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Key findings from the IPCC Fourth Assessment Report

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The process

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+2500 scientific expert reviewers

800 contributing authors

450 lead authors from

+130 countries

The Fourth Assessment Report

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Progress in knowledge

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Progress in knowledge included in the AR4 is based on:

- New and more comprehensive data
- More sophisticated analyses of data
- Improvements in understanding of processes

‘Climate change is unequivocal’

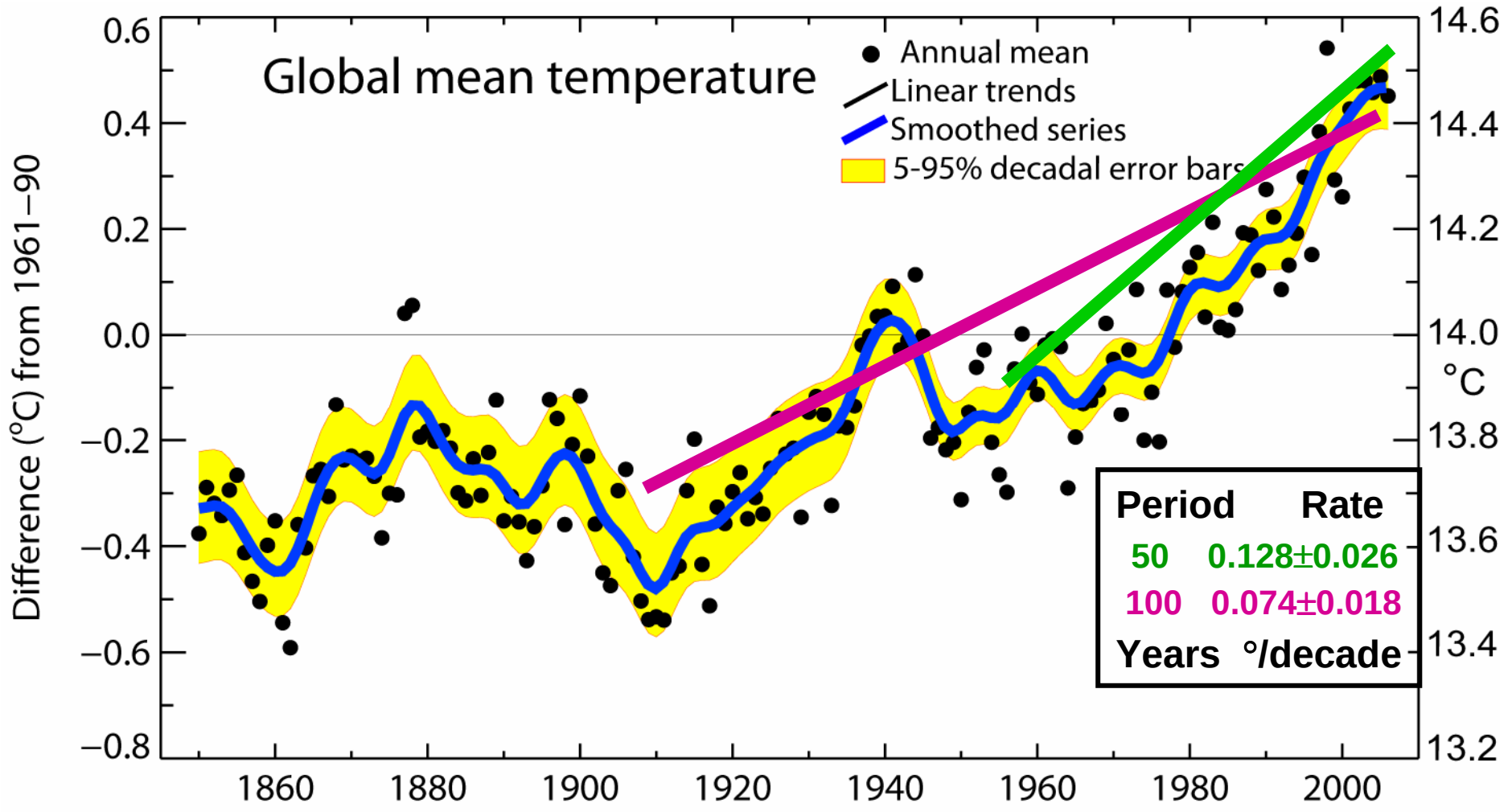
Paleoclimatic perspective

- 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**

‘Climate change is unequivocal’

