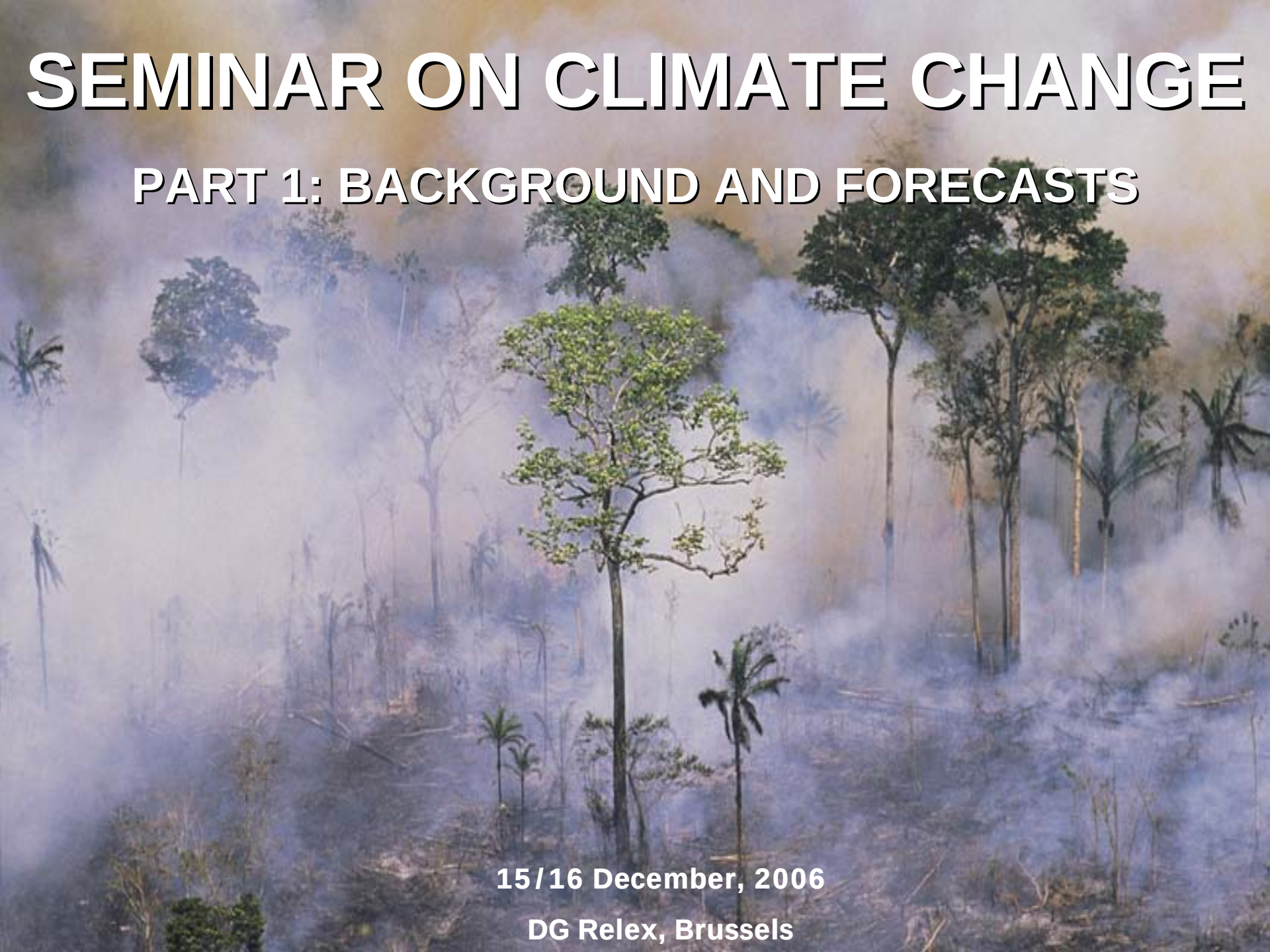
SEMINAR ON CLIMATE CHANGE

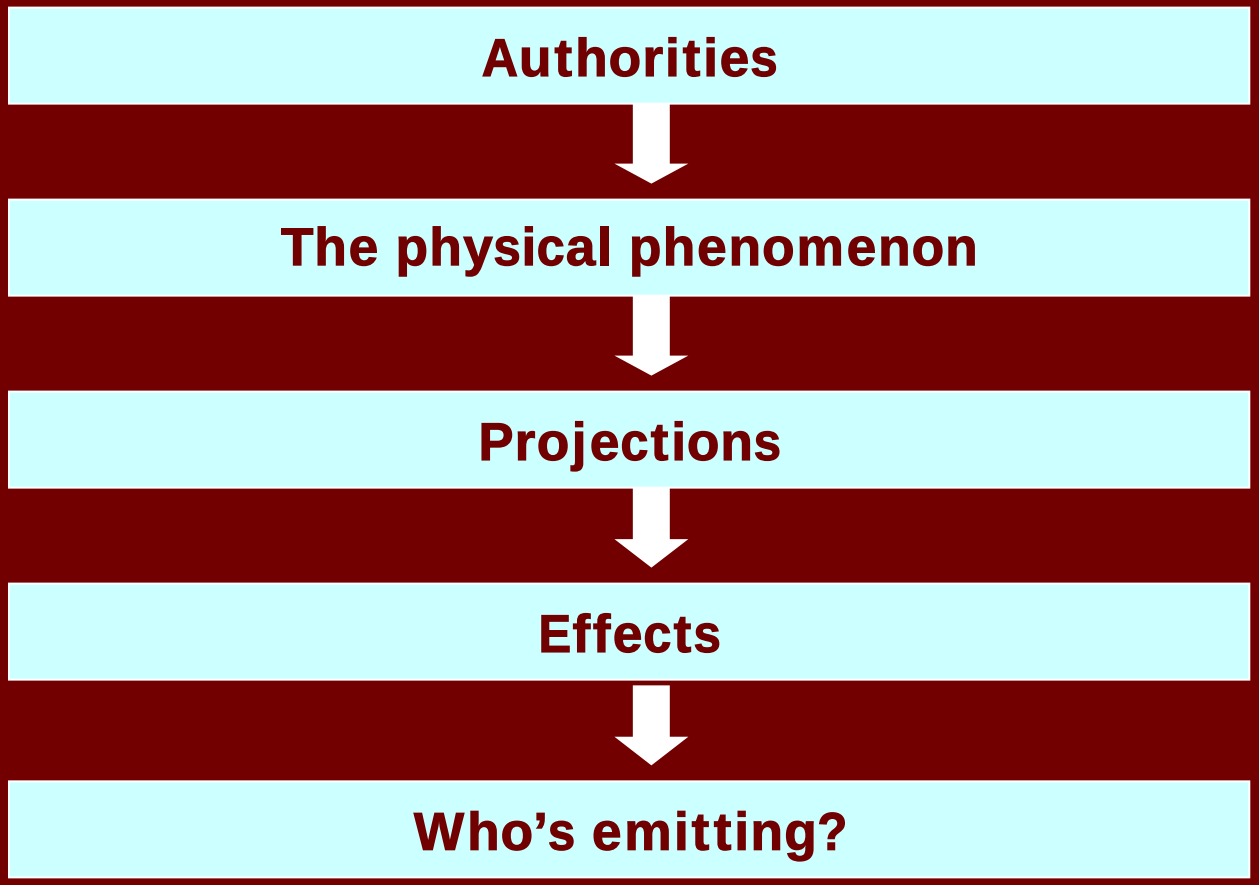
PART 1: BACKGROUND AND FORECASTS



15/16 December, 2006

DG Relex, Brussels

Presentation Overview

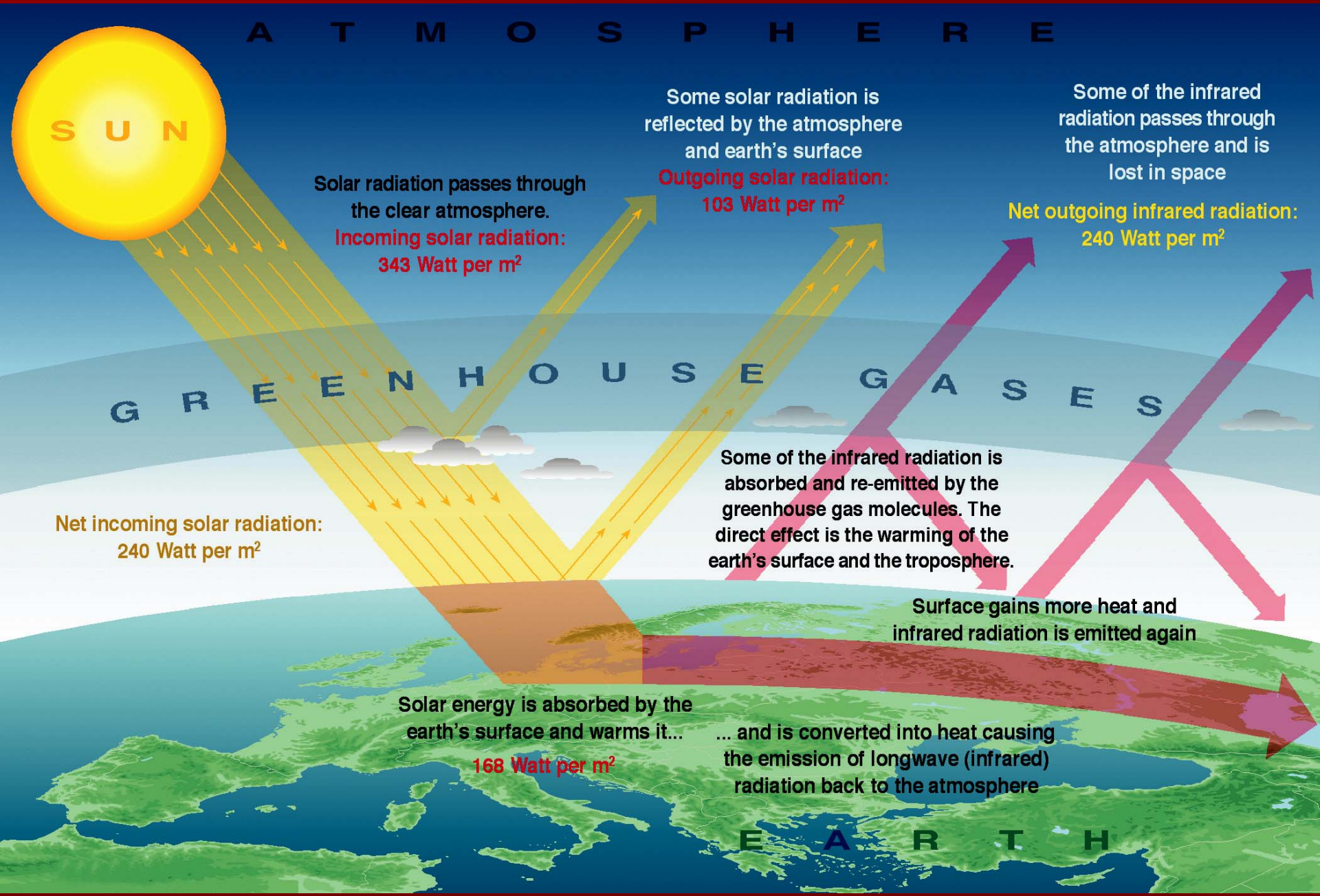


Inter-governmental Panel on Climate Change (IPCC)

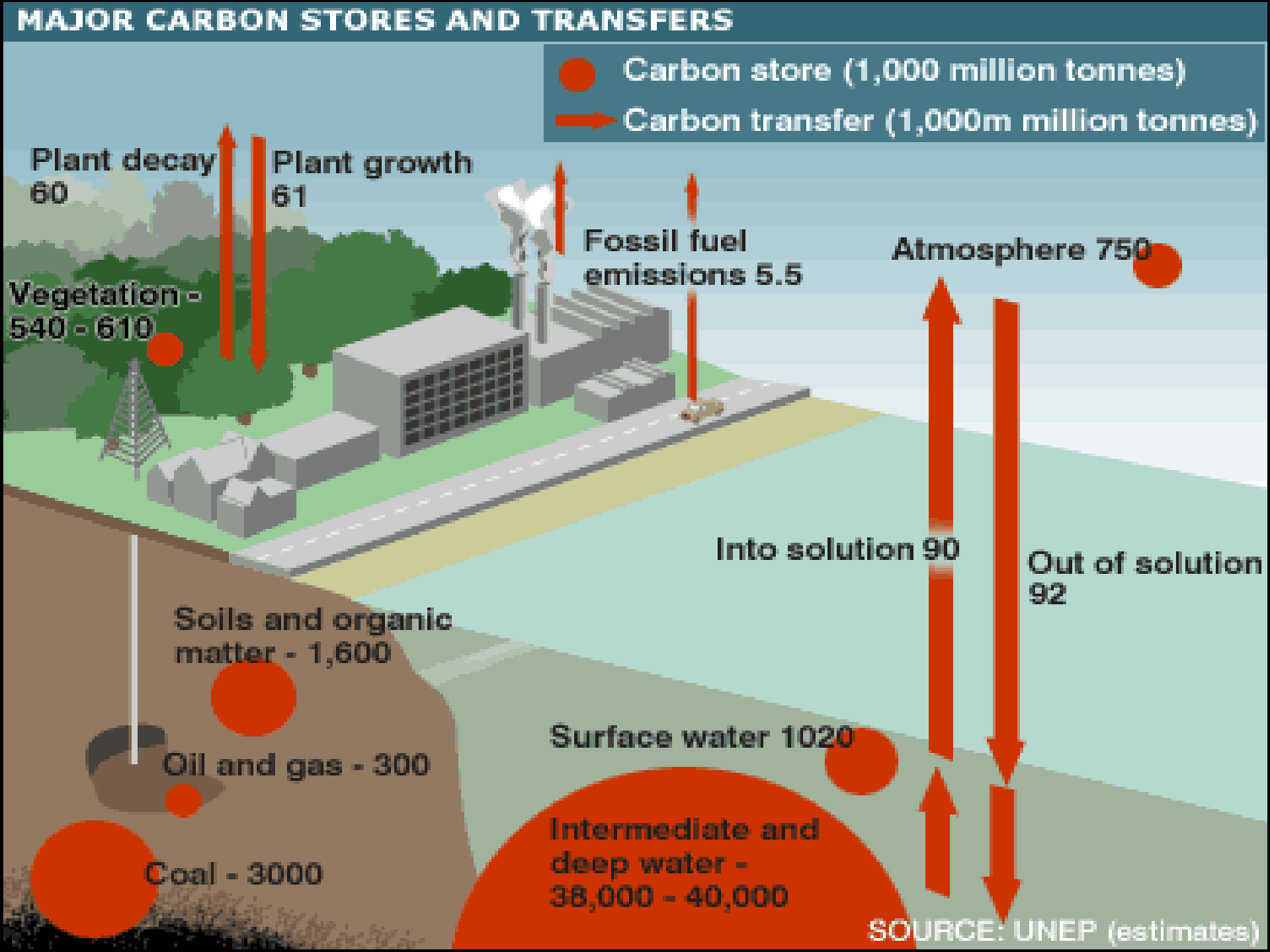
- Created in 1988 by WMO and UNEP to assess the science of climate change, its potential impacts and mitigation measures
- Consensus reports produced since 1990, 4th in 2007, (WG II plenary in Brussels)
- Hundreds of authors and expert reviewers involved

Global warming: the physical phenomenon

- 75% of world energy is derived from fossil fuels
- $C + O_2 = heat + CO_2$
- CO_2 is a “greenhouse gas”, i.e. it traps heat
- Other GHGs – CH_4, N_2O, etc = CO_2 equivalents



Source: UNFCCC (2003) *Caring for climate, a guide to the climate change convention and the kyoto protocol*

