

Atmospheric Sciences and Climate Change Programs in the FY 2004 Budget

*Eugene W. Bierly and H. Frank Eden,
American Geophysical Union*

HIGHLIGHTS

- Budget requests for major agencies that fund atmospheric sciences and climate change are mixed. The National Science Foundation's (NSF) request would be a 3.2 percent increase. R&D in the National Oceanic and Atmospheric Administration (NOAA) would decrease by 1.4 percent, but with increases in climate research and extreme weather warnings and forecasts including weather satellites. The National Aeronautics and Space Administration's (NASA) overall budget would increase by 0.9 percent. Department of Energy's (DOE) Biological and Environmental Research (BER) would decrease by 5.1 percent reflecting completion of previously earmarked projects. The Department of Defense's (DOD) basic research budget would decrease by 7.7 percent. EPA's R&D budget would decrease by 5.7 percent. Science and technology in the Department of Homeland Security (DHS) would increase by 53.7 percent, some of which would be expended on atmospheric research.
- The U.S. Global Change Research Program (USGCRP) would decrease by \$143 million to \$1.6 billion. The Climate Change Research Initiative (CCRI) would increase by \$142 million to \$182 million. These two programs have been merged into a Climate Change Science Program (CCSP), coordinated by a new interagency Climate Change Science Program Office in NOAA.
- The tri-agency (DOD, NASA and NOAA) National Polar Orbiting Environmental Satellite System (NPOESS) program that converges the civil and military systems into a single

program remains on track with a requested budget split equally between NOAA and the Air Force. The NOAA request of \$391.1 million would fund the continuation of the current polar orbiting satellites and its share of NPOESS.

- The National Space Weather Program (NSWP) would continue in FY 2004 with significant increases in NASA's Living with a Star Program and level funding for NSF's solar-terrestrial programs. NOAA's Space Environmental Center would increase modestly to \$8.3 million. A National Academy of Sciences (NAS) report, *Sun to the Earth and Beyond: A Decadal Research Strategy in Solar and Space Physics*, now in press, will influence the direction of future solar-terrestrial research.

INTRODUCTION AND POLITICAL ENVIRONMENT

The atmospheric sciences are an integral and vital part of the Earth system. Since the attack of September 11, 2001 and the continuing threat of materials released into the atmosphere, research on the diffusion of such materials within the atmosphere has become increasingly important. Agents that enter the atmosphere may interact not only with each other, but chemically and biologically with the media that transport them.

The atmosphere knows no national boundaries. The effects of the present El Niño have been felt over the entire globe. Monitoring of the atmosphere and its constituents is mandatory, but much more needs to be accomplished. This is an international responsibility. Free and open exchange of global data must continue to be available as in the past for research, operations, and education. Today, more than ever, it is critical to maintain such exchanges.

The importance of atmospheric knowledge to military activities has increased greatly in the past two decades as a result of Desert Storm, Kosovo, Afghanistan, and now Iraq. The successful use of precision-guided missiles depends on detailed knowledge of local weather. DOD actively uses weather information as a force multiplier.

The burgeoning commercial importance of weather and climate information is illustrated by the increasing use of such knowledge by the reinsurance industry and futures markets. The growth of private weather and climate services and their partnerships with universities and users is

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further evidence. An NAS report examining the balance between private and public weather services is in press.

Public and scientific interests have grown with regard to the effects of solar variability on the Earth's atmosphere, space systems, radio transmissions and ground based power transmission systems, and potentially the global climate. Major new NASA satellites, HESSI and TIMED, were launched in 2002 to observe the sun and the Earth's space environment while the NSF funded a multi-institutional Center for Integrated Space Weather Modeling (CISM).

The management and oversight of the CCSP and the accompanying National Climate Change Technology Initiative (NCCTI) have been reorganized to ensure that climate change activities are reviewed at the highest levels of government. Details are provided as a part of the section on Climate Change Programs.

