First ALOV conference
Than Pho Ho Chi Minh, August 14th, 2010

Climate and energy security in Vietnam, the world is changing

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CIRED, CNRS

Centre International de Recherche sur
l'Environnement et le Développement

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Outline

1. Global change in climate and energy systems
    1. Earth's climate is changing already
    2. Expected impacts
    3. Reducing CO2 emissions
2. Implications for Vietnam

1. Earth's climate is changing

Polar bear is unhappy of global warming

a) Arctic ice melting

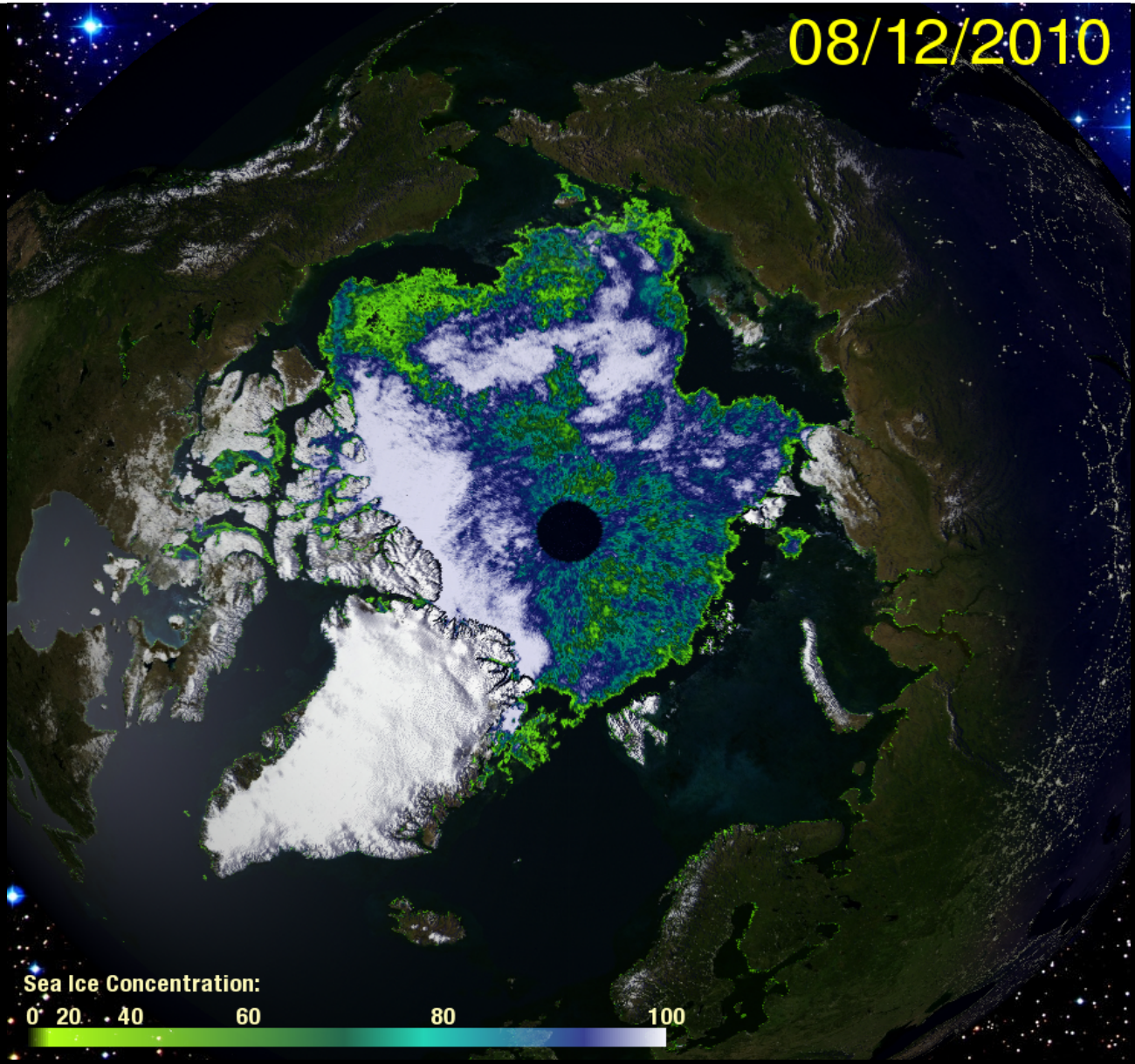
b) Global warming

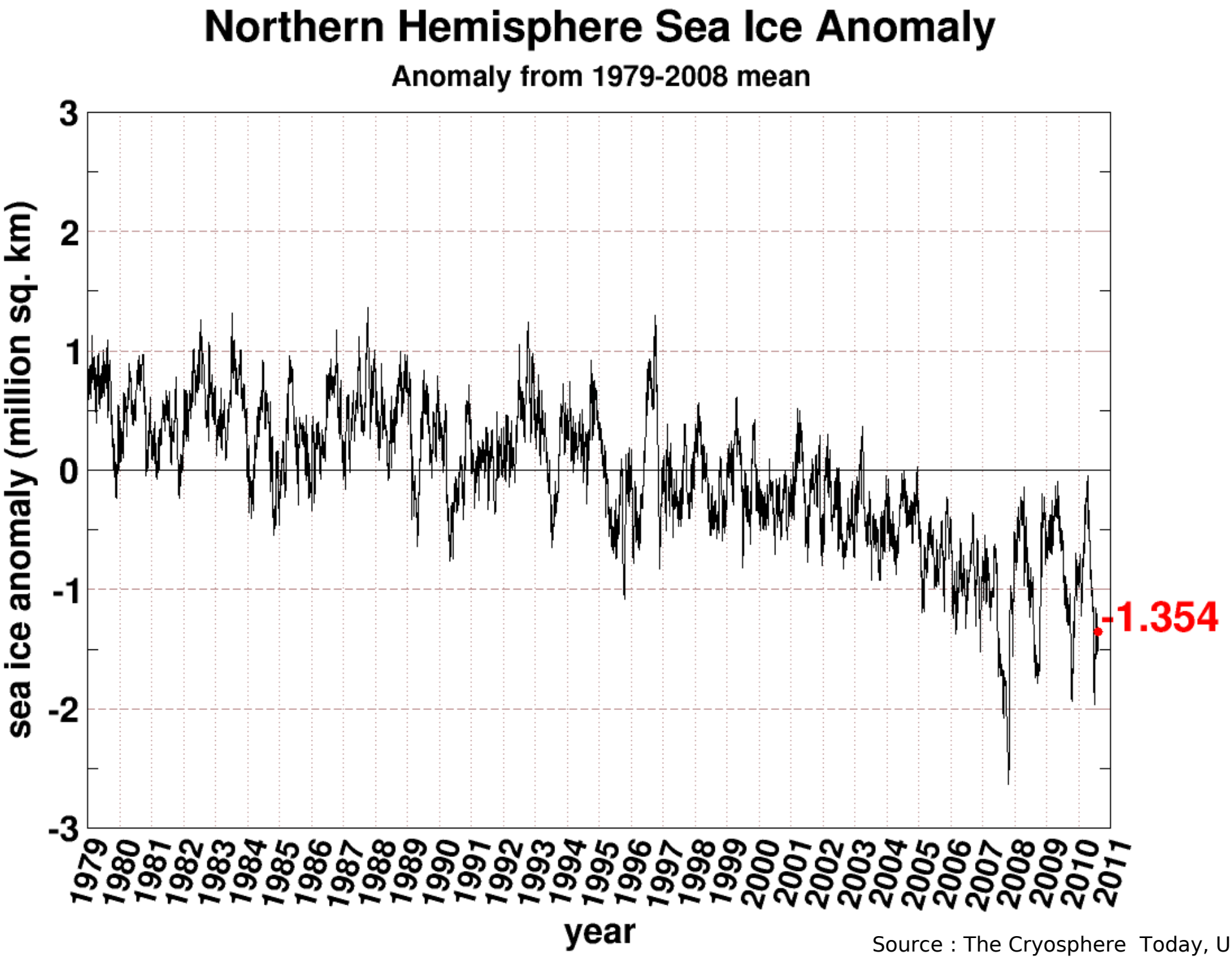
c) Radiative forcing

d) Causality

a) Arctic ice sheet melting faster than expected

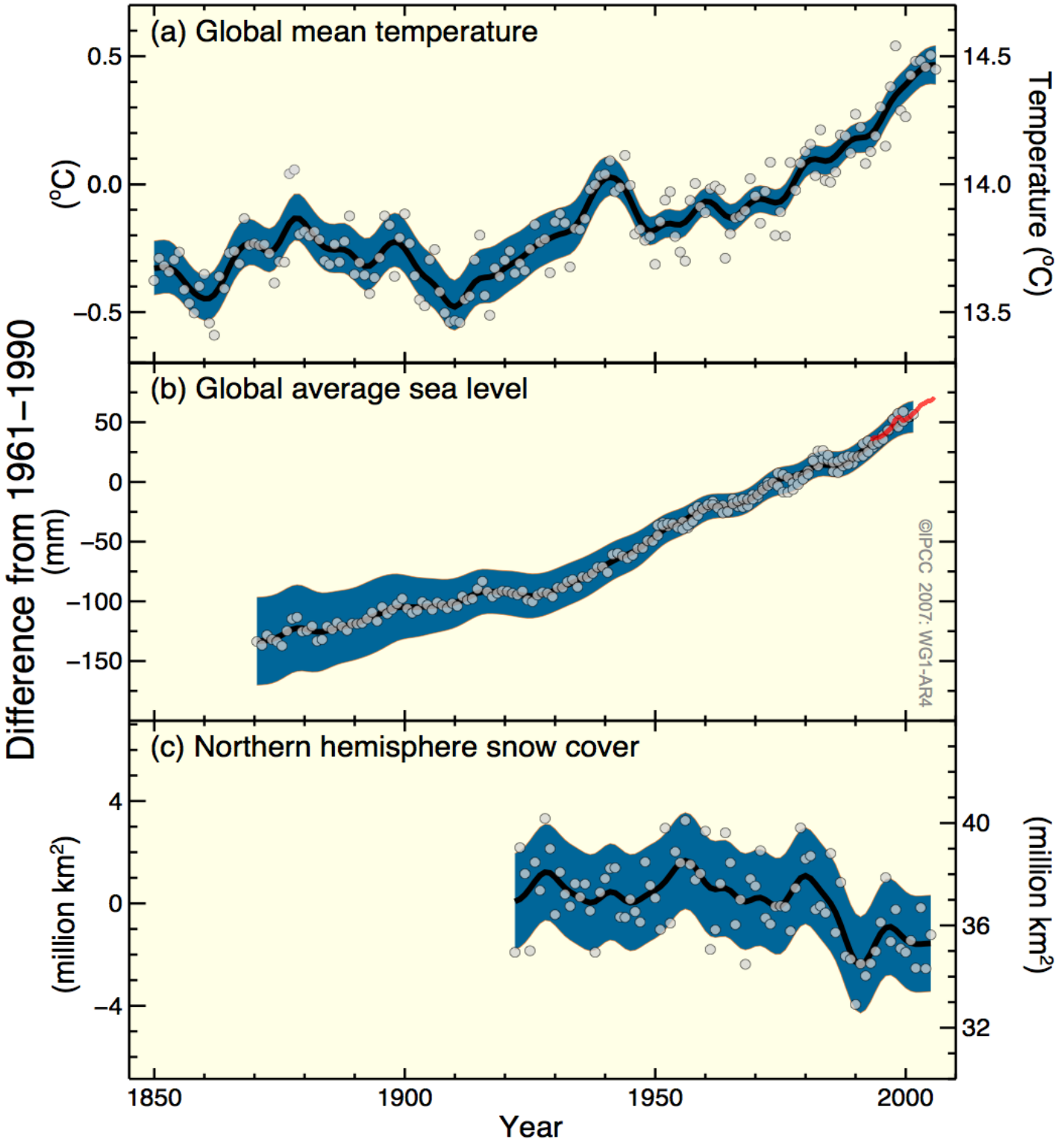
NorthWest passage open in September 2007 (Source: ESA)





