

**COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES**

HEARING CHARTER

The State of Climate Change Science 2007:

The Findings of the Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC), Working Group I Report

Thursday, February 8, 2007
10:00 a.m. to 12:00 p.m.
2318 Rayburn House Office Building

Purpose

On February 8, 2007, the Committee on Science and Technology will hold a hearing on the first section of the 2007 assessment report, *Climate Change 2007: The Physical Science Basis of Climate Change*, prepared by Working Group I of the Intergovernmental Panel on Climate Change (IPCC). Released in Paris, France, on February 2, 2007, this document presents a comprehensive appraisal of the current state of scientific knowledge of climate change.

The Committee will hear testimony from four witnesses, each of whom were involved in the preparation of the Working Group I Report. These witnesses will present the findings of the Report and discuss the relationship between the current findings and those of past IPCC reports on the state of climate change science.

Key Findings of the 2007 Working Group I Report

On February 2, 2007 the Intergovernmental Panel on Climate Change (IPCC) released the first section of its fourth assessment report, entitled “The Physical Science Basis of Climate Change.” This first section of the IPCC fourth assessment report builds upon information contained in the previous reports. It updates information from the third assessment report based upon research conducted over the past six years. Uncertainties in some areas have been reduced (e.g. quantitative estimates of radiative forcing). Climate models have improved, and expanded observations, data and information have enabled the IPCC to increase the level of confidence in some earlier findings (e.g. attribution of warming to human-induced increases in greenhouse gas concentrations). In other areas (e.g. changes in frequency of tropical cyclones) uncertainties remain and further research is needed to determine what patterns, if any, exist.

Despite remaining uncertainties, the fourth assessment report represents a significant expansion in our knowledge of the influence of human activity on the earth’s climate. It is almost 30 years since the first international scientific conference on climate suggested that human activity could be impacting the earth’s climate. This report confirms the original suspicions raised by scientists participating in the 1979 climate conference as has every report of the IPCC from the first report in 1990 to the present.

The 10 key findings in the 2007 report are:

- Atmospheric concentrations of greenhouse gases have increased significantly due to human activities since 1750 due to fossil fuel use and land-use change.
- Our understanding of human-induced influences on climate has improved since the 2001 Assessment. There is now very high confidence that Earth is warming.
- Evidence that Earth is warmer includes: increase in global average air temperature and ocean temperature, widespread melting of snow and ice, and rising global average sea level.
- Long-term changes in climate have been observed including: changes in Arctic temperatures and ice, changes in the amounts of precipitation, ocean salinity, and wind patterns and changes in extreme weather events such as droughts, heavy precipitation, heat waves, and intensity of hurricanes and typhoons.
- Changes in diurnal temperature ranges, Antarctic sea ice extent, meridional overturning circulation of the global ocean, and localized extreme weather events such as tornadoes, lightning, and dust storms have not been observed.
- The interpretation that the warming of the last 50 years is unusual in at least the previous 1300 years is consistent with paleoclimate information. During the last period when polar regions were significantly warmer than present for an extended period of time (about 125,000 years ago), reduced volume of polar ice led to sea level rise of four to six meters.
- Most of the observed increase in globally averaged temperatures since the mid-twentieth century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations. Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns.
- Analysis of climate models coupled with constraints of observations enables an assessed likely range to be given for climate sensitivity for the first time and provides increased confidence in the understanding of the climate system response to radiative forcing. The likely global average surface warming associated with a doubling of CO₂ concentration is in the range 2 to 4.5°C. It is very unlikely that climate changes of at least the seven centuries prior to 1950 were due to variability generated within the climate system alone.
- For the next 20 years a warming of 0.2°C per decade is projected for a range of emission scenarios. Even if the concentrations of all greenhouse gases and aerosols had been kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected.
- Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the twenty-first century that would very likely be larger than those observed during the twentieth century.

