CCSP FY 2007 Focus Areas

An important step in coordinating the CCSP budget for FY 2007 has been to align the agency climate programs with the goals and key research focus areas in the *CCSP Strategic Plan*, thus helping to ensure consistency. The emphasis is on ensuring alignment of current funding with a recommended list of priorities and identifying gaps that may occur, as well as identifying measurable milestones and deliverables that reflect accountability toward meeting program goals.

Within the framework provided by the *CCSP Strategic Plan*, there is a continual assessment and refinement of program priorities and activities by means of identified new initiatives and other evolutionary redirections. CCSP aspires to refresh programs during each budget cycle such that over a 5-year period, approximately one-third of CCSP research and observation activities will support new initiatives. Since many research activities involve long-term programs, this refresh rate is representative of the desired balance between program continuity to address complex, long-term issues, and program priorities to respond to new information needs as they arise. Based in part on the analysis of program progress to date and mindful of its priorities in recent years, CCSP has developed a set of near-term focus areas for FY 2007. These focus areas, which constitute only a fraction of the program's overall priorities, are areas in which interagency cooperation is particularly needed and likely to produce significant advances. The focus areas are listed here in the same order as the research elements described in the *CCSP Strategic Plan* and in the order these research elements appear in this document.

Aerosols-Clouds-Climate: Integrating New Remote-Sensing Observations with Expanded In Situ Observations to Advance the Next Generation of Climate Prediction Capabilities. The key objectives of this focus area are to quantify the uncertainty related to aerosol-cloud interactions and to develop for the first time a consensus best estimate of the current magnitude of uncertainty resulting from the effects of aerosols on clouds. This

focus area will capitalize on the first global measurements of aerosol and cloud vertical distributions and properties (i.e., the NASA enhanced "A-train" satellite formation), expanded *in situ* observations (e.g., NOAA's expanded *in situ* observation capabilities), and laboratory and controlled condition characterization of aerosols and their properties, data analysis, and modeling.

Development of an Integrated Earth System Analysis Capability. The purpose of this focus area is to improve the scientific capacity to assimilate current and planned future observations from disparate observing systems into Earth system models that include physical, chemical, and biological processes, in order to produce the best possible synthesized description of the state of the Earth system and how it is evolving over time. This capability will provide a vital information base for diagnosing and improving climate models; understanding the causes and impacts of climate variability and change; improving estimates of sources, sinks, and budgets of important parameters (e.g., water vapor, carbon); and, fundamentally, linking together the Earth system observation and modeling efforts within CCSP.

Integration of Water Cycle Observations, Research, and Modeling: A Prototype Project. The purpose of this focus area is to address significant uncertainties associated with the water cycle through a study that comprehensively addresses the water budget within a limited spatial and temporal domain. The core of this prototype activity is DOE's proposed month-long field campaign at the Atmospheric Radiation Measurement (ARM) site in the southern Great Plains [i.e., the Cloud and LAnd Surface Interactions Campaign (CLASIC)]. The campaign will feature concurrent contributions from NASA, NOAA, NSF, USGS, USDA, EPA, and others to extend CLASIC's time and space domain to capture the seasonal time scale and regional processes, and expand the observational framework by adding space-based observations, aircraft campaigns, surface and subsurface hydrologic components, isotopic measurements, CO_2 fluxes, and associated modeling.

Global Landsat Data for Answering Critical Climate Questions. The purpose of this focus area is to acquire Landsat-like global data for addressing critical climate research questions. Although a scan line malfunction has occurred on Landsat 7, it continues to collect global data. NASA and USGS are investigating alternative sources for Landsat-like data, but have not found a substitute that provides globally available satellite data at spatial scales of tens of meters. These data are required to document land use, land-cover change, glacier extent, and movements of ice sheets, and to address a wide variety of other questions related to climate variability and change. The focus will be on acquiring a global collection of data from other satellites.

