

Atmospheric Sciences and Climate Change Programs in the FY 2005 Budget

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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 3.0 percent increase over FY 2004. The National Oceanic and Atmospheric Administration (NOAA) would decrease by 8.4 percent below FY 2004, but with increases in climate research, extreme weather warnings and forecasts, and weather satellites. The National Aeronautics and Space Administration's (NASA) overall budget would increase by 5.6 percent responding to the Space Exploration Vision announced by the President. The Department of Energy's (DOE) Biological and Environmental Research (BER) would decrease by 21.8 percent reflecting the elimination of congressionally directed earmarks. The Department of Defense's (DOD) basic research budget would decrease by 5.3 percent. The Environmental Protection Agency's (EPA) basic research budget would decrease by 26.0 percent to \$66.0 million. Basic research in the Department of Homeland Security (DHS) would increase by 225.5 percent to \$153.0 million, some of which would be expended on atmospheric research.

- The U.S. Global Change Research Program (USGCRP) would decrease by \$112.0 million to \$1.72 billion. The Climate Change Research Initiative (CCRI) would increase by \$74.0 million to \$238.0 million. These two programs have been merged into what is now known as the Climate Change Science Program (CCSP; see Table I-10). An interagency Climate Change Science Program Office has been established within NOAA.

- The Intergovernmental Group on Earth Observations (GEO) will hold its working meeting to continue development of a ten-year plan for an

Earth Observation System. The framework will provide the underpinnings for a 10-year plan that will guide the international effort to build the Earth observation system. The draft framework will be presented at the next ministerial meeting in the Spring of 2004.

- The tri-agency (DOD, NASA and NOAA) National Polar Orbiting Environmental Satellite System (NPOESS) program would increase by \$31.0 million to \$307.4 million with an equal amount due from the U.S. Air Force. The geostationary satellite program GOES would increase by \$31.7 million to \$308.9 million that includes \$157.5 million for the future GOES-R program.

- The National Space Weather Program (NSWP) would continue in FY 2005 with modest increases in NASA's Living with a Star Program and level funding for NSF's solar-terrestrial programs. A recently published NAS report, *Sun to the Earth and Beyond: A Decadal Research Strategy in Solar and Space Physics* will influence the direction of future solar-terrestrial research.

INTRODUCTION AND POLITICAL ENVIRONMENT

Atmospheric Sciences is an integral and vital part of understanding the Earth system. Since the attack of September 11, 2001 and the continuing threat of materials released into the atmosphere, research on the diffusion and transport 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. Today we need to rethink what message we need to deliver to the public. Predicting the probability that people will be harmed is very different than predicting the concentration of a pollutant from either single or multiple sources. We must learn to use all of the information that we have available.

The atmosphere knows no national boundaries. The effects of an El Niño event are 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.

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The importance of atmospheric knowledge to military activities has increased greatly in the past two decades and the military has invested mainly in foreign applications where data are scarce. 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 further evidence. A recent NAS report, *Fair Weather: Effective Partnerships in Weather and Climate Services*, found the balance between private and public weather services to be functioning well.

The National Weather Center building at the University of Oklahoma is further evidence of this effective partnering. At the cost of about \$62.0 million, split between NOAA and the University, this unique facility will house over 500 students, research scientists and operational meteorologists. The world's largest private weather company, Weather News America Inc., will build its second international operations center on the same campus.

The past year saw many regions of the U.S. subjected to severe weather. Over 400 tornadoes struck the heartland. A total of 16 hurricanes and tropical storms threatened the East Coast, with Hurricane Isabel in September devastating the Carolinas and Virginia. The West Coast endured both severe marine storms and intense fire weather with its subsequent damage. In all cases including the current winter snow events, forecasts and warnings were excellent and greatly reduced life and property damage.

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. New missions are on track. The Solar-Terrestrial Relations Observatory (STEREO) will launch in FY 2006. Funding for the Solar Dynamics Observatory (SDO) would double to \$158.0 million. The NSF continues to fund a multi-institutional Center for Integrated Space Weather Modeling (CISM).

The CCSP released its strategic plan that now is being implemented. The Climate Change Technology Program (CCTP) continues to grow and will be the ultimate consumer of results provided by the CCSP.

The President's space exploration initiative shapes the NASA budget. The initiative calls for a human return to the Moon by 2020 in preparation for human exploration of Mars. The initiative calls for the establishment of a new Exploration System Enterprise and funding of \$12 billion over the next five years. Most of these funds would come from a reallocation of \$11 billion within the multi-year NASA budget of \$86 billion.

