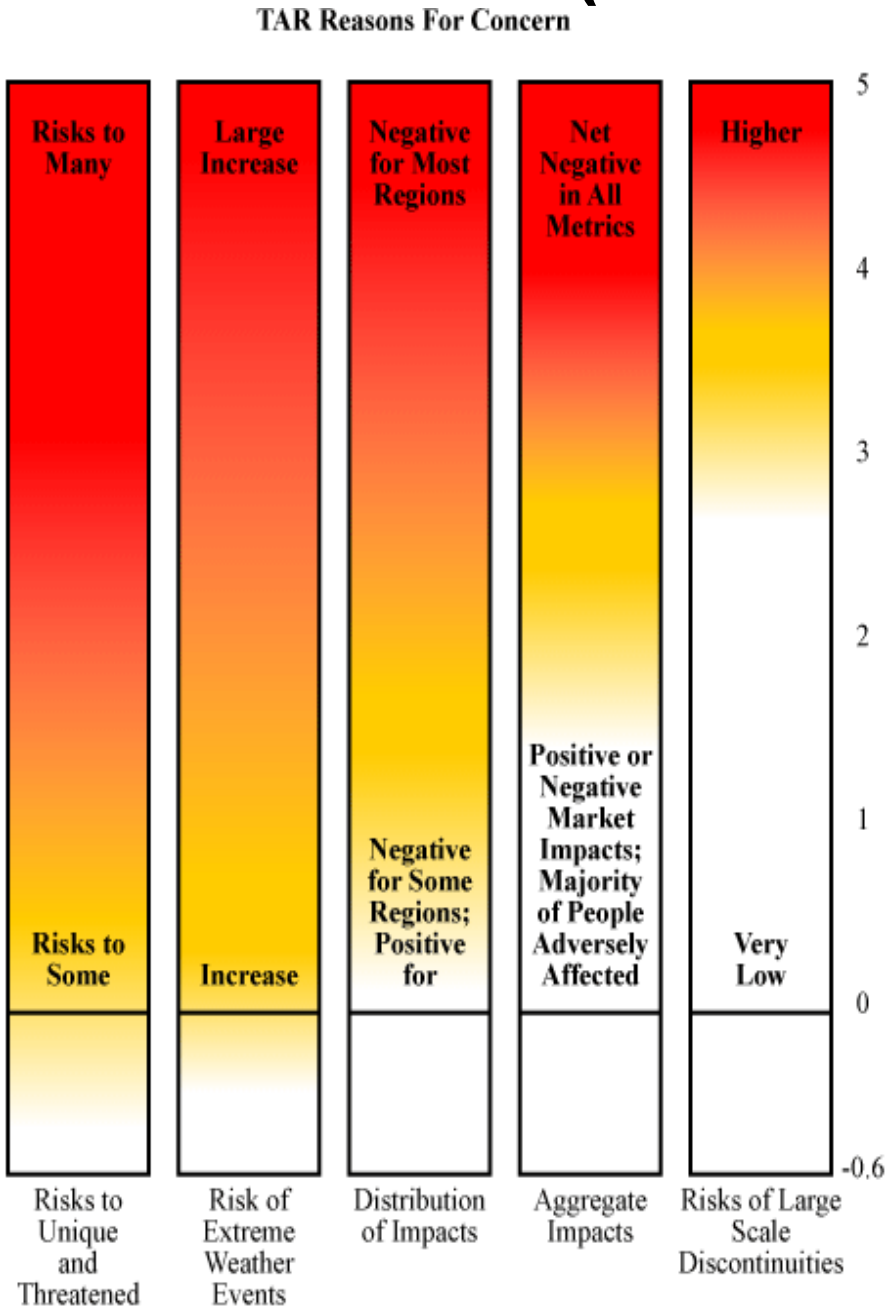
Source: IPCC WGII AR4

Adaptation will be necessary to address unavoidable impacts

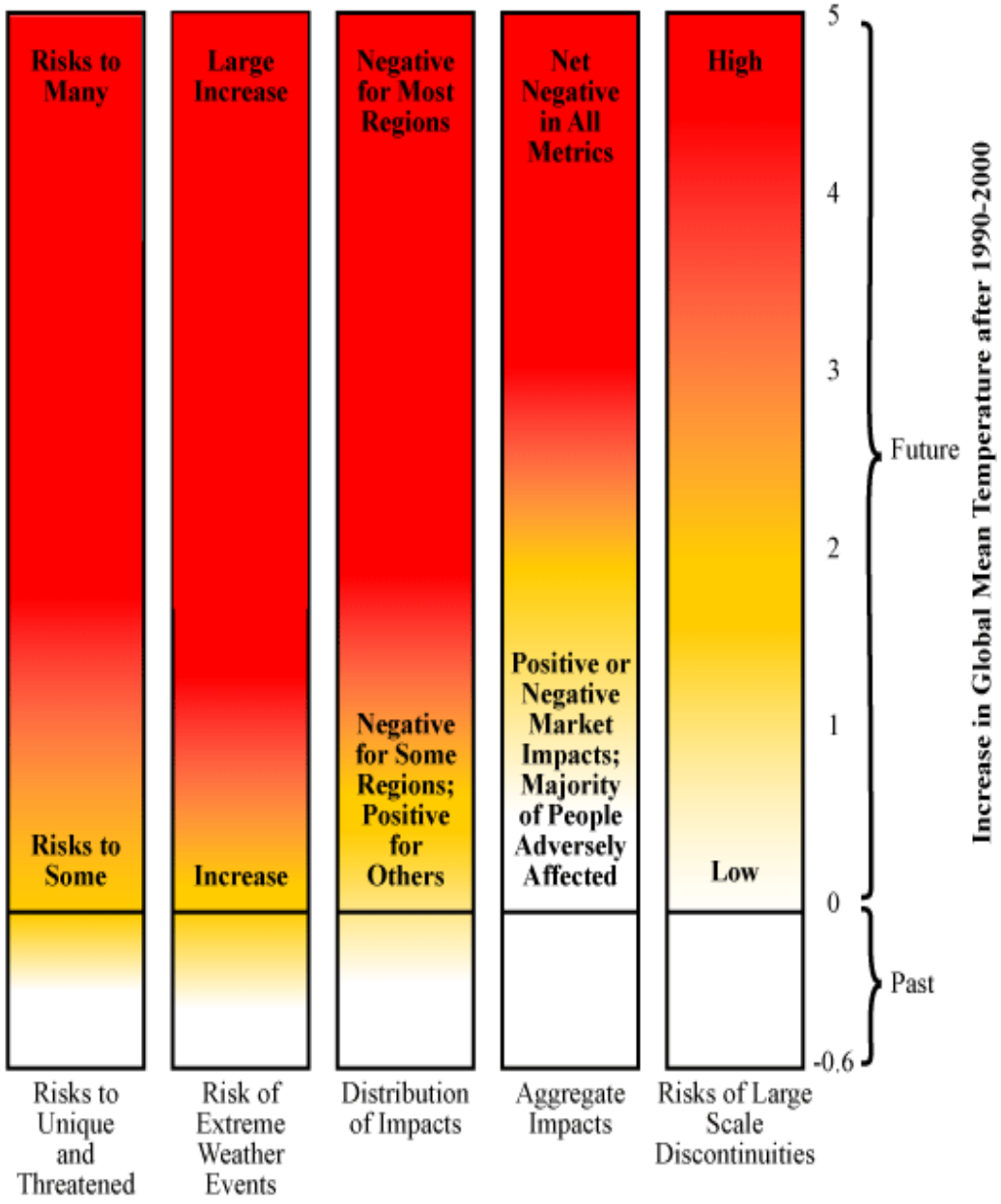
IPCC 2001:


1990
Observed
A1FI
A1B
A1T
A2
B1
B2
IS92a
Several Models
All SRES Envelope
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)