North American Carbon Program Integration. The key objective of this focus area is to quantify the carbon budget for the North American region. The research involves integration of remote observations, *in situ* measurements, and models of the atmospheric, terrestrial, and oceanic components of the carbon cycle to quantify carbon budgets at multiple spatial and temporal scales. This information is essential for developing successful carbon management strategies and reducing the uncertainties in quantifying carbon cycle dynamics. These scientific challenges are addressed in this focus area, which involves the North American Carbon Program (NACP), the Ocean Carbon and Climate Change (OCCC) Program, and a *State of the Carbon Cycle Report* that will provide the first integrated analysis of the North American carbon cycle. The research will result in a stronger scientific basis for developing technical and policy options for managing carbon.

Impacts of Climate Variability and Change on Ecosystem Productivity and Biodiversity. The purpose of this focus area is to increase understanding of the relationship between climate change and ecosystem productivity and biodiversity. A key element is the development of predictive models, at various spatial scales, to provide forecasts for aquatic and terrestrial ecosystems. Emphasis will be placed on ecosystems important to society such as forests, agricultural systems, rangelands, wetlands, fisheries, coral reefs, and alpine, river, estuary, and marine ecosystems. Emphasis will also be placed on regions where abrupt environmental changes may occur, such as high-elevation and high-latitude ecosystems (e.g., western U.S. mountain and arctic systems).

Coping with Drought through Research and Regional Partnerships. The objective of this focus area is to understand how information about near-term climate variability and longer term climate trends can best be used to aid decisionmakers in coping with drought. The approach will include the development of methods, models, and mechanisms for integrating climate information into analyses of the social and economic consequences of drought as well as the policymaking and decisionmaking processes in the face of drought. Climate information utilized in this effort may include paleoclimatic and historical information about climate and its impacts, predictions based on seasonal-to-interannual climate variability, recent trends, and future projections of decadal variability and climate change. Social and economic impact analyses utilized in this effort may include historical perspectives and near-term trends (e.g., projections of water conflicts, water demand, population changes, land-use shifts).

International Polar Year. The International Polar Year (IPY) will be an international suite of coordinated research projects, involving more than 50 nations, planned for 2007 and 2008 in both Arctic and Antarctic polar regions to address the strong links these regions have with the rest of the globe. It will emphasize multidisciplinary research across a wide range of disciplines, including societal and health issues and how these are related to the accelerating changes in the polar environment. Research will focus on a wide range of issues, including trends in extent and thickness of the polar ice sheets and sea ice, polar atmospheric variability, export of continental emissions to the polar regions, changes in the chemical composition of the polar atmosphere, and changing permafrost conditions.

Integrated Ocean Observing System. The international community is developing a strategy for a global ocean observing system in cooperation with the Intergovernmental Oceanographic Commission (IOC), WMO, the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology, and UNEP. A major U.S. contribution to this is the Integrated Ocean Observing System (IOOS), supported by the Administration's U.S. Ocean Action Plan. The *Strategic Plan for the U.S. Integrated Earth Observation System* provides a framework for understanding connections between IOOS and the broader GEOSS. Products from IOOS—such as tsunami warnings, harmful algal bloom forecasts, and real-time navigation services—are already demonstrating their value to the economy, human health, and public safety. Although funding for IOOS is largely outside of the CCSP budget, its strategy is consistent with the requirements for ocean observations in climate research.

One theme shared by many of these focus areas is the improvement of the capacity for Earth system modeling and data integration. Benefits from this integrating theme are expected to include: (a) improvements in climate predictions through advances in model coupling, model components, data assimilation, model parameterizations, and model initialization; (b) improved ability to estimate sources, sinks, and fluxes of key environmental constituents (e.g., carbon, water) required for making many different types of informed decisions such as those regarding carbon sequestration and drought mitigation; (c) improved ability to estimate the effects of climate variability and change on human and natural systems; and (d) improved understanding of Earth system processes, including component interactions, which will provide vital underpinning for future scientific advances. These advances in Earth system modeling and data integration are also critical to the ultimate success of the U.S. Integrated Earth Observation System.