Environment Canada Environnement Canada

Canada

IPCC: Past, Present and Future

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Outline

- History of the IPCC
- Science Informing Decisions: IPCC Case Study
- The Present: Key messages from the Fourth Assessment Report
- The Future: What's next for IPCC

History of the IPCC

The IPCC was created to provide independent science advice

- Established in 1988 by WMO and UNEP, following a number of international conferences and reports showing that GHG were increasing rapidly due to human activities
- Panel was asked to prepare, based on available scientific information, a report on all aspects relevant to climate change and its impacts and to formulate realistic response strategies
- This initial assessment was produced for the 1990 Second World Climate Conference which subsequently endorsed the strong IPCC findings and called for an international convention to address the threat of climate change

The IPCC has three Working Groups and a Task Force

Working Group I Physical Science Basis assesses knowledge about the physical state of the climate system and climate change

Working Group II Impacts, Adaptation and Vulnerability assesses the vulnerability of socio-economic and natural systems to climate change, negative and positive consequences of climate change, and options for adapting to it

Working Group III Mitigation assesses options for limiting greenhouse gas emissions and otherwise mitigating climate change

The Task Force on National Greenhouse Gas Inventories is responsible for the IPCC National Greenhouse Gas Inventories Program

Main Activities and Products

- All IPCC reports are based on peer-reviewed literature
- The main activity of the IPCC is to provide at regular intervals an assessment of the state of knowledge on climate change through WG technical reports, WG summaries for policy-makers and an overall synthesis report
- The IPCC also prepares Special Reports and Technical Papers on topics where independent scientific information and advice is deemed necessary e.g. Renewable Energy and Climate Change Mitigation
- It supports the UN Framework Convention on Climate Change (UNFCCC) through its work on methodologies for National Greenhouse Gas Inventories

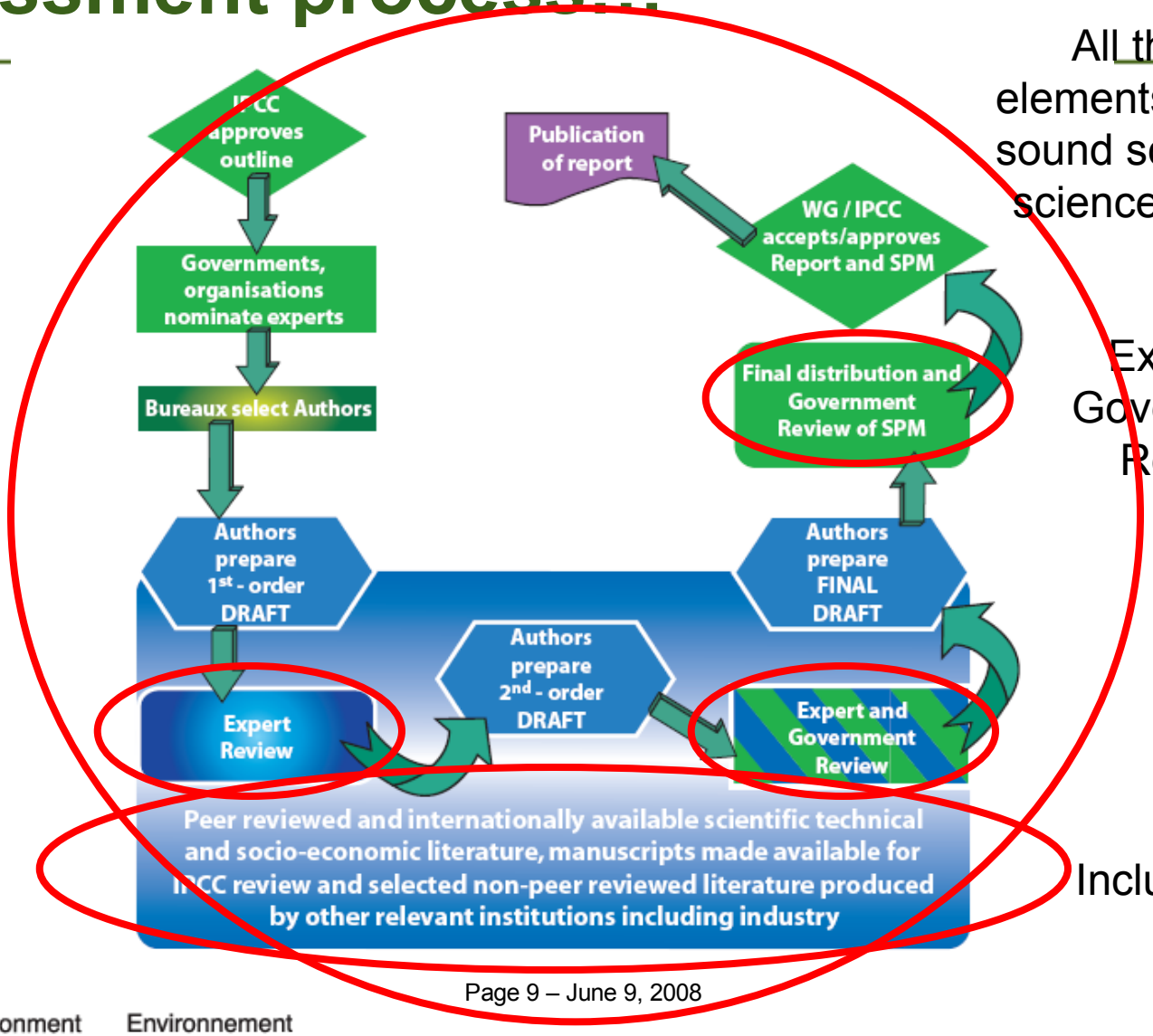
Science Informing Decisions: IPCC Case Study

SAGE: Science Advice for Government Effectiveness

- **Six key principles and guidelines to ensure the quality, integrity and objectivity of science advice to decision-makers.**

  - Early Issue Identification
  - Inclusiveness
  - Sound Science and Sound Advice
  - Uncertainty and Risk
  - Transparency and Openness
  - Review

