

# Contribution of Working Group I to the IPCC Fourth Assessment Report

## Climate Change 2007: The Physical Science Basis

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### Introduction

In November 2003, at its 21st Plenary Session, the Intergovernmental Panel on Climate Change (IPCC) approved the outline for the contribution of Working Group I (WGI) to the IPCC Fourth Assessment Report (AR4). This outline is the product of a comprehensive scoping and consultation process that lasted more than a year. It sets a structure for the WGI AR4 that includes several new topics and organizational changes from the structure of the WGI Third Assessment Report. Work on drafting the report will begin in 2004 and be completed in 2007. This poster is an introduction to the IPCC assessment process and to the outline for the WGI AR4.

### IPCC Assessments

The Intergovernmental Panel on Climate Change (IPCC) has been established by WMO and UNEP to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. It is open to all Members of the UN and of the WMO.

IPCC assessments are grounded on several principles:

- They assess published literature, and do not conduct scientific research.
- They are policy relevant, not policy prescriptive.
- They provide a balanced summary of the range of scientific views and identify consensus where it exists.
- They involve the international scientific community.
- They are rigorously reviewed.
- They have a wide range of audiences, including policy-makers, the public, and the scientific community.

The IPCC has three Working Groups and a Task Force:

- Working Group I: The physical science basis of climate change
- Working Group II: Climate change impacts, adaptation and vulnerability
- Working Group III: Mitigation of climate change
- Task Force on National Greenhouse Gas Inventories: IPCC National Greenhouse Gas Inventories Programme.

### Working Group I

#### Working Group I Bureau

The Bureau of Working Group I guides the activities of the Group.

- Co-Chairs*
- Susan Solomon (USA)
  - Qin Dahe (China)

- Vice-Chairs*
- Kansri Boonpragob (Thailand)
  - Filippo Giorgi (Italy)
  - Bubou Jallow (Gambia)
  - Jean Jouzel (France)
  - Maria Martelo (Venezuela)
  - David Wratt (New Zealand)

