WMO

Climate Change: Main Conclusions from the IPCC Fourth Assessment Report

UNEP

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New Palace Theatre, Potsdam
9th October 2007

Contents

Understanding climate change

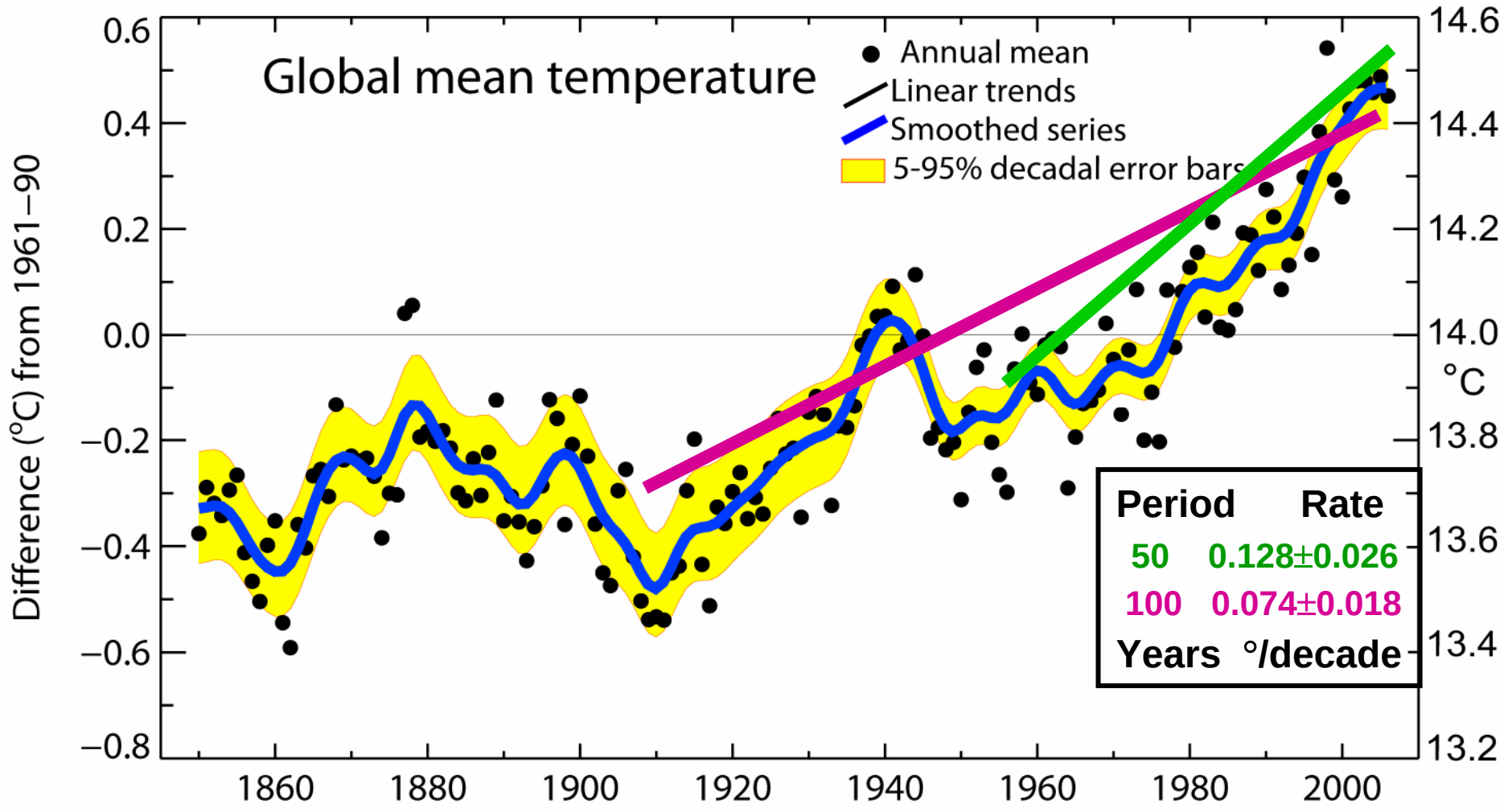
Palaeoclimatic perspective

- Last time the polar regions were significantly warmer than present for an extended period (about 125,000 years ago), reductions in polar ice volume led to 4 to 6 m of sea level rise

- Warmth of the last half century is unusual in at least the previous 1,300 years

