

**AGREED REFERENCE MATERIAL FOR THE
IPCC FIFTH ASSESSMENT REPORT**

- Working Group I outline
- Working Group II outline
- Working Group III outline
- Concept notes on Cross-Cutting issues
- AR5 Expert Meetings and Workshops

**Working Group I Contribution to the IPCC Fifth Assessment Report
Climate Change 2013: The Physical Science Basis**

Summary for Policy Makers

Technical Summary

Chapter 1: Introduction

Executive Summary

- Rationale and key concepts of the WG1 contribution
- Treatment of uncertainty
- Climate change projections since FAR

Frequently Asked Questions

Chapter 2: Observations: Atmosphere and Surface

Executive Summary

- Changes in surface temperature and soil temperature
- Changes in temperature, humidity and clouds
- Changes in atmospheric composition
- Changes in radiation fields and energy budget
- Changes in hydrology, runoff, precipitation and drought
- Changes in atmospheric circulation, including wind
- Spatial and temporal patterns of climate variability
- Changes in extreme events, including tropical and extratropical storms

Frequently Asked Questions

Chapter 3: Observations: Ocean

Executive Summary

- Changes in ocean temperature and heat content
- Ocean salinity change and freshwater fluxes
- Sea level change, ocean waves and storm surges
- Ocean biogeochemical changes, including ocean acidification
- Changes in ocean surface processes
- Changes in ocean circulation
- Spatial and temporal patterns of ocean variability

Frequently Asked Questions

Chapter 4: Observations: Cryosphere

Executive Summary

- Changes in ice sheets, including mass balance
- Changes in ice shelves
- Changes in glaciers and ice caps
- Sea ice variability and trends
- Snow and ice cover variability and trends
- Changes in frozen ground
- Dynamics of ice sheets, ice shelves, ice caps, glaciers and sea ice

Frequently Asked Questions

Chapter 5: Information from Paleoclimate Archives

Executive Summary

- Characteristics of early instrumental, documentary and natural climate archives
- Reconstruction of radiative forcing and climate response
- Reconstruction of regional variability and extremes
- Abrupt climate changes and their regional expression
- Sea level and ice sheets: patterns, amplitudes and rates of change
- Paleoclimate perspective on irreversibility in the climate system
- Paleodata-model intercomparisons

Frequently Asked Questions

Chapter 6: Carbon and Other Biogeochemical Cycles

Executive Summary

- Past changes in CO₂, CH₄, N₂O and biogeochemical cycles
- Recent trends in global and regional sources, sinks and inventories, including land use change
- Processes and understanding of changes, including ocean acidification
- Interactions between the carbon and other biogeochemical cycles, including the nitrogen cycle
- Projections of changes in carbon and other biogeochemical cycles
- Greenhouse gas stabilisation
- Carbon cycle – climate feedbacks and irreversibility
- Geoengineering involving the carbon cycle

Frequently Asked Questions

Chapter 7: Clouds and Aerosols

Executive Summary

- Observations of clouds and their representation in models
- Coupling of clouds, water vapour, precipitation and the large-scale circulation
- Cloud and water vapour feedbacks and their effects on climate sensitivity
- Observations of aerosols and their representation in models
- Aerosol types including black carbon: chemistry, sources, sinks and distribution
- Direct and indirect aerosol forcing and effects, including contrails and cosmic rays
- Aerosol-cloud-precipitation interactions
- Geoengineering involving clouds and aerosols

Frequently Asked Questions

Chapter 8: Anthropogenic and Natural Radiative Forcing

Executive Summary

- Natural radiative forcing changes: solar and volcanic
- Anthropogenic radiative forcing, including effects from land surface changes
- Effects of atmospheric chemistry and composition
- Spatial and temporal expression of radiative forcing
- Greenhouse gas and other metrics, including Global Warming Potential (GWP) and Global Temperature Change Potential (GTP)

Frequently Asked Questions

Chapter 9: Evaluation of Climate Models

Executive Summary

- The hierarchy of climate models: from global to regional
- Downscaling methods
- Assessing model performance, including quantitative measures and their use
- New model components and couplings
- Representation of processes and feedbacks in climate models
- Simulation of recent and longer term records
- Simulation of regional patterns, variability and extremes

Frequently Asked Questions

Chapter 10: Detection and Attribution of Climate Change: from Global to Regional

Executive Summary

- Evaluation of methodologies
- Atmospheric and surface changes
- Changes in ocean properties
- Cryosphere changes
- Extreme events
- Pre-instrumental perspective
- Implications of attribution for projections

Frequently Asked Questions

Chapter 11: Near-term Climate Change: Projections and Predictability

Executive Summary

- Predictability of interannual to decadal climate variations and change
- Projections for the next few decades
- Regional climate change, variability and extremes
- Atmospheric composition and air quality
- Possible effects of geoengineering
- Quantification of the range of climate change projections

Frequently Asked Questions

Chapter 12: Long-term Climate Change: Projections, Commitments and Irreversibility

Executive Summary

- Scenario description
- Projections for the 21st century
- Projections beyond the 21st century
- Regional climate change, variability and extremes
- Forcing, response and climate sensitivity
- Climate change commitment and inertia
- Potential for abrupt change and irreversibility in the climate system
- Quantification of the range of climate change projections

Frequently Asked Questions

Chapter 13: Sea Level Change

Executive Summary

- Synthesis of past sea level change and its components
- Models for sea level change
- Projections of globally averaged sea level rise
- Projections of the regional distribution of sea level change
- Extreme sea level events
- Potential ice sheet instability and its implications
- Multi-century projections

Frequently Asked Questions

Chapter 14: Climate Phenomena and their Relevance for Future Regional Climate Change

Executive Summary

- Patterns of variability: observations, understanding and projections
- Monsoon systems: observations, understanding and projections
- Extremes: observations, understanding and projections
- Interconnections among phenomena

Frequently Asked Questions

Annex I: Atlas of Global and Regional Climate Projections

Annex II: Glossary

Annex III: Acronyms and Regional Abbreviations

Annex IV: List of Authors

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Outline of the Working Group II Contribution to the Fifth Assessment Report Climate Change 2014: Impacts, Adaptation, and Vulnerability

Table of Contents

Summary for Policymakers Technical Summary

Each sectoral and regional chapter will include a standard set of topics that are referred to as [CONTEXT] in each chapter outline:

