WMO

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State of Climate Science:

Enabling Enlightened Policies

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International Scientific Congress

Copenhagen

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Historical overview of the climate science

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Evolution of international climate policy

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

1979: First World Climate Conference organised by WMO

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

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: Kyoto Protocol takes effect

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Evolution of the climate science

Awareness and partial understanding of the interactive processes that govern climate change predate the IPCC, often by many decades

Deeper understanding and quantification of these processes have progressed rapidly since the IPCC First Assessment Report (1990)

- These advances have arisen from new data, more sophisticated analyses of data, improvements in understanding and simulation of physical processes and more extensive exploration of uncertainty ranges

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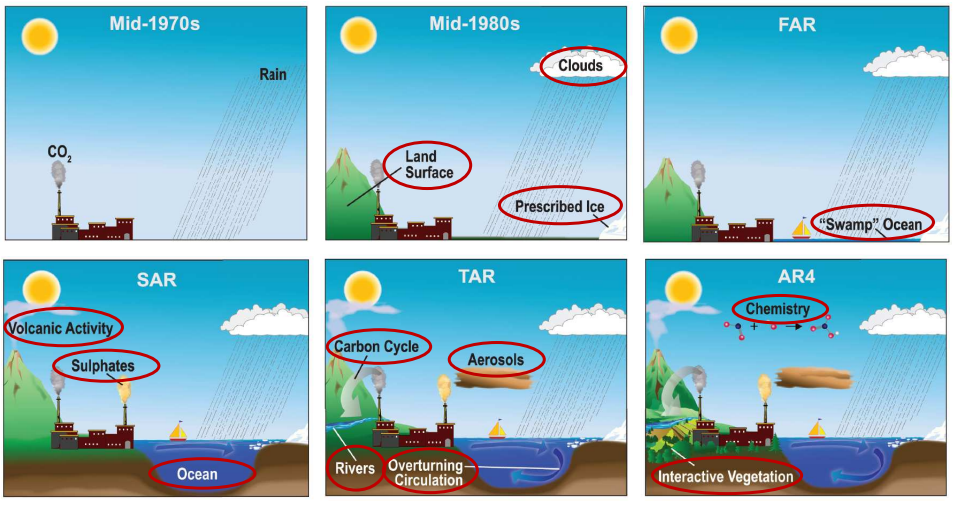
Additional physics incorporated in successive climate models



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The Intergovernmental panel on climate change:

Science at the service of policy-making

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Mandate of the IPCC

"The General Assembly […] endorses action of the World Meteorological Organisation and the United Nations Environment Programme in jointly establishing an Intergovernmental Panel on Climate Change to provide **international coordinated scientific assessments** of the magnitude, timing and potential environmental and socio-economic impact of climate change and realistic response strategies […]."

United Nations General Assembly
43rd session resolution, 6th December 1988

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The IPCC Fourth Assessment Report (2007)

+2500 scientific expert reviewers

800 contributing authors

450 lead authors

+130 countries

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The assessments carried out by the IPCC have influenced global action on an unprecedented scale

1. First Assessment Report (1990) had a major impact in defining the content of the **UNFCCC**

2. The Second Assessment Report (1996) was largely influential in defining the provisions of the **Kyoto Protocol**

3. The Third Assessment Report (2001) focused attention on the **impacts** of climate change and the need for **adaptation**

4. The Fourth Assessment Report (2007) is creating a strong basis for a **post Kyoto Protocol** agreement

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References to the IPCC Fourth Assessment Report in the Bali Action Plan (December 2007)

"Responding to the findings of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change that warming of the climate system is **unequivocal**, and that **delay** in reducing emissions significantly constrains opportunities to achieve lower stabilization levels and increases the risk of more severe climate change impacts"

"[…] emphasizing the **urgency** to address climate change as indicated in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change"

"[…] urgent and immediate needs of developing countries that are particularly **vulnerable** to the adverse effects of climate change, especially the least developed countries and small island developing States, and further taking into account the needs of countries in Africa affected by drought, desertification and floods"

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“Warming of the climate system is unequivocal”

- IPCC Fourth Assessment Report

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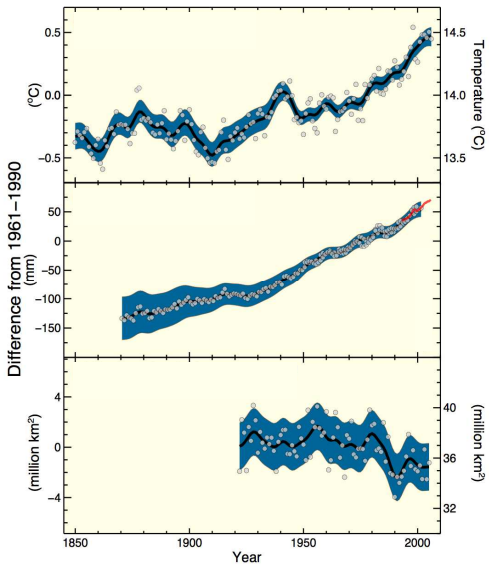
Observed changes

