

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
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**DOD Agency Representative: Dr. James E. Andrews, 703-696-4518, andrewj@onr.navy.mil**

<p><b>High Latitudes Program</b> Program Contact: Dr. Mel Briscoe, ONR 322, 703-696-4120, <a href="mailto:briscom@onr.navy.mil">briscom@onr.navy.mil</a></p>					
<p>The Office of Naval Research (ONR) High Latitudes Program is funding research focused on better understanding and quantifying the physical processes occurring in the Arctic Ocean which, in turn, are important in understanding and evaluating climate changes.</p>	na	na	Supporting	Climate Variability and Change	
<p><b>Satellite Sensor Program</b> Program Contact: Dr. Mel Briscoe, ONR 322, 703-696-4120, <a href="mailto:briscom@onr.navy.mil">briscom@onr.navy.mil</a></p>	na	na	Supporting	Climate Variability and Change	
<p>ONR and the Naval Research Laboratory (NRL) have a number of satellite and remote sensing experiments and operational sensors that could provide important insights into global change effects in the upper atmosphere. Global change models in the troposphere and oceans are complicated by numerous feedback mechanisms. This is not the case for the upper atmosphere. The earth's thermosphere, characterized by temperatures that can approach 2000oK, is unique in the solar system. Department of Defense (DoD) has a strong operational interest in both the thermosphere and ionosphere (RF propagation -Comms, GPS, surveillance- and satellite drag) and NRL has developed a number of ultraviolet remote sensing instruments designed to measure the temperature and composition from low Earth orbit.</p>	na	na	Supporting	Climate Variability and Change	
<p>Several instruments are flying aboard the ARGOS satellite with the express objective of establishing a baseline of the upper atmosphere composition from which a search for global change can begin. NRL has also built five copies of the Special Sensor Ultraviolet Limb Imager (SSULI) which will soon begin flying aboard the next block DMSP weather satellites and will measure altitude profiles of all the major thermospheric and ionospheric constituents. This data will also help establish a baseline from which to assess whether there is the beginning of global change</p>	na	na	Supporting	Climate Variability and Change	

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<p><b>Naval Oceanographic Office - Ocean Databases</b> Program Contact: Dr. Richard Spinrad, CNO-N096, 703-762-1000, spinrad.richard@hq.navy.mil</p>					
<p>GDEM is the Navy's standard climatology database for ocean temperatures. (Its name – the Generalized Digital Environmental Model – stems from the fact that what is stored are the coefficients that describe the curvature of each profile; a “model” then combines those coefficients to re-create the database.) The database generally covers all ocean areas over the whole world on a grid. The database provides depth vs. temperature and depth vs. salinity profiles. These profiles should be considered climatologically representative, one for each of the 12 months of the year. The standard deviations of these temperature and salinity values are also a part of the database.</p> <p>These profiles are determined through a process of analysis of the Navy's archive of ocean temperature and salinity measurements. This archive, MOODS (Master Oceanographic Observations Data Set), is maintained by the Naval Oceanographic Office (NAVOCEANO). Data in MOODS extend back several decades; over six million temperature profiles are available to be analyzed</p>	na	na	Supporting	Climate Variability and Change	
<p><b>Integrated Surface Hourly Data Set (FNMOD Asheville)</b> Dr. Richard Spinrad, CNO-N096, 703-762-1000, spinrad.richard@hq.navy.mil</p>					
<p>The Fleet Numerical Meteorology and Oceanography Detachment Asheville works with the National Climate Data Center (NCDC) in the development of various products and data sets that serve the goals of both agencies. Currently, FNMOD Asheville is involved in a joint project with NCDC that will result in an Integrated Surface Hourly (ISH) data set that contains surface weather observations from land stations covering the globe. This data set will greatly aid scientists in spotting short and long-term trends and analyzing events such as El Nino/La Nina.</p> <p>FNMOD Asheville's Global Marine Climatic Atlas (GMCA) provides the opportunity for those interested to retrieve and display summarized statistical analysis of virtually all marine surface observations (including sea surface temperature) for 1854 to 1997 from COADS (Comprehensive Oceanographic Atmospheric Data Set).</p>	na	na	Supporting	Climate Variability and Change	
<p><b>Master Environmental Library</b> Program Contact: Dr. Susan Numerich, DMSO</p>					
<p>Defense Modeling and Simulation Office</p>	na	na	Supporting	Climate Variability and Change	

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<p><b>Tri-agency (DOD, NOAA, NASA) Satellite Sensors, the National Polar-orbiting Operational Environment Satellite System (NPOESS)</b></p>					
<p>AF funded the high resolution Defense Meteorological Satellite Program; and AF funding half of the follow-on Polar Orbiting Environmental Satellite System NPOESS ; Two military and two civilian satellites today will converge into NPOESS by 2013; ; Mission includes Imaging, Sounding, Ozone and Space Environment data collection ; key to support climate change analysis; Sensors under development to support climate change include:</p> <ul style="list-style-type: none"> <li>; Visible/IR Imager Radiometer Suite (VIIRS) – cloud cover/ water vapor</li> <li>; Cross-track IR Sounder (CrIS) – water vapor</li> <li>; Conical MW Imager/Sounder (CMIS) – water vapor</li> <li>; Ozone Mapper/Profiler Suite (OMPS) - ozone</li> <li>; GPS Occultation Sensor (GPSOS) – scintillation in ionosphere</li> <li>; Space Environmental Sensor Suite (SESS) – on orbit environment</li> <li>; Aerosol Polarimeter (new) - aerosols</li> <li>; Advanced Technology Microwave Sounder (ATMS): In development by NASA, will provide global observations of temperature and moisture profiles at high temporal resolution</li> <li>; Earth Radiation Budget Sensor (NASA)</li> <li>; Solar Radiation Budget Sensor (NASA)</li> <li>; Solar Irradiance Sensor (TSIS): In development by NASA</li> </ul>	na	na	Supporting	Climate Variability and Change	
<p><b>Climate Science and Modeling</b></p>					
<p>Air Force Weather Climate Applications Advanced Climate Modeling and Environmental System (ACMES) Can provide gridded, synthetic climatologies for any spot on the globe Could identify climate change in the data-sparse portions Engineering Climate Database Interagency leverage and partnering climate model expertise &amp; technology (NOAA, USAF, International Research Institute, etc) Example: Afghan seasonal forecast to aid in refugee camp management... NOAA/AF collocated climate center applications</p>	na	na	Supporting	Climate Variability and Change	
<p><b>Interagency Baseline Databases to support climate research</b></p>					
<p>NOAA/AF collocated climate center data ; Data collection/data sharing (observations, forecasts, satellite) ; Joint Data Assimilation Center to better exploit NPOESS data streams ; NPOESS Integrated Operational Requirements Document identified data requirement records to include temperature, clouds, moisture, and aerosol ; NOAA and USAF Hurricane Hunters data.</p>	na	na	Supporting	Climate Variability and Change	
<p>Total</p>	0.0	0.0			

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**DOE Agency Representative: Jerry W. Elwood, Ph: 301-903-3281, email: jerry.elwood@science.doe.gov**

