

Appendix A

DEPARTMENT OF DEFENSE



Principal Areas of Focus

The Department of Defense (DOD)—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 2009

Satellite Sensors and Observations

Via the Air Force, DOD funds 50% of the National Polar-Orbiting Operational Environmental Satellite System (NPOESS)—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 real-time coastal, basin-scale, and global 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>) has been funded by the Navy for the duration of GODAE activities, which come to a close in 2008. The goal of the data server 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.

The Office of Naval Research (ONR) supports a number of research programs that, while directed toward fulfilling the objectives outlined in the *Naval Science and Technology Strategic Plan* (available at <www.onr.navy.mil>), also project onto the science goals of the CCSP. Within the “Operational Environments” focus area, ONR incorporates both observational and modeling elements into major field programs designed to learn more about the underlying physics of the ocean and atmosphere. The development of new sensors, sensing platforms, and sensing strategies is supported in order to achieve these goals, and ongoing research into predictive systems for the ocean and atmosphere is supported, with the primary goal of improving environmental forecasts for DOD. Most of this basic research

enhances fundamental understanding of the dynamics of the coupled ocean-atmosphere system, and is thus relevant to climate change issues. A recent outcome of the program is a new coupled ocean-wave-atmosphere model for hurricanes which shows significant promise in improving forecasts of storm intensity. This work is being continued in FY 2009 under two new 5-year initiatives to study the generation of tropical cyclones and their impact on the thermal structure of the upper ocean. The research may lead to a better representation of these systems in climate simulations, and improved understanding of the sensitivity of these high-impact weather events to subtle changes in the Earth's climate.

Polar Regions Research

The *Strategic Plan for the Climate Change Science Program* highlights polar and sub-polar regions as research emphases, since they 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. 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, funds research related to climate change under the call for proposals "Coastal Effects of a Diminished-Ice Arctic Ocean." The funded efforts 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.