Understanding climate change

Evolution of global mean temperature



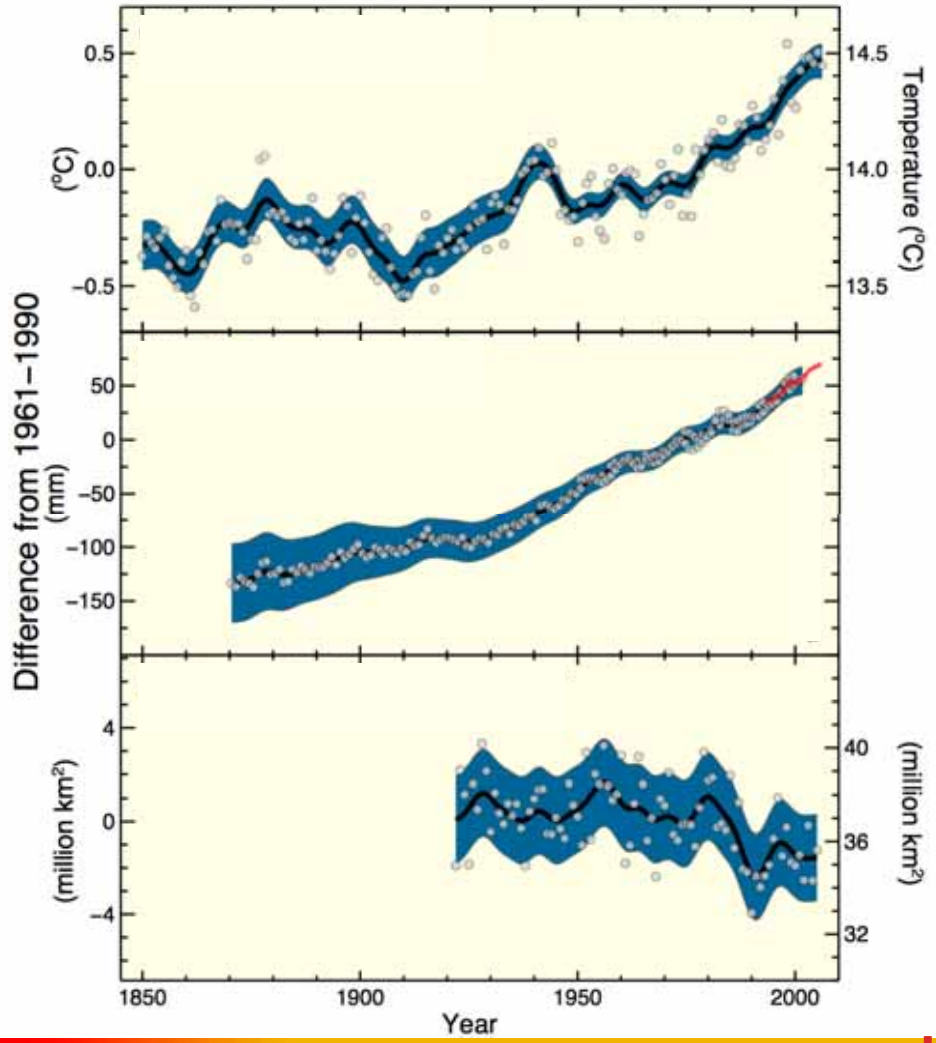
Understanding climate change

Global average temperature

Global average sea level

Northern hemisphere snow cover

Changes in temperature, sea level and northern hemisphere snow cover

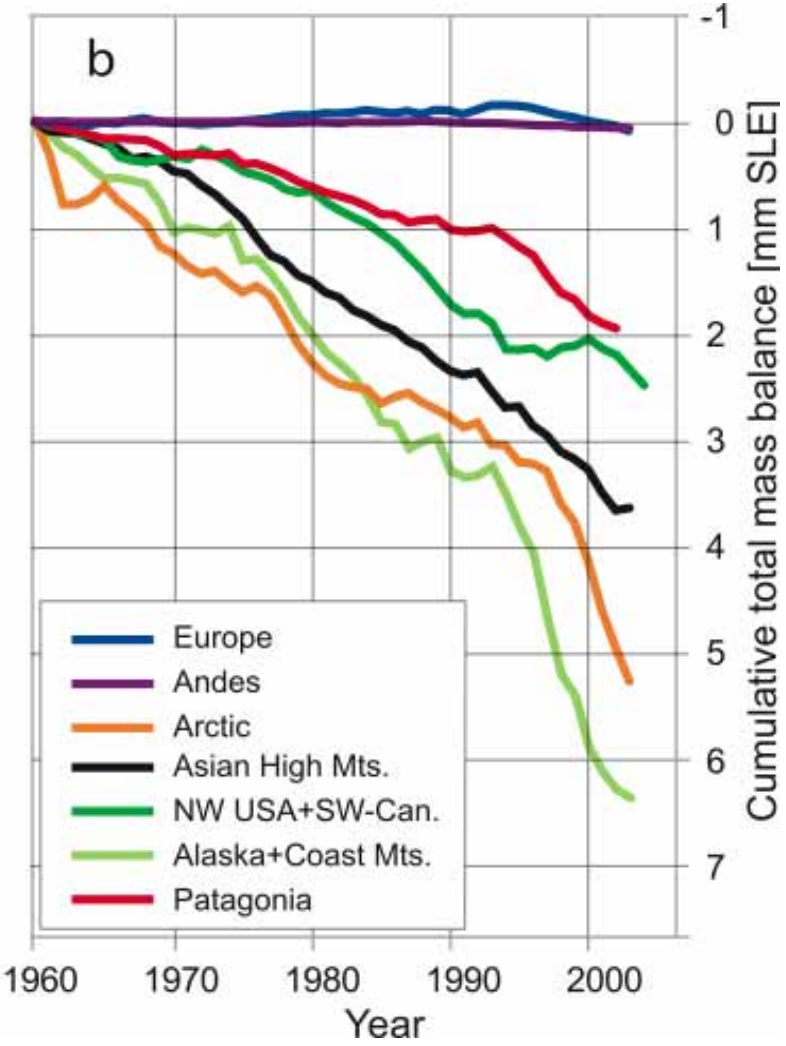


Understanding climate change

During the 20th century, glaciers and ice caps have experienced **widespread mass losses**