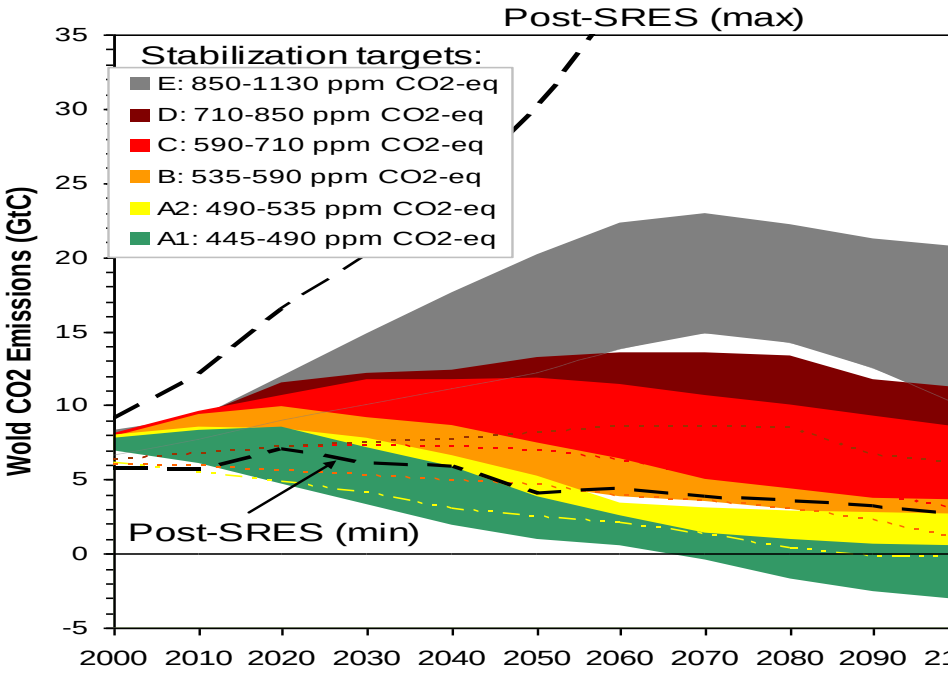
Reasons for concern (Smith et al, 2009, PNAS, based on AR4-2007)



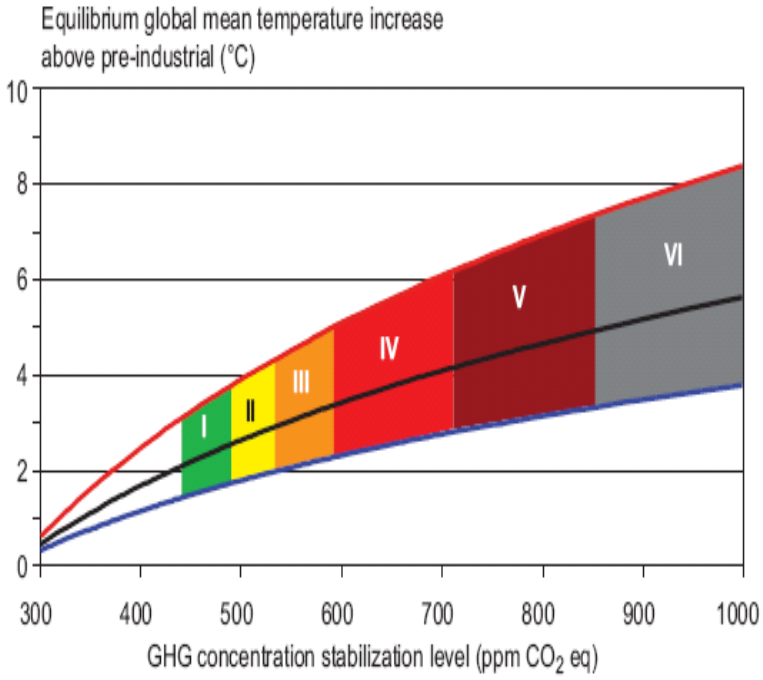
What does IPCC tell us on mitigation?