The IPCC is a very robust science assessment process…



All these elements lead to sound science & science advice

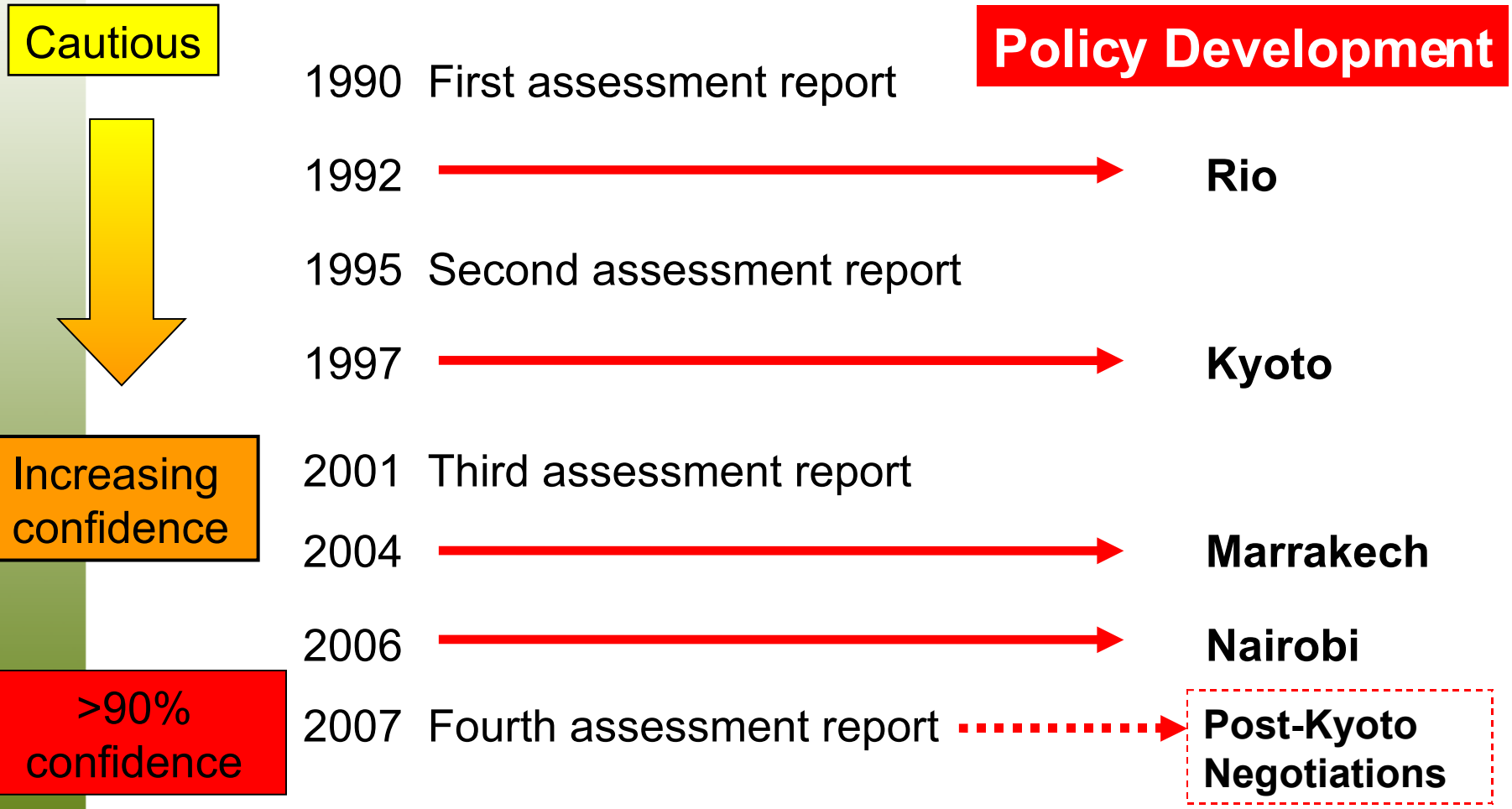
Expert & Government Review

Inclusiveness

Some Statistics

- WG I report: Physical Science Basis
  - 2 formal reviews: expert, government
  - 30,000 written comments
  - Each chapter had 3 review editors, whose task is to ensure comments are addressed
  - Example: Chapter 7 on climate system and biogeochemistry (Coordinating Lead Author: Ken Denman, EC and DFO)
    - 2,000 comments in expert review, and 1,000 in government review
    - Written response to each comment, available on the web
- WG II report: Impacts, Adaptation and Vulnerability
  - Example: Chapter 14 on North America (Coordinating Lead Author: Linda Mortsch, EC)
    - 2,300 comments, mostly from expert review

…with a 20 year history of science informing decisions



The IPCC is now a household name

- Release of the Fourth Assessment generated much media attention
- 2007 Nobel Peace Prize award also raised the profile of the IPCC

The Intergovernmental Panel on Climate Change and Albert Arnold (Al) Gore Jr. were awarded **the Nobel Peace Prize** "for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change".

- This reinforced its role as the definitive source of information on climate change

…and represents the international science community

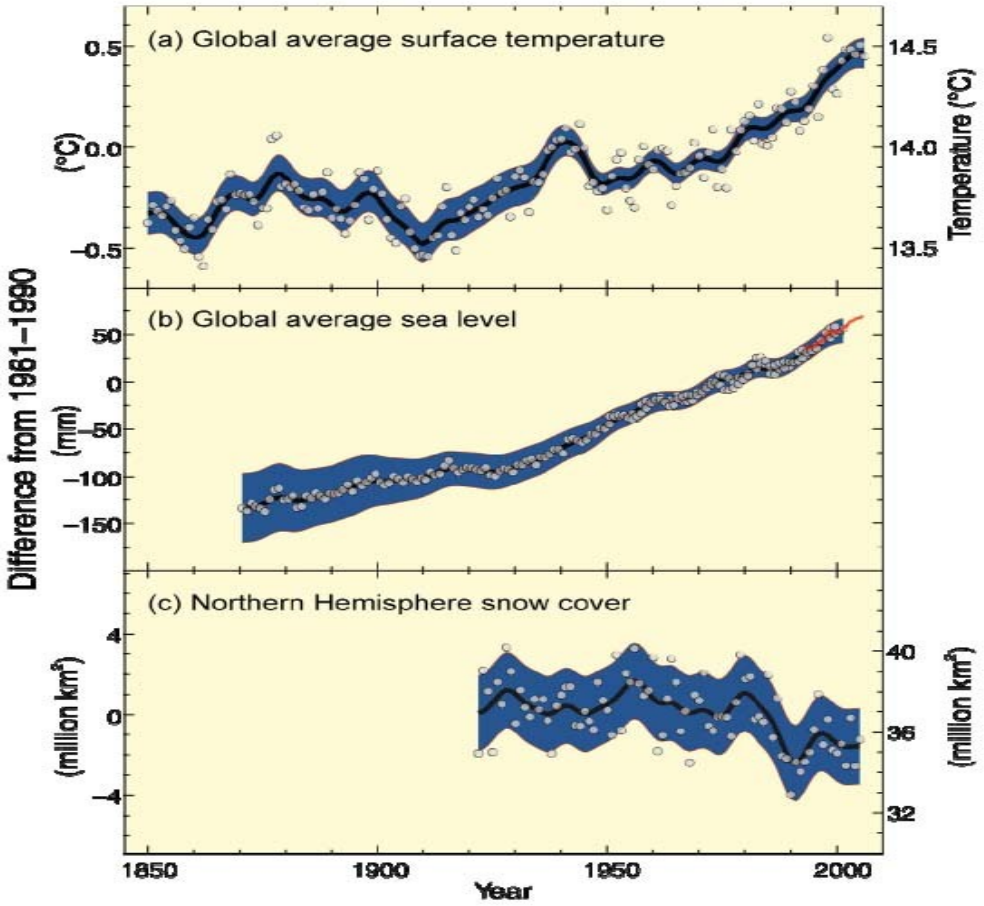
- **"The work of the IPCC represents the consensus of the international science community on climate change science. We recognize IPCC as the world's most reliable source of information on climate change and its causes and endorse its method of achieving this consensus."**

