

Climate change Background

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Nordeco



Outline

١. GHG emissions
 - Contributions of countries, sectors, etc.
 ٢. Impacts
 - Developing countries
 - Tipping point?
 ٣. Responses
 - What is needed?
- 

Emissions



The Greenhouse Effect



Some of the solar radiation is reflected by the atmosphere and the Earth's surface

Outgoing solar radiation: 103 Watts per m^2

Some of the infrared radiation passes through the atmosphere and out into space

Outgoing infrared radiations: 240 Watts per m^2

Solar radiation passes through the atmosphere
Incoming solar radiation: 343 Watts per m^2

About half the solar radiation is absorbed by the Earth's surface
Absorption solar radiation: 168 Watts per m^2

Some of the infrared radiation is absorbed and re-emitted by the greenhouse gas molecules.

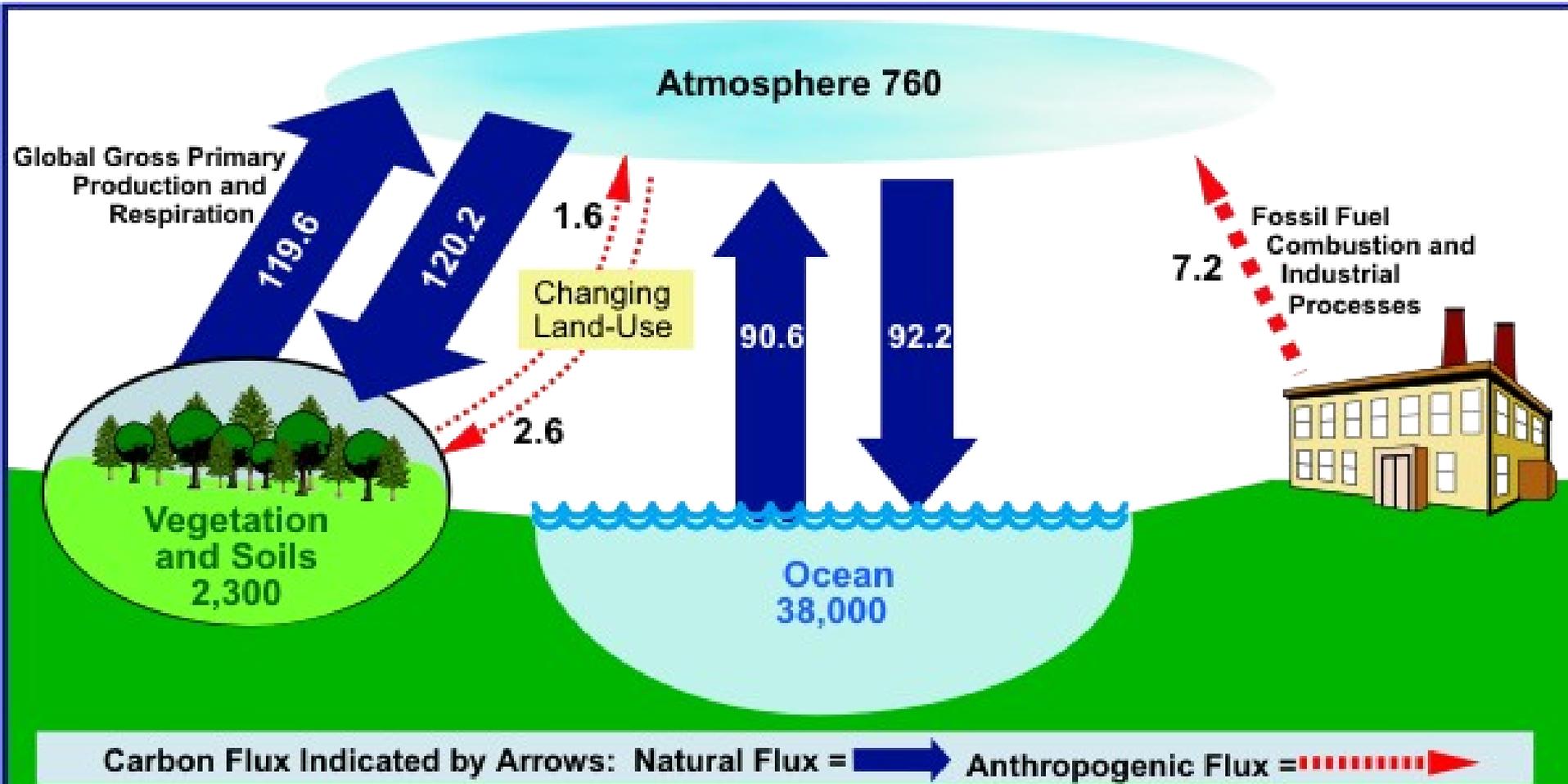
Radiation is converted to heat energy, causing the emission of longwave (infrared) radiation back to the atmosphere

