INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

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WORKING GROUP I CONTRIBUTION TO THE IPCC FOURTH ASSESSMENT REPORT (AR4)

Background Information

(Submitted by the Co-chairs of Working Group I)

IPCC Secretariat, c/o WMO, 7bis, Avenue de la Paix, C.P. N° 2300, 1211 Geneva 2, SWITZERLAND
Phone: +41 22 730 8208/8254 Fax: +41 22 730 8025/8013
E-mail: ipcc_sec@gateway.wmo.ch Website: http://www.ipcc.ch

1. Introduction

This document is provided by the co-chairs of Working Group I for the information of delegates to the IXth Working Group I Session in order to describe the broad structure and rationale of the Working Group I contribution to the IPCC Fourth Assessment Report (WG1-AR4).

The proposed outline for the WG1-AR4 is the result of a more comprehensive consultation and scoping process than has been used in the past, involving two rounds of Government comments and extensive consultations with the international scientific community.

2. The Consultation and Scoping Process

WG1 has obtained a broad range of inputs on the scope of the WG1-AR4 from the expert scientific community over the past 18 months. A series of WG1 Bureau meetings and e-mail discussions were held to consider how best to combine the following inputs:

- Leadership by international scientific experts from many countries in developing the proposed contents and structure of the report at two Scoping Meetings organized by the IPCC, in April 2003 in Marrakech, and September 2003 in Potsdam.

- Feedback from experts at international scientific meetings on presentations of the developing content.

- Participation of the chairs of the World Climate Research Program (WCRP) and the International Geosphere Biosphere Program (IGBP) at IPCC Scoping Meetings.

- Input from climate modeling groups around the world and from WCRP working groups on approaches for enabling model intercomparison during the assessment process.

- Feedback from Convening Lead Authors of the TAR on what key emerging science issues needed to be addressed in the WG1-AR4, and what issues did not need to be repeated in detail.

Government comments on the scope, content, and emerging outlines of the AR4 were solicited prior to each of the IPCC Scoping Meetings and were explicitly taken into account during these meetings. The full set of Government comments has been made available via the IPCC web site for the AR4 scoping meetings as documents AR4 Scop-1/INF.3 and AR4 Scop-2/INF.2. These comments have directly influenced the development of the broad structure of the WG1-AR4, the approach to cross-WG issues including the cross-cutting themes, and the proposed content of specific chapters.

The WG1 TSU is compiling the comments and discussion arising from this extensive scoping process into a document that will be reviewed by the WG1 Bureau. This document will then provide a detailed background for consideration by the Lead Authors in writing the WG1-AR4.

Consensus views expressed by delegates at this meeting, the IXth WG I Plenary Session, will also be included in that document to Lead Authors.

3. Proposed structure of the report

The WG1-AR4 has retained some aspects of the TAR and has a number of important new elements to reflect advances in science as well as Government comments. The structure aims to remain comprehensive in scope but be shorter and more focused than the TAR.

The resulting structure of the WG1-AR4 can be summarized as follows:

- *Introduction (Chapter 1):* This section will give a short description of the evolution of our understanding of climate change and provide a 'roadmap' to the rest of the report.

- Radiative Forcing and Observations (Chapters 2, 3, 4, and 5): This section of the report addresses the major sources of human and natural influences on climate and describes the observed trends and inter-decadal variability in climate as recorded in the instrumental record. It will cover all relevant aspects of the atmosphere, cryosphere (snow, ice, and frozen ground), and oceans (including sea level).

- Past and Present Climate Change and Couplings to Biogeochemical Cycles (Chapters 6, 7, 8, and 9): This section of the report addresses the scientific understanding of the processes that cause climate change and our ability to explain observed changes using process-based models. It will cover a longer time period than the previous section of the report to provide a perspective for more recently observed changes, and it will assess the ability of a hierarchy of climate models to explain observed climate changes. It will also assess the critical linkages between biogeochemical cycles and climate change.

- Future Climate Change (Chapters 10 and 11): This section of the report will assess projections of future climate change derived from climate models on time scales from decades to centuries at both global and regional scales. It will include coverage of the inertia in different aspects of the climate system, the differences between global and regional climate projections, related sea level rise, implications of stabilization at different levels of greenhouse gas concentrations, and a careful analysis of uncertainties.

The detailed organization differs from that of the TAR in several key ways:

- 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.

- 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).

- Appendices to each of the observational chapters and to the radiative forcing chapter will directly link measurement systems, their uncertainties, and related research needs to the information assessed in the chapters.

- 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.

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

- 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.

- 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.

4. Indicative Page Lengths

In order to meet the requirement that the AR4 be "shorter and more focused", the target for the total page length of the AR4 has been set at about two thirds that of the TAR. The following table gives indicative page lengths for each chapter of the WG1-AR4. Although these lengths may be revised, the intent is to keep within the target total number of pages.

