

Atmospheric Sciences and Climate Change Programs in the FY 2008 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. As part of the American Competitiveness Initiative, the National Science Foundation's (NSF) request would increase 8.7 percent to \$6.4 billion. The National Oceanic and Atmospheric Administration (NOAA) budget would increase by 3.4 percent above the FY 2007 request, with increases in an expanded tsunami warning network, climate research, extreme weather warnings and forecasts, and reductions for weather satellites. The National Aeronautics and Space Administration's (NASA) overall budget would increase by 6.5 percent to \$17.3 billion with Constellation Systems rising by 10.2 percent and the Science mission by 2.4 percent. The Department of Energy's (DOE) Biological and Environmental Research (BER) program would increase by 10.0 percent.
- The Climate Change Science Program (CCSP) would decline by 7.4 percent to \$1.5 billion (see Table I-9). The Climate Change Technology Program (CCTP) that parallels the CCSP would receive significant increases over the FY 2007 request level of \$3.0 billion.
- The Space Studies Board of the National Academy of Sciences (NAS) has developed a decadal strategy for research in the Earth Sciences. The report, *Earth Sciences and Applications from Space: National Imperatives for the Next Decade and Beyond*, will influence the direction of future research, especially in NASA. A pre-publication copy was released on January 15, 2007. It calls for restoring the capability to make vital climate measurements to the National Polar Orbiting Environmental Satellite System (NPOESS), which was drastically restructured (see below). It also recommends to NASA a detailed robust program of future

observations and technical development addressing important climate variables. The final report will be available in July 2007.

- More than 60 countries and the European Commission meeting in February 2005 in Brussels agreed to a plan that, over the next 10 years, will revolutionize understanding of the Earth. Agreement on the plan for a Global Earth Observation System of Systems (GEOSS) was reached by member countries of the international Group on Earth Observations (GEO). Some 43 international organizations also support the emerging global network. An international Secretariat for GEOSS is located in Geneva. The Integrated Ocean Observing System (IOOS), one of the first GEOSS programs, would receive enhanced support in the FY 2008 budget request.

- The National Space Weather Program (NSWP) would continue in FY 2008. The first radar of the three that comprise the NSF's Advanced Modular Incoherent Scatter Radar (AMISR) began full operation at Poker Flat, Alaska in January 2007. The other two will be constructed at Resolute Bay, Canada in 2008. NASA's Solar Dynamics Observatory (SDO) would launch in 2008. NSF would continue support for a center for research on space weather at Boston University. The NAS report, *Sun to the Earth and Beyond: A Decadal Research Strategy in Solar and Space Physics*, published in 2004, continues to influence the direction of future solar-terrestrial research. Space weather research results and applications are now reported in the American Geophysical Union (AGU) journal *Space Weather*. A digest of the material is published quarterly in hard copy. The first Space Weather Enterprise Forum, SWEF, will be held in Washington, D.C. in April 2007.

INTRODUCTION AND POLITICAL ENVIRONMENT

The Kyoto Protocol entered into force on February 16, 2005. The Protocol was adopted at the Conference of the Parties 3 (COP 3) in Kyoto, Japan on December 11, 1997. The Protocol sets binding targets to reduce carbon emissions 5.2 percent below 1990 levels by 2012. More than 100 nations have ratified the Protocol and many developed countries have begun efforts to meet their emission targets. The U.S. supports many Research and Development activities important to emission reductions, but has not signed the Protocol.

ATMOSPHERIC SCIENCES AND CLIMATE CHANGE PROGRAMS

In 1988 an Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization (WMO) and the United Nations Environmental Program (UNEP) to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. The IPCC has three working groups: WGI–The Science of Climate Change; WGII–Impacts, Adaptation and Vulnerability; and WGIII–Mitigation of Climate Change. Three assessments have been undertaken. The Fourth Assessment will be released in steps over the course of this year. A Summary for Policy Makers (SPM) is released first by each Working Group followed several months later by the full report on line and then in book form. The WGI SPM was released in February 2007, WGII SPM will be available in April, and the SPM for WGIII will be released in May.