Source : The Cryosphere Today, UIUC

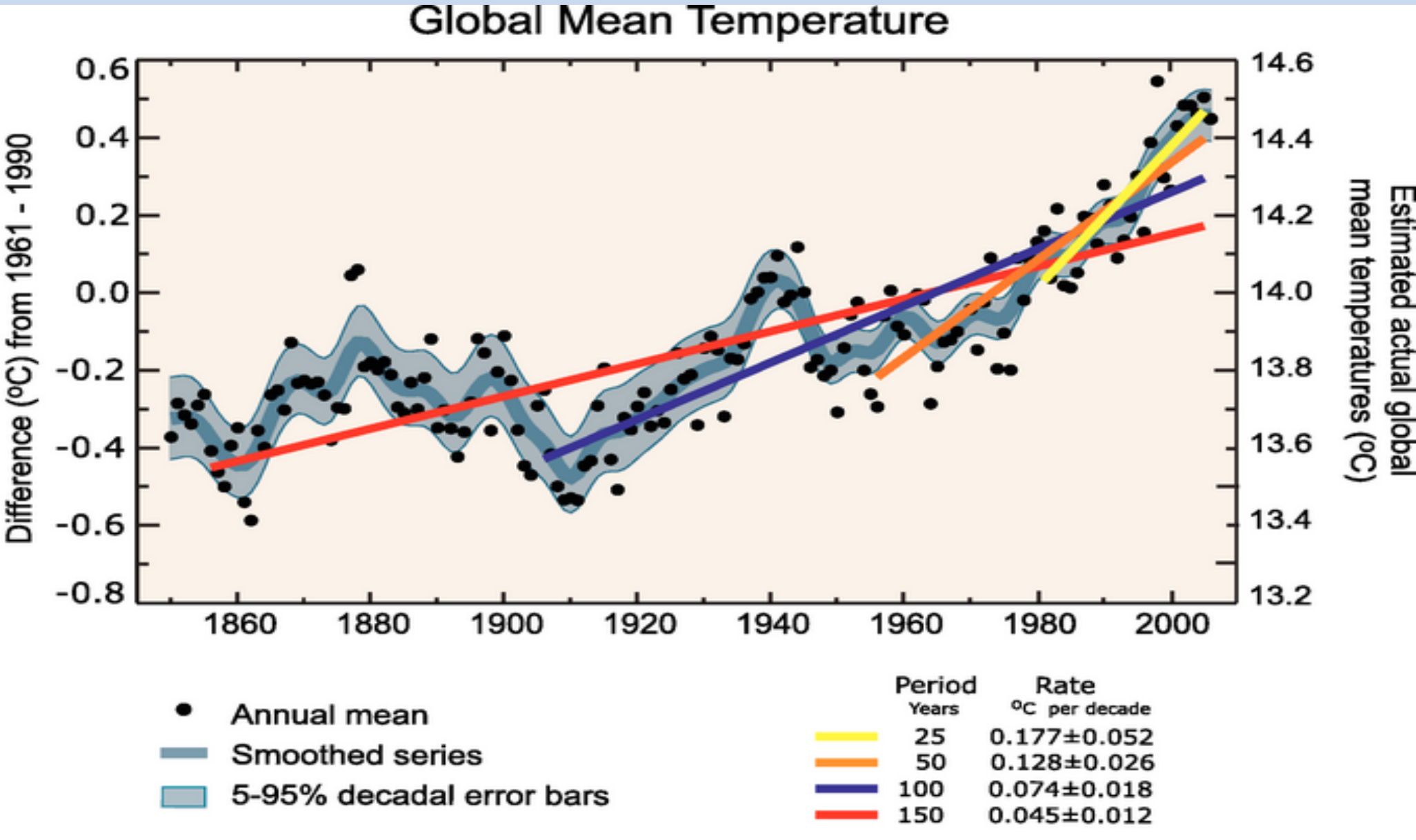
b) Evidence of global warming



Source : IPCC, 2007, AR4
WG I, Figure SPM 3

Global warming is accelerating

Source : IPCC 2007, A44, WG I, figure FAQ 1

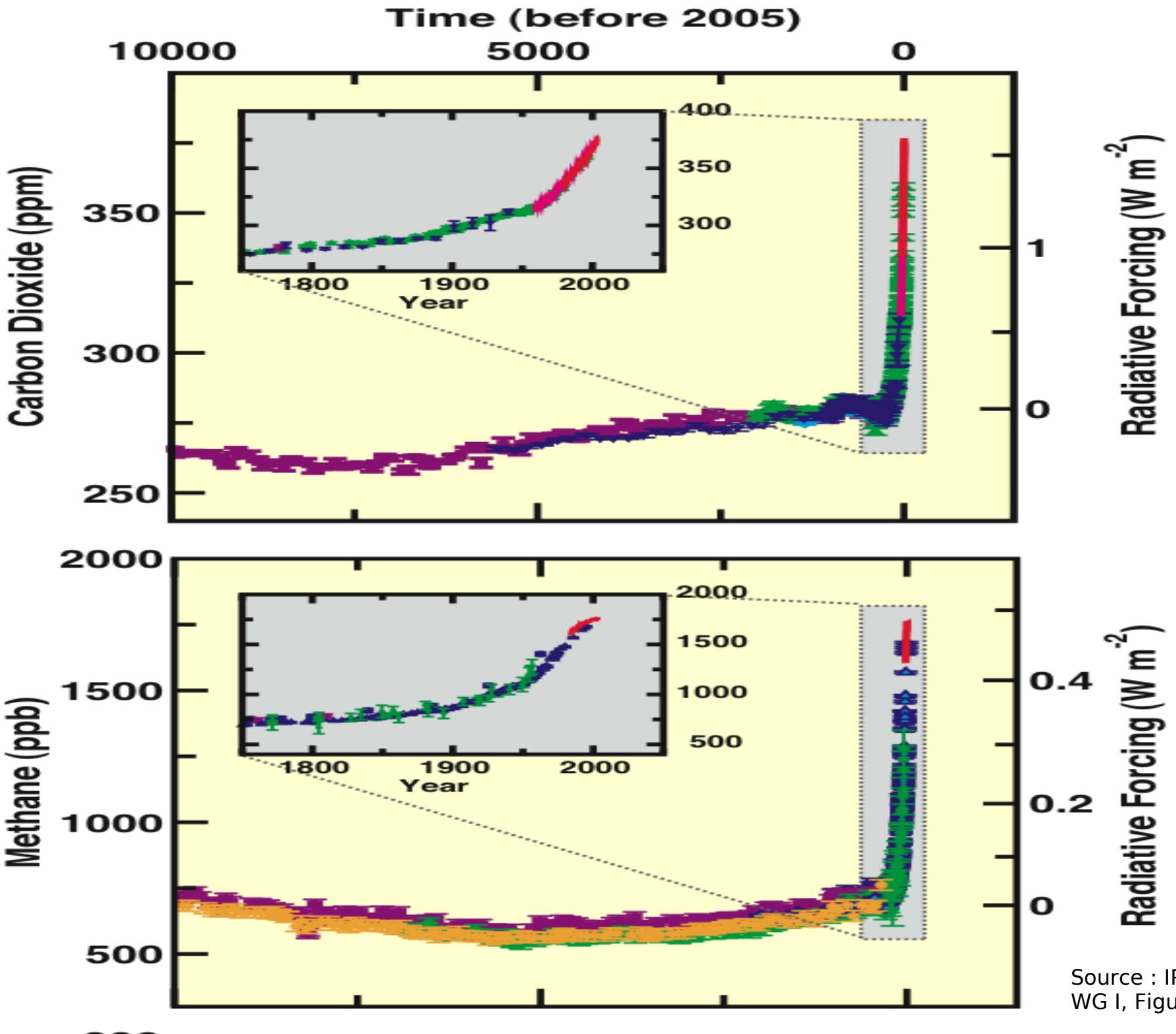


c) Greenhouse gases increase

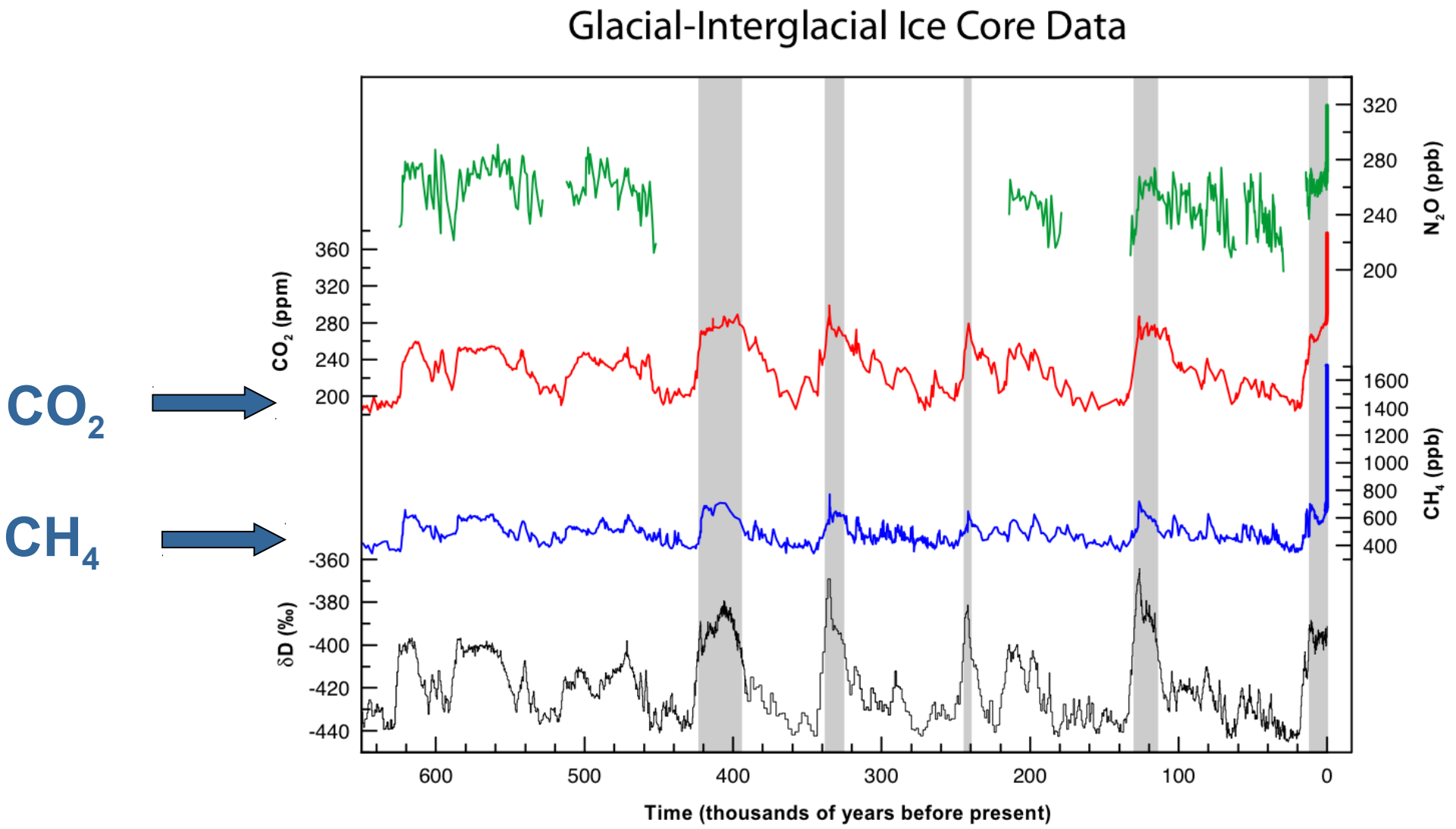
Concentrations of CO_2, CH_4, N_2O in the atmosphere are:

- Far above pre-industrial values
- Rapidly increasing since 1750, due to human activities

Radiative forcing has increased by 1.6 W/m² (CI: 0.4 – 2.4, source: IPCC AR4 WG1 TS2.5)



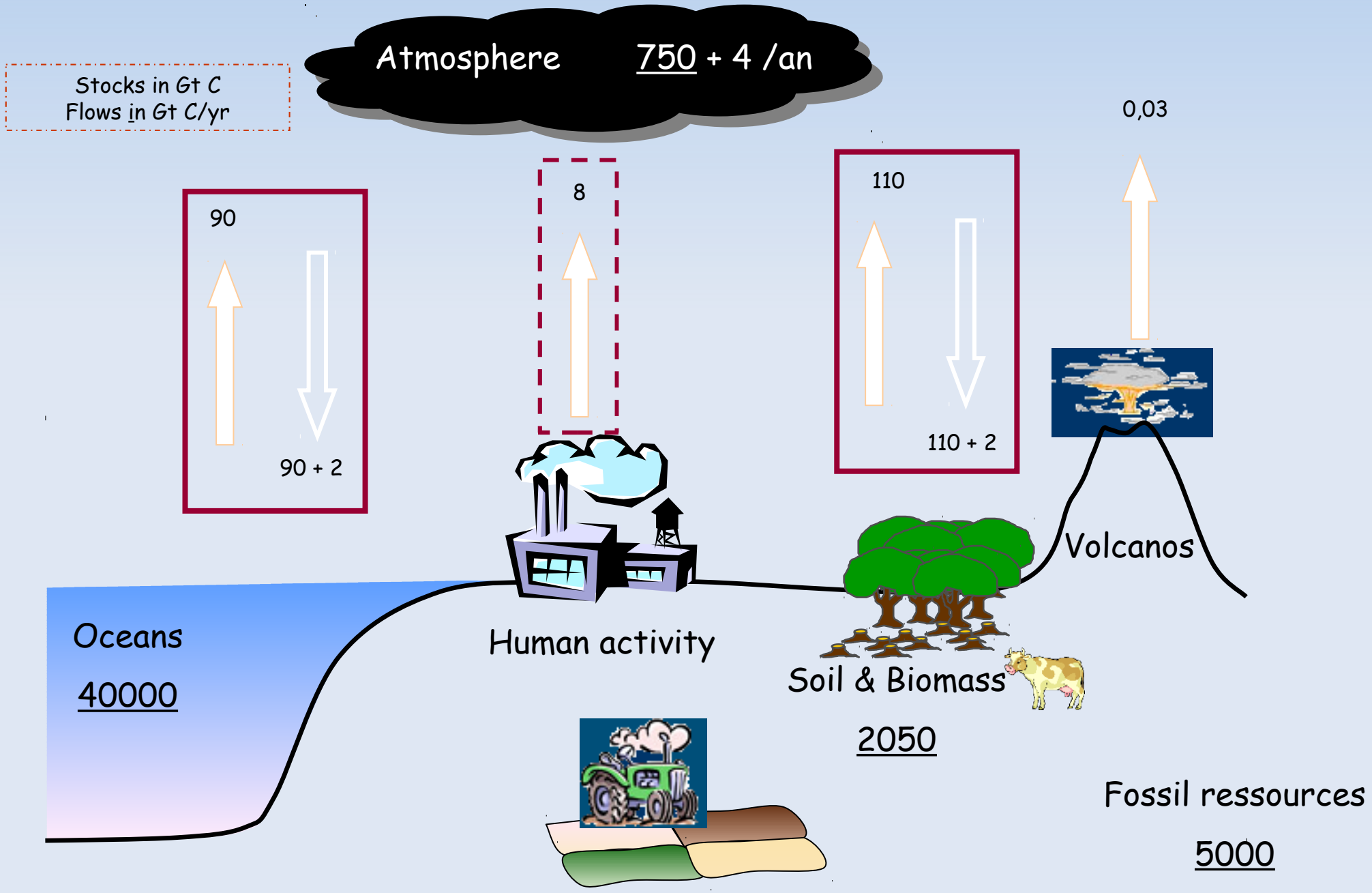
Source : IPCC, 2007, AR4 WG I, Figure SPM 1



Concentrations of CO_2 and CH_4 in 2005 exceed what has been seen since 650 000 years.