Atmosphere
Greenhouse Gases

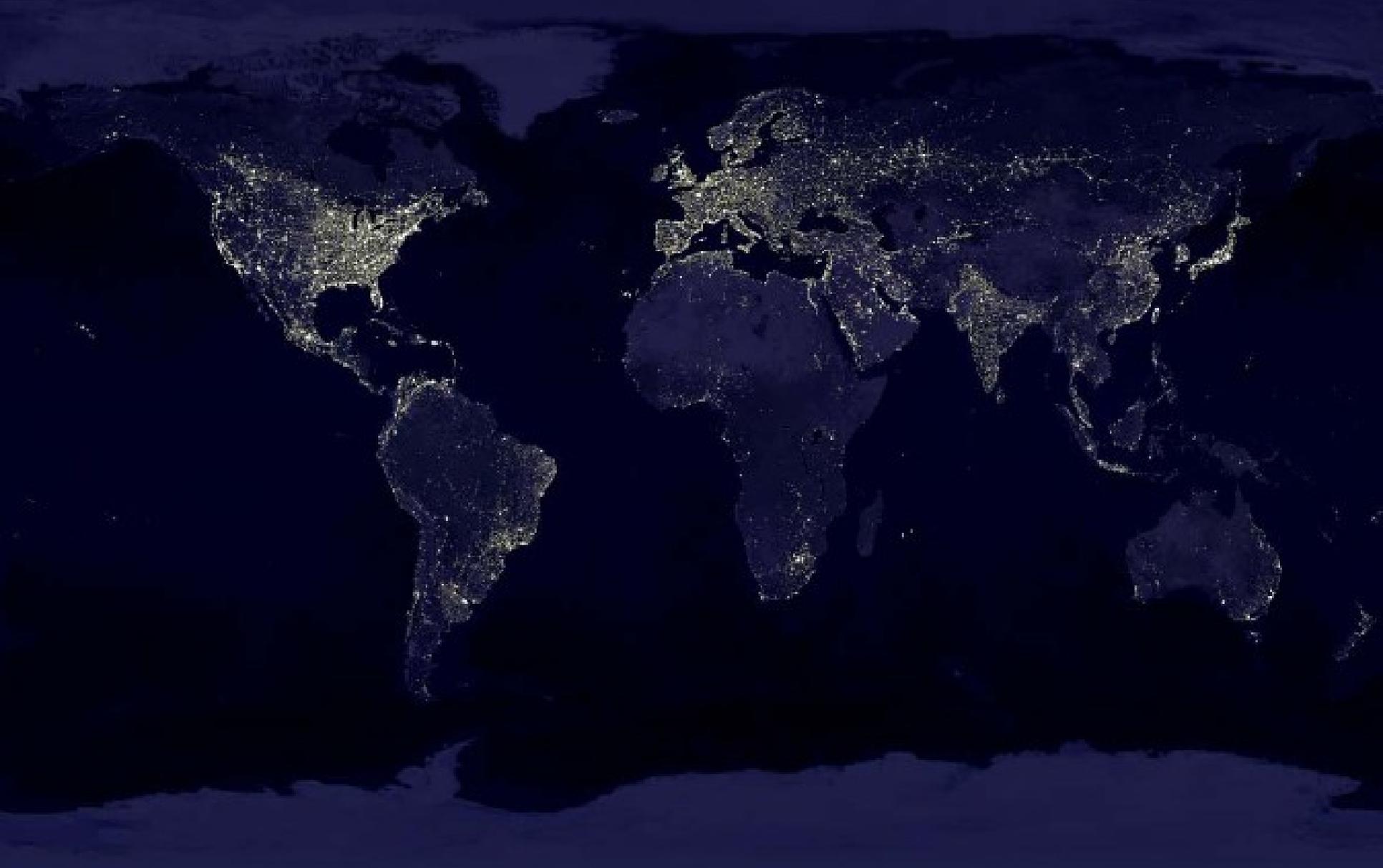
Earth

Upsetting the carbon cycle

GtC & GtC/yr



Source: Intergovernmental Panel on Climate Change, *Climate Change 2007: The Physical Science Basis*, Figure 7.3 and Table 7.1, (U.K., 2007).



Who's fault?

