WMO

UNEP

Climate change

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Key findings from the IPCC Fourth Assessment Report

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IPCC

Introduction

History of climate change

1898: Swedish scientist Svante Ahrrenius warns carbon dioxide from coal and oil burning could warm the planet

1988: NASA scientist James Hansen tells U.S. Congress global warming "is already happening now"

Exceptional drought hits the USA

Creation of the IPCC

1992: UNFCCC aims at stabilising atmospheric concentrations of GHG

1997: UNFCCC parties approve Kyoto Protocol mandating emission cuts by industrial nations

2005: Warmest year since record-keeping began in mid-19th Century

Kyoto Protocol takes effect

The IPCC

The work of the IPCC is guided by the mandate given to it by its parent organisations: the World Meteorological Organisation (**WMO**) and the United Nations Environment Programme (**UNEP**)

Its role is to assess on a comprehensive, objective and transparent basis the **scientific, technical and socio-economic** information relevant to understanding the scientific basis of climate change, its potential impacts and options for adaptation and mitigation

The IPCC

Writing and review process

1. Experts review the first draft of the report

2. Governments and experts review the second draft of the report and the draft Summary for Policymakers

3. Governments review word-by-word the revised draft Summary for Policymakers

The IPCC

The Fourth Assessment Report (2007)

+2500 scientific expert reviewers

800 contributing authors

450 lead authors

+130 countries

Warming of the climate system is unequivocal, as is now evident from observations of increases in average air and ocean temperatures, widespread melting of snow and ice, and rising average sea level