These reports provide a comprehensive and up-to-date assessment of the current knowledge on climate change. WGI's latest report describes progress in understanding of human and natural drivers of climate change, observed climate change, climate processes and attribution, and estimates of projected future climate change.

Research on and operational forecasting of tropical conditions and storms receive mixed support in the FY 2008 budget request. The Global Precipitation Mission (GPM), a follow-on to the successful Tropical Rainfall Measurement Mission (TRMM), has been restored in the NASA FY 2008 budget request. There will be delays in NOAA operational polar orbiting satellite missions. This is offset by the launch of the first of a new series of NOAA geostationary satellites on May 24, 2006. GOES 13 carries no new instruments but is a more capable spacecraft and will provide better coverage of severe mid-latitude and tropical storms.

NASA currently operates three major Earth Observing System (EOS) spacecraft (TERRA, AQUA and AURA) and a number of smaller missions aimed at specific Earth processes for a total of fourteen missions. The three EOS spacecraft would not be replaced at the end of their missions. Weather and climate researchers had planned to rely increasingly on NOAA's future operational missions for long term, continuous, global data. That strategy is now in disarray.

NOAA, jointly with NASA and the Department of Defense (DOD), is developing the National Polar-Orbiting Environmental Satellite System

(NPOESS). Major cost growth and schedule delays in the program, primarily in new instrument development, triggered the provisions of the Nunn-McCurdy Act requiring a stringent program certification process to avoid cancellation. As a result of the process NPOESS has been severely restructured with the number of spacecraft effectively halved, and the loss of six instruments, five of which are vital to the continuity of the climate record. The sixth is important for space weather. The agencies are attempting to develop mitigation strategies. The Space Studies Board of the NAS intends to recommend the decadal strategy and address the specific climate studies impact in a workshop in the summer of 2007.

The delay in the imager instrumentation has affected NASA's NPOESS Preparatory Mission (NPP) that was intended to bridge the gap between EOS and the beginning of NPOESS.

NOAA has begun the study phase with industry for the next generation geostationary spacecraft, GOES-R. The advanced spacecraft in this program were intended to carry greatly improved instruments for imagery, atmospheric sounding and possibly ocean coastal imagery. In an effort to avoid cost growth and technical risk, the hyperspectral sounder (HES) has been cancelled and the number of spacecraft reduced. HES would have provided details of the mesoscale humidity and temperature environment of severe weather and tropical storms. The Advanced Baseline Imager (ABI) can provide limited sounding capability.

Globally 2006 was the sixth warmest year on record since 1880 and the warmest on record for the USA due to an unusually warm December. Moderate to extreme drought continued to affect large parts of the Western U.S. Forecasters were calling for an above-normal frequency of tropical storms and hurricanes, raising fears of a repeat of the disasters of 2005. Near-normal conditions prevailed with only four tropical storms and five hurricanes, none of which threatened the U.S. The long-range guidance for 2007 indicates the occurrence of more severe weather.

The two-year International Polar Year (IPY) began on March 1st 2007. Scientists from over sixty nations are participating and conducting two annual observing cycles in each polar region to understand environmental change in these regions and how they influence the climate in the rest of the world. NSF is the lead U.S. agency.

ATMOSPHERIC SCIENCES AND CLIMATE CHANGE PROGRAMS

NATIONAL SCIENCE FOUNDATION (NSF)

NSF's total budget would increase to \$6.4 billion, an increase of \$513 million or 8.7 percent above the FY 2007 appropriated level (see Table II-7). Research and Related Activities would increase by 7.7 percent to \$5.1 billion. Education and Human Resources would increase to \$750.6 million, an increase of \$52 million or 7.5 percent. Major Research Equipment and Facility Construction (MREFC) would increase by 28.2 percent to \$244.7 million. This includes the Alaska Region Research Vessel (ARRV) and the Ocean Observatories Initiative (OOI) which began in FY 2007. The detailed operating plan for FY 2007 is currently under review by the Congress. Changes in some of the specific programs are therefore cited here relative to the FY 2007 request rather than the final 2007 appropriation.