Global anthropogenic GHG emissions

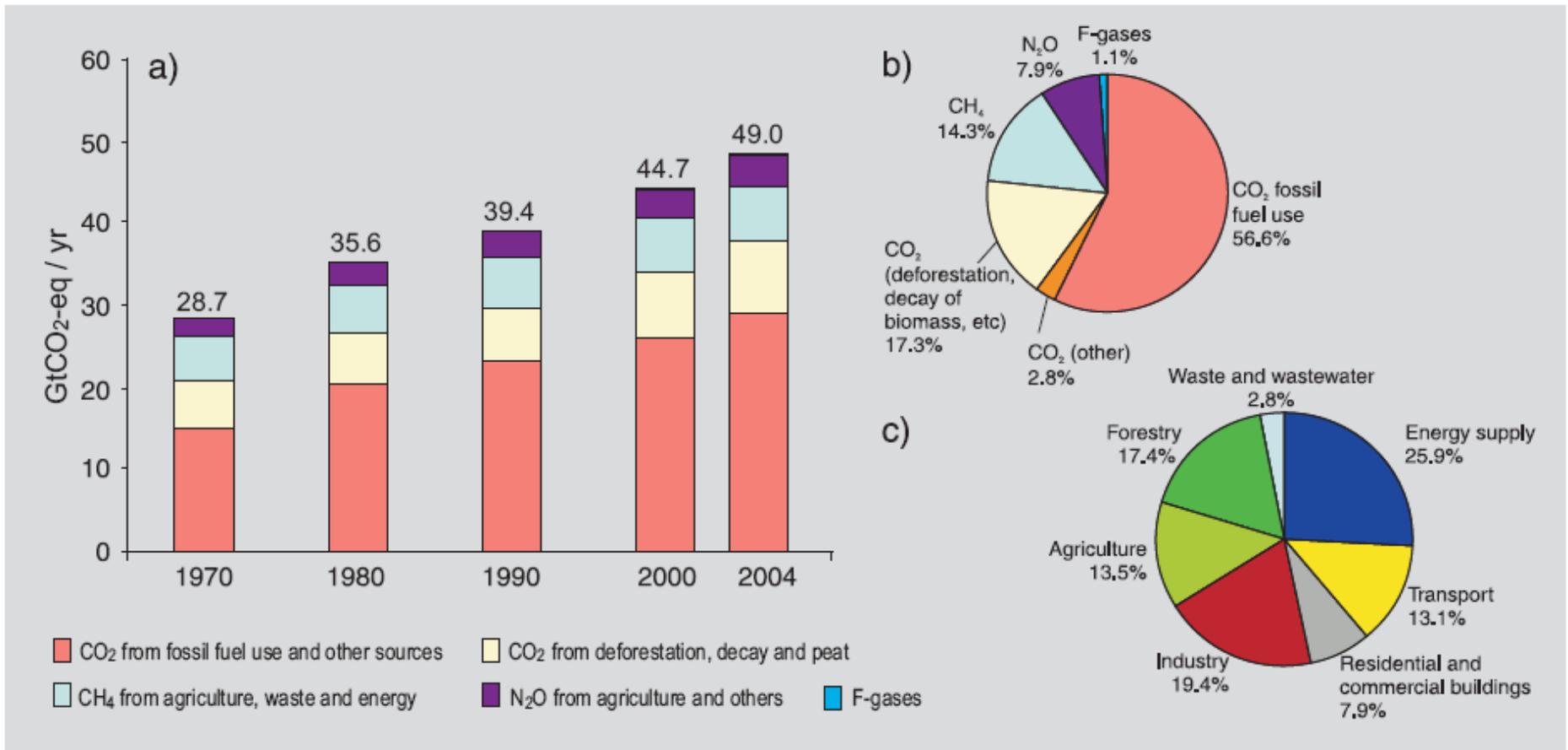
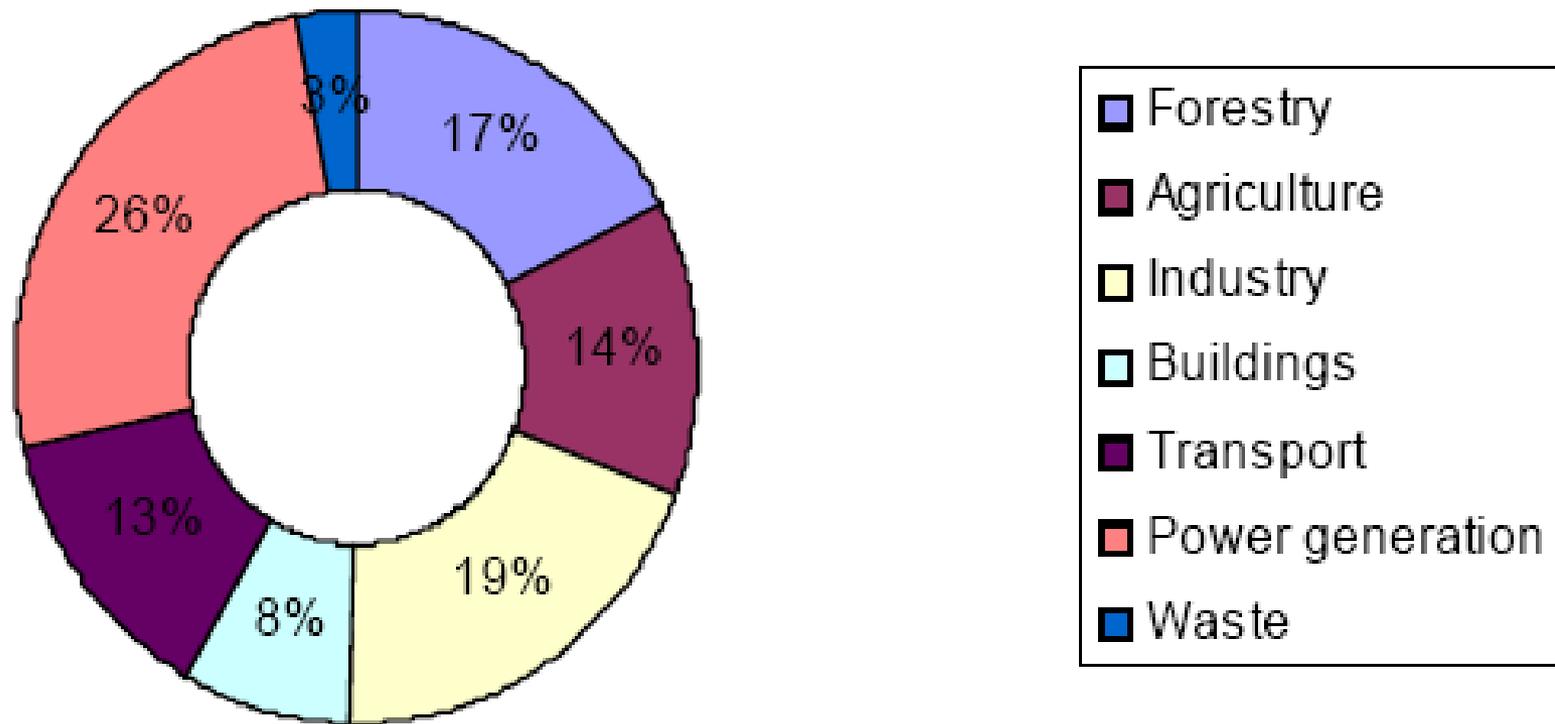


Figure SPM.3. (a) Global annual emissions of anthropogenic GHGs from 1970 to 2004.⁵ (b) Share of different anthropogenic GHGs in total emissions in 2004 in terms of carbon dioxide equivalents (CO₂-eq). (c) Share of different sectors in total anthropogenic GHG emissions in 2004 in terms of CO₂-eq. (Forestry includes deforestation.) {Figure 2.1}