New data confirm that losses from the ice sheets have contributed to sea **level rise** over 1993 to 2003

Cumulative balance of glacier mass in some regions



Understanding climate change

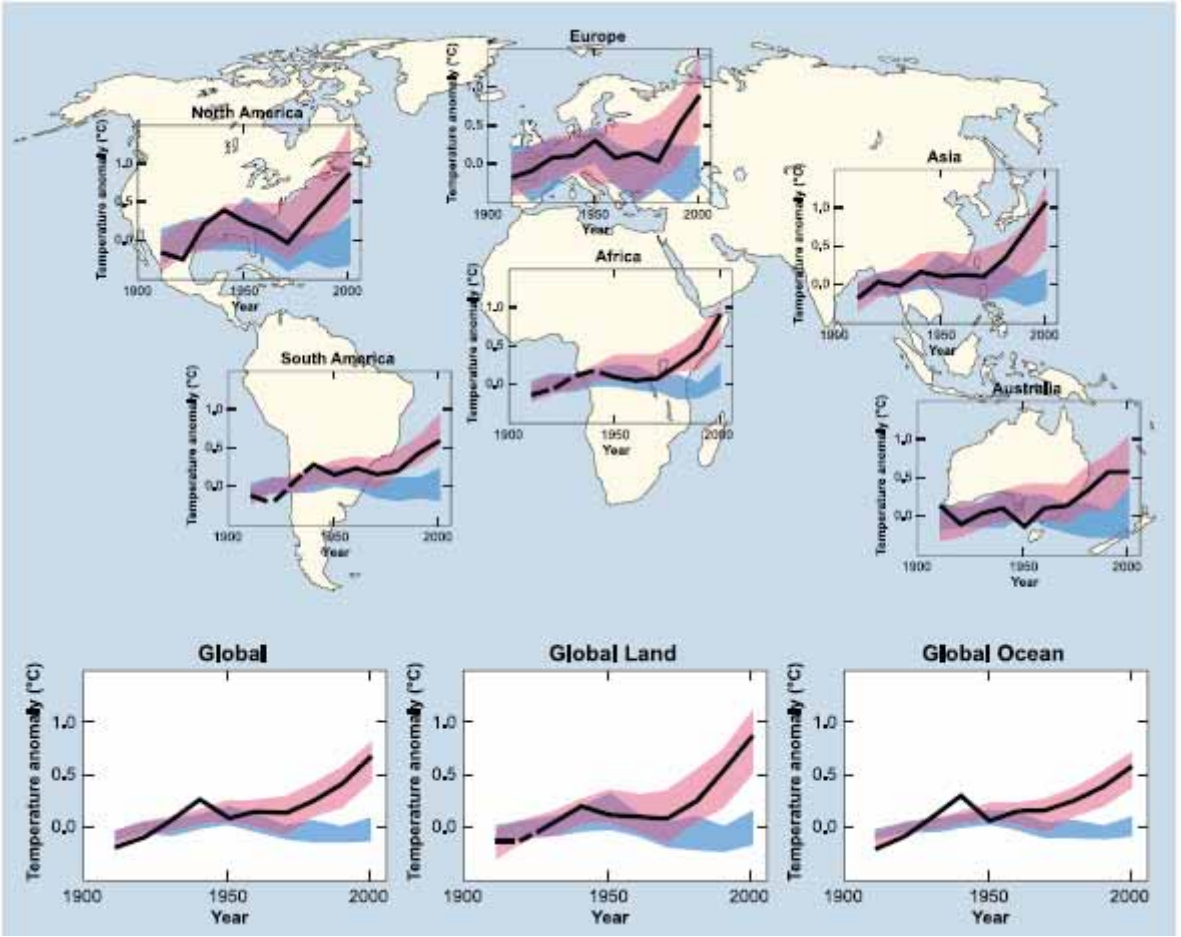
Observed impacts of climate change

- Significant changes in precipitation
- More intense, longer droughts
- Widespread change in extreme temperature
- Increasing intense cyclone activity