- Observed impacts, with detection and attribution
- Projected integrated climate change impacts, with regional variation by scenario and time slice
- Assessing impacts, vulnerabilities, and risks
 - Vulnerabilities to key drivers (including extremes)
 - Economic, social, and environmental context for uncertain futures under alternative development pathways
 - Multiple interacting stresses
 - Uncertainty
 - Valuation of impacts and adaptation
 - Key vulnerabilities
- Adaptation and managing risks
 - Adaptation needs and gaps (based on assessed impacts and vulnerabilities)
 - Practical experiences of adaptation, including lessons learned
 - Observed and expected barriers to adaptation
 - Observed and expected limits to adaptation
 - Facilitating adaptation and avoiding maladaptation
 - Planned and autonomous adaptation
 - Potential and residual impacts
 - Thresholds and irreversible changes
- Case studies
- Research and data gaps

Each chapter will include an executive summary, FAQs, and references

PART A: GLOBAL AND SECTORAL ASPECTS

Context for the AR5

1. Point of departure
 - The setting
 - Major conclusions of WGII AR4
 - Major conclusions of Special Report on *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*
 - Major conclusions of WGI AR5
2. Foundations for decisionmaking
 - Key concepts
 - Impacts, adaptation, and vulnerabilities on a range of scales
 - Assessing impacts, vulnerabilities, and risks
 - Multi-metric valuation
 - Treatment of uncertainty
 - Key vulnerabilities
 - Managing risks
 - Climate-resilient pathways: adaptation, mitigation, and sustainable development interactions

Natural and Managed Resources and Systems, and Their Uses

3. Freshwater resources

- Diversity of world water resources and their sensitivity to climate change
[CONTEXT]
- Cryosphere
- Interactions among water resources, human activities, and the built environment
- Water management, water security, and sustainable development

4. Terrestrial and inland water systems

- Diversity of world ecosystems and their sensitivities to climate change: from the mountains to the coast, from the tropics to the poles
 - o Intensively managed systems: forestry, fiber, and fuel production
 - o Wildlands and extensively managed systems
 - o Protected and conservation areas[CONTEXT] {for each ecosystem}
- Ecosystem services
- Interactions among ecosystems; land use, land-use change and forestry; and other human activities
- Vulnerability of carbon pools, bio-energy implications, and carbon management potentials
- Threats to human activities, infrastructure, and biodiversity

5. Coastal systems and low-lying areas

- Diversity of world ecosystems and their sensitivities to climate change
[CONTEXT] {for each ecosystem}
- Ecosystem services
- Interactions among ecosystems, human activities, and the built environment
- Sea-level rise, changes in coastal dynamics, and threats to human activities, infrastructure, agriculture, and biodiversity

6. Ocean systems

- Diversity of world ecosystems and their sensitivities to climate change
[CONTEXT] {for each ecosystem}
- Ecosystem services
- Water property changes, including temperature and ocean acidification
- Interactions between ecosystems and human activities
- Threats to human activities and biodiversity

7. Food production systems and food security

- Food production: farming, livestock, and fisheries and their sensitivities to climate change
[CONTEXT]
- Food systems: processing, distribution, and access
- Food security and the means to achieve it

Human Settlements, Industry, and Infrastructure

8. Urban Areas

[CONTEXT]

- Urbanization processes, sustainable habitats, and climate change risks
- Urban micro-climates, including urban heat islands
- Civic services and infrastructure
- Housing and settlements
- Economic base
- Development plans and development pathways, including social capital
- Urban planning, management, and governance
- Landscape and regional interconnections

9. Rural Areas

[CONTEXT]

- Landscape and regional interconnections (including migration)
- Housing and settlements
- Economic base and livelihoods
- Infrastructure
- Social capital and resilience

10. Key economic sectors and services

[CONTEXT]

- Networked infrastructure, including transportation, energy, water, and sanitation
- Industry and manufacturing
- Tourism
- Social and other economic services
- Market impacts (supply chains, systemic risks, and insurance)
{Food production, building on Chapter 7}

Human Health, Well-Being, and Security

11. Human health

[CONTEXT]

- Determinants of health: current and future trends
- Health outcomes and their sensitivity to climate change
 - o Extreme events
 - o Air quality
 - o Foodborne and waterborne diseases
 - o Vectorborne and zoonotic diseases
 - o Malnutrition
- Water quality, availability, and sanitation
- Children and other vulnerable populations
- Health inequalities, gender, and marginalized populations

12. Human security

[CONTEXT]

- Social and economic activities, including employment
- Education
- Inequalities, gender, and marginalized populations
- Culture, values, and society
- Indigenous peoples
- Local communities
- Local and traditional knowledge
- Migration and population displacement
- Conflict
- Community resilience

13. Livelihoods and poverty

[CONTEXT]

- Chronic and transient poverty
- Effects of climate change responses on poverty
- Interactions between climate change and poverty-reduction initiatives
- Inequalities, gender, and marginalized populations

Adaptation

14. Adaptation needs and options

- Synthesis of adaptation needs and options
- International, national, and sectoral assessments, including National Adaptation Programmes of Action (NAPAs)
- Measuring adaptation
- Addressing maladaptation

15. Adaptation planning and implementation

- Local, national, regional, and global strategies, policies, and initiatives
- Technology development, transfer, and diffusion
- Financing for adaptation
- Insurance and social protection
- Knowledge sharing, learning, and capacity building
- Institutional arrangements: public- and private-sector stakeholders and priorities
- Links between adaptation and development
- Decision support tools and methods
- Adaptation status and indicators

16. Adaptation opportunities, constraints, and limits

- Cross-sectoral synthesis
- Limits to adaptation, including ethical dimensions and resources
- Interactions among limits
- Effects of alternative mitigation pathways on adaptation
- Ancillary social and ecological effects of adaptation

17. Economics of adaptation

- Adaptation costs and benefits at global, national, sectoral, and local levels
- Inter-relationships between adaptation costs and residual damage
- Economic instruments to provide incentives
- Using market-based approaches for adaptation decisionmaking
- Ancillary economic effects

Chapters 14-17 will include case studies of, e.g., Least Developed Countries, indigenous peoples, and other vulnerable countries and groups

