Outstanding Accomplishments in Research

Climate Change

Research is at the center of all NOAA services. NOAA's Office of Oceanic & Atmospheric Research (OAR) helps improve weather forecasts, and enhances navigation and aviation safety, as well as a variety of coastal services.

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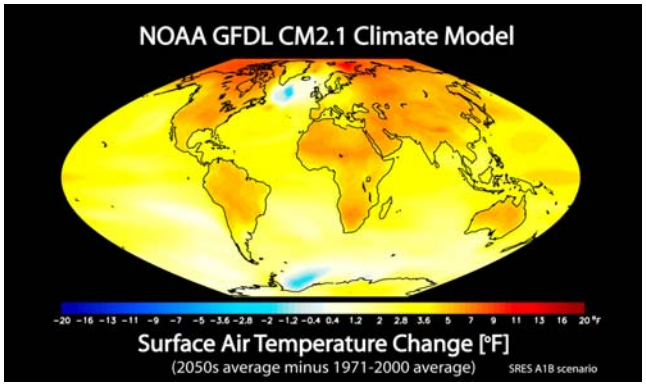
NOAA Research plays a key role in improving the understanding and prediction of global climate and how it is changing. NOAA researchers are working both to improve our understanding and prediction of natural climate variability, as well as to identify and predict human-caused, or anthropogenic, climate change.



Projected change in annual mean surface air temperature from the late 20th century (1971-2000 average) to the mid—21st century (2051-2060 average). The change is in response to increasing greenhouse gases and aerosols based on a "middle of the road" estimate of future emissions.

Working Across National Boundaries, Disciplines

NOAA individuals and technology made major contributions to the Intergovernmental Panel on Climate Change (IPCC) international climate science report. For their collective efforts, the nearly 2,000 scientists who comprised the IPCC (including more than 120 NOAA scientists) were awarded the 2007 Nobel Peace Prize.

In February 2007, the IPCC released the Summary for Policy Makers of the first chapter of the Fourth IPCC Assessment Report—The Physical Science Basis for Climate Change. NOAA Senior Scientist Dr. Susan Solomon, co-chair of IPCC Working Group 1, was instrumental in the production of the report. Nine lead and review authors were NOAA scientists, and NOAA observations networks, computer modeling labs, and research programs provided data and analysis. NOAA's contributions to this international effort, from a leadership role, providing observations, data, model simulations, analysis, authors and review editors, highlight the preeminence of NOAA research.

NOAA's investment in enhanced computing power at the Geophysical Fluid Dynamics Lab (GFDL) made it possible for the lab to provide 20 model runs to the IPCC that enhanced the projections used in the report. GFDL contributed climate models, which couple the interactions of the atmosphere and the ocean to help understand climate phenomena on time scales of decades to centuries. The new models show improved resolution and can incorporate more sophisticated physical parameters.

Monitoring Moderating Ocean Currents

NOAA researchers are studying the naturally-occurring Atlantic Ocean Meridional Overturning Circulation (MOC) that brings warm waters northward, and causes sinking colder water from the North Atlantic to move southward. Climate models show that if the Greenland ice sheet partially melts due to warmer Arctic temperatures, the Atlantic MOC could be slowed, lowering Atlantic air temperatures and changing the climate in only a matter of decades on both sides of the Atlantic.

NOAA scientists and their partners recently installed an array of moorings in the mid-Atlantic to help study the MOC over time and to assess its relationship to observed climate fluctuations. Research cruises recover the moorings, so NOAA scientists can download the data, and then redeploy the moorings.

In the Pacific Ocean, NOAA researchers have identified a slowing of the northern Pacific Meridional Overturning Circulation, which can impact marine ecosystems and the climate of North America.

National Oceanic and Atmospheric Administration (NOAA) Office of Oceanic and Atmospheric Research (OAR)
www.research.noaa.gov
Oar.Communications@noaa.gov

Consequences of CO_2 Increases

NOAA researchers recently documented how carbon dioxide (CO_2) in the atmosphere is dramatically altering ocean chemistry and threatening the health of marine organisms, including corals.