<p><b>Climate Change Prediction Program</b> Program Contact: Dave Bader, DOE/BER, Ph: 301-903-5329; email: Dave.Bader@science.doe.gov</p>					
<p>Developing, testing, and applying climate simulation and prediction models that are at the leading edge of scientific knowledge and computational technology. The program develops models based on definitive theoretical foundations and new computational methods that will run efficiently on current and future generations of high-performance scientific computers with the intent of increasing dramatically both the accuracy and throughput of computer model-based predictions of future climate system response to the increased atmospheric concentrations of greenhouse gases.</p>	27.0	27.2	Core GCRP	Climate Variability & Change	Ensemble runs of decade-to-century-scale climate change forcing scenarios that include atmospheric chemistry, carbon cycle feedbacks, and interactive vegetation; climate models of increased spatial resolution that can be used to produce more accurate and useful regional scenarios of climate change; analyses of the contribution of human-induced forcing to climate change.
<p><b>Atmospheric Radiation Measurement Program</b> Program Contact: Wanda Ferrell, Ph: 301-903-0043, email: Wanda.Ferrell@science.doe.gov</p>					
<p>Research that addresses the largest uncertainty in climate models, the parameterization of clouds and radiation. The program consists of 3 major activities: observations, process studies, and modeling. Extensive, continuous, surface-based observations of key climate variables are made at three climatically significant locales: the U.S. Southern Great Plains, the Tropical Western Pacific, and the North Slope of Alaska. Process studies use ARM data to improve understanding of cloud physical processes in the atmosphere and to use the results to isolate areas of weakness in how they are represented in models and improve them. Modeling activities include data fusion, modeling of detailed cloud processes using cloud resolving models, and the development of a new super-parameterization model for testing submodels in GCMs.</p>	43.2	47.5	Core GCRP	Climate Variability and Change, also contributes to Water Cycle	Continuous, long-term data on atmospheric radiation for testing radiative transfer models used in atmospheric GCMs, improved climate models with less uncertainty of cloud effects and cloud-climate feedbacks; more accurate simulations and predictions of climate and regional weather.

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<p><b>Carbon Cycle Research Program</b> Program Contact: Roger Dahlman, DOE/BER, Ph: 301-903-4951; Anna Palmisano, DOE/BER, Ph: 301-903-9963, Email: Roger.Dahlman@science.doe.gov</p>					
<p>Research to measure and model atmospheric CO2 trends and net exchange of CO2 between atmosphere and biosphere for selected terrestrial ecosystems and regions of N. America. Also supports research to study the coupling of carbon and nitrogen cycles in coastal environments of N. America using modern molecular biology and biogeochemistry. Modeling research uses ecosystem data and models to predict sources and sinks of atmospheric CO2 at ecosystem and landscape scales, including interannual variation of atmospheric CO2. Experimental research provides information on effects of elevated CO2 on carbon sinks in terrestrial systems and provides parameterizations of elevated CO2 effects on carbon cycling in terrestrial ecosystem carbon models.</p>	13.2	13.7	Core GCRP	Carbon cycle	Estimates of net CO2 exchange between atmosphere and selected terrestrial ecosystems; new methods for rapid assessment of carbon cycling and uptake from the atmosphere in nearshore environments; and estimates of regional-scale carbon sinks; results contribute to NACP goals, and to quadrennial Federal State of the Carbon Cycle Report.
	0.0	3.0	Core CCRI	Carbon cycle	
<p><b>Atmospheric Sciences Program</b> Program Contact: Peter Lunn, DOE/BER, Ph: 301-903-4819, email: Peter.Lunn@science.doe.gov; Rick Petty, DOE/BER, Ph: 301-903-5548, Email: Rick.Petty@science.doe.gov</p>					
<p>Program supports basic research to understand the atmospheric processes that control the transport, transformation, and fate of energy-related chemicals and particulate materials emitted to the atmosphere. Emphasis is on processes relating air quality standards for troposphere ozone and particulate matter and their effects on climate. Field and laboratory studies acquire data to develop and test predictive models of atmospheric processes, including gas-to-particle conversion processes, ozone formation, and deposition, resuspension, and transport of aerosols. Program also supports research to improve understanding of meteorological processes controlling the dispersion of energy-related chemical and particulates in the lower atmosphere.</p>	12.9	12.6	Core GCRP	Atmospheric Composition	Catalog of ozone production efficiencies and ozone production rates for selected metropolitan areas of the U.S. and their immediate downwind influence regions; an aerosol data set associated with the Texas 2000 Air Quality Study; an assessment of the importance of heterogeneous chemical processes in the formation of oxidants on urban and regional scales; an assessment of the processes responsible for vertical transport and mixing of trace gases and pollutants in the lower atmosphere and how well they are represented in numerical models used to generate forecasts of air quality, local weather, and climate.

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<p><b>Ecosystem Research Program</b> Program Contact: Jeff Amthor, DOE/BER, PH: 301-903-2507, Email: jeff.amthor@science.doe.gov</p>					
<p>Program provides unique knowledge derived from field experiments of the effects of elevated temperature, altered precipitation, elevated ozone, and elevated CO<sub>2</sub>, singly, and in combinations on the structure and functioning of several important terrestrial ecosystems. The research will help determine which ecosystems are most susceptible or resistant to climate and atmospheric changes and how they are likely to respond to such changes in the future. Program includes long-term (decadal) observations of hydrology, forest productivity, tree species demographics, and biogeochemistry of an eastern mixed deciduous forest. Program uses data obtained in experiments to critically evaluate (test) ecosystem models that are used in integrated assessments of climate change effects. The evaluation is critical to instilling confidence in the use of ecosystem models as decision support tools.</p>	12.6	13.9	Core GCRP	Terrestrial and Marine Ecosystems	Data sets from large-scale field experiments quantifying effects of climate change variables (warming, altered precipitation, elevated ozone, and elevated CO <sub>2</sub> ) on the structure and functioning of important terrestrial ecosystems. Ecosystem model-data comparisons needed to evaluate models that could be used for decision support.
<p><b>Human Interactions Program</b> Program Contact: John Houghton, DOE/BER, Ph: 301-903-8288, Email: john.houghton@science.doe.gov</p>					
<p>Research to develop, improve, and apply integrated assessment methods and models for analyzing the human (including economics), physical, and biological aspects of climate change from the cause, such as greenhouse gas emissions, through impacts, such as changes to unmanaged ecosystems, sea level rise, and altered growing conditions for crops. Emphasis is on develop tools that represent all three aspects in such a way that actions to mitigate climate change can be evaluated, including their economic and environmental costs and benefits. Research on topics that usually involve economics and provides a decision support product—integrated assessment models.</p>	8.0	8.1	Core GCRP	Socio-economic analyses	Integrated assessment models capable of providing policy analysis for a wide variety of mitigation options of interest to decision makers at the national level; annual updates of global, regional, and national annual CO <sub>2</sub> emissions from fossil fuel combustion.

