

Earth Sciences in the FY 2009 Budget

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HIGHLIGHTS

- **Department of Energy (DOE).** Natural gas and petroleum research are slated for elimination in the President's request. Geothermal and hydropower research would get a boost. Geoscience research within the Basic Energy Sciences account would increase as part of the American Competitiveness Initiative (ACI) and the America COMPETES Act.

- **U.S. Geological Survey (USGS).** The President has requested a 3.8 percent decline for the survey. Similar to the President's last two requests, the minerals program is poised to take a major cut. Funding for hazards and water programs would be cut significantly.

- **National Science Foundation (NSF).** The Geosciences Directorate is funded at a 13 percent increase over FY 2008. The Major Research Equipment and Facilities Construction account would be cut by 33 percent, deferring the development of the Alaska Regional Research Vessel and the Ocean Observatories Initiative (OOI).

- **National Aeronautics and Space Administration (NASA).** Earth Systematic Missions is slated for a 28 percent increase to maintain more than a dozen Earth-observing satellites and continue the implementation of the Landsat Data Continuity Mission and the Global Precipitation Measurement Mission (GPM). The high-priority missions of the National Academies decadal survey will receive a \$70 million increase, offset by large funding cuts to other Earth science programs.

INTRODUCTION

The Earth sciences cover a broad range of the R&D spectrum, running the gamut from fundamental research into the internal processes of Earth's interior to highly applied, interdisciplinary investigations that

address energy resources, water resources, land-use practices, natural hazards, and environmental issues. Although this chapter focuses on Earth science programs in four key departments and agencies, Earth science activities can be found in 16 other departments and agencies.

Table 1: Budget request for principal agencies and programs supporting earth-science R&D (budget authority in millions of dollars).

Agency / Program	FY 2007 actual	FY 2008 enacted	FY 2009 request	% Change FY 08-09
Department of Energy				
- Basic Energy Sciences				
Chemical Sciences, Geosciences & Energy Biosciences	217	223	297	+33%
- Fossil Energy R&D				
Natural Gas Research	12	20	--	-100%
Petroleum Research	3	5	--	-100%
- Efficiency & Renewable Energy				
Geothermal	--	20	30	+52%
Department of the Interior				
- U.S. Geological Survey*	976	1,006	969	-4%
<i>Geologic Division*</i>	237	243	208	-14%
<i>Water Resources Div. *</i>	215	221	203	-8%
NASA				
- Earth Science	1,199	1,280	1,368	+7%
National Science Foundation				
- Geosciences Directorate	746	753	849	+13%
<i>Earth Sciences Division</i>	153	156	178	+14%

Source: Agency budget materials and Office of Management and Budget.

* - Includes non-R&D components.

The budget favors Earth science research associated with several broad-based initiatives. Basic Earth science research within the Office of Science in the Department of Energy (DOE) and the National Science Foundation (NSF) would receive increases associated with the President's ACI and the America COMPETES Act of 2007.

The U.S. Geological Survey (USGS), and the National Oceanic and Atmospheric Administration (NOAA) would receive small increases for specific initiatives, however the USGS budget would decrease by almost 4 percent and the NOAA budget cannot keep pace with R&D needs as costs rise and research funds are redirected to satellite development.

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Although climate change, energy resources and natural hazards have remained in the spotlight for the public and policymakers, Earth science R&D to address these issues is woefully under funded, even with the increases highlighted in this report. Earth science funding at NASA has decreased by 30 percent since 2000 and although more funding will be requested for FY 2009 for Earth observing satellites, the removal of key instruments and launch delays will limit NASA's abilities to provide observations that address climate change and other issues. Non-defense energy R&D at DOE has also declined by 85 percent since 1978, limiting the nation's capacity to diversify our energy resource portfolio and provide the advances needed for a secure and clean energy future. Overall, rising fixed costs, rising operating costs, cost overruns on some major projects and steady under funding of mission objectives means that vital Earth science R&D is not being completed in a timely fashion.

DEPARTMENT OF ENERGY (DOE)

Fossil Energy R&D: The Office of Fossil Energy has tended to focus on coal R&D over the past few years, while decreasing spending on petroleum and natural gas R&D. This year's request eliminates the natural gas technologies and the petroleum/oil technologies programs that previously supported fundamental research and future innovations in oil and natural gas exploration, drilling, and production. More than a dozen universities and many national laboratories will lose all of their research funding for these projects. The Coal Technology program would receive \$632.7 million, an increase of 28 percent, while the President's Clean Coal Power Initiative would increase 23 percent to \$85 million. FutureGen would receive \$156 million, however the project has been significantly restructured. FutureGen was to consist of a single plant to demonstrate the co-production of hydrogen and electricity from a clean coal-fired facility in Illinois but, due to estimated cost increases, DOE decided to divert the funds to multiple demonstration projects. The request also calls for \$30 million in new funds for carbon dioxide capture and storage R&D in Fossil Energy and \$5.5 million in new funds within the Office of Science, to partially satisfy authorizations in the Energy Independence and Security Act of 2007.

Basic Energy Sciences: Earth science research resides within the Chemical Science, Geosciences, and Energy Biosciences program of the Basic Energy Sciences within the Office of Science. This program provides peer-reviewed grants to universities and DOE national

laboratories for fundamental Earth science research in geochemistry, hydrology, rock mechanics, and geophysical imaging. The FY 2009 request is \$297 million, an increase of 33 percent. The \$7.5 million increase specifically for the Geoscience research program is focused on solid earth geophysics and geochemistry for understanding of the stability and transformation of deep carbon sequestration, nanoscale geochemistry, chemical imaging, experimental and theoretical studies of complex subsurface fluids and mid-scale instrumentation.