Source : IPCC, 2007, AR4 WG I, Figure TS.1

d) Humans caused GHG increase

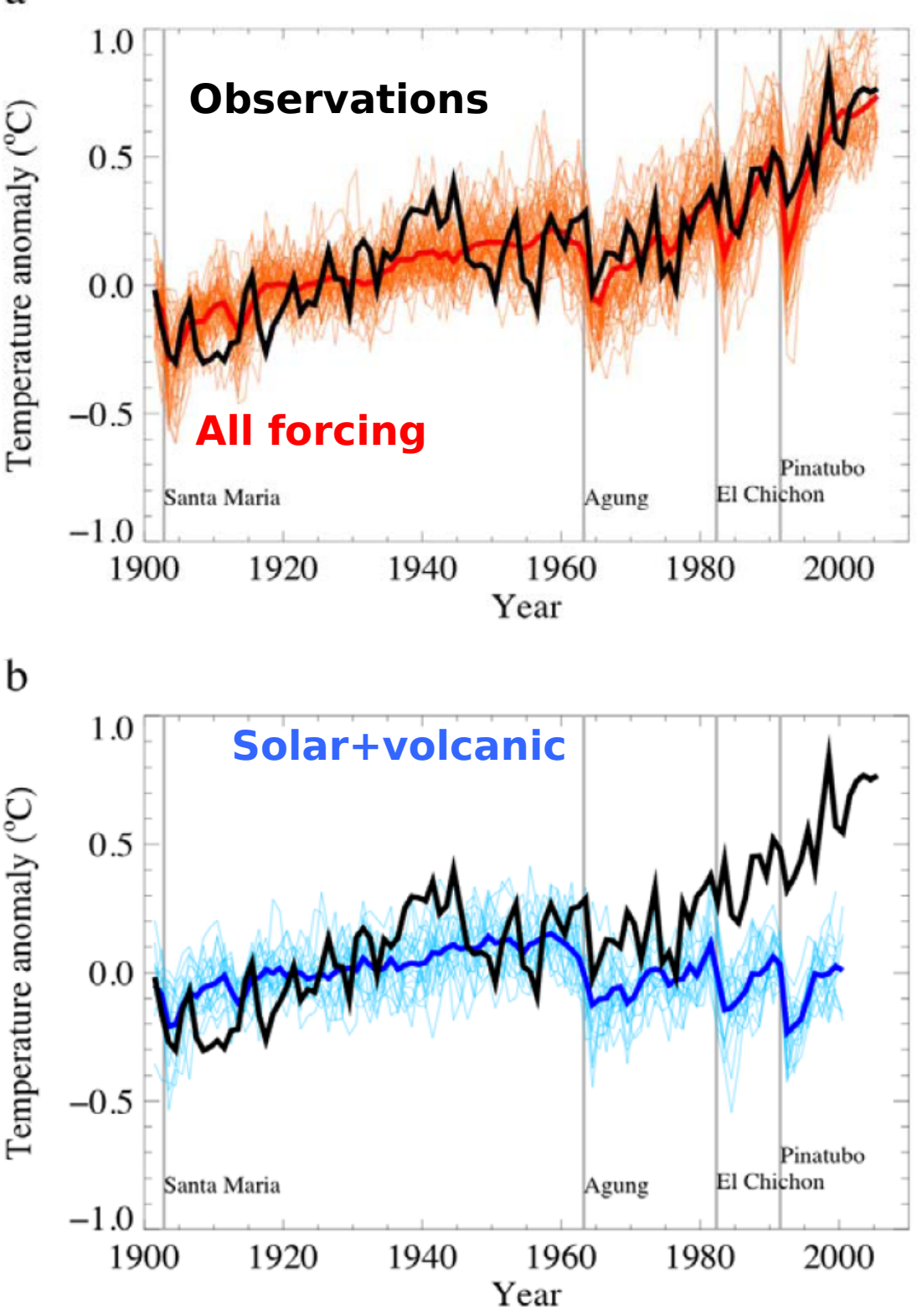


GHG increase caused climate change

- Observed changes (solid black line)

☑ Agree with responses expected from radiative forcing increase (top panel)

☒ Cannot be explained by other reasons (solar+volcanic)



Source : IPCC, 2007, AR4 WG I, Figure TS.23

IPCC conclusions

(2007, WGI, SPM, Understanding and attributing climate change)

Most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations.

Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns

2. Expected impacts

a) CO2 emissions scenarios

b) Greenhouse gases concentrations increase

c) Temperature and water cycle changes

d) Impacts on humans, ecosystems, economy

a) Emissions scenarios

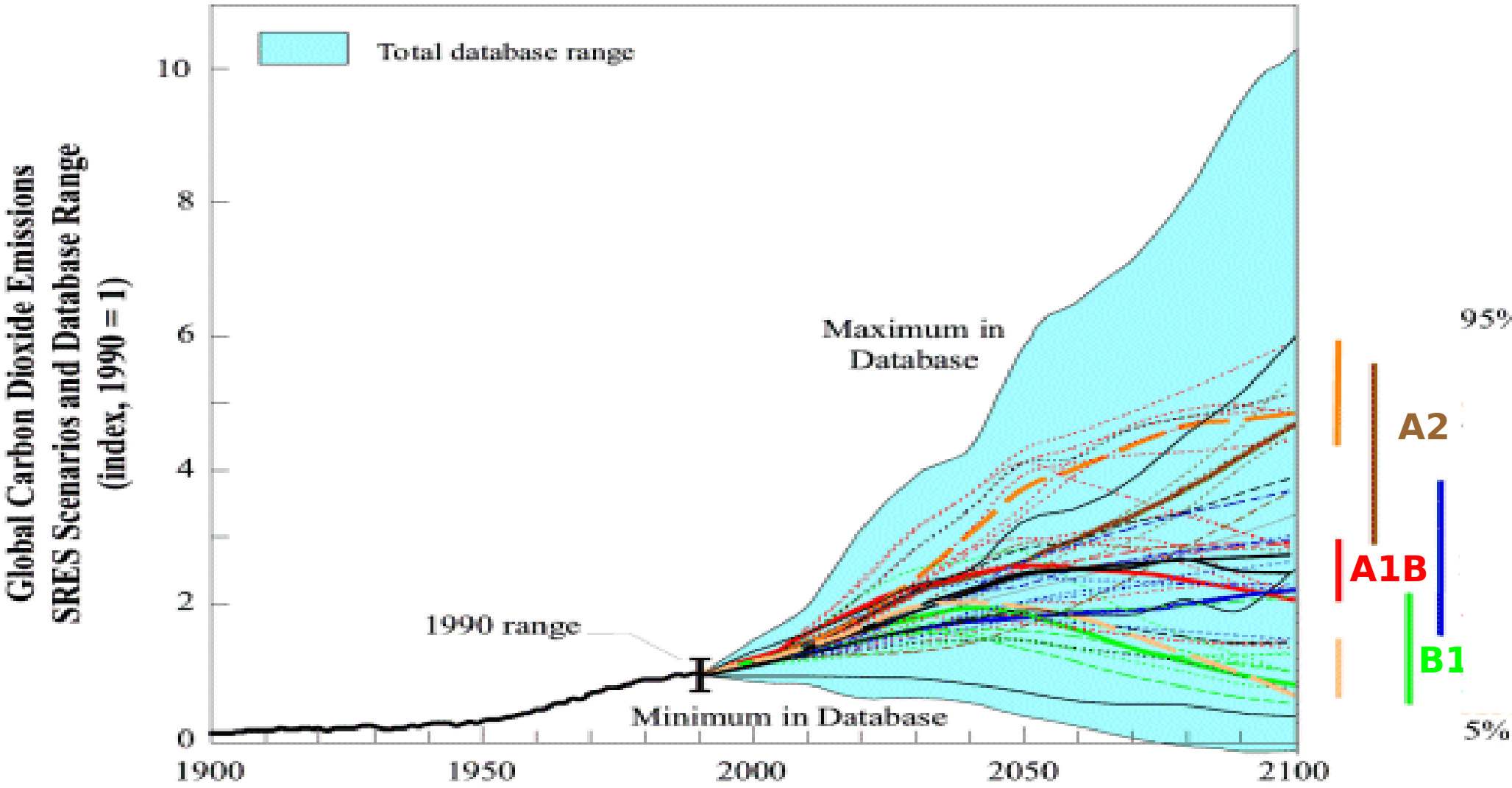
Storylines assuming no intervention

A2: Heterogenous world – High CO2 emissions
Slow globalization. Late demographic transition.
Lower technical progress & economic growth.

A1B: Convergence and growth – Medium CO2
Technological progress is balanced between fossil intensive and non-fossil energy sources.

B1: Internet age – Low CO2 emissions
Rapid changes toward a service and information economy, reductions in material intensity, introduction of clean and resource-efficient technologies.