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<p><b>Carbon Sequestration Research</b>      Program Contact: Roger Dahlman, DOE/BER, Ph: 301-903-4951; Email: roger.dahlman@science.doe.gov; Anna Palmisano, DOE/BER, Ph: 301-903-9963; Email: anna.palmisano@science.doe.gov</p>					
<p>Research on natural mechanisms that sequester CO<sub>2</sub> in terrestrial and oceanic systems and how they can be enhanced. Models and data needed to predict and assess the carbon sequestration potential of alternative strategies or policies intended to enhance the carbon sequestration in terrestrial and ocean systems, including their potential environmental costs and benefits. Includes information on land management options and for periodic carbon policy management and assessments, information and data that contributes to quadrennial Federal State of the Carbon Cycle Report. Information on complete DNA sequences of organisms that are important or potentially important in carbon sequestration and carbon management, ranging from microbes to the Poplar tree, on the proteins expressed by these organisms, and on the genetic regulation of their genes and proteins that effect carbon sequestration.</p>	na	na	Supporting program	Contributes to carbon cycle research	<p>Information on how to alter net photosynthesis, carbon partitioning and soil organic matter stabilization to enhance carbon sequestration in terrestrial systems. Information on enhancing natural sequestration mechanisms using iron fertilization and ands the environmental consequences of it and direct CO<sub>2</sub> injection into the deep ocean; scientific foundation for decision-making relative to the potential for enhancing carbon sequestration in "high nutrient, low chlorophyll" areas of the ocean. Data for using in designing or more effectively using biological strategies to enhance sequestration of excess atmospheric CO<sub>2</sub> in terrestrial and/or ocean ecosystems.</p>
<p><b>SBIR / STTR</b></p>					
<p>The Small Business Innovation Research (SBIR) program, mandated by Public Law 97-219, requires all Federal agencies with an extramural research budget in excess of \$100 million to reserve a percentage of these dollars for small business concerns to fund research projects.</p>	3.1	3.0	Core GCRP	Other	
<p>Total</p>	120.0	129.0			

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EPA Agency Representative: Michael Slimak, 202-564-3324, slimak.michael@epa.gov; Joel Scheraga, 202-564-3385, scheraga.joel@epa.gov

<p><b>Global Change Research Program: Biology and biochemistry of ecosystems</b> Program Contact: Joel Scheraga, National Program Director, Global Change Research Program (202-564-3385; scheraga.joel@epa.gov)</p>					
<p>This is a research and assessment-oriented program with primary emphasis on understanding the potential consequences of global change on human health, air quality, water quality, and ecosystems in the United States. This entails: (1) improving the scientific basis for evaluating effects of global change in the context of other stressors and human dimensions (as humans are catalysts of and respond to global change); (b) conducting assessments of the risks and opportunities presented by global change; and (3) assessing adaptation options and developing <b>decision-support tools</b> to increase society's resilience to change. This program is operated out of the EPA Office of Research and Development.</p>	16.6	17.6	Core (supports both USGCRP and CCRI) don't think CCRI?	Socio-Economic Analyses	Interactive, web-based decision-support tools for various resource managers and decision makers (e.g., water resource managers, air quality managers, coastal zone officials, and public health officials). In partnership with Penn State University, create a publicly accessible, web-based climate service for the Mid-Atlantic Region that enables assessment of climate-sensitive vulnerabilities and impacts by decision makers. The climate service will include historical observations, global climate model results, high-resolution output from regional climate models and from "downscaling" efforts, and the capability to map (sub) regions, combine data sets, and add layers of variables of interest to the user, e.g., that could affect outcomes from decisions about infrastructure replacements near flood plains. Final assessment of the effects of global change on drinking water infrastructure in the United States, and potential adaptation options for decision makers. Final assessment of the effects of global change on waste water treatment in urban areas of the United States, and potential adaptation options fo
<p><b>Global Change Research Program: Biology and biochemistry of ecosystems</b> Program Contact: Joel Scheraga, National Program Director, Global Change Research Program (202-564-3385; scheraga.joel@epa.gov)</p>					
<p>The ecosystem-based research is designed to understand and predict ecosystem exposure, responses, and vulnerabilities to global change, and to high-risk chemical and non-chemical stressors (e.g., invasive species, genetically altered organisms) at multiple scales of biological organization and geographic scales. This research area will be impacted by and is inextricably interrelated with climate change. This program is operated out of the EPA Office of Research and Development.</p>	3.0	3.0	Core GCRP	Terrestrial and Marine Ecosystems	Final assessment of the potential vulnerability of aquatic ecosystems in the United States to global change and options available to managers to increase ecosystem resilience to these stressors.



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<p><b>Global Change Research Program: UV monitoring network</b>  <b>Program Contact: Joel Scheraga, National Program Director, Global Change Research Program (202-564-3385; scheraga.joel@epa.gov)</b></p>					
<p>The <b>monitoring ("observations")</b> program supports (in cooperation with the National Park Service) a network of continuously operated stations in rural areas monitoring UV radiation at a range of longitudes, latitudes, and elevations across the U.S. The UV monitoring network was established in 1992 to provide reliable data to 1) improve understanding of the status and trends in UV flux, temporally and spatially, 2) to characterize the physical and chemical parameters that modify UV flux, and 3) to improve radiative transfer models and inferences that can be drawn from them, including consequences of UV exposure for human and ecological health. Data from these monitors make it possible to evaluate the intensity of and trends in UV radiation reaching the Earth's surface and can be used as input for human and ecological assessments. The program also supports a small network of urban stations. EPA's primary concern is the effect of changes in UV radiation on ecosystems, their components, and the services they provide. This program is operated out of the EPA Office of Research and Development.</p>	1.4	1.4	Core GCRP	Terrestrial and Marine Ecosystems	Website with ongoing reporting to the public of UV data obtained from the EPA monitoring network.
Total	21.0	22.0			

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**NASA Agency Representative: Jack Kaye, 202-358-2559, Jack.Kaye@hq.nasa.gov**