- WG3: Mitigation

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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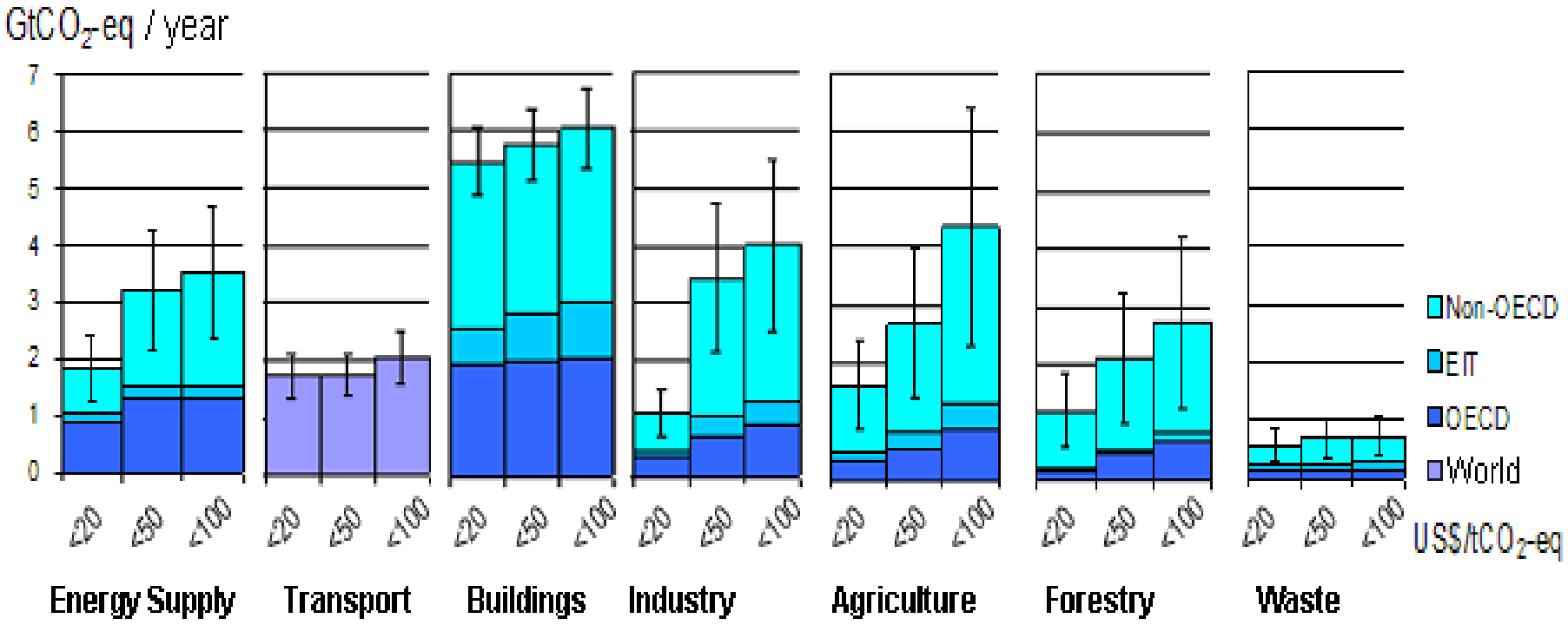
All sectors and regions have the potential to contribute by 2030



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.**	**Key mitigation technologies and practices projected to be commercialized before 2030. (Selected)**
Transport	More fuel efficient vehicles; hybrid vehicles; biofuels; modal shifts from road transport to rail and public transport systems; cycling, walking; land-use planning	Second generation biofuels; higher efficiency aircraft; advanced electric and hybrid vehicles with more powerful and reliable batteries

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.