Evolution of global mean temperature

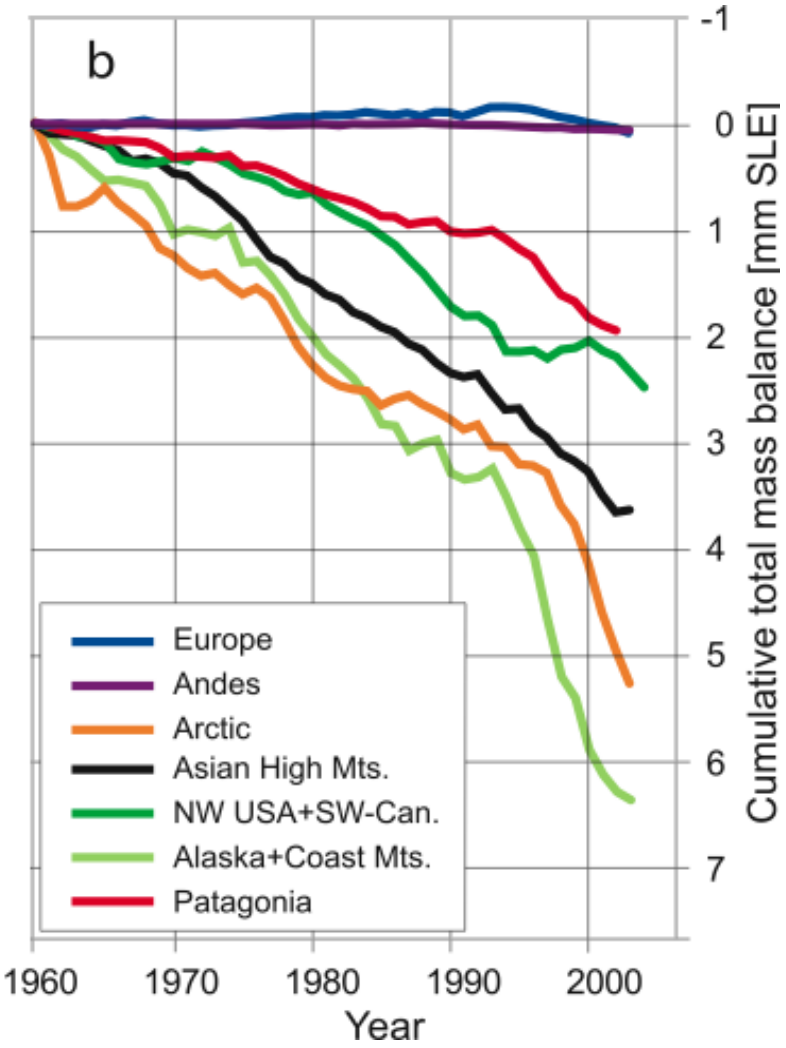


‘Climate change is unequivocal’

Cumulative balance of glacier mass

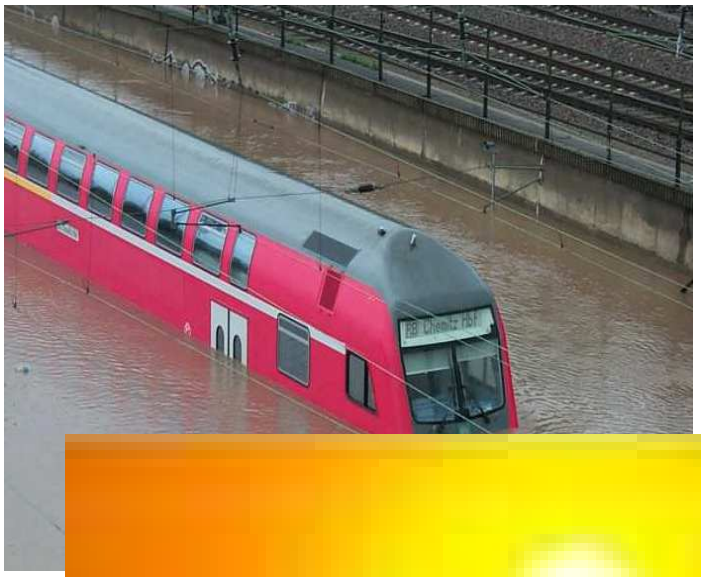
During the 20th century, glaciers and ice caps have experienced **widespread mass losses**