Multi-Sector Impacts, Risks, Vulnerabilities, and Opportunities

18. Detection and attribution of observed impacts

- Integration of observed impacts across sectors and regions
- Attribution of observed impacts across sectors and regions

19. Emergent risks and key vulnerabilities

- Multiple interacting systems and stresses
- Indirect impacts, transboundary impacts, and impacts over longer distances
- Key vulnerabilities, aggregate impacts, thresholds, irreversible changes, and reasons for concern

20. Climate-resilient pathways: adaptation, mitigation, and sustainable development

- Multi-metric valuation
- Ecosystem services and biodiversity threats
- Consumption patterns, lifestyles, behavior, culture, education, and awareness
- Human well-being
- Adaptation, mitigation, and sustainable development, including tradeoffs and cobenefits

PART B: REGIONAL ASPECTS

{Subtitle: Contribution of IPCC WGII Incorporating Inputs from IPCC Working Group I “The Physical Science Basis” and Working Group III “Mitigation of Climate Change”}

This part will include analyses of consistently defined sub-regions and crossregional hotspots (e.g., Mediterranean, megadeltas), based on the availability of regional information.

21. Regional context

- Introduction
- Information on observed climate changes and relevant non-climate factors
- Regional projections: added value and limitations
- Similarities and pertinent differences in systems across regions
- Cross-regional hotspots

Regional Chapters

- 22. Africa
- 23. Europe
- 24. Asia
- 25. Australasia
- 26. North America
- 27. Central and South America
- 28. Polar Regions
- 29. Small Islands
- 30. Open Oceans

Chapter structure (22-30)

- Introduction
- Major conclusions from previous assessments
[CONTEXT] {with sub-regional information}
- Adaptation and mitigation interactions
- Inter- and intra-regional impacts
- Multi-sector synthesis

Appendix I: Glossary

Appendix II: Acronyms

Appendix III: Contributors to the IPCC WGII Fifth Assessment Report

Appendix IV: Reviewers of the IPCC WGII Fifth Assessment Report

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**Working Group III:
AR5 Outline Agreed by WG III Plenary**

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Summary for Policy Makers
Technical Summary
Frequently Asked Questions (extracted from the chapters below)

I. INTRODUCTION

1. Introductory Chapter

- Lessons learned from AR4
- New challenges for the AR5
- Historical, current and future trends
- The mitigation challenges
-

II. FRAMING ISSUES

2. Integrated Risk and Uncertainty Assessment of Climate Change Response Policies

- Risk perception
- Risk and uncertainty in climate change
- Metrics of uncertainty and risk
- Managing uncertainty, risk and learning
- Tools for analyzing uncertainty and risk
- Frequently asked questions

3. Social, Economic and Ethical Concepts and Methods

- Assessing methods of policy choice
- Ethical and socio-economic principles
- Metrics of costs and benefits
- Economics, rights and duties
- Justice, equity and responsibility
- Behavioural economics and culture
- Policy instruments and regulation
- Technological change
- Frequently asked questions

4. Sustainable Development and Equity

- Determinants, drivers and barriers
- Mitigative capacity and mitigation
- Links to adaptive capacity and adaptation
- Development pathways
- Consumption patterns and carbon accounting
- Integration of framing issues in the context of sustainable development
- Implications for subsequent chapters
- Frequently asked questions

III. PATHWAYS FOR MITIGATING CLIMATE CHANGE

5. Drivers, Trends and Mitigation

- Global trends in stocks and flows of greenhouse gases and short-lived species
- Key drivers of global change
- Production, consumption and trade patterns
- Contribution of technological change to mitigation
- Contribution of behavioural change to mitigation
- Co-benefits and tradeoffs of mitigation including air pollution
- Carbon and radiation management and other geoengineering options including environmental risks
- The system perspective: linking sectors, technologies and consumption patterns
- Frequently asked questions

6. Assessing Transformation Pathways

- Tools of analysis
- Climate stabilization: Concepts, costs and implications for the macroeconomy, sectors and technology portfolios, taking into account differences across regions
- Integrating long- and short-term perspectives
- Integrating technological and societal change
- Sustainable development and transformation pathways, taking into account differences across regions
- Risks of transformation pathways
- Integrating sector analyses and transformation scenarios
- Frequently asked questions

7. Energy Systems

[Note: All sections should consider regional specificities including as appropriate to developed and developing countries and economies in transition.]

- Energy production, conversion, transmission and distribution
- New developments in emission trends and drivers
- Resources and resource availability
- Mitigation technology options and practices (including energy efficiency)
- Infrastructure and systemic perspectives
- Climate change feedback and interaction with adaptation
- Technological, environmental and other risks and uncertainties; and social acceptability
- Co-benefits, tradeoffs, spill-over effects
- Barriers and opportunities (technological, physical, financial, institutional, cultural, legal, etc.)
- Sustainable development and behavioural aspects
- Costs and potentials
- Gaps in knowledge and data
- Frequently asked questions

8. Transport

[Note: All sections should consider regional specificities including as appropriate to developed and developing countries and economies in transition.]

- Freight and passenger transport (land, air, sea and water)
- New developments in emission trends and drivers
- Mitigation technology options and practices (including energy efficiency)
- Infrastructure and systemic perspectives
- Climate change feedback and interaction with adaptation
- Technological, environmental and other risks and uncertainties; and social acceptability
- Co-benefits, tradeoffs, spill-over effects
- Barriers and opportunities (technological, physical, financial, institutional, cultural, legal, etc.)
- Sustainable development and behavioural aspects
- Costs and potentials
- Gaps in knowledge and data
- Frequently asked questions

9. Buildings

[Note: All sections should consider regional specificities including as appropriate to developed and developing countries and economies in transition.]

- Commercial, residential and public buildings
- New developments in emission trends and drivers
- Mitigation technology options and practices (including energy efficiency)
- Infrastructure and systemic perspectives
- Climate change feedback and interaction with adaptation
- Technological, environmental and other risks and uncertainties; and social acceptability
- Co-benefits, tradeoffs, spill-over effects
- Barriers and opportunities (technological, physical, financial, institutional, cultural, legal, etc.)
- Sustainable development and behavioural aspects
- Costs and potentials
- Gaps in knowledge and data
- Frequently asked questions

10. Industry

[Note: All sections should consider regional specificities including as appropriate to developed and developing countries and economies in transition.]

