

DEPARTMENT OF COMMERCE / NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Principal Areas of Focus

NOAA's mission is: "To understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet the Nation's economic, social, and environmental needs." The long-term climate efforts of NOAA are designed to develop a predictive understanding of variability and change in the global climate system, and to advance the application of this information in climate-sensitive sectors through a suite of process research, observations and modeling, and application and assessment activities.

Specifically, NOAA's research program includes ongoing efforts in operational *in situ* and satellite observations, with an emphasis on oceanic and atmospheric dynamics, circulation, and chemistry; understanding and predicting ocean-land-atmosphere interactions, the global water cycle, atmospheric composition, and the role of global transfers of carbon dioxide among the atmosphere, ocean, and terrestrial biosphere in climate change; improvements in climate modeling, prediction, and information management capabilities; the projection and assessment of variability across multiple time scales; the study of the relationship between the natural climate system and society and the development of methodologies for applying climate information to problems of social and economic consequences; the relationship of climate to coastal and marine ecosystems; and archiving, managing, and disseminating data and information useful for global change research.

Program Highlights for FY 2004 and FY 2005

Climate Observations and Analysis

- Determine actual long-term changes in temperature and precipitation over the United States through deployment of the Climate Reference Network.
- Make the experimental monthly North America Drought Monitor product an operational product by the end of FY 2005. The North American Drought Monitor is a joint effort between drought experts from the United States, Canada, and Mexico. Within the United States, the major participants include NOAA's National Climatic Data Center, NOAA's Climate Prediction Center, the USDA, and the National Drought Mitigation Center.
- Expand deployment of the U.S. component of the Global Ocean Observing System, with emphasis on reduced uncertainty in sea level and sea surface temperature and deployment of the Argo global profiling float array.
- Establish indices for the intensity of the meridional overturning circulation, for decadal variability of the ocean gyres, and for oceanic heat flux in the Atlantic Ocean.
- Analyze long-term oceanographic and atmospheric records of upper ocean currents and temperatures and sea level pressure to interpret large-scale oceanographic and atmospheric interactions (e.g., the North Atlantic Oscillation, meridional overturning circulation, or hurricane formation and sea surface temperature).
- Analyze oceanic heat budgets and their effects on interannual to multidecadal climate fluctuations.



Appendix

Climate Forcing

- Make airborne, shipboard, and ground-based observations of climate forcing species above the U.S. Northeast and western North Atlantic Ocean in the summer of 2004, helping to evaluate and improve model simulations that link pollutant emissions to radiative forcing.
- Complete 22 of the 36 stations in the U.S. carbon dioxide (CO₂) observing system, a key step in assessing and modeling carbon sources and sinks throughout the United States.
- Conduct CO₂ inventory and transport studies in the North Atlantic and North Pacific to determine decadal changes in physical and biogeochemical processes affecting the distribution of CO₂ in the oceans and to estimate anthropogenic carbon uptake in the basins. Additionally, new research will be initiated in 2004 on carbon transport and fate from drainage basins to ocean margins.
- Quantify the seasonal and interannual variations of air-sea CO₂ fluxes in the North Atlantic and North Pacific via measurements of surface ocean pCO₂ conducted by research and volunteer observing ships as they are underway.

Climate Predictions and Projections

- Assess the possible impacts of global warming on hurricane intensities, using scenarios from major modeling centers.
- Compare and evaluate possible 21st and 22nd century climate system impacts via scenarios used in the 2007 Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report and the latest model runs conducted by the Geophysical Fluid Dynamics Laboratory (GFDL) and National Center for Atmospheric Research (NCAR), both of which contribute to the IPCC process.
- Assess the uptake of greenhouse gases by natural systems in the 21st century for a baseline scenario utilized by CCSP and CCTP, utilizing the GFDL Earth System model.
- Assess possible changes in the El Niño-Southern Oscillation cycle from the 19th to the 21st centuries resulting from changes in radiative forcing, utilizing observations and GFDL climate simulations.
- Operationalize an end-of-the-month update for the 15-day lead temperature and rainfall monthly outlooks generated by the Climate Prediction Center.
- Operationalize a new coupled atmosphere-ocean system for seasonal forecasting [currently being tested at the National Centers for Environmental Prediction (NCEP) Environmental Modeling Center]. The components are the operational (July 2003) NCEP global atmospheric forecast model (200-km horizontal resolution and 64 levels) and the GFDL Modular Ocean Model (1° resolution and 40 levels). The two models are coupled directly without flux correction. Limited retrospective forecasts for this system show it to be very skillful, with an El Niño 3.4 sea surface temperature anomaly correlation averaging 0.80 out to 9 months for representative April initiation and 0.60 out to 9 months for January initiation. An operational implementation is anticipated in June-July 2004, once full calibration runs have been made and analyzed.
- Implement a calibrated forecast system to improve week-1 and week-2 extended range predictions issued routinely by the Climate Prediction Center. This system is a result of research efforts at the Climate Diagnostics Center, and its implementation at the NCEP Environmental Modeling Center will transition this product from research into operations.

Climate and Ecosystems

- Develop two new indices of ecosystem productivity based on anomalies in zooplankton species abundance from long-term observations of zooplankton in the northern California Current. The indices will demonstrate how changes in ocean productivity are linked to interannual and decadal scale climate variability and to marine fisheries. To date, zooplankton anomalies correlate with survival and growth of coho and chinook salmon, and with recruitment of black cod.

Regional Decision Support

- Develop a social science-based prototype information system for urban planning based on information about climate variability and change. The system will be completed in FY 2005 and will contribute to the CCSP deliverable of “best practice approaches for characterizing, communicating, and incorporating scientific uncertainty in decisionmaking.”

Related Research

In addition to focused CCSP efforts, related activities include short-term weather forecasting and advance warning services; maintenance of operational polar-orbiting and geosynchronous satellites; marine ecosystem research; prediction and observation systems in support of weather and seasonal to interannual climate forecasts; and facilitating the dissemination of global change information.

DOC’s National Institute of Standards and Technology (NIST) provides measurements and standards that support accurate and reliable climate observations. NIST also performs calibrations and special tests of a wide range of instruments and techniques for accurate measurements. NIST provides a wide array of data and modeling tools that provide key support to developers and users of complex climate prediction models.