#### Technical Support Unit

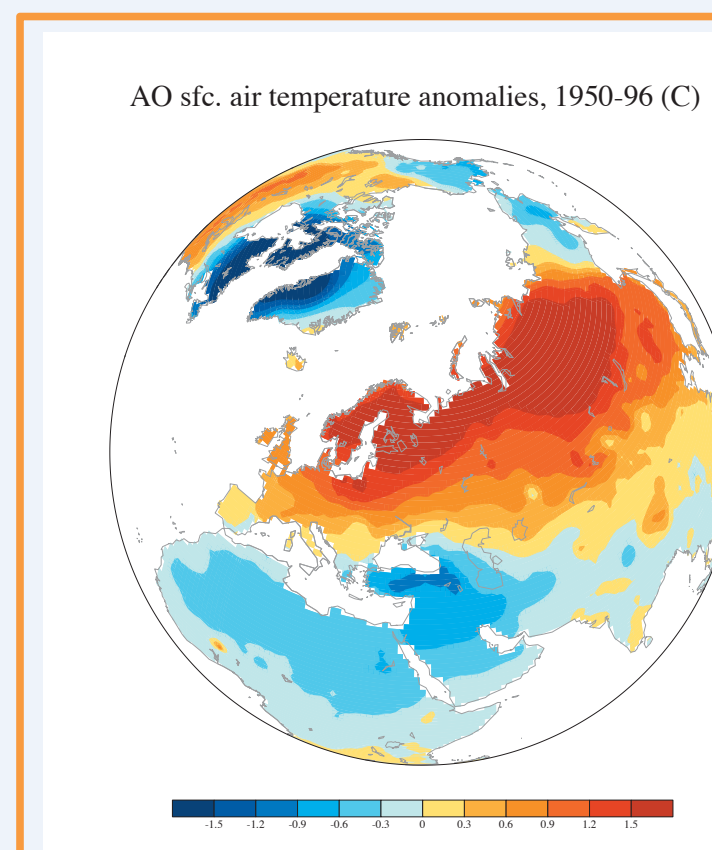
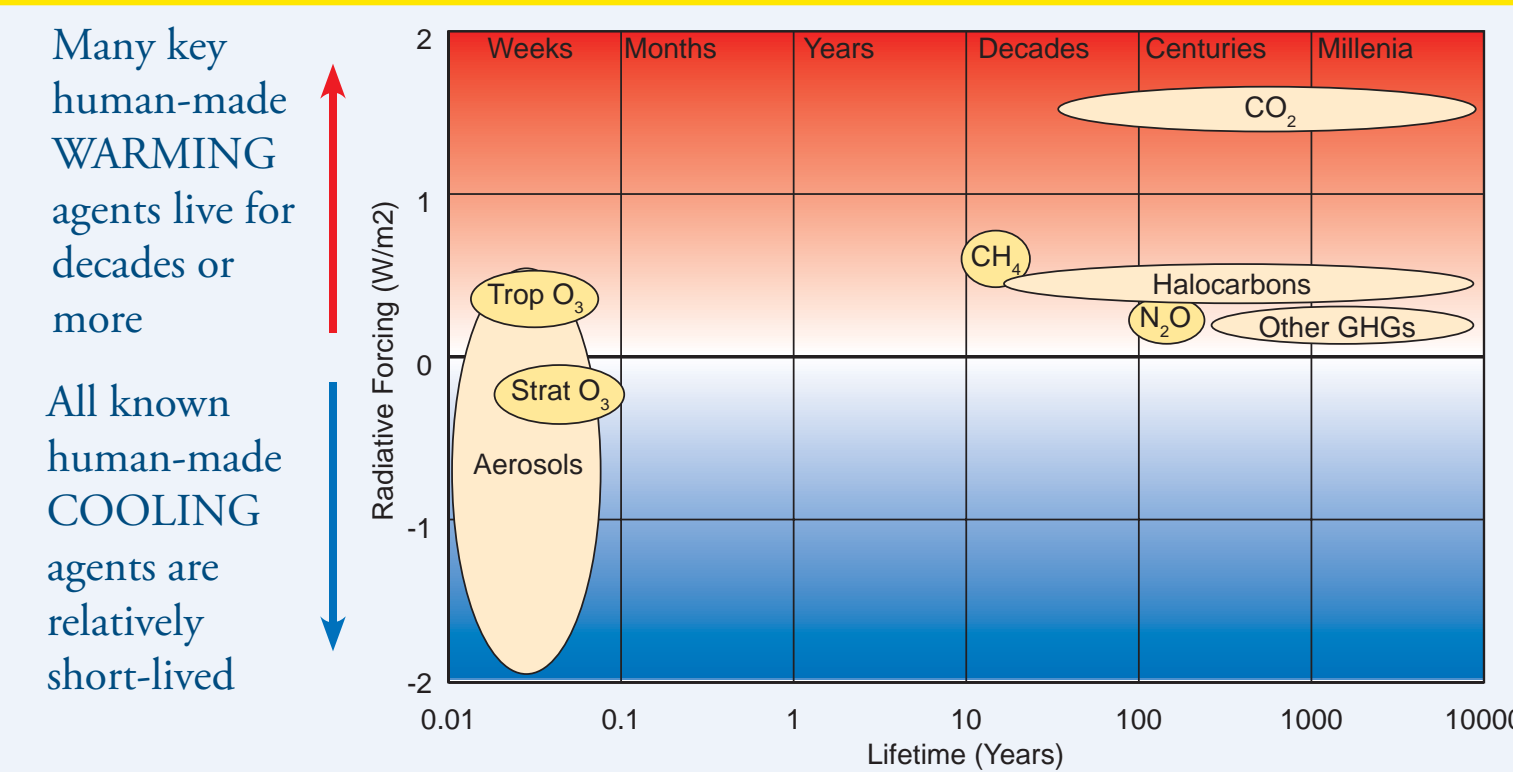
The activities of WGI, including meetings, drafting, reviewing, publishing, and outreach, are organized and supported by a Technical Support Unit (TSU), which is based in Boulder, CO, USA, and is headed by Martin Manning.

### What's New in the WGI AR4?

Here are some new elements in the WGI AR4, with examples shown at the Scoping Meetings.