- New developments in extractive industries, manufacturing and services (including tourism)
- New developments in emission trends and drivers
- Material substitution, material reuse and waste
- Mitigation technology options and practices (including efficiency improvements, household and industry waste)
- Infrastructure and systemic perspectives
- Climate change feedback and interaction with adaptation
- Technological, environmental and other risks and uncertainties; and social acceptability
- Co-benefits, tradeoffs, spill-over effects
- Barriers and opportunities (technological, physical, financial, institutional, cultural, legal, etc.)
- Sustainable development and behavioural aspects
- Costs and potentials

- Gaps in knowledge and data
- Frequently asked questions

11. Agriculture, Forestry and Other Land Use (AFOLU)

[Note: All sections should consider regional specificities including as appropriate to developed and developing countries and economies in transition.]

- Introduction to integrated assessment of AFOLU
- Emission trends (including agricultural productivity) and drivers
- Competition and opportunities for land-use (energy, food, feed and timber production; housing, nature conservation, biodiversity and other land uses)
- Mitigation technologies and practices in forestry, agriculture (e.g. biochar) and livestock farming
- Mitigation effectiveness (non-permanence: human and natural impacts; displacement; saturation)
- Systemic perspectives (including integrated land-use assessment)
- Synergies, tradeoffs and interactions with adaptation and other mitigation options
- Climate change feedback, natural disturbance and extreme events
- Environmental and other risks and uncertainties
- Co-benefits, tradeoffs, spill-over effects
- Opportunities and barriers (technological, physical, financial, institutional, cultural, legal, etc.)
- Sustainable development and behavioural aspects
- Costs and potentials
- Gaps in knowledge and data
- Frequently asked questions

12. Human Settlements, Infrastructure and Spatial Planning

[Note: All sections should consider regional specificities including as appropriate to developed and developing countries and economies in transition.]

[Note: Working Group III Plenary suggests that the WG III Bureau and the authors have the mandate to revisit the structure and the title of the bullets in this chapter based on the outcome of the Expert Meeting on “Human Settlements and Infrastructure” to be held in 2010.]

- Urbanisation challenges and opportunities for climate change mitigation
- Settlement structures, density, forms and lifecycle assessments
- Infrastructure, spatial planning and mitigation
- Lifestyle changes and efficiency
- Waste
- Water/energy nexus
- Human settlements and climate change: Experiences across countries
- Frequently asked questions

IV. ASSESSMENT OF POLICIES, INSTITUTIONS AND FINANCE

13. International Cooperation: Agreements and Instruments

- Introduction
- Framing concepts and an assessment of means for international cooperation
- International agreements: Examples and lessons for climate policy
- Multilateral and bilateral agreements across different scales
- Climate policy architectures
- Mechanisms for technology and knowledge development, transfer, diffusion
- Capacity building
- Linkages between international and national policies
- Linkages between international and regional cooperation

- Interactions between climate change mitigation policy and trade
- Performance assessment on policies and institutions including market mechanisms
- Investment and finance
- The role of public and private sectors and public-private partnership
- Frequently asked questions

14. Regional Development and Cooperation

- Introduction
- Opportunities and barriers of regional cooperation
- Current development patterns and goals
- Energy and development
- Urbanisation and development
- Consumption and production patterns in the context of development
- Low carbon development: Opportunities and barriers
- Links between mitigation, adaptation and development
- Investment and finance
- The role of public and private sectors and public-private partnership
- Frequently asked questions

15. National and Sub-national Policies and Institutions

- Introduction
- Characteristics and classification of policy instruments and packages
- Approaches and tools used to evaluate policies and institutions
- Research and development policy
- Assessment of the performance of policies and measures in developed and developing countries taking into account development level and capacity
- Framework: Role of institutions and governance
- Capacity building
- National, state and local linkages
- Links to adaptation
- Synergies and tradeoffs among policies
- Assessing policy design options
- Investment and finance
- The role of public and private sectors and public-private partnership
- The role of stakeholders including NGOs
- Frequently asked questions

16. Cross-cutting Investment and Finance Issues

- Financing low-carbon investments, opportunities, key-drivers and barriers
- Financing developed countries' mitigation activities
- Financing mitigation activities in and for developing countries including for technology development, transfer and diffusion
- Financing infrastructure and institutional arrangements
- Synergies and tradeoffs between financing mitigation and adaptation
- Directing and leveraging private financing
- Innovative financing
- Approaches and scale of financing at national, regional and international level in short-, mid- and long-term
- Enabling environments
- Frequently asked questions

Glossary

List of Authors and Reviewers

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FIFTH ASSESSMENT REPORT

Concept notes on Cross-Cutting issues¹

Consistent Evaluation of Uncertainties and Risks (CCM)

Background and scope

The quality of the uncertainty guidance notes for AR4 was recognized, but it was noted that their application has been uneven across and within Working Groups. Aspects of risks have not been treated consistently among Working Groups.

Further, the increased awareness and concern of policy makers regarding low-probability, high-consequence events, and the increased interest in risk assessment and risk management was recognized, even though these concepts are understood differently in different disciplines and Working Groups.

The overarching goal of refining and conveying consistent information on uncertainty and risk is to serve as a useful input for decision making on climate change.

Working Group involvement

All three Working Groups are and should continue to be involved, with the Co-Chairs of the Working Groups taking the lead.

Suggested approach

- The Working Group Co-Chairs to discuss their needs for guidance in the area of risk and uncertainty, and engage a process for updating and extending the existing guidance prior to the first LA meeting of each Working Group;
- The distinction between likelihood and confidence and the use of the confidence scale needs to be further clarified;
- The guidance paper to include a discussion of the meaning and significance of risk, specifically to address the treatment of low-probability, high-consequence events;
- Concerning risk assessment and risk management, to use a common language among Working Groups and Special Reports, without being prescriptive regarding its application;
- Once authors have been designated, for each Working Group to designate a small group of authors in order to ensure communication, coordination, and consistency of this issue across Working Groups and throughout the assessment process;
- Early on in the guidance development process, to use concrete case studies to test the approach recommended to deal with uncertainty and risk.