<b>Terrestrial and Marine Ecosystems</b> Program Contact: Woody Turner, NASA/ESE Research Division, 202-358-1662, wturner@hq.nasa.gov	66.9	60	Core-GCRP	Ecosystems	
Research: This activity uses remote sensing approaches to observe terrestrial and marine ecosystems, understand their responses to global environmental change, and assess the consequences of these changes. The focus is on understanding the role of biological processes. Products include terrestrial and marine primary productivity, their distribution and patterns of change; Ecosystem models driven by remote sensing data inputs; Model improvements that incorporate realistic ecosystem responses, including biospheric feedbacks for climate models.					
Observations: Long-term measurement of key biophysical and biochemical properties of vegetation and oceanic ecosystems (e.g., vegetation indices, ocean color, fire occurrence); Process-oriented field campaigns to measure in situ properties that also provide validation for satellite algorithms used for space-based measurements. Development of new remote sensing techniques and evaluation from airborne platforms.					
Decision Support: Assessments of terrestrial and marine primary productivity for use by farmers, foresters, fishermen, international famine relief programs, and other food and fiber resource managers; Databases on disease vector habitat and environmental conditions to assess public health risks; Assessments of public health impacts of ecosystem change and information on the occurrence of and models for the prediction of harmful algal blooms (HABs) and hypoxia. Modeling tools and databases to assess the consequences of changes in terrestrial and marine ecosystems for sustainable resource management and biodiversity conservation. Development of scientific basis for longer-term creation of predictive models of invasive species patterns and vulnerable habitats; develop partnerships with other agencies (DOI, USDA) towards long-term goal of creation of operational decision support systems for management and control of invasive species. Activities support HAB and Hypoxia Research and Control Act, Amended Clean Water and coastal Zone Managements Act and the Sustained Fisheries Act.		7.3	Supporting		(1) Improved ecosystem response scenarios for use in national and international assessment modeling; (2) Monitoring and modeling tools to assess economic and public health risks associated with changes in terrestrial and marine ecosystems; (3) Prediction of transport, speed, and direction of harmful algal blooms (HABs)/hypoxia (4) Forecasting the initiation, landfall, and evolution of HABs/hypoxia; (5) Development of forecasting systems and monitoring approaches for non-indigenous invasive species on land (including rangeland for livestock grazing) and in fresh water and coastal ecosystems.

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<b>Carbon Cycle</b> Program Contact: Diane Wickland, NASA/ESE Research Division, 202-358-0245, <a href="mailto:dwicklan@hq.nasa.gov">dwicklan@hq.nasa.gov</a>	98.4	125.8	Core-GCRP	Carbon	
<p>Research: The Global Carbon Cycle program conducts remote sensing-oriented research to: quantify global sources and sinks for carbon, advance carbon cycle models, elucidate the role of terrestrial and marine ecosystems in the global carbon cycle, and develop new approaches for deriving carbon cycle information. Products include information on the fate of carbon in the environment, its sources and sinks and how they change over seasons to years; Carbon cycle models driven by remote sensing data inputs; Improvements to land and ocean carbon dynamics models, atmospheric transport models and inversions, and coupled models (e.g., land-ocean-atmosphere; physical-biological-chemical); Model-based estimates of air-sea carbon dioxide fluxes; Evaluation of satellite data for quantifying biomass and growing season length.</p>					
<p>Observations: Satellite-measured ocean color and chlorophyll, vegetation indices, natural fluorescence in the ocean, carbon monoxide, fire occurrence, and land cover; Airborne lidar measurements of vegetation height; Field and airborne observations for calibration and validation of satellite data products; Satellite observations to evaluate derivation of total column atmospheric carbon dioxide concentration; Airborne carbon dioxide concentration observations.</p>		1.0	Core - CCRI		
<p>Decision Support: Monitoring and modeling tools to assess changes in global carbon sources and sinks and their implications for carbon storage in ecosystems. Move findings into information and decision support tools for land managers in agricultural and forestry sectors. Characterization of the consequences of changes in coastal regions and of fire and other forms of disturbance on global carbon balance. Assessments of primary productivity and carbon dynamics and their interannual variability for use by agricultural, forest, and fisheries resource managers; Development of tools to provide information needed by land managers and other decision makers concerning best practices for carbon sequestration projects. Collaborators include USDA, DOE, and USAID.</p>		2.6	Supporting		<p>(1) Validated global data products to quantify climate change and manage carbon; (2) Carbon cycling models capable of producing more realistic carbon source-sink change scenarios for use in regional and international assessments; (3) Monitoring and modeling tools to assess carbon sequestration in biomass and soils. Assessment of carbon fluxes and sequestration in the coastal zone; (4) Soil carbon sequestration - provide information to be used in interagency (USDA) partnership for predicting change in soil carbon for carbon credits and improving agricultural productivity; (5) Forest management - monitoring of carbon sequestration in above ground biomass for carbon credits and climate impact; (6) Crop planning and rotation - provide scientific basis for development of interagency products to assess impact of changing agricultural practices on carbon sequestration and the agricultural economy.</p>

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<p><b>Land Cover/ Land Use Change</b> Program Contact: Garik Gutman, NASA/ESE Research division, 202-358-0276, ggutman@hq.nasa.gov</p>	0.0	35.4	Core-GCRP	Land cover	
<p>Research: This activity develops the capability to utilize remotely sensed observations to increase our understanding of the changes in land cover and land use taking place at the Earth's surface and their impacts on ecosystem goods and services, carbon and water cycles, and the management of natural resources. The program provides a scientific base for future studies of sustainability, vulnerability, and resilience of land systems and their use.</p>					
<p>Observations: Provide capability for repeated global inventories of land cover from space through use of long-term high resolution space-based data systems (esp. Landsat, Landsat Data Continuity Mission), as well as research-oriented instruments. Apply to studies of phenomena such as deforestation, fires, urban sprawl, and desertification.</p>					
<p>Decision Support: Produce products, including maps of land cover and its evolution over active regions of physical and biogeochemical change, information on fire history and current fires, estimates of carbon budget and impact of changes in land cover on stored carbon in forests.</p>					<p>(1) Estimates of deforestation extent in Amazon ;(2) New information on the effects of the forest-urban dynamics; (3) Satellite derived estimates of changes in regional land covers over more than 2 decades; (4) Contribution of land cover change in Alaska to Carbon budget; (5) Analysis of land use and land cover change in middle eastern U.S. ecological regions; (6) Satellite-based information for fire and water management</p>

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<p><b>Water Cycle</b> Program Contact: Jared Entin, NASA/ESE Applications Division, 202-358-0275, jentin@hq.nasa.gov</p>	213.7	212.9	Core-GCRP	Water Cycle	
<p>Research: This activity supports the improvement of understanding of processes that describe the movement of water between components of the Earth system (esp. precipitation, evaporation, surface ground flow), the relationship between fluxes of water and the amount in various reservoirs (e.g., soil moisture, atmospheric moisture), and the connection between changes of state of water and the global energy cycle in the atmosphere. It supports the development of models for key water exchange processes that can be included in improved future climate models.</p>					
<p>Observations: This activity supports long-term measurements of a limited number of critical environmental parameters (esp. atmospheric moisture) and their ultimate transition to operational providers. It also has enabled satellite observations of precipitation and lightning, and supports limited-duration observations of specific aspects of the water cycle, such as planned observations of the three dimensional structure of aerosols and thin clouds (CALIPSO) and thick clouds (Cloudsat), and the development of first global observational systems for precipitation (GPM, planned launch ~ 2007). Field campaigns utilizing aircraft and satellites to study key elements of water and energy cycle (e.g., hurricanes, cold land processes, tropical cirrus clouds) are carried out. Assimilated data sets that emphasize mutual interactions between land and atmospheric components of climate system are created. Development and airborne testing of new techniques to enable future global observations of additional parameters (e.g., soil moisture) is also carried out.</p>					
<p>Decision Support: Improved forecast models that utilize space-based observations are developed and transitioned to operational partners. New data sets on precipitation in the tropics and subtropics have been prepared and will be extended with improved temporal resolution to higher latitudes. Experimental near-real time data information products for precipitation are provided to support quasi-operational applications. Provide forecasts of the future state of country's water supply and link to decision support systems for water supply and quality and to improve efficiency of water use. Cooperative activities will be carried out to increase productivity of US farms in context of varying future availability of water. Decision support systems will exploit data and modeling capabilities in public and private sector to guide within- and between-season farm management. Information supports Clear Water Act, Safe Drinking Water Act, and Water Resources Development Act. Partners include USGS Bureau of Reclamation, USDA, EPA, NOAA, and commercial entities.</p>		7.2	Supporting		<p>(1) Global characterization of aerosols and impact on cloudiness, solar radiation, precipitation, general circulation; (2) Triennial assessment of state of knowledge of global impact of aerosols, including Black Carbon as part of the National Aerosol Climate Interactions Program (NACIP); (3) Water supply assessments and forecasts for better laws and economic decisions related to water consumption and river flows; (4) snow pack assessments for power generation as well as water supply issues; (5) models to simulate the impacts of land cover-land use change on the surface water cycle for use in assessments; (6) improved drought and flood predictions based on improved capability to provide short-term predictions of nominal and severe weather events and information on precipitation; (7) weather-related decision support system displays of new high-volume satellite data; (8) new satellite-derived satellite data products for weather forecasters; (9) better understanding of basic atmospheric science related to severe storms for improved forecast accuracy and warn</p>