#### Radiative Forcing

All of the radiative forcing factors are covered in one chapter. This organization will enable a uniform assessment of the important process-based links between emissions and radiative forcing and a more consistent overall view of key processes and uncertainties in radiative forcing.



#### Observations

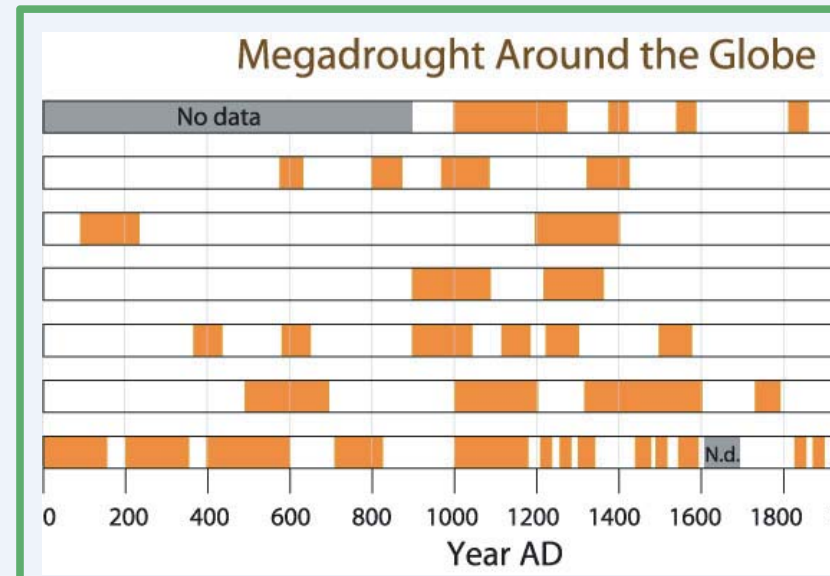
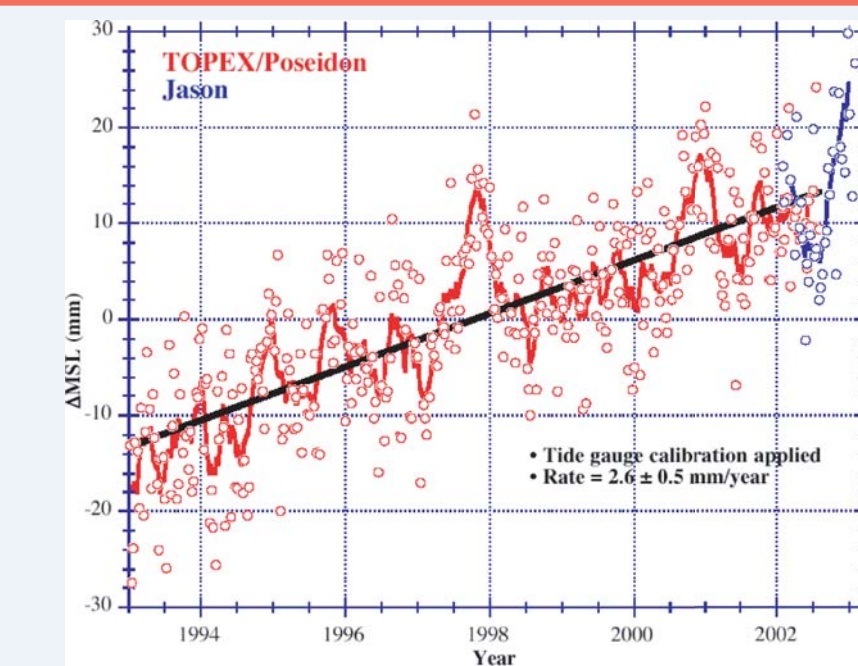
The single observational chapter in the TAR has been divided into three chapters dealing with observations of changes in atmospheric and surface climate, in ice, and in the oceans. This organization will enable an effective assessment of the large amount and new types of observational data that have become available since the TAR as well as improved understanding in areas such as modes of climate variability (e.g., ENSO, NAO).