Global average temperature →

Global average sea level →

Northern hemisphere snow cover →



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The frequency of heavy precipitation events has increased over most land areas
- Rainfall in Mumbai (India), 2005:
1 million people lost their homes


The proportion of tropical cyclones reaching higher intensity have increased over the past 3 decades
- Cyclone Nargis in Myanmar, 2008:
100 000 estimated deaths
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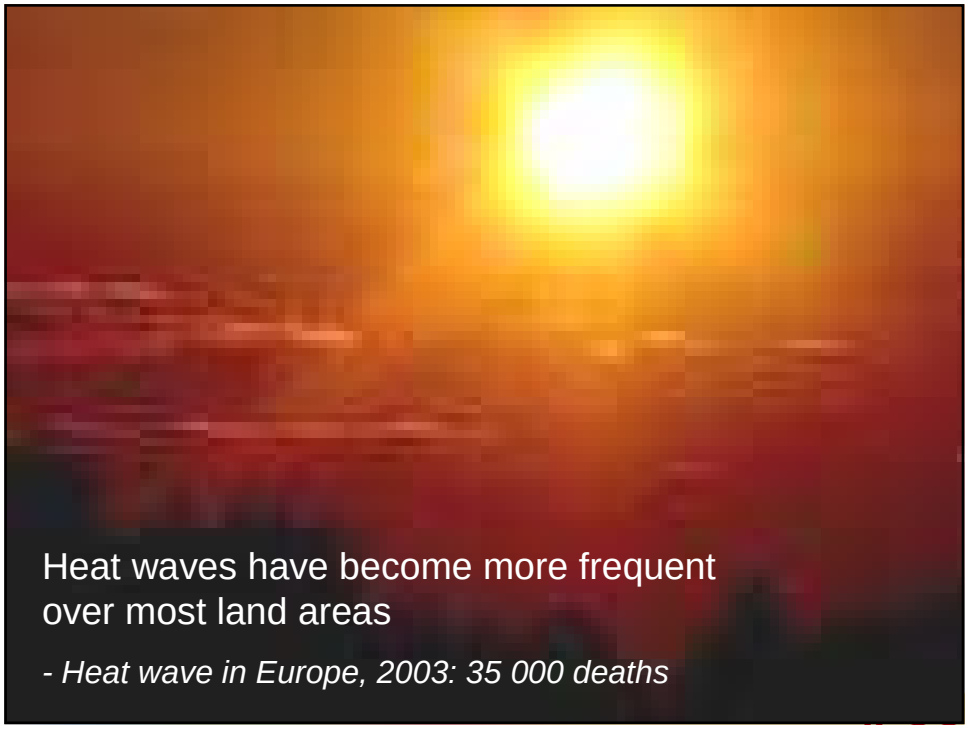

"Continued GHG emissions [...] would induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century"

- IPCC Fourth Assessment Report

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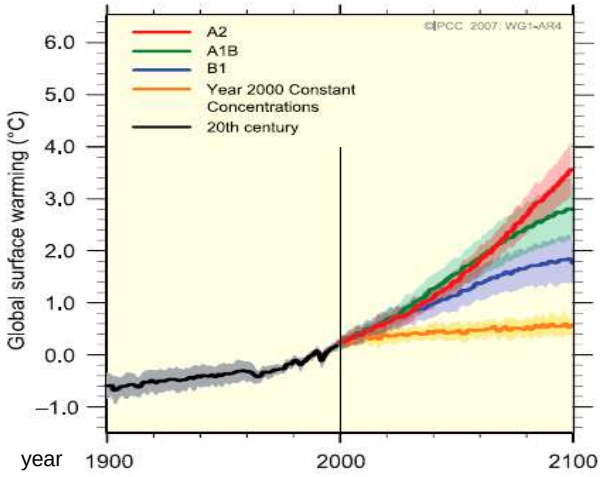
Ranges for predicted surface warming



Continued emissions would lead to further warming of **1.1ºC to 6.4ºC** over the 21st century (best estimates: **1.8ºC - 4ºC**)

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Determining what constitutes "dangerous anthropogenic interference with the climate system" in relation to Article 2 of the **UNFCCC** involves value judgements

Science can support informed decisions on this issue, including by providing criteria for judging key vulnerabilities