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Climate Variability</b> Program Contact: Waleed Abdalati, NASA ESE Research Division, 202-358-0746, wabdalat@hq.nasa.gov	195.8	192.1	Core-GCRP	Climate	
<p>Research: This activity supports the improvement of understanding of processes that determine the behavior of the slower elements of the physical climate system. Particular foci include the processes by which the ice-covered regions of the high latitude Earth behave, by which the distribution of sea ice varies, and the way in which our knowledge of ocean and atmospheric circulation can be enhanced through use of global observations of ocean state, land surface, and atmospheric forcing parameters. The development and testing of new capability for measuring climatic properties, such as ocean surface salinity, mixed layer depth, and ice thickness is also carried out here. Models that simulate the behavior of the coupled Earth system (atmosphere, ocean, land surface) for retrospective and predictive studies of the Earth system on seasonal/interannual and long term scales are also carried out under this portion of the program. NASA emphases include the accurate representation of forcings for these models and their initialization and evaluation using global remotely-sensed data.</p>					
<p>Observations: This activity supports the obtaining of systematic data sets for a limited number of earth system parameters such as ocean surface topography, ocean surface winds, and sea ice extent, and will shortly enable the initiation of regular observations of ice sheet thickness (IceSAT to be launched later this year). Data assimilation systems using satellite data that provide for accurate geophysically consistent data sets are also carried out through this program. <i>Airborne observations to explore new measurement capabilities to complement satellite observations are carried out.</i></p>		2.0	Core - CCRI		

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p>Decision Support: The ocean observations and models support initialization and verification of climate models and real-time decision making for the US Navy and commercial maritime interests. Cryospheric observations support climate model development and verification of high latitude changes. Climate models support national and international assessments, including long-term Earth system evolution (both retrospective and predictive) and seasonal-to-interannual forecasts initialized with remotely sensed data that can address shorter-term regional responses. Information to support President's Energy Policy by providing energy sector with enhanced information for optimizing selection and placement of energy producing crops, and improving forecasting of electric power loads to reduce unnecessary energy use and better forecast availability of renewable energy production. Provide predictive models of how climate variation may affect incidence of diseases, and provide input into decision support systems for surveillance of diseases and predicting and responding to disease outbreaks.</p>		5.2	Supporting		<p>(1) Estimates of global sea level changes; (2) Warnings of major climate events such as El Nino; (3) Ocean state estimation (like weather forecasting) supports U.S. commerce and defense capabilities; (4) new information on sea ice processes and changes in sea ice cover to reduce uncertainty in and support validation of assessment models; (5) long-term climate simulations tested against observations for assessment of models' ability to simulate prior changes; (6) improved capability to simulate observed regional climate variation given global and regional forcings and provide resolved forecast products; (7) provide inputs to energy industry for improvements in locating and orienting renewable energy sources and better planning for production of renewable biomass-based energy based on improved knowledge of future climate; (8) improved ability of epidemiologists to more accurately predict occurrences of conditions favorable to disease outbreaks and improved ability of public health community to respond to infectious disease outbreaks and other chronic disease conditions</p>

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Atmospheric Composition</b> Program Contact: Philip DeCola, NASA/ESE Research Division, 202-358-0768, pdecola@hq.nasa.gov	174.6	154.6	Core-GCRP	Atmos. Comp.	
<p>Research: This activity supports the improved understanding of processes by which trace constituents are transformed and transported in the atmosphere. Studies of how atmospheric chemistry, composition, and climate are linked are emphasized, including those processes that control the abundance of constituents that affect the Earth's radiation budget, such as tropospheric methane, ozone, and aerosols, and stratospheric ozone and water vapor. Computational models are developed to analyze past changes and to predict future changes in atmospheric composition and the linkage between atmospheric chemical and climate change.</p>					
<p>Observations: Ground-based observations of the short- and long-term evolution of naturally and industrially emitted radiatively and chemically active greenhouse gases and their breakdown products are made. To obtain global distribution and variability, satellite observations of a limited number of atmospheric parameters over long periods of time (including climatically relevant parameters such as ozone, aerosols, solar irradiance, and water vapor) and more comprehensive suites of observations over briefer periods are made. Airborne observations of a comprehensive suite of trace constituents to improve knowledge of processes such as polar ozone depletion, stratosphere/troposphere exchange, and long-range transport of pollutants and their precursors are carried out.</p>					
<p>Decision Support: Data sets on the tropospheric abundance of industrially produced chemically and radiatively active forcing agents are used to assess the effectiveness of present control strategies under the Montreal Protocol. Retrospective and Predictive modeling of atmospheric composition for use in national and international assessments. Data sets on total column ozone and associated surface UV radiation fluxes are provided to the human and ecosystem health communities. Information on background concentration of pollutants and their long-range transport is being applied to develop improved forecasting models for regional air quality, including improvements in planning for and assessing compliance with air quality standards and forecasting of pollution episodes. Information on atmospheric aerosols is being used to improve knowledge of the distribution and processes that control the abundance of aerosol particles. Information supports modifications to Clean Air Act called for in President's National Energy Policy and emphasizes collaboration with EPA.</p>		3.6	Supporting		<p>(1) Abundances and trends of halocarbons, both naturally occurring and anthropogenic, including chemicals regulated under the Montreal Protocol and their replacements; (2) Global models which can be used in assessments for predictive and retrospective studies of atmospheric chemical and associated climate change; (3) Long-term trends of variability of solar irradiance, atmospheric ozone, temperature, and water vapor needed as input for global and regional climate assessment models; (4) Long-term data sets for surface UV flux for use by ecological and human health communities; (5) Integrated models of impacts of long-range transport of gas phase and particulate atmospheric pollutants and their precursors on regional air quality and harmful exposure for human and ecosystem health; (6) improved capability for forecasting of pollution episodes and identification of regions at risk and information to guide targeted reduction of emissions in focused regions.</p>



Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Data System Development</b>  <b>Program Contact: Martha Maiden, NASA/ESE Program Planning and Development Division, 202-358-1078, mmaiden@hq.nasa.gov</b></p>	293.0	74.3	Core-GCRP	Shared	
<p>Research: Although mostly focused on the large job of providing science data management systems for large satellite streams, this activity also supports the improvement of data quality and accuracy, especially for climate records spanning satellite instruments. Includes studies to organize and process data for key interdisciplinary Earth system science questions and development of computational tools to enhance ease of data access and usability. New and emerging technologies are integrated. NASA OES would like to grow the amount of support in this area, which mines the past and leads to the future.</p>					
<p>Observations: This activity supports the development of a data system capable of processing, archiving, and disseminating the large amounts of data generated by the satellites that constitute NASA's Earth Observing System. Current data increases at the rate of 2 Tbytes/day. Total data volume to date is about 1.2 Petabytes. Current implementation of development program completes Earth Observing System Data and Information System (EOSDIS) in FY02 and will evolve to new more distributed system (SEEDS) in the future.</p>					
<p>Decision Support: NASA is generating geospatial data of unprecedented quality and quantity, and technology to transform data into information products and use the data in analysis and prediction tools. This activity supports projects that address applications of national importance and, through research, validation and verification, and demonstration, provide data products and tools for resource management and policy decision support.</p>					
<p><b>Data System and Satellite Operations</b> Program Contact: Martha Maiden, NASA/ESE Program Planning and Development Division, 202-358-1078, mmaiden@hq.nasa.gov; Ed Chang, NASA/ESE Program Planning and Development Division, 202-358-0742, echang@hq.nasa.gov</p>					
<p>Observations: This activity comprises the Earth Science Data and Information Operations, adding EOS satellites and EOSDIS operations beginning in FY03 with the completion of major development. It provides maintenance and operations of the distributed EOSDIS system for the EOS satellites, which includes command and control of and data receipt from the satellites, satellite data preprocessing and the associated communications networks among scientists, engineers, and users of Earth science data/information, science data systems that process the data, and the Distributed Active Archive Centers (DAACs). The DAACs are NASA's primary Earth science data centers, holding heritage and research data sets as well as EOS and other satellite data and providing open access to the broad user community. This activity includes the operation and data processing of satellites whose launch pre-dates the EOS period. The total number of satellites operated by ESE is now 12 (does not include Landsat).</p>	47.6	211.5	Core - GCRP	Shared	Archive and Distribute more than 2 Terabytes of information per day and provide scientific information to more than 2 million users per year.

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Suborbital Science</b> Program Contact: Cheryl Yuhas, NASA/ESE Research Division, 202-358-0758, cyuhas@hq.nasa.gov</p>	27.0	30.0	Directly Related	Shared	
<p>Research: This activity supports the development of highly calibrated airborne observations of the Earth through assurance of calibration facilities and the development and maintenance of a suite of airborne instruments that can be used to study Earth system processes, provide calibration/validation for Earth observing satellites, and serve as sensor test beds for new on-orbit sensors.</p>					
<p>Observations: This activity supports the maintenance and operations of a small fleet of unique high altitude and heavy lift aircraft for Earth observations. It also investigates the utility of new technology platforms for Earth observation. Aircraft are used in process-oriented and satellite calibration/validation field campaigns that are carried out over key geophysical and biogeochemical regions of the Earth.</p>					<p>(1) High resolution multispectral, hyperspectral lidar, and radar observations of Earth surface at needed locations for disaster assessments, documentation of Earth system change, and resource evaluation; (2) in situ measurements of atmospheric concentrations of substances regulated under Montreal Protocol and their atmospheric breakdown products; (3) in situ and remotely sensed measurements of atmospheric pollutants and their contribution to long-range transport and thus inflow for regional air pollution models; (4) combined observations of atmospheric composition and radiation for assessment of atmospheric radiation models used in climate assessment models</p>
<p>Decision Support: This activity allows high quality observations of the Earth system to be made over critical regions in a timely fashion. Applications include such events as the Hutchinson, KS methane leaks; local environmental impacts after the World Trade Center collapse; and search and rescue activities.</p>					

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Information Systems and Computational Technology Program Contact: Tsengdar Lee, NASA/ESE Research Division, 202-358-0860, tlee@hq.nasa.gov; Azita Valinia, NASA/ESE Research Division, 202-358-4471, avalinia@hq.nasa.gov</b></p>	21.8	19.0	Directly Related	Shared	
<p>Research: This activity supports the high end computing requirements for the Earth Science Enterprise, especially computationally demanding applications for data assimilation and modeling for long-term and seasonal/interannual climate. It includes the development of new computational methodologies, algorithms, and software systems suited to take advantage of the capabilities of evolving computational hardware and software. A particular focus is the development of the Earth System Modeling Framework, linking together the high end climate models of multiple federal agencies and key participants in the academic research community, to enhance the interoperability of components of climate models and their exchange among modeling groups in the US.</p>					
<p>Observations: The assimilated data sets enabled by the computing systems are a unique resource for studying the spatial and temporal variability of a broad range of interrelated Earth system parameters based on global observations of the atmosphere, oceans, and land surface. By combining the accuracy of satellite observations with the geophysical completeness of global models, the assimilated data sets are an idea for the study of global variations of the processes that couple Earth system components. The introduction of new computers made available through this activity is dramatically enhancing the capability for generation of assimilated data sets. This past year, progress made has enabled a nearly 10-fold increase in the rate by which assimilated data sets can be produced.</p>					
<p>Decision Support: The climate models run on these systems support international assessments, especially the evaluation of impacts of a range of climate forcing scenarios (esp. those involving non-CO2 forcing factors such as methane and tropospheric aerosols) on the global environment. Seasonal-to-interannual studies focus on the early identification of El Niño/Southern Oscillation events through innovative use of remote sensing data for initializing models and the identification of expected regional impacts.</p>					<p>(1) Long-term model simulations of Earth's climate in response to broad range of forcing factors; (2) Seasonal-to-interannual climate simulations based on global remotely-sensed data for model initiation and validation; (3) Global data assimilation products for use in assessments of climate variability and change; (4) Development of data assimilation approaches for new types of observational data that can be transitioned to partner agencies for use in operational prediction systems.</p>