¹ Cross-Cutting Methodology (CCM)
Cross-Cutting Theme (CCT)

Costing and Economic Analysis (CCM)

Background

Economic analysis has been widely applied across the climate change domain – analyses of the economic cost of climate-related damages, the costs and benefits of mitigation options, the costs and benefits of adaptation options, the economic implications of policy design and instrument choice, the economic consequences of alternative architectures for international treaties on climate policy, and the economics of decision-making under uncertainty are primary examples. Past IPCC Reports have assessed these analyses, and this tradition will continue in the AR5.

Scope

The application of common economic fundamentals and measurement processes to analyses of adaptation and mitigation depends on the constraints that define their context. Even though these analyses accommodate enormous diversity in context, common fundamentals suggest that common criteria can be applied in the assessment of the resulting disparate literature. The point is not to decide whether the underlying analytical approach of any specific study is right or wrong; it is, instead, to judge the degree to which its specific application recognizes, to the extent practicable, elements that have played critical roles in driving results in one direction or another. The scope of this CCM would also comprise matters related to finance and investment.

Working Group Involvement Coverage

Costing and economic analysis will permeate the work of Working Groups II and III. Exploiting common language and common fundamentals should help in making the confidence assessments of economic conclusions that will be offered in both Reports more comparable and more transparent than in the past.

Suggested Approach

An Expert Meeting is proposed to assist authors in conducting their upcoming work. The expert meeting will not conduct a comprehensive assessment of literatures involved. It will, instead, work to incorporate a diverse set of views and to suggest how assessment frameworks can be created so that confidence levels drawn from economic analyses of all types can be more comparable. If the Meeting were scheduled after the author teams had been assembled but before the writing had begun, Lead Authors who will be responsible for the economic and valuation parts of the various chapters in both Working Groups could attend, participate, and begin the collaborative relationships that will, themselves, facilitate integration. The Expert Meeting should produce a volume that contains invited papers, discussant comments, and summaries of subsequent audience discussions. A Guidance Paper could then be created based on the content of the Meeting Report and other documents. This Paper would be designed to promote quality in the assessment of economic literature included across the various chapters of Working Groups II and III as well as consistency in judgments of quality across multiple chapters and both Working Groups. Elements of the guidance paper might even be incorporated into the both Working Group contributions to the AR5.

Regional Aspects (CCM)

Background and Scope

At its 30th Session held in Antalya, Turkey, in April 2009, the IPCC decided that much greater attention was required to improve the treatment of regional issues in AR5. The scoping meeting was also tasked to consider options for a more detailed regional division. The Scoping meeting took note of the following documents: the guidance paper on regional issues prepared for AR4, the report of the Task Group on the Future of IPCC (IPCC-XXX/Doc. 10), the draft report of the 30th session of the IPCC, the compromise proposal on the improved treatment of regional information in AR5 (AR5-SCOP/INF.3), and a document titled "Consideration of regional division for the IPCC AR5" prepared by the IPCC Secretariat for this meeting.

Reflection of Regional Information in the AR5 Working Groups

In order to improve the treatment of regional information in AR5, for the benefit of all users of the AR5 reports, it is suggested that the WGII contribution is split in two parts, completed at the same time and subject to a single review and SPM/TS approval process (There would be only one SPM and one TS, both included in each part, so that the overall context is present in each part.):

General title: *Vulnerability, Impacts, and Adaptation*

- Part A scope and subtitle: *"Global and sectoral aspects"*
- Part B scope and subtitle: *"Regional aspects"*. The cover for this Part would also mention: *"Contribution of IPCC WGII, incorporating inputs from IPCC Working Group I "The Physical Science Basis" and Working Group III "Mitigation of Climate Change"*

For further details see outline of the Working Group II report contained in IPCC-WG-II:9th /Doc.2.

To make this regional Part possible, a number of suggestions were made:

- Ensure consistency in the presentation and transfer of regional information on observed and projected climate changes (including changes in extreme events), future scenarios, and mitigation and adaptation issues between Working Groups I, II and III;
- Holding an IPCC Workshop or an Expert Meeting on Regional Aspects of Climate Change jointly between Working Groups I, II and III at an appropriate stage of the development of the AR5 would be very useful to help achieving this consistency, increase the knowledge base from region specific literature and promote mutual understanding around the regional aspects. One possibility is to organize it in conjunction with a TGICA meeting;
- As in AR4, make use of detailed case studies in specific regions ("hot spots") that focus on different aspects of the climate issue, often spanning different Working Groups;
- Offer mechanisms for making the most efficient use of regional expertise on chapters in different Working Groups requiring the transfer and presentation of regional information, e.g.: WGI and WGIII nominate authors who would be willing to review, from the outset, draft regional chapters in WGII; A small number of Lead Authors from one Working Group accustomed to working in an interdisciplinary perspective be nominated as "Attending" Contributing Authors for another Working Groups. At the invitation of the Co-Chairs they can attend relevant parts of LA meetings (they would be LA in one WG and CA in another WG);
- Make the draft texts of Part A of WGII available in a timely manner to WGIII so that WGIII can take into account the latest information available for integrated assessment. Similarly, timely exchanges of relevant draft texts between WGI and WGII will be useful.
- Promote the use of Geographical Information Systems (GIS) and Internet tools to present and communicate regional information both during AR5 preparation (for technical

exchange) and after its completion (for outreach), and could possibly be aided by TGICA and DDC.

- Consider scheduling the WGII final plenary after both WGI and WGIII have completed their volumes. This would allow the WGI and WGIII material to be available in an approved form, and allow the WGI and WGIII author teams and TSUs to be able to contribute effectively with their material to the regional Part B of the WGII report. This would facilitate the effective contribution of WGIII to the regional WGII Part B, and the approval process of this Part B, so that WGIII-related material in WGII Part B can be founded on already approved WGIII material. This is particularly important given the number of WGII chapters.

Suggested approach for the division of the world into regions

For the division of the world into regions to be used in AR5 a number of different criteria, depending of the kind of analysis intended or the discipline concerned need to be considered, while noting that there is no regional division which can satisfy perfectly all needs. A number of principles were suggested, including: no area should be left out of the division, and the sum of the parts should cover the entire globe; a geographical approach is suggested to divide the world into regions, with additional sub-regional information as feasible.

Some of the advantages of such an approach are that it is easy to communicate and widely recognized, and that geography does not change fast. Users can easily know where they can find the information immediately relevant to them. Any other disaggregation (for example socio-economic) could be incorporated in those regions. This is also consistent with AR4.

