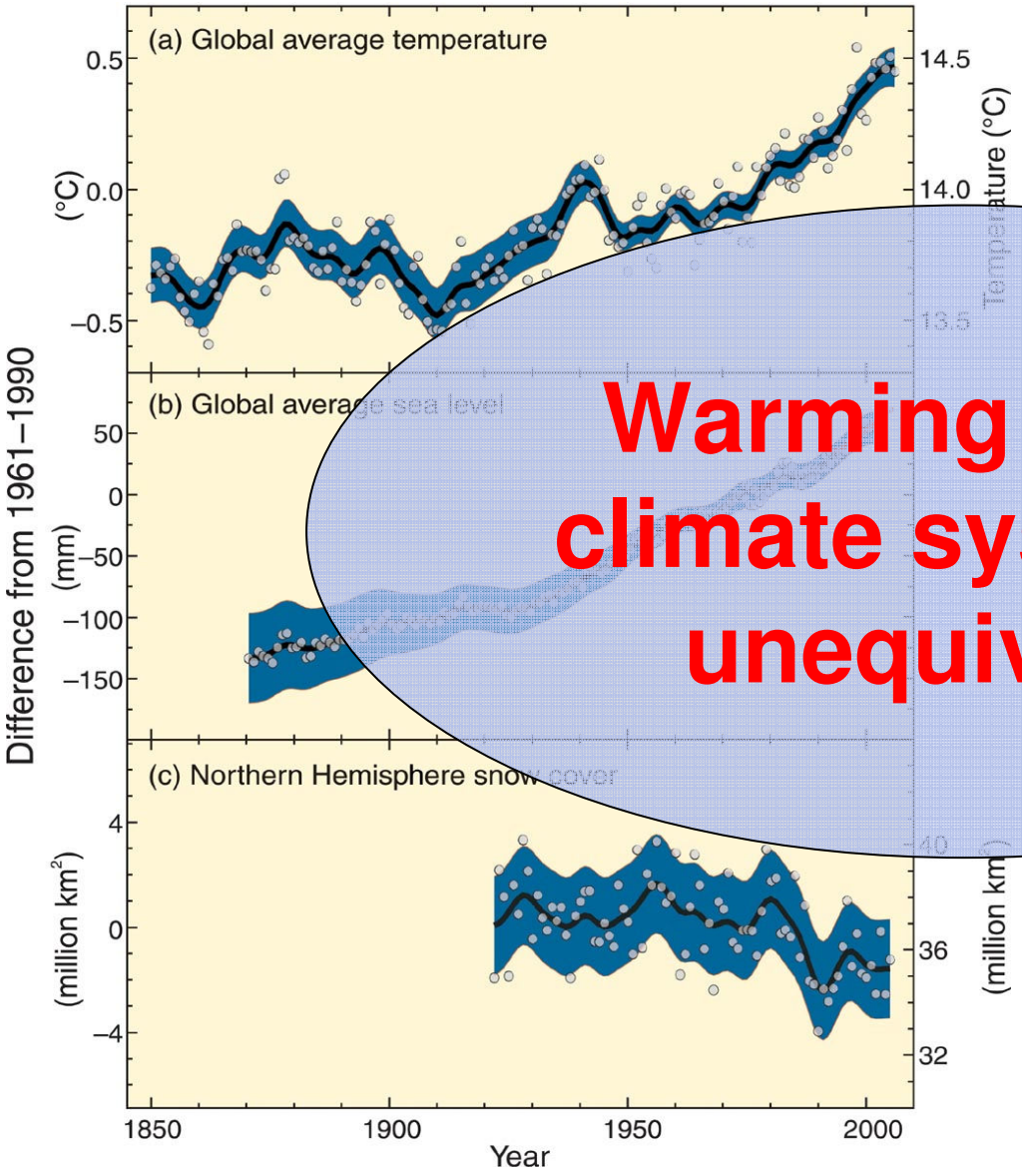
Climate Change and Population
Key Findings from the
IPCC Fourth Assessment Report

Presentation at the Launch of the
International Year of the Planet Earth

Renate Christ
Secretary of the IPCC

Paris, 12 February 2008

Observed Climate Change



100-yr warming trend (1906-2005) of 0.74°C.

Increased since TAR.

Warming of the climate system is unequivocal

Sea level rise:

1961 – 2003: 1.8 mm per yr

1993 – 2003: 3.1 mm per yr

Decreasing:

- snow and ice extent
- Arctic sea ice extent
- Mountain glaciers

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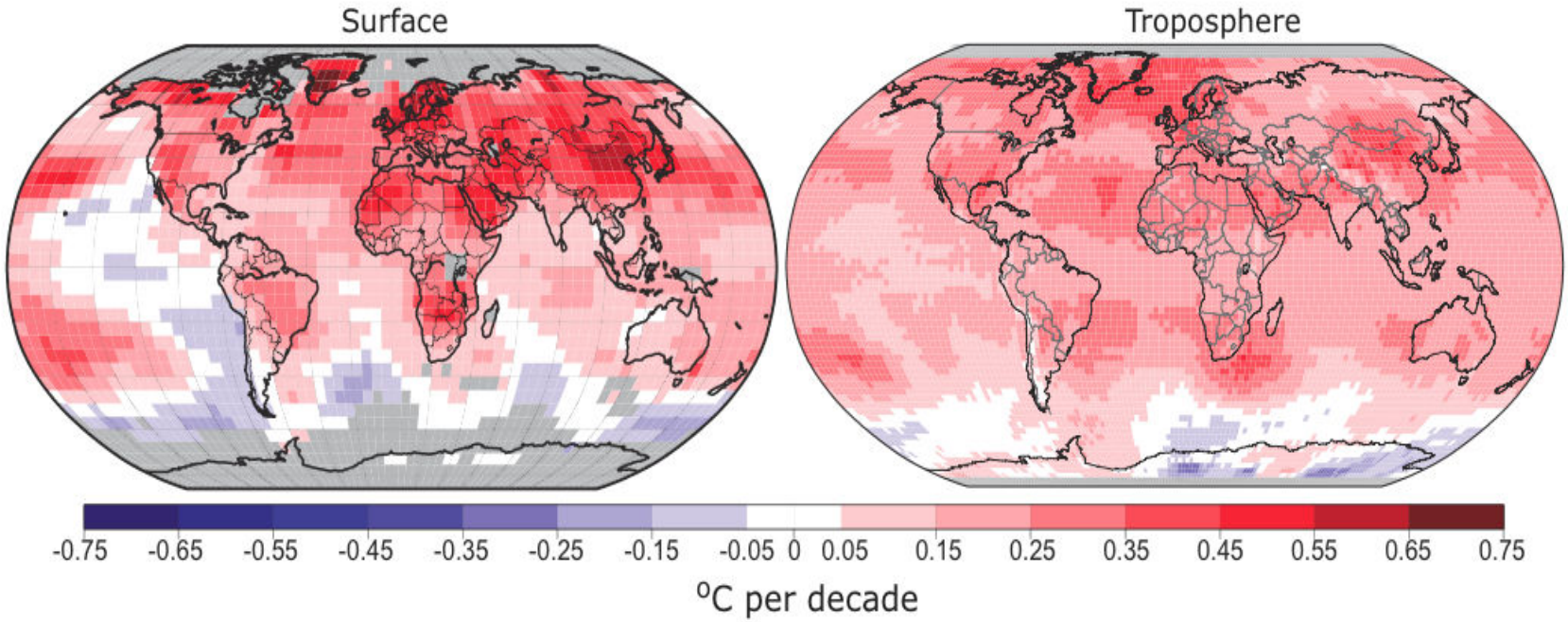
Warming is truly global

- Warming everywhere at surface except in eastern Pacific, Southern Ocean and parts of Antarctica;
- Land warming significantly faster than over ocean;
- Mid-troposphere warming consistent with that at surface.