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



‘Climate change is unequivocal’

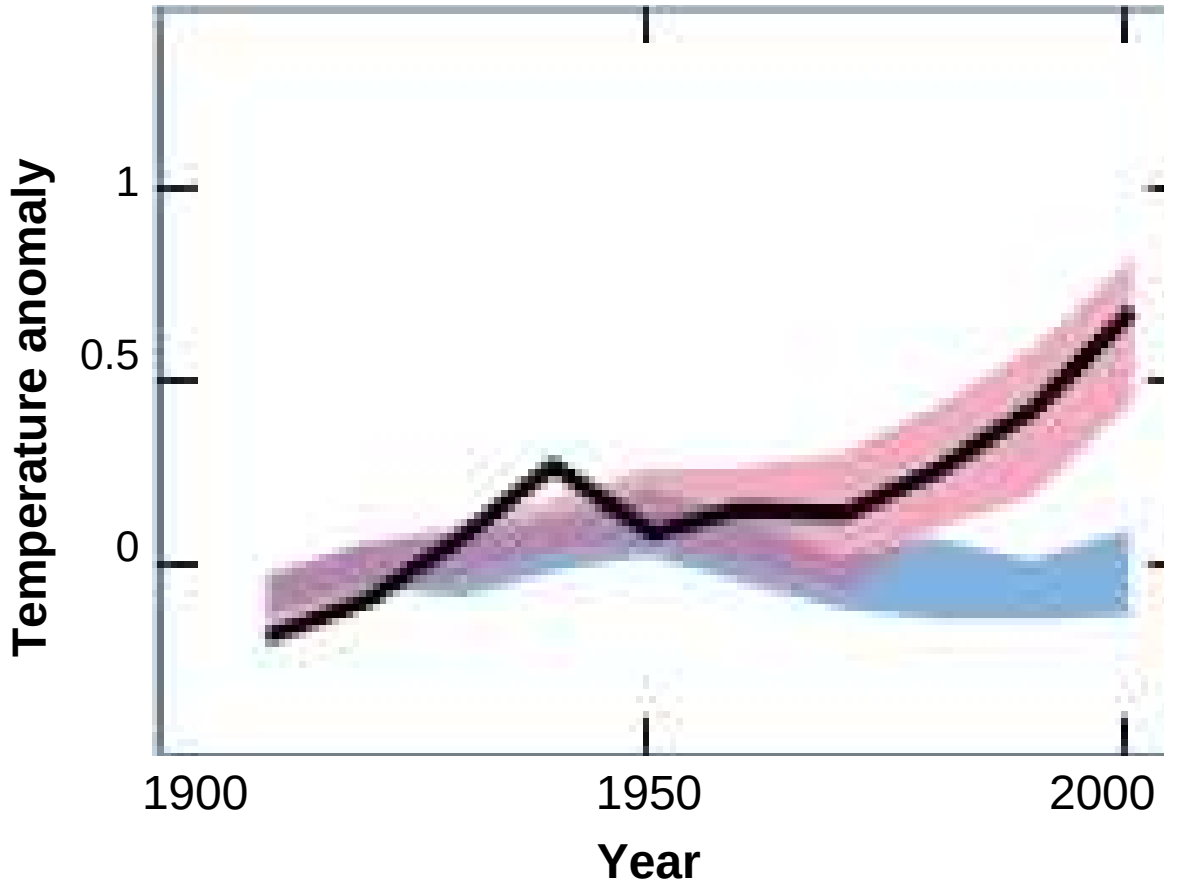
Observed impacts



‘Climate change is unequivocal’