Understanding climate change

There is now stronger evidence of **human influence** on climate

Global and continental temperature change

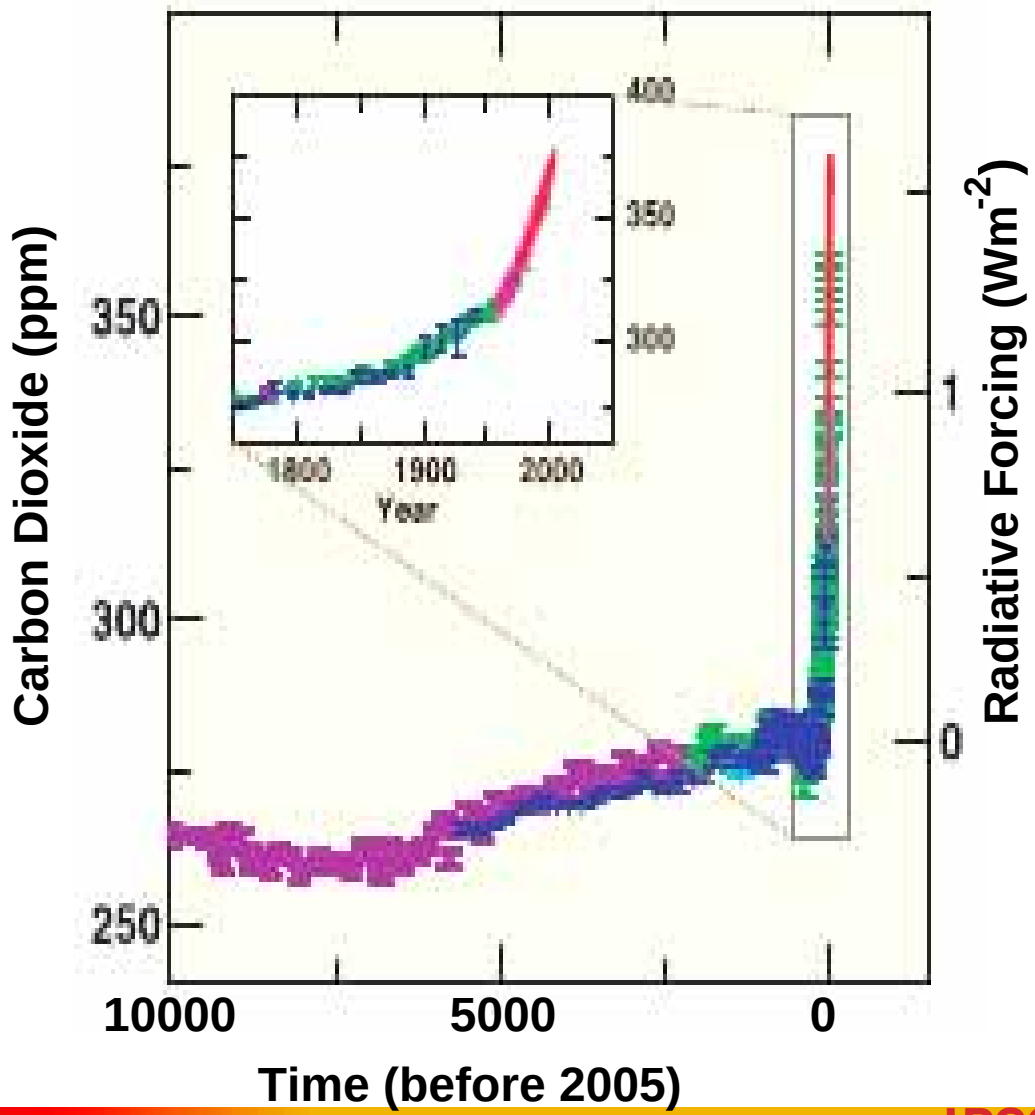


Understanding climate change

Global atmospheric concentrations of greenhouse gases **increased markedly as result of human activities**

In 2005 concentration of CO_2 **exceeded by far the natural range** over the last 650,000 years