Observed changes in climate

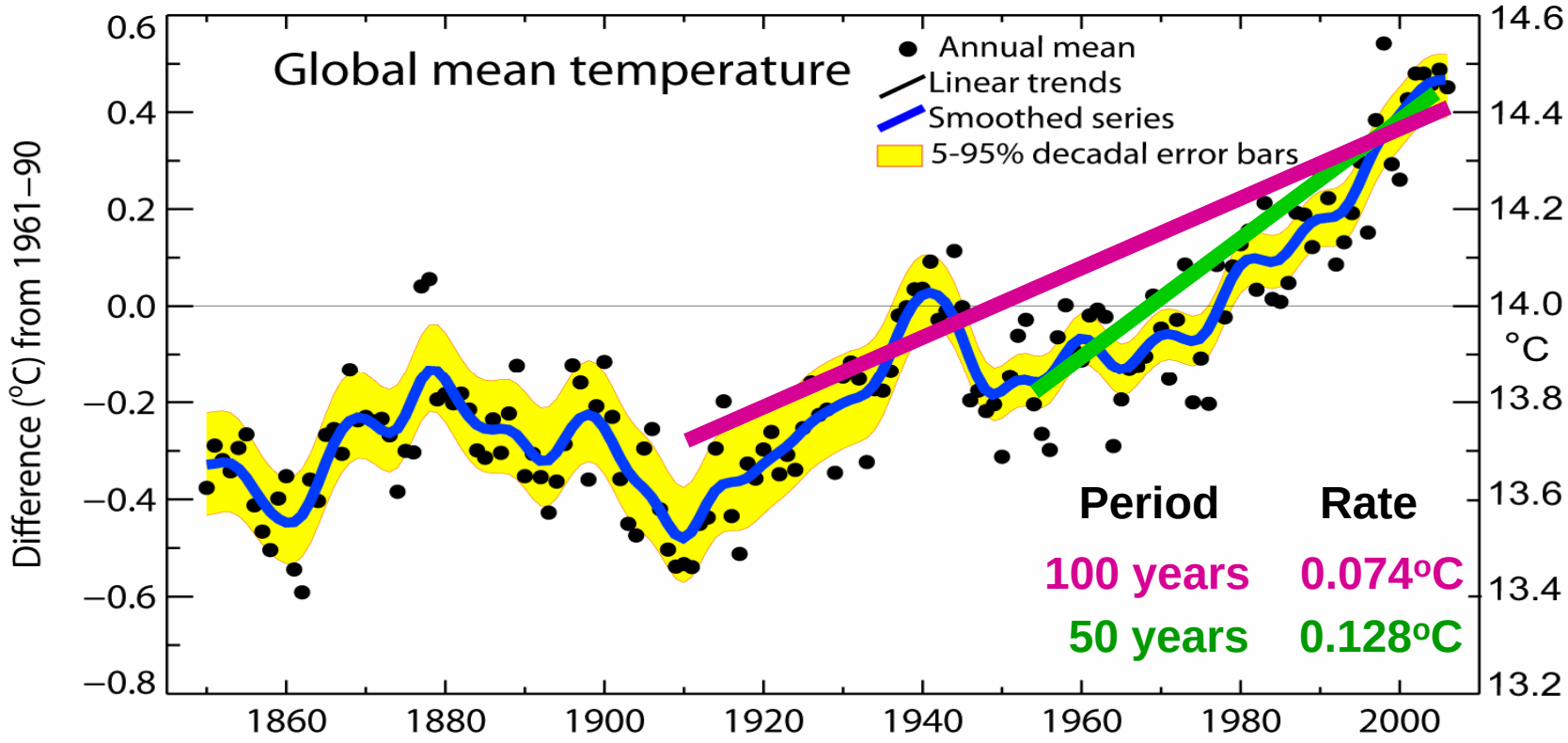
Paleoclimatic perspective

The warmth of the last half century is unusual in at least the previous **1,300 years**

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**

Observed changes in climate

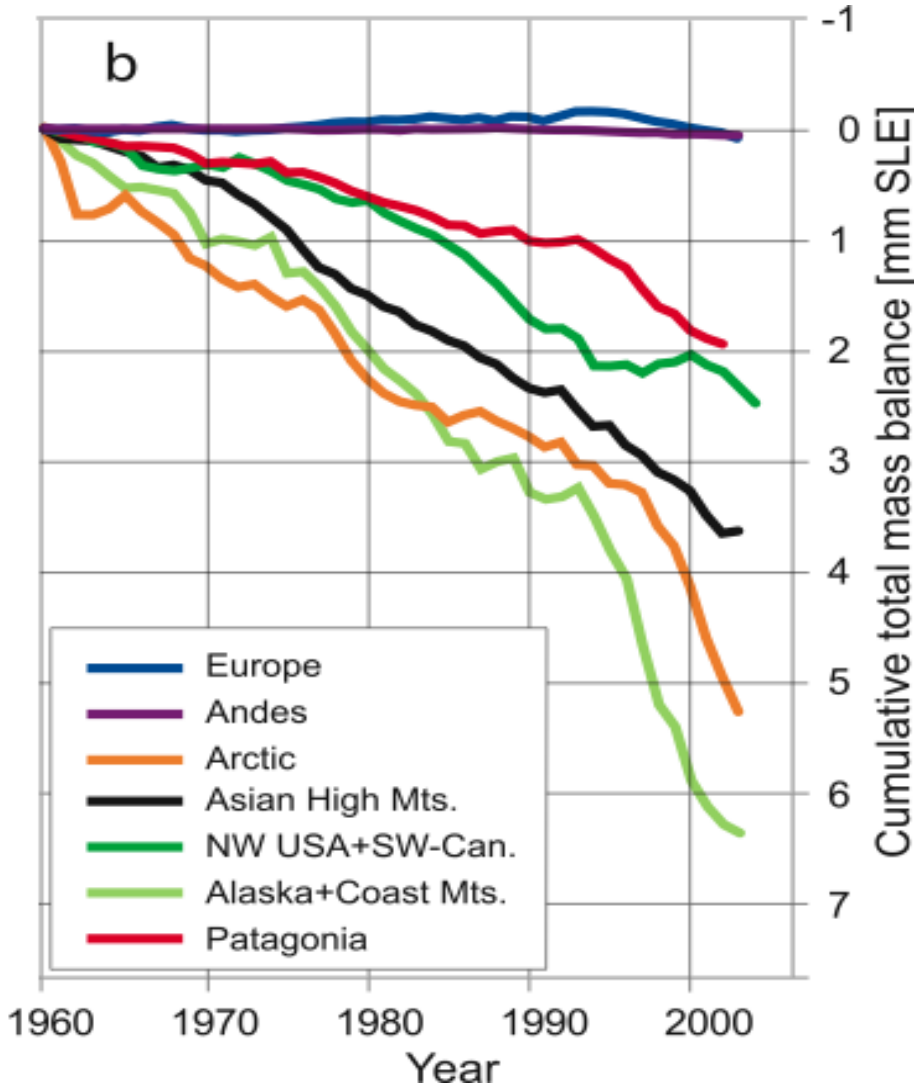
Changes in global average surface temperature



Eleven of the last twelve years rank among the twelve warmest years in the instrumental record of global surface temperature

