

CLIMATE CHANGE ASSESSMENTS

Anne Mette K. Joergensen

Danish Meteorological Institute, Denmark

Keywords: Global, climate change, scientific, assessment, anthropogenic, greenhouse effect, impacts, vulnerability, mitigation, adaptation

Contents

1. Introduction
2. The IPCC First Assessment Report, 1990, and the 1992 Supplementary Report
3. The IPCC Second Assessment Report, 1995
 - 3.1. The Working Group I Report—*The Science of Climate Change*
 - 3.1.1. Greenhouse Gas Concentrations
 - 3.1.2. Anthropogenic Aerosols
 - 3.1.3. Climate Change over the Twentieth Century
 - 3.1.4. A Discernible Human Influence on Global Climate
 - 3.1.5. Future Climate Change
 - 3.1.6. Uncertainties
 - 3.2. The Working Group II Report—Impacts, Adaptations, and Mitigation of Climate Change: Scientific-Technical Analyses
 - 3.2.1. Energy
 - 3.2.2. Agriculture, Rangelands, and Forestry
 - 3.2.3. Policy Instruments
 - 3.3. The Working Group III Report—Economic and Social Dimensions of Climate
 - 3.3.1. Decision Making
 - 3.3.2. Equity and Social Considerations
 - 3.3.3. Intertemporal Equity and Discounting
 - 3.3.4. Applicability of Cost and Benefit Assessments
 - 3.3.5. The Social Costs of Anthropogenic Climate Change: Damages of Increased Greenhouse Gas Emissions
 - 3.3.6. Generic Assessment of Response Strategies
 - 3.3.7. Costs of Response Options
 - 3.3.8. Integrated Assessment
 - 3.3.9. An Economic Assessment of Policy Instruments to Combat Climate Change
 - 3.4. The Synthesis Report—IPCC Second Assessment Synthesis of Scientific-Technical Information Relevant to Interpreting Article 2 of the UNFCCC
4. The Third Assessment Report
- Glossary
- Bibliography
- Biographical Sketch

Summary

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the World Meteorological Organization (WMO) and United Nations Environment

Programme (UNEP) and issued its first assessment report (*Climate Change*) in 1990. In this article which was finalized in 2001, the main emphasis is on the conclusions of its second assessment report (*Climate Change 1995*).

The concentration of greenhouse gases in the atmosphere has increased since the middle of the nineteenth century and the global surface mean temperature has increased during the same period. The second assessment report (SAR) concludes that “the balance of evidence suggests a discernible human influence on global climate.”

Future emissions of greenhouse gases are described in emission scenarios. For each scenario, the future climate is projected using climate models. For the IS92 scenarios the models project an increase in global mean temperature of 1°C–3.5°C by 2100 and a global sea level rise of 15 cm to 95 cm.

Most studies of climate change impacts have assessed qualitatively how systems would respond to future climate conditions. In SAR, it is stressed that human-induced climate change adds an important new stress to many ecological and economic systems.

Successful adaptation to climate change depends on technological advances, institutional arrangements, availability of financing, and information exchange.

Options to mitigate climate change include gains in energy efficiency of 10%–30%, which may be realized over the first few decades of the twenty-first century at negative to zero cost. Further, it is noted that the potential of renewable energy sources is not fully realized and that forestry options are cost effective.

Governments may use different criteria such as efficiency, cost effectiveness, equity, and consistency with national priorities when assessing greenhouse policy instruments. Policy instruments include phasing out price distortions, tradable quotas/permits, joint implementation, harmonizing domestic carbon taxes, international carbon taxes, and non-tradable quotas.

The literature indicates that “no-regret” opportunities are available in most countries and that the precautionary principle gives good reasons for further actions.

1. Introduction

The greenhouse effect has been known since the middle of the nineteenth century, and the first evaluations of a possible climatic effect of the increasing concentrations of greenhouse gases were made in the 1890s. Potential human influence on global climate has been discussed from time to time since then, but the breakthrough came in 1985 with the international conference The Greenhouse Effect, Climate Change and Ecosystems held in Villach, Austria.

Anthropogenic climate change is a global issue that presents much complexity to decision makers. Future greenhouse gas emissions are uncertain, and climate projections based on these emissions add further uncertainty to the issue, as well as the risk of irreversible damage. A long planning horizon is necessary, as the climatic effect of greenhouse gas emissions appears long after the emissions. The technological and

economic projections are uncertain, and equity considerations such as the share of resources, income, and assets in and between generations add further difficulties.