NATIONAL SCIENCE FOUNDATION (NSF)

NSF's total budget would increase to \$5.75 billion, an increase of \$167 million (3.0 percent; see Table II-7). Research and Related Activities would increase to \$4.45 billion, an increase of 4.7 percent. Education and Human Resources would decrease to \$771 million, an decrease of 17.9 percent. Major Research Equipment and Facilities Construction (MREFC) would increase to \$213 million, an increase of 37.6 percent. Biocomplexity in the Environment would remain level at \$99.8 million.

NSF's Geosciences Directorate would receive an increase of \$15.4 million (2.2 percent) for a total of \$728.5 million. There are two new activities within the MREFC account that would have an impact on the atmospheric sciences. The first would be \$40.9 million to support the conversion and outfitting of a state-of-the-art ocean drill ship. 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 \$4.85 million (2.0 percent) to \$243.6 million. Atmospheric Sciences Research Support would increase to \$160.1 million. The National Center for Atmospheric Research (NCAR) would increase to \$83.5 million.

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. The USPP would increase to \$349.7 million (2.2 percent). The research programs would receive \$281.7 million, an increase of \$7.6 million (2.8 percent). (For more on NSF, see Chapter 7.)

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

NOAA's total budget request reflects its strategic plan at \$3.38 billion, a decrease of \$310 million (8.4 percent) below the FY 2004 estimate. The reductions would be primarily in the National Ocean Service (NOS), down 35.0 percent; and the Office of Oceanic and Atmospheric Research (OAR), down 13.0 percent. The National Environmental Satellite, Data and Information Service (NESDIS) would increase by 7.9 percent.

In the satellite area, increases in the polar orbiting satellite system including NPOESS would be included in the FY 2005 request of \$414.1 million. DOD would match NOAA's contribution to NPOESS. A total of \$308.9 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 for GOES-R has slipped to 2012 reflecting the increased life of the present generation of satellites. The NESDIS budget would include \$9.6 million for data archive enhancements.

Climate Research would increase \$23.7 million. Funds would be used for an aerosol program, establishment of a climate modeling center, continued implementation of the Global Ocean and Global Climate Observing Systems, and carbon cycle research.

The National Weather Service (NWS) would begin the development of a new Center for Weather and Climate Prediction, potentially located in Maryland; operate the Space Environment Center; implement air quality forecasts for Northeastern U.S.; and support the US Weather Research Program including THORPEX, an experiment whose goal is to extend forecast accuracy.

The Oceanic and Atmospheric Research (OAR) operations, research and facilities budget would decrease to \$306.7 million, down \$53.5 million (13.0 percent). In part this reflects transfers to the NWS, but there are reductions across the board. (For more on NOAA, see Chapters 13 and 17.)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA's FY 2005 budget request aligns with the goals set forth in the President's Vision for Space Exploration. Programs linked to this vision would do well, while those with weak links would see reductions.

NASA's overall budget would increase 5.6 percent to \$16.24 billion (see Table II-12). Space Science would increase to \$4.1 billion (up 4.2 percent) without the initiative in nuclear propulsion that will be moved to the new Exploration System Enterprise. The Space Sciences program includes important projects aimed at solar activity and the Earth's space environment. The Sun-Earth Connections (SEC) program missions would include the Solar-Terrestrial Relations Observatory (STEREO) scheduled for launch in FY 2006 and the implementation of development of Solar Dynamics Observatory (SDO), the cornerstone satellite mission of the Living with a Star program. NASA requests a doubling of the SDO budget to \$158.0 million and a 10 percent increase to \$195.0 million for SEC research. This would delay other missions that would complement SDO.

The Earth Science Enterprise (ESE) budget would decrease by 7.9 percent to \$1.49 billion. The NPOESS Preparatory Project (NPP) would remain on track with a requested \$141.0 million to bridge the gap between research on the atmosphere as exemplified by AQUA and the future operational NPOESS. Launches of other Earth Science satellites, Calipso and Cloudsat, are scheduled for 2005. The Global Precipitation Mission is delayed. AURA, the last of the EOS spacecraft, is scheduled for launch in June 2006. Research would increase to \$560.0 million (7.0 percent) to utilize the data from 80 instruments on 18 operating satellites. (Please see Chapter 10 for more on NASA.)