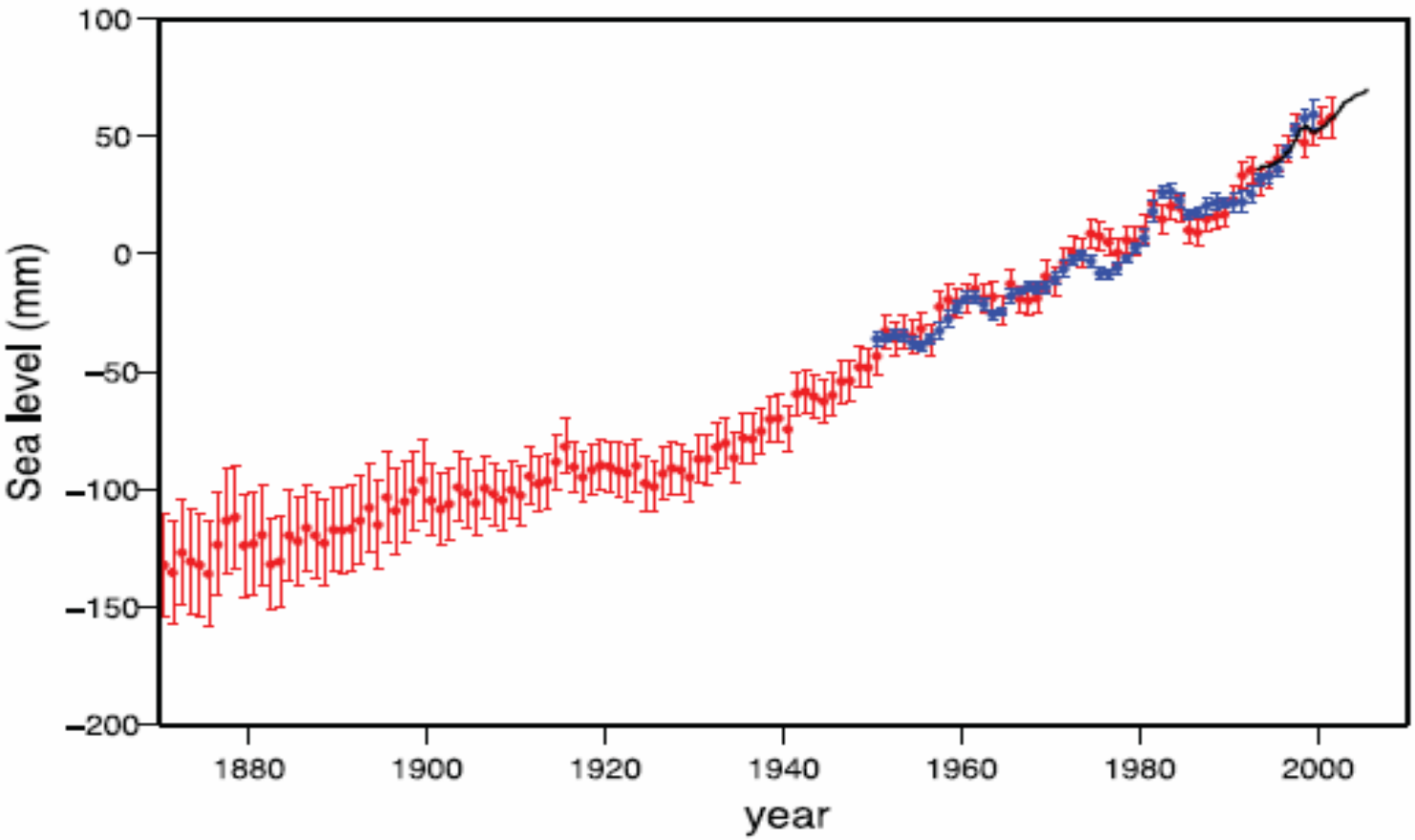
Observed changes in climate

Cumulative balance of glacier mass



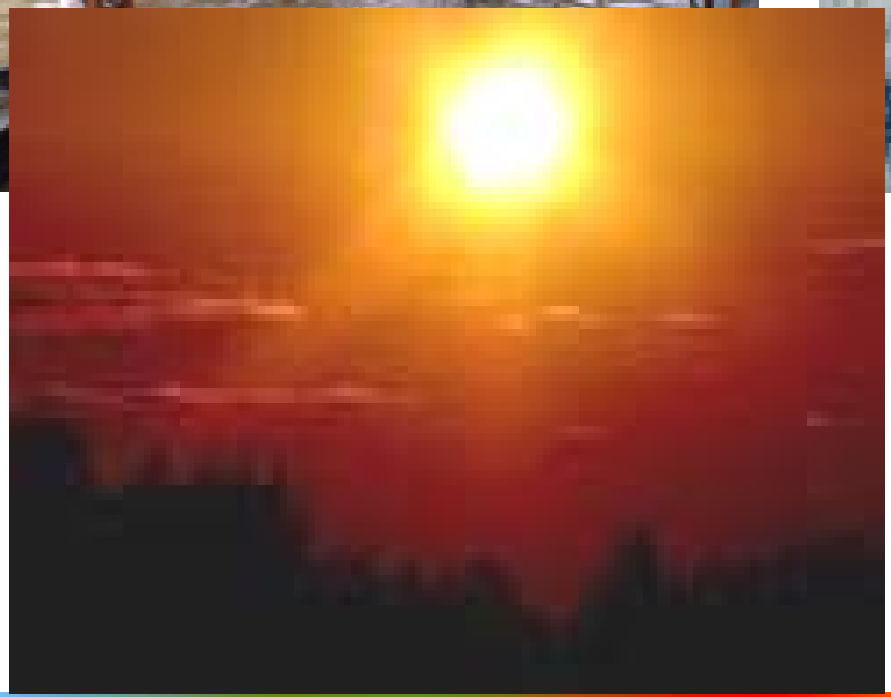
Observed changes in climate

Changes in global average sea level



Global average sea level has risen since 1961 at an average rate of 1.8mm/yr and since 1993 at 3.1mm/yr