Scientists observed measurable increases in ocean acidity in the North Pacific, which may be the result of the ocean's uptake of anthropogenic CO_2. The increased acidity lowers the concentration of a building block of the calcium carbonate that many marine organisms use to grow their skeletons and create coral reef structures.

PREEMINENT RESEARCH

Observations in the atmosphere have been going on for centuries, but it has been researchers at NOAA and its predecessor organizations that began careful, continual measurements of trace gases in the atmosphere, particularly greenhouse gases like CO_2 that can cause warming by keeping heat from escaping. In 2007, air monitoring stations operated by NOAA Research at the South Pole and Mauna Loa celebrate 50 years of monitoring CO_2 and other gases. NOAA has been involved in creating a Global Ocean Observing System, deploying buoys in all the world's oceans, and participating in research cruises to get more measurements. NOAA is also testing unmanned aerial systems that could provide key data in remote sections of the ocean or over the Arctic that are now too difficult or costly to collect. The data are valuable to improving models, which then improve predictions of climate variability and change. Working in the field and the laboratory, researchers also are exploring how chemical reactions and radiative processes drive atmospheric change.

NOAA scientists are working to move modeling efforts beyond the physical climate system to encompass biological, geological, and chemical cycles as well as ecosystems. They are now designing "Earth system" models, an approach that offers the capability to integrate theory, observations, and modeling to tackle key unknowns in climate change science. The global model developed by the Geophysical Fluid Dynamics Laboratory in Princeton, NJ, was used for the current IPCC and was independently judged one of the most credible models in the world.

NOAA is the lead agency in U.S. Climate Change Science Program (CCSP), directing research to answer questions on the science and impacts of climate change. NOAA's specific threads of CCSP research include reducing uncertainties of the global carbon cycle to learn more about carbon reservoirs, like the ocean, and how carbon cycling might change. Another key area for NOAA is research on air particles, or aerosols, that affect air quality and have an effect on climate as well.

Working with academic and international partners, NOAA scientists have helped deploy and maintain the Meridional Overturning Circulation and Heat-flux Array (MOCHA), a network of moorings in the subtropical Atlantic that provide important data about ocean currents and circulation that can affect climate worldwide.

VALUE TO SOCIETY

The climate affects every aspect of life on Earth: energy use and natural resources; human and ecosystem health; economies; and national and international policies. To deal with a changing and uncertain climate, people and governments need sound, scientific information upon which they can base decisions. NOAA scientists are working to produce better and more timely information about climate variability and change, including products on seasonal and regional climate variability and change that can help people, businesses, and resource managers make the best decisions on future activities. NOAA is also studying feedback mechanisms in the climate system to understand how abrupt change could potentially occur, and possible effects of increased levels of greenhouse gases in the atmosphere and in the oceans could have on the environment, agriculture, fisheries, and other sectors of society.

To Learn More, Visit These Sites:

NOAA Research (OAR): http://www.oar.noaa.gov/
NOAA's Climate Program Office, http://www.cpo.noaa.gov/
Geophysical Fluid Dynamics Laboratory http://www.gfdl.noaa.gov
Arctic Research Office, http://www.arctic.noaa.gov/aro/
U.S. Climate Change Science Program, http://www.climatescience.gov/
Intergovernmental Panel on Climate Change: http://www.ipcc.ch/

To Work or Study at OAR, Visit These Sites:

NOAA Careers: http://www.careers.noaa.gov
Hollings Scholarships: http://www.orau.gov/noaa/HollingsScholarship/
Knauss Fellowships: http://www.seagrant.noaa.gov/knauss/

OAR's mission is to conduct environmental research, provide scientific information and research leadership, and transfer research into products and services to help NOAA meet the evolving economic, social, and environmental needs of the Nation.