A regional division and an indicative regional subdivision has been proposed for the regional Part B, but it is suggested that the regional subdivision be finalized by the chapter authors after the Workshop/Expert meeting suggested in section 7.2. For further details see outline of the Working Group II report contained in Section C.

Water and the Earth system: changes, impacts and responses (CCT)

Background

The title was changed from “*Hydrological cycle*” to “*Water and Earth system: changes, impacts and responses*” to better reflect the main interests of stakeholders. There needs to be more consistency among Working Groups and more involvement of WGIII on this topic.

Scope

The following outlines the main variables and activities that should be covered. These are broken into areas relevant to the three IPCC Working Groups. It is recommended that all three Working Groups undertake a synthesis of their components of this CCT.

Working Group involvement

WG I – There should be a comprehensive assessment of information available on variables related to the water cycle including observations, modeling capabilities, attribution of the changes to causes, predictions from daily to decadal time scales, projections of the longer term future, and an assessment of all of these for use by decision makers. Variables of particular interest include the following: precipitation; temperature; water vapor; extremes; runoff, river flow, discharge into the oceans; water storage, soil moisture, lakes, ground water; drought, evaporation; sea level; cryosphere changes; and air pollution. There is a need to use observations to evaluate models and factor these results into model projections, because there are still limitations in simulating precipitation. Simulation needs to be improved of the diurnal cycle, tropical storms, ENSO, and other phenomena. Down-scaling uncertainties need to be properly accounted. Issues include observational networks that are becoming degraded, especially for *in situ* observations, and the science on the attribution of changes to variables beyond temperature should be advanced.

WG II – Stakeholder needs should be addressed by:

- *defining the main drivers of change.* In addition to changes in climatic variables, non-climatic drivers include increasing population and water demand, economic development, urbanization; changing diet and lifestyle; and governance on water.
- *addressing fresh water issues on regional scales through observations, attribution, predictions and projections of impacts on the following:* resources; agriculture, food security, fisheries; human well-being, security; desertification, erosion; built environment; infrastructure; ecosystems; sea level; lake storage, ground water, frozen ground; snow cover, glaciers and ice caps, river and lake ice; rivers; trans-boundary aquifers (relationships between ground and surface water, aquifer recharge); extreme frequency and intensity; water quality; virtual water.
- *identifying vulnerabilities of fresh water systems.*
- *addressing coping strategies and responses* including short and long term adaptation.
- *addressing sustainable development.*

WG III - Water and climate change mitigation issues include:

- low carbon energy: bioenergy, biofuels (use of water, added pollution); nuclear power (cooling); hydro power; co-benefits and tradeoffs; side effects of solar, wind, etc.
- land use change: sequestration of carbon; fires.
- infrastructure: energy/water efficiency, energy recovery; technology;
- potential changes in precipitation and water quality with some geoengineering options
- questions exist on whether CCS would have side effects
- non-conventional water: (desalination, etc.).

Suggested approach

Working Group II should have the lead in addressing this CCT, but all three Working Groups need to be included. All Working Groups should recognize the need for a water cycle theme and provide appropriate insights, including on regions and extremes. There is a need to ensure exchange of information and coordination of information among the three Working Groups and accomplish the coordination among Working Groups. The most appropriate and effective way of doing this would be developed by the Co-Chairs (e.g. designated contributing authors). Links should be established with other activities including the special report on extreme events, the CCT on regions, and the planned "*Human Settlement and Infrastructure*" expert meeting; and water related extreme events should be taken into account at the proper level in each chapter. It is not expected that a new Technical Paper would come from this activity.

Carbon Cycle including ocean acidification (CCT)

Background

The carbon cycle is a central component of the Earth system. It integrates multiple forcings, responses and feedbacks related to climate change over a range of different time-scales, concerns additional biogeochemical cycles and is therefore a theme of paramount importance for all Working Groups of the AR5, as well as for the Synthesis Report. Since the completion of the IPCC-TAR, ocean acidification has been identified as a further critical and direct consequence of increasing atmospheric GHG concentrations – a full assessment of it will have to be presented by AR5. Multiple types of active management of the carbon cycle are now envisaged by many governments. Given the emergence of substantial new scientific literature on these themes, it is recommended that all the issues described in this document are reviewed and updated by all AR5 WGs, and that a mechanism is put in place to ensure this coverage, as well as ensuring the avoidance of inconsistencies between different sections of the assessment.

Scope

- Major *issues* concerning CO₂, CH₄ and N₂O including ocean acidification, feedback mechanisms between biogeochemical cycles and climate, and aspects of land use and land management including competition between bioenergy and food production, etc;
- *process* knowledge including direct CO₂ effects ('fertilization') on physiology and functioning of land ecosystems, variability of carbon pools, ocean acidification, the marine biological pump, nutrient interactions with terrestrial and marine carbon dynamics, interactions among CO₂ effects, climate, and other stressors, carbon feedbacks from land/ocean ecosystems to climate;
- *knowledge of past dynamics* of biogeochemical cycles, ocean pH, anthropogenic GHG emissions, including budgets of CO₂, CH₄, N₂O, DIC and other quantities;
- *present day budgets* with improved attribution to different sources and sinks;
- *projections* of atmospheric CO₂, other GHGs and ocean pH including of relevant feedbacks, the longer-term (beyond 2100) scope, and reversibility;
- sensitivity of major carbon pools to changes in climate, land use etc. including stratification by climate zones (land and ocean) and major regional case studies (coral reefs, Amazon forest, polar oceans);
- impacts of changing biogeochemistry on biological productivity, food web structure, biological resources, fisheries, crops, fibre, bioenergy;
- carbon management for mitigation, changes in energy systems with implications for biogeochemistry and climate, urban carbon metabolism, impacts from agroindustrial system development to GHG emissions from transport, packaging and distribution.
- It is likely that further issues related to global biogeochemistry and climate arise during the coming few years – these will have to be considered as well by the AR5 assessment.

Working Group involvement

An important role will likely be played by the WGI chapter on carbon cycle and other biogeochemical cycles: it should assess the full range of Earth system wide implications for climate change of changing biogeochemistry. WGII and WGIII should implement suitable sections to summarize this, as well as accounting for any outstanding issues as they are relevant for the respective WG.