NATIONAL SCIENCE FOUNDATION (NSF)

NSF's total budget would increase to \$5.5 billion, an increase of \$171 million (3.2 percent; see Table II-7). Research and Related Activities would increase to \$4.1 billion, an increase of 1.2 percent. Information Technology Research would increase to \$218 million, up 4.2 percent. Biocomplexity in the Environment would increase to \$99.8 million.

NSF's Geosciences Directorate would receive an increase of \$3.9 million (0.5 percent) for a total of \$687.9 million. There are several activities within the Major Research Equipment and Facilities Construction (MREFC) account that would have an impact on the atmospheric sciences. The first would be \$25.5 million to complete funding for the High-performance Instrumented Airborne Platform for Environmental Research (HIAPER). The second would be \$12.0 million to begin funding for the National Ecological Observing Network (NEON).

The Atmospheric Sciences Subactivity (ATM) would increase by \$12.9 million (6.1 percent) to \$229.9 million. Atmospheric Sciences Research Support would increase to \$151.1 million. The National Center for Atmospheric Research (NCAR) would increase to \$78.8 million. Within ATM there would be additional funds from CCRI to enhance and accelerate development of climate assessment models.

U.S. Polar Programs (USPP) include the Arctic Research Program, Arctic Research Support and Logistics, the Arctic Commission, Antarctic Research Grants Program, and Antarctic Operations and Science Support. All of these activities would increase. The USPP would receive \$330 million (up 3.4 percent). From the MREFC account would be \$96 million for modernization of the South Pole station.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

NOAA's total budget would increase to \$3.3 billion, an increase of \$172 million (5.4 percent). NOAA's R&D budget, however, would decrease by 1.4 percent to a level of \$675 million. The reductions would be primarily in the National Ocean Service (NOS), down 21.6 percent; the Office of Oceanic and Atmospheric Research (OAR), down 2.3 percent; and the National Environmental Satellite, Data and Information Service (NESDIS), down 0.2 percent (see Table II-14).

In the satellite area increases in NPOESS and decreases in the current polar orbiting satellite system would be included in the FY 2004 request of \$391.1 million. DOD would match NOAA's contribution to NPOESS. A total of \$277.6 million for the Geostationary Global Observational Environmental Satellite (GOES) system would provide post launch requirements of GOES I through M and planning and development of the next GOES-R system of satellites and instruments. The launch date has slipped from 2010 to 2012 reflecting the increased life of the present generation of satellites.

Climate Research would reach \$184.8 million, an increase of \$18.5 million (11.1 percent). Funds would be used for a new aerosol program, establishment of a climate modeling center, continued implementation of the Global Ocean and Global Climate Observing Systems, and the establishment of the CCSP Office.

The National Weather Service (NWS) would begin the development of a new Center for Weather and Climate Prediction, potentially located in Maryland. NWS also would request \$3.7 million for NEXRAD product improvement.

The Oceanic and Atmospheric Research operation, research and facility budget would decrease to \$332 million, down 2.3 percent. The U.S. Weather Research Program would increase to \$12.6 million, an increase

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of \$4.8 million (61.6 percent) which would include The Observing System Research and Predictability Experiment (THORPEX) to improve forecast accuracy. (For more on NOAA, see Chapters 13 and 17.)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA's overall budget would increase 0.9 percent to \$15.5 billion (see Table II-12). Space Science would increase to \$4.0 billion (up 12.7 percent) which includes major new initiatives in nuclear propulsion and optical communications. The Space Science program includes important projects aimed at solar activity and the Earth's space environment. The launch of HESSI to study the dynamics of solar flares and TIMED will provide global data in the region where the Earth's atmosphere tails off into space. Both complement the Living with a Star program. The Solar-Terrestrial Relations Observatory (STEREO) will complete integration and testing for a launch in 2005. The Solar Dynamics Observatory (SDO) enters the development phase in January 2004 as the first cornerstone satellite mission of the Living with a Star program.