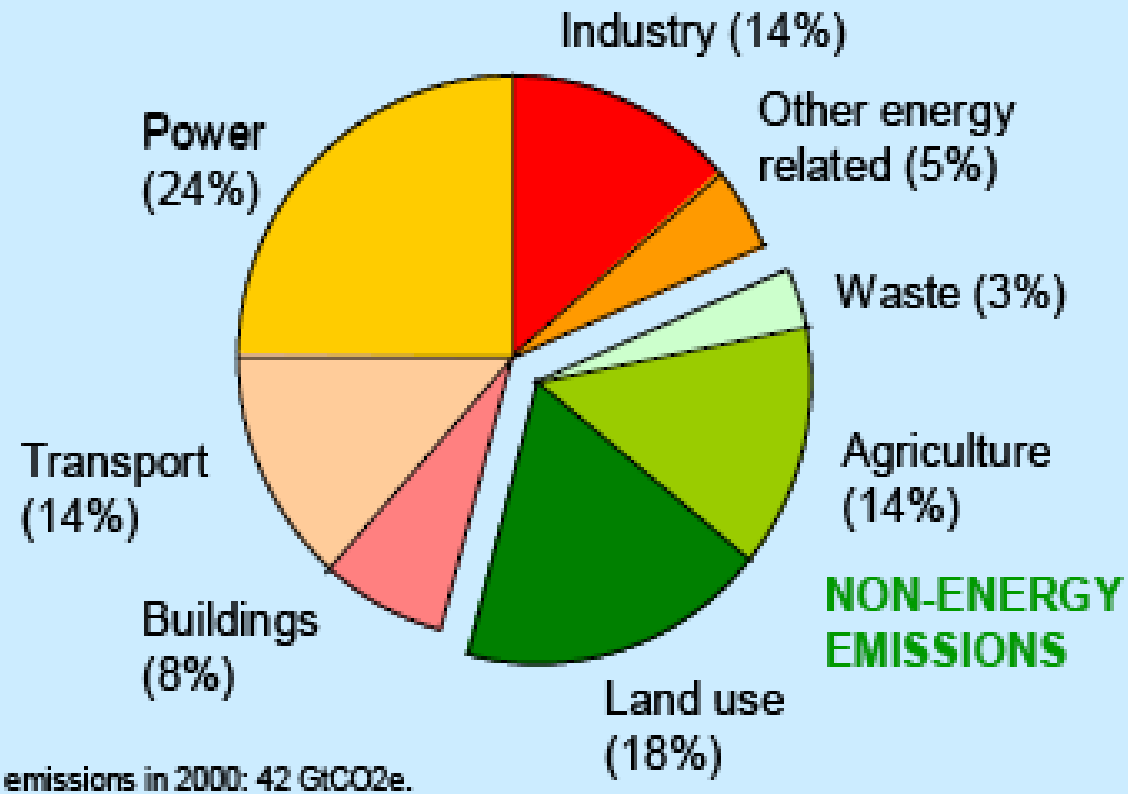

MAJOR CARBON STORES AND TRANSFERS
Carbon store (1,000 million tonnes)
Carbon transfer (1,000m million tonnes)
Plant decay 60
Plant growth 61
Fossil fuel emissions 5.5
Atmosphere 750
Vegetation - 540 - 610
Into solution 90
Out of solution 92
Soils and organic matter - 1,600
Surface water 1020
Oil and gas - 300
Intermediate and deep water - 38,000 - 40,000
Coal - 3000
SOURCE: UNEP (estimates)

Some key points

- CO_2 concentration has increased 31% since 1750
- Global average surface temperature increased 0.6°C over the 20th Century
- Most observed warming over the past 50 years is likely to have been due to the increase in GHG concentrations
- Half of the CO_2 emitted remains for approx. 100 years, accumulating, inertia.

GHG emissions by source, 2000

Figure 7.1 GHG emissions in 2000, by source*



Total emissions in 2000: 42 GtCO2e.

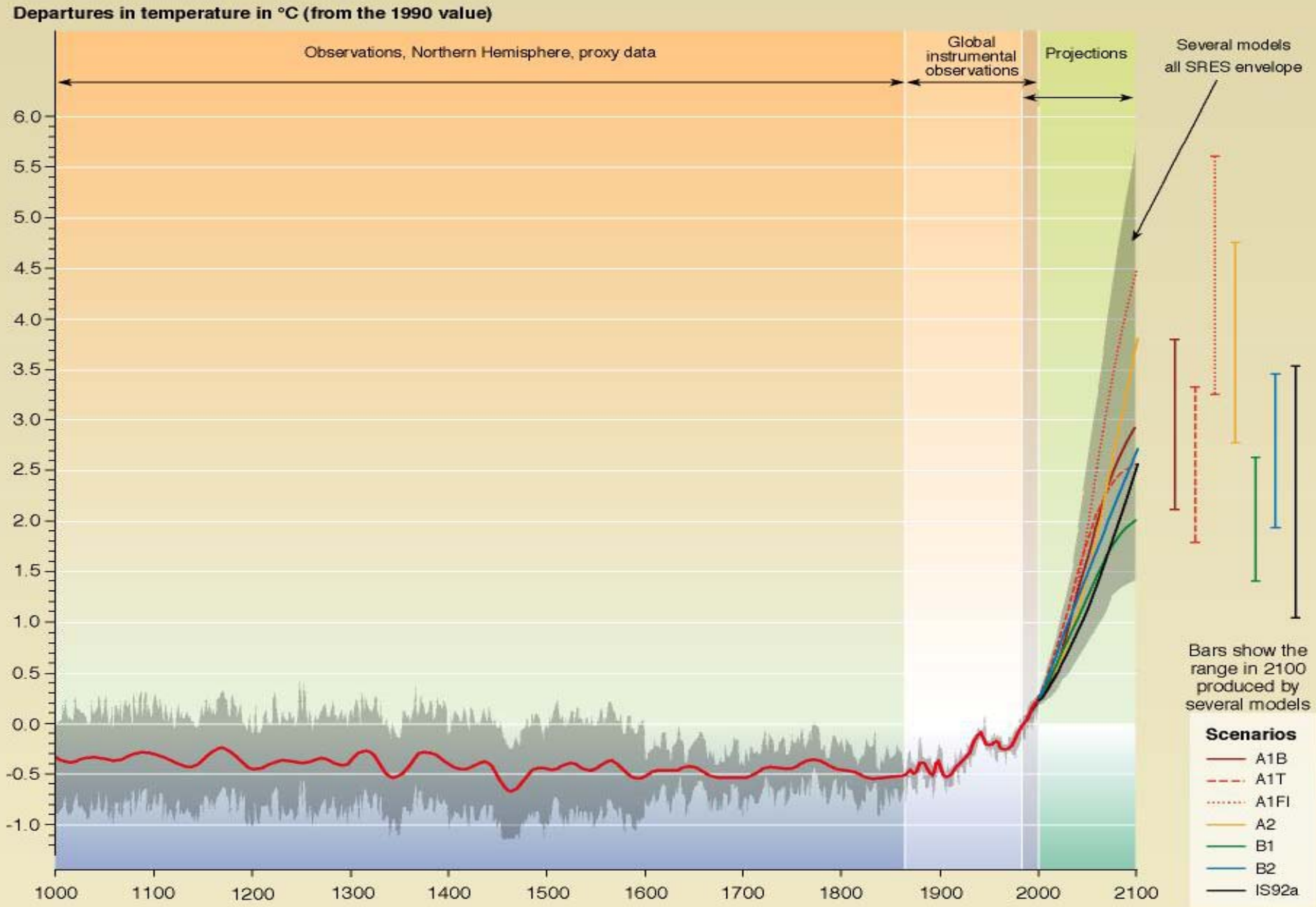
Energy emissions are mostly CO_2 (some non-CO_2 in industry and other energy related). Non-energy emissions are CO_2 (land use) and non-CO_2 (agriculture and waste).

Source: WRI (2006)