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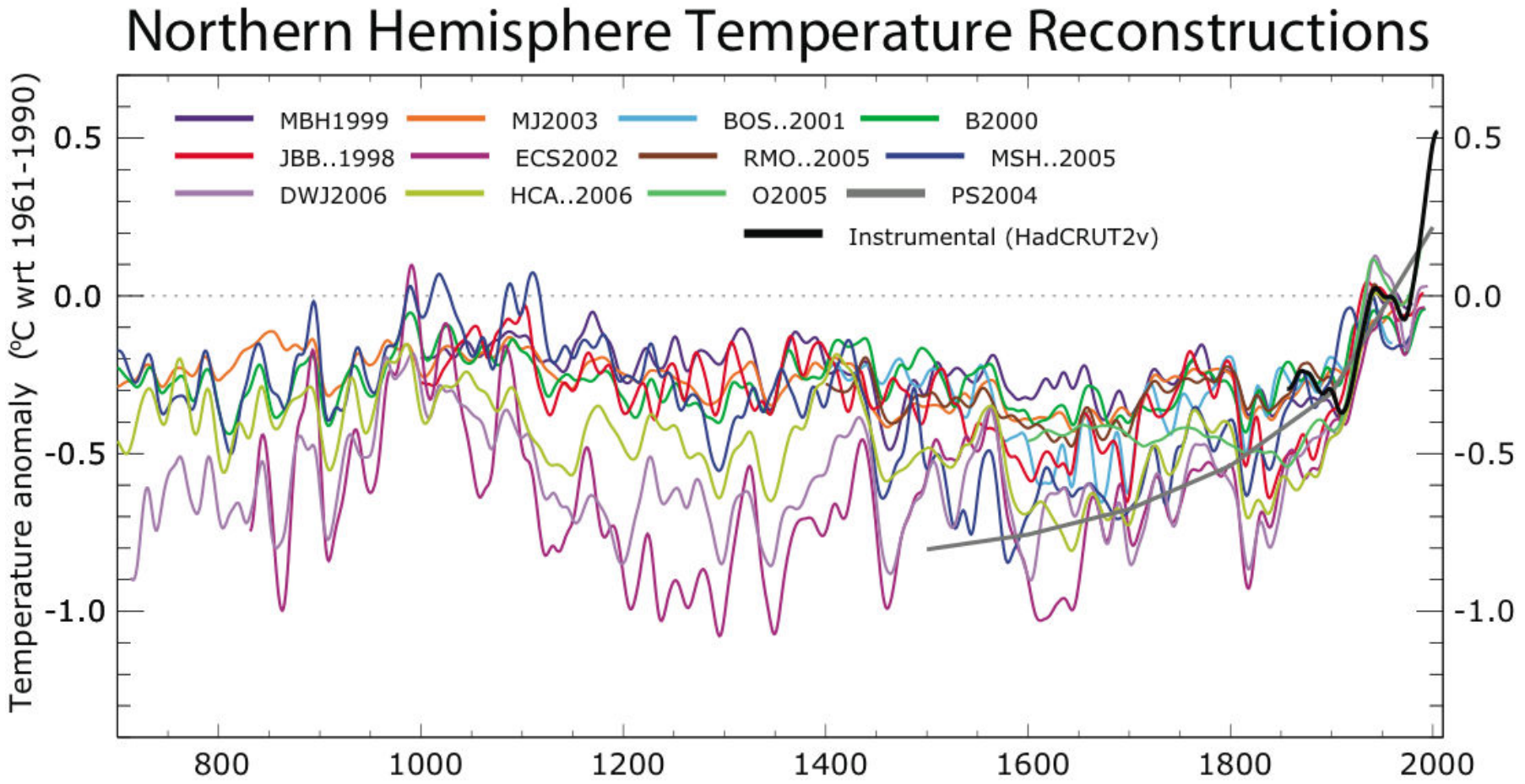
Warmth of the last half century is unusual in at least the previous 1300 years



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Many natural systems are affected

- Increased number and size of glacial lakes
- Ground instability in mountain & permafrost regions

- Spring events occur earlier in year
- Plant and animal ranges shift poleward or upward

Anthropogenic warming over the last three decades *likely* had a discernible influence at the global scale

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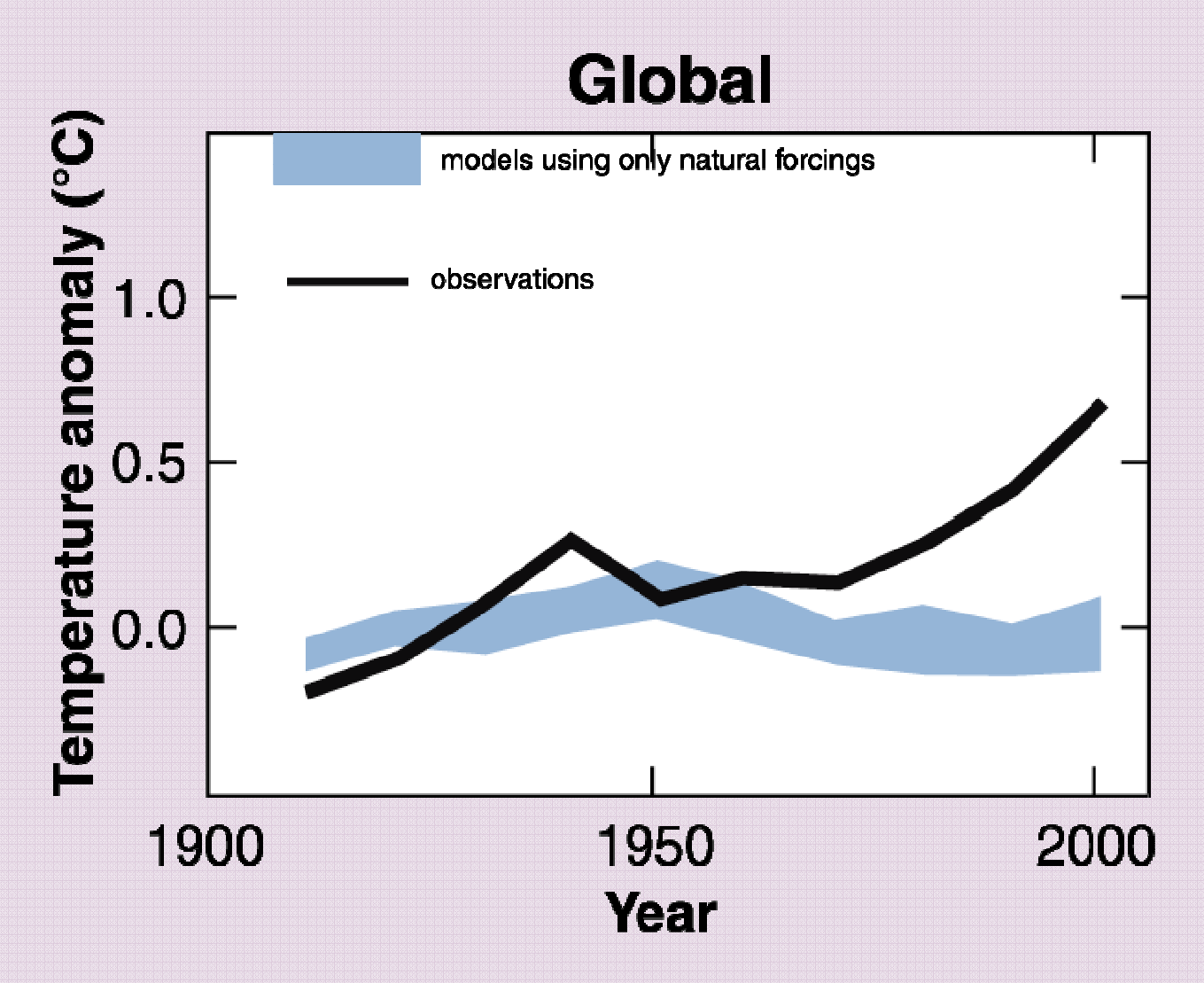
Natural forcings would have led to cooling



Decadal averages of observed and simulated global average surface temperature

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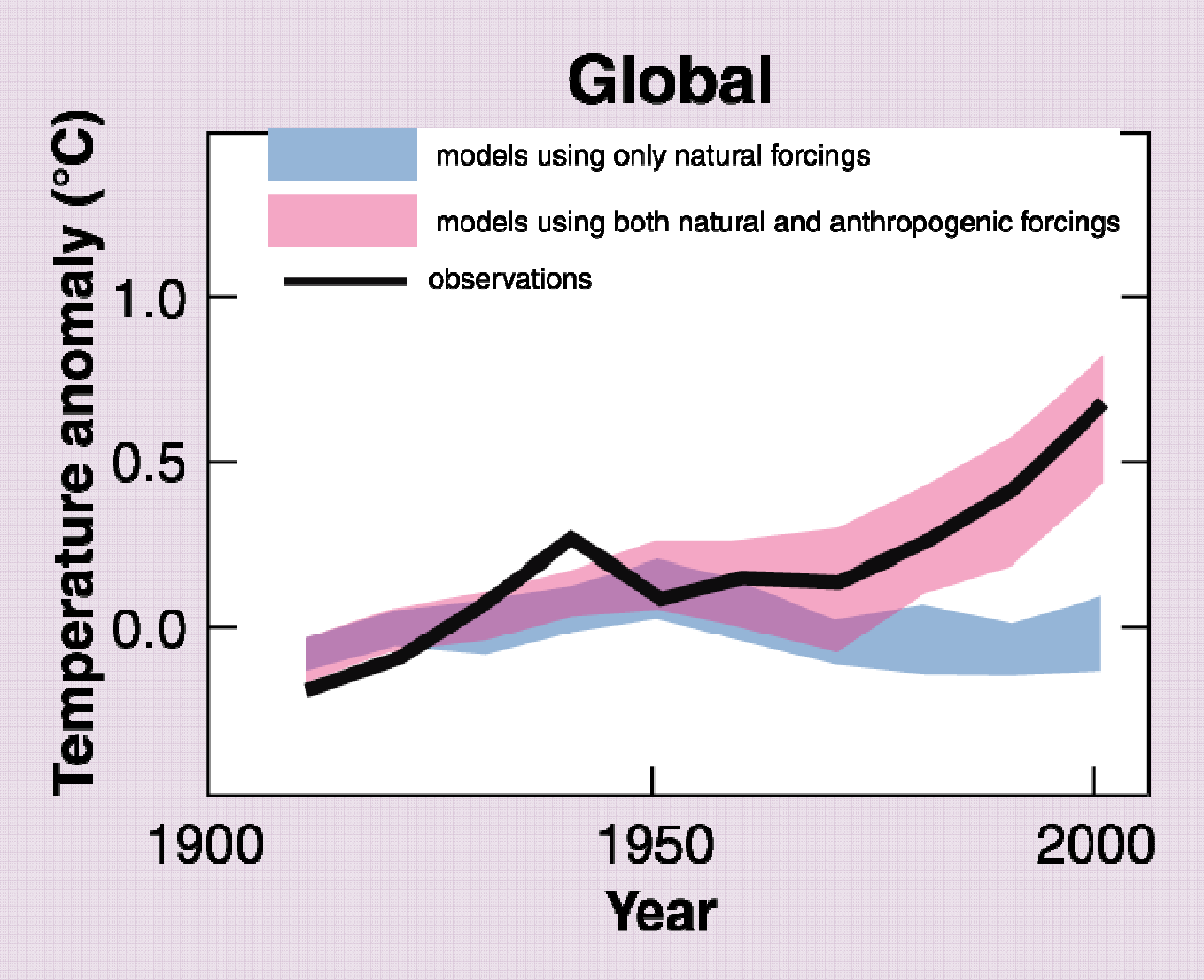
Observed warming simulated only by models that include anthropogenic forcings



