

Atmospheric and Ocean Sciences in the FY 2002 Budget

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HIGHLIGHTS

- Budget requests for the atmospheric and ocean sciences funding agencies are mixed. The National Science Foundation's (NSF) request would result in a 1.3 percent increase and the National Oceanic and Atmospheric Administration's (NOAA) a 2.0 percent decrease. The National Aeronautics and Space Administration's (NASA) overall budget would increase by 1.8 percent, while Space Science would increase by 6.2 percent and Earth Science would decrease by 11.7 percent. The Department of Energy's (DOE) Biological and Environmental Research (BER) account would decrease by 8.2 percent.
- The U.S. Global Change Research Program (USGCRP) would decrease by \$75 million to \$1.6 billion across nine agencies (see Table I-10). The major reduction of \$89 million would be in NASA's remote sensing hardware development. An increase of \$14 million to \$811 million would support research and surface based observations among several agencies.
- The tri-agency (Department of Defense (DOD), NASA & NOAA) National Polar Orbiting Environmental Satellite System (NPOESS) program that converges the civil and military systems into a single program remains on track. Technology transfer from NASA would include the NPOESS Preparatory Project (NPP). A European contribution to the program has been diminished with the delay of plans for a European spacecraft to fly U.S.

instruments. The delayed launch of NASA's Aqua satellite (formerly EOS PM-1) into late FY 2001 would provide advanced meteorological research data in FY 2002.

- Oceanographic research in NOAA would increase with improved ocean monitoring using Argo floats and enhanced ocean exploration. Basic research in the Navy would rise approximately 2.1 percent. NASA's JASON mission, the follow-on spacecraft to the successful ocean topographic experiment (TOPEX) mission, would be launched in late FY 2001. NSF oceanography programs would be reduced by 1.5 percent. The establishment of partnerships by industries, government agencies (state and federal), academic institutions, educators at all levels, media companies, and nongovernmental organizations are needed to realize the full benefits of ocean exploration.
- The National Space Weather Program (NSWP) would continue in FY 2002 with reductions in NASA's Living with a Star Program and level funding for the NSF's solar-terrestrial programs. NOAA's Solar-Terrestrial Services and Research Program would increase \$0.3 million. Helping to offset budget decreases would be the impact of launches in late FY 2001 of NASA's Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) mission and the High Energy Solar Spectroscopic Imager (HESSI) spacecraft that would yield vital information on the sun's output and impact on the Earth's space environment.

INTRODUCTION AND POLITICAL ENVIRONMENT

Atmospheric and Ocean Sciences are an integral part of the Earth system. Research in these two areas provides information on the constituency of these two media, how they change in time and space, where they move, and how they affect the Earth system. They are interdisciplinary, as illustrated by research on the role of carbon in the environment.

Neither the atmosphere nor the oceans know national boundaries. Effects of the El Niño of 1997-1998 and its successor the La Niña of 1999-2000

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influenced life on a global scale. Global monitoring of the atmosphere and oceans is improving, so better long-term guidance is available. The assessment of impacts by research groups will develop into operational climate guidance. Free and open exchanges of global data are required for research, operations, and education. Activities in these disciplines often have impact on societal issues and extend across governmental jurisdictions, both national and international.

The USGCRP has developed from primarily a research program to a program that includes assessment of the impacts of climate change within geographical regions of the U.S., for example water availability in the western U.S. On the international scene the Intergovernmental Panel on Climate Change (IPCC) has released its third report detailing the most recent scientific review of potential global warming, potential impacts, and options for adaptation and mitigation. The Kyoto Protocol that mandates greenhouse gas emission reductions by industrial nations has met severe opposition, necessitating a rethinking of the protocol and what must be accomplished to reduce effectively the buildup of atmospheric greenhouse gases.

The importance of atmospheric and oceanographic knowledge to military activities has increased greatly in the past two decades as a result of Desert Storm and Kosovo operations. The successful use of precision guided missiles depends on detailed knowledge of local weather. Improved marine information is vital to the success of surface ship, submarine and amphibious operations. DOD acknowledges weather information as a force multiplier. As emphasis is again placed on a national missile defense system, the need to understand the atmosphere to detect distant threats becomes vital. An enhanced, focused defense space program has been emphasized as national policy.

