


The IPCC WGII AR4 Main Findings (IPCC=Intergovernmental Panel on Climate Change; WGII="Impacts, Vulnerability, and Adaptation"; AR4= 4th Assessment Report, 2007)



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Outline



- ⌘ **How does IPCC work?**
- ⌘ **A few additional words on the WG I findings**
- ⌘ **The main IPCC WG II findings (with focus on Latin America)**
- ⌘ **A few words on WG III findings**
- ⌘ **How to move forward ?**

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How does IPCC work?



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What is the IPCC (Co-laureate, with Al Gore, of the Nobel Peace Prize 2007)?

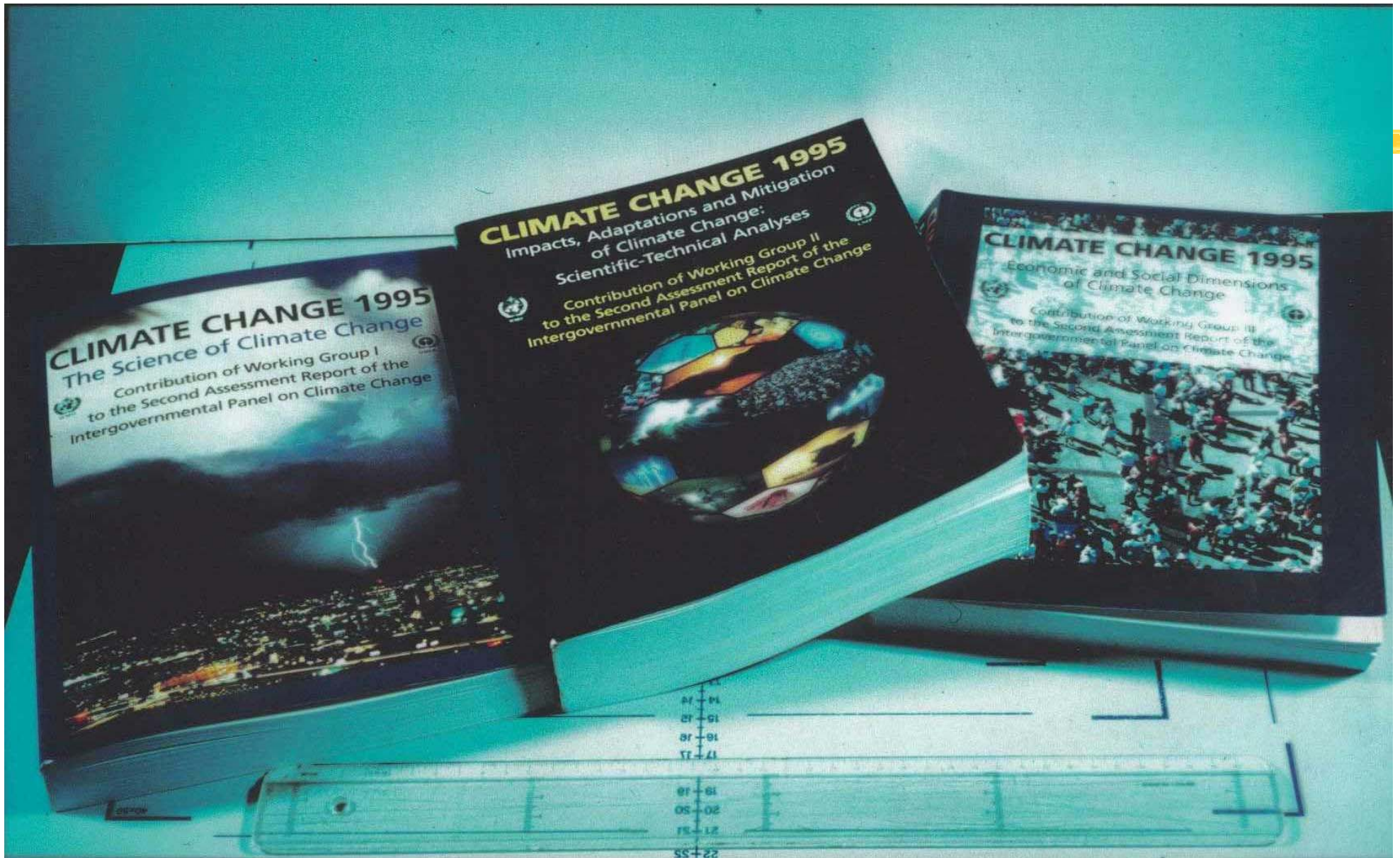
- ⌘ IPCC : Intergovernmental Panel on Climate Change (GIEC in French)
- ⌘ Created by World Meteorological Organisation (WMO) & United Nations Environment Programme (UNEP) in 1988
- ⌘ Mandate : **ASSESS** the science of climate change, impacts and adaptation, mitigation options
- ⌘ Publishes consensus reports (1990, 1996, 2001, 2007) (Cambridge University Press)
- ⌘ Advises Climate Change Convention
- ⌘ 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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IPCC AR4 products

(see www.ipcc.ch) (AR4= Assessment Report n°4)

- ⌘ **Summaries for Policy Makers (SPM)** of the 3 Working groups (English, Spanish...)
- ⌘ **WG1: Full report (English)**
- ⌘ **WG2: Full report (English)**
- ⌘ **WG3: Full report (English)**
- ⌘ **Synthesis Report (SyR):** English, Spanish...
- ⌘ **Everything free on www.ipcc.ch;**
- ⌘ **Hard copies of the full reports and the SyR available from Cambridge University Press**

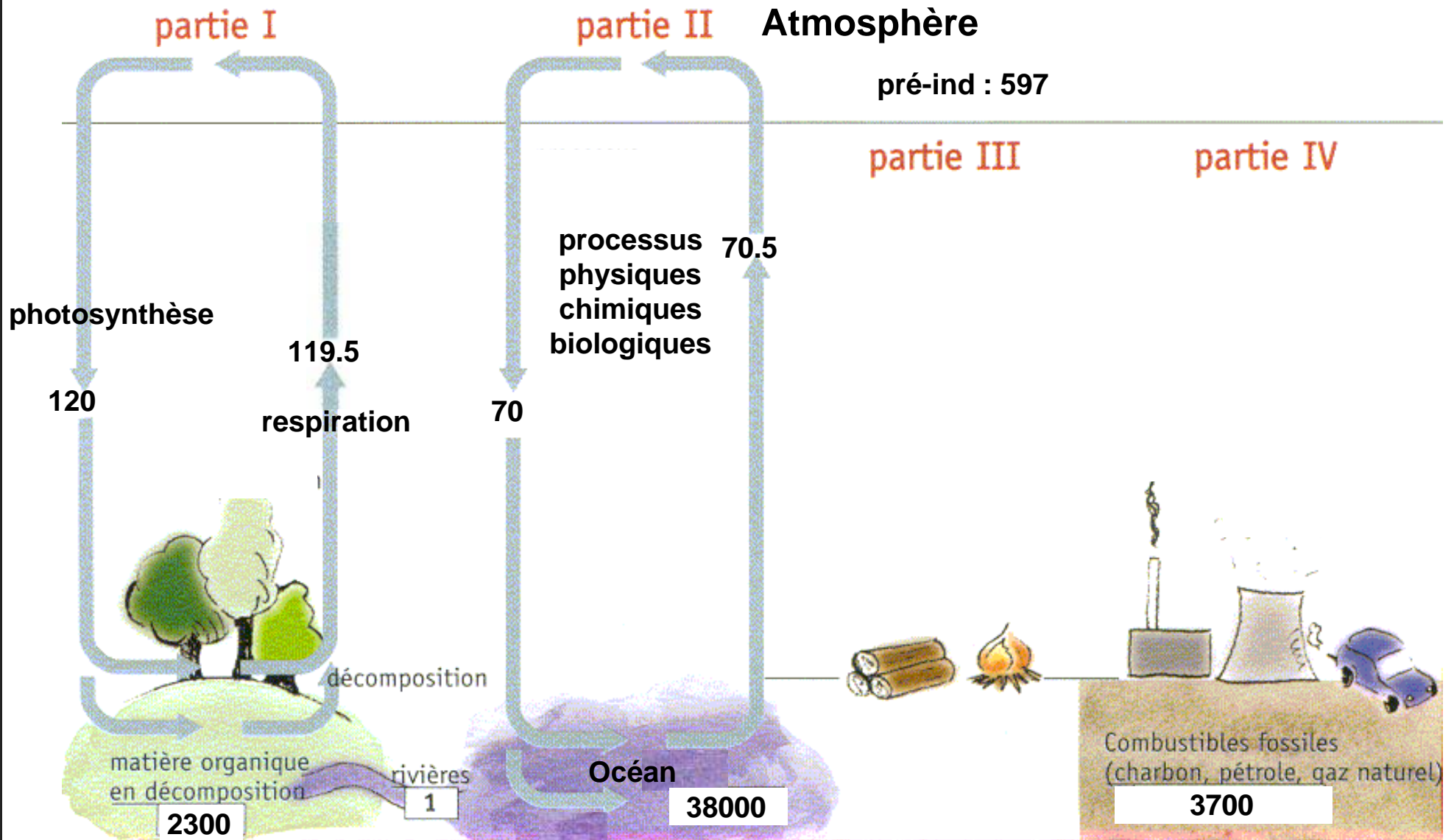
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Which warming ? !