Decadal averages of observed and simulated global average surface temperature.

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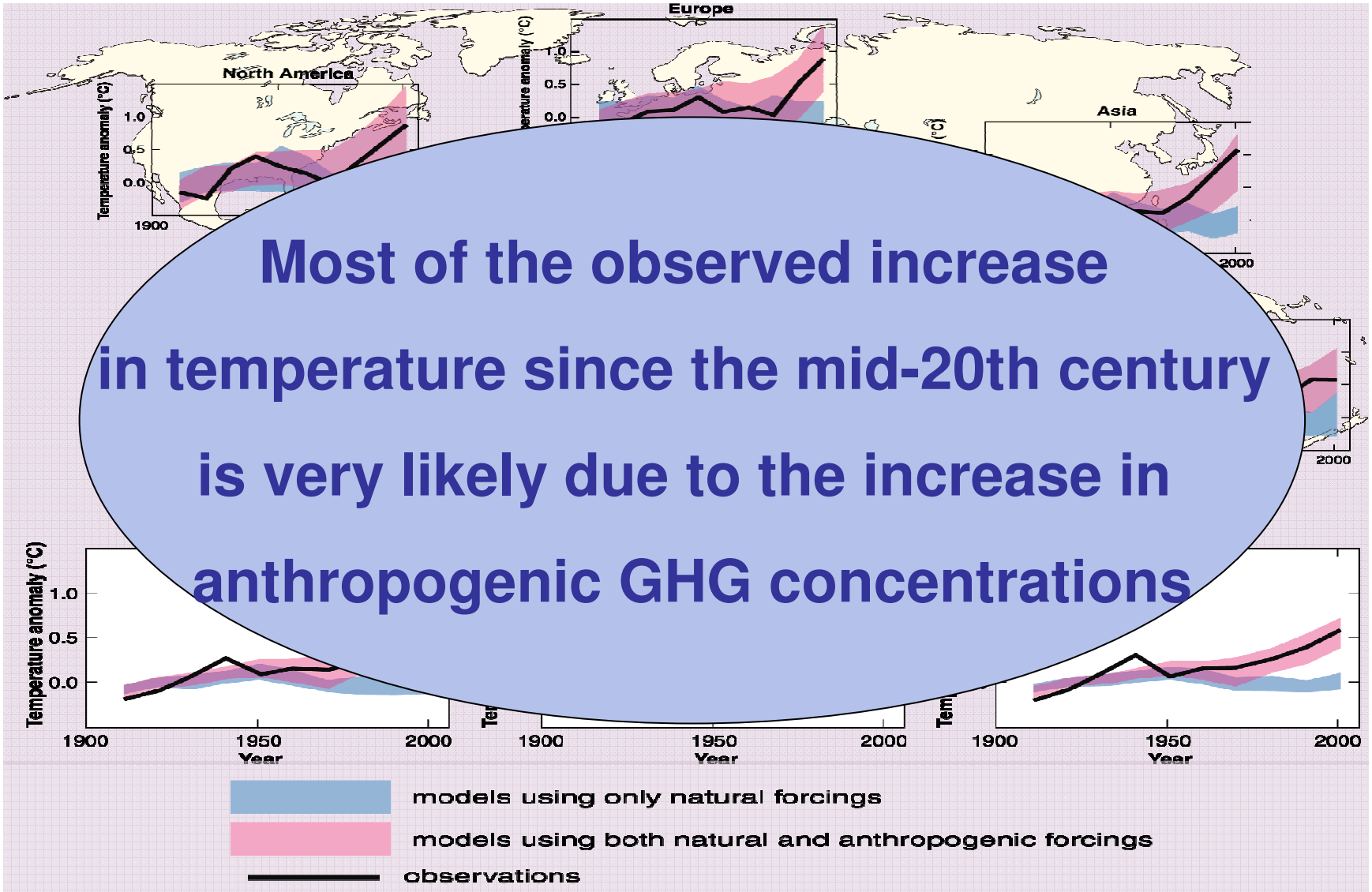
Global and Continental Warming



Most of the observed increase in temperature since the mid-20th century is very likely due to the increase in anthropogenic GHG concentrations

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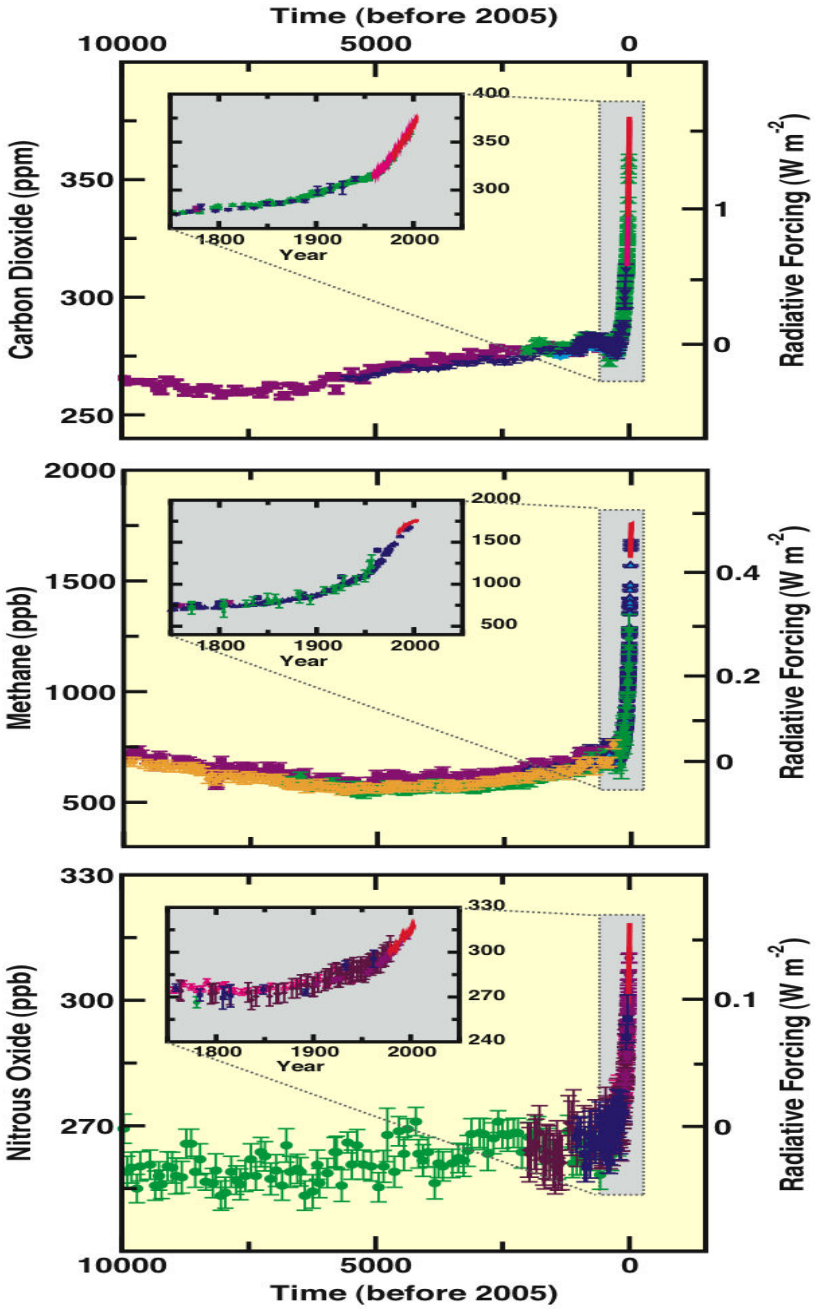
Industrial Revolution and the Atmosphere