Joint statement by Academies of Science from 16 countries – May 2001

The Royal Society of Canada
The Canadian Academy of the Sciences and Humanities
La Société royale du Canada
L'Académie canadienne des sciences, des arts et des lettres

The Present: Key messages from the Fourth Assessment

Warming of the climate system is unequivocal

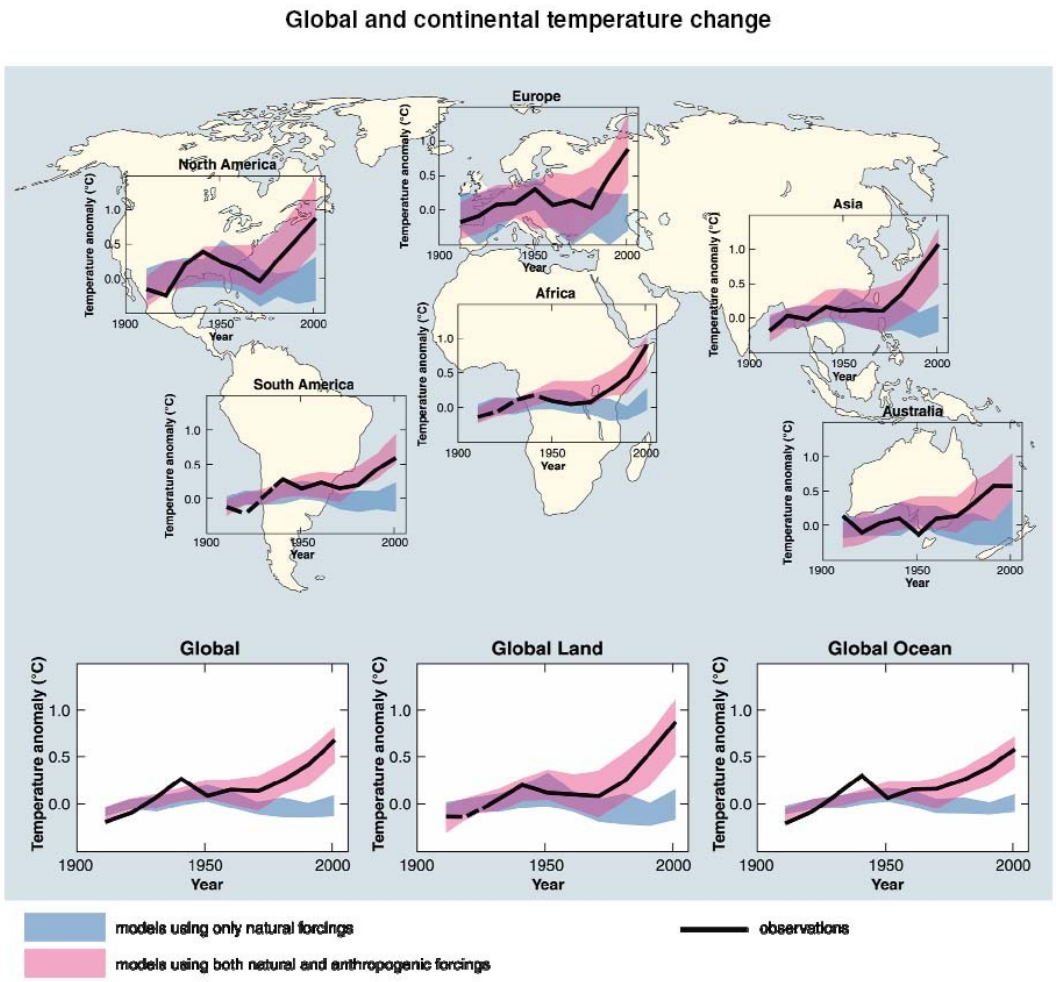


Additional evidence:

- Arctic temperatures and ice
- Precipitation amounts
- Ocean salinity
- Wind patterns
- Droughts, heavy precipitation, heat waves and intensity of tropical cyclones

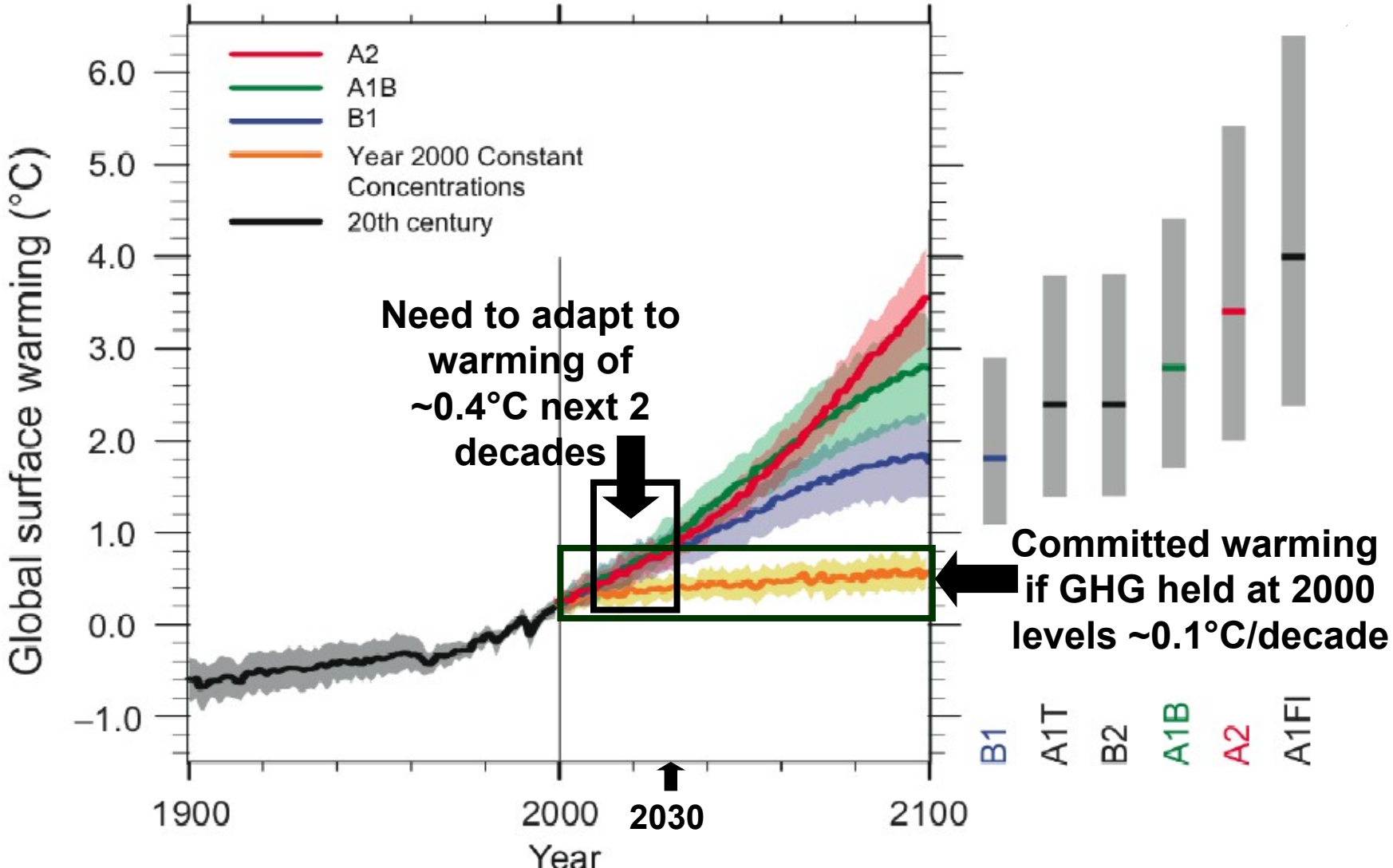
Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes

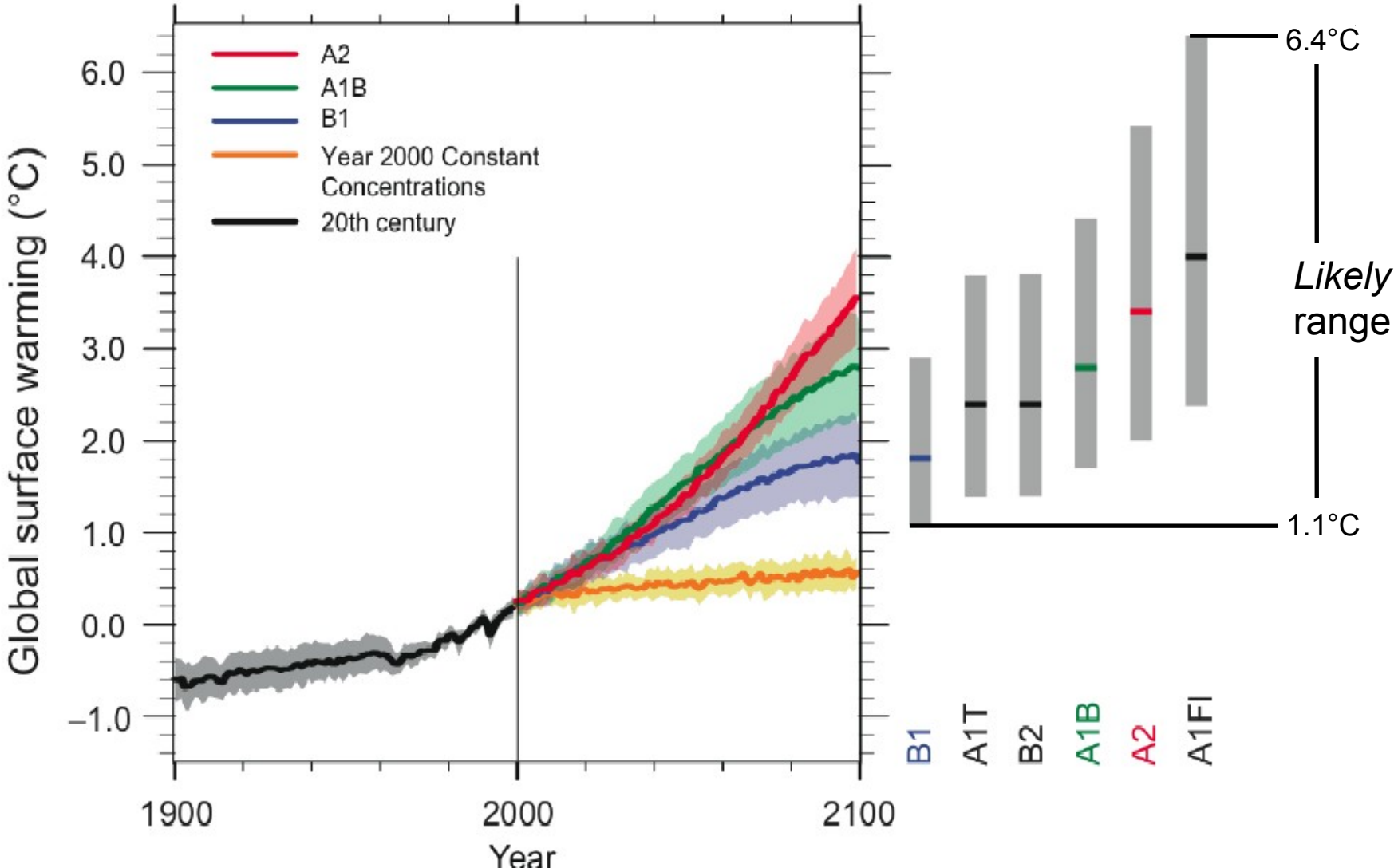
Significant anthropogenic warming over each continent in the last 50 years



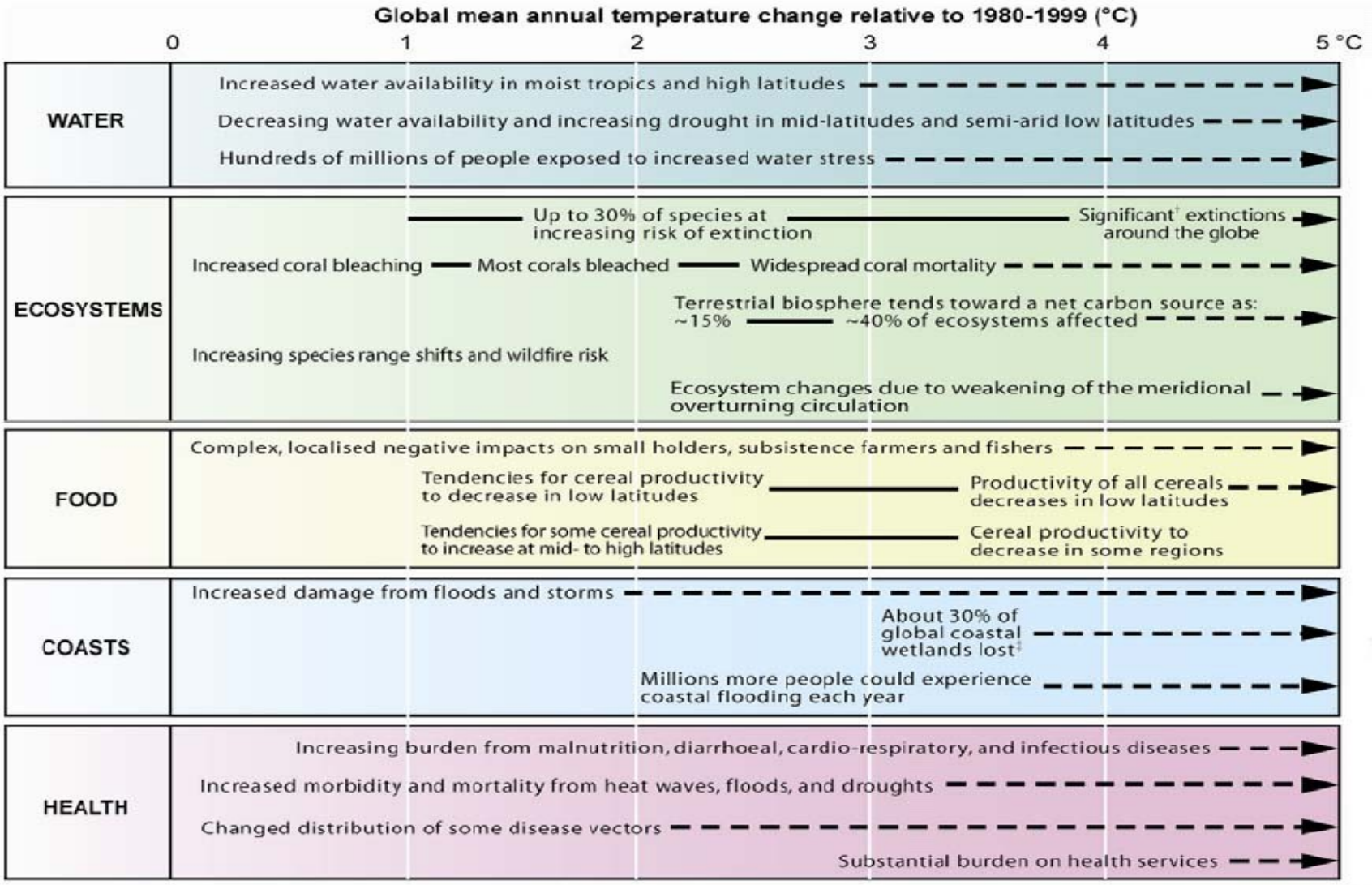
"Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic GHG concentrations"