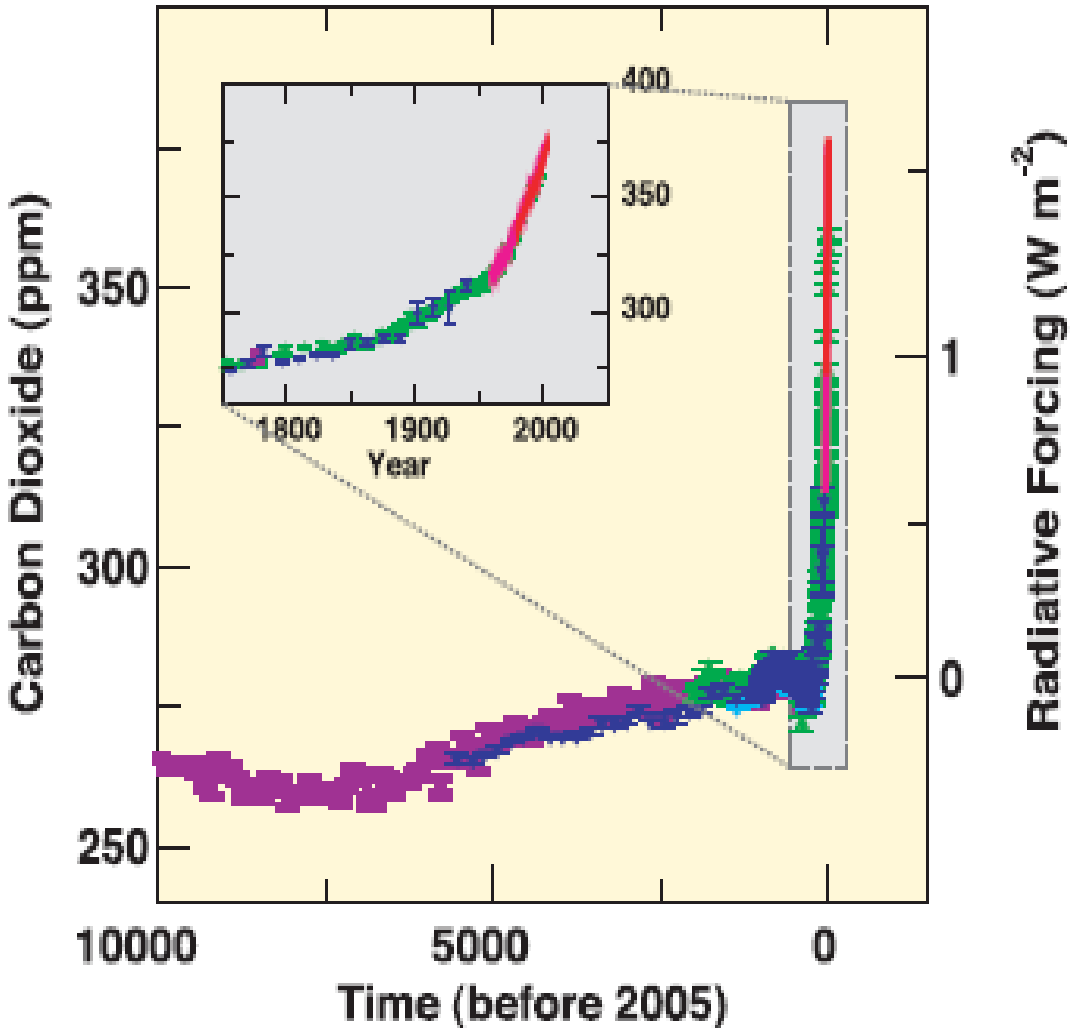
Observed changes in climate



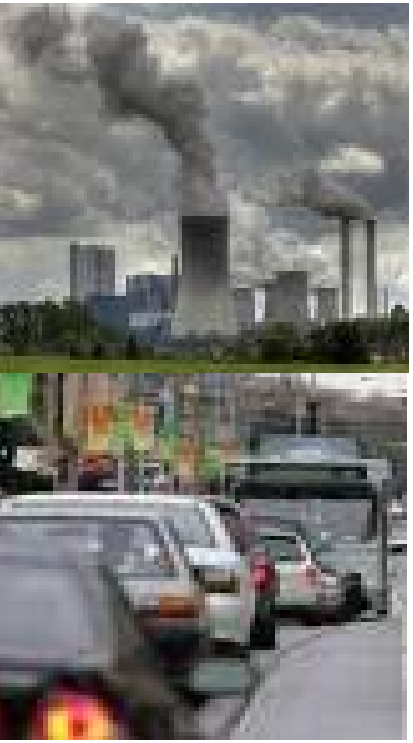
Causes of change

Changes in carbon dioxide concentrations

The atmospheric concentration of carbon dioxide in 2005 exceeds by far the