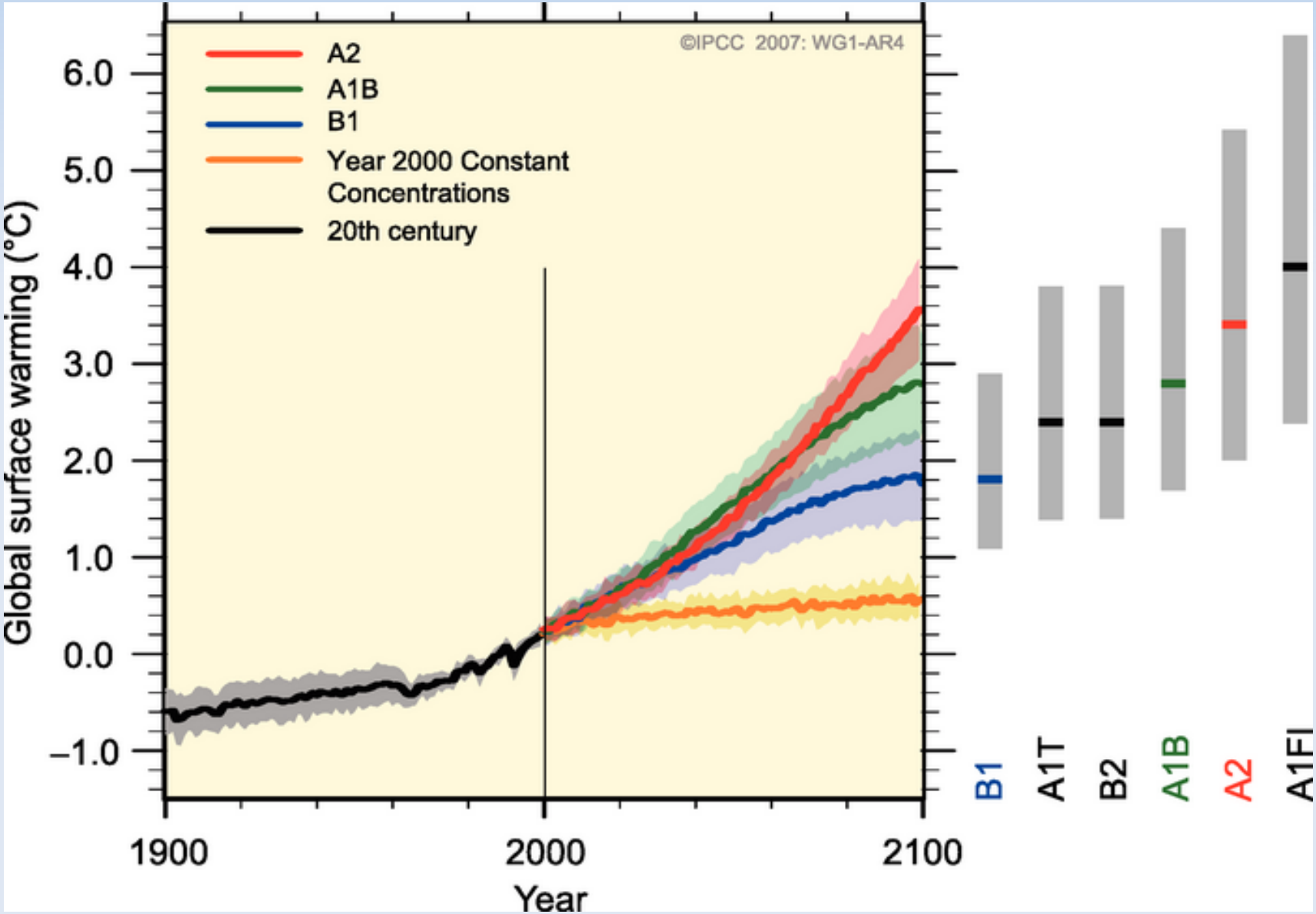
Global CO2 emissions simulations



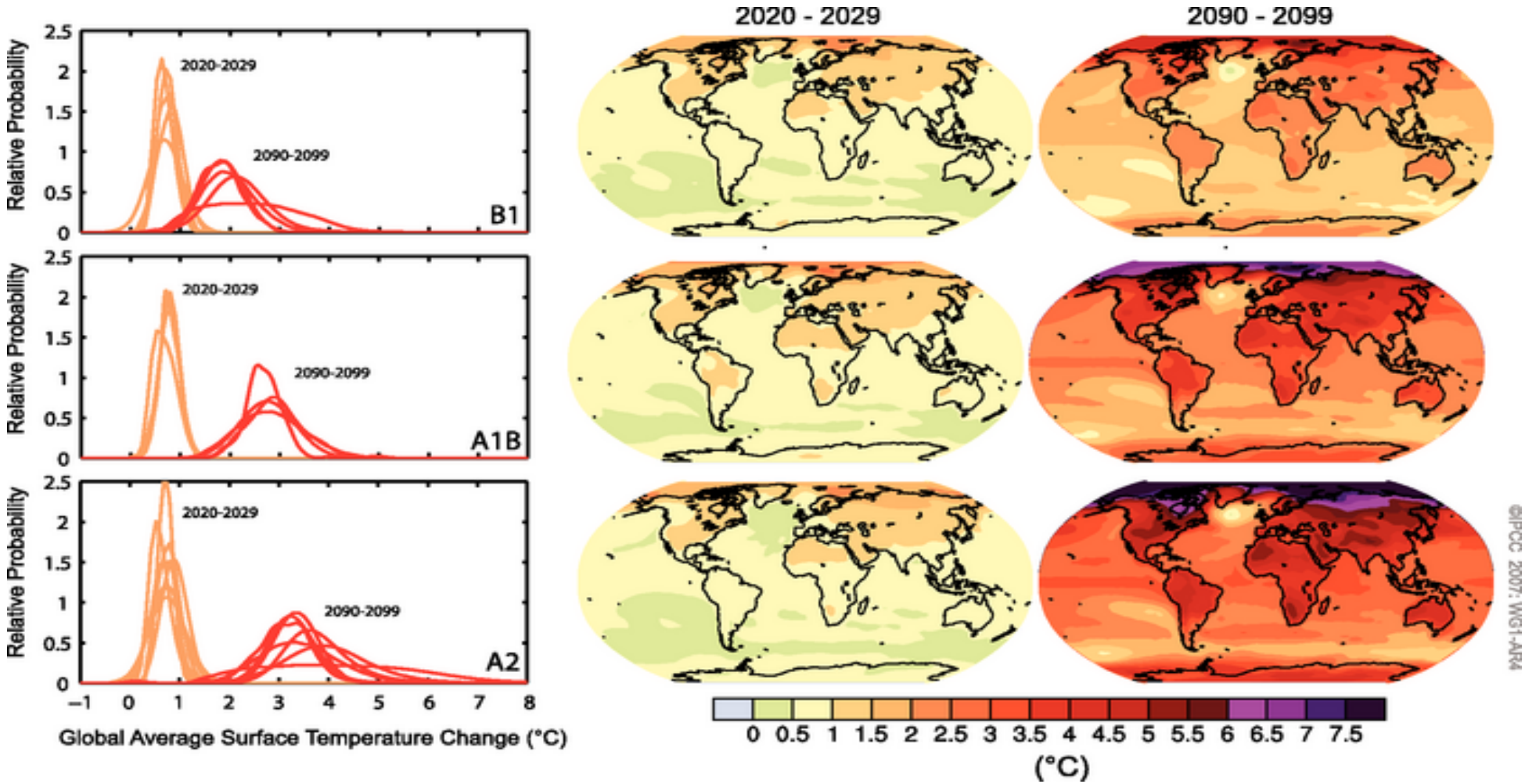
Source : IPCC, SRESI, Figure TS.7

c) Even B1 does not prevent +2°C

Source: IPCC 2007, AR4, WG 1, Figure SPM.5. Solid lines are multi-model global averages of surface warming (relative to 1980–1999) for the scenarios A2, A1B and B1, shown as continuations of the 20th century simulations. Shading denotes the ±1 standard deviation range of individual model annual averages. The grey bars at right indicate the best estimate (solid line within each bar) and the likely range assessed for the six SRES marker scenarios.

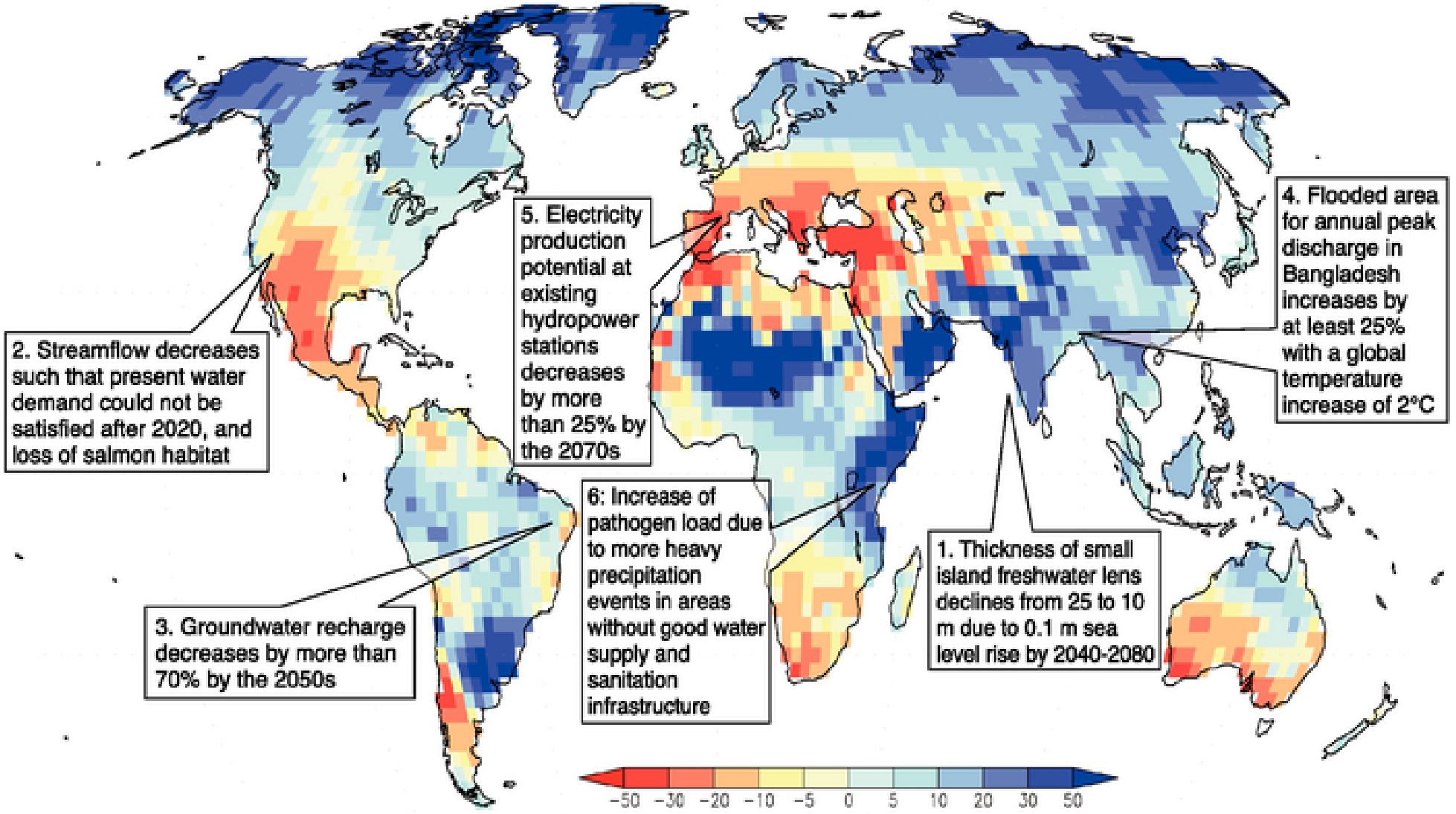


c) Projection of surface temperatures



IPCC 2007, AR4 WG 1 Figure SPM.6. Projected surface temperature changes for the early and late 21st century relative to the period 1980 to 1999. The central and right panels show the AOGCM multi-model average projections (°C) for the B1 (top), A1B (middle) and A2 (bottom) SRES scenarios averaged over the decades 2020 to 2029 (centre) and 2090 to 2099 (right). The left panel shows corresponding uncertainties as the relative probabilitiess.