Continued GHG emissions would induce many changes that would *very likely* be larger than those already observed




A2
A1B
B1
Year 2000 Constant Concentrations
20th century
Global surface warming (°C)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
–1.0
1900
2000
2100
Year
6.4°C
Likely range
1.1°C
B1
A1T
B2
A1B
A2
A1FI

Impacts increase with warming



Global mean annual temperature change relative to 1980-1999 (°C)

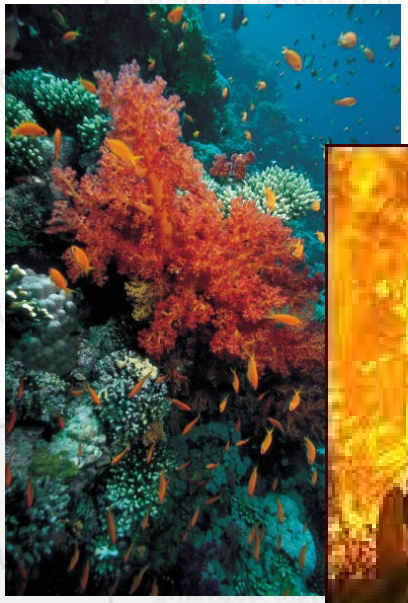
0 1 2 3 4 5 °C

WATER	Increased water availability in moist tropics and high latitudes
	Decreasing water availability and increasing drought in mid-latitudes and semi-arid low latitudes
	Hundreds of millions of people exposed to increased water stress

Global mean annual temperature change relative to 1980-1999 (°C)

0 1 2 3 4 5 °C

ECOSYSTEMS	Up to 30% of species at increasing risk of extinction → Significant† extinctions around the globe Increased coral bleaching → Most corals bleached → Widespread coral mortality Terrestrial biosphere tends toward a net carbon source as: ~15% → ~40% of ecosystems affected Increasing species range shifts and wildfire risk Ecosystem changes due to weakening of the meridional overturning circulation



Global mean annual temperature change relative to 1980-1999 (°C)

0 1 2 3 4 5 °C

FOOD	Complex, localised negative impacts on small holders, subsistence farmers and fishers	
	Tendencies for cereal productivity to decrease in low latitudes	Productivity of all cereals decreases in low latitudes
	Tendencies for some cereal productivity to increase at mid- to high latitudes	Cereal productivity to decrease in some regions

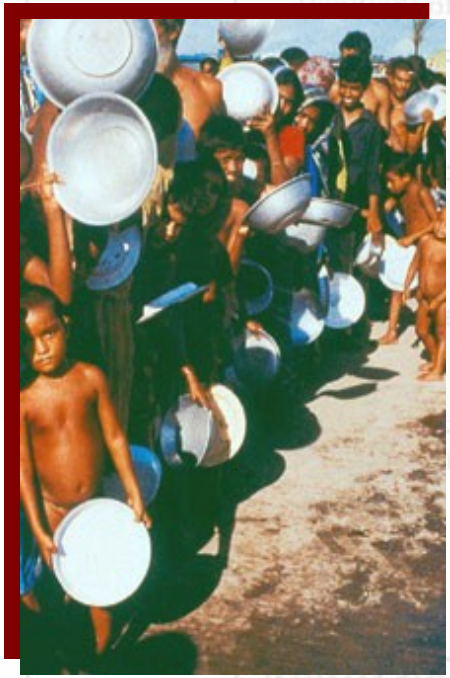
Global mean annual temperature change relative to 1980-1999 (°C)

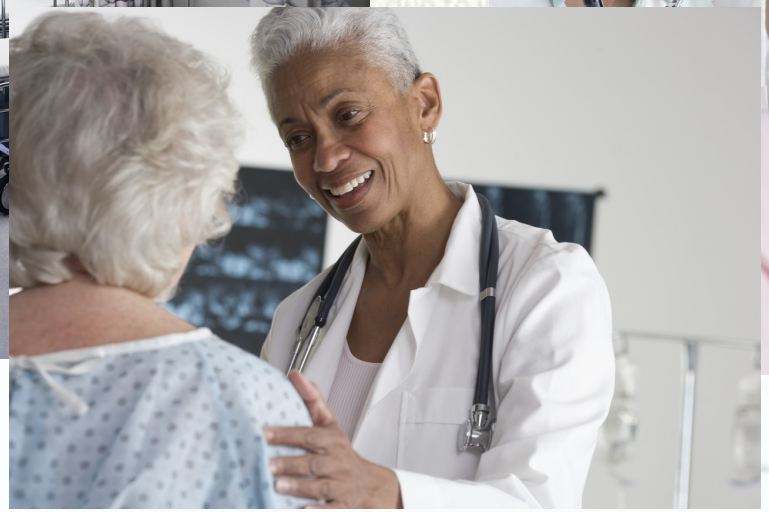
0 1 2 3 4 5 °C

COASTS	Increased damage from floods and storms About 30% of global coastal wetlands lost[4] Millions more people could experience coastal flooding each year

Global mean annual temperature change relative to 1980-1999 (°C)

0 1 2 3 4 5 °C





HEALTH	Increasing burden from malnutrition, diarrhoeal, cardio-respiratory, and infectious diseases
	Increased morbidity and mortality from heat waves, floods, and droughts
	Changed distribution of some disease vectors
	Substantial burden on health services

Some systems, sector and regions are *likely* to be especially affected by climate change

Regions include:

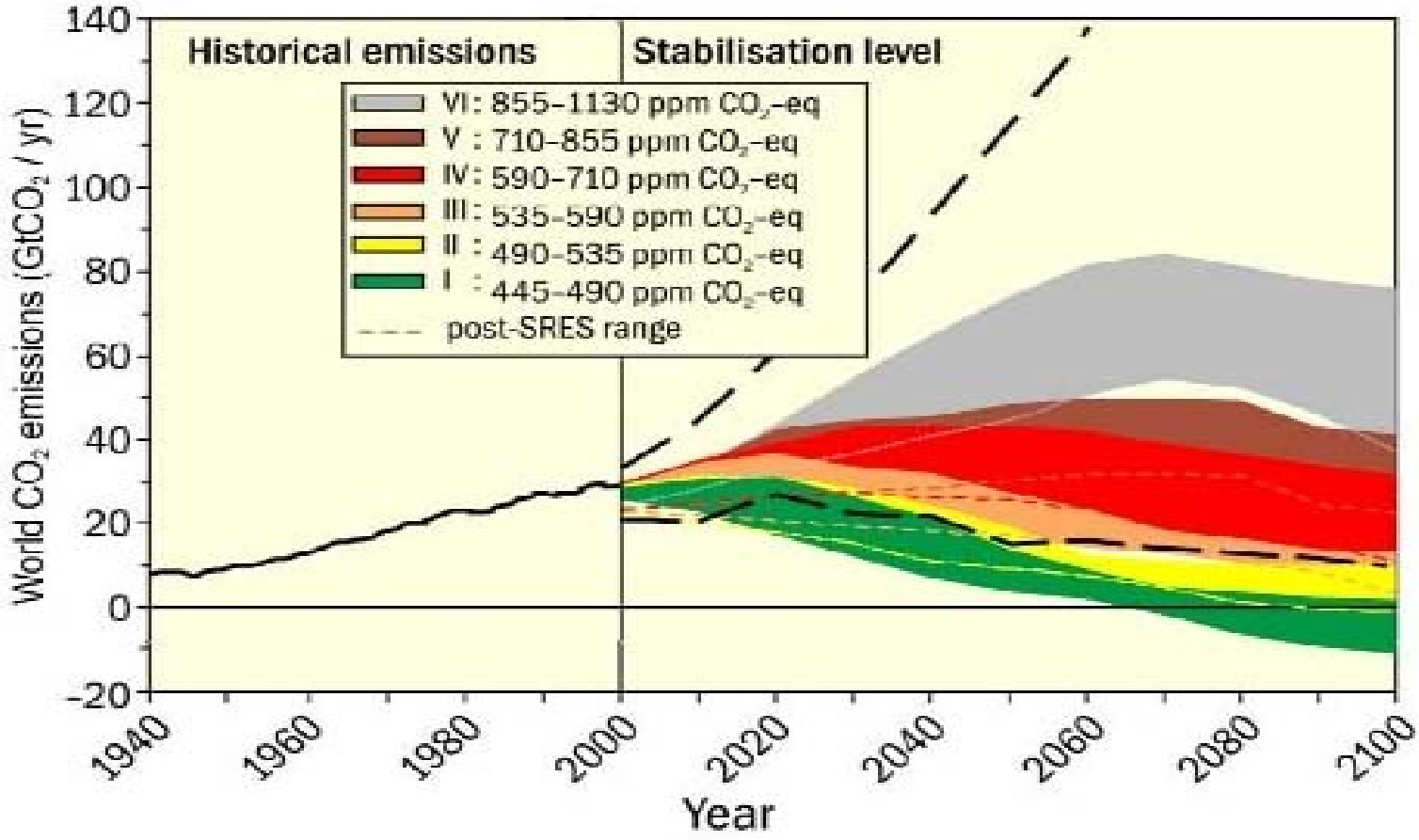
- The Arctic, because of high rates of projected warming
- Africa, because of low adaptive capacity
- Small islands, where there is high exposure of population and infrastructure to projected climate change impacts
- Asian and African megadeltas, due to large populations and high exposure to sea level rise, storm surges and river flooding



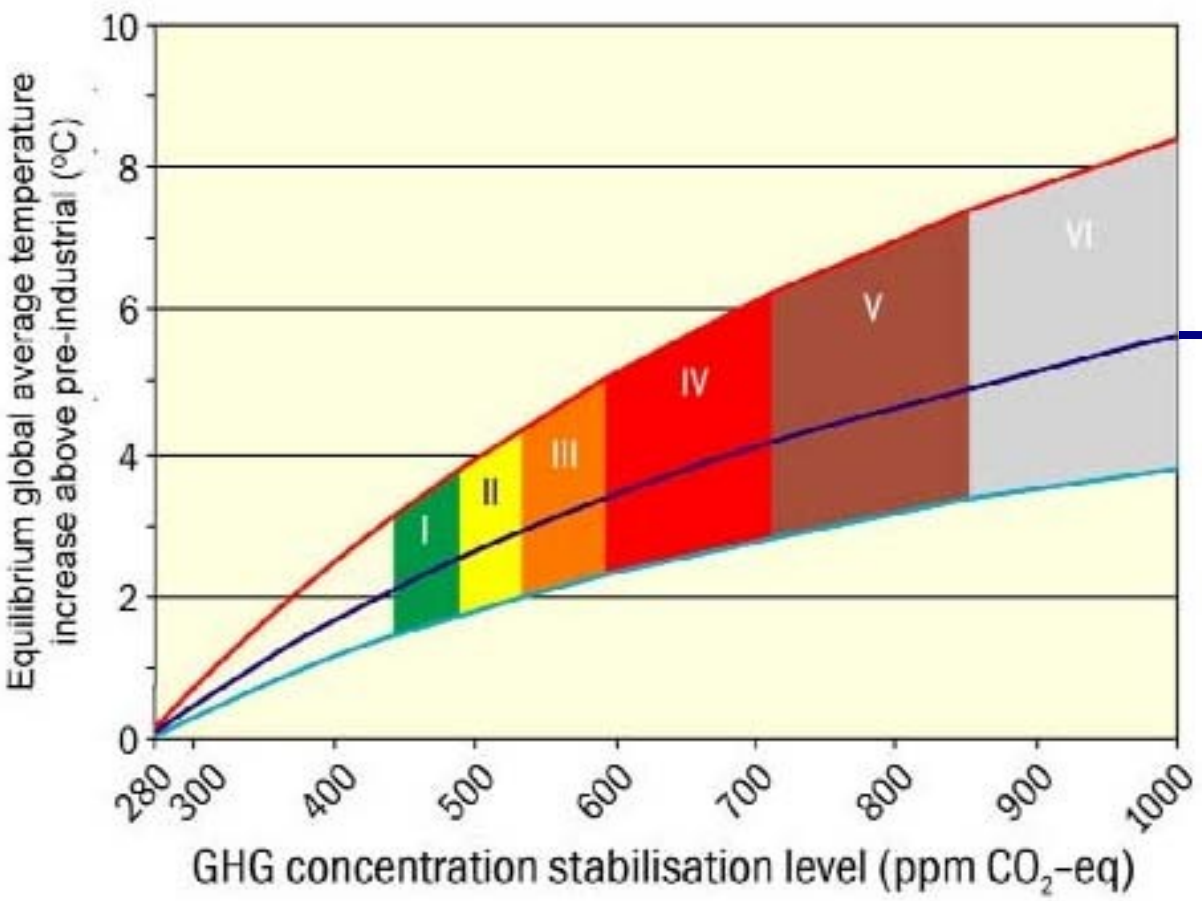
Adaptation and Mitigation are complementary

- Adaptation is necessary in the short and longer term to address impacts resulting from the warming that would occur even for the lowest stabilization scenarios assessed
- There are barriers, limits and costs which are not fully understood.
- Unmitigated climate change would, in the long term, be *likely* to exceed the capacity of natural, managed and human systems to adapt.
- Adaptation capacity is intimately connected to social and economic development but is unevenly distributed across and within societies.

