CLIMATE CHANGE SCIENCE PROGRAM

Climate has a pervasive effect on the U.S. through its impact on the environment, natural resources, and the economy. To respond to the challenge of understanding climate and climate variability, the Climate Change Science Program (CCSP) was established in 2002 (http://www.climatescience.gov/). It is providing the Nation and the world with the science-based knowledge to predict change, manage risk, and take advantage of opportunities resulting from climate change and climate variability. Research conducted through CCSP builds on the scientific advances of the last few decades and deepens our understanding of how the interplay between natural factors and human activities affect the climate system. The CCSP engages thirteen U.S. agencies in a concerted interagency program of basic research, comprehensive observations, integrative modeling, and development of products for decision-makers. NSF provides support for the broad range of fundamental research activities that form a sound basis for other mission-oriented agencies in the CCSP and the Nation at large.

The Earth's climate is determined by highly complex interactions between and among the atmosphere, hydrosphere, cryosphere, geosphere, and biosphere. NSF programs address these components by investing in challenging research, creative people, and new research tools. As a key participating agency in the CCSP, NSF encourages interdisciplinary activities and focuses particularly on Earth system processes and the consequences of change. High priorities for the agency include data acquisition and information management activities necessary for global change research, the enhancement of models designed to improve our understanding of Earth system processes, the development of new, innovative Earth observing instruments and platforms, and the development of advanced analytic research methods. NSF also supports fundamental research on the general processes used by organizations to identify and evaluate policies for mitigation, adaptation, and other responses to varying environmental conditions. Through its investment, NSF contributes to CCSP by providing a comprehensive scientific foundation for many of the synthesis and analysis products identified in the CCSP Strategic Plan.

Climate Change Science Program Funding
(Dollars in Millions)

	FY 2005 Actual	FY 2006 Current Plan	FY 2007 Request	Change over FY 2006 Amount	Change over FY 2006 Percent
Biological Sciences	15.10	15.10	15.10	-	-
Engineering	1.00	1.00	1.00	-	-
Geosciences	150.35	149.35	157.72	8.37	5.6%
Mathematical and Physical Sciences	5.45	5.45	5.45	-	-
Social, Behavioral and Economic Sciences	15.48	15.48	15.48	-	-
Office of Polar Programs	10.50	10.50	10.50	-	-
Total, Climate Change Science Programs	$197.88	$196.88	$205.25	$8.37	4.3%

Totals may not add due to rounding.

FY 2007 Areas of Emphasis:

Atmospheric Composition – NSF programs in tropospheric and stratospheric chemistry will continue in FY 2007 to address the composition of the atmosphere and its relation to climate variability and change, and linkages between the atmosphere and the biosphere, land surface, oceans, and cryosphere. Studies of the transformation and transport of gaseous constituents and aerosols provide insights into the radiative

and cloud nucleating properties of the atmosphere. Studies of the global distributions of greenhouse gases will provide input for future scenarios of radiative forcing.

Climate Variability and Change – As a major focus in FY 2007, NSF programs continue to emphasize climate variability and change across temporal scales. This research element supports observational campaigns and numerous analytical and modeling activities. Ocean science efforts will concentrate 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 improve model physics and parameterizations that will lead to more comprehensive models incorporating interactive chemistry and biogeochemical cycles. Studies of paleoclimatology will continue to be supported as a means to provide baseline data on natural climate variability from the past and from key climatic regions. These studies will improve our understanding of the natural variability of the climate system and in particular will enable reconstructions and evaluations of past environmental change as inputs for model validations.

The Global Water Cycle – NSF supports a broad-based effort to understand all aspects of the global water cycle. Relevant programs will continue to explore ways to optimally and effectively utilize the wide range of hydrologic data types – continuous and discrete time and space information from a variety of platforms – for research purposes. Information from process studies will be used to refine models through scaling and parameterizations of sub-grid processes, particularly the fluxes of water through the Earth system. New ultra-high resolution "cloud system resolving" models are being developed and refined to address the persistent problem of representing moist convection and cloud processes – two of the most challenging and uncertain components in climate change calculations. Planning and initiation of several prototype hydrologic observatories, both physical and virtual, are being carried out. Science and Technology Centers will continue to work with stakeholders responsible for water management and with educators to translate research advances into useful products, particularly exploring issues related to decision-making in the face of uncertainty as applied to the urbanizing and drought-prone Southwest.

Land-Use and Land-Cover Change – Several NSF programs continue to address key aspects of land-use and land-cover change through 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 use.

Global Carbon Cycle – FY 2007 funding supports a wide variety of carbon cycle research activities. Investigations will examine a range of topics in terrestrial and marine ecosystems and their relations to the carbon cycle. Research in terrestrial settings will explore, for example, carbon storage, delivery of carbon by rivers, carbon fluxes from high-latitude soils, carbon export from mountains, and submarine groundwater discharge. In the oceans, clathrate stability, the "biological pump", abiotic carbon cycling, and the upper ocean carbon budget will be addressed. Carbon cycle studies will integrate observational data into models to provide insights for understanding key aspects of the global carbon cycle and feedbacks on the climate system.

Ecosystems – Several NSF programs address terrestrial and marine ecosystems through observational, experimental, modeling, and laboratory studies. The Long Term Ecological Research (LTER) Program supports the collection of time-series data on key ecosystem processes and funds research on the drivers of ecosystem change in terrestrial and marine systems. The Global Ocean Ecosystem Dynamics program will continue to study the impact of global ocean changes on marine ecosystems through specific

synthesis activities focused on the North Atlantic and the North Pacific. One new theme will focus on understanding the impact of increasing carbon dioxide levels on the calcification rates, productivity and symbiotic relationships of hermatypic corals.

Human Contributions and Responses – NSF supports basic research on the processes through which people (individually, in groups, or through organizations) interact with natural environmental systems. FY 2007 funding supports projects that focus on decision-making under uncertainty associated with climate change. These projects are expected to produce new knowledge and tools that should facilitate improved decision-making by various stakeholder groups trying to deal with uncertainties associated with future climate variability and change.