Geothermal: The geothermal research program within the Renewable Energy account, which funds Earth science research in materials, geofluids, geochemistry, geophysics, rock properties, reservoir modeling, and seismic mapping, would receive \$30 million in the President's budget. The increase of 51 percent comes one year after the Administration proposed to terminate the program. The new funds satisfy in part an authorization in the Energy Independence and Security Act.

Yucca Mountain Site Characterization: Yucca Mountain was approved for development in 2002 and DOE had to delay its request for a site license for construction in 2004. Submission of the license application to the Nuclear Regulatory Commission is expected in 2008. Spending in FY 2009 will focus on the department's defense of the license application, planning facilities for the receipt of spent nuclear fuel and high-level radioactive waste transportation development and emergency and security planning. Overall, the Yucca Mountain project would receive \$495 million, an increase of about \$108 million.

U.S. GEOLOGICAL SURVEY (USGS)

The President's request for the USGS is \$969 million, a decrease of 3.8 percent from the current budget of \$1.0 billion. Projects highlighted this year include two new initiatives, Water for America and Birds Forever as well as the continuation of the Healthy Lands initiative and the Ocean and Coastal Frontiers initiative in support of the U.S. Ocean Action Plan.

Geologic programs would receive \$208 million, a 14 percent decrease. The Mineral Resources Program, the sole federal provider of scientific information for objective mineral resource assessments and unbiased research results on mineral potential, production, consumption, and environmental effects, is again slated for a cut of about \$25 million or 48 percent. This large reduction would terminate or limit research on

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industrial minerals, research on inorganic toxins, the Mineral Resources External Research program and the internationally coordinated global mineral resource assessment; it would also eliminate more than 200 full-time USGS positions at facilities in Reston, Reno, Tucson, Denver and Menlo Park, among others. The program will focus on funding for minerals surveys and studies relevant to ongoing federal land management, regulatory, and remediation activities.

Funding for USGS natural hazards programs would also decline. The Earthquakes program would get the largest reduction of 9 percent, with a \$3 million decline in the external grants program, resulting in the loss of 20 systematic analyses generated by USGS scientists, a potential reduction in the delivery of urban seismic hazard maps, and fewer awards than the 100 awards typically funded each year.

The FY 2009 budget would provide \$2 million for the U.S. National Land Imaging Program (NLIP) in the Department of the Interior. The new program office would assume management control of civilian U.S. land imaging satellites to ensure consistent planning and budgeting for future land imaging missions. The Landsat missions would be managed from this new program office.

Overall, water programs would receive \$203 million, a decline of 8 percent. The request establishes a new water initiative, Water for America, which would increase funding for the National Cooperative Geologic Mapping Program by \$1.5 million, increase the Ground-Water Resources Program by \$3 million and raise the National Streamflow Information Program by \$5.3 million. NSF is also part of the water initiative and would receive \$5.3 million in new funding for the Dynamics of Water Processes program. Once again the 54 State Water Resources Research Institutes, which received about \$6 million in FY 2008, are slated for termination; this would result in the loss of support for over 250 research projects and the training of 600 students. The President requested \$54 million for the National Water Quality Assessment program, a decline of \$11 million from this year's level.

The budget includes an increase of \$7 million for USGS to continue its efforts in the U.S. Ocean Action Plan with NOAA and other agencies. The Coastal and Marine Geology Program would receive \$47.4 million, up \$6.8 million, with much of the increase for data collection along the Arctic Continental Shelf to determine energy and mineral rights.

USGS also restructured its climate change R&D, creating a Global Change program with a request of \$26.6 million, plus \$5 million more to the Geographic and Biologic divisions. About \$1 million will be used to initiate a plan for a national assessment of carbon capture and storage reservoirs and about \$1 million will be directed to the National Cooperative Geologic Mapping program. The Energy Independence and Security Act of 2007 requires the USGS to conduct a carbon storage assessment, but the requested funding is insufficient to begin it.

NATIONAL SCIENCE FOUNDATION (NSF)

The Geosciences Directorate (GEO) would receive \$848.7 million, an increase of 12.8 percent or \$96 million. The majority of the solid Earth science research within GEO is funded through the Earth Science Division (EAR) that has requested \$177.7 million, up 13.9 percent. Much of the \$21 million increase would be directed toward EarthScope operations and maintenance. EarthScope—comprised of the U.S. Seismic Array (USArray), the San Andreas Fault Observatory at Depth (SAFOD), and the Plate Boundary Observatory (PBO)—would receive \$26.3 million (up \$8.7 million) for operations and scientific support.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA's Science Mission Directorate (SMD) would receive \$4.4 billion in FY 2009, a decline of 6 percent. However, the Earth Science Division (ESD) within SMD is slated for \$1.4 billion, a 7 percent increase. ESD has 13 operational missions on orbit, 5 missions in development, and 2 missions in formulation. The 7 percent increase will be devoted primarily to the implementation of the Earth Systematic Missions—the NPOESS Preparatory Project (NPP), the Landsat Data Continuity Mission (LDCM), the Global Precipitation Measurement (GPM), and at least three decadal survey missions by 2013. Even with the increases, many of these missions have been pared down and most will have delayed launch dates. While Earth science research will be increased by 1.3 percent or \$4.8 million, all other programs will see large cuts; the Multi-Mission Operations will decline by 16 percent, the Earth System Science Pathfinder, which includes the Orbiting Carbon Observatory (OCO) and Aquarius, will decrease by 22 percent, and Earth Science Technology and Applied Sciences will fall 3 percent and 26 percent, respectively.