**Figure:** Temperature trends over 1950-1996, related to the North Atlantic Oscillation. (From Mitchell, <http://tao.atmos.washington.edu/analyses0500/ao.html>)

#### Sea Level

Observations of sea-level changes will be treated consistently and jointly with other oceanic observations. This organization will enable assessment of the important scientific linkages that are now emerging in this area. Similarly, future sea level projections will be merged with projections of the climate system as a whole.

**Figure:** Interannual variability and trends in global mean sea level from satellite observations. (From Cazenave and Nerem, 2004)



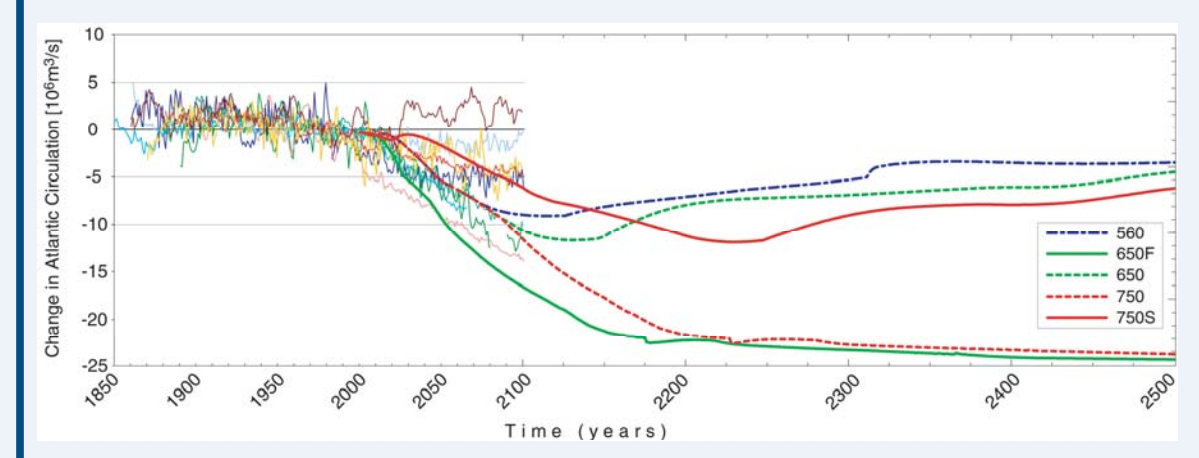
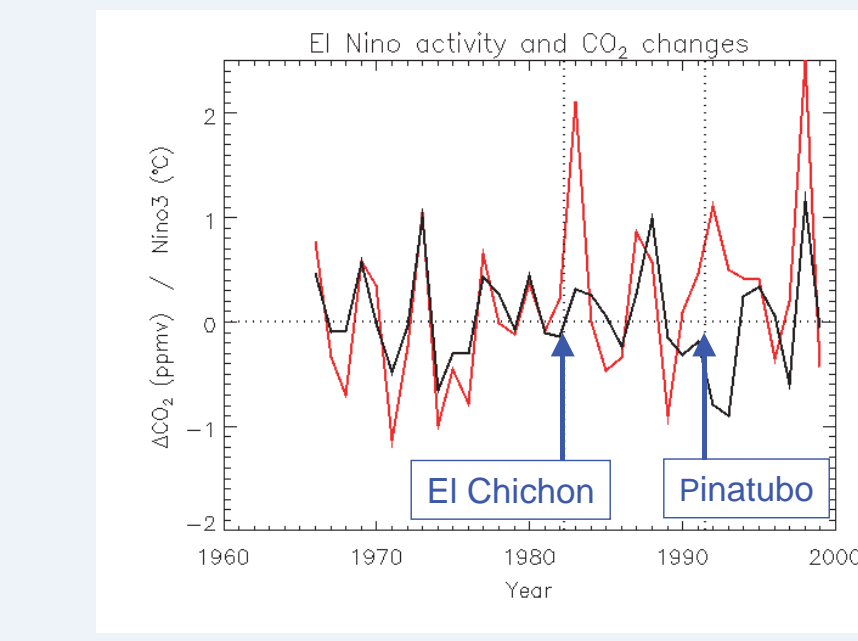
#### Paleoclimate

A separate chapter will be devoted to the large amount of new paleoclimatic data and related studies, rather than distributing this material across the assessment as in the TAR. This organization will enable a clearer assessment of the quality and use of paleoclimatic data, as distinct from instrumental data, and will provide a stronger perspective for evaluation of recent observed changes in comparison to past climate variations and abrupt climate change.