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. The phrase Space Weather was coined to describe conditions in the Earth's space environment. The interagency NSWP was developed to coordinate research, improve prediction, and investigate related impacts. At present a Solar Maximum is occurring. It is a cyclical phenomenon when the sun exhibits enhanced sunspot activity

resulting in increased auroral activity, major geomagnetic storms and increased solar wind interaction with the Earth's atmosphere. The IMAX film *Solar Max*, funded by NSF, testifies to the public's interest. As the ability to forecast solar events improves, space craft operators and managers of power transmission grids will become increasingly more dependent on Space Weather warnings.

NATIONAL SCIENCE FOUNDATION (NSF)

NSF's \$4.5 billion budget would represent an increase of \$56.1 million (1.3 percent; see Table II-7). Within the total budget, Information Technology Research would increase \$13.1 million (5.0 percent) to \$272.5 million and Biocomplexity in the Environment would increase \$3.2 million (5.9 percent) to \$58.1 million, both of which would provide additional resources for atmospheric and ocean sciences.

NSF's Geosciences (GEO) Directorate would receive a decrease of \$3.7 million (0.6 percent) for a total of \$558.5 million. That would support the operation and enhancement of national user facilities as well as fundamental research including emphasis on the USWRP, NSWP, USGCRP, the Biocomplexity in the Environment priority area, and research on key physical, chemical and geologic cycles within the Earth System. There would be no new Major Research Equipment (MRE) starts in GEO.

Within GEO, Atmospheric Sciences would decrease by \$2.0 million (1.0 percent) to \$186.5 million. Atmospheric Sciences Research Support would decrease by \$1.2 million (1.0 percent) to \$115.9 million. The National Center for Atmospheric Research would receive \$70.6 million, a decrease of \$0.8 million (1.1 percent).

Ocean Sciences would decrease by \$2.7 million (1.0 percent) to \$255.3 million. The Ocean Section would decrease by \$1.5 million (1.5 percent) to \$96.1 million. The Academic Research Fleet would receive \$59.9 million, an increase of \$2.7 million (4.7 percent) to enhance research in fields related to biocomplexity and planetary dynamics. The Ocean Drilling Program Facilities would receive \$31.0 million, an increase of \$0.5 million (1.6 percent) for technical support and scientific studies of Earth system history, continental margins and the deep biosphere.

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U.S. Polar Programs, including U.S. Polar Research Programs and U.S. Logistical Support Activities, would receive \$276.6 million, a 12 percent increase. The budget would provide interdisciplinary research support for Arctic environmental changes and expanded access to Arctic oceans. Investigation of Antarctic subglacial lakes and improvements in communications capabilities also would be undertaken. (For more information on NSF, please see Chapter 7.)

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

The agency's FY 2002 budget request of \$3.2 billion represents a decrease of \$60.8 million or 2.0 percent below the FY 2001 budget. The reductions are primarily in the National Ocean Service (NOS; down \$25.9 million) and the National Marine Fisheries Service (NMFS; down \$36.0 million). Other program realignments would allow increases totaling \$270 million in selected areas including infrastructure (ships, computers, aircraft and buildings), satellite systems, severe weather prediction, coastal conservation, living marine resources and climate services.

In the satellite area, NPOESS would increase by \$83.4 million to \$156.6 million for NOAA's matching share to DOD's contribution to the future converged, environmental polar-orbiting, operational satellite program. The ongoing polar-orbiting program would increase by \$9.6 million with some emphasis on ground systems and data production. There would be an increase of \$3.1 million for a total of \$293.3 million for the Geostationary Global Observational Environmental Satellite (GOES) system, including developing upgraded imaging and sounding instrumentation.

Climate Services would increase by \$16.5 million to \$34.7 million with new efforts in carbon cycle research of \$2.3 million involving a network of measuring sites across North America. Climate Change Assessments would be funded at \$0.7 million to improve the availability of weather, water and climate information. Ocean Exploration would increase by \$10 million to \$14 million. Marine Environmental Research would increase by \$1.8 million to \$11.6 million.

The initiative to improve Severe Weather Forecasts would increase by \$9 million for a total of \$18.5 million. The USWRP would receive an