CO_2, CH_4 and N_2O concentrations
- increased markedly since 1750 due to human activities

CO_2 and CH_4 concentrations
- far exceed natural range of last **650.000 years**

Relatively little variation before the industrial era



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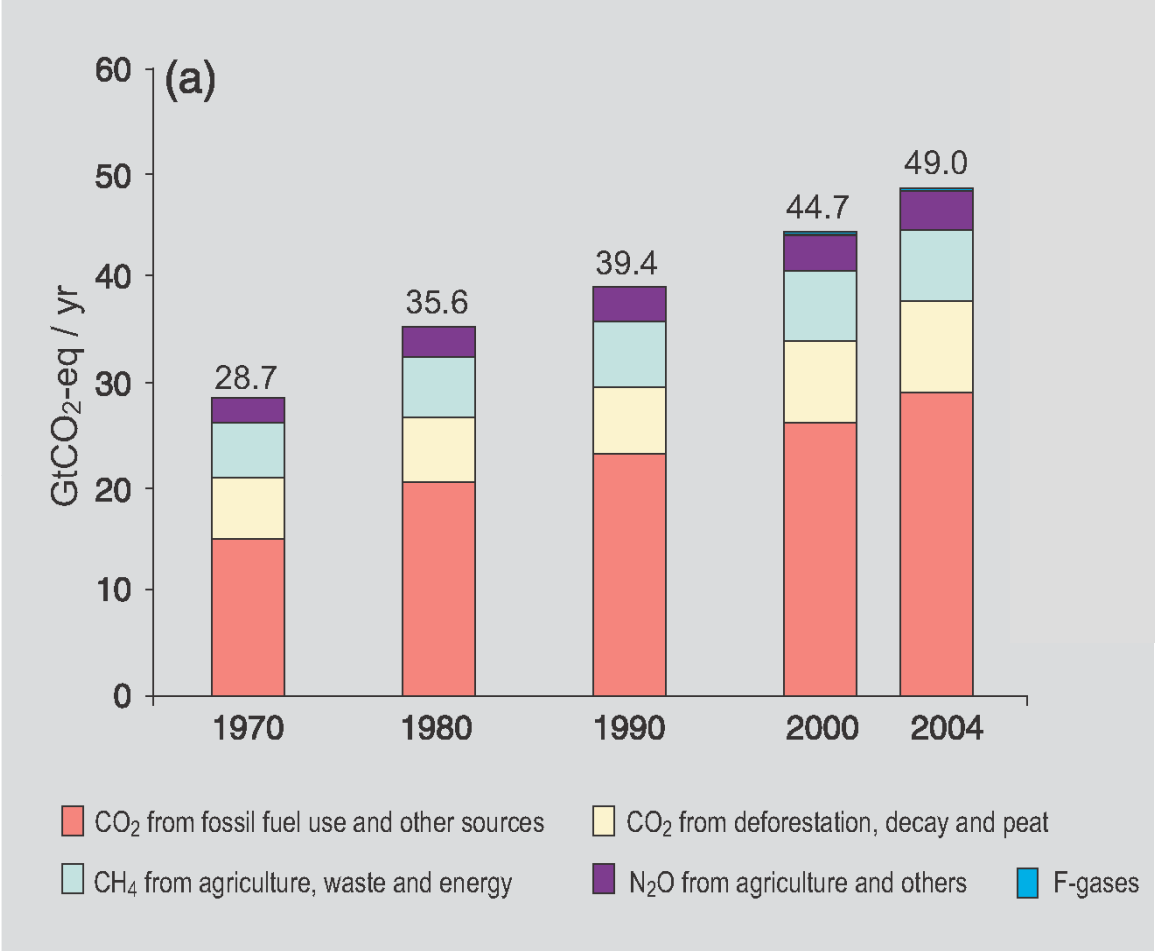
Recent Growth in Global Anthropogenic Greenhouse Gas (GHG) Emissions



Between 1970 and 2004 anthropogenic GHG emissions grew by 70%;

Annual emissions of CO_2 grew by about 80%

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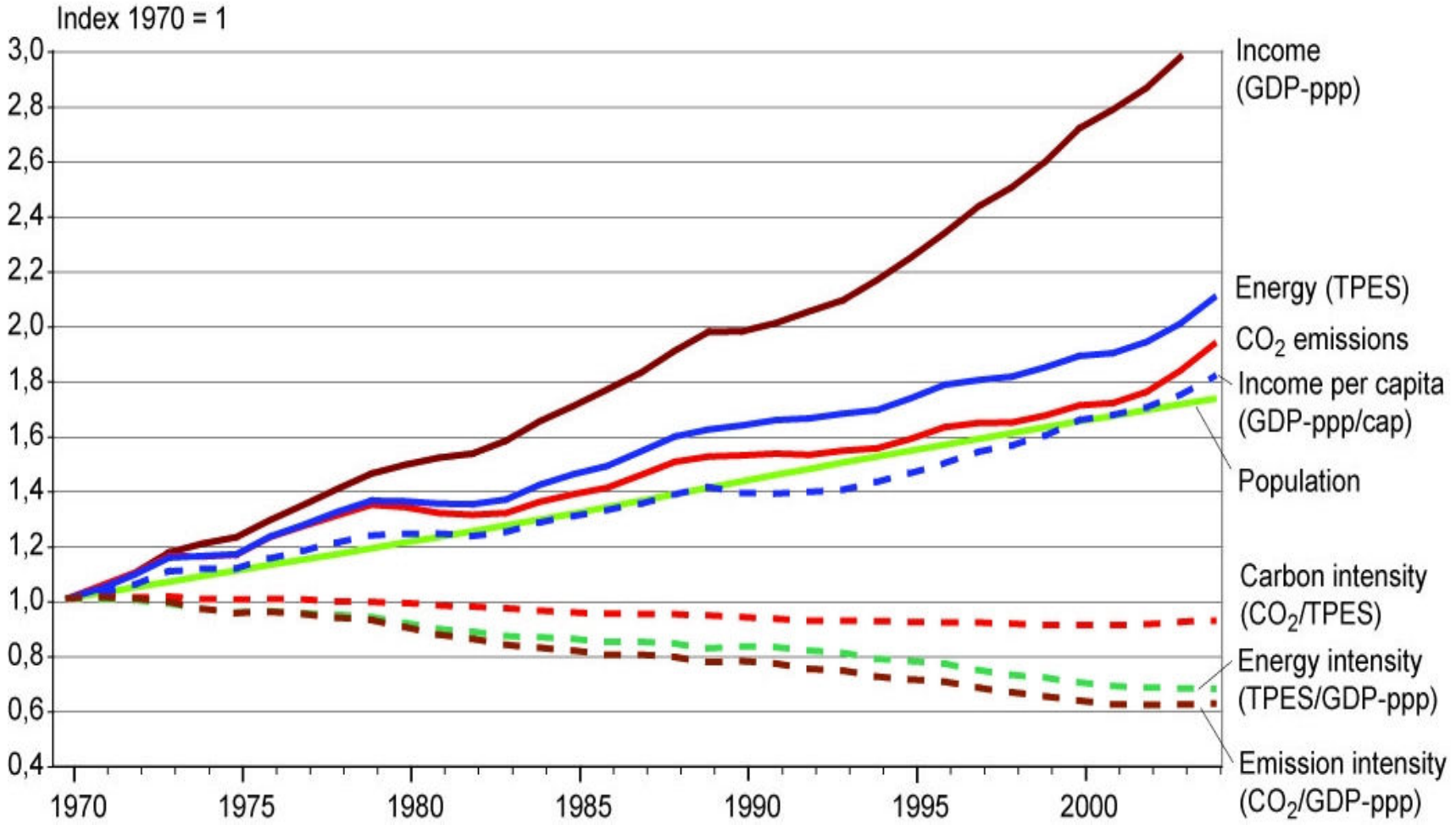
Emissions, Population, Income and Energy Intensity