Background

Prior to the establishment of the IPCC, the World Meteorological Organization (WMO) convened two international meetings on greenhouse gas emissions and global climate. In 1979, the first World Climate Conference issued the following concern: “continued expansion of man’s activities on earth may cause significant extended regional and even global changes in climate.” In 1985 the United Nations Environment Program (UNEP), WMO, and the International Council for Science (ICSU) organized a joint conference on the “Assessment of the Role of Carbon Dioxide and of Other Greenhouse Gases in Climate Variations and Associated Impacts.” This conference concluded that “as a result of the increasing greenhouse gases it is now believed that in the first half of the next century (twenty-first century) a rise of global mean temperature could occur which is greater than in any man’s history.”

In response to the findings of these earlier conferences, the IPCC was created by WMO and UNEP in 1988. The IPCC was created to provide assessments of scientific, technical and socio-economic information relevant to understanding the risk of human-induced climate change, its potential impacts and options for adaptation and mitigation.

The IPCC is organized into a Plenary which meets once a year and is attended by officials and experts from relevant ministries, agencies, and research institutions from member countries and from participating organizations. This body makes the decisions about preparation of new reports, their scope and content, and accepts reports prepared by expert teams. It elects the IPCC Chair, currently Rajendra K. Pachauri, and the members of the IPCC Bureau. It also establishes IPCC principles and procedures, designs the workplan and budget for the Panel and its activities. The IPCC Secretariat is located in Geneva, Switzerland.

The IPCC relies upon primarily peer reviewed, published scientific and technical literature. The IPCC also prepares special reports and technical papers on topics where independent scientific information and advice is deemed necessary. The panel operates within extensive peer review and governmental review, thus ensuring a high level of transparency, scientific credibility, and policy relevance. Hundreds of experts from around the world contribute to the assessment reports as authors, contributors, and reviewers. Participants are selected by the members of the IPCC Bureau (30 members each from a different nation) who are all elected for five to six years and who are all experts in climate change. Participants may be nominated by governments or participating organizations or they may be chosen due to their recognized expertise.

The IPCC published the first assessment report in 1990, a supplementary report in 1992, a special report in 1994, a second assessment report (SAR) in 1995, and a third assessment report (TAR) in 2001. Each of the assessment reports are comprised of three volumes from three corresponding working groups (I, II and III).

First Assessment Report

The first IPCC assessment report was completed in 1990 and provided policymakers with a comprehensive assessment of what was then known, and not known, about human influence on climate. The report provided the main scientific basis for the negotiation of the Framework Convention on Climate Change (UNFCCC). The 1992 United Nations Framework Convention on Climate Change was ratified by the United States and called for a “non-binding,” voluntary goal for industrialized countries to stabilize their emissions of greenhouse gases at 1990 levels by the year 2000.

The 1990 IPCC report, as well as two supplementary reports (1992 and 1994) supplied critical information for the United Nations Conference on Environment and Development in Rio de Janeiro in June 1992. The Convention went into effect in March 1994 and the first session of the Conference of the Parties (COP) was held in Berlin in April 1995.

In the 1990 assessment, the authors’ wrote, “The size of the warming is broadly consistent with predictions of climate models, ... but the unequivocal detection of the enhanced greenhouse effect from observations is not likely for a decade or more.” The report projected an increase in average global temperature during the twenty-first century of 0.3 degrees Celsius per decade and discussed the possible consequences of that temperature change in relation to rising sea levels, increase in extreme weather events, and serious pressure on aquatic and terrestrial ecosystems.

Second Assessment Report

Completed in 1995, the second IPCC assessment report expanded on the findings of the 1990 assessment. The second assessment report stated that the climate of the earth had changed over the past century, increasing the global mean surface air temperature somewhere between 0.3 and 0.6 degrees Celsius. The report stated that climate was expected to change further in the future and projected an increase of 1.0 to 3.5 degrees Celsius by 2100.

In the 1995 report, the IPCC concluded that "... the balance of evidence suggests that there is a discernible human influence on global climate." This second assessment provided key input to the negotiations that led to the adoption of the Kyoto Protocol in 1997. More than 160 nations, parties to the Framework Convention on Climate Change, adopted the Kyoto Protocol, with legally binding obligations to limit emissions of industrialized nations for the years 2008 to 2012. The Protocol's emissions targets are hailed as important first steps toward the Framework Convention's objective of avoiding dangerous climate change.