GHG Emmissions by Sector

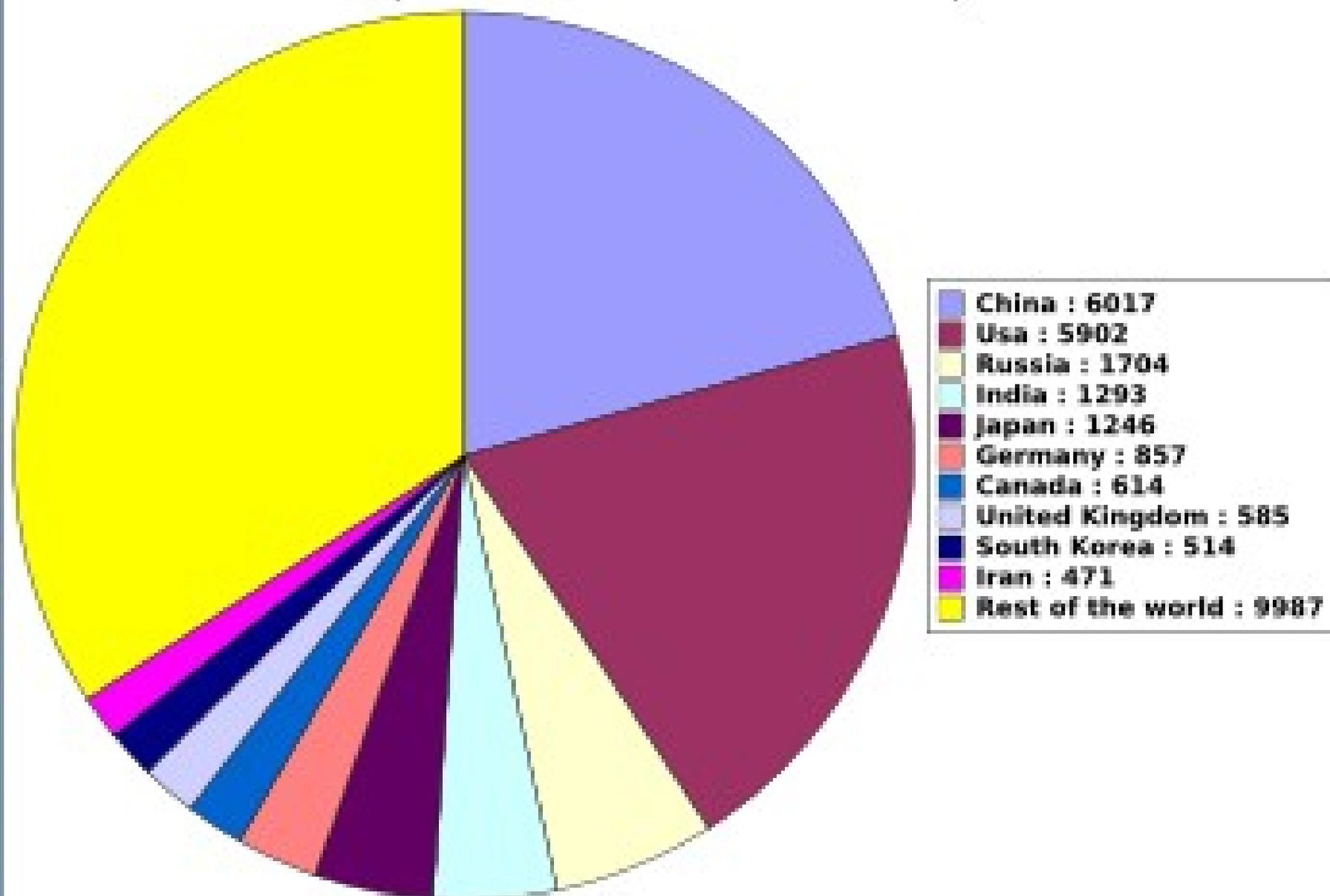


One ton of CO₂

- One ton = 1000kg
 - One cubic meter = 1000liters
 - One mole CO₂ = 44.0g (CO₂ = 12.0g + 32.0g = 44.0g)
 - One ton contains 22730 moles of CO₂ (1,000,000g / 44.0g/mole)
 - One mole is 24.47L (Boyle's law at 25°C and 1 atmosphere pressure)
 - Volume of one ton CO₂ = 22730moles × 24.47L/mole = 556200L = 556.2m³
 - One ton of CO₂ occupies 556.2m³ of volume.

- Height of CO₂ on US land surface
 - US 1997 CO₂ production = 5,456,000,000ton
 - US volume of CO₂ production = 5,456,000,000ton × 556.2m³/ton = 3,035,000,000,000m³
 - US land surface area 9,158,960km²
 - Height of CO₂ on US land surface = CO₂ volume / surface area = 3,035,000,000,000m³ / 9,158,960km² = 33.14cm (about 1.1 feet high)
 - Every year the United States emits a 33.14cm high blanket of carbon dioxide over its land area.

World Carbon Dioxide Emissions from the Consumption and Flaring of Fossil Fuels, 2006
(Million Metric Tons of Carbon Dioxide)