⌘ **A few additional words on the WG I!
findings
(WG I: Climatology)**

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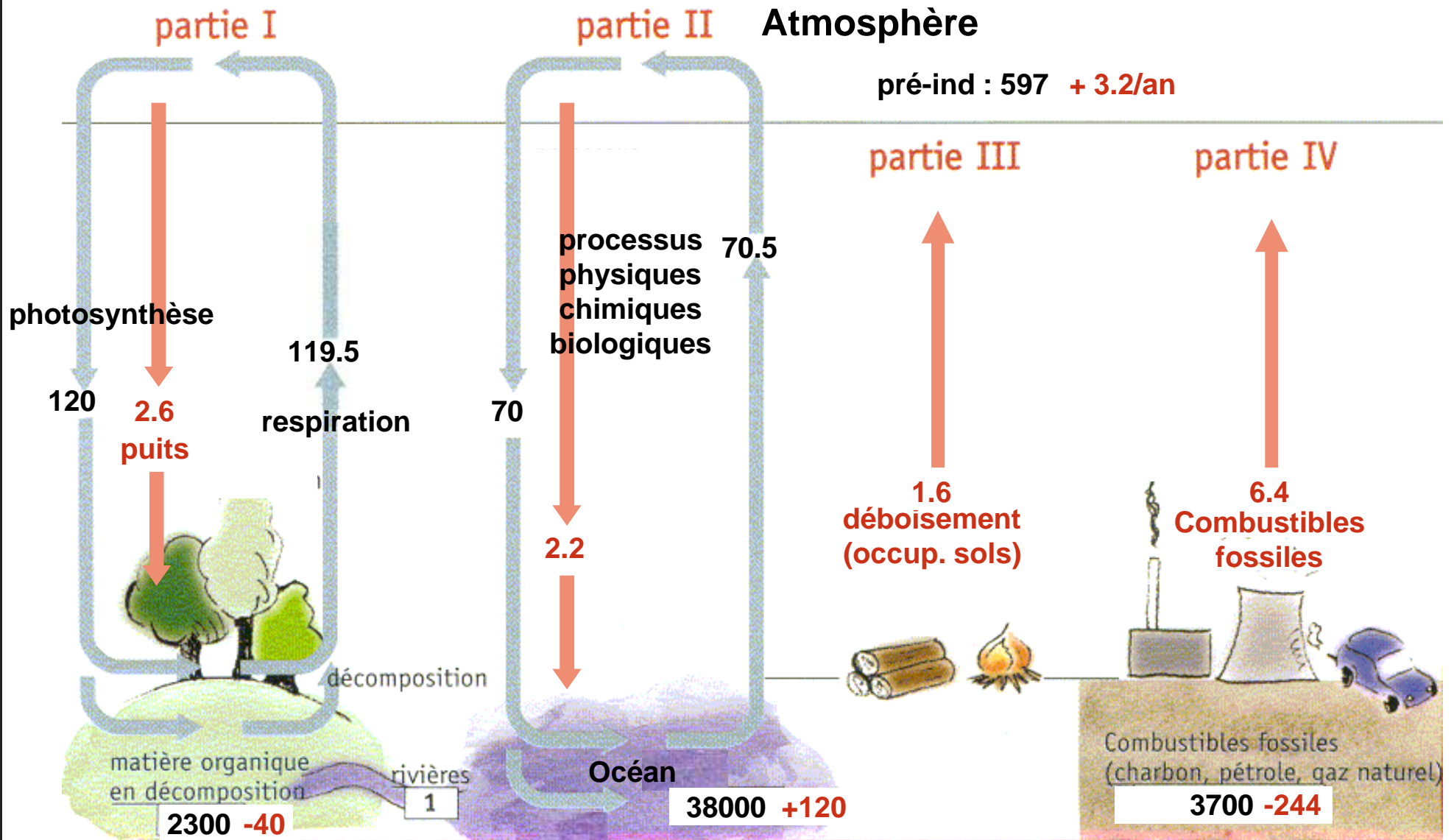
Cycle du carbone



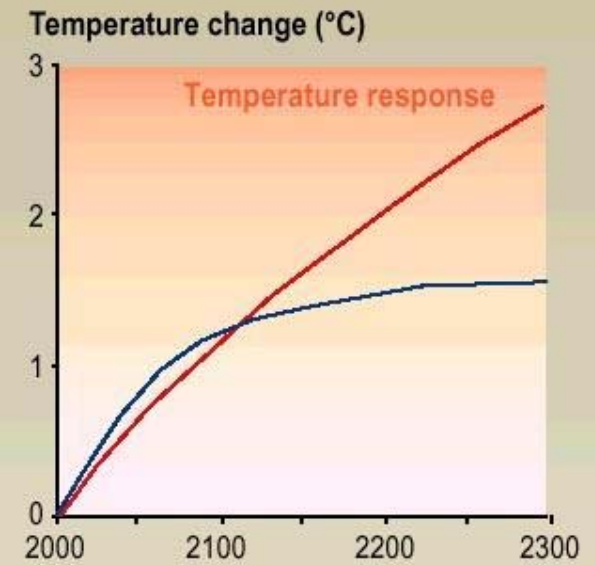
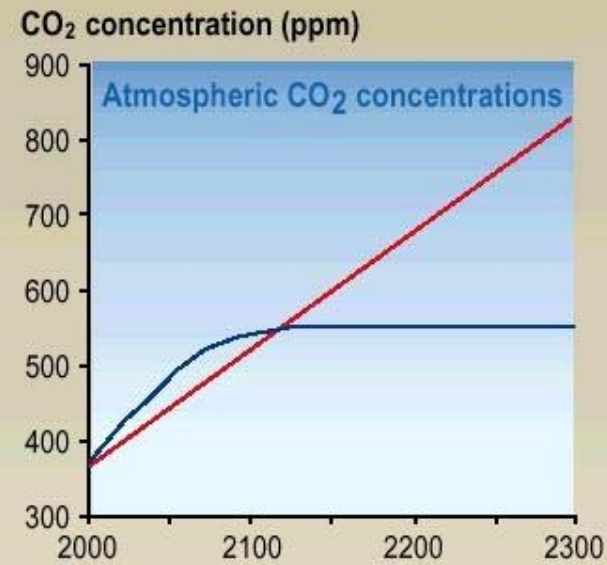
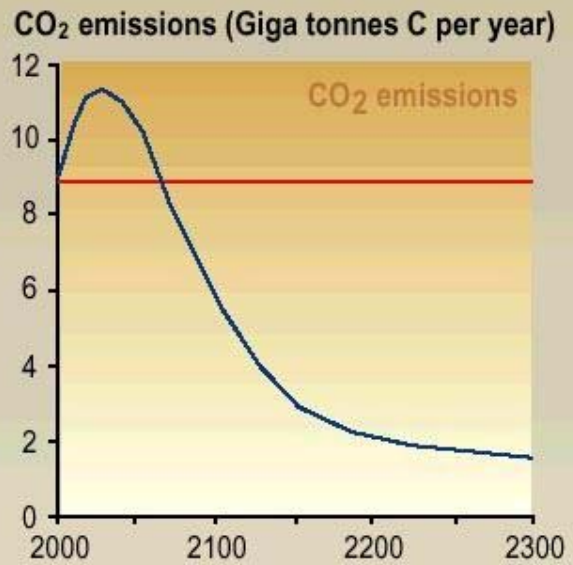
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Unités: GtC (milliards de tonnes de carbone) ou GtC/an

Cycle du carbone



Impact of stabilising emissions versus stabilising concentrations of CO₂

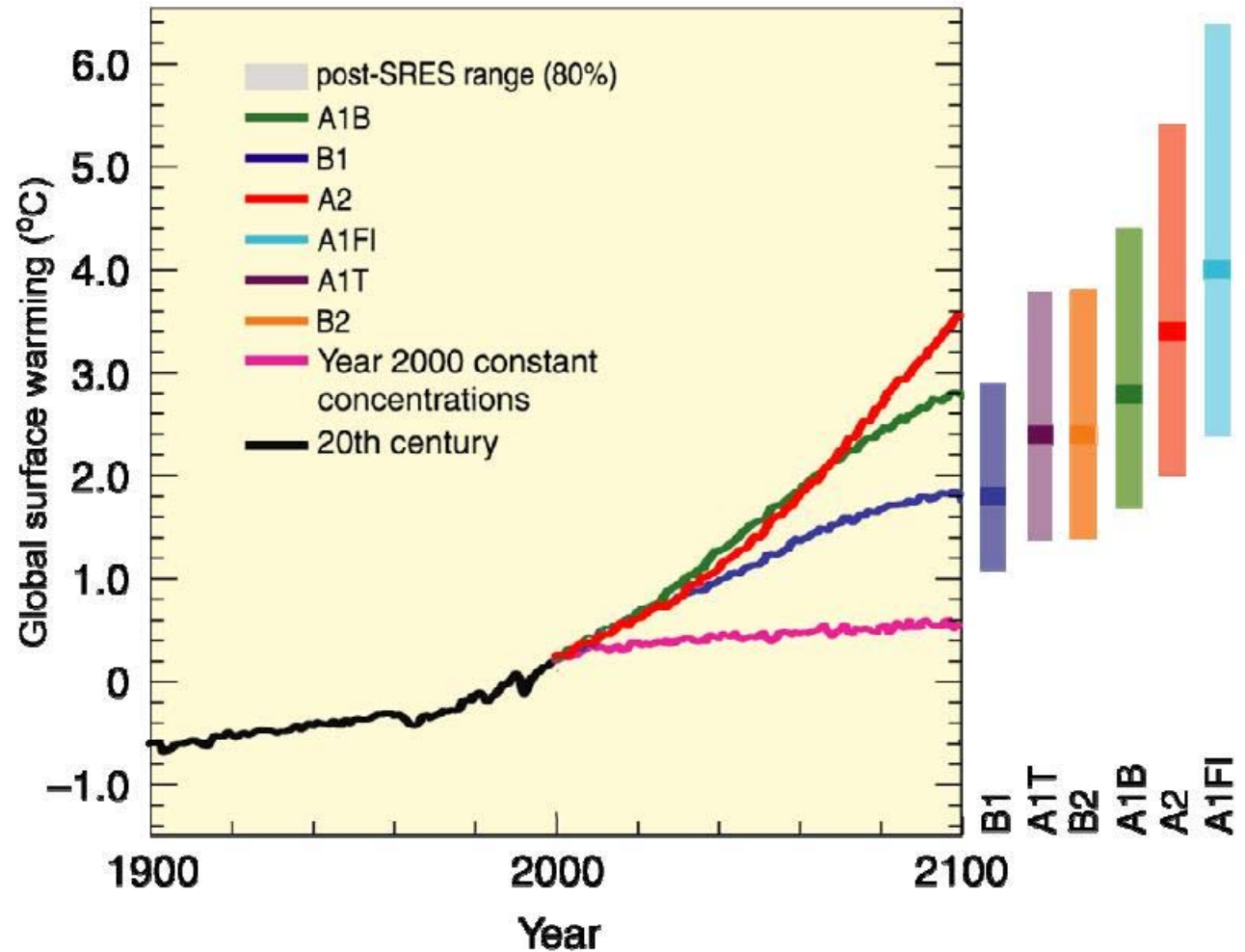
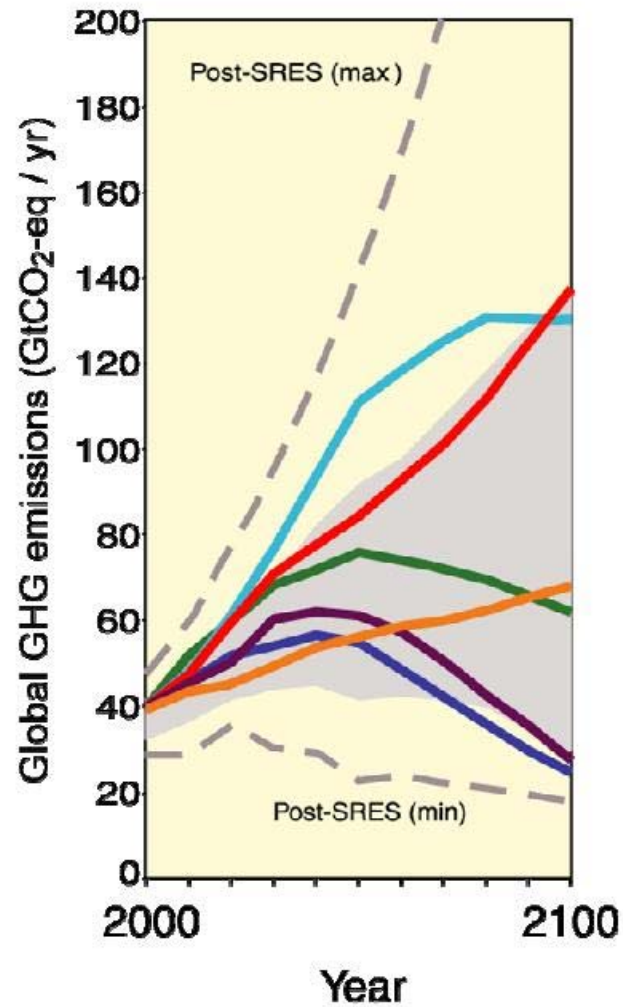