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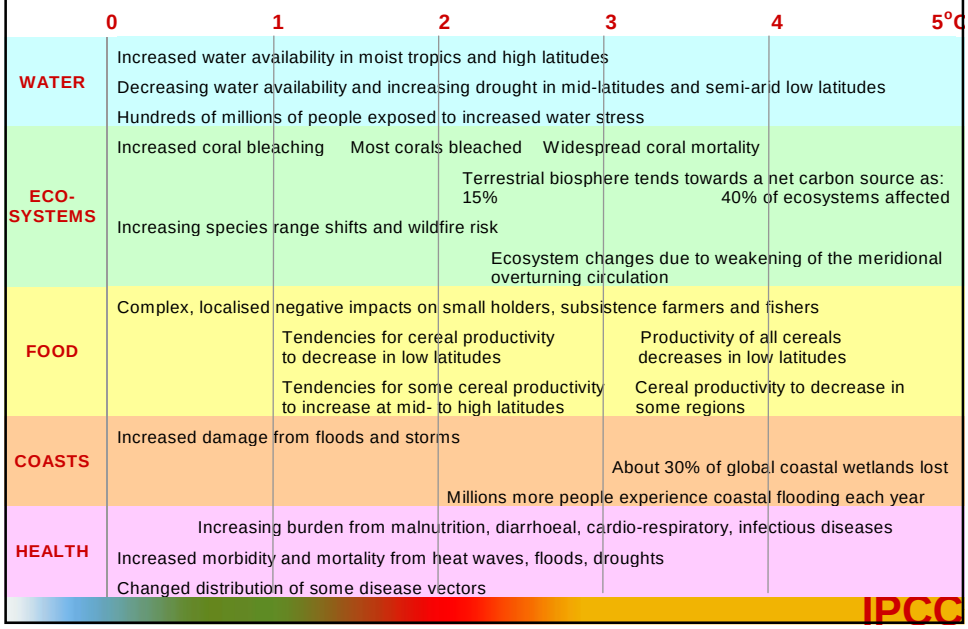
Examples of impacts associated with global average temperature change relative to 1980-1999



Regions likely to be especially affected

The Arctic, because of the impacts of high rates of warming on natural systems and human communities

Africa, because of low adaptive capacity and projected climate change impacts

Small islands, which are highly vulnerable to projected sea level rise

Asian and African megadeltas, due to large populations and high exposure to sea level rise, storm surges and river flooding

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Negative impacts on Europe

Inland and coastal flooding

- More North Sea storms leading to increases in storm surges along the North Sea coast, especially in Denmark

Health risks due to heat-waves

Reduction of water availability and crop productivity in South Europe

Species losses and reduced snow cover in mountains

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"Delayed emission reductions significantly constrain the opportunities to achieve lower stabilisation levels and increase the risk of more severe climate change impacts"

- IPCC Fourth Assessment Report

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Climate system inertia: even if GHG concentrations were held constant at year 2000 levels, a 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

Mitigation actions need to start in the short term in order to have medium- and longer-term benefits

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Stabilisation scenarios

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

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Costs of mitigation in 2030

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

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

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"There is substantial […] potential for the mitigation of global GHG emissions over the coming decades that could […] reduce emissions below current levels"

- IPCC Fourth Assessment Report

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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 appropriate and effective **incentives** are in place for their development, acquisition, deployment and diffusion

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Key policies

Improving scientific understanding of the issues at stake

Promoting research & development and technology transfer

Informing and educating

Mainstreaming environmental policies in decision making

Internalising the environmental costs of economic activity

- E.g. effective carbon-price signal

➧Effective policies are those that provide **long-term signals and incentives on a predictable basis**

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The road to Copenhagen, Dec. 2009

Needed outcomes from the Copenhagen conference:

- Institutional framework for mitigation and adaptation
- Viable economic solution to climate change
- Ambitious commitments

The world has reached an **unprecedented level of awareness** of the science behind climate change, which should hopefully drive the negotiations on the right direction

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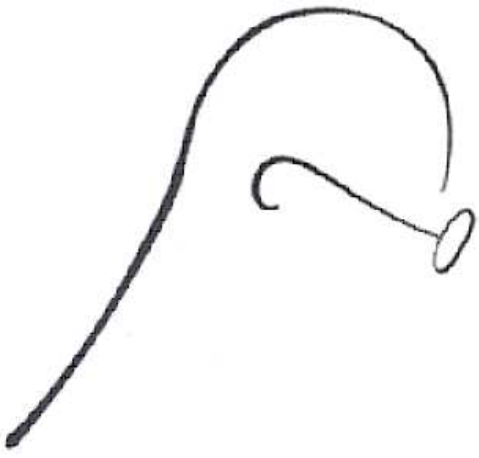

Democracy must in essence therefore, mean the art and science of mobilizing the entire physical, economics and spiritual resources of all the various sections of the people in the service of the common good for all.