increase of \$2.2 million for a total of \$3.7 million. The USWRP would focus on improving the accuracy of hurricane landfall predictions and quantitative precipitation forecasts. Other increases would occur in surface observing systems and efforts to transfer proven weather forecasting science into operations. (For additional information on NOAA, please see Chapter 16.)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA's overall budget would increase 1.8 percent to \$14.5 billion (see Table II-12). Space Science would increase to \$2.8 billion (up 6.2 percent), after adjusting for a transfer of funds for mission support. The Space Science program includes important projects aimed at solar activity and the Earth's space environment. Two satellite missions would be launched in late FY 2001 that will provide important new measurements for future Sun-Earth systems research. The High Energy Solar Spectroscopic Imager (HESSI), scheduled to be launched in June 2001, will study the dynamics of solar flares by producing high-resolution movies of the initiation and decay of solar flares. The Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) mission, scheduled to be launched in August 2001 as a part of the Solar Terrestrial Probes (STP) program, would complement the Living with a Star Program. TIMED would provide global data of the region where the Earth's atmosphere tails off into space. These advances would be offset by the cancellation of the Solar Probe mission that would have traveled to the Sun and directly studied its activity. The Solar-Terrestrial Relations Observatory (STEREO) would receive initial funds of \$50.3 million in FY 2002.

Earth Science would decrease by 11.7 percent to \$1.5 billion. The Earth Explorers Program drops to \$84.6 million (down 40.2 percent). Despite the successful launch and performance of Terra and the upcoming launch of Aqua that would study the Earth's atmosphere, the Earth Observing System (EOS) would decrease to \$371.9 million (down 10.2 percent). Funding for EOS Data and Information System (EODIS) also would decrease to \$252.7 million (down 10.2 percent). The Earth Science research program would increase to \$357.4 million (up 1.9 percent). Offsetting the reductions are outyear funds that would amount to \$1.4 billion for follow-on generations of EOS missions. Scheduled missions in

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addition to Aqua would study stratospheric ozone and atmospheric aerosols and clouds, ocean topography and winds, ice-sheet topography and the Earth's gravity field. The NPP would remain on track to bridge the gap between research on the atmosphere as exemplified by Aqua and the future operational NPOESS. (Please see Chapter 10 for more information on NASA.)

OTHER AGENCIES

DOE's Biological and Environmental Research (BER) would decrease to \$443.0 million (down 8.2 percent; see Table II-11). Much of the reduction reflects completion of congressionally mandated projects. The Environmental Processes Program would receive \$129.5 million, the same funding level as this year. There would be a slight increase in funding for terrestrial and ocean carbon cycle research.

DOD R&D in all categories would increase by approximately 2.1 percent in the FY 2002 request, subject to completion of the Defense Strategy Review (see Chapter 6 and Table II-2 for DOD details). The Navy and the Air Force in particular have been traditional sponsors of atmospheric and oceanic research. The Defense Strategy Review has so far highlighted a missile defense program that would necessitate increased atmospheric research.

U.S. GLOBAL CHANGE RESEARCH PROGRAM (GCRP)

The USGCRP is an interagency program that began as a Presidential Initiative and was codified by the Global Change Research Act of 1990. Its purpose is to increase understanding of the Earth system and provide a sound scientific basis for national and international decision making on global change issues. A new strategic plan is being developed for the next decade.

The FY 2002 budget request for the USGCRP would be \$1.6 billion, a reduction of \$75 million (see Table I-10). Of the total request, \$811 million would be for scientific research and surface-based observations (an increase of \$14 million) and \$819 million would be for NASA's global change remote-sensing hardware development (down \$89 million).

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The USGCRP budget is allocated among six interdisciplinary research program elements: Climate Variability and Change, Atmospheric Composition, Global Carbon Cycle, Global Water Cycle, Changes in Ecosystems, and Human Dimensions of Global Change. The FY 2002 USGCRP budget for these research elements would include:

- \$487 million to enhance observational and modeling capabilities for improved understanding, prediction, and assessment of climate variability and change on all timescales.
- \$310 million to enhance understanding of changes in atmospheric composition and of processes affecting stratospheric and tropospheric chemistry. In FY 2002, the U.S. will play a major role in preparing an updated international assessment of scientific understanding of the stratospheric ozone layer to provide scientific input to decisions made under the Montreal Protocol.
- \$225 million for understanding and quantifying carbon sources and sinks, particularly for North America, including carbon sinks on land and processes controlling the uptake and storage of carbon in the ocean. The research community has developed a plan to identify, characterize, quantify, and project major regional sources and sinks of carbon dioxide.
- \$312 million to improve capabilities to measure the global water cycle. The research community has developed a science plan for understanding the global water cycle. USGCRP has developed a long-term strategy for implementation.
- \$198 million to support research and observations to understand changes in managed and unmanaged ecosystems. USGCRP will focus on ecological process research to improve prediction of ecosystem changes.
- \$107 million to support research and assessments of the effects of human activities on the global environment and the potential societal consequences of global change. USGCRP will continue to support research on human health consequences of global change.