#### Biogeochemical Cycles

The carbon cycle and other relevant atmospheric chemistry, aerosol, and biogeochemical cycles are assessed in the context of climate change in one chapter. This organization enables the emerging science of feedbacks in these areas to be considered carefully and consistently.

**Figure:** Black - change in CO<sub>2</sub>; red - Niño3 sea surface temperature. (From Jones et al., 2001)



#### Processes

The discussion of model evaluation has been merged with that of climate processes, to assess how well key processes are represented within models.

**Figure:** Projected Atlantic thermohaline circulation changes. (From Rahmstorf and Stocker, 2003)

### WGI AR4 Outline

#### 1. Historical Overview of Climate Change Science

- Introduction
- Progress in observations
- Progress in understanding of radiative forcing, processes, and coupling
- Progress in climate modelling
- Advances in understanding uncertainties
- Appendix: Glossary of terms

#### 2. Changes in Atmospheric Constituents and in Radiative Forcing

- Introduction
- Definition and utility of radiative forcing
- Recent changes in greenhouse gases
- Aerosols – Direct and indirect radiative forcing
- Radiative forcing due to land use changes
- Contrails and aircraft-induced cirrus
- Variability in solar and volcanic radiative forcing
- Synthesis of radiative forcing factors
- GWPs and other metrics for comparing different emissions
- Appendix: Techniques, error estimation, and measurement systems

#### 3. Observations: Surface and Atmospheric Climate Change

- Introduction
- Changes in surface climate
- Changes in the free atmosphere
- Changes in atmospheric circulation
- Patterns of variability
- Changes in the tropics and sub-tropics
- Extra-tropical changes
- Changes in extreme events
- Synthesis: Consistency across observations
- Appendix: Techniques, error estimation, and measurement systems

#### 4. Observations: Changes in Snow, Ice and Frozen Ground

- Introduction
- Changes in snow cover and albedo
- Sea ice extent and thickness changes
- Changes in glaciers and small ice caps
- Changes and stability of ice shelves
- Changes and stability of ice sheets
- Appendix: Techniques, error estimation, and measurement systems

#### 5. Observations: Oceanic Climate Change and Sea Level

- Introduction
- Changes in ocean salinity, temperature, heat uptake, and heat content
- Biogeochemical tracers
- Changes in ocean circulation and water mass formation
- Sea Level: Global and regional changes
- Appendix: Techniques, error estimation, and measurement systems

#### 6. Paleoclimate

- Introduction
- Proxy methods and their uncertainty
- Inferred past climate system change
- Abrupt climate change
- Paleo-environmental model evaluation and sensitivity
- Synthesis: Insights into climate system behavior
- Appendix: Guide to the use of paleoclimatic information

#### 7. Couplings Between Changes in the Climate System and Biogeochemistry

- Introduction to biogeochemical cycles
- The carbon cycle and the climate system
- Global atmospheric chemistry and climate change
- Air quality and climate change
- Aerosols and climate change
- The changing land surface and climate
- Synthesis: Interactions among cycles and processes

#### 8. Climate Models and their Evaluation

- Advances in modeling
- Evaluation of contemporary climate as simulated by coupled global models
- Evaluation of large scale climate variability as simulated by coupled global models
- Evaluation of the key relevant processes as simulated by coupled global models
- Model simulations of extremes
- Climate sensitivity
- Evaluation of model simulations of thresholds and abrupt events
- Representing the global system with simpler models

#### 9. Understanding and Attributing Climate Change

- Introduction
- Radiative forcing and climate response
- Seasonal-to-interannual predictions of climate change and their reliability
- Understanding Pre-Industrial climate change
- Understanding climate change during the Instrumental era
- Appendix: Methods used to assess predictability
- Appendix: Methods used to detect externally forced signals (detection/attribution)
- Appendix: Methods used to assess uncertainty

#### 10. Global Climate Projections

- Introduction
- Projected radiative forcing
- Timescales of response
- Climate change to 2100 and beyond
- Sea level projections
- Scenarios and simple models
- Uncertainties in global model projections

#### 11. Regional Climate Projections

- Introduction
- Evaluation of regionalization methods
- Alternative simple methods
- Projections of regional climate changes
- Small islands
- Uncertainties in regional projections

### Organization of the WGI AR4

The AR4 will have four broad sections:

#### Introduction

*How has the understanding of the scientific basis of climate change advanced since IPCC began?*  
Describe the context and reasons for changes in understanding.