Third Assessment Report

The Third Assessment Report, “Climate Change 2001” consisted of three working group reports on “The Scientific Basis,” “Impacts, Adaptation and Vulnerability,” and “Mitigation.” The findings also contained a synthesis report, which addressed a range of policy relevant scientific and technical questions. This third report emphasized the findings from the previous five years and projected that average global temperature would rise from 1.4 to 5.8 degrees Celsius over the next century. In addition, authors explained how precipitation patterns are expected to change, the degree to which sea level is expected to rise, and the possibility of the increases in extreme weather events.

By the release of the 2001 report, confidence in the ability of models to project future climate increased and authors concluded, “There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.” Furthermore, extensive and widespread evidence is present demonstrating that the earth is warming and clear signals of a changing climate exist.

Witnesses

Dr. Susan Solomon of the National Oceanic and Atmospheric Administration (NOAA):

Dr. Susan Solomon serves as co-chair of Working Group I of the Intergovernmental Panel on Climate Change (IPCC), providing scientific information to the United Nations Framework Convention on Climate Change. Her current research includes climate change and ozone depletion, and she served as an overall coordinator for the report. After receiving her Ph.D. in chemistry from the University of California at Berkeley in 1981, she has been employed by the National Oceanic and Atmospheric Administration as a research scientist. Her scientific papers have provided not only key measurements but also theoretical understanding regarding ozone destruction, especially the role of surface chemistry.

Dr. Solomon will provide an overview of the key findings of the report. Working Group I’s contribution to the fourth assessment report includes 11 chapters. Each chapter has two coordinating lead authors who are responsible for pulling together the material for the chapter. In addition to the coordinating lead authors, there are a number of lead authors as well as numerous contributors and reviewers associated with each chapter.

Each of the other IPCC authors, Dr. Trenberth, Dr. Alley, and Dr. Meehl will discuss the findings with a focus on their respective chapters.

Dr. Kevin Trenberth of the National Center for Atmospheric Research (NCAR):

Dr. Kevin Trenberth served as a coordinating lead author for Chapter 3 of the report entitled: *Observations: Surface and Atmospheric Climate Change*. Currently, Dr. Trenberth is Head of the Climate Analysis Section at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado. From New Zealand, he completed his undergraduate degree in mathematics at the University of Canterbury, Christchurch, New Zealand, and obtained his Sc. D. in meteorology in 1972 from Massachusetts Institute of Technology, Cambridge, Massachusetts.

Dr. Richard Alley of the Department of Geosciences, Pennsylvania State University:

Dr. Richard Alley served as a lead author for Chapter 4 of the report entitled: *Observations: Changes in Snow, Ice, and Frozen Ground*. Dr. Alley is Evan Pugh Professor of Geosciences and Associate of the Earth and Environmental Systems Institute at The Pennsylvania State University, University Park, where he has worked since 1988. He received his Ph.D. in 1987 from the University of Wisconsin-Madison and his M. Sc. (1983) and B. Sc. (1980) degrees from The Ohio State University-Columbus, all in Geology. Dr. Alley teaches, and conducts research on the climatic records, flow behavior, and sedimentary deposits of large ice sheets, to aid in prediction of future changes in climate and sea level.

Dr. Gerald Meehl of the National Center for Atmospheric Research (NCAR):

Dr. Meehl is a coordinating lead author for Chapter 10 of the report: *Global Climate Projections*. Dr. Meehl received his Ph.D. in Climate Dynamics from the University of Colorado in 1987. His expertise is in the field of climate modeling. He has been a scientist on staff at NCAR since 1979. He has been a member of the Working Group One Report Group since 1989 and has participated in the development of several IPCC assessment reports.

Definitions:

Radiative forcing - an external disturbance in the radiative energy budget of Earth's climate system brought about by changes in atmospheric concentrations of greenhouse gases, changes in solar radiation, or changes in the surface reflective properties of Earth.

Meridional overturning circulation – the circulation system of the world's oceans driven by variations in temperature and salinity. Cold, dense water formed in polar oceans sinks and is replaced by warmer, less dense surface water from temperate latitudes.