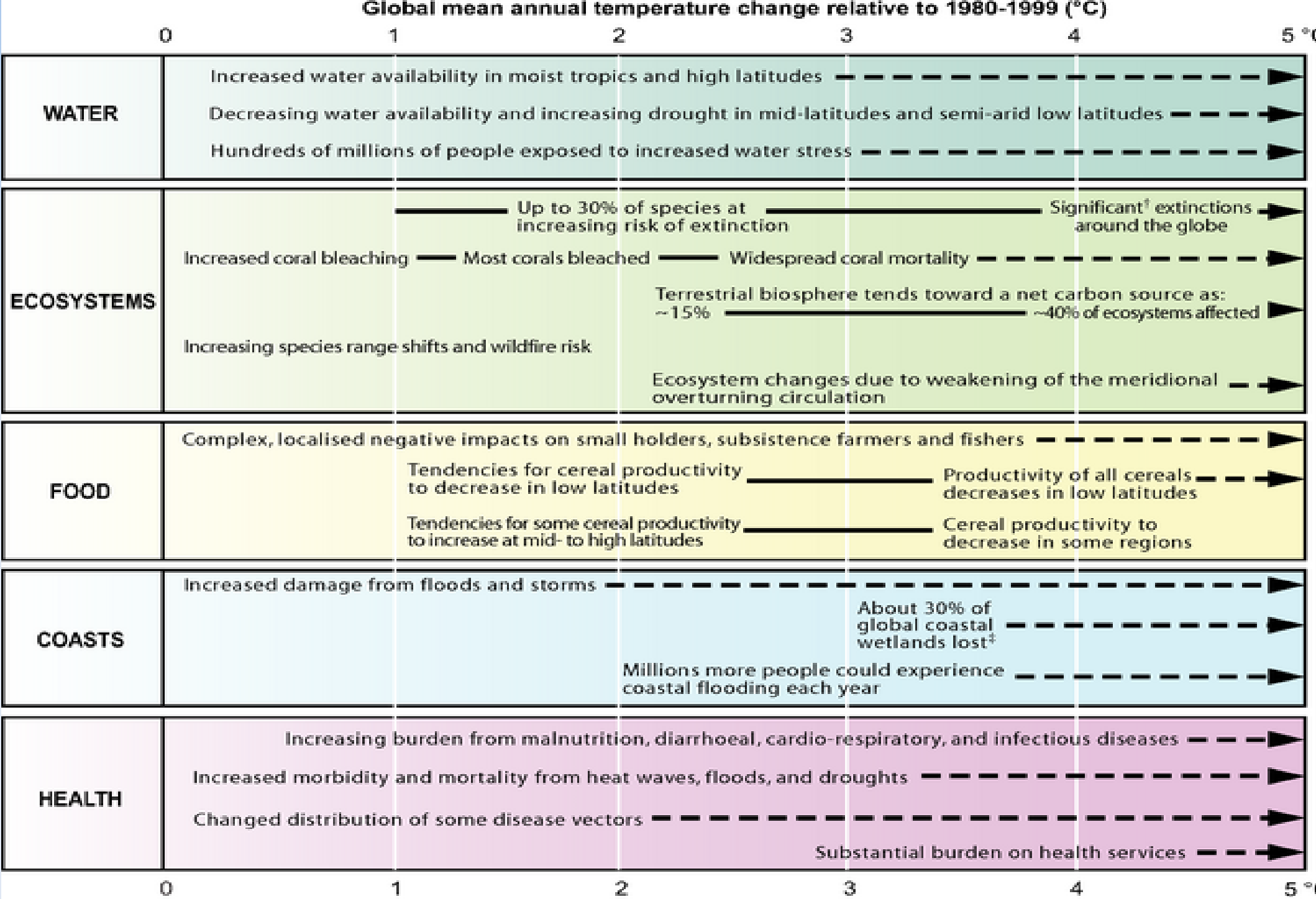
Impacts on freshwater



IPCC AR4 WG 2 Figure 3.8. Background map: Ensemble mean change of annual runoff, in percent, between present (1981 to 2000) and 2081 to 2100 for the SRES A1B emissions scenario (after Nohara et al., 2006).

d) What is a dangerous level of global warming?

- Still difficult to quantify
  - Local effects
  - Market and non-market impacts
  - Risk of larger, faster climate change
- Qualitative, global estimates
  - +4°C seems clearly dangerous
  - +2°C not necessarily safe



Source : IPCC 2007, AR4, WG2 figure SPM.2

† Significant is defined here as more than 40%.

‡ Based on average rate of sea level rise of 4.2 mm/year f

Conclusions on impact

- +2°C in 2100 is average in the B1 scenario
- Adaptation is already necessary
- Risk of larger, faster climate change

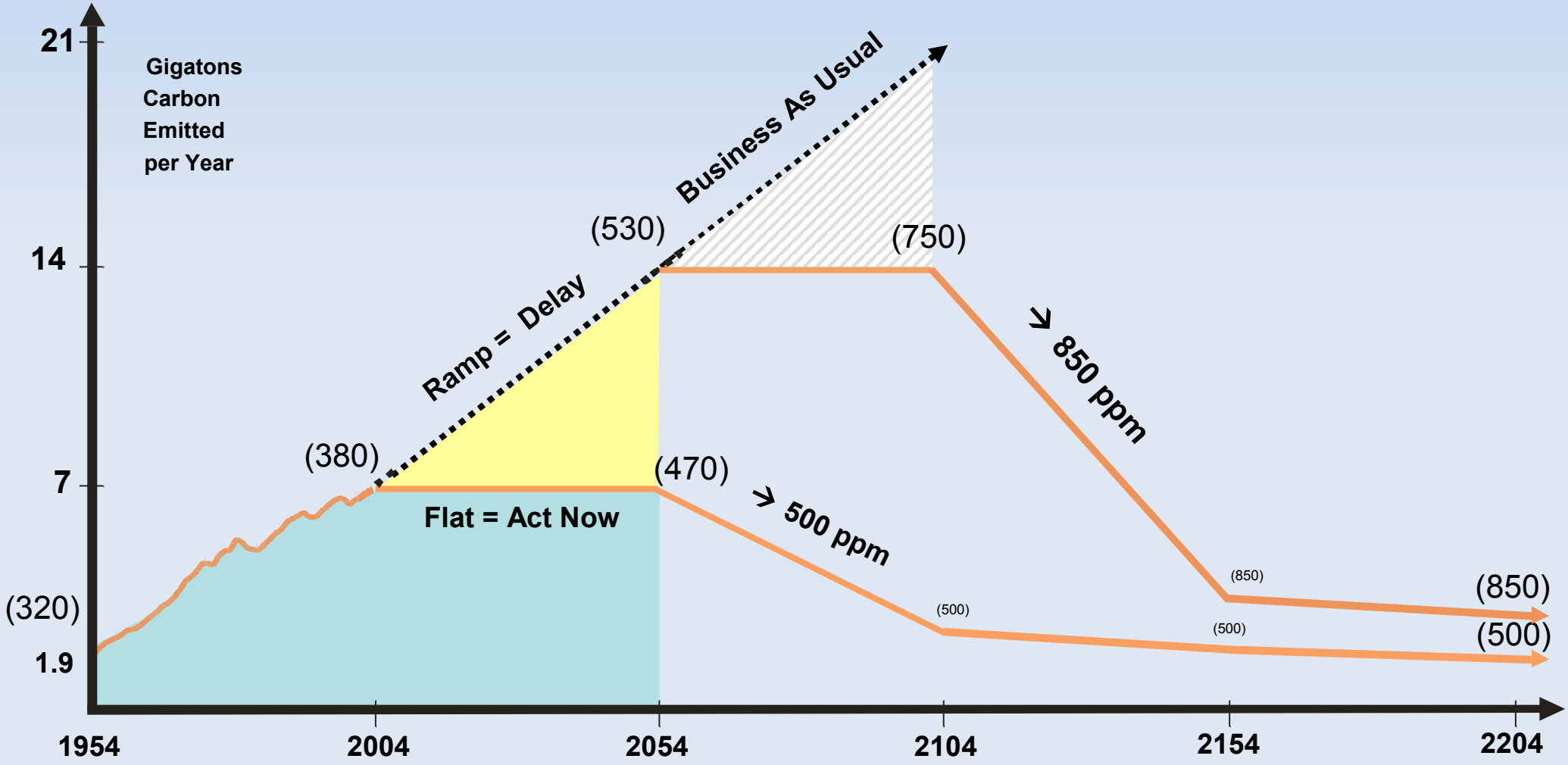
3. Reducing CO2 emissions

Toyota Prius, symbol of the revolution in car markets towards low emissions vehicles

Reaching peak CO_2 emissions

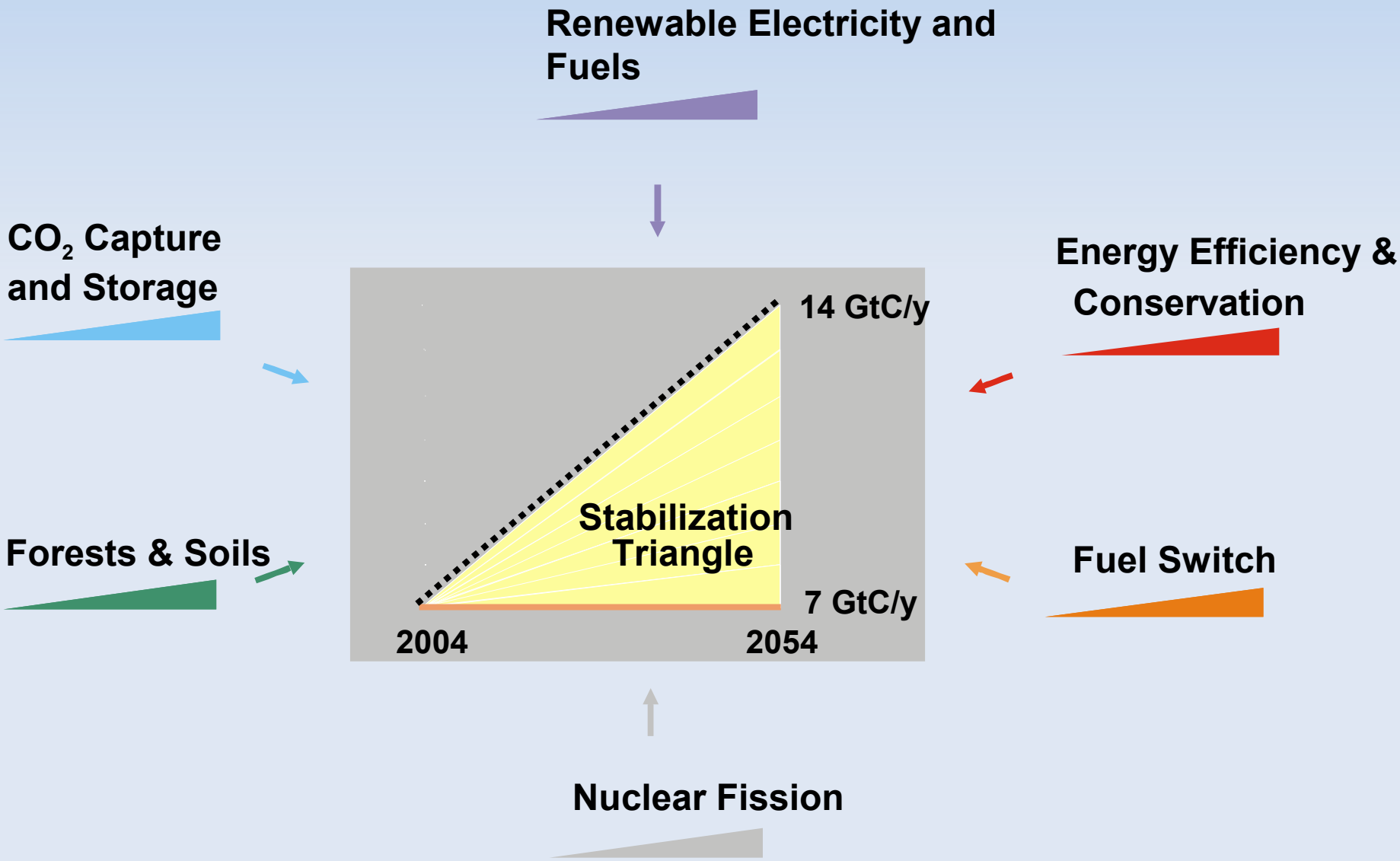
- Needed as soon as possible
- Feasible with existing technologies
- Barriers are economics and politics