— Constant CO₂ emissions at 2000 level
 — Emissions path to stabilise CO₂ concentration at 550 ppm

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IPCC (2001)

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)

Case	Temperature Change (°C at 2090-2099 relative to 1980-1999) ^a		Sea Level Rise (m at 2090-2099 relative to 1980-1999)
	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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You can try (it's free!):



⌘ www.climate.be/JCM: interactive climate
model developed at UCL,
Belgium, by Dr. Ben Matthews

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Which impacts and adaptation ?!

⌘ **The main IPCC WG II findings
(WG II: Impacts, Vulnerability, and
adaptation)**

Subjects addressed by WG II in !

AR4:

- Impacts observed so far
- Future scenarios
- Impacts on sectors:
 - Water
 - Ecosystems
 - Agriculture, forestry, fisheries
 - Coasts
 - Settlements and industry
 - Health !

Subjects addressed (cont.):

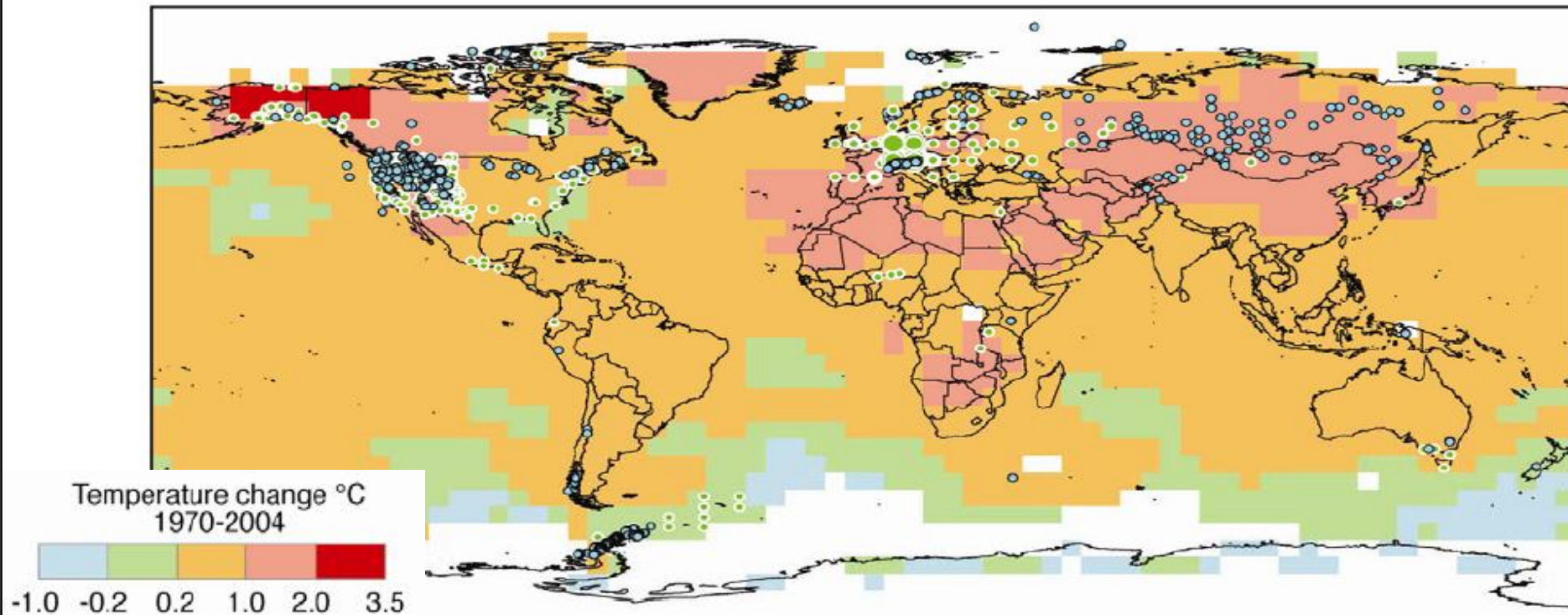
- Impacts on regions:
 - Africa, Asia, Australia and New Zealand, **Latin America**, North America, Polar regions, Small islands, and Europe

- Adaptation practices
- Adaptation vs. mitigation
- Key vulnerabilities
- Sustainability

Impacts observed so far

- **Many** natural systems on all continents and some oceans **affected** by **regional** climate change (rising temperatures)
- Warming caused by **human activities** has **likely** had a **discernible impact** on many physical and biological systems at **the global level**

Temperature changes since 1970 and! observed changes in physical and biological systems



NAM	LA	EUR	AFR	AS	ANZ	PR*	TER	MFW**	GLO
355 455	53 5	119 28,115	5 2	106 8	6 0	120 24	764 28,586	1 85	765 28,671
94% 92%	98% 100%	94% 89%	100% 100%	96% 100%	100% -	91% 100%	94% 90%	100% 99%	94% 90%

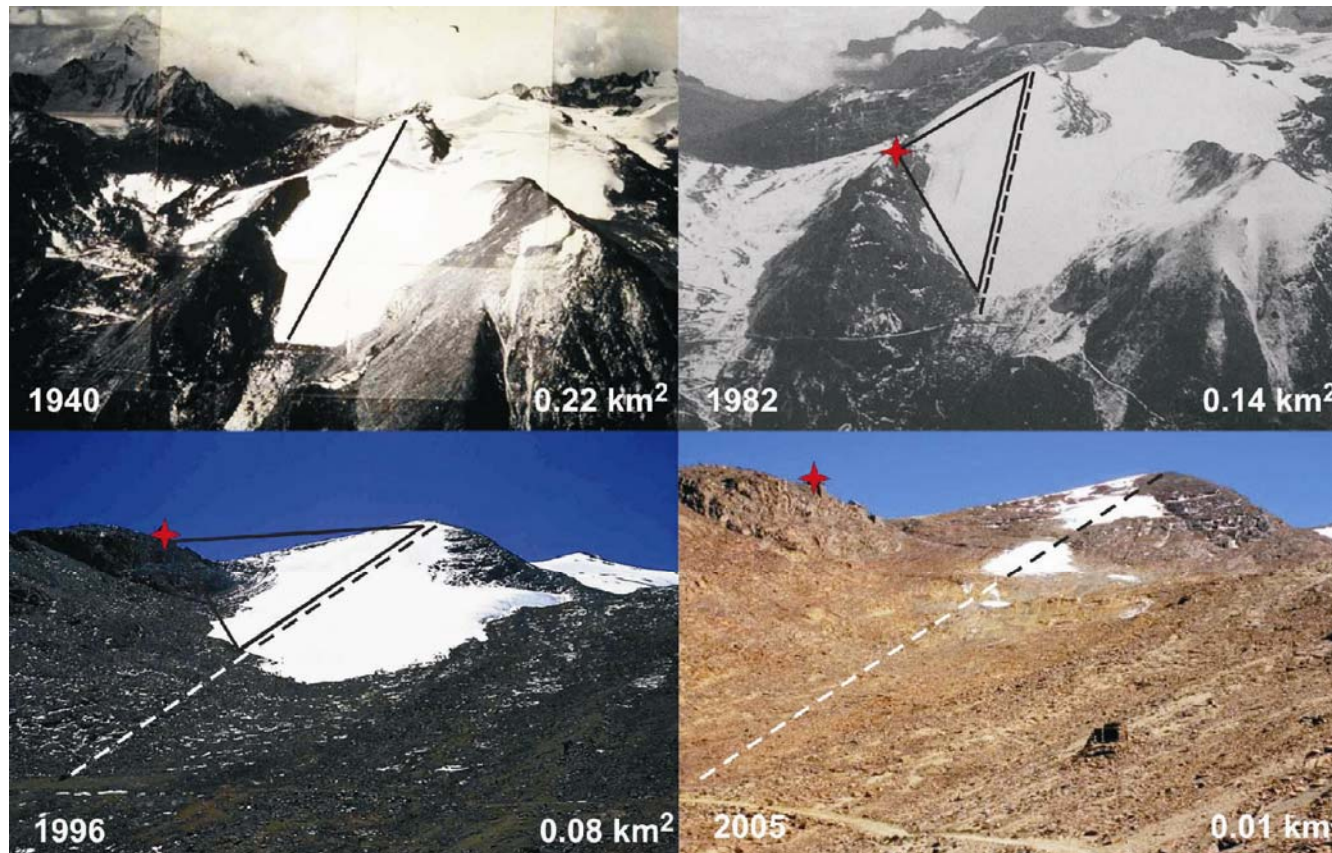
- Physical systems (snow, ice and frozen ground; hydrology; coastal processes)
- Biological systems (terrestrial, marine, and freshwater)