#### Radiative Forcing and Observations

*Can humans affect the climate system? What changes in the climate system have been observed?*  
Human and natural influences on climate, followed by observed variability and trends: atmosphere, ice and frozen ground, and oceans including sea level.

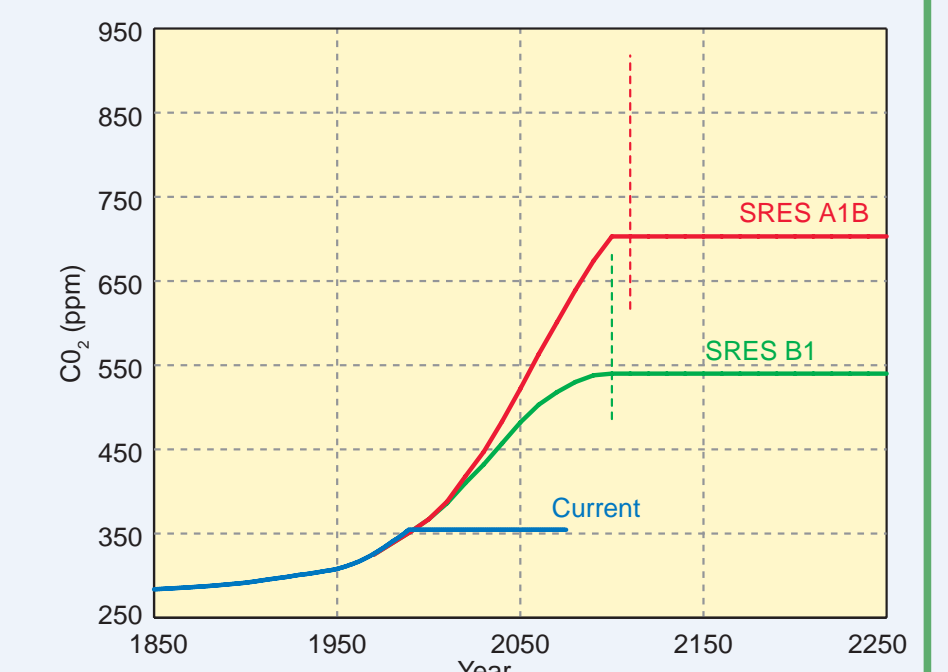
#### Past and Present Climate Change and Couplings to Biogeochemical Cycles

*How well do we understand human contributions to past and present climate change?*  
Paleoclimate, roles of biogeochemical cycles and human effects upon them, evaluation of models, understanding and attributing observed changes.

#### Future Climate Change

*How is climate projected to change in the future?*  
Projections of future climate change globally and regionally, on time scales from decades to centuries.

**Figure:** Climate modelling groups have been asked to run scenarios that will provide information on long-term changes at different greenhouse-gas levels. In addition, standard model experiments, such as 1% per year CO<sub>2</sub> growth, will be used to compare the models. (Bern Carbon Cycle model, WGI-TAR, Appendix II. Bars indicate uncertainty range.)



### Writing the WGI AR4

#### Lead Authors

The WGI Bureau has selected 140 Lead Authors, from 33 countries, to write the WGI AR4. The selection, from a large pool of experts nominated by governments, was based on scientific expertise, geographical balance, and a balance of views, and aimed to include young experts and experts who are new to the IPCC assessment process. Each chapter has two Coordinating Lead Authors and 7–15 Lead Authors.

#### Reviews

To ensure that the WGI AR4 reflects the best available scientific information and a balance of views, it will undergo one internal and two formal rounds of external review.

#### Review Editors

Review Editors will ensure that the Authors respond appropriately to the formal review comments.

#### Contacts

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INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