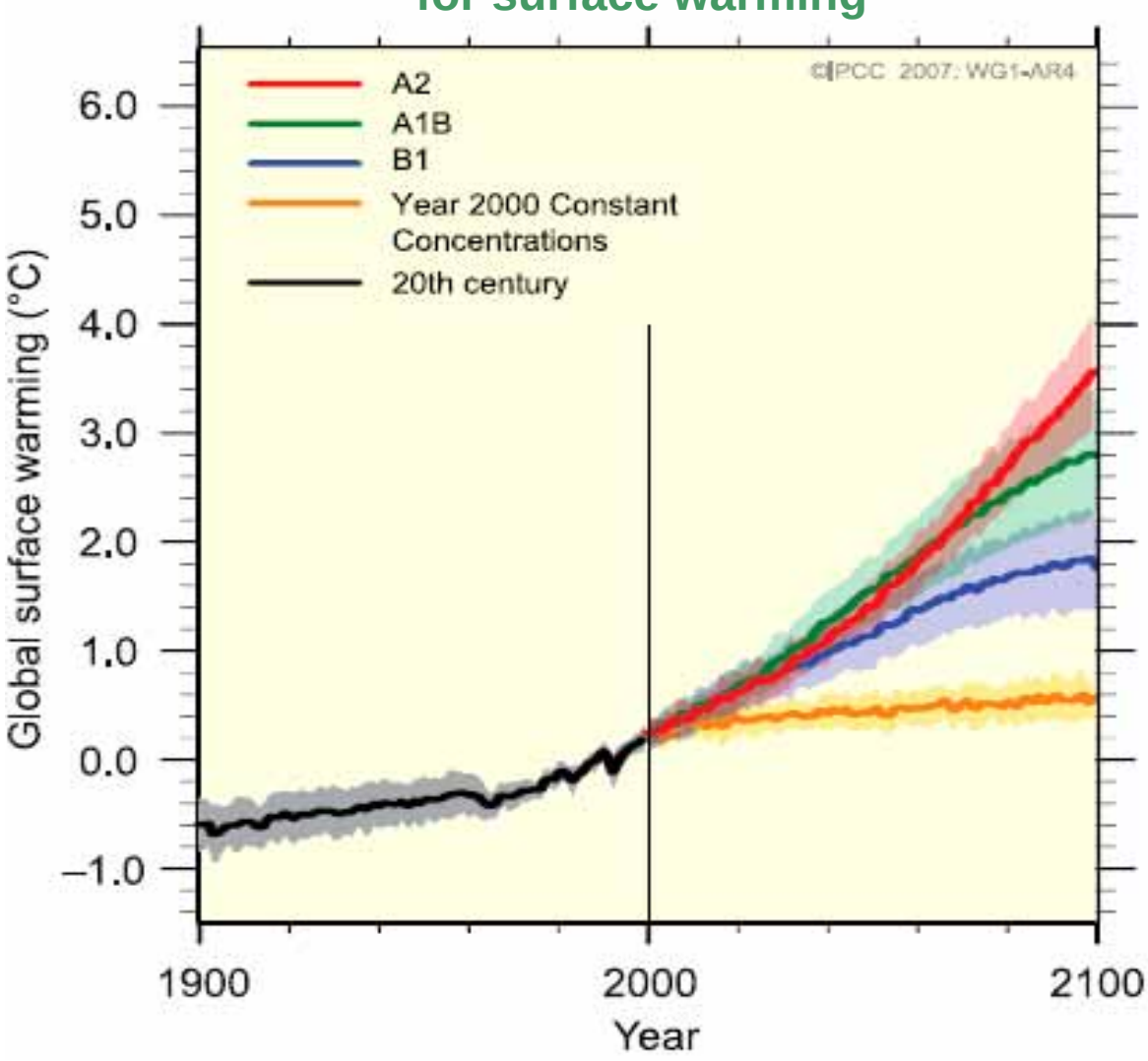
Changes in CO_2 from ice core and modern data



Understanding climate change

Continued emissions would lead to further warming of **1.8ºC to 4ºC** over the 21st century, depending on different scenarios

Multi-model averages and assessed ranges for surface warming



Expected impacts of climate change

Effects on poor regions

- **Malnutrition** further exacerbated by reduced length of growing season in Sahelian region of Africa. In some countries, yields from rain-fed agriculture could be reduced by up to 50% by 2020

- **Increased water stress** imposed on 75 to 250 million people in 2020 in Africa

- **Food insecurity and loss of livelihood** further exacerbated by loss of cultivated land and nursery areas for fisheries by inundation and coastal erosion in low-lying areas of tropical Asia

Expected impacts of climate change

Coastal settlements most at risk

Expected impacts of climate change

Impacts in Europe

- **Mountainous areas**: glacier retreat, reduced snow cover and winter tourism, extensive species losses
- **Southern Europe**: worsened climate conditions (high temperatures and drought), reduced water availability, crop productivity and summer tourism
- **Central and Eastern Europe**: higher water stress, increased health risks due to heat waves, increased frequency of peatland fires
- **Northern Europe**: more frequent winter floods, endangered ecosystems and increasing ground instability and some benefits such as reduced demand for heating

Expected impacts of climate change

Impacts on natural ecosystems

- Climate change will reduce biodiversity and perturb functioning of most ecosystems, and **compromise the services they currently provide**
- 20-30% of plant and animal species at **risk of extinction** if increases in global average temperature exceed 1.5-2.5°C
- **Some ecosystems** are highly vulnerable:
  - Coral reefs, marine shell organisms
  - Tundra, boreal forests, mountain and Mediterranean regions

