

THE SCIENCE OF CLIMATE CHANGE

The Basics of Climate Change Science

Climate change refers to a long-term rise in global average temperature. More specifically, it refers to the ongoing rise in temperature that started a century ago and is believed to be caused mainly by greenhouse gas pollution. 'Greenhouse gases' trap heat from the sun at the Earth's surface. Human activities are rapidly increasing the amount of greenhouse gases in the atmosphere, causing more heat to be trapped and increasing global temperatures. Rising temperatures have already resulted in an increase in extreme weather events, loss of sea ice and glaciers, rising sea level, and harm to wildlife. But it is not too late to avoid the most severe consequences of climate change: a sharp reduction of greenhouse gas pollution would significantly slow global warming and reduce the likelihood of dangerous and irreversible impacts.

Scientific Consensus on the Impacts of Climate Change

The recently released Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, a comprehensive review of the state-of-the-knowledge on climate change, highlights the overwhelming scientific consensus that human activities are contributing to changes in the climate system. This report reinforces the conclusions outlined in existing consensus statements by respected scientific organizations, such as the statement on climate change from 11 different national scientific academies, including the United States,¹ the official position statement by the American Geophysical Union,² and the official position statement by the American Meteorological Society.³

The IPCC's Summaries for Policymakers from each of its three working groups outline the scientific aspects of climate change, the ongoing and predicted impacts, and opportunities for mitigation and adaptation. These summaries state that:

¹ See Joint Science Academies' Statement: Global Response to Climate Change (June 2005), available at <http://www.royalsoc.ac.uk/displaypagedoc.asp?id=20742>.

² Position Statement, American Geophysical Union Council, Human Impacts on Climate (Dec. 2003), available at http://www.agu.org/sci_soc/policy/positions/climate_change.shtml.

³ Information Statement, American Meteorological Soc'y, Climate Change (Feb. 1, 2007), available at <http://www.ametsoc.org/POLICY/2007climatechange.html>.

- "Warming of the climate system is unequivocal, as is now evident from observation of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level."⁴
- "Most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic [human-produced] greenhouse gas concentrations."⁵
- "At continental, regional, and ocean basin scales, numerous long-term changes in climate have been observed. These include changes in arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones."⁶
- "Impacts of climate change will vary regionally but, aggregated and discounted to the present, they are *very likely* to impose net annual costs which will increase over time as global temperatures increase."⁷
- "The most vulnerable industries, settlements and societies are generally those in coastal river flood plains, those whose economies are closely linked with climate-sensitive resources, and those in areas prone to extreme weather events, especially where rapid urbanization is occurring."⁸

⁴ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Summary for Policymakers*, in CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 5 (2007), available at http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_SPM.pdf.

⁵ *Id.* at 10. According to the Summary for Policymakers: "...the following terms have been used to indicate the assessed likelihood, using expert judgment, of an outcome or result...*Very likely* >90%, *Likely* >66%." *Id.* at 3 n.6.

⁶ *Id.* at 7.

⁷ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Summary for Policymakers*, in CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 17 (2007), available at <http://www.ipcc-wg2.org/index.html>.

⁸ *Id.* at 12.

- "Both bottom-up and top-down studies indicate that there is substantial economic potential for the mitigation of global GHG emissions over the coming decades, that could offset the projected growth of global emissions or reduce emissions below current levels."⁹

The IPCC is "the leading body for the assessment of climate change, established by the United Nations to provide the world with a clear, balanced view of the present state of understanding of climate change."¹⁰ IPCC reports are written by teams of authors nominated by governments and international organizations. Over 800 contributing authors and 450 lead authors were involved in the writing of the Fourth Assessment, and more than 2,500 scientific expert reviewers were involved in the review process. Each Summary for Policymakers is approved line by line by relevant experts and government officials.¹¹

Other resources

In addition to the attached IPCC reports, excellent and accessible summaries of the science of climate change can be found from the following resources:

- NASA's Earth Observatory website on Global Warming gives a basic overview of climate change science and findings:
<http://earthobservatory.nasa.gov/Library/GlobalWarmingUpdate/>
- The National Center for Atmospheric Research maintains a website that explains the basics of weather and climate science: <http://www.eo.ucar.edu/basics/index.html>
- The IPCC has published a pdf of Frequently Asked Questions that cover a number of climate science topics: http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Pub_FAQs.pdf

⁹ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Summary for Policymakers, in CLIMATE CHANGE 2007: MITIGATION 9* (2007), available at <http://arch.rivm.nl/env/int/ipcc/>.

¹⁰ Fact Sheet, Intergovernmental Panel on Climate Change, <http://www.ipcc.ch/press/factsheet.htm>.

¹¹ *Id.*

Appendix B

- Spencer R. Weart's *Discovery of Global Warming*, published by the American Institute of Physics, give a thorough history of climate change research and science: <http://www.aip.org/history/climate/>