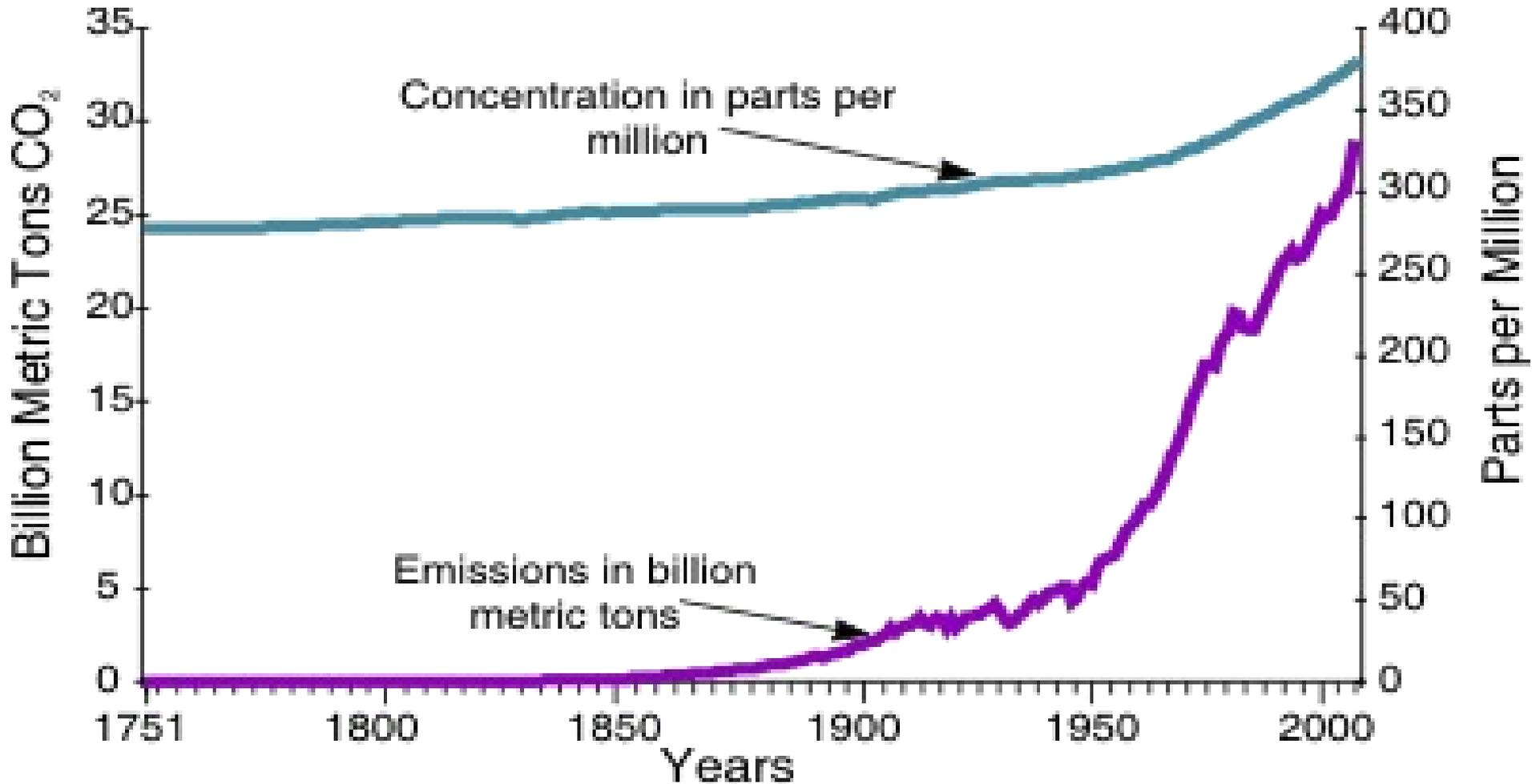


Source : Energy Emission Administration

Impacts

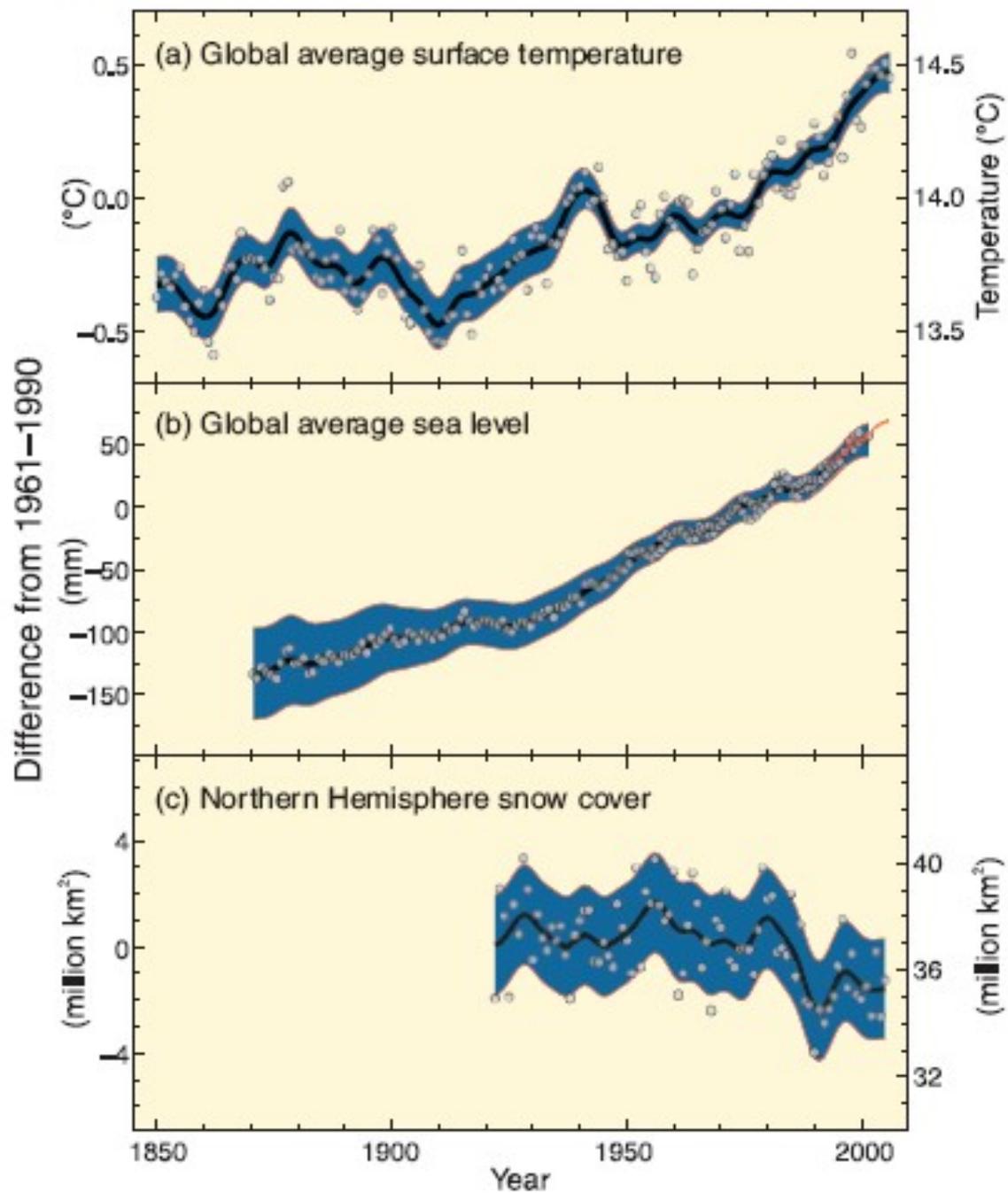


Carbon Dioxide Emissions and Carbon Dioxide Concentrations (1751-2004)