The lower the stabilization level, the more quickly an emissions peak and decline must occur



For any given stabilization scenario, expected warming depends on climate sensitivity



Canadian role in the IPCC is strong

- About 250 Canadians involved as Coordinating Lead Authors, Lead Authors, Contributing Authors and Review Editors since the First Assessment Report
- AR4: 4 Coordinating Lead Authors, ~80 others as Lead Authors, Contributing Authors and Review Editors covering all three working groups
- Currently 2 Bureau members who assist in the management of the IPCC
- 10 government representatives with a range of expertise attended the AR4 Plenary meetings where the Summary for Policymakers was negotiated line-by-line
- IPCC Focal Point for Canada: ADM, Science and Technology, Environment Canada

The Future

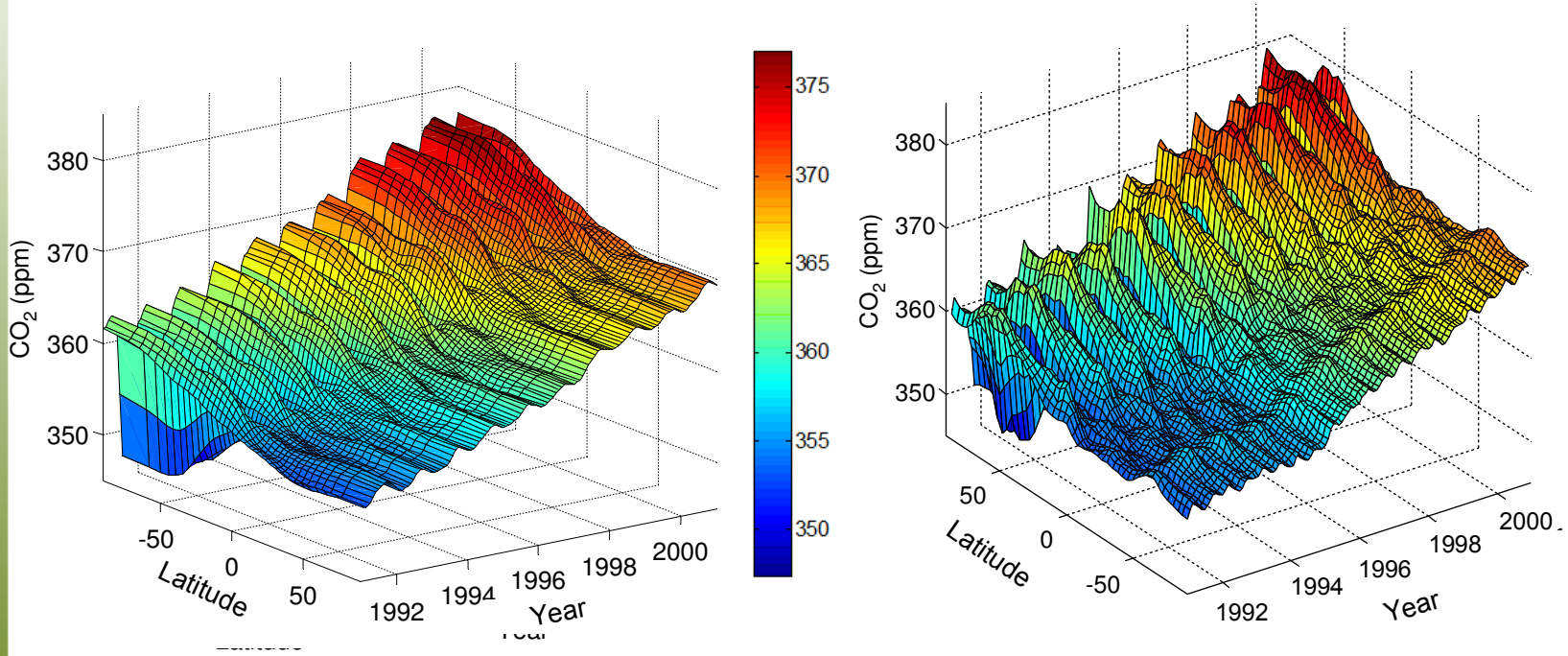
- IPCC has decided to produce a Fifth Assessment Report (AR5), with Working Group structure and mandate essentially the same as in the past
- Staggered approach to WG report release:
  - Working Group I - early 2013
  - Working Group II, III & Synthesis Report – by end of 2014
- This is intended to help integration between working groups and to ensure significant use of the new emissions scenarios, currently in development by the research community, in the AR5

Future themes for the IPCC

- Risk Assessment – low probability, high impact events
- Integration of adaptation and mitigation, particularly at the regional level
- Regional analysis of climate change impacts, as well as opportunities for adaptation and mitigation. Regional modelling is likely to play a larger role too.
- Economic analysis of the costs of climate change impacts, adaptation and mitigation

More sophisticated climate modelling: An example with the carbon cycle

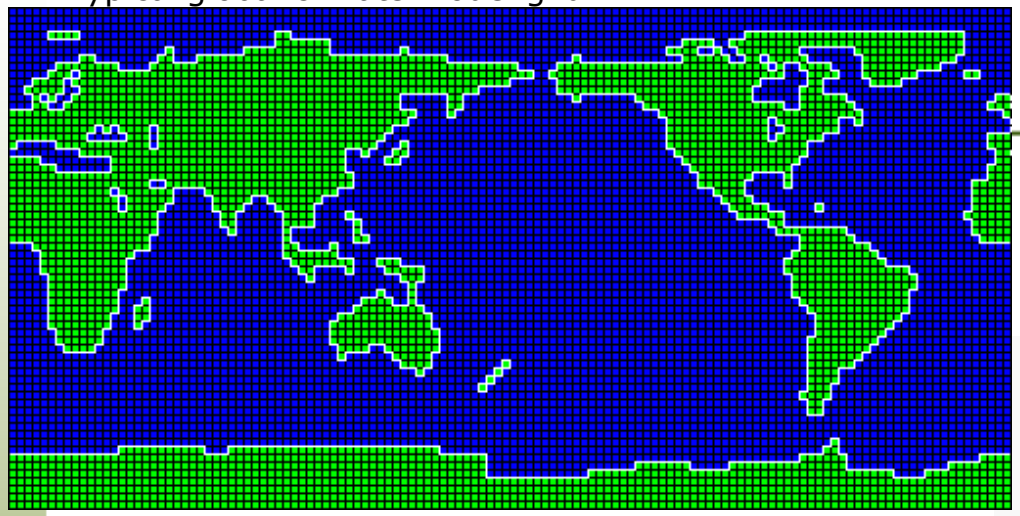
Transient response of CanESM1 to 1850-2000 emissions