natural range over the last 650,000 years



Causes of change



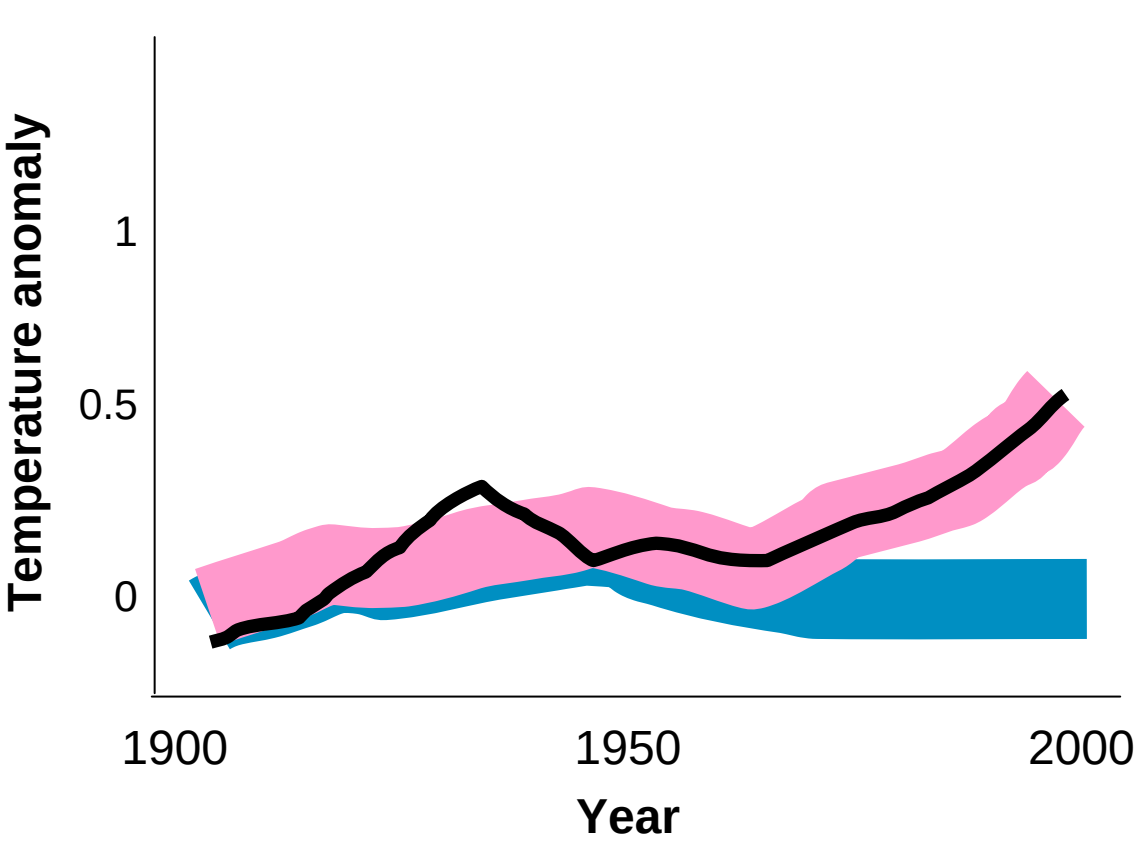
Global **GHG emissions** due to human activities have grown since pre-industrial times, with an increase of **70%** between 1970 and 2004