Implications for emerging economies

Key vulnerabilities in Asia

- **Agriculture and food supply**
  - Decrease in crop yields up to 30% in Central and South Asia by 2050
- **Water management**
  - Decrease of freshwater availability affecting more than a billion people by 2050
- **Human health**
  - Endemic morbidity and mortality due to diarrhoeal disease and exacerbation of abundance / toxicity of cholera in South Asia
- **Coastal areas**
  - Coastal erosion and inundation in heavily-populated megadeltas

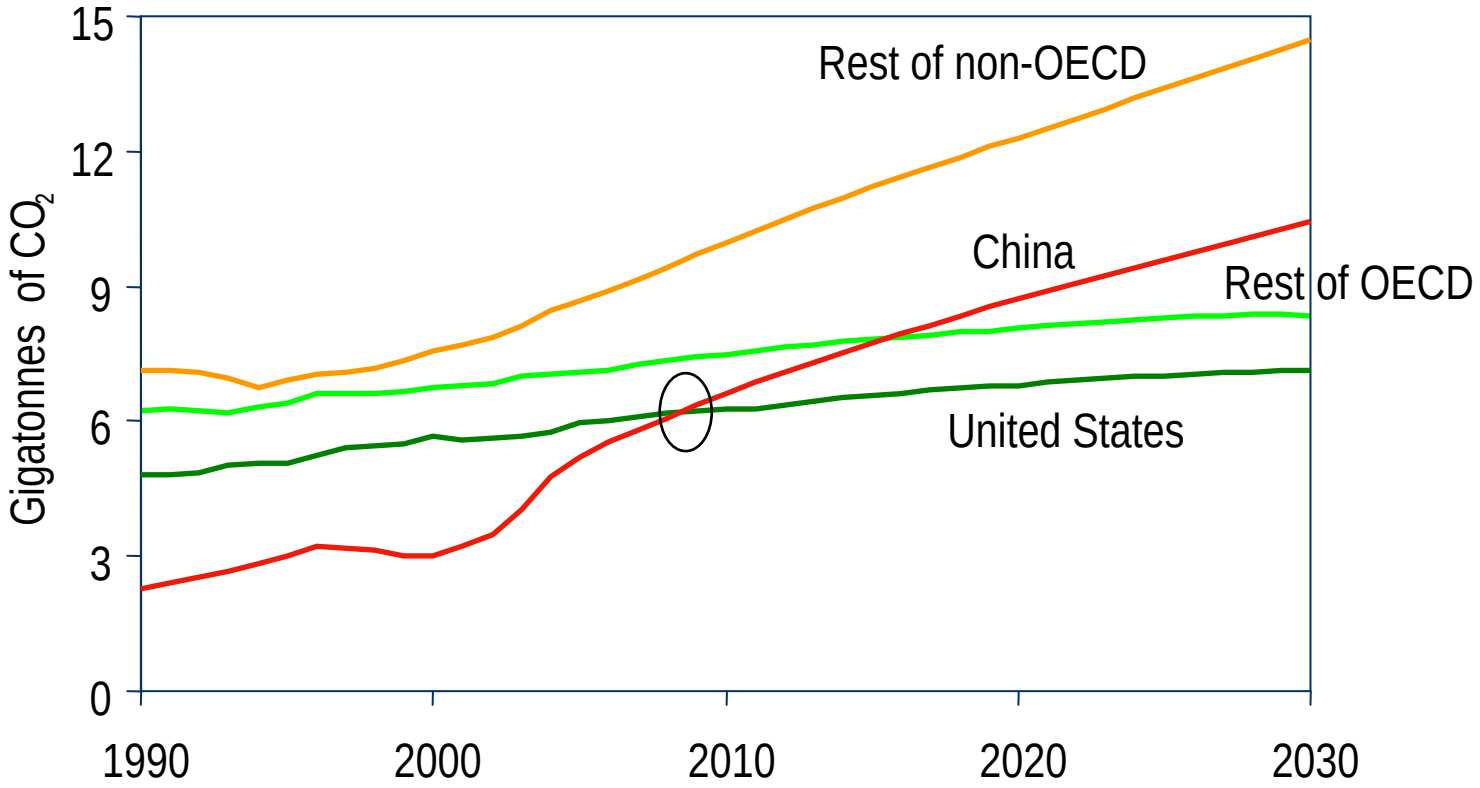
Implications for emerging economies

Adaptation strategies

- **Enhancing social capital and reducing the vulnerability of developing countries**
  - Increasing income levels, education and technical skills
  - Promoting good governance including responsible policy and decision making and communities empowerment
- **Increasing agriculture adaptive capacity**
  - Modifying farming practices
  - Investing in new technologies and infrastructure
- **Preventing water scarcity**
  - Restoration and re-establishment of vegetation
  - Water saving schemes for irrigation

Implications for emerging economies

Energy-Related CO_2 emissions by Region
(WEO Reference Scenario)



China overtook the US as the world's biggest emitter in 2007, though its per capita emissions reach just 60% of those of the OECD in 2030

Source: WEO 2006

Mitigation urgently needed

- **Adaptation to climate change is necessary** to address impacts resulting from the warming which is already unavoidable due to past emissions