The Earth Science budget would decrease by 8.1 percent to \$1.6 billion reflecting reductions following the recent successful launches of AQUA, GRACE, ICESat, SORCE, and the Sea Winds instrument aboard a Japanese spacecraft. The NPOESS Preparatory Project (NPP) would remain on track with a requested \$96.0 million to bridge the gap between research on the atmosphere as exemplified by AQUA and the future operational NPOESS. Launches of other Earth Sciences satellites, AURA, Calipso, and Cloudsat are scheduled for 2004.

NASA is a major player in the CCSP. Funds would support new programs in Non-CO₂ Greenhouse Forcing and Polar Feedbacks. Also funded would be an acceleration of the NPOESS Aerosol Polarimetry Sensor (APS) and the provision of system engineering support to benchmark the assimilation of Earth science measurements and predictions from science models. (Please see Chapter 10 for more information on NASA.)

OTHER AGENCIES

The DOE's Biological and Environmental Research (BER) would decrease to \$500 million (down 5.1 percent; see Table II-11). The climate change research program within BER would increase to \$143.0

million, an increase of \$5.0 million (3.6 percent). The DOE plays a significant role in the CCSP. In FY 2004 the Atmospheric Radiation Program (ARM) would deploy a mobile cloud and radiation test bed facility to fill gaps in selected data poor regions. The DOE's climate change prediction program would develop, improve, evaluate, and apply coupled atmosphere-ocean GCMs to climate and climate changes in response to various forcing scenarios. Much excellent science within BER has been deferred due to earmarking.

Total DOD basic research would decrease to \$1.3 billion, a decrease of \$109 million (7.7 percent). The Army and the Air Force have been traditional sponsors of atmospheric research and have a significant interest in the CCSP.

EPA's total budget would decrease to \$7.6 billion, a decrease of \$448 million (5.5 percent). Funding toward EPA's clean air goal would increase slightly to \$598 million. Funding for clean air programs would be at \$6.0 million to continue the National Air Quality Standards (NAAQS) program that would reduce air toxics and acid rain risks. Global and Cross-Border Environmental Risk programs would receive \$276 million, down 2.5 percent. These programs deal with greenhouse gas emissions, ozone depletion, and the development of cleaner technologies. EPA's involvement in the CCSP is primarily an assessment oriented program emphasizing understanding the potential consequences of climate on human health, ecosystems, and socioeconomics.

The Department of Homeland Security's (DHS) science and technology activity would increase to \$801 million, up \$280 million (53.7 percent). DHS would interact with other agencies that have responsibilities for research in atmospheric dynamics, physics and chemistry in order to know the composition of the atmosphere and to forecast concentrations of components and where they might be transported.

CLIMATE CHANGE PROGRAMS

The USGCRP is an interagency research program that began as a Presidential Initiative and was codified by the Global Change Research Act of 1990. Its goal is to increase understanding of the Earth system and provide a sound scientific basis for national and international decision making on global change issues. That program has produced a large body of important and useful research that should now be used to help

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countries, especially in the developing world, adapt to and assess the impact of regional changes in climate.

In June 2001 the President established two new climate initiatives: the Climate Change Research Initiative (CCRI) and the National Climate Change Technology Initiative (NCCTI). The CCRI focuses primarily on areas of significant uncertainty and on enhancing the observational system in order to reduce those uncertainties. The aim of the NCCTI is to strengthen the federal leadership of climate change related technology R&D by improving coordination of and focusing the federal portfolio on the President's goals.

On February 14, 2002 the White House released its report (*U.S. Climate Change Strategy: A New Approach*) on the President's new approach to the challenge of global climate change. The plan builds on the President's commitments to global climate science and technology. That plan provided a new management structure to integrate and provide direction to the USGCRP and the CCRI. (See Figure 1 for details.)