Zonal and temporal behaviour of observation-based and simulated 1991-2000 CO_2 concentrations

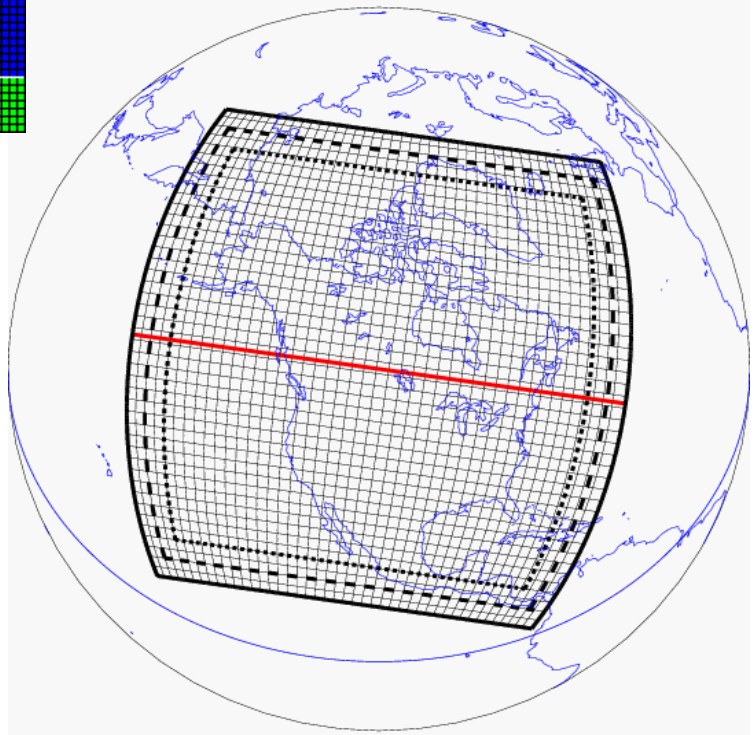
Regional Climate Modelling

Typical global climate model grid



Decision makers typically need finer detail

Nested Regional Climate Model



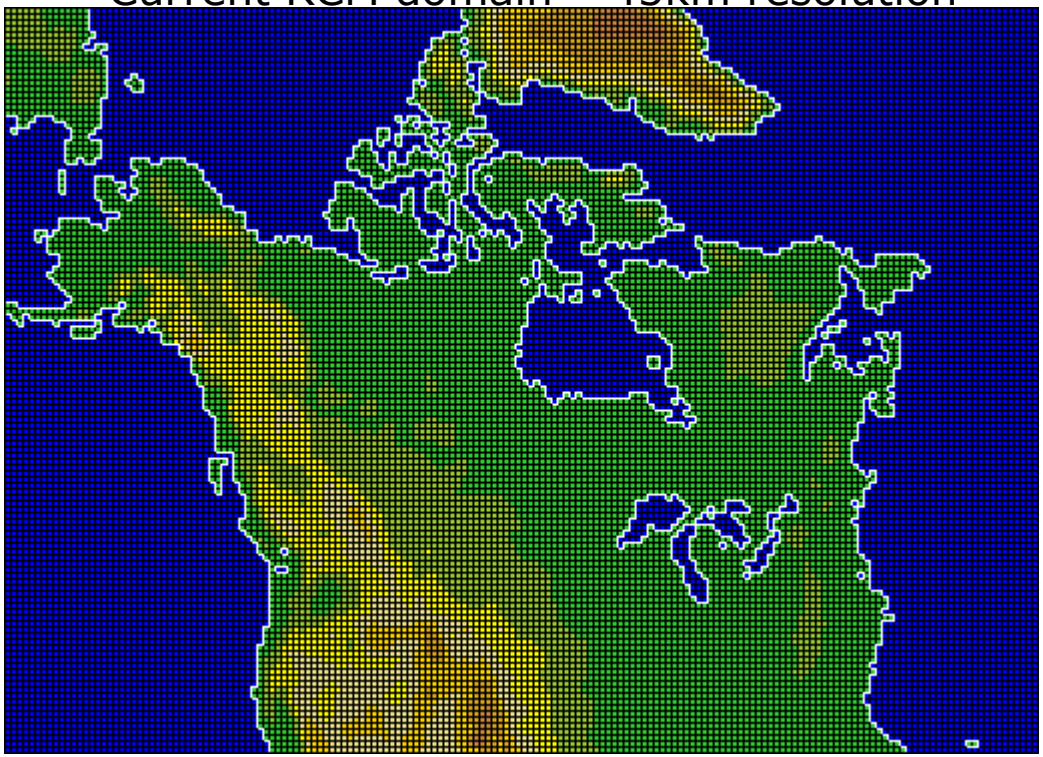
Present Canadian Regional Climate Model is based on CCCma physics package (AGCM2) and run at Ouranos.

Driven by boundary conditions provided by Canadian global climate model.

Currently available RCM results are disseminated via the CCCma web site (www.cccma.ec.gc.ca)

Results are available for historical (1970-1994) and future (2039-2063) time slices, using the 'business as usual' (IS92a) greenhouse gas scenario.

Current RCM domain – 45km resolution



Next Generation Regional Climate Model

As part of the CFCAS-funded CRCMD network, CCCma and RPN are jointly developing a new Canadian RCM

- It is based on the latest version of the CCCma 'physics' package (AGCM4), developed for the global climate model, and the GEM dynamical core, developed at RPN for numerical weather prediction.

- This effort will yield a global and regional climate model pair that share the same physics package.

- The new RCM will be used to provide high-resolution downscaled climate change results for Canada (driven at the boundaries by results from the new global model).

- It will also be used to undertake research into the parameterization of climate processes at higher resolution in preparation for later, high-resolution, global model versions.

A Key Challenge: Remaining Policy Relevant, but Neutral

- One of the key tenants of the IPCC is its aim to be policy relevant but not policy prescriptive
- The rigorous, open review process is key to the IPCC's credibility, as is the line-by-line negotiations of text by government delegates
  - Review ensures scientific integrity
  - Plenary negotiations ensures that the Summary for Policymakers is balanced, presented in plain language and the key conclusions are accepted by all governments
- Will be increased pressure on the IPCC to provide *policy advice* but must remain rooted in its core expertise: science assessment
- Canada is committed to remain engaged in the IPCC


10th SESSION OF IPCC WORKING GROUP I
10e SESSION DU GROUPE DE TRAVAIL I DU GIEC
Paris, France
29 January - 1st February 2007
Climate change 2007
the physical science basis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