Mitigation potential in the transport sector till 2030

- Goods transport, **public transport: not quantified**
- Vehicle efficiency: net benefits (many cases), but big barriers
- Aviation: efficiency, but not offsetting growth
- Biofuel potential :
  - Depends on production pathway, vehicle efficiency, oil and carbon prices
  - 3% of global transport energy in 2030; 5-10% , if cellulose biomass is commercialised
  - Watch out for: local land and water availability, competition with food

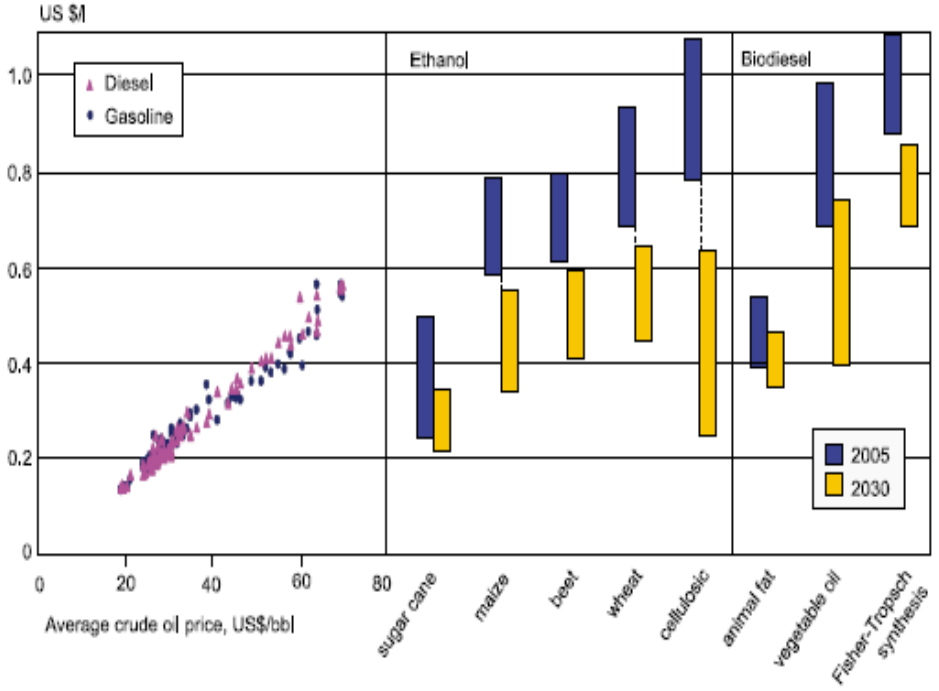


Figure TS.16: Comparison between current and future biofuels production costs versus gasoline and diesel ex-refinery (fob) prices for a range of crude oil prices [Figure 5.9].
Note: prices excl. taxes