- However:
  - Adaptation alone cannot cope with all the projected impacts of climate change
  - The costs of adaptation and impacts will increase as global temperatures increase

Need for a mix of strategies including adaptation and mitigation of GHG emissions

Mitigation urgently needed

UN Framework Convention on Climate Change, Article 2

"The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, **stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system**"

Mitigation urgently needed

Defining mitigation targets

- **Climate system inertia**: even if GHG concentrations were held constant, further warming trend would occur in the next two decades at a rate of about 0.1°C per decade

- **Energy system inertia**: delayed emission reductions lead to investments that lock in more emission intensive infrastructure and development pathways

Choices about the scale and timing of GHG mitigation involve balancing costs of emission reductions against risks of delay

Mitigation urgently needed

Characteristics of stabilization scenarios

Stabilization level (ppm CO_2-eq)	Global mean temp. increase at equilibrium (°C)	Year CO_2 needs to peak	Year CO_2 emissions back at 2000 level	Reduction in 2050 CO_2 emissions compared to 2000
445 – 490	**2.0 – 2.4**	**2000 - 2015**	**2000- 2030**	**-85 to -50**
490 – 535	2.4 – 2.8	2000 - 2020	2000- 2040	-60 to -30
535 – 590	2.8 – 3.2	2010 - 2030	2020- 2060	-30 to +5
590 – 710	3.2 – 4.0	2020 - 2060	2050- 2100	+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

Mitigation efforts over the next two to three decades will have a large impact on opportunities to achieve lower stabilization levels

Mitigation urgently needed

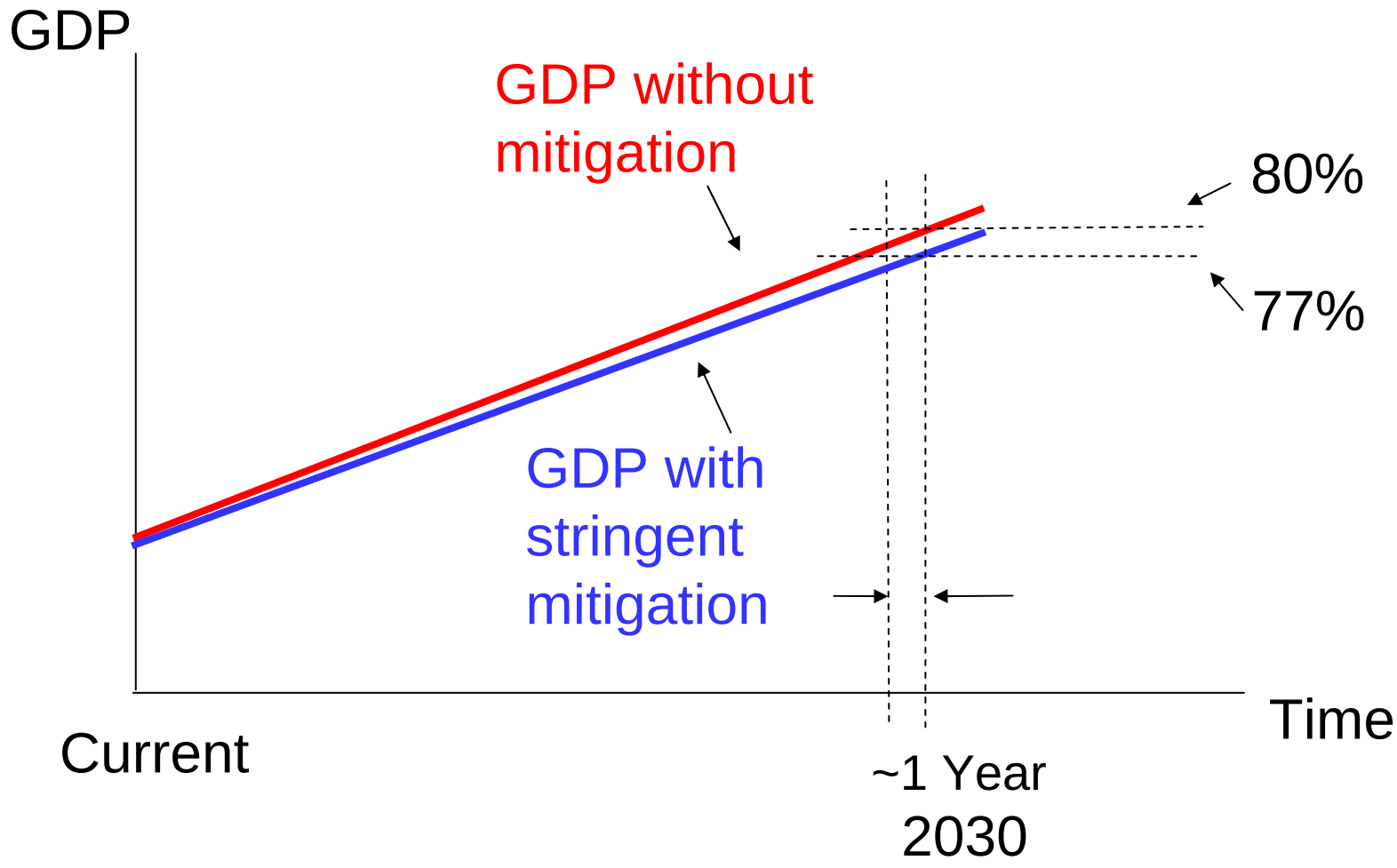
Estimated global macro-economic costs in 2030 for least-cost trajectories towards different long-term stabilization levels