Physical	Biological
# significant observed changes	# significant observed changes
% of significant changes consistent with warming	% of significant changes consistent with warming

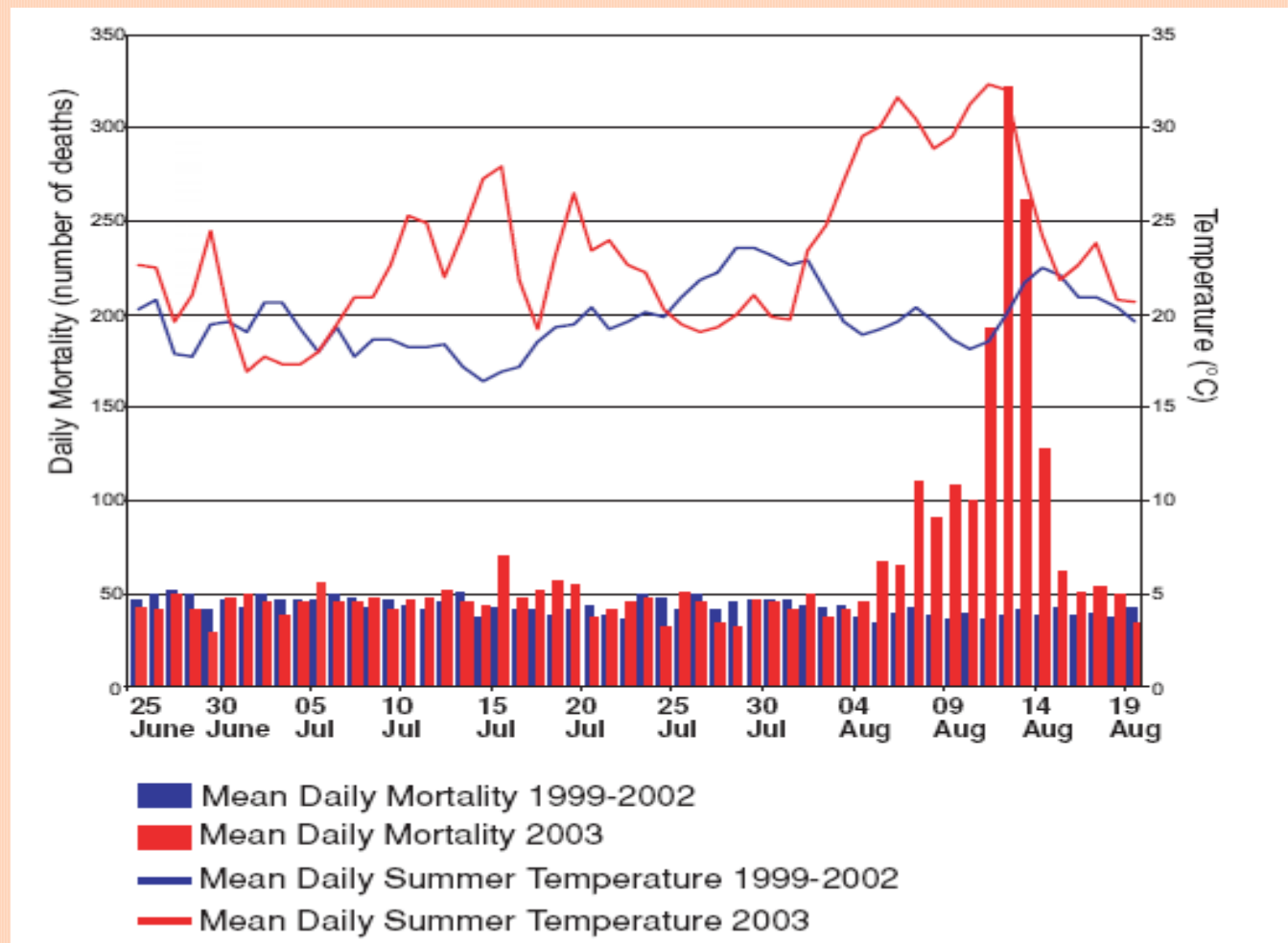


The Chacaltaya glacier and ski-lift, Bolivia

Skiing was no longer possible after 2004



Daily mortality in Paris! (summer 2003) (IPCC AR4 Ch 8)

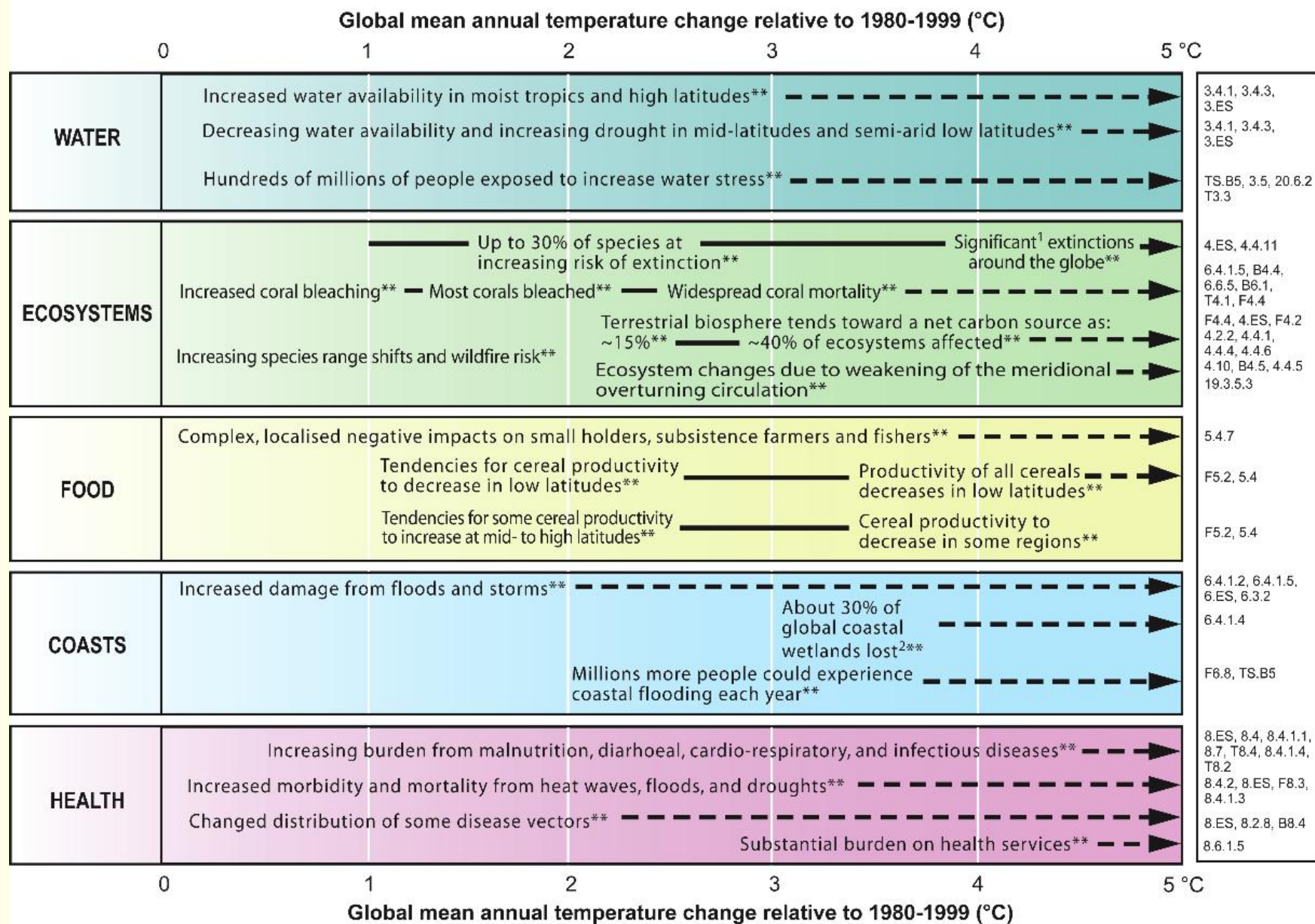


Future impacts in function of warming



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Key Impacts as a Function of Increasing Global Average Temperature Change (Impacts will vary by extent of adaptation, rate of temperature change, and socio-economic pathway)



Source: IPCC AR4 WG2 SPM

¹ Significant is defined here as more than 40%.

² Based on average rate of sea level rise of 4.2 mm/year from 2000 to 2080.