Projections

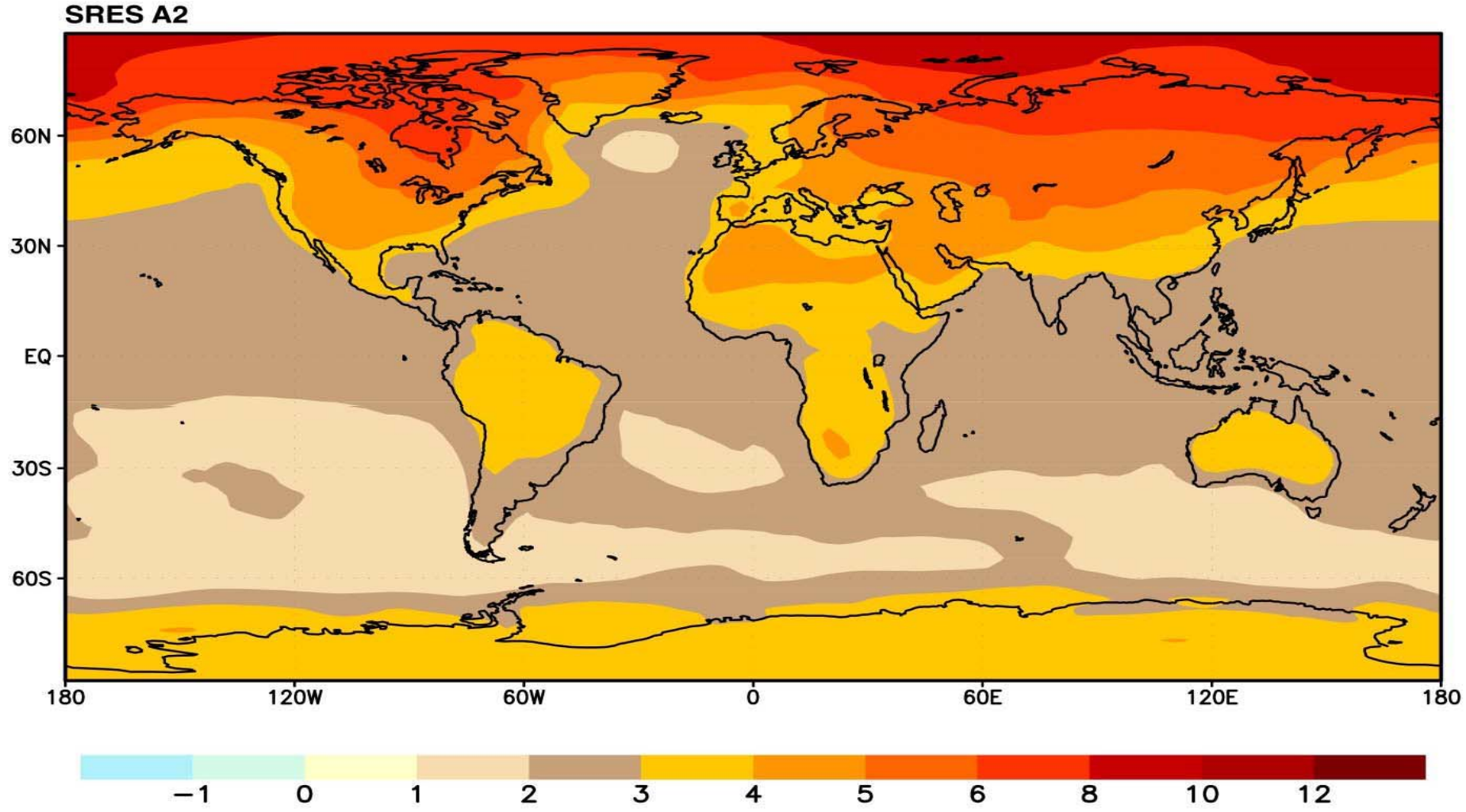
- By 2100, the atmospheric CO_2 concentrations are projected to be 75-350% higher than the 1750 value
- Global average surface temperature is projected to increase by 1.4–5.8°C from 1990 to 2100
- No precedent for at least the last 10,000 years!

Variations of the Earth's surface temperature: 1000 to 2100



Annual mean temperature change (2071-2100) relative to 1990

(land areas and high latitudes warm more)



Expected effects – Physical

(projected during 21st Century)

- Higher maximum temperatures and more hot days over majority of land areas
- Higher minimum temperatures, fewer cold days over majority of land areas
- More intense precipitation events
- Increased summer continental drying and associated risk of drought

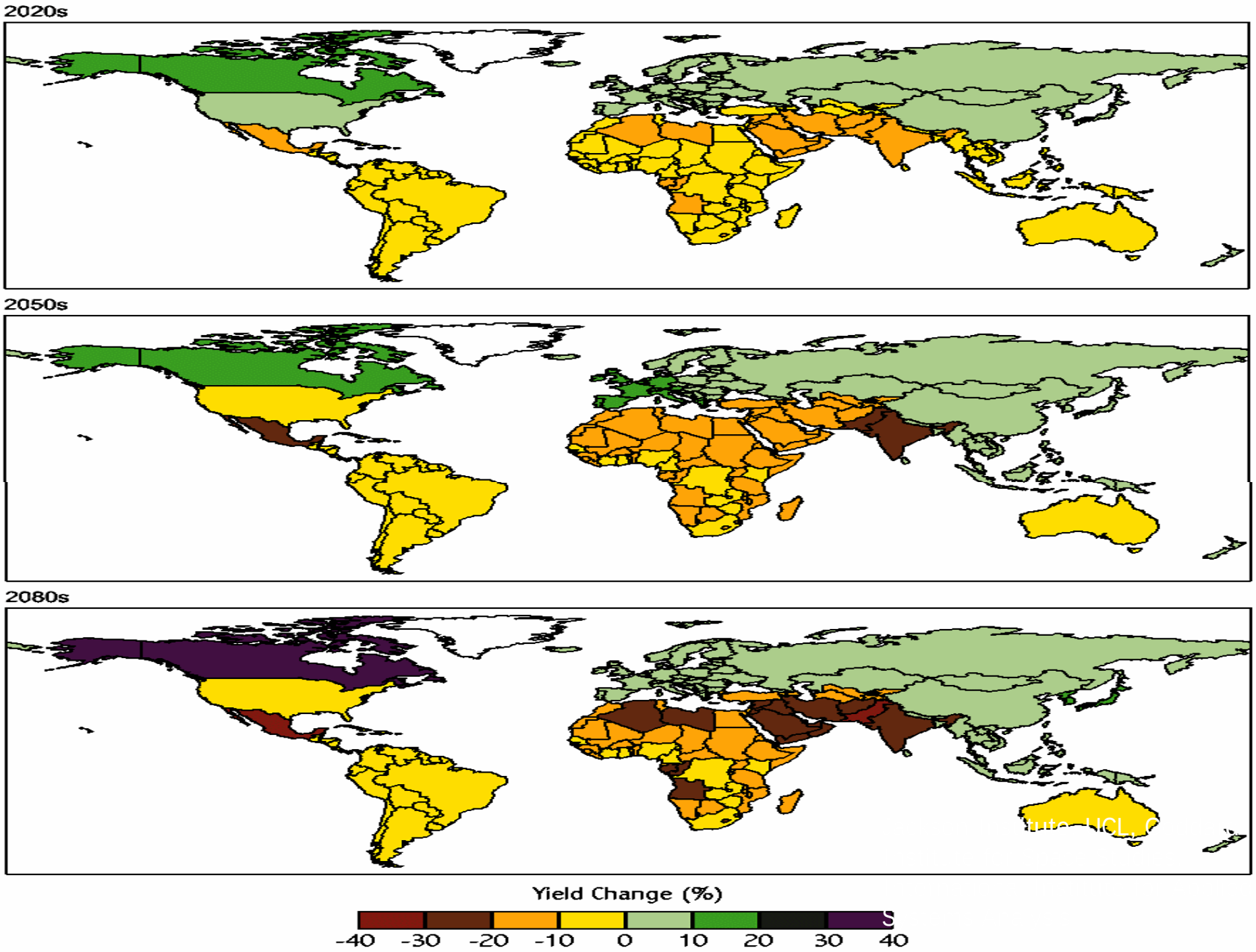
Expected effects - Physical (cont.)

- Sea level rise projected to continue for centuries after stabilisation of GHG concentrations
- Gulf stream to slow down, or even stop
- Greenland and West Antarctic ice sheet melt could contribute up to 3m to sea level rise over next 1000 years

Expected effects – food security

- Falling crop yields in most tropical and subtropical regions

- Increased crop yield in some mid-latitude regions (sometimes only in the short- and medium-term)