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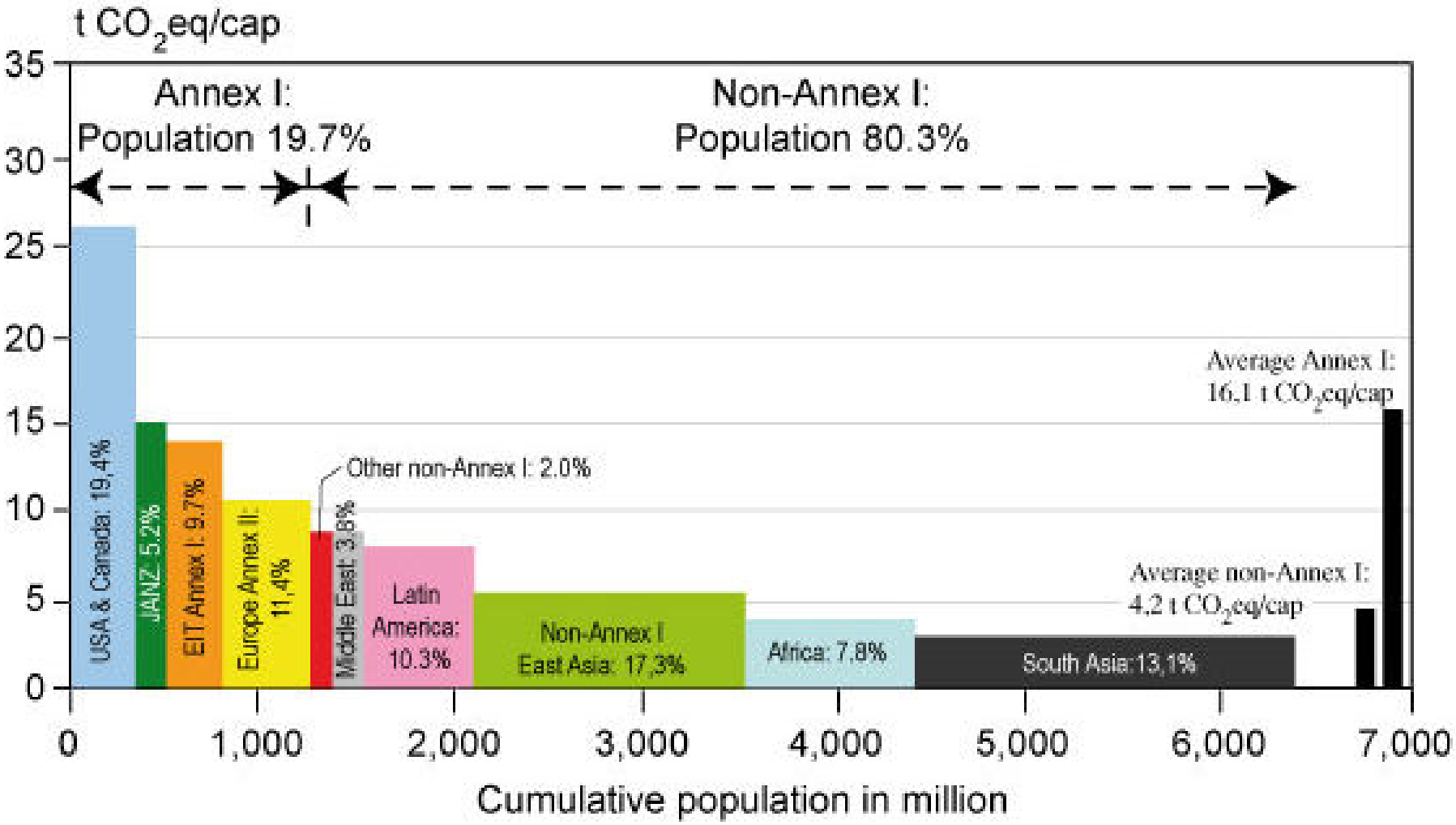
Distribution of Regional per-capita GHG Emissions in 2004



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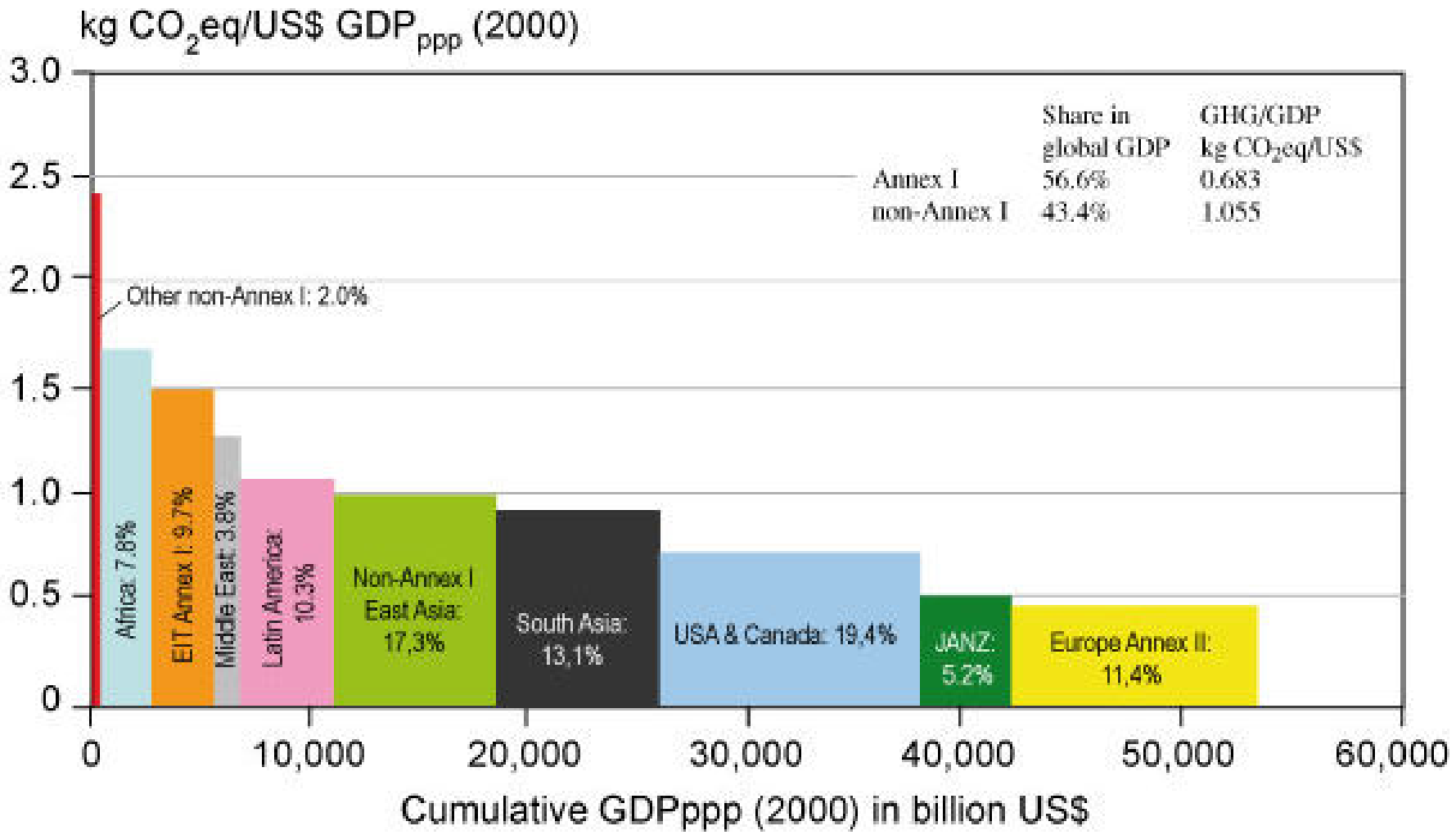
Distribution of Regional GHG Emissions per GDP in 2004