Human influence on global temperature change

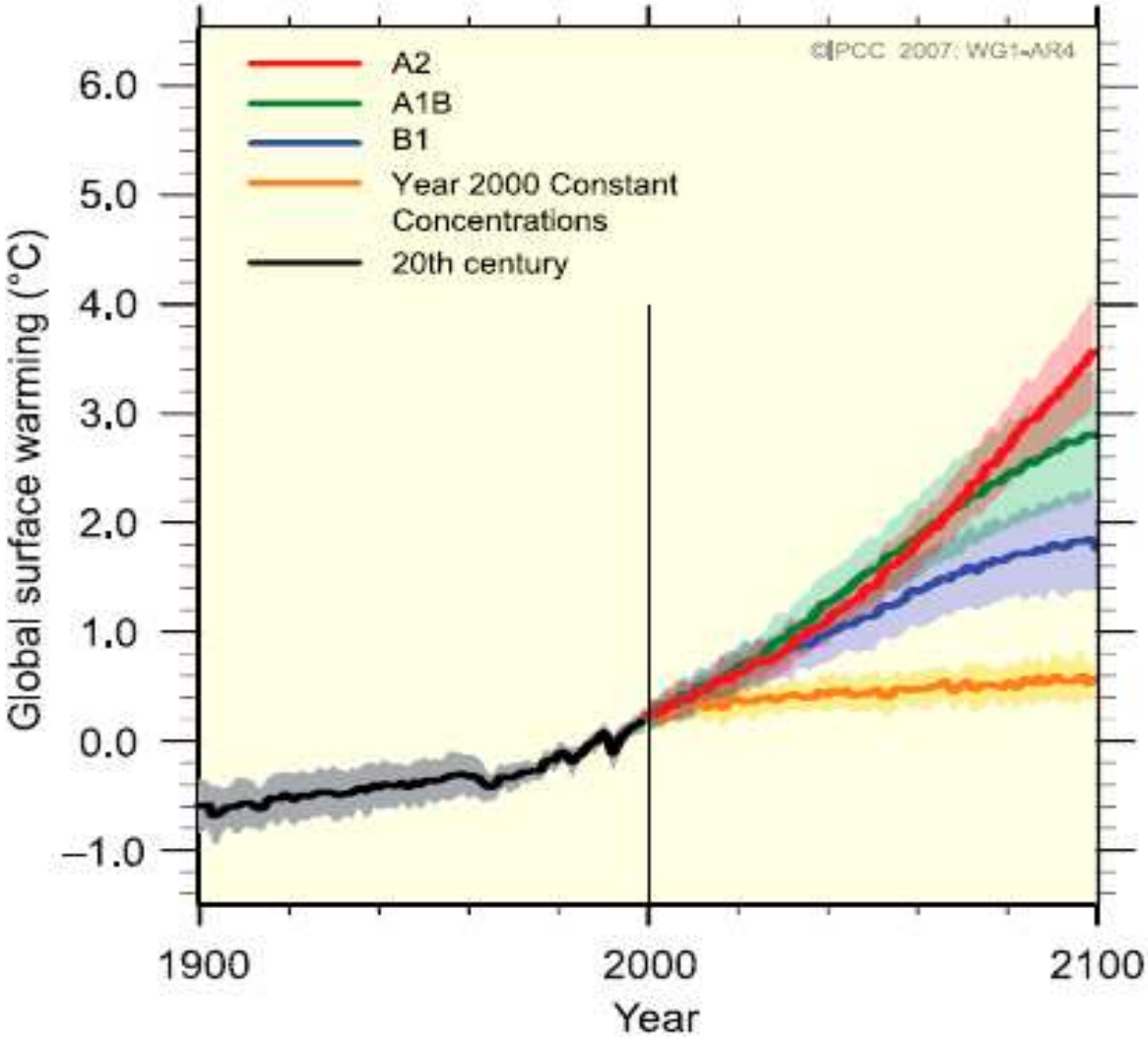
There is now **stronger evidence** of human influence on climate



Expected trends and impacts

Assessed ranges for surface warming

Continued emissions would lead to further warming of **1.8ºC to 4ºC** over the 21st century



Expected trends and impacts

Vulnerability of poor regions

- Aggravation of **malnutrition, water stress and health** problems in Africa, Asia and Latin America

- Vulnerability exacerbated by **existing stresses**:
  - Endemic poverty
  - Limited access to capital
  - Ecosystem degradation
  - Disasters and conflicts
  - Failure of government system to respond effectively