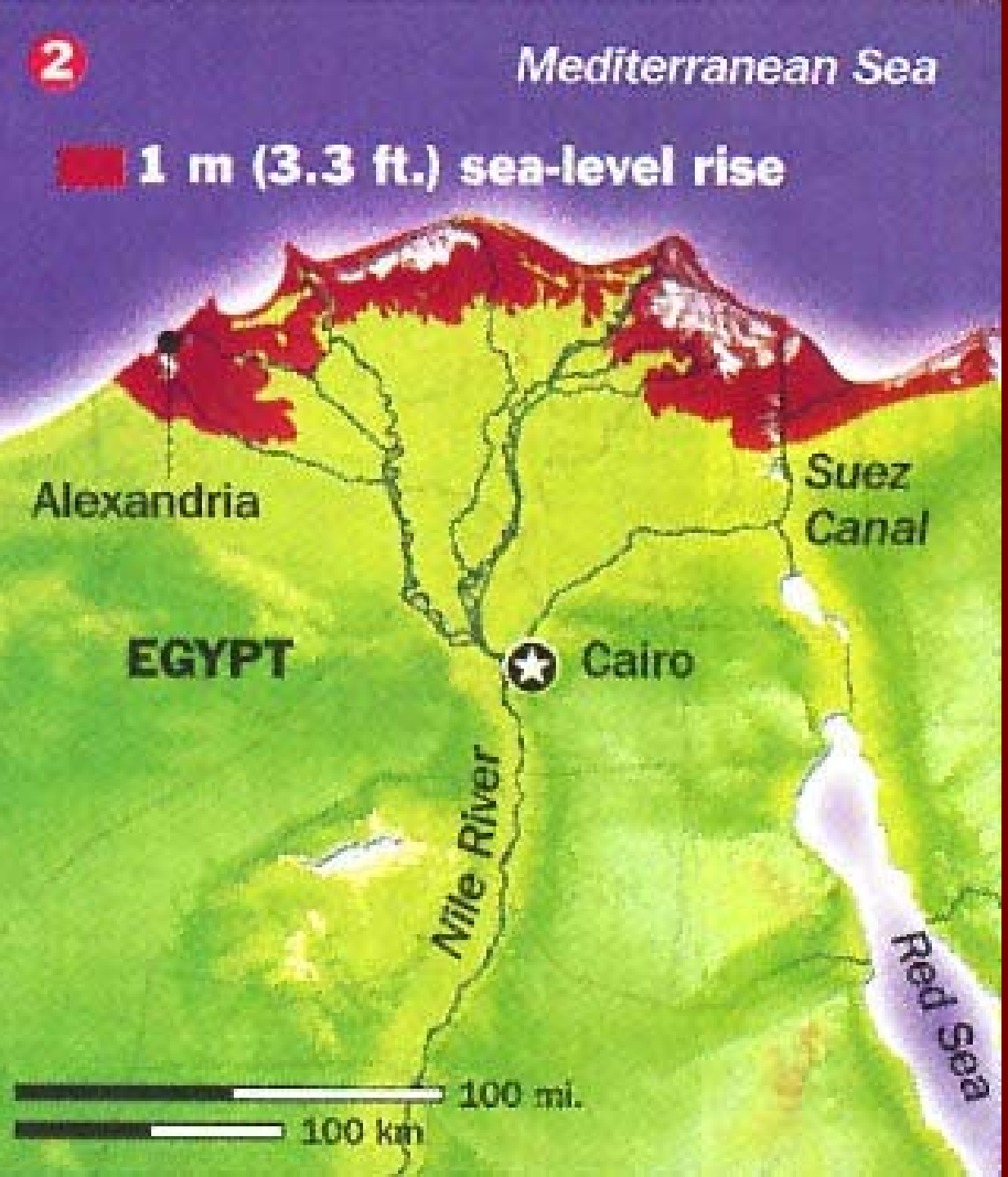

2020s
2050s
2080s
Yield Change (%)
-40 -30 -20 -10 0 10 20 30 40

Expected effects – water

- Rising sea levels
- Increase in risk of flooding for many human settlements, from increased heavy precipitation events
- Increase in flood risk from melting glaciers

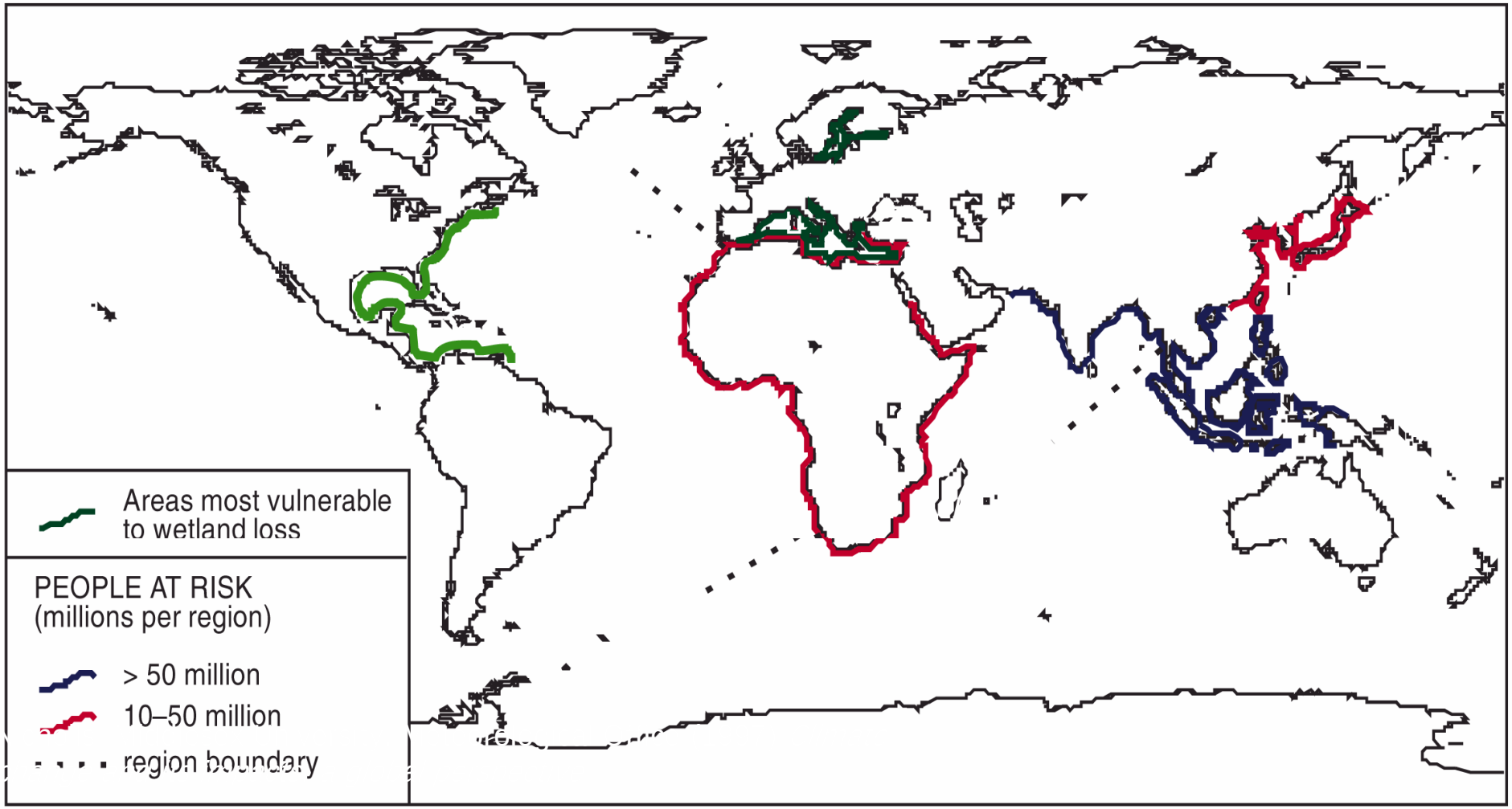
Expected effects – water availability

- Decreased water availability for populations in many water scarce regions (especially sub-tropics)
- Melting glaciers reduce water supplies in some regions (Tibet, Alps, Andes...)
- Increased water availability for populations in some water scarce regions (e.g. parts of SE Asia)



Inundation effects on Nile Delta: 10 million people below 1m

Tens of millions at risk of being displaced by sea level rise (assuming 1990s level of flood protection)