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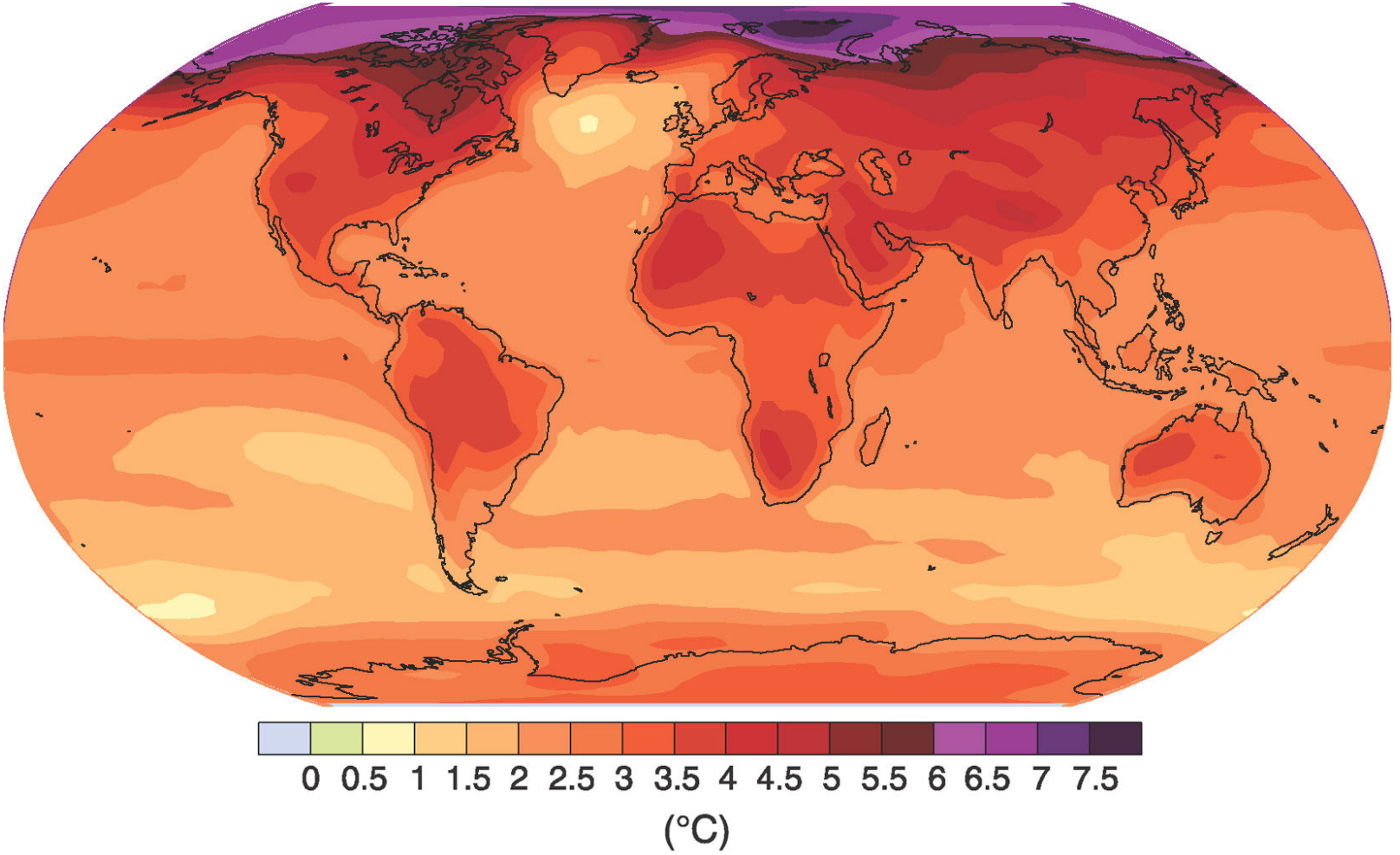
Surface Warming Pattern

2090-2099 relative to 1980-1999 for A1B Scenario



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Projected Impacts on Water Resources

By mid-century river runoff and water availability
- increase by 10-40% at high latitudes,some wet tropics
- decrease by 10-30% over dry mid-latitudes and dry tropics

Drought-affected areas will likely increase in extent.

More heavy precipitation events will augment flood risk.

In the course of the century, water supplies stored in glaciers and snow cover are projected to decline, reducing water availability in regions where more than one-sixth of the world population currently lives.

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Crop responses depend on latitude

Low latitude:

- Production decreases with 1-2°C rise in local mean temperatures
- Increased drought/flood frequency affect especially subsistence sectors at low latitudes

High latitude:

- Production increases with 1-3°C rise in local mean temperature depending in the crop.

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The health status of millions of people is projected to be affected

- Increases in malnutrition
- Increased deaths, diseases and injury due to extreme weather events
- Increased burden of diarrhoeal diseases
- Increased frequency of cardio-respiratory diseases due to changes in air quality
- Altered spatial distribution of some infectious diseases.

Biodiversity - Most Vulnerable

20% - 30% of higher plants and animals at high risk of extinction
if ΔT 1.5℃ - 2.5℃
over present

Human Settlements and Low-lying Areas

- Risks associated with extreme events
- High vulnerability in riverine and coastal areas
- Urbanization often in high risk areas

- Millions of people could experience more coastal flooding if $\Delta T > 2^{o}C$ in this century.
- **Sea level rise is inevitable** and will continue for centuries
- Partial loss of ice sheets on polar land could imply meters of sea level rise

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Distribution of Impacts

- Sharp differences across regions
- Low-latitude and less-developed areas generally face greater risk

- Those in weakest economic position are often the most vulnerable to climate change
- Greater vulnerability of specific groups such as poor and elderly - also in developed countries

Multiple non-climate stresses increase vulnerability

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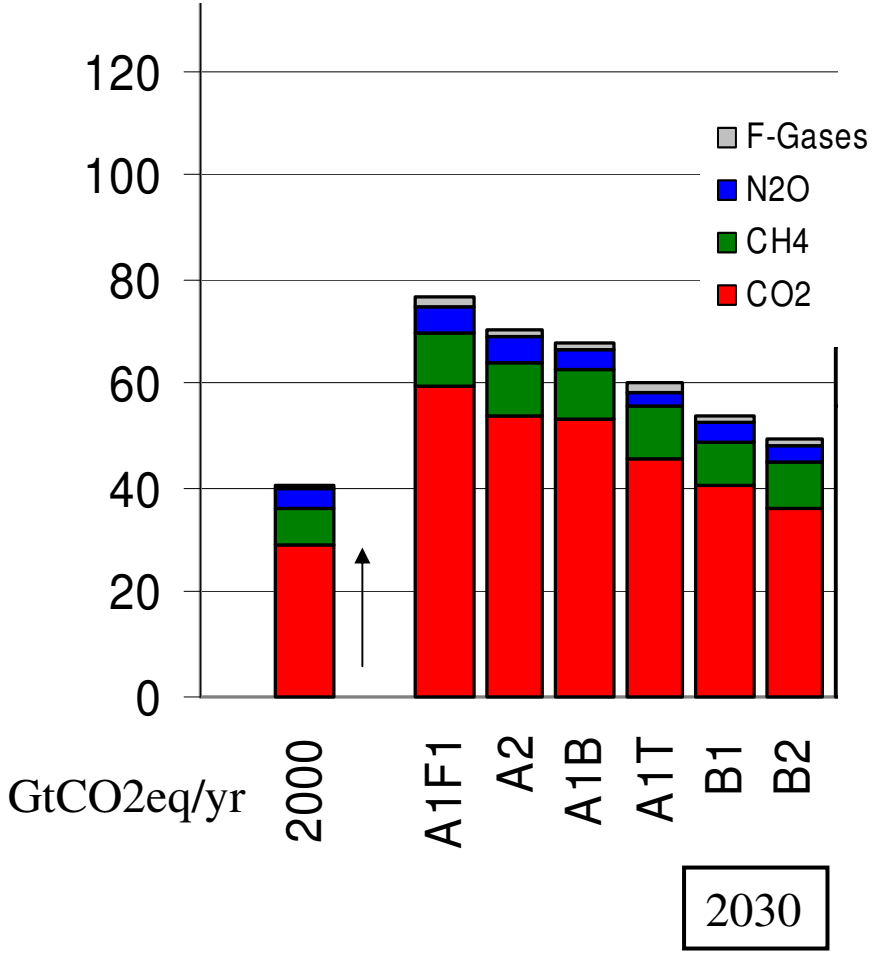
With current climate change mitigation policies and related sustainable development practices, global GHG emissions will continue to grow

Increase by **2030** relative to 2000 according to IPCC SRES scenarios:

- GHG emissions 25-90 %
- CO2 emissions from energy use 40-110%
- Two thirds to three quarters from Non-Annex I countries



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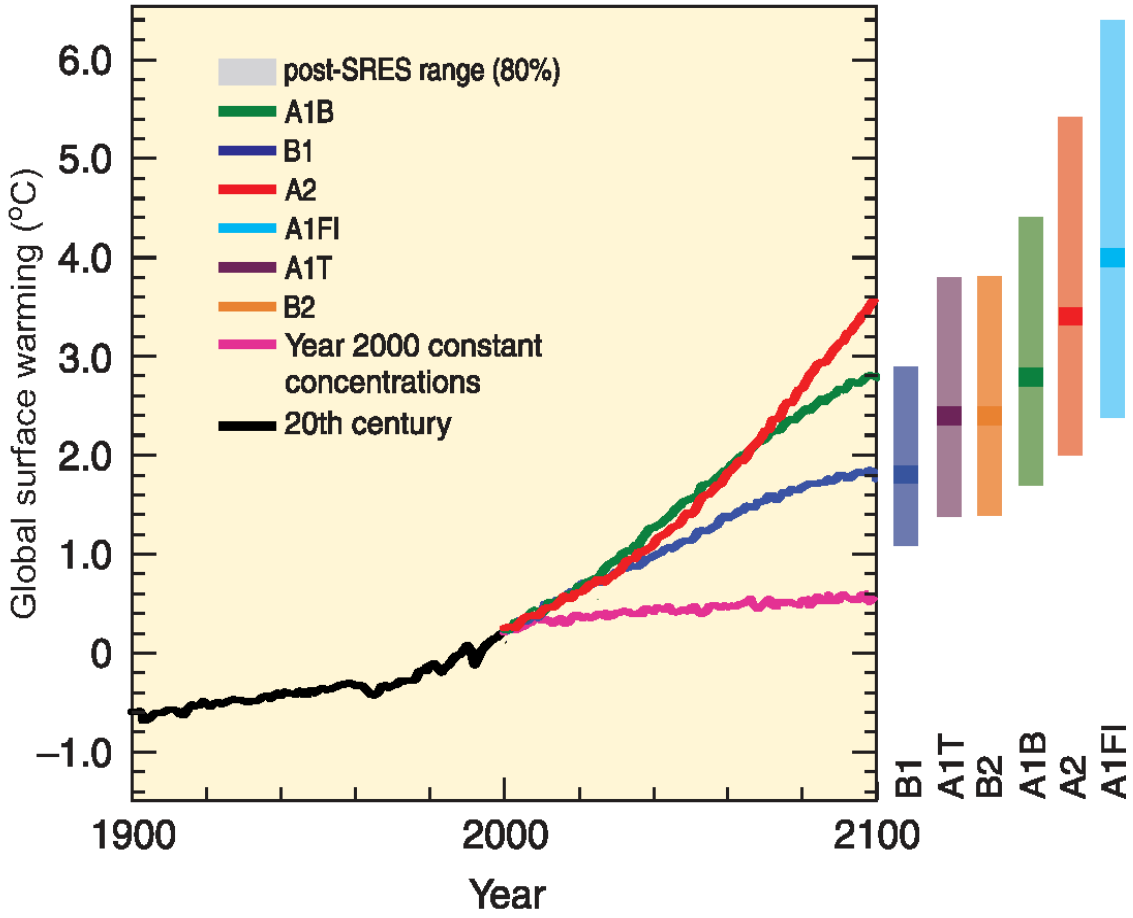
…. resulting in further warming