Which impacts for which warming? (a selection)

**⌘ $\sim +1.5^\circ\text{C}$ above the global pre-industrial !
value: !**

- ☒ Crop productivity increases slightly at mid- to high latitudes but decreases at lower latitudes, especially in seasonally dry and tropical regions; !**
- ☒ Hundreds of millions of people would be exposed to increased water stress; !**
- ☒ Coral bleaching would increase; !**
- ☒ Coastal regions would be subjected to increased damage from flood and storms, !**
- ☒ Heat waves, floods, and droughts would induce increased morbidity and mortality. !**

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Which impacts for which warming? (a selection)

- ⌘ **~ + 2.5°C above the global pre-industrial value (in addition of intensified above impacts):**
 - ☒ **Up to 30% of living species assessed so far would be at increasing risk of extinction,!**
 - ☒ **Most corals would be bleached**
 - ☒ **Terrestrial biosphere would tend towards a net carbon source (hindering hopes to compensate fossil fuel emissions with forest projects...).!**
- ⌘ **~+ 3.5°C above the global pre-industrial value (in addition of intensified above impacts):**
 - ☒ **Millions more people could experience coastal flooding each year.!**

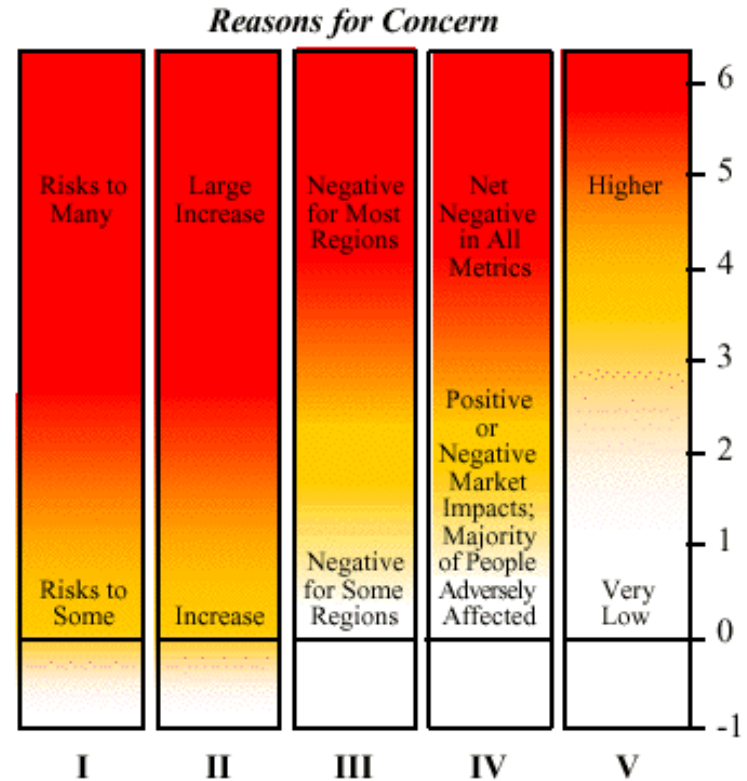
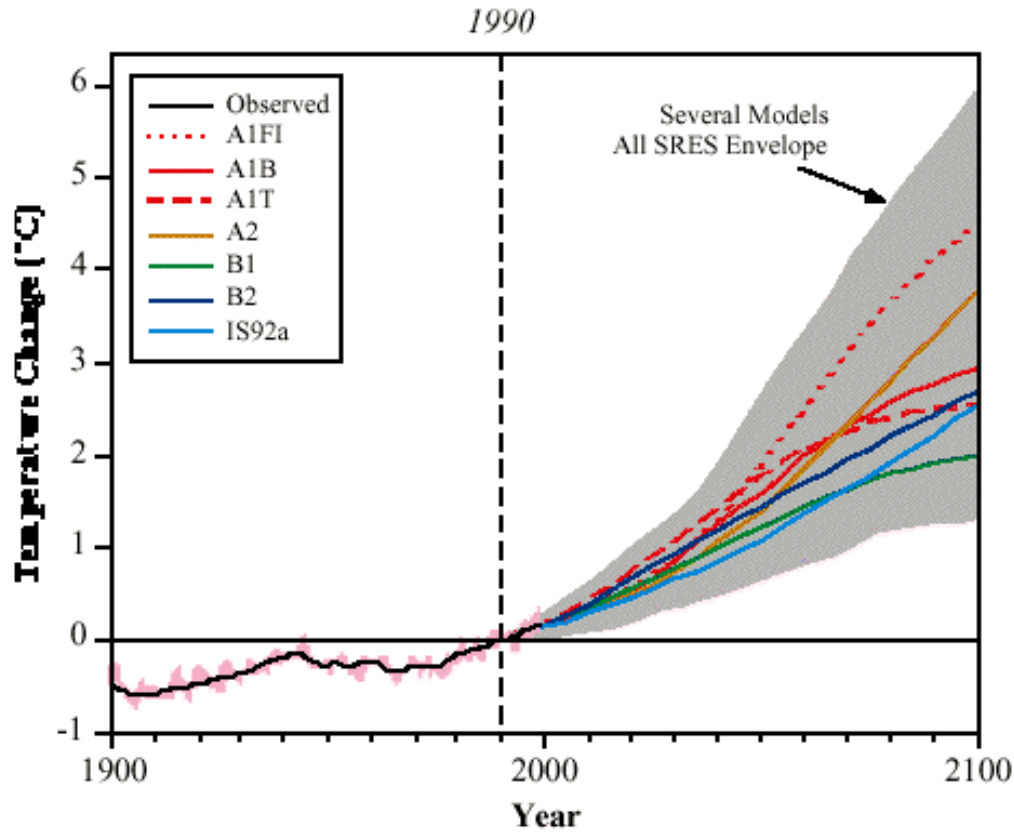
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Which impacts for which warming? (a selection)



- ⌘ In general, the net annual costs of the impacts of climate change are projected to increase over time as global temperatures increase.**
- ⌘ While developing countries are expected to experience larger percentage losses, global mean losses due to climate change could be 1 to 5% GDP for 4°C of warming.**
- ⌘ Overall, the “reasons for concern” put forward by the IPCC in 2001 are confirmed and strengthened.**

IPCC 2001 « reasons for concern »:



- | | |
|-----|---|
| 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 |

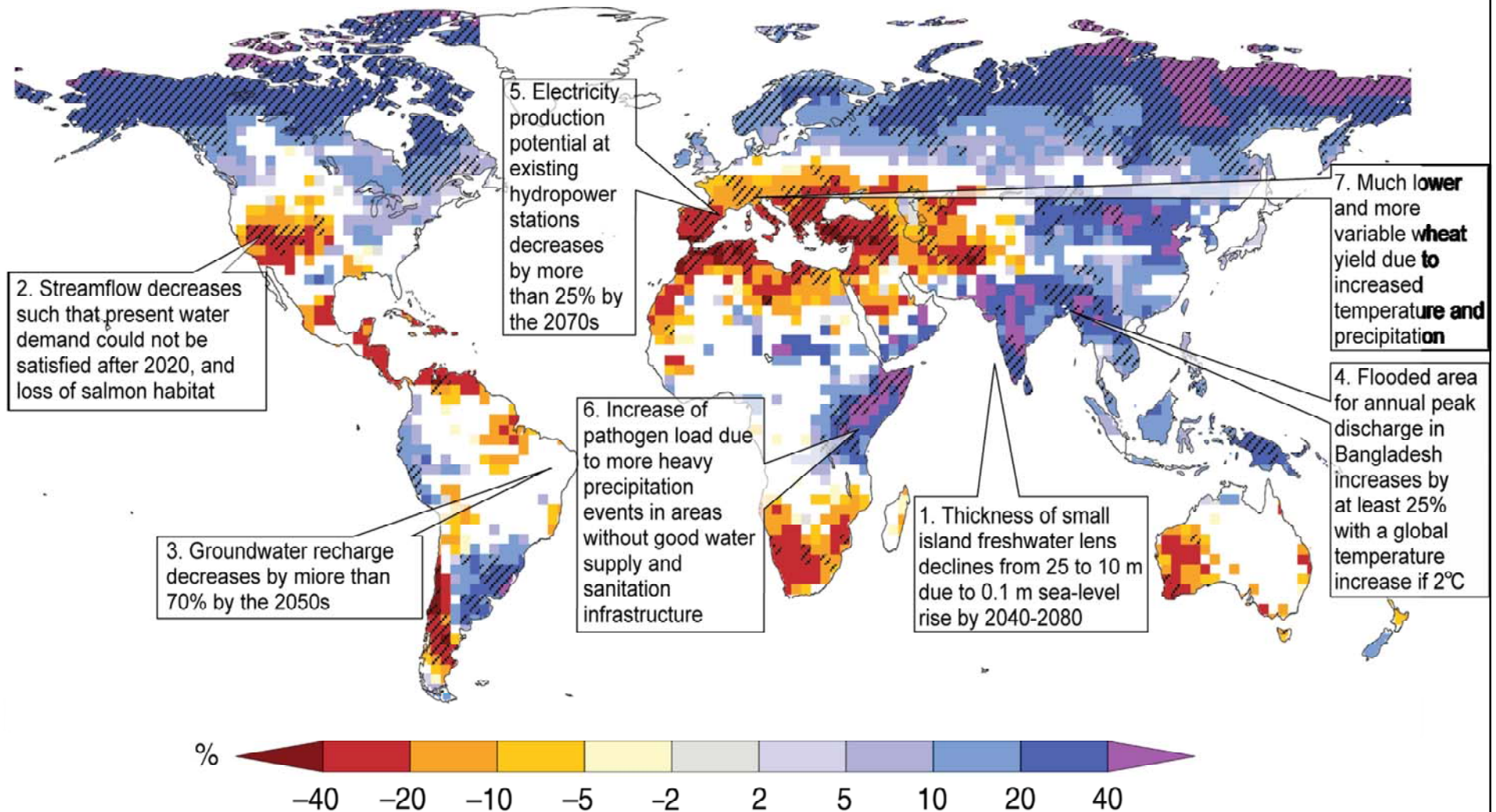
**In all regions, there are some !
areas and communities which !
are particularly vulnerable**

- The poor
- Young children
- The elderly

Developing countries are the most vulnerable to climate change (source: IPCC 2001)

- ⌘ **Impacts are worse** - already more flood and drought prone and a large share of the economy is in climate sensitive sectors
- ⌘ **Lower capacity to adapt** because of a lack of financial, institutional and technological capacity and access to knowledge
- ⌘ **Climate change is likely to impact disproportionately upon the poorest countries and the poorest persons within countries,** exacerbating inequities in health status and access to adequate food, clean water and other resources.
- ⌘ **Net market sector effects are expected to be negative in most developing countries**