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Education</b> Program Contact: Ming-Ying Wei, NASA/ESE Applications Division, 202-358-0771, mwei@hq.nasa.gov</p>	12.5	13.1	Supporting	Shared	
<p>Research: This activity supports the training of graduate students through research fellowships and the development of early professional careers in Earths science and remote sensing through the New Investigator Program. It also supports the improvement of teaching and learning in Earth System Science for K-16, and any learning, by children and adults alike, outside the classrooms.</p>					<p>(1) More highly trained pool of scientists through support of ~ 140 graduate student fellowships and ~ 35 new Investigators; (2) Continuation of Earth System Science courses at a total of 45 universities and colleges - student enrollment at the 23 campuses which constituted the second stage of this effort has ranged 4000 +/- 400 per academic year over the last several years; (3) Improved science education through deployment of Earth and Space Systems Science as a full-year curriculum in all 13 high schools in the Anne Arundel, MD county school district, impacting thousands of students each year and getting them excited about science, while meeting core learning goals of state.</p>
<p>Observations: This activity supports inquiry-based learning by students through making observations of environmental variables. Coordinated through observation protocols; the student-made observations are integrated into an internationally accessible data base and to be used in climate research.</p>					
<p>Decision Support: New activities will aim to build capacity for the productive use of Earth science results technology, and information in support of everyday decisions made in public and private sectors</p>					

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Solid Earth Science</b> Program Contact: John Labrecque, NASA/ESE Research Division, 202-258-1373, jlabrecq@hq.nasa.gov</p>	25.1	27.5	Supporting	Shared	
<p>Research: This Program develops a wide variety of research and development within disciplines of space geodesy, gravity, geomagnetism, lidar, and synthetic aperture radar. The contributions include space geodesy networks for the determination of the terrestrial reference frame, the application of spaceborne and airborne systems to risk assessment, disaster mitigation and disaster management. The study of the structure and dynamics of the solid earth and its interaction with the atmosphere, hydrosphere and cryosphere. Solid Earth Science contributes significantly to the climate change programs through its development of the reference frame for sealevel and ice monitoring, precision orbit determination techniques for altimetry satellite tracking, the development of GPS limb sounding another related GPS technologies, the development of precision global topography, and other such contributions.</p>					<p>(1)Improved Terrestrial reference frame with mm accuracy for sealevel and ice mass balance monitoring (2) Advanced spaceborne lidar measurements for precision mapping of coastal zone and flood plains (3) Real time global GPS navigation capability for satellite and airborne precision research with 1 cm accuracy (4). Global magnetic anomaly field to track global field change and reveal solid Earth structure (5). Real time and near real time GPS network for monitoring of ionosphere TEC and atmospheric temperature and water vapor. Volcano monitoring via SAR and GPS are being adopted by USGS and other agencies to forecast volcanic eruptions and plumes affecting ground and aircraft safety.</p>
<p>Observations: The program gathers from its SLR, GPS, VLBI geodetic networks real time and near real time Earth Orientation and length of day. Global crustal deformation, Satellite limb sounding data from the NASA GPS limb sounding constellation. Regional crustal deformation estimated from GPS networks, satellite gravity from orbiting SLR, and GPS satellites. Geomagnetic Field observations from the international partnership satellites. Airborne SAR and lidar for precision topographic measurements.</p>					
<p>Decision Support: this activity provides critical data from the global geodetic networks and the analysis of these data for the determination of the Terrestrial and Celestial Reference Frames, which are key elements in ocean weather and civilian and military use. Ionospheric activity maps are developed from the Global GPS network and real time navigation products are provided for global agriculture. Regional GPS networks provide local crustal deformation studies for earthquake hazards. Global geomagnetic and gravity field maps are developed for navigation, exploration, surveying, and other applications. Precision real time GPS orbits and tracking supplied for global use of precision GPS. Global topography field from the SRTM data set is used by civilian, military, and research community. Program contributes to integration of observations and models for broad range of hazards, and includes use of satellites and aircraft to improve decision making before and after natural disasters. Improved natural hazard detection capabilities will be incorporated into HAZUS model of FEMA.</p>					<p>(1) Terrestrial reference frame with cm accuracy for sealevel and ice mass balance monitoring (2) First global topography derived from satellite radar (3) Real time global GPS navigation capability for satellite and airborne precision operations with 10 cm accuracy (4). Global magnetic anomaly field to track global field change (5). Real time and near real time GPS network for monitoring of ionosphere TEC and atmospheric temperature and water vapor. (6) Global gravity field - such as EGM96 and now upcoming GRACE field at 10 -1000 improved accuracy for climate, weather, navigation, and surveying. (7) Improved natural hazard detection, and rapid response to events, enabling improved public safety and disaster management (mitigation, response, and recovery).</p>

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Technology Development</b> Program Contact: Granville Paules, ESE Program Planning and Development Division, 202-358-0706, gpaules@hq.nasa.gov</p>	80.0	68.3	Supporting	Shared	
<p>Research: This activity supports the development of new technology that will enable new capability, improved performance and reliability, and reduced implementation costs for NASA's space and airborne science, as well as data systems. Component programs include those for development of new components for Earth observations, new instruments for use in airborne and satellite systems for Earth observations, and new approaches to handling the large amounts of data generated by space-based Earth observations, with the handling done both on the ground and on orbit.</p>					
<p>Observations: This activity include the Earth Science component of NASA's New Millennium Program. Current projects include the operation of the EO-1 satellite with its Advanced Land Imager instrument (which allows land cover observations using an instrument significantly less expensive than that used on Landsat and also provides the first space-based use of a hyperspectral imager) and the EO-3 GIFTS-IOMI mission (jointly with NOAA and the US Navy) to provide a test of the next generation of sounding instruments for future use in operational geostationary meteorological satellites. Following an approximately one year test over the Continental US, the satellite will be turned over to the US Navy for operation over the Indian Ocean to provide meteorological support for the Asian region.</p>					(1) Ability to provide observational information about the Earth system at significantly reduced cost for use in future space-based measurement systems; (2) Improvements to weather forecasts (jointly with NOAA) through use of new geostationary observations together with meteorological assimilation and prediction systems.
<p><b>NASA-wide ground system Support</b> Program Contact: Bill Watson, NASA/ESE Program Planning and Development Division, 202-358-4689, wwatson@hq.nasa.gov</p>					
<p>Observations: This activity supports a global network of stations for tracking and data acquisition from ten Earth Science and five Space Science satellites in addition to suborbital rockets, balloons and areal vehicles. The polar commercial and NASA stations are the primary data acquisition sites for the EOS satellite data. Mid-latitude sites support the Space Shuttle launch and landing communications. Sub-orbital radar and telemetry support is provided for the national and international launch ranges.</p>		42.4	Core GCRP	Shared	Note: erroneously considered Core USGCRP in FY03 USGCRP report. Should be corrected and considered supporting.
<p><b>National Applications (in addition to those incorporated into science themes)</b> Program Contact: Ron Birk, NASA/ESE Applications Division, 202-358-1701, rbirk@hq.nasa.gov</p>					
<p>Note: a separate document exists (Socio-Economic Report) for projected cost-savings and economic benefits.</p>	77.3		Directly Related	Shared	Broken down by 3 areas below that crosscut the research areas identified above.