Chapter	Title	Pages
	Summary for Policymakers	15
	Technical Summary	60
1	Historical Overview of Climate Change Science	15
2	Changes in Atmospheric Constituents and in Radiative Forcing	60
3	Observations: Atmospheric and Surface Climate Change	60
4	Observations: Changes in Snow, Ice and Frozen Ground	25
5	Observations: Oceanic Climate Change and Sea Level	35
6	Paleoclimate	30
7	Couplings Between Changes in the Climate System and Biogeochemistry	50
8	Climate Models and their Evaluation	50
9	Understanding and Attributing Climate Change	50
10	Global Climate Projections	50
11	Regional Climate Projections	60
	(total)	560

5. Incorporation of Cross Cutting Themes

The WG1-AR4 will link to five of the seven cross-cutting themes of the AR4 as follows:

- Uncertainty and Risk: Uncertainties will be covered comprehensively in all sections of the report. As noted in the concept paper for the Uncertainty and Risk theme, there have been

significant advances in methods for characterizing uncertainty in the physical climate sciences, e.g. through the use of model ensemble runs and probability distributions for key climate parameters. Such advances will be summarized in Chapter 1 of the WG1-AR4. Lead Authors will be asked to characterize uncertainties objectively where that is possible and to use standard approaches to identifying levels of confidence. The proposed IPCC Workshop on Uncertainty and Risk will consider further ways to improve the description and quantification of uncertainty in the AR4 and its outcomes will be taken into account by WG1.

- Regional Integration: WG1-AR4 will ensure regional integration through a carefully coordinated and continuous exchange of information between WG1 and WG2. The sub-continental climate projections will cover the same regions used in the WG2-AR4. As small islands are not generally resolved in current climate models they will be dealt with in a separate section of the regional projections chapter, and larger scale climate of the nearby sub-continental regions will also be discussed where relevant to small islands. Experts at both the AR4 scoping meetings stressed the preliminary nature of current regional scale climate modeling. Thus it appears unlikely that all regions can be addressed in a comprehensive or uniform manner. For this reason a careful assessment of uncertainties associated with regional climate modeling will also be included in Chapter 11. Working Group I supported a recent workshop on regional climate held in July 2003 and is co-sponsoring an expert meeting on the related issue of drought in November 2003. Further meetings will be conducted during the course of the assessment process with the next being planned jointly with WCRP for summer, 2004. These provide an important opportunity to compare methods and data used in different regions, to assist in comparing regional climate models with observations, and to support the transfer of expertise between countries.

- Water: The hydrological cycle and its role in the climate system is a key aspect for the WG1-AR4, and consequently much of the report will be directly relevant to the Water theme. Water vapor plays a dominant role in the greenhouse effect, cloud processes, and heat transport within the atmosphere. Change in the hydrological cycle and its feedbacks with climate change are a major focus of climate models. Chapters 3 and 4 will provide both global and regional perspectives on observed changes in the hydrological cycle and will provide key information on the changes in rainfall and snow pack that are required for an assessment of river, lake and water supply changes by WG2. Chapter 7 will include an assessment of recent studies of potential linkages between aerosols and rainfall. Chapter 8 will include an assessment of how well climate models can simulate change in the hydrological cycle, particularly issues such as increase in the frequency of drought and extreme precipitation events. Chapters 10 and 11 will include assessments of the projections of such change at both global and regional levels. Water is closely tied to the regional theme, and the upcoming drought workshop referred to above thus supports development of both themes and their linkages.

- Key Vulnerabilities (including UNFCCC Article 2 issues): The WG1-AR4 will provide a broad range of inputs for the consideration of key vulnerabilities in accordance with this theme. This area also provides an important area for exchange of information between WG1 and WG2. Assessment of observations of trends and variability for different components of the climate system in Chapters 3, 4 and 5 will provide a necessary context for consideration of key vulnerabilities. Furthermore, the WG1-AR4 will contribute to this theme through topics that have advanced significantly since the previous assessment. Chapter 6 will provide new information, from paleoclimatic evidence, on the magnitude and rates of abrupt climate change at regional and global levels. Chapter 7 will assess the

couplings of biogeochemical cycles with the climate system and the potential roles of feedbacks in future climate. Chapters 8 and 9 will provide a critical contribution to this theme through a new assessment of the uncertainty range for the climate sensitivity parameter (facilitated by the WG1 climate sensitivity workshop to be held in July, 2004). Chapter 10 will consider what is known about the long term response of the climate system to stabilization at different levels of greenhouse gases.

- Technology: The WG1 aspect of the Technology theme includes measuring, monitoring and verification of observations. The WG1-AR4 will cover these aspects explicitly in a series of appendices to the chapters based on observations that will cover advances in remote sensing and other technologies relevant to the detection of climate change. The assessment of climate change and climate models in WG1 provides the underlying basis for integrated assessment of the role of technology in climate change.