Expected trends and impacts

Impacts on natural ecosystems

- Climate change will reduce **biodiversity** and perturb functioning of most ecosystems
- 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, Mediterranean regions

Expected trends and impacts

Coastal settlements most at risk

Expected trends and impacts

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

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

Global mean temp. increase (°C)	Stabilization level (ppm CO_2-eq)	Year CO_2 needs to peak	Year CO_2 emissions back at 2000 level
2.0 – 2.4	445 – 490	2000 - 2015	2000- 2030
2.4 – 2.8	490 – 535	2000 - 2020	2000- 2040
2.8 – 3.2	535 – 590	2010 - 2030	2020- 2060
3.2 – 4.0	590 – 710	2020 - 2060	2050- 2100

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

The cost of mitigation

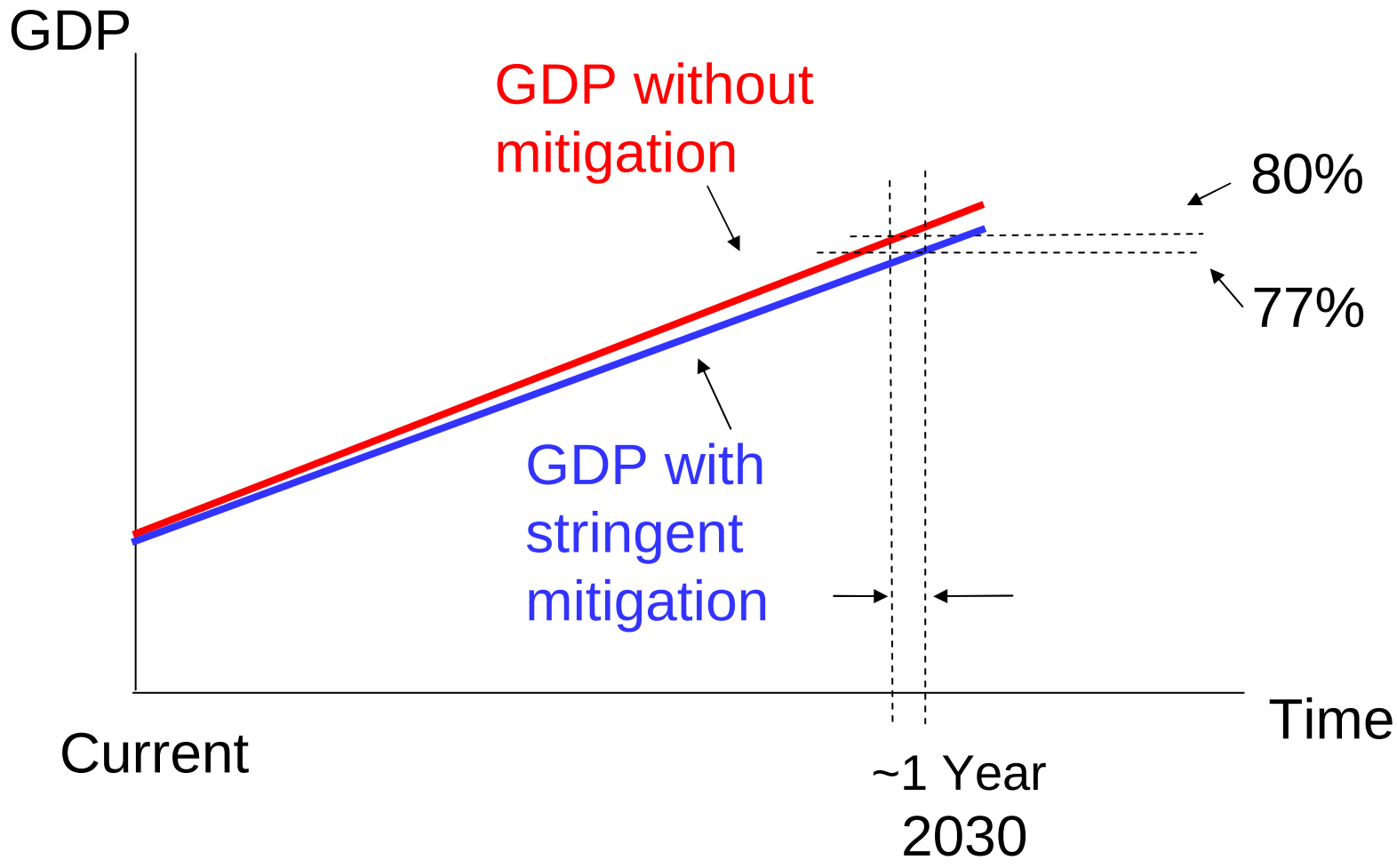
Global costs in 2030 for least-cost trajectories