a) We can target 550 ppm CO2
but only if emissions peak now



b) Technology & lifestyles options

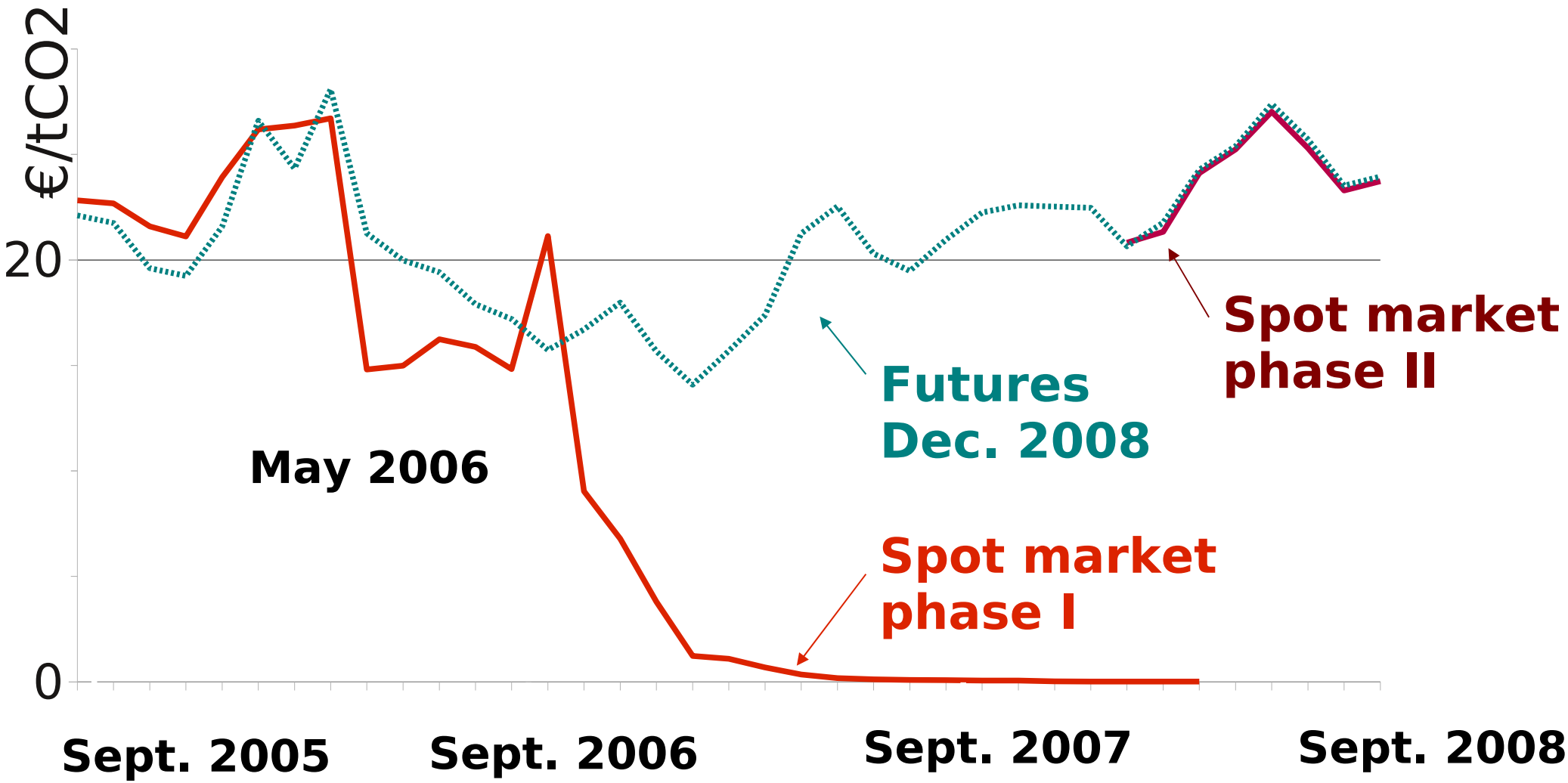
All these can save up to 1GtC/yr in 2050



Mitigation already happens

CO2 reinjection in Sleipner natural gas field, Norway

Price of a CO_2 emission permit in Europe

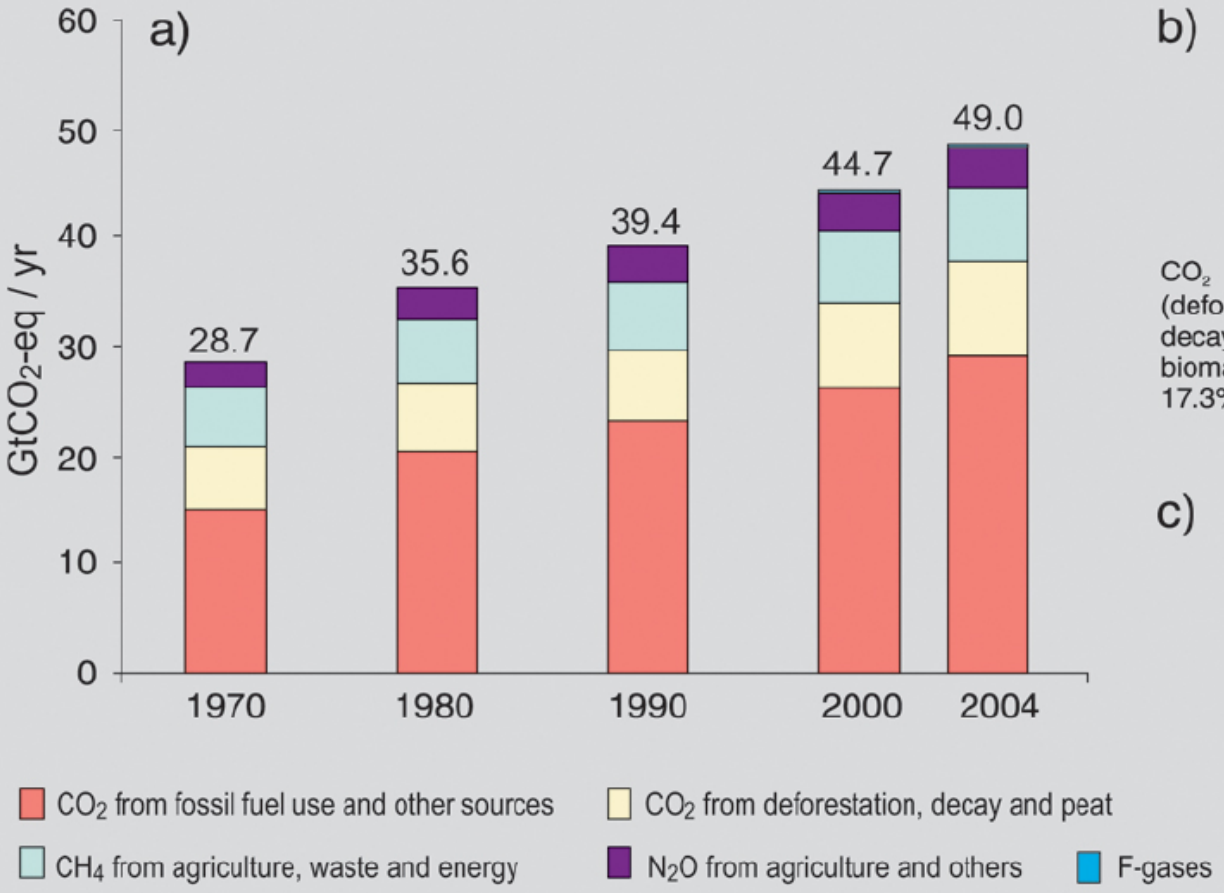


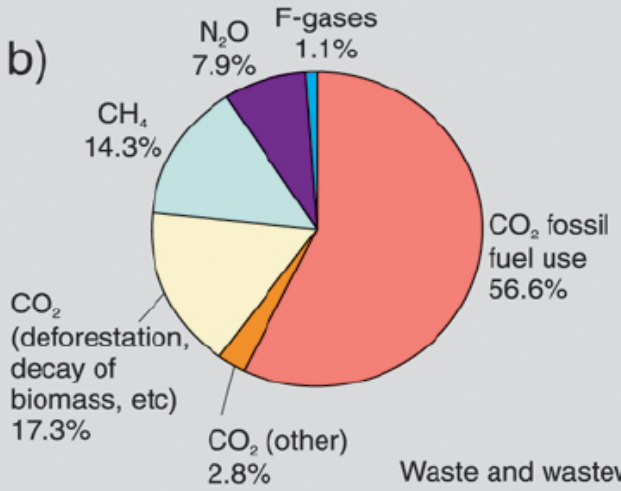
Source: Tendances Carbone, Mission Climat, CDC