In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was signed by 154 countries at the Earth Summit in Rio de Janeiro. When governments throughout the world found a need for a global framework convention on climate change, they based their judgment primarily on the climate change assessment reports of the Intergovernmental Panel on Climate Change (IPCC) issued in 1990 and updated in 1992. These reports formed a generally accepted scientific and technical assessment of the climate change issue, including possible mitigation options and abatement measures, and subsequent reports from the panel have also been very important for the UNFCCC process.

The IPCC was established jointly by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) in 1988 as a follow up to the 1987 Brundtland Commission report *Our Common Future*, its main message being that sustainable growth is a prerequisite for the fight against poverty and environmental degradation. The IPCC was charged with the task of providing scientific, technical, and socioeconomic advice to the world community. Three main tasks were defined:

- To assess available scientific information on climate change
- To assess environmental and socioeconomic impacts of climate change
- To formulate response strategies

The panel is open to all member countries of the United Nations (U.N.) and WMO, and scientists from all over the world have been involved in preparing the IPCC assessment reports. The assessments, which are periodic, are based on mainly peer-reviewed scientific and technical literature, and detailed rules of procedure for the IPCC's work have been prepared to ensure that the panel is not policy prescriptive but remains a scientific-technical body. For further information on the IPCC and the UNFCCC, see *The Intergovernmental Panel on Climate Change (IPCC)* and *The United Nations Framework Convention on Climate Change (FCCC) and the Conference of Parties (COP)*.

Climate monitoring has been an important objective of national meteorological institutes since their establishment in the middle of the nineteenth century, coordinated first by the International Meteorological Organization (IMO), and later by the WMO. National meteorological institutes carry out national and regional climate assessments and WMO issues periodic statements on the global climate. This information contributes to the IPCC assessments.

This article which was finalized in 2001, describes the major conclusions of the IPCC 1990 assessment and the second assessment report (SAR), which was accepted by the panel in December 1995. Further, an introduction is given to the third assessment report (TAR), which was issued in 2001.

2. The IPCC's First Assessment Report, 1990, and the 1992 Supplementary Report

The climate of the earth varies on a range of time and space scales due to natural internal variability (caused by complex interactions between various components of the climate system) and external forcings such as volcanic eruptions, solar variations, and anthropogenic emissions of greenhouse gases and aerosols.

The IPCC's first assessment report (*Climate Change*) in 1990 concluded that continued accumulation of anthropogenic greenhouse gases in the atmosphere would lead to climate changes whose rate and magnitude were likely to have important impacts on natural and human systems. Based on what were called "business as usual" emission scenarios, climate model results projected temperature increases of 0.2°C–0.5°C per decade during the twenty-first century. It was also suggested that policies to reduce greenhouse gas emissions could slow this warming to perhaps 0.1°C per decade. Shorter-term measures to mitigate climate change included improved energy efficiency, use of cleaner energy sources and technologies, improved forest management, phasing out of chlorofluorocarbon (CFC) gases, improved waste management, altered use of fertilizers, and other land-use changes. In the longer term, measures could include, for example, development of new technologies, and coordinated and strengthened research to reduce scientific and socioeconomic uncertainties.

The IPCC's 1992 supplementary report (*Climate Change 1992*) confirmed the conclusions of the first assessment and added quantitative information on the impact on climate of anthropogenic aerosols and their precursors. The first assessment report played an important role in establishing the Intergovernmental Negotiating Committee for the UNFCCC.

3. The IPCC Second Assessment Report, 1995

The IPCC's SAR (*Climate Change 1995*) consists of reports from its three working groups (WG) and a synthesis report. The panel accepted SAR in December 1995, and it provided key input to the negotiations that lead to the Kyoto Protocol to the UNFCCC in 1997.

The titles of the four volumes of SAR are:

- *Climate Change 1995: The Science of Climate Change. Contribution of Working Group I to the Second Assessment of the Intergovernmental Panel on Climate Change*
- *Climate Change 1995: Impacts, Adaptations, and Mitigation of Climate Change: Scientific-Technical Analyses: Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change*
- *Climate Change 1995: Economic and Social Dimensions of Climate. Contribution of Working Group III to the Second Assessment of the Intergovernmental Panel on Climate Change*
- *IPCC Second Assessment, Climate Change 1995* (often referred to as the synthesis report, this contains summaries for policymakers, and IPCC second assessment

synthesis of scientific-technical information relevant to interpreting Article 2 of the UNFCCC)

The three WG reports all include a *Summary for Policymakers* (SPM), which gives a quick overview of the full reports. These summaries were carefully reviewed and discussed in detail before they were approved line by line at meetings of the WGs and accepted by the IPCC plenary. Therefore, a summary of the SAR would ideally be the three WG SPMs and the synthesis report, about 65 pages. This would, however, be outside the limits of this article, and instead only some highlights and major conclusions will be presented.