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

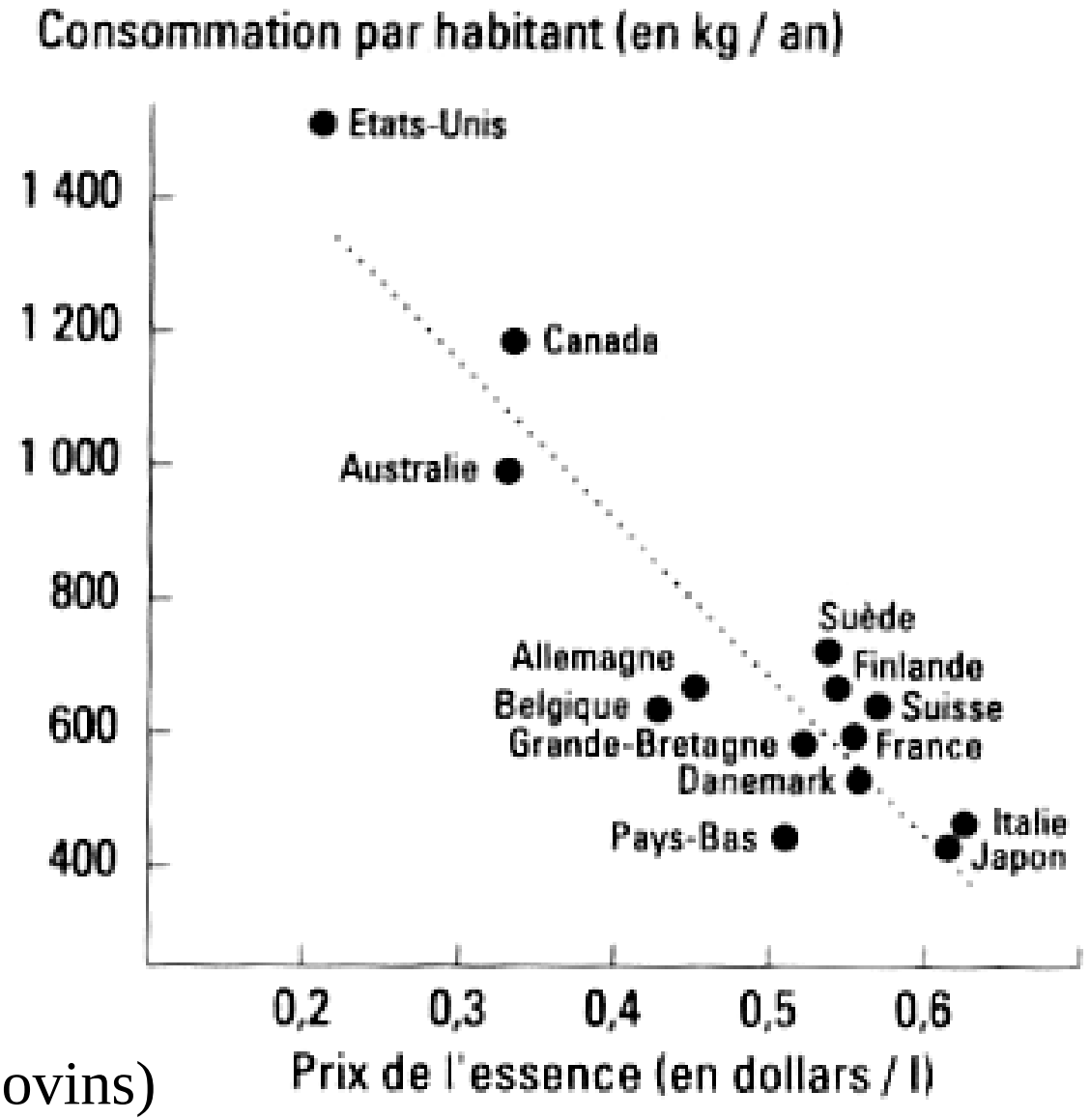
The importance of a "price of carbon"

- **Policies that provide a real or implicit price of carbon could create incentives for producers and consumers to significantly invest in low-GHG products, technologies and processes.**
- **Such policies could include economic instruments, government funding and regulation**
- **For stabilisation at around 550 ppm CO_{2eq} carbon prices should reach 20-80 US$/t$CO_{2eq}$ by 2030 (5-65 if "induced technological change" happens)**
- **At these carbon prices large shifts of investments into low carbon technologies can be expected**
- **For stabilisation at around 450 ppm CO_{2eq} carbon prices should reach 100-200 US$/t$CO_{2eq}$ by 2030 (multiply by 25 for a tonne of CH_4)**

What does US$ 100/ tCO2eq mean?