NSF's Geosciences Directorate (GEO) would receive an increase of \$47.1 million or 6.3 percent above the FY 2007 request for a total of \$792.0 million. The OOI represents part of GEO's contribution to the GEOSS. OOI would cost \$309.5 million over six years with initial construction costs of \$13.5 million in FY 2007. The Science and Technology Centers for Multi-Scale Modeling of Atmospheric Processes at Colorado State University and for Coastal Margin Observation and Prediction at Oregon Health and Science University which began in FY 2007 would continue. A major thrust in FY 2008 would be responding to the Ocean Research Priorities Plan.

The Atmospheric Sciences Subactivity (ATM) would increase by \$14.0 million or 6.2 percent to \$240.8 million. Atmospheric Sciences Research Support would increase by 7.1 percent to \$151.1 million. Funding for the National Center for Atmospheric Research (NCAR) would increase by 4.7 percent to \$89.8 million. These increases include full operation of the HIAPER aircraft, operation of the AMISR radar, improved cyberinfrastructure and numerical models and continued support of the U.S. Ocean Action Plan, the U.S. Weather Research Program, the National Space Weather Program, and cooperative international programs.

NSF's Office of Polar Programs (OPP) would receive \$464.9 million in FY 2008, an increase of \$26.8 million above FY 2007. The OPP supports atmospheric science and climate research together with oceanographic and biological research in the Arctic and Antarctic regions. The budget

would allow improved communications at South Pole Station and continued funding of the icebreakers. OPP would continue to provide a major part of the NSF's total support of \$59.0 million for the IPY.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

NOAA's total budget would increase by 3.4 percent or \$131.1 million above the FY 2007 request. It includes additions for support of the U.S. Ocean Action Plan, climate monitoring and research, hurricane data buoys and the tsunami warning program and reductions for satellite systems.

National Environmental Satellite, Data and Information Service (NESDIS) funding would decrease by 5.3 percent or \$55.6 million below the FY 2007 request to \$978.0 million. In 2006, NOAA successfully launched the geostationary satellite GOES-13. Funding for the next generation polar-orbiting meteorological satellites, NPOESS, would decrease by \$6.6 million to \$331.3 million in FY 2008, an amount matched by DOD. This budget reflects the program restructuring resulting from the Nunn-McCurdy certification process.

The next-generation geostationary satellites, now under study by industry teams beginning with GOES-R, would be funded at \$279.0 million with a launch date no earlier than 2014. This reflects the restructured program including the cancellation of the HES instrument. The first of the predecessor series GOES-13 was launched in May 2006 enabling the current GOES-11 to be moved to provide better coverage of Latin America.

The budget of the Office of Oceanic and Atmospheric Research (OAR) would increase by 5.7 percent above the FY 2007 request to \$368.8 million. New climate reanalysis data sets would be developed. Research in climate change, drought, hurricane intensification and water vapor processes as well as high-performance computing efforts would be expanded.

NOAA's climate efforts would seek \$240.0 million, an increase of \$14.0 million over the FY 2007 request. This includes U.S. Integrated Earth Observation System activities, implementation of the National Integrated Drought Information System (NIDIS), the Global Ocean Observing

ATMOSPHERIC SCIENCES AND CLIMATE CHANGE PROGRAMS

System component of GEOSS, climate reference networks and climate research.

The National Weather Service (NWS) would seek \$23.2 million to strengthen the tsunami warning program and \$4.4 million for hurricane buoy maintenance and operations. NWS would receive \$6.0 million, a reduction of \$1.5 million, for the U.S. Weather Research Program aimed at improving global weather forecasts and forecasts for severe storms, particularly hurricanes. Funding for the Space Environment Center would be \$6.2 million.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA's budget would increase by 6.5 percent over the FY 2007 final appropriation (see Table II-12). The Science Mission Directorate has been restructured from the three components of Solar System Exploration, Universe and Earth-Sun Systems to four: Planetary Science, Astrophysics, Heliophysics and Earth Science.

The Science Mission Directorate would be funded at \$5.5 billion with the Earth Science program at \$1.5 billion, a \$33.0 million increase over the FY 2007 request. This would support development of the Landsat Continuity Mission, the NPP mission whose launch date is slipping; the Glory aerosol mission; the Orbiting Carbon Observatory; the Global Precipitation Mission; and reduced support for research and analysis. The Heliophysics program would launch the Solar Dynamic Observatory (SDO) in 2008. (See Chapter 9 for more on NASA.)