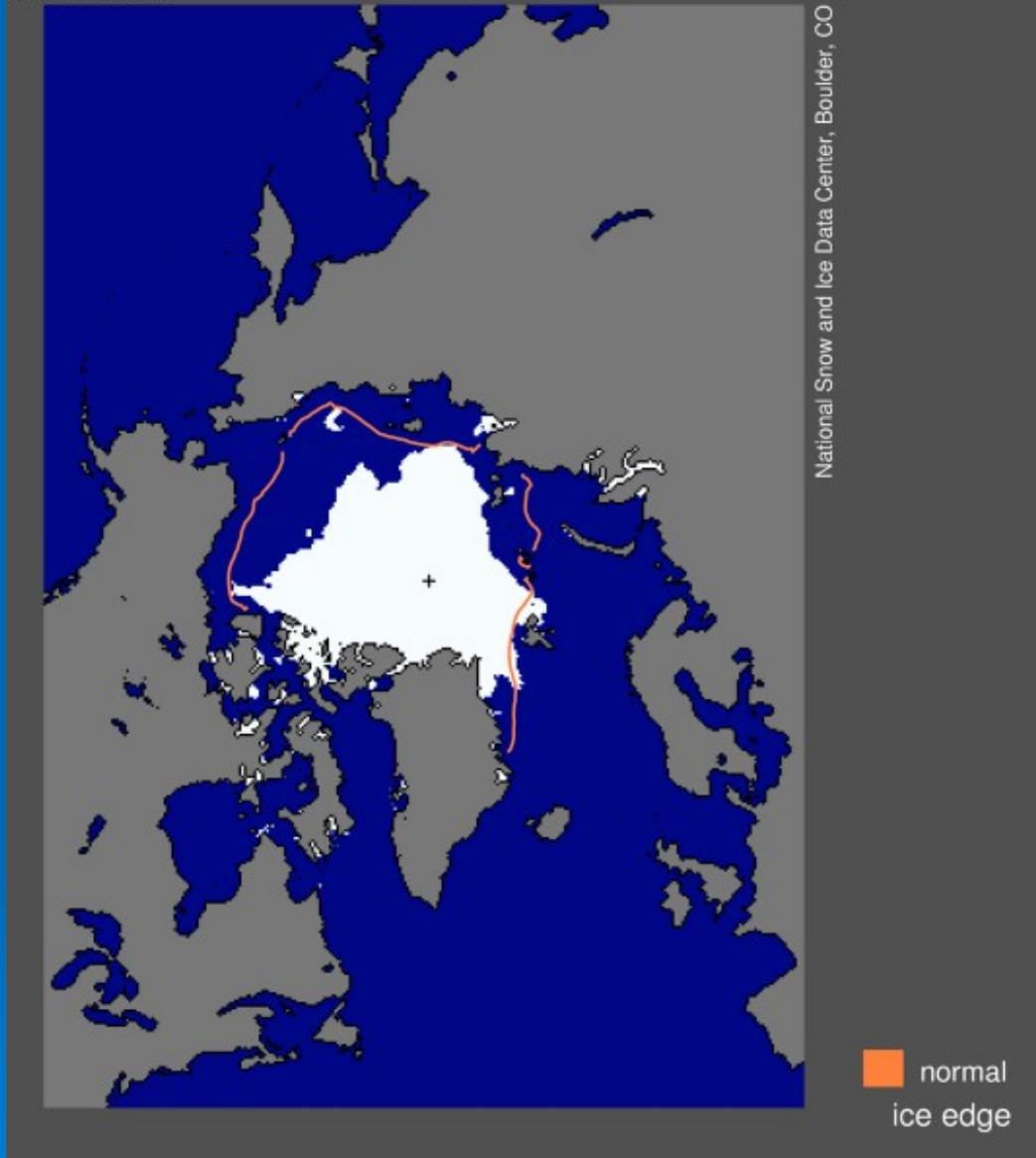


Source: Oak Ridge National Laboratory, Carbon Dioxide Information Analysis Center.

Changes in temperature, sea level and Northern Hemisphere snow cover



Sea Ice Extent
09/12/2008



NASA image showing ice levels (in white) for September 12, 2008, at the Arctic. The orange line indicates the average amount of ice coverage for that day between 1979 and 2000. The black cross is the geographic North Pole.



FUNAFUTI, TUVALU, MAIN ISLAND OF NATION ONLY 4 METERS HIGH IN So.
PACIFIC, THREATENED BY SEA LEVEL RISE. © 2005 GARY BRAASCH



Tipping point?

- Average global temperatures have warmed by close to 1 degree Celsius (almost 1.8 degrees Fahrenheit) since the pre-industrial era. Research shows additional warming of about 1 degree C may be the threshold for dangerous climate change
- <http://www.breathingearth.net/>