The President established a Cabinet-level Committee on Climate Change Science and Technology Integration (CCCSTI) lead by the Secretaries of Commerce and Energy in close coordination with the President's Science Advisor. Research will continue to be coordinated through the National Science and Technology Council (NSTC) in accordance with the Global Change Research Act of 1990.

Another result is the creation of the Climate Change Science Program (CCSP) that will provide direct oversight and ensure that the USGCRP and the CCRI coordinate their activities and accelerate progress on substantial uncertainties. An early example of such activity involves the effect of clouds, water vapor, and radiation on climate which is not well understood. DOE began a program in Atmospheric Radiation Measurements (ARM) under the USGCRP to help resolve some of the unknowns. In FY 2004 the CCRI would accelerate that effort by providing a mobile observatory to fill data gaps in data sparse regions that would address specific modeling needs.

CLIMATE CHANGE SCIENCE PROGRAM (CCSP)

The budgets of the USGCRP and the CCRI are separate; however, the programs are being managed in a coordinated way under the direction of

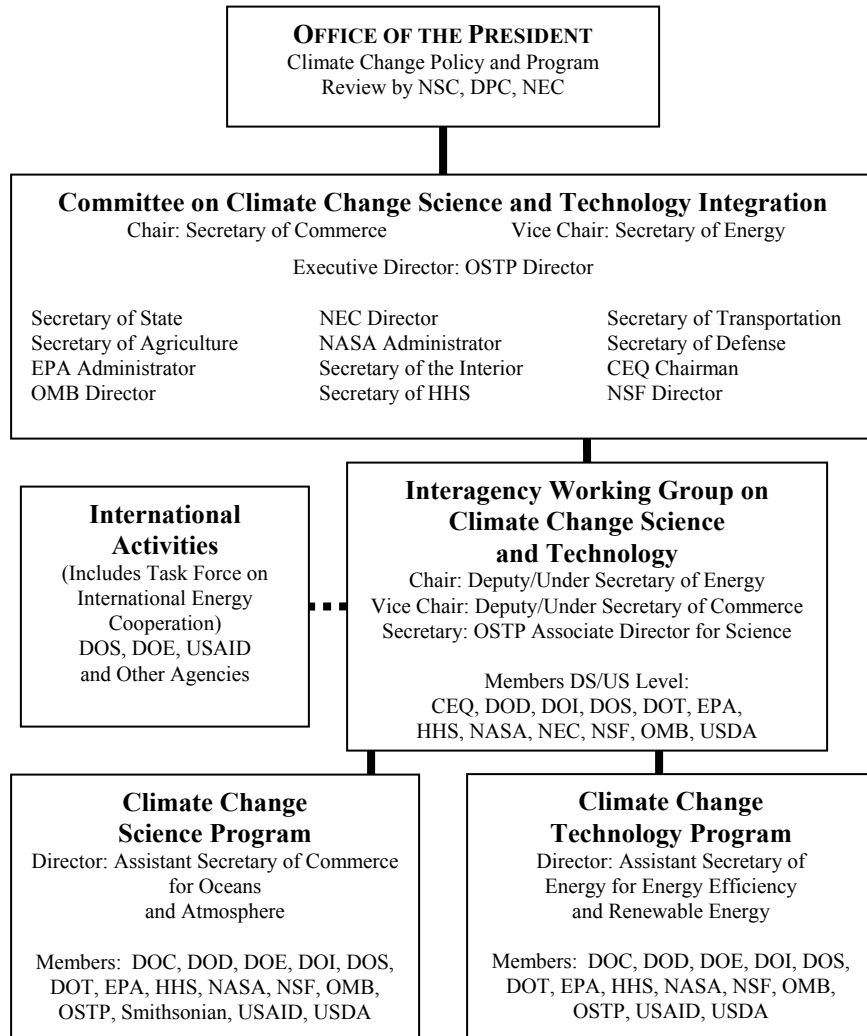


FIGURE 1. STRUCTURE FOR COORDINATING THE FEDERAL CLIMATE CHANGE PROGRAMS

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the CCSP. At present a joint strategic plan is being developed. A draft strategic plan was prepared for a workshop held in Washington, DC in December 2002, and the final strategic plan is scheduled to be available in April 2003. The National Academy of Sciences - National Research Council (NAS/NRC) has been requested to hold a comprehensive review of the draft and final versions of the plan. Their report on the draft plan is now in press. It is titled *Planning Climate and Global Change Research - A Review of the Draft U.S. Climate Change Science Plan Strategic Plan*.

The FY 2004 budget would provide \$1.6 billion for the USGCRP, a decrease of \$143 million. (Details of funding for CCSP, of which USGCRP is the main component, are in Table I-10.) Expenditures for NASA satellites are the largest single item in the USGCRP's budget, consuming nearly half of the budget. The USGCRP budget is allocated among the following program elements: Atmospheric Composition, Climate Variability and Change, Water Cycle, Land Use/Land Cover Change, Carbon Cycle, Ecosystems, Human Contributions and Responses to Environmental Change, and Grand Challenges in Modeling, Observations and Information Systems. Actual budget allocations will not be complete until after the strategic plan is finalized.

The FY 2004 budget would provide \$182 million for the CCRI. To be included in the CCRI, a program must both provide significant decision or policy relevant deliverables within the next two to four years and contribute substantively to one or more of the following activities:

- address areas that offer significant improvement in understanding climate change where additional resources would accelerate development of decision support information;
- optimize observations, monitoring and data management systems for trend analysis, process evaluation and model development and calibration for both climate and ecosystems; and/or
- develop decision support resources including scenario development and comparisons; quantification of the sensitivity and uncertainty of the climate system to natural and anthropogenic forcings; and structured information to inform national, regional and local discussions about possible global change causes, impacts, and mitigation and adaptation strategies.

CCRI activities would cover all three research areas: key and emerging climate change science areas from ongoing USGCRP elements (\$34.9 million); climate quality observations, monitoring and data management (\$70.4 million); and decision support resources (\$79.2 million).

CLIMATE CHANGE TECHNOLOGY PROGRAM (CCTP)

There is a growing Climate Change Technology Program (CCTP) that parallels the CCRP. It is composed of two parts, a climate change technology related research and development (R&D) program and the National Climate Change Technology Initiative (NCCTI). The R&D program has as its aim strengthening the federal leadership of climate change related technology R&D by improving coordination of R&D investments across federal agencies and by focusing the federal R&D portfolio on the President's climate change goals, near- and long-term. The NCCTI's main thrust is to examine the federal portfolio of R&D and strengthen its coordination and focus on achieving those goals.

The potential global impacts of technology are relatively long-term. Thus the CCTP is guided by the climate change goals of the United Nations Framework Convention on Climate Change of 1992. To achieve the long-term goal of stabilization of greenhouse gas concentrations in the Earth's atmosphere, net emissions of greenhouse gases on a global scale must approach levels that are lower than they are today.

The R&D program is extensive in its scope and involvement among the federal agencies. Federal agencies with relevant R&D programs participating in the CCTP include: the Departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, Interior, and Transportation, as well as EPA, NASA and NSF.

The NCCTI would increase from \$20.0 million to \$40.0 million in FY 2004. That increase would be used to fund the NCCTI Competitive Solicitation Program. This solicitation would spur innovation and accelerate technical progress on high-value climate change technology development in significant ways such as: (a) future reductions in or avoidance of greenhouse gas emissions; (b) greenhouse gas capture and sequestration (permanent storage); (c) capture and conversion of greenhouse gases to beneficial use; (d) enhanced monitoring and measurement of greenhouse gas emissions, inventories and fluxes in a variety of settings.