Stabilisation levels (ppm CO2-eq)	Range of GDP reduction (%)	Reduction of average annual GDP growth rates (percentage pts)
590 - 710	-0.6 – 1.2	< 0.06
535 - 590	0.2 – 2.5	< 0.1
445 - 535	< 3	< 0.12

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

The cost of mitigation

Illustration of costs numbers



Key technologies and policies

Key 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 policies

Key policies and measures

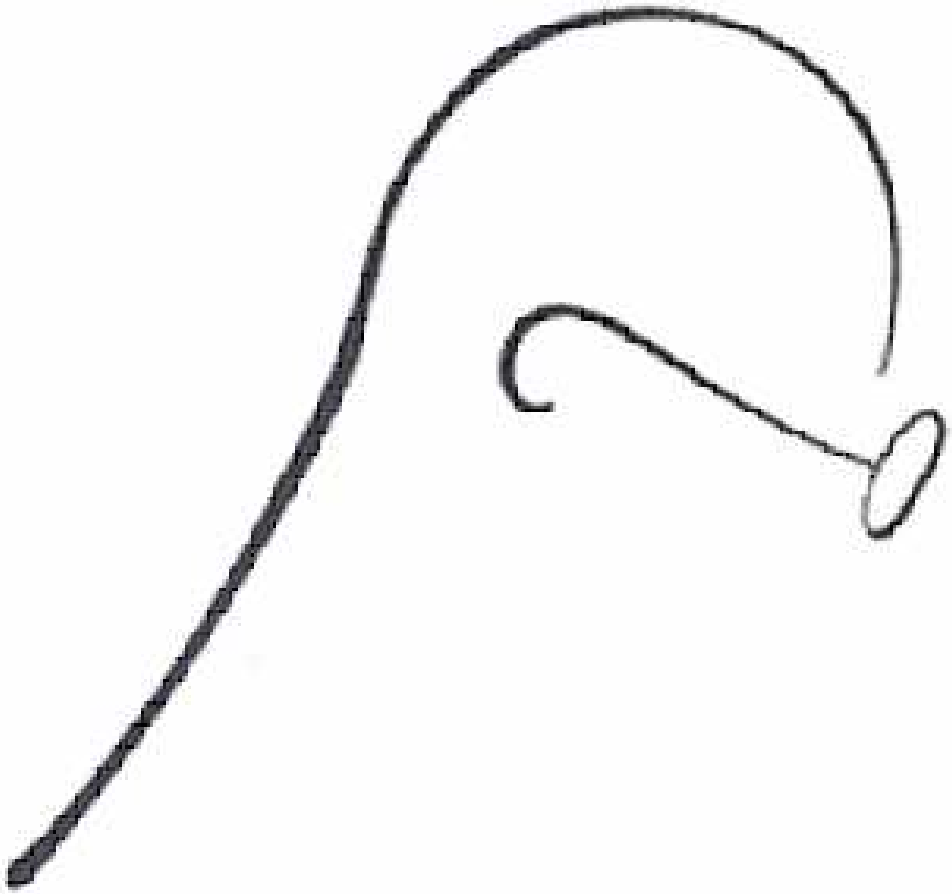
- Appropriate incentives for **development of technologies**
- Effective **carbon price** signal
- Appropriate **energy infrastructure** investments
- Changes in **lifestyle and behavior**

Key technologies and policies

Towards a new development path

- Committing to **alternative development paths** can result in very different future GHG emissions

- This will require **major changes** in areas other than climate change:
  - Economic structure
  - Technology
  - Geographical distribution of activities
  - Consumption patterns
  - Urban design and transport infrastructure
  - Demography
  - Institutional arrangements and trade patterns



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.