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



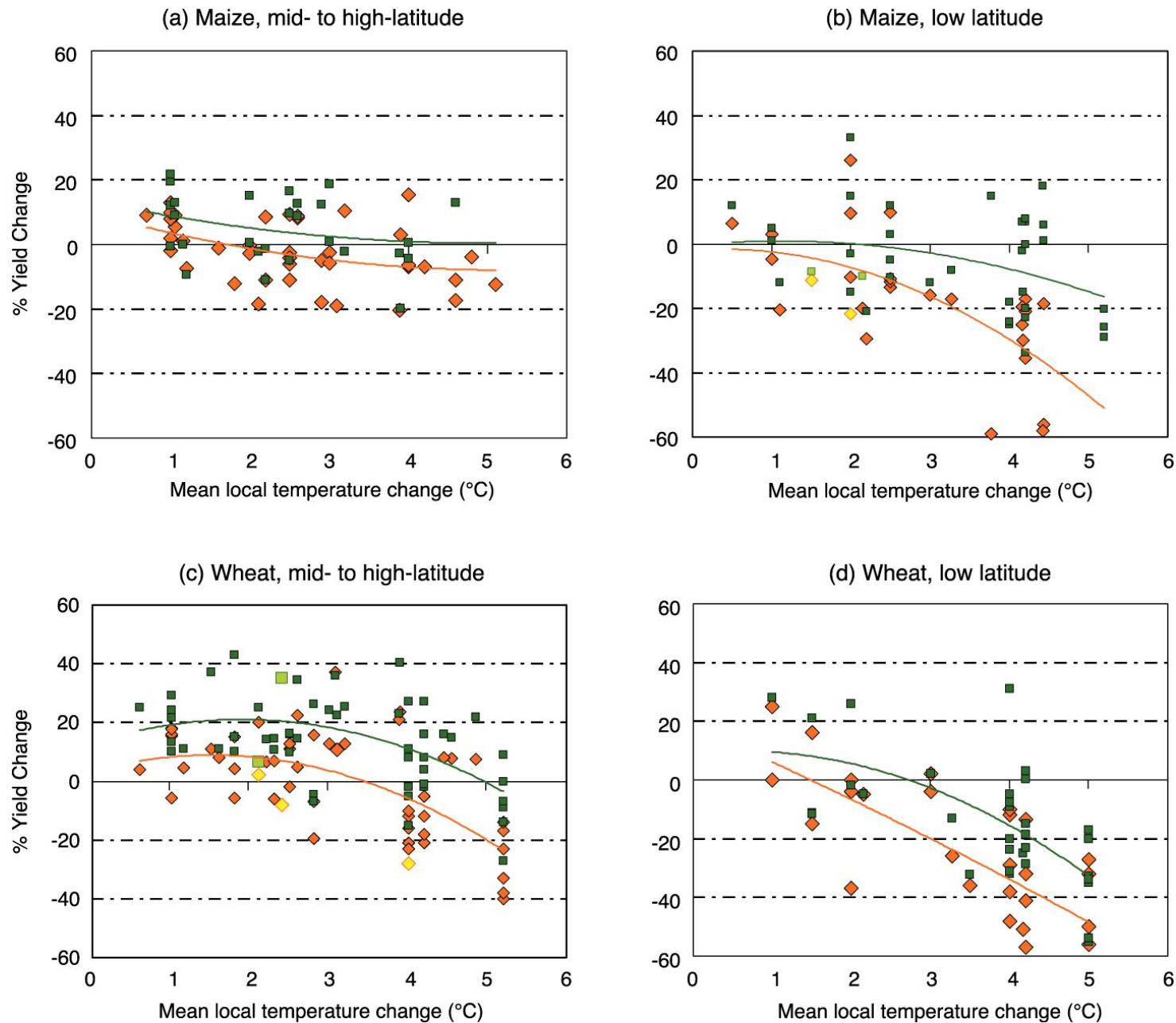
TP Figure 3.4: Ensemble mean change of annual runoff, in percent, between present (1980-1999) and 2090-2099 for the SRES A1B emissions scenario (based on Milly et al., 2005).

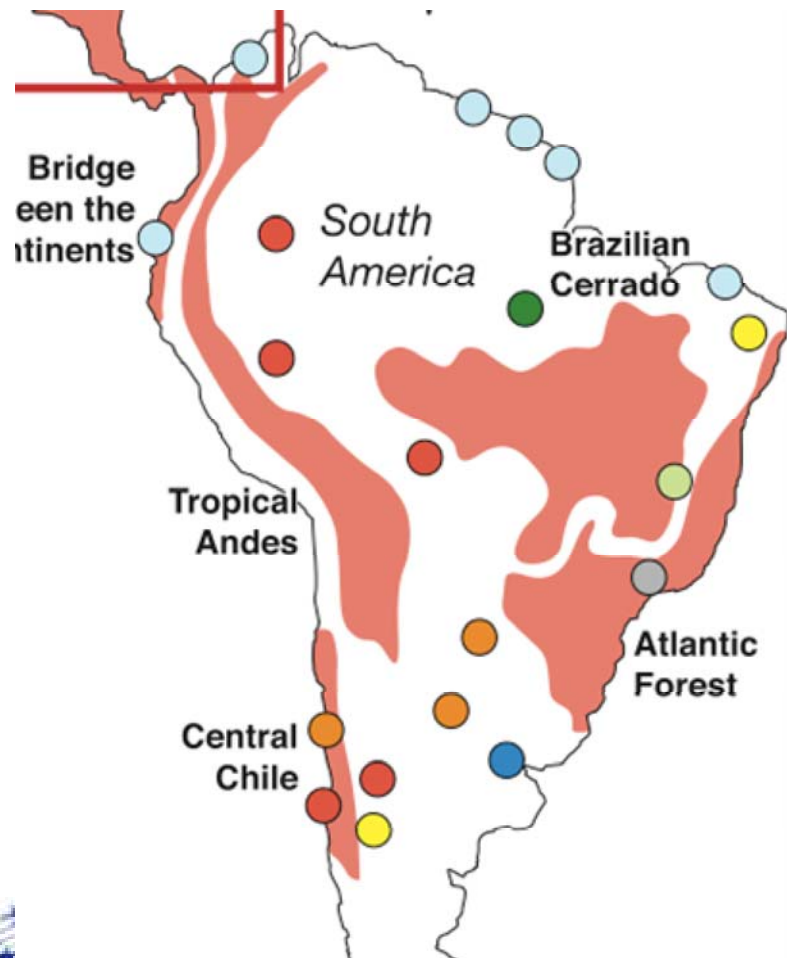
Source: IPCC AR4 SYR, 2007



- In the course of the century, water supplies stored in glaciers and snow cover are projected to decline, reducing water availability in regions supplied by meltwater from major mountain ranges, where more than one-sixth of the world population currently lives. (IPCC AR4! WG II SPM)

Figure TS.7. Sensitivity of cereal yield to climate change





- Coral reefs and mangroves seriously threatened with warmer SST
- Under the worst sea-level rise scenario, mangroves are very likely to disappear from low-lying coastlines
- Amazonia: loss of 43% of 69 tree species by the end of 21st century; savannisation of the eastern part
- Cerrados: Losses of 24% of 138 tree species for a temperature increase of 2°C
- Reduction of suitable lands for coffee
- Increases in aridity and scarcity of water resources
- Sharp increase in extinction of: mammals, birds, butterflies, frogs and reptiles by 2050
- Water availability and hydro-electric generation seriously reduced due to reduction in glaciers
- Ozone depletion and skin cancer
- Severe land degradation and desertification
- Rio de la Plata coasts threatened by increasing storm surges and sea-level rise



Excerpts from IPCC AR4 WG II! (Chapter Latin America)

- By mid-century, increases in temperature and associated decreases in soil water are projected to lead to gradual replacement of tropical forest by savanna in eastern Amazonia. Semi-arid vegetation will tend to be replaced by arid-land vegetation. There is a risk of significant biodiversity loss through species extinction in many areas of tropical Latin America.!



Excerpts from IPCC AR4 WG II! (Chapter Latin America)

- In drier areas, climate change is expected to lead to salinisation and desertification of agricultural land.
- Productivity of some important crops is projected to decrease and livestock productivity to decline, with adverse consequences for food security. In temperate zones soybean yields are projected to increase.!



Excerpts from IPCC AR4 WG II! (Chapter Latin America)

- Sea-level rise is projected to cause increased risk of flooding in low-lying areas. Increases in sea surface temperature due to climate change are projected to have adverse effects on Mesoamerican coral reefs, and cause shifts in the location of south-east Pacific fish stocks. !

Excerpts from IPCC AR4 WG II! (Chapter Latin America)

- Changes in precipitation patterns and the disappearance of glaciers are projected to significantly affect water availability for human consumption, agriculture and energy generation.

Excerpts from IPCC AR4 WG II ! (Chapter Latin America)

- Some countries have made efforts to ! adapt, particularly through conservation ! of key ecosystems, early warning ! systems, risk management in ! agriculture, strategies for flood drought ! and coastal management, and disease ! surveillance systems. !

Excerpts from IPCC AR4 WG II ! (Chapter Latin America)

- However, the effectiveness of these ! efforts is outweighed by: lack of basic ! information, observation and monitoring ! systems; lack of capacity building and ! appropriate political, institutional and ! technological frameworks; low income; ! and settlements in vulnerable areas, ! among others. !