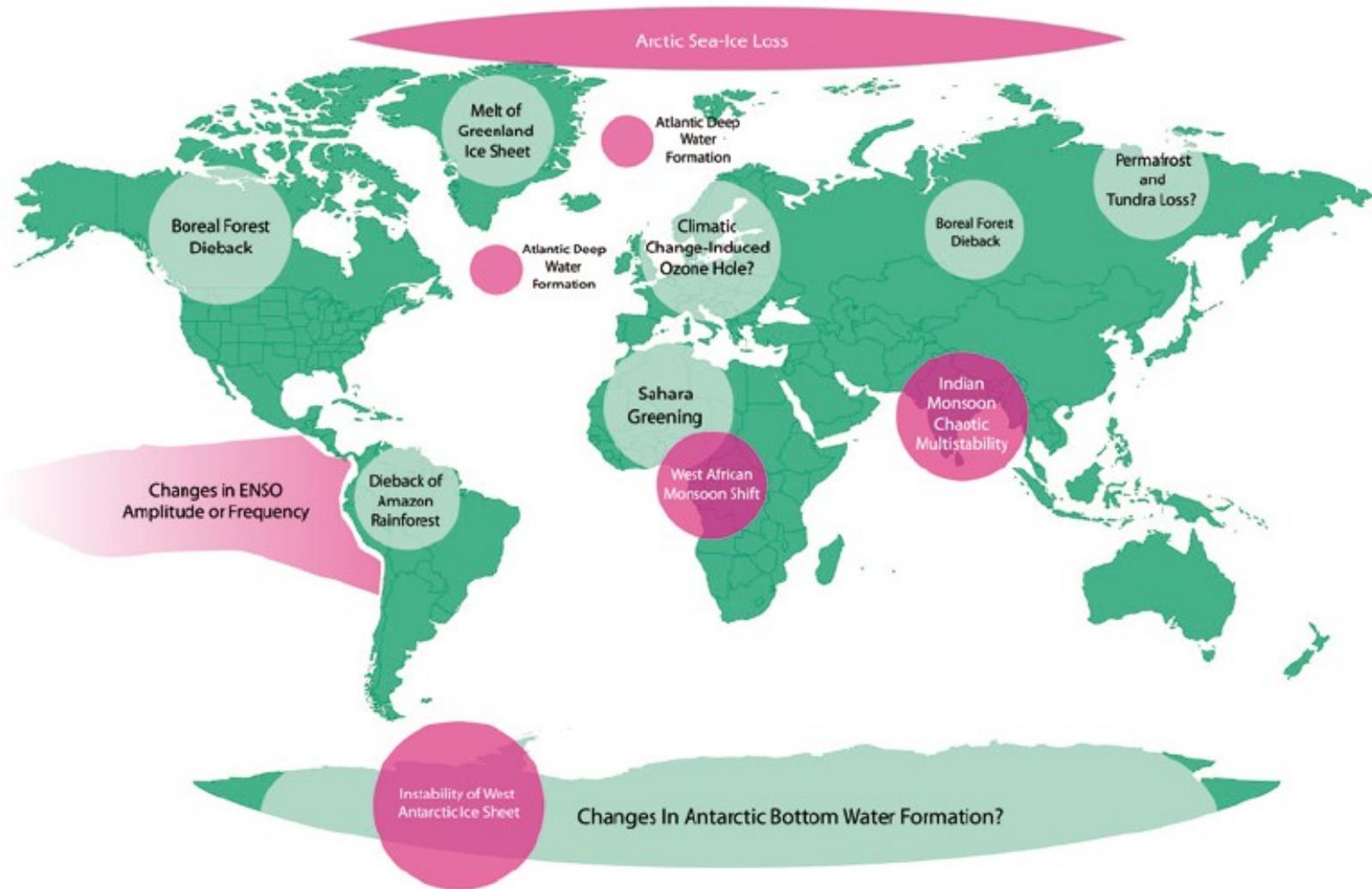


Figure 7
 Map of potential climatic “tipping elements”. Tipping elements are regional-scale features of the climate that could exhibit threshold-type behaviour in response to human-driven climate change – that is, a small amount of climate change at a critical point could trigger an abrupt and/or irreversible shift in the tipping

element. The consequences of such shifts in the tipping element for societies and ecosystems are likely to be severe. Question marks indicate systems whose status as tipping elements is particularly uncertain^{27,30}.

Vulnerability = exposure, sensitivity, adaptive capacity

- 94% of disasters and 97% of natural disaster related deaths occur in developing countries
- Poor dependent on climate sensitive sectors (CC exacerbates inequality)



Adaptive capacity

➤ Depends on:

- Wealth
- Technology
- Education
- Institutions
- Information
- Infrastructure
- "Social capital"



➤ Having vs using adaptive capacity...

Responses



Basis for 2° C limit for global temperature increase?

- Pre-industrial atmospheric CO₂ = 284 ppm; over 380 ppm today; under 450 ppm to stay within 2° C limit
- U.S. Climate Change Science Program modelling shows 450 ppm attainable if the world quickly adapts conservation practices and new green technologies to cut emissions dramatically
- Equivalent to 70% emission cuts, this would stabilize climate change and avoid catastrophe
- Unchecked, emissions will reach about 750 ppm by 2100
- Significant warming no longer avoidable during this century

<http://www.timetolead.eu/>

The Debate

See where the policies are taking us

> EU Commission's proposal

> The response we need

> EU Parliament's opinion

> The latest forecast

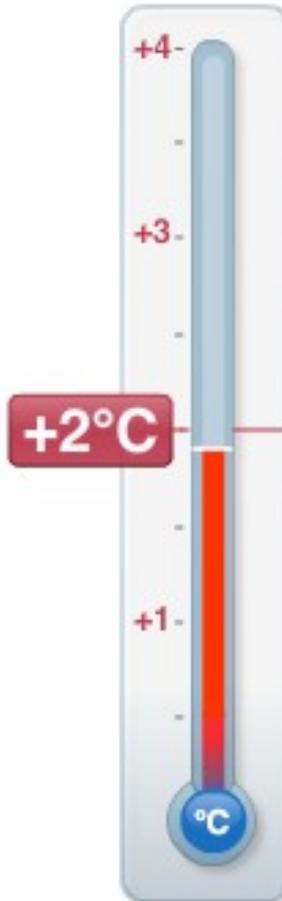
At +2°C...

WATER

FOOD

ECOSYSTEMS

Around 1 billion people will be subjected to scarcer water availability and increasing drought.



The response we need

At least 30% cuts needed in European emissions



Forecast rise: < 2°C

To have a chance of keeping global warming below 2°C, developed countries must make emission cuts of at least 30% by 2020, and developing countries must also tackle their emissions growth.[1]

Europe must show leadership by making at least a 30% cut in its own emissions by 2020, with yearly cuts in EU countries required by law.

But because developed countries have produced the emissions which have caused climate change, Europe must show real leadership by also supporting developing



Impacts from 450 ppm CO₂ in atmosphere

Source: National Center for Atmospheric Research (NCAR), USA

- Sea level rise: 14 centimeters (vs 22) as water temperatures rise. Significant additional sea level rise expected from melting ice sheets and glaciers.
- Arctic ice: would shrink by about a quarter in volume in summer and stabilize by 2100 (vs shrinking at least three-quarters and continuing to melt). Some research suggests summertime ice will disappear altogether this century
- Arctic warming would be reduced by almost half, helping preserve fisheries and populations of sea birds and Arctic mammals in such regions as the northern Bering Sea.
- Regional changes in precipitation could be halved in some areas
- The climate system would stabilize by about 2100, instead of continuing to warm.

Keys to success

- Awareness – Global consciousness; One world (Science, technology, politics)
- Vision and political leadership (financial and political commitment, global framework)
- Correct economic instruments (Green GDP — The Real Chinese Revolution*?)
- Fairness and opportunity

*Study by Shanxi's Academy of Social Sciences: the officially announced 2002 GDP of 134 billion RMB would decrease 44% — if negative factors such as coal resources depleted, land resources exploited, water used and environmental pollution were accounted for. The 11.7% growth reported for that year would decrease to less than 1%.

UK example

- Electrify transport (more energy-efficient)
- Solar-thermal heating, and electrify most heating of air and water in buildings using heat pumps, which are four times more efficient than ordinary electrical heaters.
- Green electricity from:
 - Our own renewables
 - from other countries' renewables – “solar power in deserts has the technical potential to provide us, them, and everyone with 125 kWh per day per person.”