CO_2 annual emissions grew by about **80%** between 1970 and 2004

Most of the observed increase in temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations

Causes of change

Global temperature change



Models using only natural forcing

Models using both natural and anthropogenic forcing

Observations

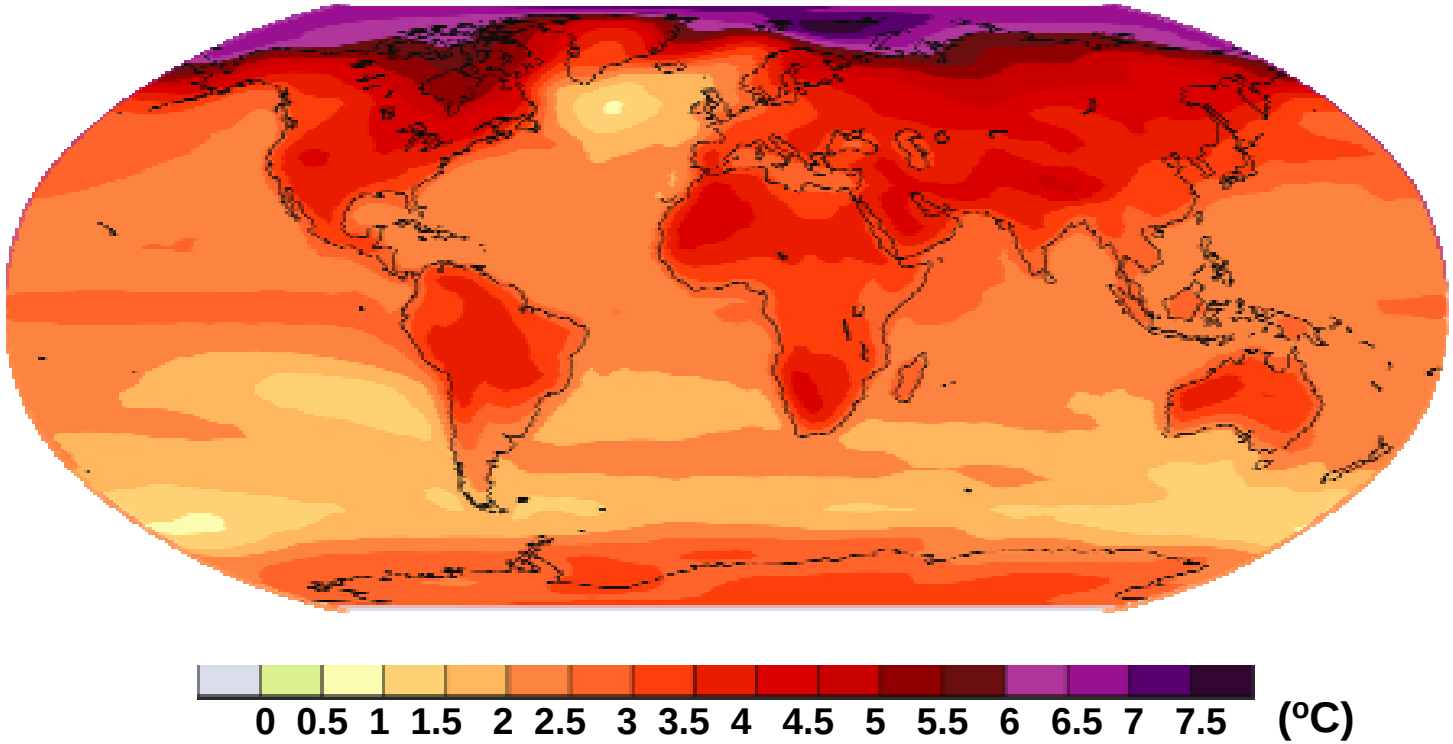
Observed patterns of warming are simulated only by models that include anthropogenic forcings

Continued GHG emissions
at or above current rates would cause
further warming and induce
many changes in the global climate
system during the 21st century that
would very likely be **larger than those
observed during the 20th century**