Expected effects – Ecosystems

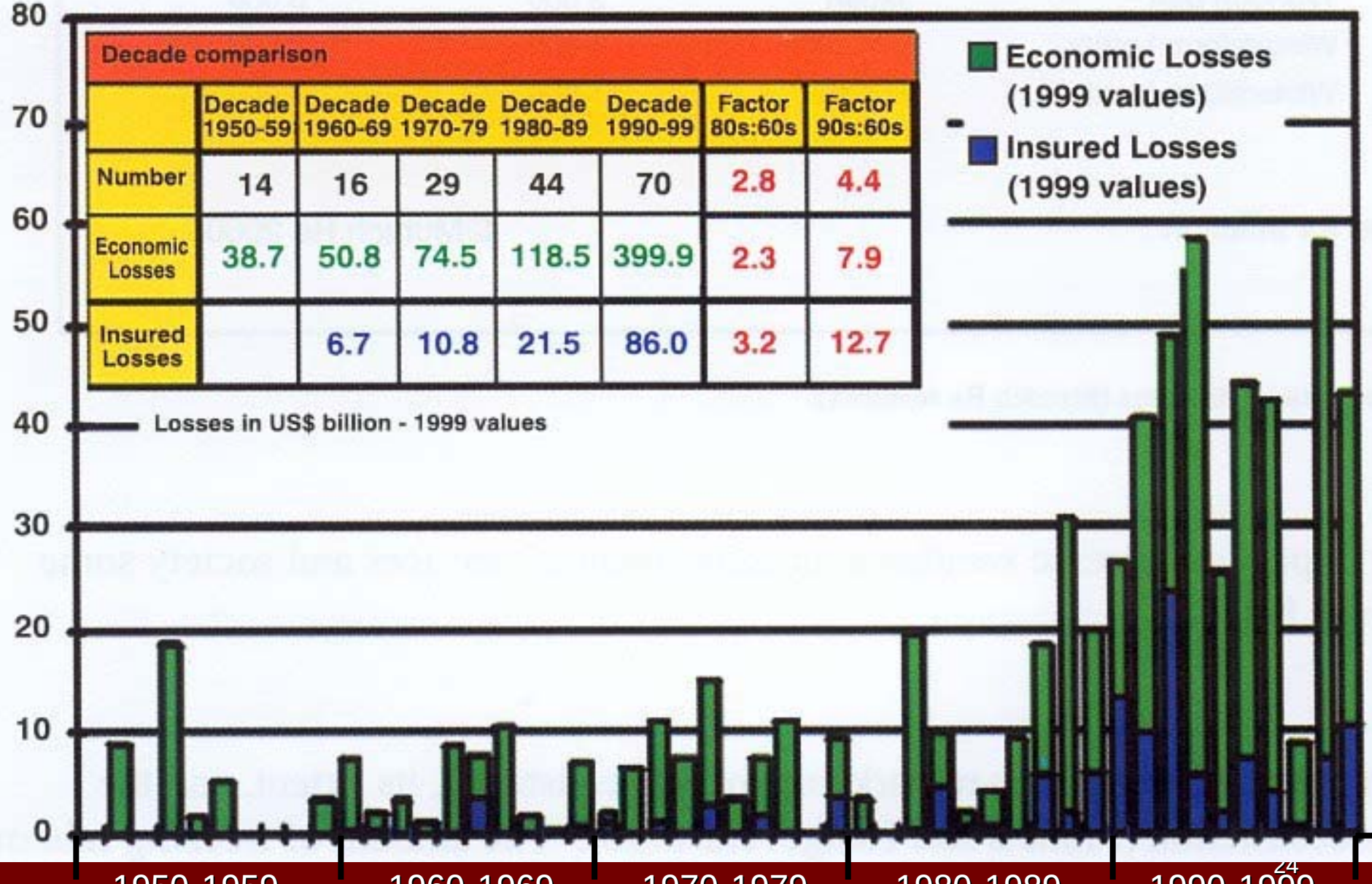
- 15-40% of species potentially facing extinction with 2°C warming
- Ocean acidification due to increased CO_2, with major effects on marine ecosystems
- Coral reef ecosystems extensively and eventually irreversibly damaged (1-2 °C warming)
- Ecosystems unable to maintain functions

Expected effects – Health

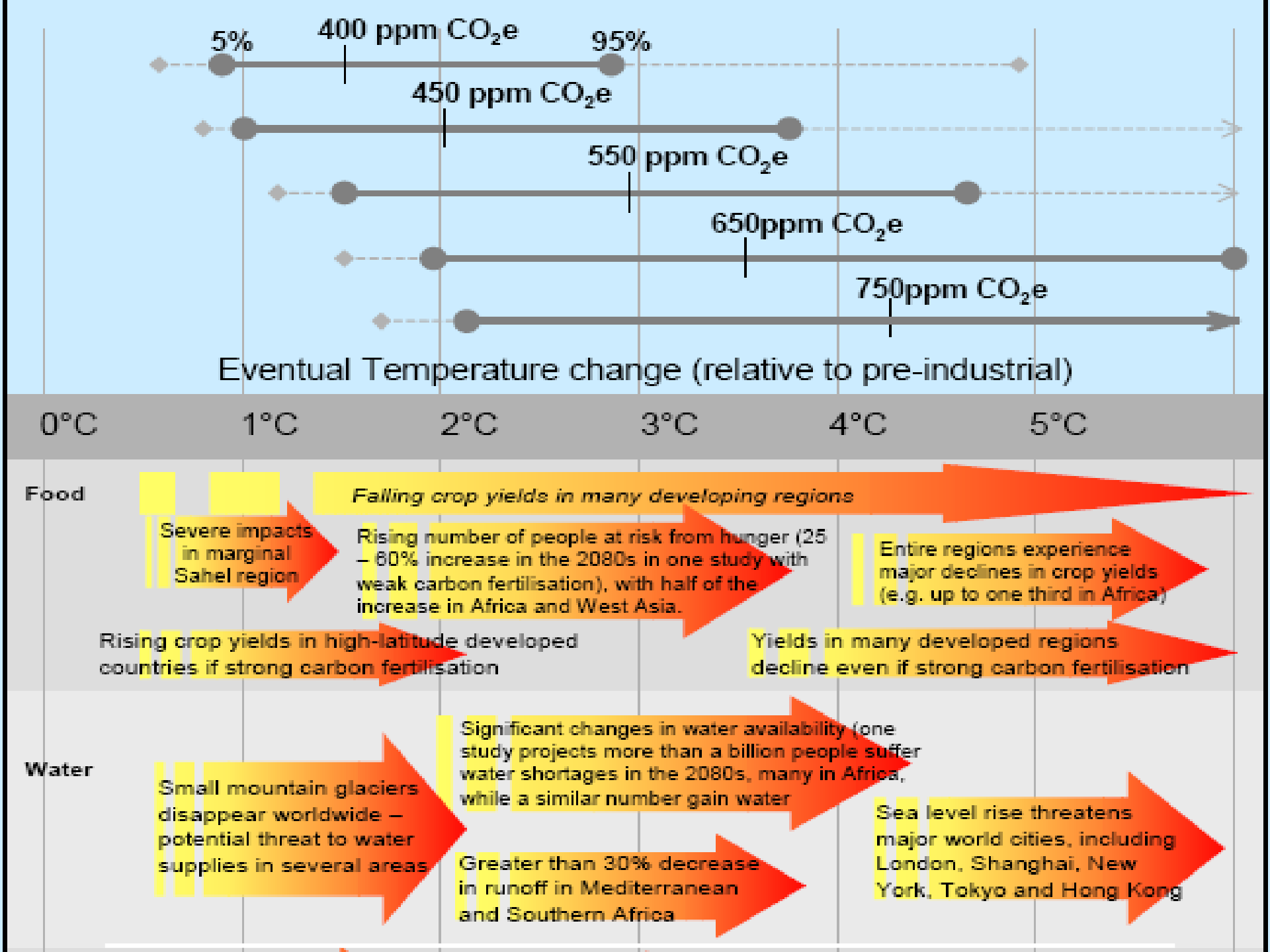
- Increased number of people exposed to disease e.g. malaria, cholera
- Increase in heat stress mortality
- Reduced winter mortality in mid- and high-latitudes