Trajectories towards stabilization levels (ppm CO_2-eq)	Median GDP reduction (%)	Range of GDP reduction (%)	Reduction of average annual GDP growth rates (percentage points)
590-710	0.2	**-0.6 – 1.2**	< 0.06
535-590	0.6	0.2 – 2.5	<0.1
445-535	Not available	**< 3**	< 0.12

Mitigation measures would induce 0.6% gain to 3% decrease of GDP in 2030

Mitigation urgently needed

Illustration of costs numbers



Key technologies and measures

Key mitigation technologies currently available

Energy Supply

Efficiency; fuel switching; renewable (hydropower, solar, wind, geothermal and bioenergy); combined heat and power; nuclear power; early applications of CO2 capture and storage

Transport

More fuel efficient vehicles; hybrid vehicles; biofuels; modal shifts from road transport to rail and public transport systems; cycling, walking; land-use planning

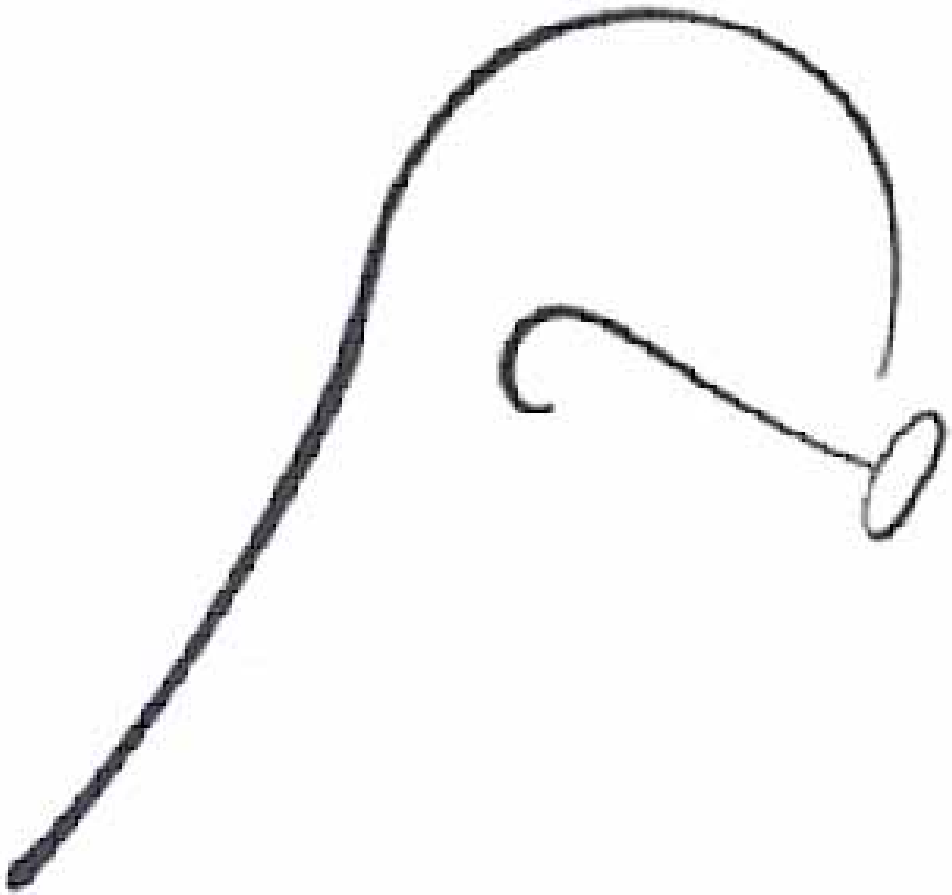
Buildings

Efficient lighting; efficient appliances and aircodition; improved insulation ; solar heating and cooling; alternatives for fluorinated gases in insulation and appliances

Key technologies and measures

Key policies and measures

- Appropriate incentives for **development of technologies**
- Effective **carbon price** signal
- Appropriate **energy infrastructure** investments
- Changes in **lifestyle and behavior**



A technological society has two choices. First it can wait until catastrophic failures expose systemic deficiencies, distortion and self-deceptions…

Secondly, a culture can provide social checks and balances to correct for systemic distortion prior to catastrophic failures.