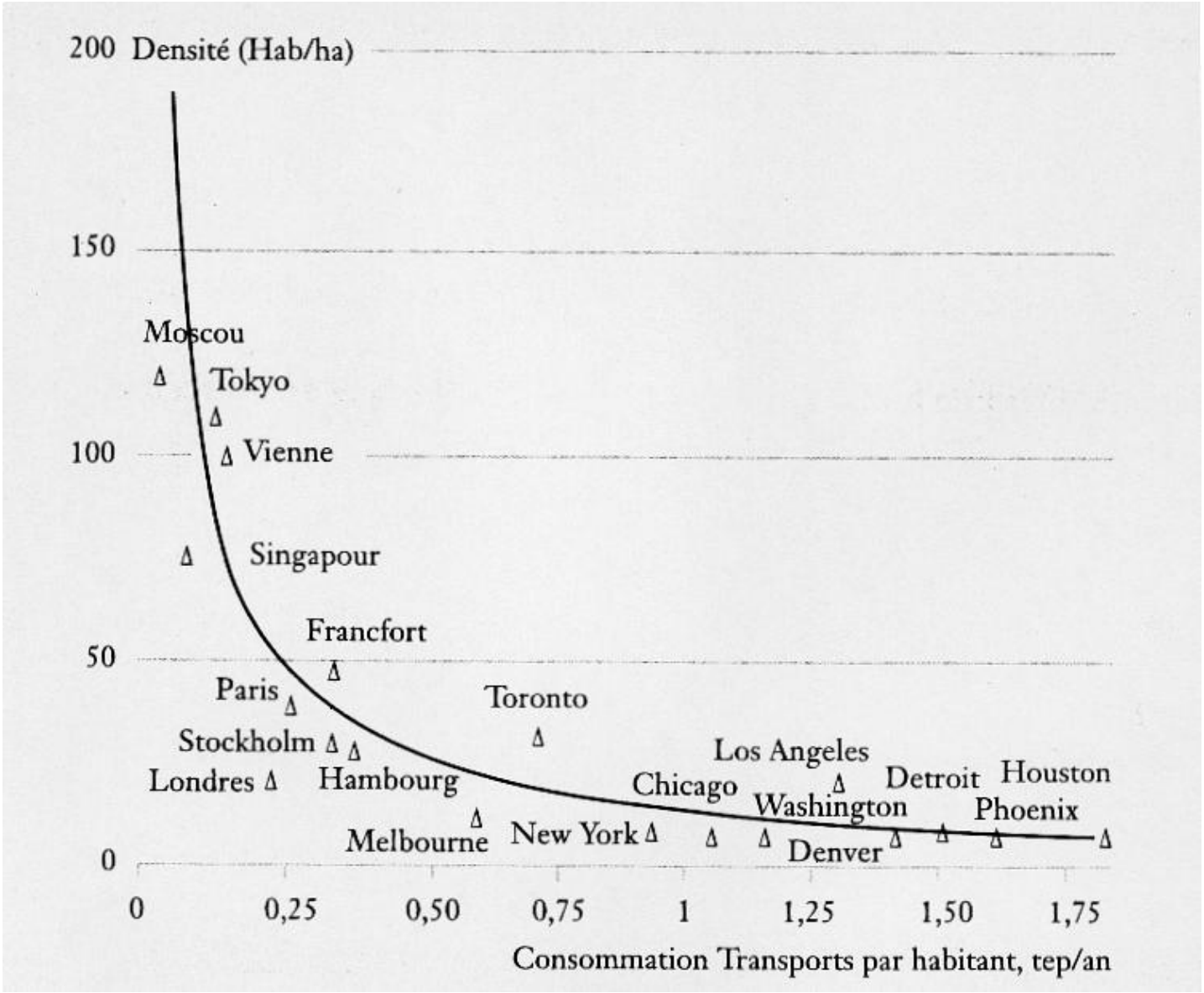
- Crude oil: ~US$ 50/ barrel
- Gasoline: ~24 US cent/ litre (1 US$/gallon)
- Electricity:
  - from coal fired plant: ~10 US cent/kWh
  - from gas fired plant: ~3 US cent/kWh

Correlation fuel price/consumption



(Source: Lovins)

Influence du type d'urbanisme sur la consommation d'énergie des transports



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”).

Stern Review (2006): *Climate change is the greatest market failure the world has ever seen*

- ***Three elements of policy are required*** *for an effective global response.*
  - ***Pricing of carbon****, implemented through tax, trading or regulation.*
  - ***Policy to support innovation and the deployment of low-carbon technologies****.*
  - *A to* ***remove barriers to energy efficiency****, and to* ***inform, educate and persuade*** *individuals about what they can do to respond to climate change*

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What is in store before Copenhagen?

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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.**

In the text that was on the table in Bangkok last week (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**
- **Significant risks are assessed to be occurring for lower temp. increase than assessed earlier**
- **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
- Coherence between different policies (energy, environment, trade, transport, industry, …) is essential, and offers many opportunities
- We have to fight inertia, which is particularly large in infrastructure
- Public transportation has a key role to play

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- The « Climate express » will leave Brussels for Copenhagen on 5/12 trough Köln: why not an ICE ?

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Useful links:

- www.ipcc.ch : IPCC
- www.climate.be/JCM: interactive climate model
- www.climate.be/vanyp : many of my slides

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