**Adaptation will be !
necessary to address !
the unavoidable !
fraction of impacts !**

Mitigation & adaptation

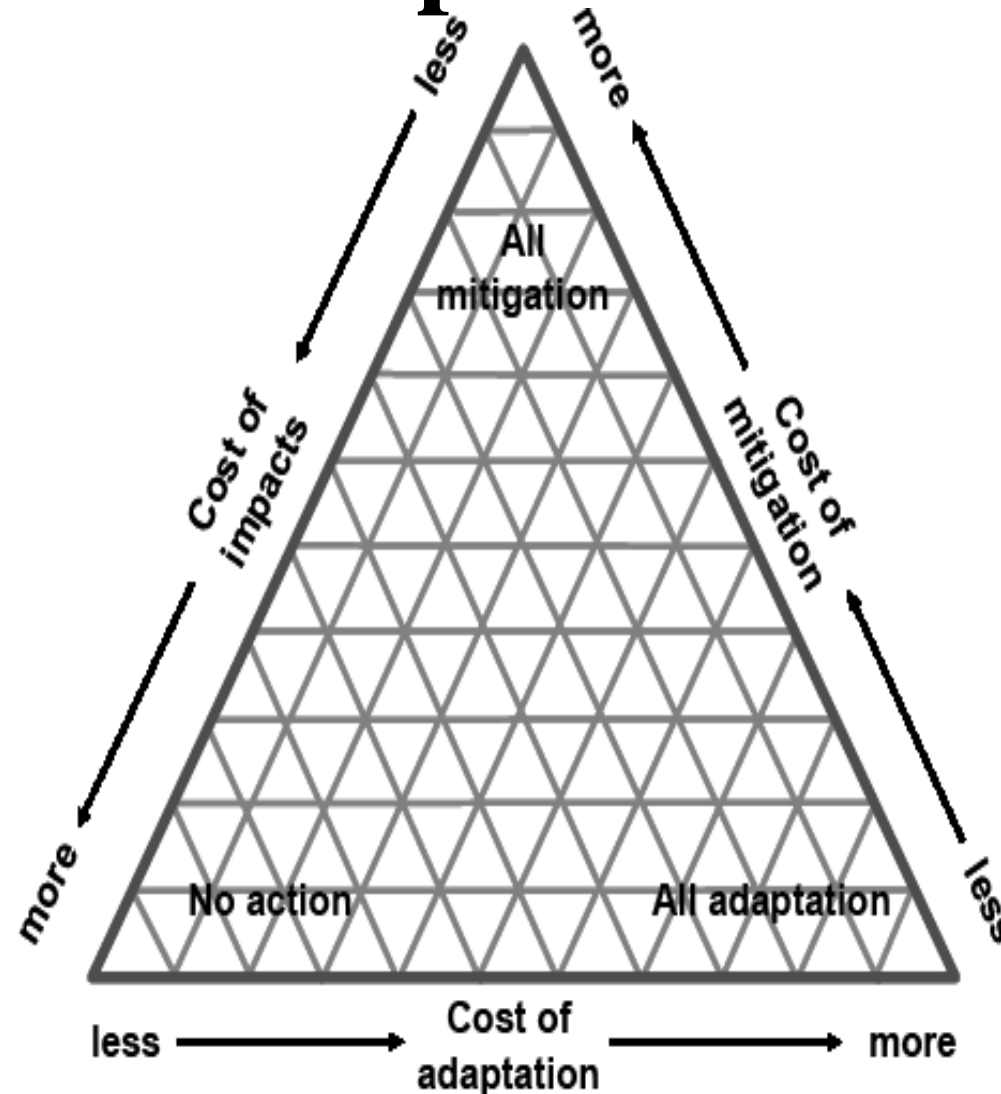


Figure 18.1: A schematic overview of inter-relationships between adaptation, mitigation and impacts, based on Holdridge's life-zone classification scheme (Holdridge, 1947, 1967).

Source: IPCC AR4 WG2 Chap 18

Response to climate change (adaptation)

- **Some adaptation is occurring now, to observed and projected future climate change, but on a limited basis.**
- **Adaptation will be necessary to address impacts resulting from the warming which is already unavoidable due to past emissions.**

Response to climate change (adaptation)

- **A wide array of adaptation options is available, but more extensive adaptation than is currently occurring is required to reduce vulnerability to future climate change.**
- **There are barriers, limits and costs, but these are not fully understood.**
- **Although many early impacts of climate change can be effectively addressed through adaptation, the options for successful adaptation diminish and the associated costs increase with increasing climate change.**

Response to climate change (adaptation)

- **Vulnerability to climate change can be exacerbated by the presence of other stresses.**
- **Future vulnerability depends not only on climate change but also on development pathway.**
- **Sustainable development can reduce vulnerability to climate change, and climate change could impede nations' abilities to achieve sustainable development pathways.**

Response to climate change (mitigation & adaptation)

- **Many impacts can be avoided, reduced or delayed by mitigation.**
- **A portfolio of adaptation and mitigation measures can diminish the risks associated with climate change.**
- One way of increasing adaptive capacity is by introducing the consideration of climate change impacts in development planning, for example, by:
 - including adaptation measures in land-use planning and infrastructure design;
 - including measures to reduce vulnerability in existing disaster risk reduction strategies

Challenge for adaptation policy

- ⌘ **Uncertainties on future climate come from uncertainty on !**
 - ⊠ Which scenario will be the real one ?
 - ⊠ Which climate change for a given scenario, particularly for hydrological parameters
- ⌘ **Uncertainty on future impacts is also related to !**
 - ⊠ the future socio-economic conditions (incl. equity aspects)
 - ⊠ The degree and quality of adaptation implemented
- ⌘ **Hence the need to:**
 - ⊠ consider the full range of plausible futures, !
 - ⊠ and maintain as much flexibility as possible
- ⌘ **In addition, be « ready for surprises »**
- ⌘ **Who is going to pay?**

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A few words on mitigation

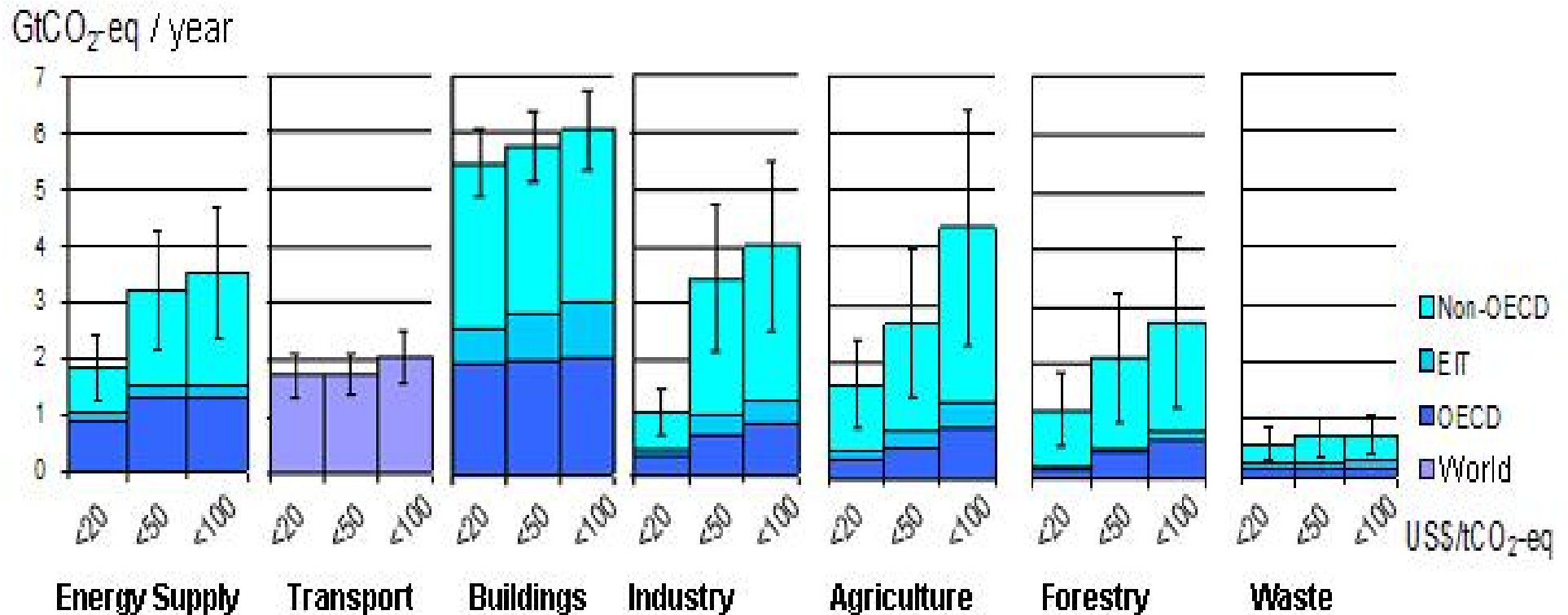


⌘ IPCC WG3: Mitigation

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All sectors and regions have the potential to contribute by 2030

Source: IPCC AR4 SYR, 2007



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

Long term mitigation (after 2030)

Source: IPCC AR4 SYR, 2007

- 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 CO ₂ -eq)	Global Mean temp. increase at equilibrium (°C)	Year CO ₂ needs to peak	Reduction in 2050 compared to 200
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
<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).

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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.

Please remember:

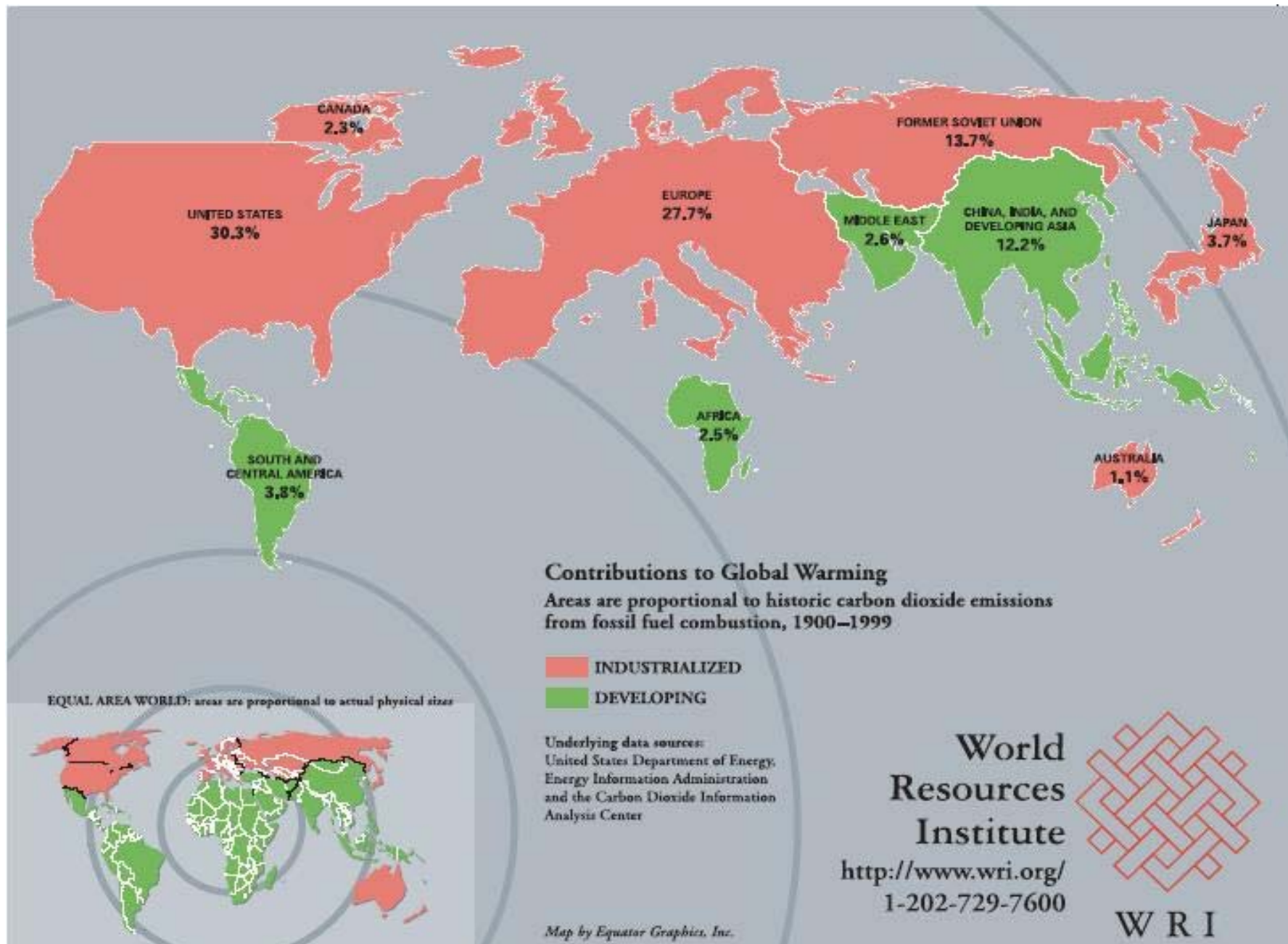


- ⌘ The Sun gives us, globally, ***every hour*** the amount of energy we use commercially **in one year!**
- ⌘ **And it will still do so for at least! another 3 billion years**