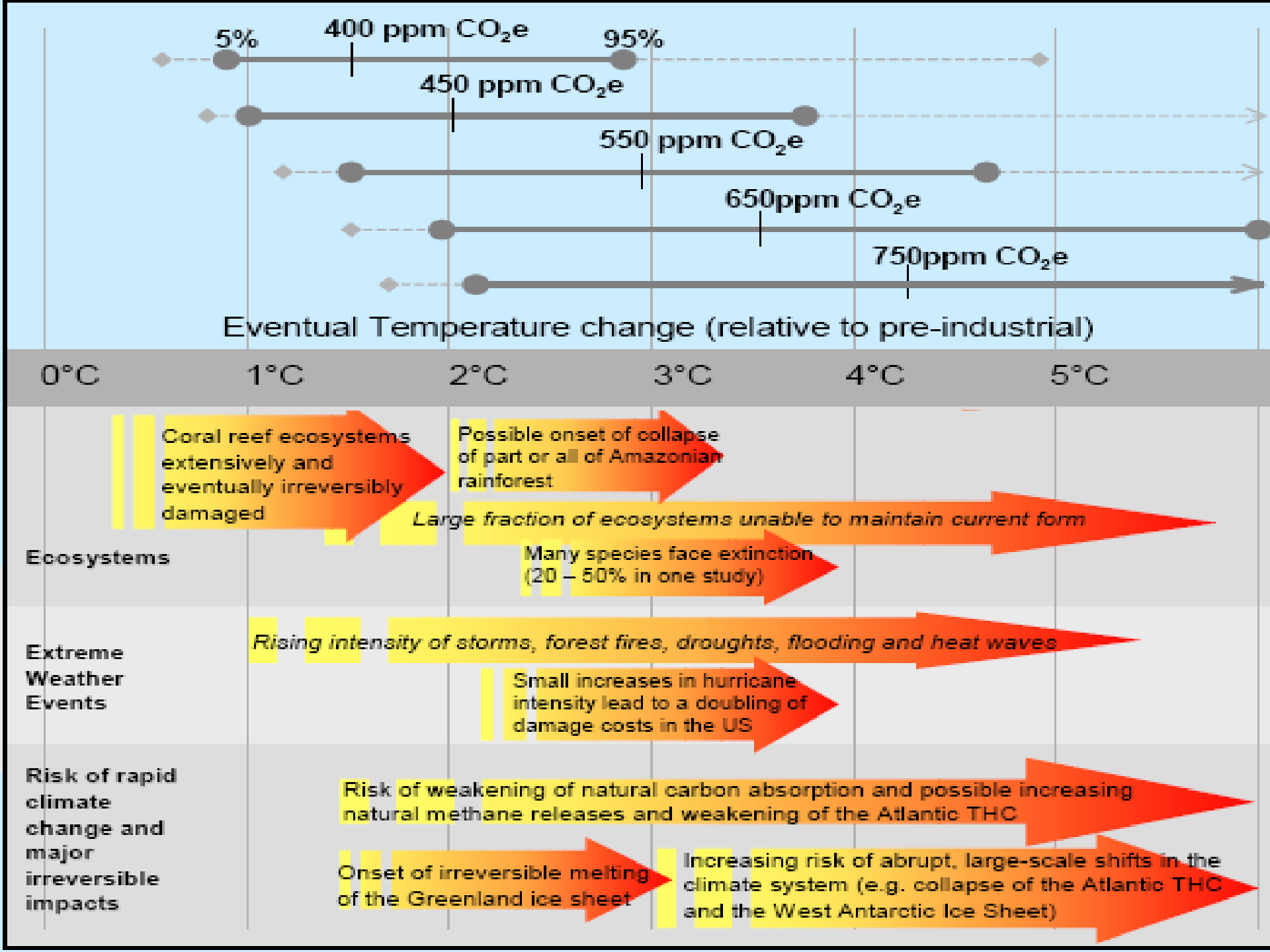
Great Weather Related Disasters 1950-1999

Economic and Uninsured Losses - Decade Comparison



	Decade 1950-59	Decade 1960-69	Decade 1970-79	Decade 1980-89	Decade 1990-99	Factor 80s:60s	Factor 90s:60s
Number	14	16	29	44	70	2.8	4.4
Economic Losses	38.7	50.8	74.5	118.5	399.9	2.3	7.9
Insured Losses		6.7	10.8	21.5	86.0	3.2	12.7


5%
400 ppm CO_2e
95%
450 ppm CO_2e
550 ppm CO_2e
650ppm CO_2e
750ppm CO_2e
Eventual Temperature change (relative to pre-industrial)
0°C
1°C
2°C
3°C
4°C
5°C
Food
Falling crop yields in many developing regions
Severe impacts in marginal Sahel region
Rising number of people at risk from hunger (25 – 60% increase in the 2080s in one study with weak carbon fertilisation), with half of the increase in Africa and West Asia.
Entire regions experience major declines in crop yields (e.g. up to one third in Africa)
Rising crop yields in high-latitude developed countries if strong carbon fertilisation
Yields in many developed regions decline even if strong carbon fertilisation
Water
Small mountain glaciers disappear worldwide – potential threat to water supplies in several areas
Significant changes in water availability (one study projects more than a billion people suffer water shortages in the 2080s, many in Africa, while a similar number gain water
Greater than 30% decrease in runoff in Mediterranean and Southern Africa
Sea level rise threatens major world cities, including London, Shanghai, New York, Tokyo and Hong Kong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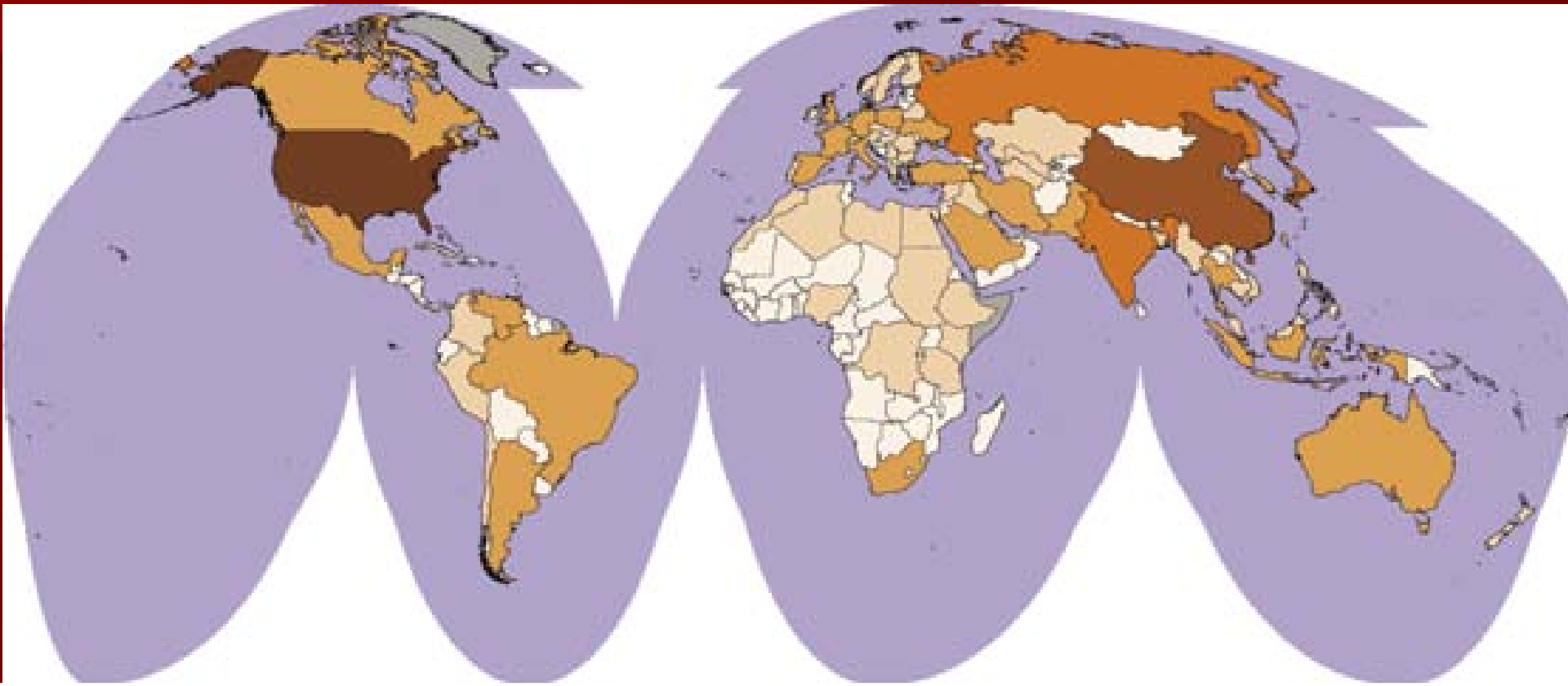
Eventual Temperature change (relative to pre-industrial)
0°C
1°C
2°C
3°C
4°C
5°C
Coral reef ecosystems extensively and eventually irreversibly damaged
Possible onset of collapse of part or all of Amazonian rainforest
Large fraction of ecosystems unable to maintain current form
Many species face extinction (20 – 50% in one study)
Ecosystems
Rising intensity of storms, forest fires, droughts, flooding and heat waves
Small increases in hurricane intensity lead to a doubling of damage costs in the US
Extreme Weather Events
Risk of weakening of natural carbon absorption and possible increasing natural methane releases and weakening of the Atlantic THC
Onset of irreversible melting of the Greenland ice sheet
Increasing risk of abrupt, large-scale shifts in the climate system (e.g. collapse of the Atlantic THC and the West Antarctic Ice Sheet)
Risk of rapid climate change and major irreversible impacts

Who's emitting?