Projections and impacts

Projected surface temperature changes

(2090-2099 relative to 1980-1999)



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

Projections and impacts

Abrupt or irreversible impacts

Partial loss of ice sheets on polar land could imply several metres of sea level rise

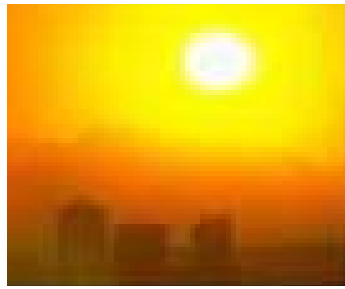
20-30% of species are likely to be at risk of extinction if increases in warming exceed 1.5-2.5°C

Projections and impacts

Impacts on North America

Warming in western **mountains** is projected to cause decreased snowpack and reduced summer flows, exacerbating competition for over-allocated water resources

Increased number, intensity and duration of **heatwaves** will have potential for adverse health impacts



Coastal communities and habitats will be increasingly stressed by climate change impacts interacting with development and pollution

Key vulnerabilities

Vulnerable populations

The poor have **limited adaptive capacities** and are more dependent on **climate-sensitive resources**

Vulnerability in **Africa, Asia and Latin America** is aggravated by other multiple stresses

Within other areas, **the poor, marginalised communities and the elderly** are particularly at risk

Key vulnerabilities

Security

The threats to stability and human security inherent in the impacts of climate change have been acknowledged by the Norwegian **Nobel** Committee in 2007

Climate change could adversely impact **basic needs**:

- Access to food
- Access to water
- Stable health conditions

Key vulnerabilities

Coastal deltas

Coastal populations are expected to increase rapidly, while coastal settlements are at increased risk of sea-level rise

Key vulnerabilities
Food supply

Agricultural productivity at low latitudes likely to suffer severe losses because of:

- high temperature
- drought
- flood conditions
- soil degradation

Possible yield reduction of:

- 50% by 2020 in some African countries
- 30% by 2050 in Central and South Asia
- 30% by 2080 in Latin America

Crop revenues could fall by 90% by 2100 in Africa

Key vulnerabilities

Water availability

Water availability will be affected for consumption, agriculture and energy generation due to:

- Changes in precipitation patterns
- Increasing salinity of groundwater
- Glaciers melting decreasing river flows

Ranges of people exposed to increased water stress:

- 120 million to 1.2 billion in Asia by 2020
- 75 to 250 million in Africa by 2020
- 16 to 44 million in Europe by 2070

Key vulnerabilities

Human health

Increased **deaths, disease and injury** due to heat waves, floods, storms, fires and droughts

Increased frequency of **cardio-respiratory diseases**

Increases in **malnutrition** and consequent disorders

Increased burden of **diarrhoeal disease**

Exacerbation of abundance and/or toxicity of **cholera**

Key vulnerabilities

Need for study of impacts specific to North Carolina

- Coastal settlements
- Mountain ecology
- Human health
- Agriculture
- Water resources

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 targets

Stabilisation scenarios

Stabilization level (ppm CO_2-eq)	Global mean temp. increase (°C)	Year CO_2 needs to peak	Global sea level rise above pre-industrial from thermal expansion (m)
445 – 490	2.0 – 2.4	2000 – 2015	0.4 – 1.4
490 – 535	2.4 – 2.8	2000 – 2020	0.5 – 1.7
535 – 590	2.8 – 3.2	2010 – 2030	0.6 – 1.9
590 – 710	3.2 – 4.0	2020 – 2060	0.6 – 2.4

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

Mitigation targets

Beyond the Kyoto Protocol

The emission target to limit warming to a 2.0 to 2.4°C increase would require **developed countries** to significantly reduce their emissions below 1990 levels:

- 10-40% by 2020
- 40-95% by 2050

Developing country emissions need to deviate below their projected baseline within the next few decades