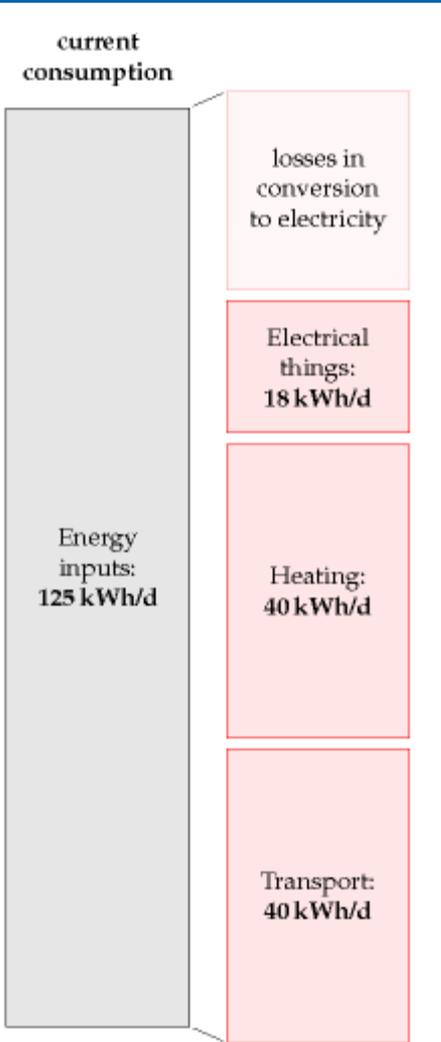
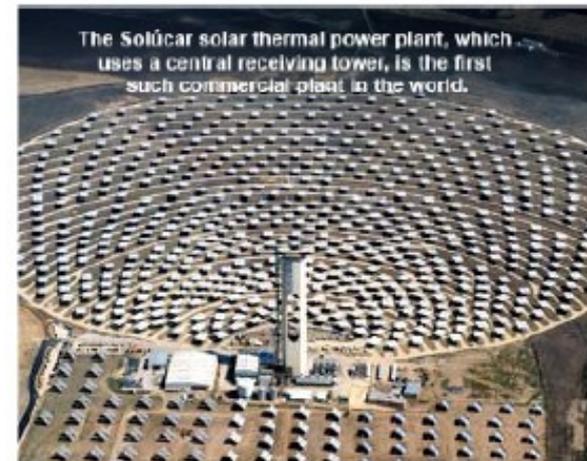
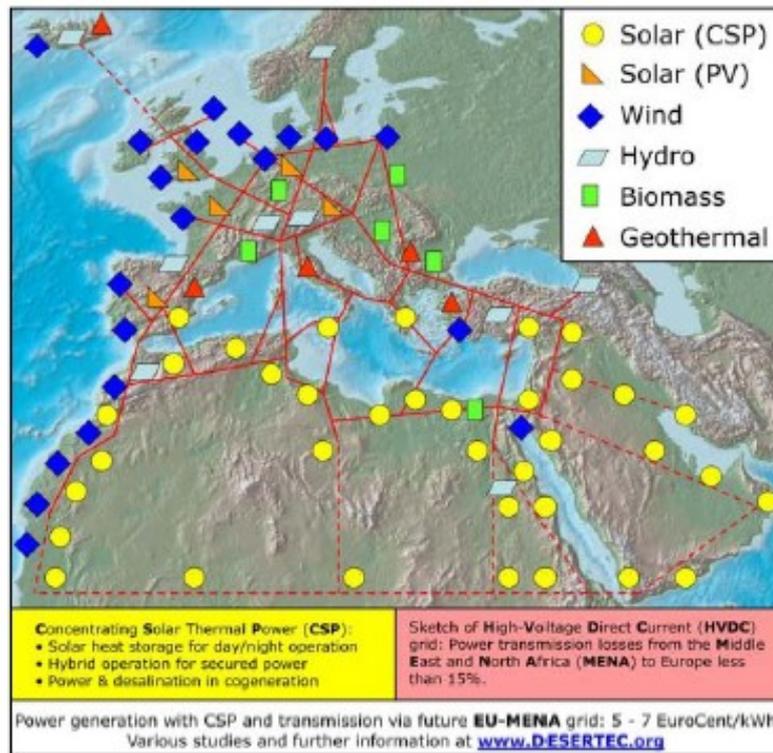


Figure 19.3. Current consumption in “cartoon-Britain 2008.”



MCP - Concentrateur de puissance solaire

DESERTEC, une nouvelle voie pour le solaire, un projet qui nous montre comment envisager plusieurs solutions interconnectées entre elles



Erik Rasmussen

Founder, Copenhagen Climate Council;
CEO and Editor-in-Chief, Monday MorningAs



As founder and CEO of Scandinavia's largest think tank, Monday Morning, Erik Rasmussen is a leading figure in the public debate and media in the Northern countries. This is partly due to the fact that Monday Morning has its own weekly media, Monday Morning Weekly, an intellectual journal directed at decision makers across the political world, in business life and in knowledge institutions. Concurrently, Monday Morning has positioned itself internationally with the establishment of Monday Morning Weekly in Norway and projects in Sweden and other European countries.

Katherine Richardson Christensen

Vice Dean, Professor in Biological Oceanography

➤ <http://climatecongress.ku.dk/>



**“Solving the climate problem is not a bar on growth.
It's the only path to growth that we can afford.”**

Danish Minister of Climate, Connie Hedegaard



Web links

- Scientific community:
 - <http://www.ipcc.ch/ipccreports/assessments-reports.htm>
 - <http://climatecongress.ku.dk/>
 - <http://www.eea.europa.eu/themes/climate>
- UN system gateway:
 - <http://www.un.org/climatechange/index.shtml>
- Media initiatives:
 - <http://en.cop15.dk/climate+consortium/news/view+news?newsid=807>
 - <http://www.copenhagenclimatecouncil.com>
 - <http://www.climatemediapartnership.org/>
 - <http://www.earthjournalism.net/>
 - <http://www.theglobalist.com/StoryId.aspx?StoryId=4156>
 - <http://www.wwviews.org/> (Danish government initiative)
 - <http://www.dailyclimate.org/>
 - <http://climatedebatedaily.com/>
 - <http://en.cop15.dk/blogs/climate+thinkers+blog?gclid=CJuCrfP125oCFVOK3god41cfdg>
- Development perspective:
 - <http://www.essp.org/index.php?id=76> (Climate Change, Agriculture and Food Security, CGIAR)
 - <http://earthtrends.wri.org/>
 - <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTCC/0,,me>
- Practical home guidance
 - <http://www.energysavingtrust.org.uk/>
- Images
 - <http://www.worldviewofglobalwarming.org/>