GHG emissions by country



Millions Tons CO_2 Eq.

> 6,000	1,316 - 2,000	45 - 215
2,000 - 6,000	215 - 1,316	0 - 45

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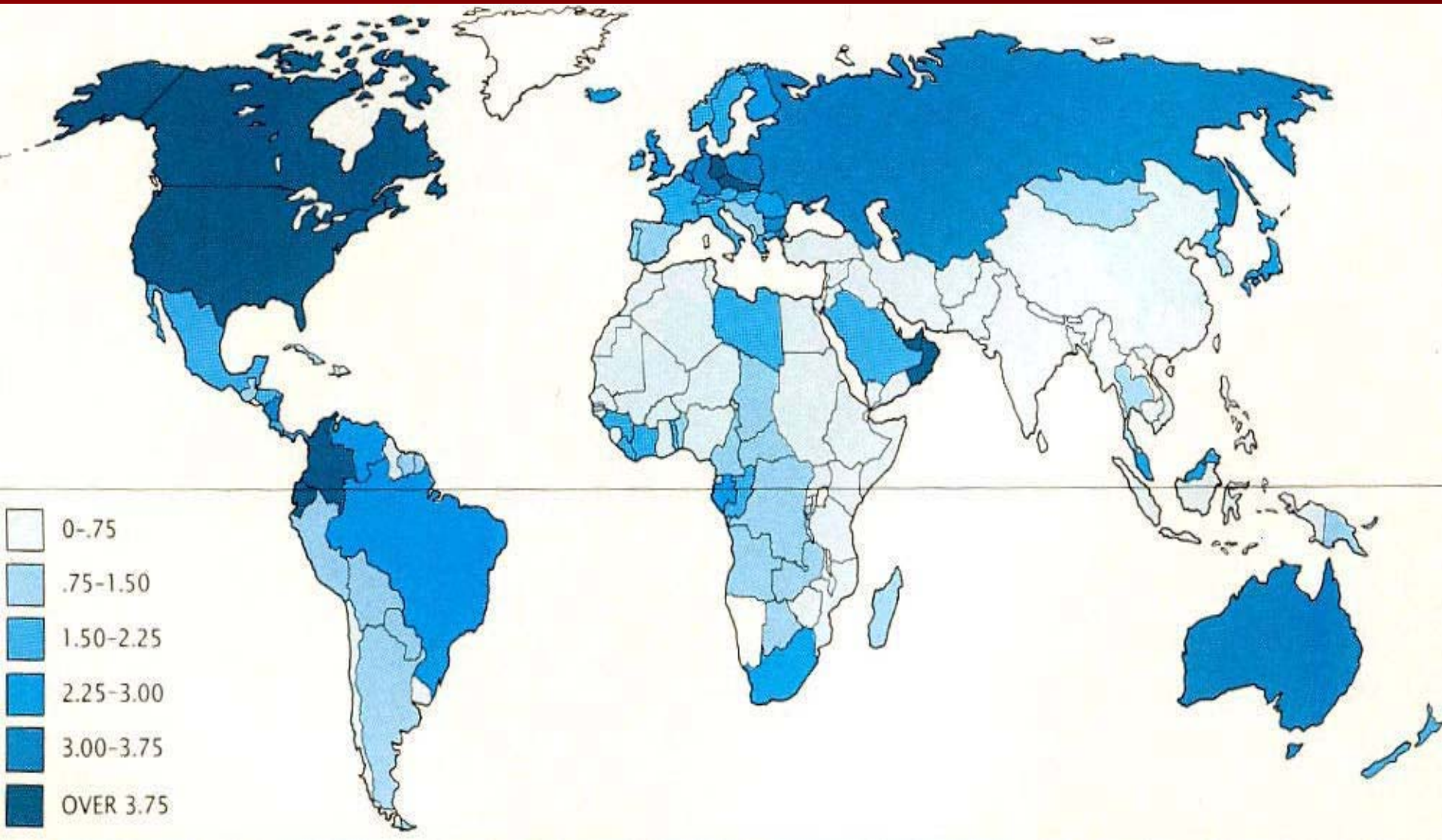
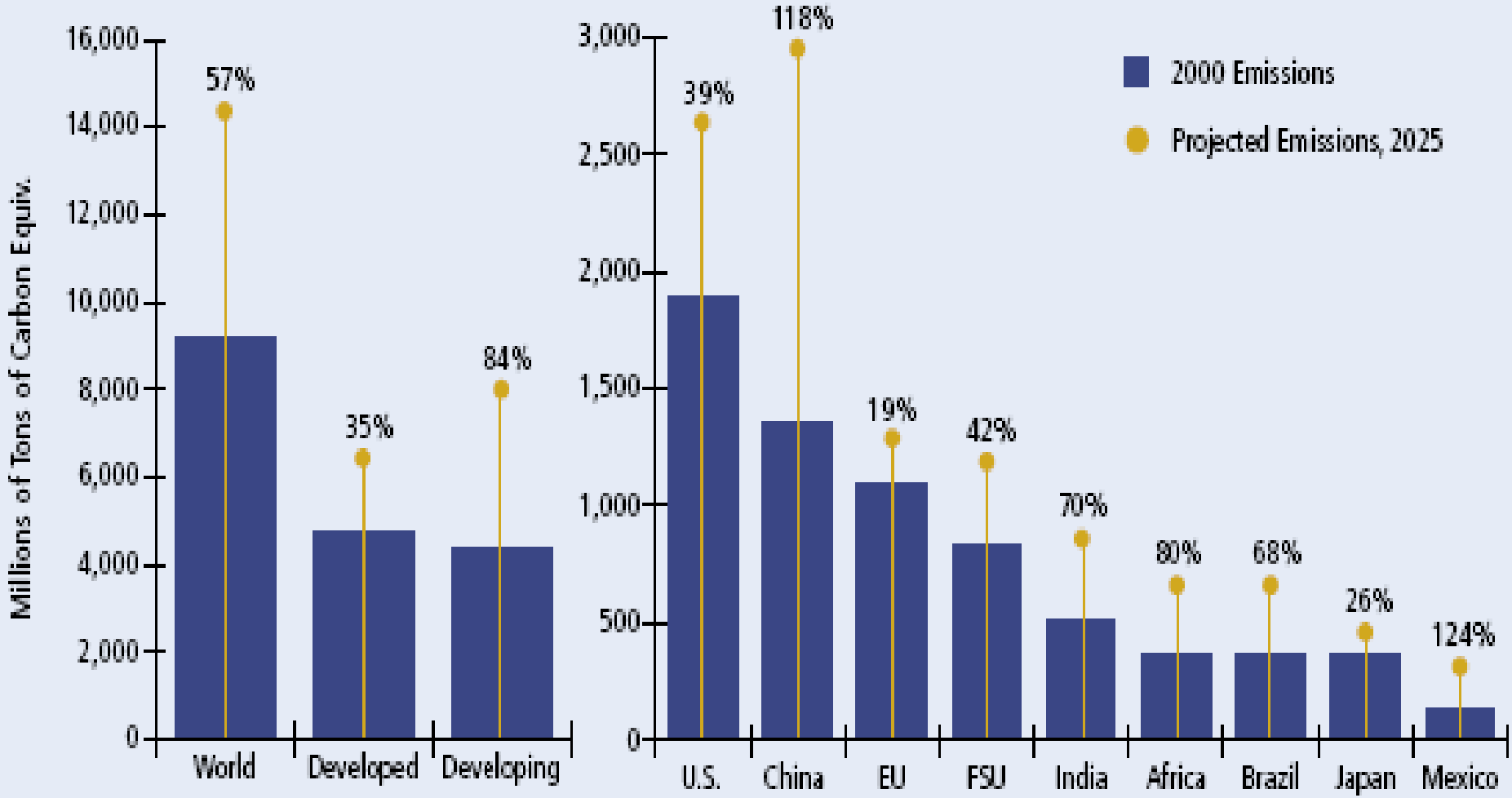
Who's emitting?

Emissions per capita (tC/cap, 1990)



Projected emissions of GHG, 2025



Sources & Notes: Projections are based on EIA, 2003 (reference case, CO_2 from fossil fuels) and POLES (non-CO_2 gases) (EC, 2003). GHGs do not include CO_2 from land use change. "FSU" is former Soviet Union.