Potential and cost of mitigation

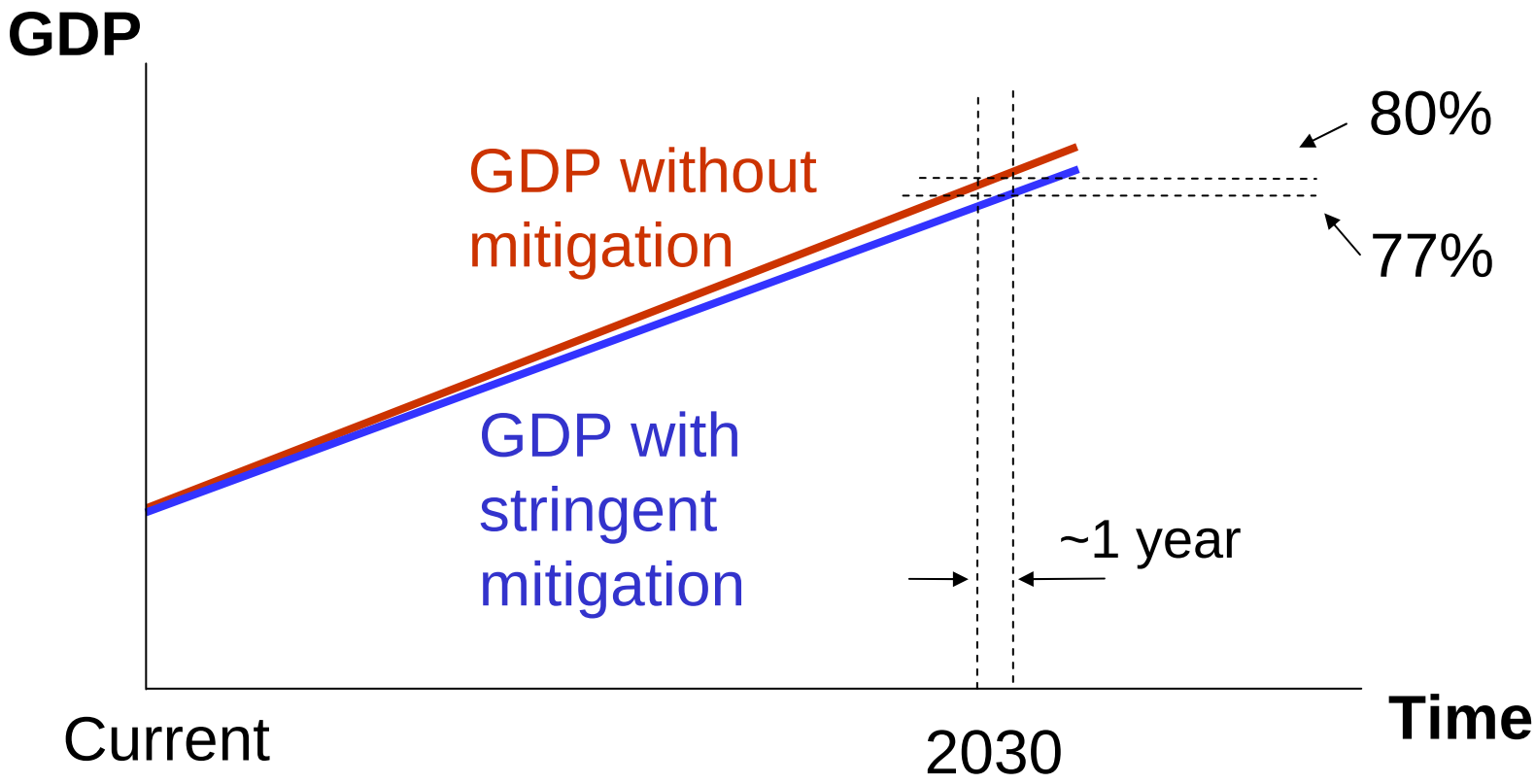
Costs of mitigation in 2030

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

Potential and cost of mitigation

Impacts of mitigation on GDP growth



Stringent mitigation would postpone GDP growth of one year at most over the medium term

Potential and cost of mitigation

Co-benefits of mitigation

Health co-benefits from reduced air pollution

Increased **energy security**

More rural **employment**

Increased **agricultural production** and reduced pressure on **natural ecosystems**, due to decreased tropospheric ozone concentrations

The co-benefits of mitigation may offset a substantial fraction of mitigation costs

Mitigation options

All stabilisation levels assessed can be achieved by deployment of a portfolio of **technologies that are currently available or expected to be commercialised** in coming decades

This assumes that **investment flows, technology transfer and incentives** are in place for technology development

Mitigation options

Key mitigation policies and practices

Appropriate energy infrastructure investments

Research, development and demonstration

Changes in lifestyle & management practices

Effective carbon price signal

Mitigation options

Companies that take the lead would meet with success in both business and societal contexts

- ✘ Those that lag behind would suffer from losses in the marketplace and loss of reputation

Nations that show commitment to the growing global consensus would gain prestige

- ✘ Those that stand unmoved would lose political power and influence

Man did not weave the web of life,
he is merely a strand in it.

Whatever he does to the web,
he does to himself.

Chief Seattle, 1854