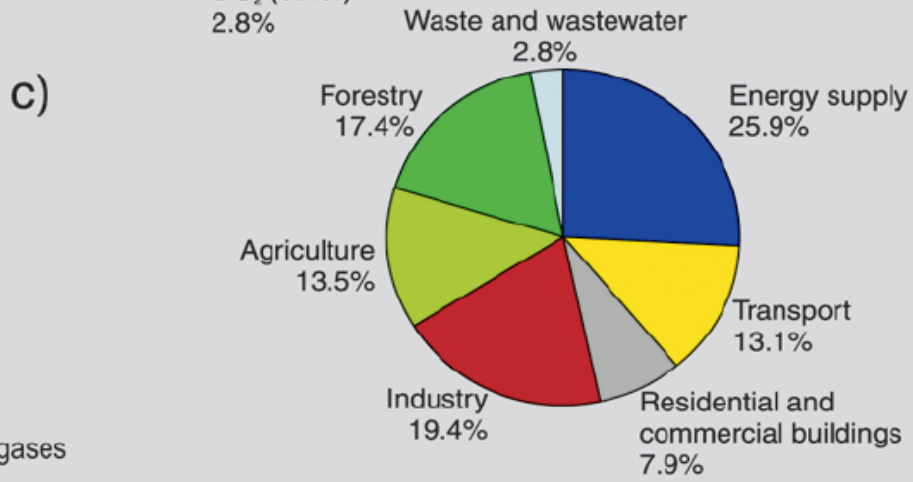
c) Political and economic challenge :
Acting at the global scale on the whole economy

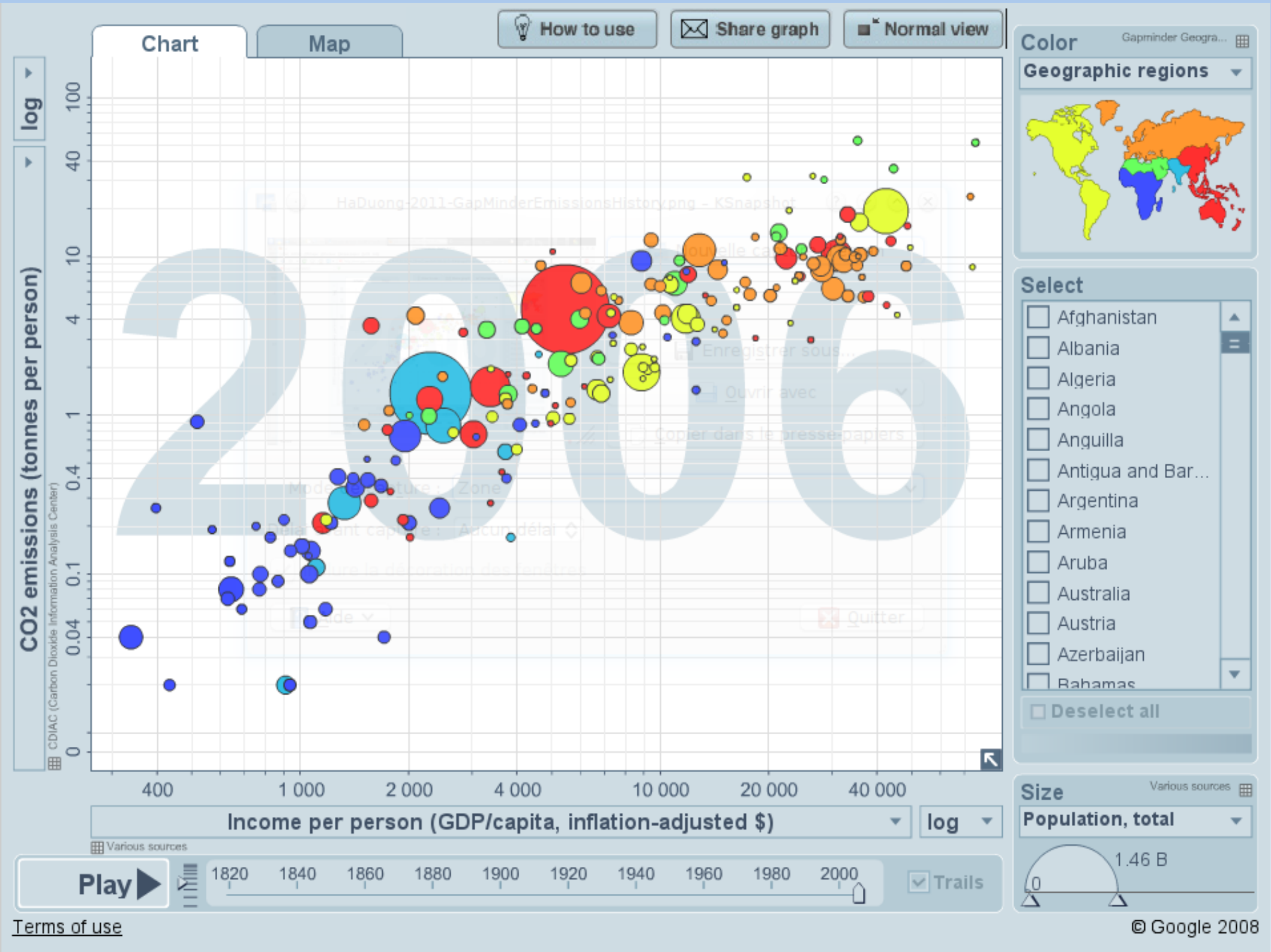
Source : Sokona (2009), Copenhaguen

Global anthropogenic GHG emissions have grown since pre-industrial times, with an increase of 70% between 1970 and 2004. Carbon dioxide is the larger contributor.





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CO2 emissions (tonnes per person)
CDIAC (Carbon Dioxide Information Analysis Center)
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0.1
0.4
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4
10
40
100
2006
400
1 000
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40 000
Income per person (GDP/capita, inflation-adjusted $)
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Various sources
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Various sources
Population, total
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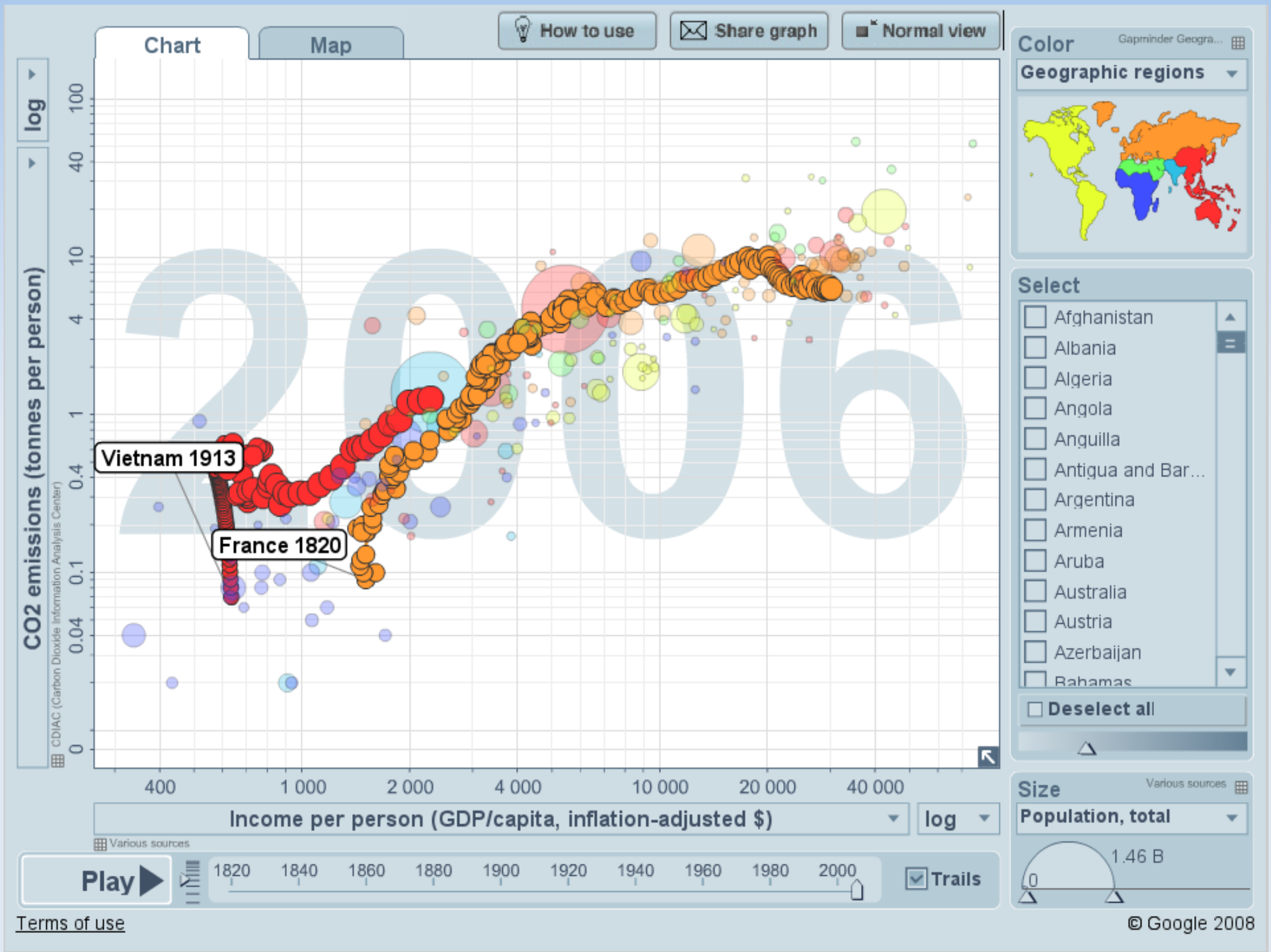
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log
CO2 emissions (tonnes per person)
CDIAC (Carbon Dioxide Information Analysis Center)
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0.1
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1
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100
2006
Vietnam 1913
France 1820
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Conclusions

- +2°C long term global warming, sea level rise, acidification... hard to avoid
- Risk of larger, faster climate change
- Adaptation and mitigation just started