Projections of surface temperatures in 2100 for a range of scenarios

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Emissions and Equilibrium Temperature Increases for a Range of Stabilisation Levels

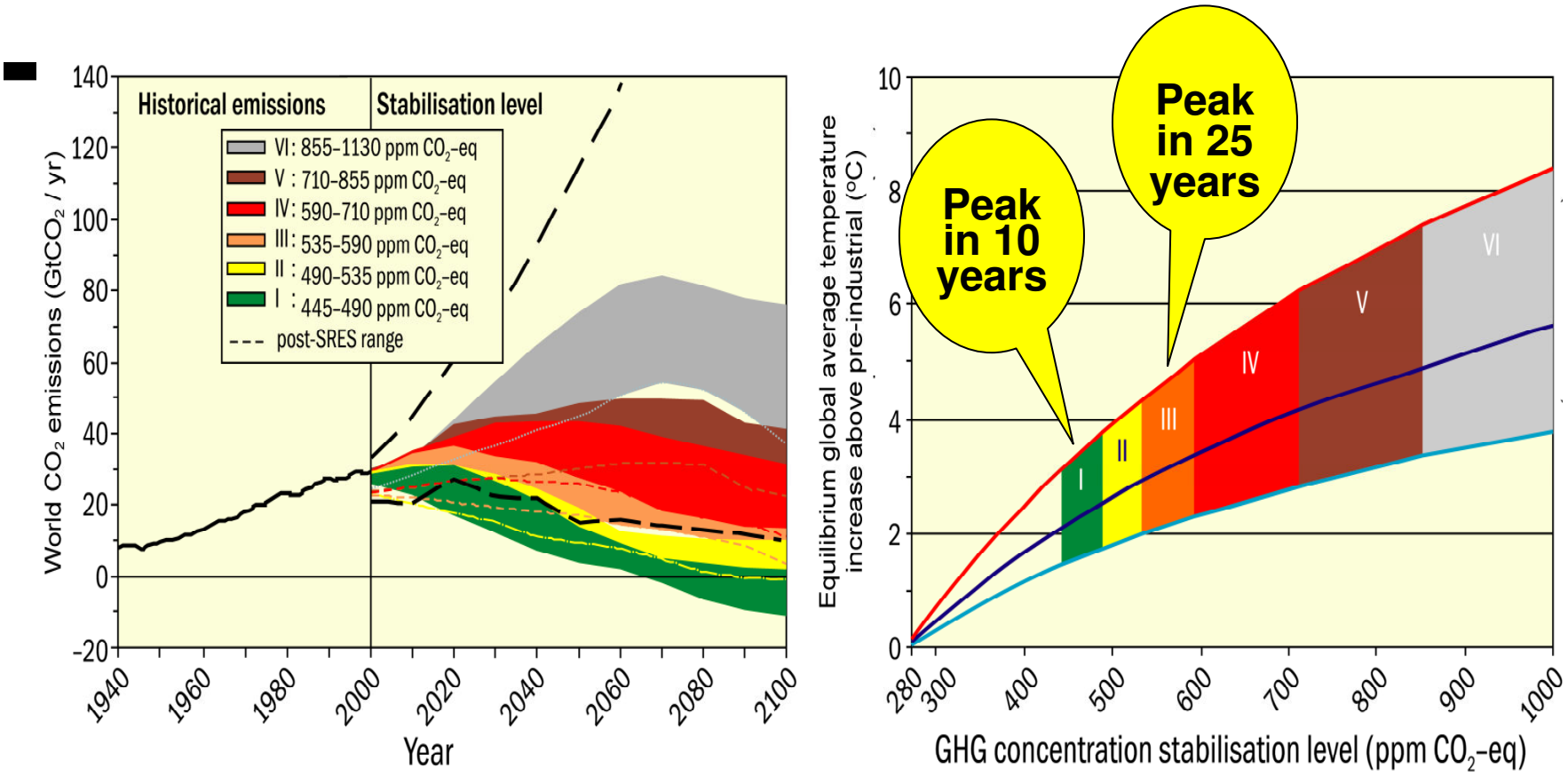

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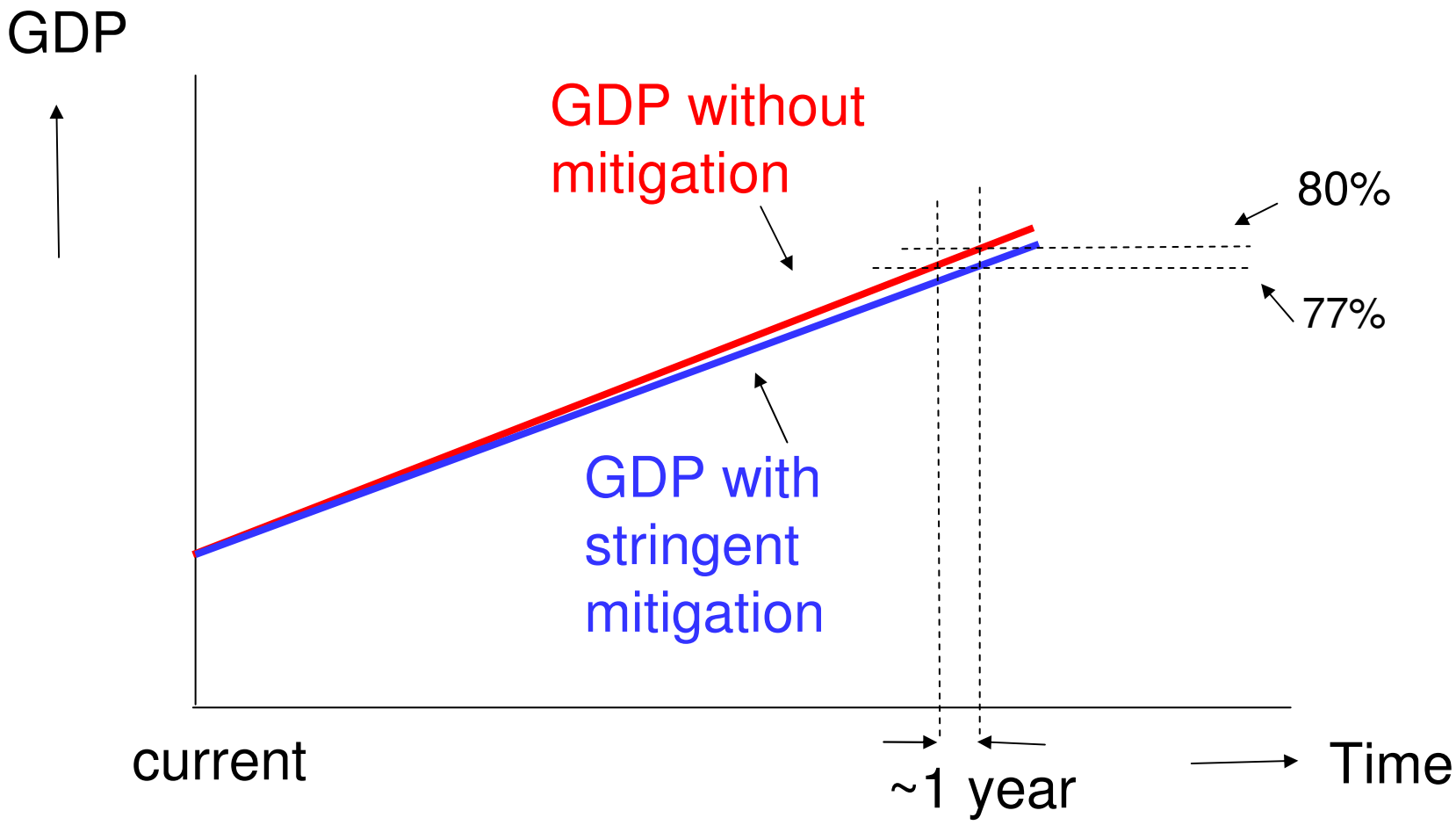
Illustration of cost numbers