Suggested approach

Coordination meetings (e.g., after completion of the zero-order draft from all WGs) may be held to ensure implementation of the goals stated above. No specific "product" is being envisaged, rather adequate coverage of biogeochemistry and ocean acidification issues across the AR5 are of high importance.

Ice Sheets and Sea-Level Rise (CCT)

Background

The potential significant contribution of the ice sheets to future sea-level rise has raised concern about the implications for adaptation and mitigation policy options. To build on the experience gained in the AR4, there is strong interest in ensuring good communication between all three Working Groups (WGs).

Scope

The focus of the cross-cutting theme was on sea-level rise and its implication for coastal zone and island adaptation and vulnerability. A particularly important focus was the heavily populated megadeltas. For understanding the adaptation issues, there is a need for scenarios of sea-level rise, including the upper and lower end of the range and not just the central estimates. The regional distribution of sea-level rise and trends in extreme events and surface waves (both amplitude and direction) were recognized as important issues. There are also potential implications for mitigation policy.

Working Group involvement

WGI and WG II (and potentially WG III) have strong interest in this cross-cutting theme. Leadership would depend on the appointment of lead authors but would naturally lie in either or both of WGI and WG II. A range of issues will be addressed in the appropriate WGI and WGII chapters.

Suggested approach

Mechanisms for ongoing communication across the Working Groups proposed were:

- exchange of outlines between WGI and WG II;
- video conferences between relevant lead authors. The IPCC budget may need to consider providing financial support to ensure adequate regional representation;
- explore the ability to use the IPCC Data Distribution Centre as a resource to facilitate inter-WG data exchange.

The Co-Chairs of WGI will propose to the Panel at its 31st Session an IPCC Workshop on Sea Level Rise and Ice Sheet Instability to be held in June 2010.

Joint lead authors or joint lead author meetings were not seen as essential. No need for a guidance paper or Technical Paper was identified.

There is a need to ensure optimum use is made of authors' time and to facilitate attendance and the communication of outcomes with Working Groups. IPCC Lead Author participation in the relevant workshops should be encouraged.

Mitigation, Adaptation and Sustainable Development (CCT)

Background

This cross-cutting theme was addressed in both WGII and WGIII of the IPCC Fourth Assessment Report (AR4). It addresses the ways that processes, responses and outcomes affect for individuals, communities, social-ecological systems, etc., which are experiencing climate change within the context of multiple, interacting stresses. The theme includes not only assessments of the economic, social and environmental costs and benefits of responses to climate change, but the human security implications for present and future generations.

Scope

This CCT can be considered an overarching framework for considering climate change impacts, adaptation, and vulnerability. Within the AR5, this theme involves identifying the linkages between adaptation and mitigation; and assessing the social, economic, and ecological consequences of adaptation and mitigation responses, evaluating implications for sustainable development, while at the same time highlighting the new challenges to sustainable development raised by climate change. Attention would be paid to all relevant sectors, technologies and practices including biodiversity, land use planning and development, lifestyle and behavioral changes and geo-engineering.

Working groups involved

The theme is very relevant to both WGII and WGIII, and to the SYR. There is a need to coordinate and integrate approaches and outputs among the chapters and groups.

Suggested approach

Questions that can be considered within assessments in both WGII and WGIII:

- How do climate change responses influence a wider transition to sustainability and resilience?
- How do adaptation and mitigation policies and strategies influence vulnerability and equity? What are the implications for sustainable development (SD)?
- What types of strategies and approaches to poverty reduction and disaster risk reduction contribute to mitigation, adaptation & SD?
- How does a “sustainable” development pathway influence adaptation and mitigation?
- What is the role of transversal sectors such as energy, transport, tourism, agriculture, and fisheries
- What types of approaches and tools are being used to evaluate costs and benefits, of adaptation and mitigation measures from the perspective of SD? (i.e., what are the “co-costs” and “co-benefits”?)
- Are the metrics and values that are being used to evaluate impacts and responses explicit and transparent?

The relationship and interactions among mitigation, adaptation & SD could be framed and discussed up front in WGII, WGIII and the SYR, and assessed in the concluding chapters or sections. The empirical evidence on the consequences of adaptation and mitigation policies including synergies and conflicts and strategies for SD could also be assessed in relevant chapters. Human and societal implications and significance for SD could be included in each sectoral and thematic chapter that discusses responses to climate change. Equity dimensions of climate change responses and implications for SD could be raised in the introductory chapters of both WGs and in the SYR. Finally, individual authors that take an integrated perspective could be included in key chapters in WGII, WGIII and the SYR, and there is a need for interactions and consultations among CLAs and LAs within and among WGII, WGIII and the SYR. Inputs for dealing with this theme would also be provided from the proposed expert meeting on “*Human Settlements and Infrastructure*”.

Issues related to Article 2 of the UNFCCC

Aim

The aim of this Cross Cutting Theme is to provide comprehensive and consistent scientific information in the AR5 that is relevant to and informs the consideration of Art. 2 of the UNFCCC, including key vulnerabilities and development.

Background

The United Nations Framework Convention on Climate Change (UNFCCC)'s Article 2 states: "The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."

Document IPCC-XXXI/Doc. 4 (*Scoping of the IPCC 5th Assessment Report – Background, Cross cutting issues and AR5 Synthesis Report*) addresses the treatment of Cross Cutting Themes in the AR5. Document IPCC-XXXI/INF.3 (*Scoping of the IPCC 5th Assessment Report Cross cutting issues – Previous IPCC work related to Article 2 of the UNFCCC*) provides further background on how previous IPCC reports have addressed issues related to Article 2 of the UNFCCC. Furthermore, Document AR5-SCOP/INF. 2 (*Treatment of Cross Cutting Themes (CCTs) in TAR and AR4, and Questionnaire Result*) provides an evaluation of the treatment of the cross-cutting issues in the Third Assessment Report (TAR) and the Fourth Assessment Report (AR4). The AR4 CCT "Key vulnerabilities (including issues relating to Article 2 of the UNFCCC)" was covered by this report.

