NATIONAL SCIENCE FOUNDATION

Principal Areas of Focus

NSF programs address global change issues through investments in challenging ideas, creative people, and effective tools. In particular, NSF global change research programs support research and related activities to advance the fundamental understanding of physical, chemical, biological, and human systems and the interactions among them. The programs encourage interdisciplinary activities and focus particularly on Earth system processes and the consequences of change. NSF programs facilitate data acquisition and information management activities necessary for fundamental research on global change. The programs promote the development of advanced analytic methods and the creation of digital models designed to improve understanding of Earth system processes and interactions. NSF also supports fundamental research on the general processes used by organizations to identify and evaluate policies for mitigation, adaptation, and other responses to the challenge of varying environmental conditions. Through its investment, NSF will contribute to CCSP by providing a comprehensive scientific foundation for many of the synthesis and analysis products identified in the *CCSP Strategic Plan*.

Program Highlights for FY 2004 and FY 2005

During FY 2004 and FY 2005, NSF will support research and related activities addressing all of the CCSP program elements and the interdisciplinary science aspects that link them. NSF will also support several key Climate Change Research Initiative topics. NSF will continue to invest in collaborative international programs such as the World Climate Research Programme, the International Geosphere-Biosphere Programme, the International Human Dimensions Programme, and Diversitas.

Atmospheric Composition
A major focus on atmospheric composition and atmospheric chemistry will continue through programs in tropospheric and stratospheric chemistry. Studies of atmospheric transport of constituents and aerosols will continue to provide insights about how they affect the radiative and cloud nucleating properties of the atmosphere and ultimately the climate. Studies to reduce uncertainty in global distributions of greenhouse gases should provide input for future scenarios of radiative forcing.

Climate Variability and Change
NSF will continue its emphasis on climate variability and change as a major component of its investments. This element will support observational campaigns and numerous analytical and modeling activities. A number of ocean and atmospheric science projects will address topics identified in the CLIVAR implementation plans. Ocean science efforts will focus on changes in ocean structure, circulation, and interactions with the atmosphere to improve our current understanding of the processes and models that address future changes, particularly those that may happen abruptly. Major support will continue to permit the Community Climate System Model to develop more comprehensive models through the incorporation of improved parameterizations. Paleoclimate studies will continue to be supported as a means to provide baseline data on natural climate variability from key climatic regions (e.g., the high latitudes) to improve understanding of natural variability. These data will be used to reconstruct and evaluate past environmental change due to climate and as an input for model validations.

Appendix

The Global Water Cycle

NSF supports a broad-based effort to understand all aspects of the global water cycle. For FY 2004 and FY 2005, the program will continue to address the wide range of hydrological data types—continuous and discrete time and space information from a variety of platforms—that are major obstacles facing water cycle researchers. Information from process studies will be used to refine models through scaling and parameterizations of sub-grid processes. For example, a high-resolution cloud model is run "inside" a lower resolution global model to create a "multi-scale modeling framework." Results show major improvements in the simulation of weather, climate systems, and hydrological variables.

Land-Use and Land-Cover Change

Several NSF programs address key aspects of land-use and land-cover change. Support continues for studies in ecological rates of change and related species diversity, Arctic systems, temporal variability, water and energy influences on vegetative systems, and diverse human influences on land utilization. These activities support numerous research needs in the *CCSP Strategic Plan*.

Global Carbon Cycle

NSF will continue to support a wide variety of carbon cycle research activities. For FY 2004 and FY 2005, one specific program—Integrated Carbon Cycle Research—will focus on the transport of materials from their origin in various river basins to their deposition along ocean margins. The transport process, including modification en route, and the ultimate fate of carbon species will be addressed and used as key input for the North American Carbon Program. Integration of observational data into models will continue to provide insights for the global carbon cycle.

Ecosystems

Several NSF programs address terrestrial and marine ecosystems through observational and laboratory studies. NSF will continue to support the collection of ecosystem data through its Long-Term Ecological Research programs. For FY 2004 and FY 2005, the Global Ocean Ecosystem Dynamics program will evaluate the impact of global ocean changes on marine ecosystems.

Human Contributions and Responses

NSF will support basic research on the processes through which people (individually, in groups, or through organizations) interact with natural environmental systems. For FY 2004 and FY 2005, NSF programs will support a set of centers that focus on decisionmaking under uncertainty associated with climate change. The work of these centers will contribute to decisionmaking in the following years.

Related Research

NSF will continue to support "contributing" research on broader topics that are closely related to global change and climate change. These include, *inter alia*, studies of the atmosphere, ocean, land surface, ecosystems, paleoclimatology, and human dimensions that add substantively to the specific programs supporting CCSP objectives, and cyberinfrastructure which will enable more effective utilization of the research information. In addition, projects that integrate research with education on global and climate change are supported to demonstrate that scientific visualization, incorporated into inquiry-based learning, can enable students to develop an understanding of complex global change phenomena. Students address these issues by evaluating multimedia data at various spatial and temporal resolutions, reviewing scientific evidence, and considering social concerns that contribute to global and climate change debates.