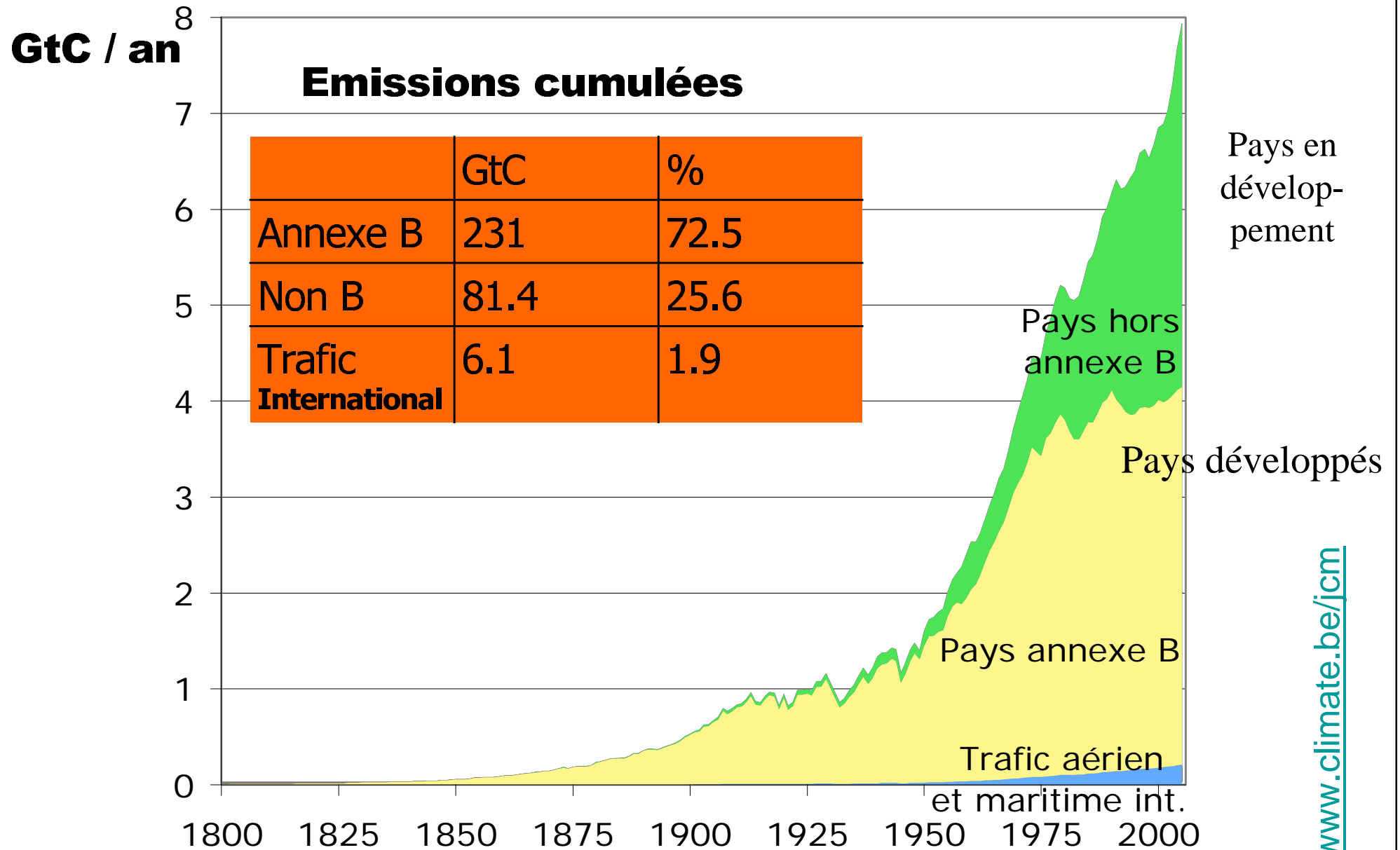
How to move forward?

- ☒ 1) Implement meaningful adaptation policies, integrated in the (sustainable) development process and funded following the polluter's pays principle
- ☒ 2) develop real partnership with developing countries to address common threat; Promote technology transfers
- ☒ 3) Use « Contraction and Convergence » as long-term framework, on ethical basis. Use it as guide to assign quotas over the next commitment period.
- ☒ 4) Take the logic of the market approach to the extreme, and follow Anil Agarwal's proposal: « one human = one GHG unit; & allow global trade of allowances »

Areas proportional to historic CO₂ emissions 1900-1999



Emissions historiques : CO₂

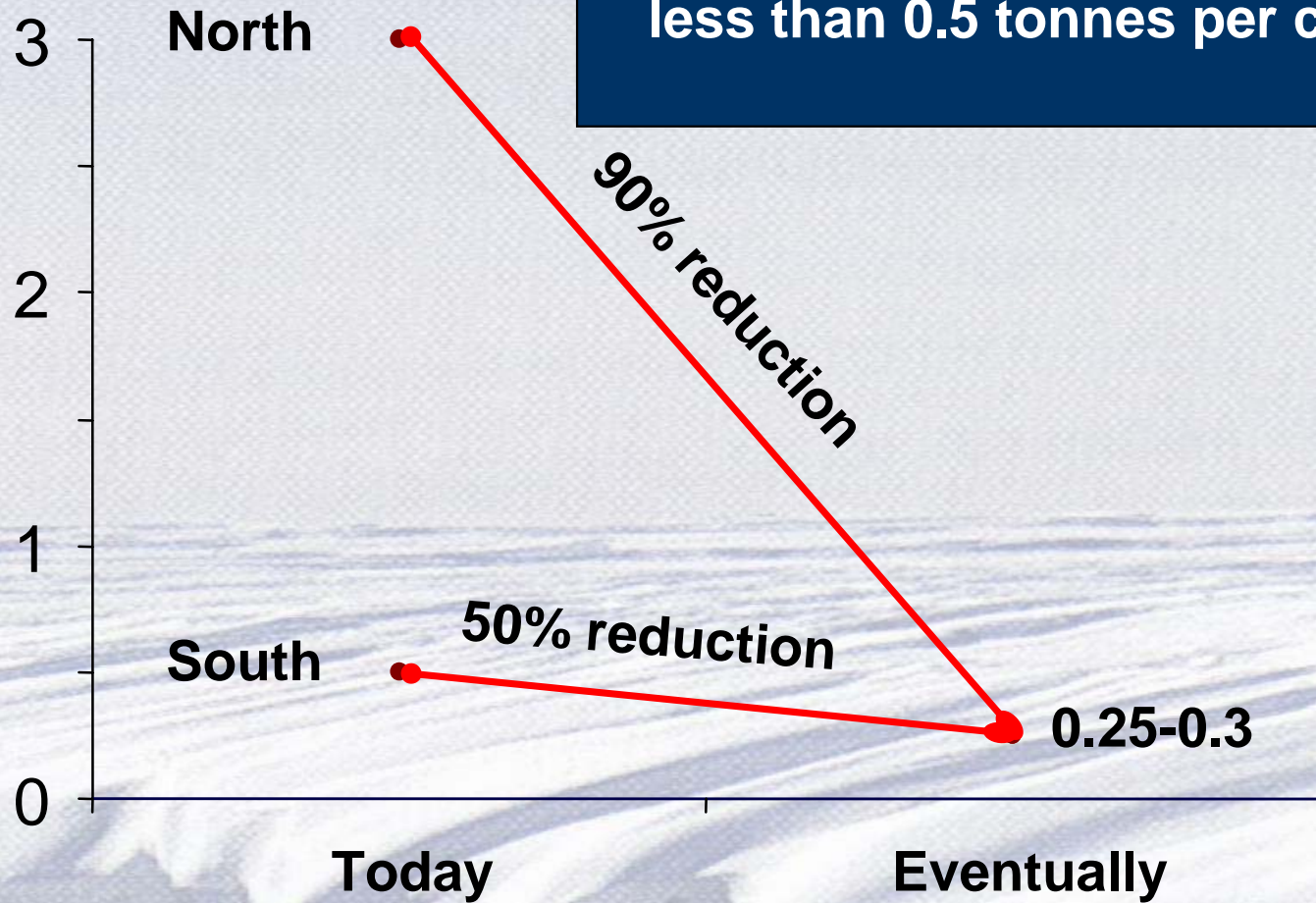




carbon emissions

**ultimate climate challenge
less than 0.5 tonnes per capita**

t. C / capita / year



Conclusion

- ⌘ **Climate is changing due to our activities**
- ⌘ **...and fast**
- ⌘ **Mitigation is essential to prevent the avoidable**
- ⌘ **Adaptation is essential to cope with the unavoidable**
- ⌘ **The more integrated they are in all policies, the more efficient and cheap they will be**
- ⌘ **Use and peruse the IPCC reports!**

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John Holdren, President of the American Association for the Advancement of Science

- ⌘ *'We basically have three choices:— mitigation, adaptation, and suffering.!***
- ⌘ *We're going to do some of each. The question is what the mix is going to be.!***
- ⌘ *The more mitigation we do, the less! adaptation will be required, and the less! suffering there will be.'***

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Useful links:



⌘ www.ipcc.ch : IPCC!

⌘ www.climate.be/JCM: interactive climate model

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