The Expert Meeting on the Science to Address UNFCCC Article 2 including Key Vulnerabilities was held in Buenos Aires, Argentina in 2004 ("IPCC Expert Meeting on The Science to Address UNFCCC Article 2 including Key Vulnerabilities" Expert Meeting – Long and Short Report). The Expert Meeting considered how this issue could be incorporated in AR4, particularly for an integrated treatment of the subject across the three Working Groups.

Scope

This cross-cutting theme is to provide comprehensive and consistent scientific information, drawing from the assessments of the working groups in the AR5 that are relevant to and inform the consideration of Art.2 of the UNFCCC. The theme is very relevant to all working groups, and to the synthesis report. There is a need to coordinate approaches and outputs among the chapters and groups. An initial consideration of relevant material in each working group and the cross cutting issues is outlined in the following indicative list:

WGI

- Anthropogenic and natural radiative forcing; detection and attribution of climate change: from global to regional
- Near-term and long-term climate change projections, including sea level change and regional aspects
- Abrupt climate change, extremes and irreversible climate change
- Scenarios/stabilisation levels, including rate of change
- Other relevant issues

WGII

Related to different magnitudes and rates of climate change under stabilization and other scenarios, including regional aspects, information on:

- Emergent risks and key vulnerabilities
 - Aggregate impacts, thresholds, irreversible changes, and reasons for concern
- Natural and managed resources and systems, and their uses
- Food production systems and food security
- Human settlements, industry, and infrastructure
- Adaptation opportunities, constraints, and limits
- Adaptation planning and implementation
- Climate-resilient pathways: adaptation, mitigation, and sustainable development
- Other relevant issues

WGIII

- Integrated risk and uncertainty assessment of climate change response policies
- Drivers, trends and mitigation
- Climate stabilization: concepts, costs and implications for the macro-economy, sectors and technology portfolios, taking into account differences across regions
- Sustainable development and transformation pathways, taking into account differences across regions
- Integrating long and short-term perspectives
- Integrating technological and societal changes
- Social, economic and ethical concepts and methods
- International cooperation: agreements & instruments
- Regional development and cooperation
- National and sub-national policies and institutions
- Cross-cutting investment and finance issues
- Other relevant issues

There are a number of cross-cutting issues including:

- Linkages and feedbacks between and among: greenhouse gas emissions, atmospheric greenhouse gas concentrations, temperature increase, precipitation, ocean acidification, sea level rise, impacts, adaptation, mitigation and sustainability
- Consistent use of scenarios and treatment of uncertainties and risks throughout the three working group reports

Working group involvement

This CCT involves WGI, WGII and WGIII. All three working groups are asked to provide comprehensive and consistent scientific information pertaining to the consideration of Article 2 of the UNFCCC and to draw from their contributions to these issues.

Suggested approach

Due to the importance of this CCT, the relationship and interactions related to this cross cutting theme between and within the three working group reports should be discussed up front and in the Lead Author meetings of the WGI, WGII, WGIII and the SYR, and assessed in concluding chapters or sections. It is proposed that the indicative list of topics above could be further developed at the scoping meeting of the SYR in 2010 based on the approved scoping documents of the AR5.

It is proposed to arrange a Cross Working Group meeting early 2010. This meeting could provide further guidance including on the arrangement of an expert meeting on this Cross Cutting Theme. This group would prepare a progress report to inform subsequent lead author meetings and for further consideration by the panel at its 32nd session. The progress report would further provide recommendations from the cross working group on the arrangement of an expert meeting on this cross cutting theme.

FIFTH ASSESSMENT REPORT Expert Meetings and Workshops²

An updated list of meetings is available on the IPCC website at :
http://www.ipcc.ch/calendar_of_meetings/calendar_of_meetings.shtml

PLANNED AR5 EXPERT MEETINGS AND WORKSHOPS (OVERVIEW)

Title	Proposed by Working Groups involved	Related to CCM/ CCT or new scenarios	Time	Duration	Location	Participants	Proposal attached
IPCC Expert Meeting on Detection and Attribution Related to Anthropogenic Climate Change	WGI / WGII Co-Chairs		14-16 Sep.09 (Already Held)	3 days	Geneva, Switzerland	40	√
IPCC Expert Meeting on Assessing and Combining Multi Model Climate Projections	WGI / WGII Co-Chairs		25-27 Jan 2010	2.5-3 days	Boulder, CO, USA	40	√
Expert Meeting on Human Settlement, Water, Energy and Transport Infrastructure - Mitigation and Adaptation Strategies	WGIII Co-Chairs	Mitigation, adaptation and sustainable development	March/ April 2010	tbd	tbd	80	√
IPCC Workshop on Sea Level Rise and Ice Sheet Instabilities	WGI Co-Chairs	Ice sheets and sea level rise	21-24 June 2010 (tbc)	4 days	Malaysia (tbc)	120	√
IPCC Workshop on Socioeconomic Scenarios for Climate Change Impact and Response Assessments	Joint WGII / WGIII	New scenarios	Oct 2010 (tbd)	3-4 days	tbd	70	√
Expert Meeting on consistent evaluation of uncertainties and risks	WGII, possibly involving all WGs	Consistent evaluation of uncertainties and risks	Nov 2010 (tbd)	2 days	tbd	tbd	
IPCC Workshop on Impacts of Ocean Acidification on Marine Biology and Ecosystems	Government of Japan, WGI / WGII Co-Chairs	Carbon cycle including ocean acidification	Feb 2011 (tbd)	tbc	Japan	100	√
Expert Meeting on Economic Analysis, Costing Methods and Ethics	WG III/WG II Co-Chairs	Costing and economic analysis	March 2011 (tbd)	3 days (tbd)	tbd	70 (tbd)	√
Other expert meetings and workshops							
Joint IPCC-NRC expert meeting on RCP-2	WG II	New Scenarios	2010	tbd	tbd	tbd	
Expert meetings on bottom-up/top/down	WG III	WG III	4x2 days, back to back with LA meetings			LA s	
Regional expert meetings	WG II	to support Part B of WGII	2011-2012	tbd	tbd	tbd	
Expert meetings with business and NGOs	WG III, possibly other WGs	to support AR5 review process	tbd	tbd	tbd		
GEO-IPCC Expert Consultation: "How GEOSS could serve the data needs of the climate impacts and adaptation research communities and support the IPCC assessments"	WGII	General support	17-19 May 2010	3 days	Geneva, Switzerland	40	√

² For any updates please consult the IPCC Website