OTHER AGENCIES

DOE's Biological and Environmental Research (BER) program would decrease to \$501.6 million (down 21.8 percent). The climate change research program within BER would increase to \$143.0 million, an increase of \$0.9 million (0.6 percent; see Table II-11). The DOE plays a significant role in the CCSP. In FY 2005 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

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response to various forcing scenarios. In FY 2005 BER would reconfigure its atmospheric science program to support aerosol research emphasizing radiative forcing due to indirect effects on clouds and the role of black carbon and organic aerosols on climate.

Total DOD S&T would decrease to \$10.5 billion, a decrease of \$1.5 billion (12.7 percent; see Table II-2). Within this aggregate, basic research funding would decline by 5.3 percent and applied research by 12.3 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 \$7.8 billion, a decrease of \$576 million (6.9 percent; see Table II-17). The biggest impact would be on water quality and science and technology programs. The S&T programs would be reduced by 11.9 percent to \$689.2 million. STAR fellowships and research grants would decline by approximately 30 percent.

CLIMATE CHANGE PROGRAMS

The U.S. Global Change Research Program (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 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 (see Table 1 for details of CCRI funding). 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 a report (*U.S. Climate Change Strategy: A New Approach*) that provided a new management structure to integrate and provide direction to the USGCRP and the CCRI. The President also established a Cabinet-level Committee led by

the Secretaries of Commerce and Energy in close coordination with the President's Science Advisor.

Another result is the creation of the Climate Change Science Program (CCSP), a merging of the USGCRP and the CCRI whose activities are coordinated as a single, integrated program. (See Table I-10 for funding details of the integrated CCSP.)

CLIMATE CHANGE SCIENCE PROGRAM (CCSP)

The budgets of the USGCRP and the CCRI are separate; however, the programs are being coordinated through the CCSP Office. The CCSP released its strategic plan in July 2003. The National Academy of Sciences - National Research Council (NAS/NRC) held a comprehensive review of the draft and final versions of the plan. Their report has been published and is titled *Implementing Climate and Global Change Research - A Review of the Final U.S. Climate Change Science Program Strategic Plan*.

Table 1: Climate Change Research Initiative (budget authority in millions of dollars).

Agency	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Request	% Change FY 04-05
Department of Energy	3	26	26	0%
Department of Transportation	0	0	3	--
Department of State	0	1	1	0%
NASA	3	65	100	54%
NOAA (Commerce)	18	35	64	83%
National Science Foundation	15	25	25	0%
Agency for Int'l Development	0	6	6	0%
Department of Agriculture	2	6	13	217%
TOTAL CCRI	41	164	238	45%

Source: Agency budget materials, Office of Management and Budget. See Table I-10 for details of Climate Change Science Program (CCSP) funding.

The FY 2005 budget would provide \$1.72 billion for the USGCRP, a decrease of \$112 million, and \$238 million for the CCRI, an increase of \$74 million (see Table 1). Expenditures for NASA satellites are the

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largest single item in the USGCRP's budget, consuming nearly half of the budget.

The CCSP 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, Modeling Strategy, Decision Support Resources Development, Observing and Monitoring the Climate System, and Data Management and Information. The abbreviated goals of the CCSP are:

- Improve knowledge of the Earth's past and present climate and environment, including its natural variability.
- Improve quantification of the forces bringing about changes in the Earth's climate and related systems.
- Reduce uncertainty and projections of how the Earth's climate and related systems may change in the future.
- Understand the sensitivity and adaptability of different natural and managed ecosystems and human systems to climate; and
- Explore the uses and identify the limits of evolving knowledge to manage risks and opportunities to climate variability.

CLIMATE CHANGE TECHNOLOGY PROGRAM (CCTP)

There is a growing climate change technology program (CCTP) that parallels the CCRP. It would approach a funding level of nearly \$3.0 billion in FY 2005. 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

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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. Most of the R&D funds would be found in the DOE, but when it comes to deployment of technologies, then USDA and EPA become involved.

The CCTP is preparing a Strategic Plan. A working group structure has been organized that covers the following areas: Energy Production, Energy Efficiency, Sequestration, Other gases, Monitoring and Measurement, and Supporting Basic Research.

A program of competitive solicitation that seeks new ideas is being proposed that would receive funds for the first time in FY 2005.

The CCTP crosses program boundaries thus making it difficult to discuss an integrated program. Nevertheless, the following is a partial list of areas of interest: renewable energy sources, tax credits to spur deployment, FreedomCAR, hydrogen fuel initiative, hybrid electric, biofuels, FutureGen, nuclear energy, fusion, and sequestration.