-
-
-

TO ACCESS ALL THE 16 PAGES OF THIS CHAPTER,
[Click here](#)

Bibliography

Bolin B., Döös B., Jäger J. and Warrick R.A., eds. (1986). *The greenhouse effect, climatic change and ecosystems*. *Scope* 29, 541 pp. Chichester, U.K.: John Wiley. [This presents a comprehensive report from the scientific conference held in Villach, Austria, in 1985, arranged by the WMO, UNEP, and ICSU. This conference was a breakthrough in scientific and political understanding of climate change.]

World Commission on Environment and Development (1987). *Our Common Future*, 398 pp. Oxford: Oxford University Press. [This report, often called the Brundtland Report (it was chaired by Dr. Gro Harlem Brundtland), presents a comprehensive assessment of expected environmental problems, and contributes to the understanding of the global nature of environmental problems and their connection with resources and development.]

IPCC First Assessment Report 1990

Houghton J.T., Jenkins G.J. and Ephraums J.J., eds. (1990). *Climate Change, The IPCC Scientific Assessment*, 364 pp. Cambridge, U.K.: Cambridge University Press. [This first assessment report of the IPCC was an important reference and foundation for the discussions and negotiations leading to the UNFCCC.]

Tegart W.J. McG., Sheldon G.W. and Griffiths D.C., eds. (1990). *Climate Change, The IPCC Impacts Assessment*, 290 pp. Canberra, Australia: Australian Government Publishing Service.

World Meteorological Organization and UNEP (1990). *Climate Change, The IPCC Response Strategies*, 270 pp. Geneva: WMO.

Supplementary Report of the IPCC 1992

Houghton J.T., Callandar B.A. and Varney S.K., eds. (1992). *Climate Change 1992—The Supplementary Report to the IPCC Scientific Assessment*, 200 pp. Cambridge, U.K.: Cambridge University Press, Cambridge, published for the IPCC. [These supplementary reports update the 1990 report and were prepared for the Earth Summit in 1992.]

Tegart W.J. McG. and Sheldon G.W., eds. (1992). *Climate Change 1992—The Supplementary Report to the IPCC Impacts Assessment*, 116 pp. Canberra, Australia: Australian Government Publishing Service.

IPCC Special Report 1994

Houghton J.T. et al. (1995). *Climate Change 1994—Radiative Forcing of Climate Change and an Evaluation of the IPCC IS92 Emission Scenarios*, 339 pp. Cambridge, U.K.: Cambridge University Press. [A special report of the IPCC that presents an overview of new findings, including an evaluation of the radiative forcing of anthropogenic aerosols. The report further presents an evaluation of the IS91 emission scenarios.]

IPCC Second Assessment Report: Climate Change 1995

Bruce J., Lee H. and Haites E., eds. (1996). *Climate Change 1995: Economic and Social Dimensions of Climate. Contribution of Working Group III to the Second Assessment of the Intergovernmental Panel on Climate Change*, 448 pp. Cambridge, U.K.: Cambridge University Press, published for the IPCC.

Houghton J.T. et al., eds. (1996). *Climate Change 1995: The Science of Climate Change. Contribution of Working Group I to the Second Assessment of the Intergovernmental Panel on Climate Change*, 572 pp. Cambridge, U.K.: Cambridge University Press. [The second assessment report of the IPCC updates the information presented in IPCC (1990), and provides technical issues related to socioeconomic aspects of climate change. It has been important to the UNFCCC process.]

IPCC (1995). *IPCC Second Assessment, Climate Change 1995* (contains summaries for policymakers, and IPCC second assessment synthesis of scientific-technical information relevant to interpreting Article 2 of the UNFCCC), 64 pp. Geneva: IPCC.

Watson R.T., Zinyowera M.C. and Moss R.H., eds. (1996). *Climate Change 1995: Impacts, Adaptations, and Mitigation of Climate Change: Scientific-Technical Analyses: Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change*, 878 pp. Cambridge, U.K.: Cambridge University Press.

Biographical Sketch

Anne Mette K. Joergensen is director of the Research and Development Department and of the Danish Climate Centre at the Danish Meteorological Institute. The Department and the Centre cover a broad range of scientific areas, but weather and climate modelling are central topics. She has been a member of various Danish and international committees and working groups. She has been involved in the work of the IPCC since 1990 and has co-authored or edited several publications on climate change, including a comprehensive monograph *Climate Change Research—Danish Contributions*, which was published in 2001.