OTHER AGENCIES

The DOE's Biological and Environmental Research (BER) budget would be increased by 10.0 percent to \$531.9 million (see Table II-11). The Climate Change Research program that is an integral and vitally important component of the Climate Change Science Program (CCSP) would increase by 2.4 percent to \$138 million. Emphasis still would be on the role of clouds and aerosols in an effort to parameterize better their effects in climate change prediction models used in international assessments. Global carbon cycle and basic research on the biological sequestration in the biosphere would be continued with some support coming from the Climate Change Technology Program (CCTP).

Within the DOD's Science and Technology programs aggregate basic research ("6.1") funding would decline by 8.7 percent to \$1.4 billion, and aggregate applied research ("6.2") would decline by 18.2 percent to \$4.4 billion (see Table II-2). The Army and the Air Force have been traditional sponsors of atmospheric research and have a significant interest in the CCTP.

EPA's total budget would decrease from \$7.3 billion to \$7.2 billion. The S&T programs in clean air and global change would be increased by 3.2 percent to \$216.0 million. This would support research on air pollution and risk assessment methodologies.

CLIMATE CHANGE PROGRAMS

The U.S. Global Change Research Program (USGCRP), an interagency climate research program, 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 now needs to be used especially in the developing world. There is evidence that such research is now being recognized and appropriate activities undertaken.

In June 2001 the President established two climate initiatives: the Climate Change Research Initiative (CCRI) that focuses on areas of uncertainty and reduction of those uncertainties and the National Climate Change Technology Initiative (NCCTI) whose aim is to strengthen and coordinate the Federal leadership of climate change related to technology R&D.

CLIMATE CHANGE SCIENCE PROGRAM (CCSP)

The USGCRP and the CCRI have been merged into a Climate Change Science Program (CCSP). The program consisting of 13 departments and agencies is coordinated through an interagency program office located within NOAA. CCSP funding would decrease by \$123.0 million or 7.4 percent for a total of \$1.5 billion (see Table I-9).

The CCSP released its Strategic Plan in July 2003 that was reviewed by the National Academy of Sciences and the National Research Council (NAS/NRC). Research efforts are coordinated through a set of seven

ATMOSPHERIC SCIENCES AND CLIMATE CHANGE PROGRAMS

linked interdisciplinary research elements: Atmospheric Composition, Climate Variability and Change, Global Water Cycle, Land Use and Land Cover Change, Global Carbon Cycle, Ecosystems, and Human Contributions and Responses.

During FY 2008, CCSP would continue research into important scientific uncertainties and preparation of Synthesis and Assessment reports. These reports would be reviewed by the NAS/NRC under the terms of a continuing advisory agreement. See the CCSP Strategic Plan for proposed program details and *Our Changing Planet, The U.S. Climate Change Science Program for Fiscal Year 2008*, a forthcoming supplement to the President's Budget for Fiscal Year 2008, for details of the 2008 program.

CLIMATE CHANGE TECHNOLOGY PROGRAM (CCTP)

The CCTP was created by the President in 2002 and was authorized in the Energy Policy Act of 2005. A *Strategic Plan* was released in 2006. The program has as its goals the coordination and prioritization of the Federal Government's portfolio of investments in climate-related technology, research, development, demonstration, and deployment. The portfolio totaled about \$3.0 billion in FY 2007.

The CCTP is extensive in its scope. It involves eleven Federal departments and agencies. The Department of Energy (DOE) plays a lead role in this program. Since it is scattered throughout the Executive Branch and crosses program boundaries, it is difficult to discuss an integrated program.

Some of the areas in which the CCTP is involved are: clean coal, biofuels, hydrogen fuels, nuclear power, the International Thermonuclear Experimental Reactor (ITER), FutureGen and FutureGen Alliance. India and South Korea are involved with the U.S. in the Alliance with the possibility of China also joining the Alliance.

Details of the program and associated funding for the activities will be available when the FY 2008 budgets are released. See the Strategic Plan for the CCTP. (See Chapter 8 on DOE for details of many of the CCTP component programs.)