

Appendix A

DEPARTMENT OF DEFENSE



Principal Areas of Focus

The Department of Defense—while not supporting dedicated global change research—continues a history of participation in the CCSP through sponsored research that concurrently satisfies national security requirements and stated goals of the CCSP. All data and research results are routinely made available to the civil science community. DOD science and technology investments are coordinated and reviewed through the Defense Reliance process and published annually in the *Defense Science and Technology Strategy*, the *Basic Research Plan*, the *Defense Technology Area Research Plan*, and the *Joint Warfighting Science and Technology Plan*.

Program Highlights for FY 2008

Satellite Sensors and Observations

DOD will fund 50% of the National Polar-Orbiting Operational Environmental Satellite System (NPOESS), as a result of the convergence of national sensing suites. NPOESS will monitor global environmental conditions, and collect and disseminate data related to weather, atmosphere, oceans, land, and near-space environment. The NPOESS Program is managed by the tri-agency Integrated Program Office run by DOC, DOD, and NASA.

Global Observations and Models

The Navy is a principal member of the National Oceanographic Partnership Program, incorporating the Integrated Ocean Observing System and associated data management and communications, the Global Ocean Observation System, the Global Ocean Data Assimilation Experiment (GODAE), and the National Federation of Regional Associations (<www.ocean.us> and <usnfra.org>). This broad partnership of agencies collaborates in the development and demonstration of integrated ocean observations systems, data management systems, and eddy-resolving, real-time global and basin-scale ocean prediction systems. As part of GODAE, the Navy funds development of the Hybrid Coordinate Ocean Model (HYCOM), a predictive model which runs efficiently in parallel computing environments and includes sophisticated techniques for assimilation of satellite and *in situ* observations. The U.S. GODAE data server (see <usgodae.org>) is also funded by the Navy. The goal of this project is to develop and implement a comprehensive data management and distribution strategy that allows easy and efficient access to HYCOM-based ocean prediction system outputs to coastal and regional modeling sites, making them available to the wider oceanographic and scientific community, including climate and ecosystem researchers, and the general public especially students in middle and high schools. This is accomplished through a data-sharing system that uses existing open source software packages to distribute the ocean prediction system data via the Internet.

The Coupled Boundary Layers Air-Sea Transfer Defense Research Initiative focuses on processes that occur in the oceanic and atmospheric wave boundary layers (i.e., regions influenced by ocean surface waves). This Office of Naval Research program combines observational and modeling components in all of its investigations. These investigations will focus on processes that couple the turbulent atmospheric and oceanic boundary layers across the interface through the exchange of momentum, mass, and heat. The observational components include *in situ* investigations of ocean-atmospheric turbulence and mean

flow from fixed towers and moorings, remote sensing of 2- and 3-D structure of the boundary layers and ocean surface, appropriate surface wave measurements with particular emphasis on small-scale and breaking waves, and Autonomous Underwater Vehicle and aircraft-based measurements. A significant outcome of the program is a coupled ocean-wave-atmosphere model for hurricanes which shows significant promise in intensity forecasts. This may lead to a better representation of these systems in climate simulations.

Results from the Monterey Bay 2006 (MB 06) experiment are being analyzed. This program builds on earlier work of the Autonomous Ocean Sampling Network I and II programs to demonstrate the coordination of a diverse collection of unmanned observing platforms within the context of data-assimilation models to form an effective ocean observing and undersea monitoring system. MB 06 is an integrated experiment that involves the interaction and coordination of four related but distinct programs: Adaptive Sampling and Prediction (ASAP), Undersea Persistent Surveillance (UPS, or UPS/PLUSNet), Assessing the Effects of Sub-Mesoscale Ocean Parameterizations (AESOP), and Layered Organization in the Coastal Ocean (LOCO).

Polar Regions Research

A priority in the CCSP research plan has been the polar and sub-polar regions, which have exhibited more rapid changes than the lower latitudes. The U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) is America's lead Federal laboratory for polar and sub-polar research. The CRREL research program responds to the needs of the military, but much of the research also benefits the civilian sector and is funded by non-military customers such as NSF, NOAA, NASA, DOE, and state governments. DOD research has examined impacts of climate change on retreating Arctic sea ice—defining the requirements for U.S. Coast Guard icebreaking ships for the next 30 years. Satellite data show that the extent of Arctic sea ice has decreased by about 10%, and the sonar data collected by U.S. Navy submarines in the Arctic between 1957 and 2000 show the average ice thickness has decreased between 33 and 42%. CRREL and the University of Alaska are developing a web-accessible Alaska Engineering Design Information System—an analytic toolkit for engineers that presents a broad array of geospatial terrestrial, oceanic, and atmospheric environmental data in a geographic information system.

The Navy, through its participation in the National Oceanographic Partnership Program, is funding research related to climate change under the call for proposals “Coastal Effects of a Diminished-Ice Arctic Ocean.” The funded efforts will explore ocean observing system strategies for the Alaska Beaufort and Chukchi Seas, changes in the circulation and wave dynamics of the coastal arctic, the impact on coastal production and sediment transport, and the measurement and prediction of seasonal changes in sea ice cover in the Beaufort and Chukchi Seas.

Related Research

Other DOD-sponsored research and supporting infrastructure also contribute to observing, understanding, and predicting environmental processes related to global change. Associated research programs include theoretical studies and observations of solar phenomena, monitoring and modeling of unique features in the middle and upper atmosphere, terrestrial and marine environmental quality research, and energy conservation measures. DOD's continued investment in environmental infrastructure—such as the Oceanographic Research Vessel Fleet, and the various services' operational oceanographic and meteorological computational centers—will continue to provide data and services useful to CCSP.