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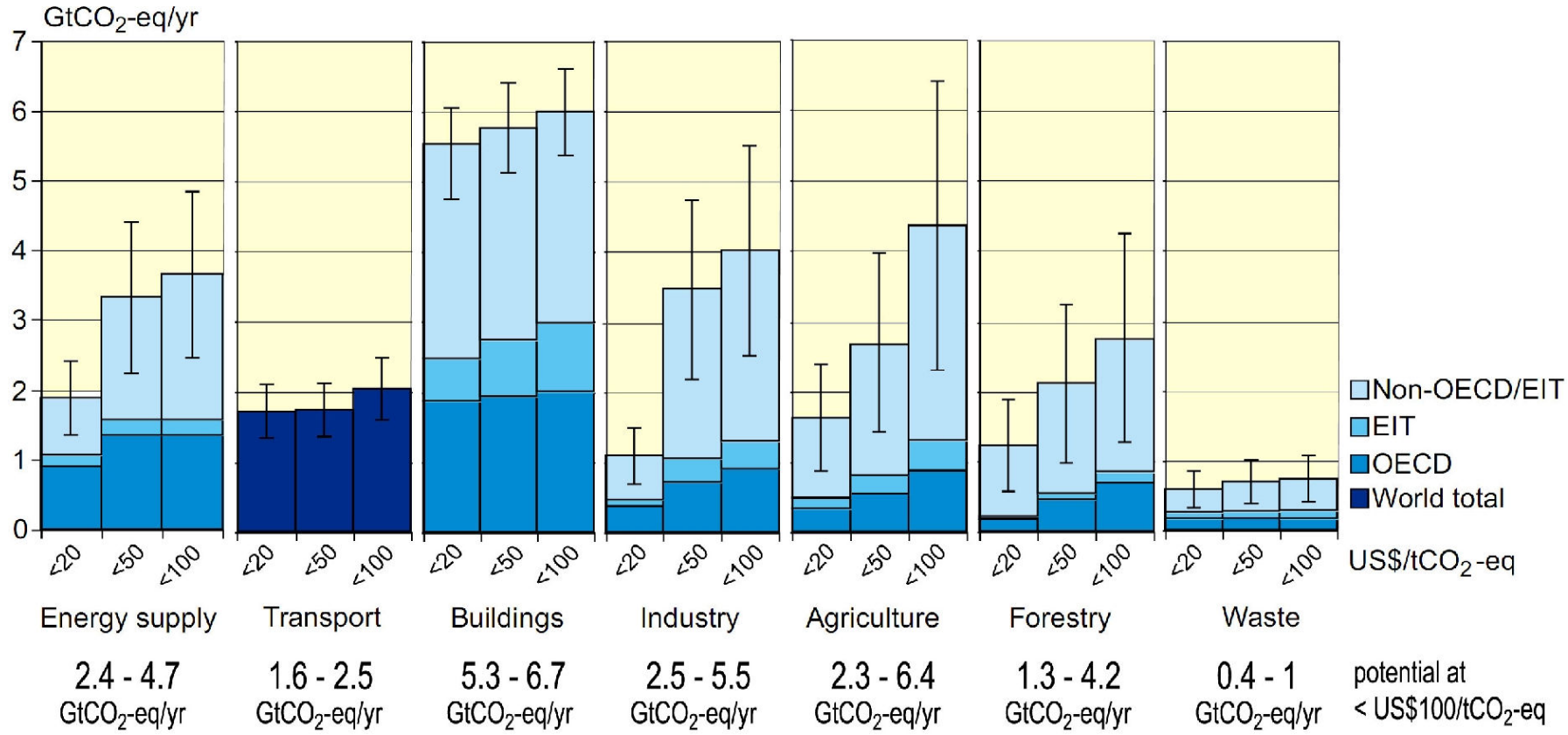
Economic mitigation potential could offset projected growth in emissions to 2030 or reduce below current levels



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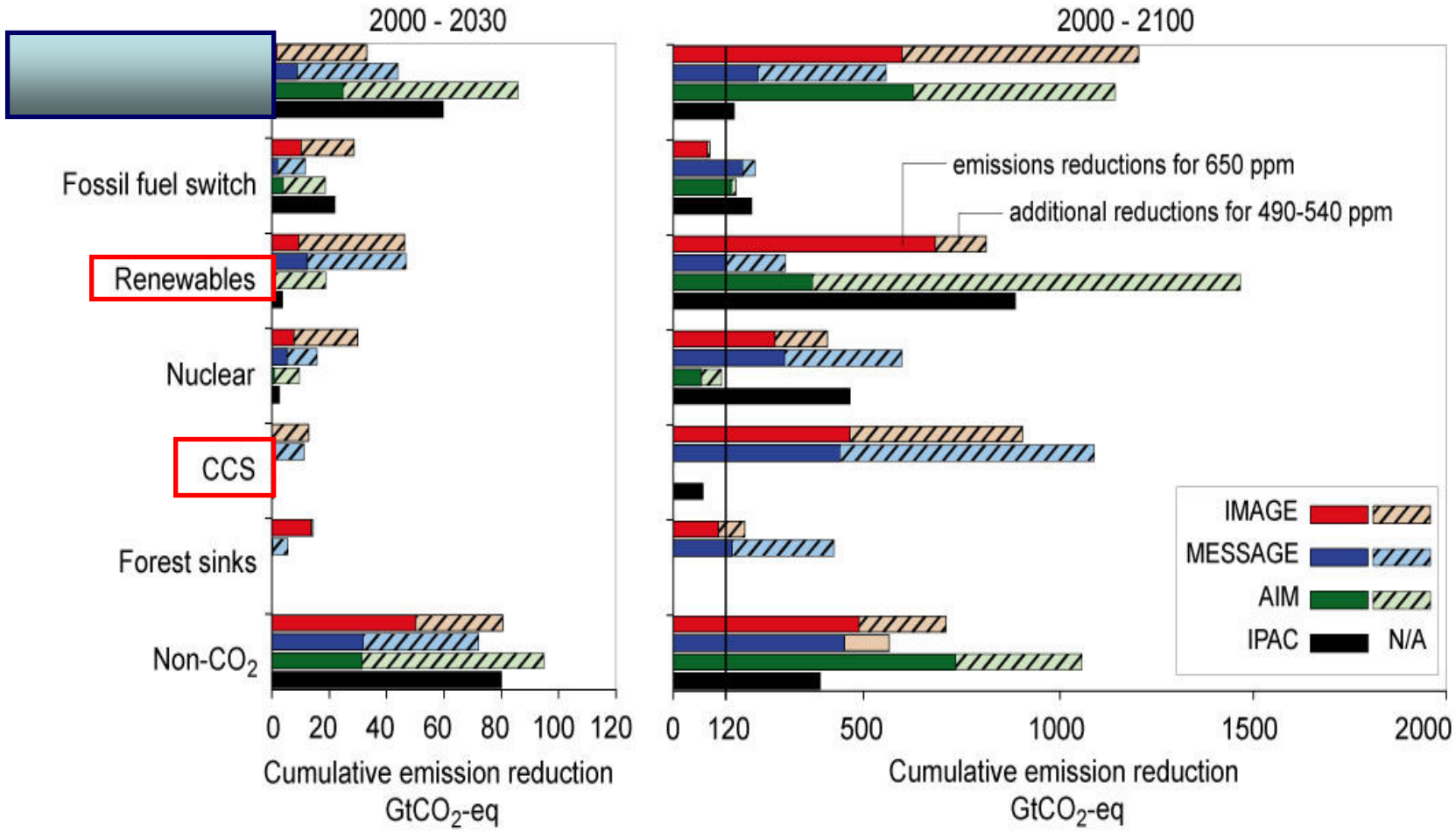
Technology

Cumulative emissions reductions 2000-2030 and 2000-2100



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Examples of Side-effects of Climate Mitigation

OPTIONS	*SYNERGIES*	*TRADEOFFS*
Energy: efficiency, renewables, fuel-switching 	• air quality • supply security • employment • costs (efficiency)	• particulate emissions (diesel) • biodiversity (biofuels) • costs (renewables)
Forestry: reduce deforestation, plant trees 	• soil protection • water management • employment • biodiversity (deforest.)	• biodiversity (plantations) • competition food production
Waste: landfill gas capture, incineration 	• health & safety • employment • energy advantages	• ground water pollution • costs

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Examples of Future Research Needs

- New scenarios of future socio-economic conditions – also suitable for impacts research
- Earth system models with carbon cycle feedback
- Improved regional climate models
- Observation and early warning systems
- Improved understanding and management of risks
- Better understanding of potential of new technologies and integration in future energy systems

Further information and all reports are available on

www.ipcc.ch