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Aviation Safety (“Digital Airspace”)</b></p> <p>A national blueprint has been put forth by the White House to increase the safety of the national Aviation system by 2007. This program supports this initiative by integrating current GOES data into operational aviation weather products to enable better warnings for phenomena such as convective weather, turbulence and volcanic ash and developing next-generation weather products responsive to operational aviation needs. NASA’s primary investment consists of its contributions to GIFTS, NPP, NPOESS, and AIRS.</p>		3.6	Supporting		<p>(1) High spectral (vertical), horizontal and temporal resolution satellite measurements will provide precise numerical weather forecasts and extremely high-resolution wind fields based on the tracking of atmosphere water vapor; (2) NAS-wide Data Link WX Products provide severe weather location and movement data.</p>
<p><b>Smart Growth for Infrastructure</b></p> <p>Program involves effects urban expansion on local/regional environments and biophysical characteristics influencing human health. Forecasts and strategies for growth of urban areas and value indexes for trading development for rural benefits assist regional development planners. Land protection, housing stock assessment, revitalization and in-fill are considered important characteristics of urban landscapes.</p>		3.6	Supporting		<p>(1) Ground feature analysis to support EPA National Pollution Discharge and Elimination System permitting FEMA's NFIP map modernization and HAZUS data bases; (2) Urban change detection to support US Census Bureau Assessments; (3) Incorporation of urban heat island applications results into planning; (4) Increased knowledge of impervious surfaces for water runoff planning; (5) Land suitability analyses for state, regional, and local planning</p>
<p><b>Early Warning for Homeland Security</b></p> <p>Program will support Office of Homeland Security’s Situation Center and other homeland defense efforts with measurements, technology validation and consultation, models, and visualization techniques to support preparation, warning, and response activities. Information for advanced weather prediction and data from numerous NASA satellites, aircraft, and in situ sensors will feed decision mechanisms to support a variety of homeland threats and events.</p>		3.6	Supporting		<p>(1) Monitoring of air and water quality; (2) Tracking the spread of potentially dangerous plumes and particulates.; (3) Planning and mapping of evacuation routes and related scenarios; (4) Baseline inventories, vulnerability, and mitigation assessments.</p>
<p><b>Miscellaneous</b></p>	3.8	3.7	Supporting		
<p><b>Total</b></p>	1,270.6	1,250.3			

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
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**NIH Agency Representative: Mary Gant/NIEHS, 301-496-3511, gant@niehs.nih.gov**

<b>NCI</b>					
<b>Behavioral Research</b>					
Projects are behavioral interventions designed to prevent skin cancer, aimed at school aged children.	1.0	1.2	Core - GCRP	Other	
<b>Biochem and Pharmacology</b>					
Projects focus on assessment of biological and pharmacological basis of cancer development in response to environmental factors, such as UV.	2.2	2.5	Core - GCRP	Other	
<b>Biological, Chemical, and Physical Carcinogenesis</b>					
These projects focus on the role of these viruses in tumorigenicity and understanding the biological and genetic mechanisms involved in chemical carcinogenesis.	2.5	2.9	Core - GCRP	Other	
<b>Chemoprevention</b>					
Studies focus on agents that reduce UV-induced carcinogenesis. Additionally, studies on the role of diet in cancer development are being pursued.	2.9	3.3	Core - GCRP	Other	
<b>DNA Chromosome Aberration</b>					
DNA repair and its relationship to carcinogenesis is a common theme in this cancer program.	11.0	12.8	Core - GCRP	Other	
<b>Epidemiology and Cancer Survivorship</b>					
These studies will focus on epidemiological assessment of cancers and their relationship to specific environmental factors and whether shorter disease-free survival correlated with higher levels of environmental factors.	6.9	7.9	Core - GCRP	Other	



Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Health Communications and Health Promotion Studies</b>					
These projects produce multimedia programs in both English and Spanish that target home-based child care providers and the preschool children in their care. Included are web based tools, a CD-Rom with games, songs and other activities. Additionally, projects will foster promotion on intervention and strategies for cancer.	5.9	6.8	Core - GCRP	Other	
<b>Multidisciplinary</b>					
This program activity contains numerous cancer center support grants. The research activities of these cancer centers include basic research, clinical research, prevention and control, therapeutics, diagnosis, technology development and epidemiological studies. As all of the research included is multidisciplinary, some of these projects are relevant to the effects of UV radiation to human health, and the health effects related to the use of pesticides and agricultural chemicals.	2.5	3.0	Core - GCRP	Other	
<b>Not Assigned</b>					
The following contracts were not assigned to any of the previous cancer program areas. A contract performing efficacy studies of chemopreventive agents in animals, examines basal cell carcinoma induced by UV radiation and the efficacy of chemopreventive agents such as DFMO, cyclopamine, polyphenone E and celecoxib. Another contract will screen chemopreventive agents in a UV irradiated cell model of human melanoma, including DFMO, numesilid, polyphenone E and 4-hydroxyphenyl retinamide. The Agricultural Health Study-Field Stations contracts will examine the exposure of farmers and their families by collecting data on pesticide exposure. Another contract will run a phase II clinical trial using topical polyphenol E in subjects with actinic keratoses	2.2	2.7	Core - GCRP	Other	
Subtotal, NCI	37.1	43.1			
<b>NHLBI</b>					
<b>Air Pollution and Chronic Lung Disease</b>					
This program addresses the lung health consequences of air pollutants that may induce chronic lung disease or impair childhood growth in lung function. Supported research ranges from epidemiological studies that assess the lung effects of ambient pollution in humans to animal and biochemical and genetics studies of cellular and molecular mechanisms that are involved in injury and repair in the lung from inhaled challenges, especially ozone. These studies are important for predicting how environmental changes may alter the prevalence of chronic lung disease.	5.2	5.8	Supporting	Other	

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Malaria and HTLV 1 &amp; II</b>					
<p>The Division of Blood Diseases and Resources, NHLBI supports a small portfolio of research that investigates parasitic diseases that target the blood system and are a major cause of human morbidity and mortality, particularly in the tropical world. Malaria, which is transmitted by the bite of an infected female Anopheles mosquito, is the most common cause of hemolytic anemia and remains one of the most destructive infectious diseases. The growing threat of drug resistant forms of malaria has created an urgent need for new drugs. Research efforts currently underway address the basic biology of the parasite and the development of new drugs or vaccines that would inhibit the invasion of erythrocytes (red blood cells) by the malaria parasites by identifying and characterizing the molecules and signaling pathways that are involved in this process. The Division also supports research on infectious pathogens such as HTLV types I and II, HIV and hepatitis that threaten the world's blood supply. Current studies involve the development of a supplemental diagnostic test for HTLV types I and II; to extend knowledge about the na</p>	2.6	2.5	Supporting	Other	
<b>Acute Chagasic Myocarditis</b>					
<p>Increased activity of inducible nitric oxide synthase (Inos) is an important factor contributing to the occurrence of apoptosis in the heart in various disorders. The present study was designed to evaluate the correlation of these changes in acute Chagasic myocarditis. Apoptosis was most common in macrophages and lymphocytes, but was also observed in endothelial cells, as well as in infected and uninfected myocytes and dendritic cells in areas of inflammation. The parasites within some of the infected myocytes gave a positive reaction for apoptosis. Reactivity for iNOS and nitrotyrosine was strong in myocytes and macrophages. In myocytes, the extent of apoptosis in intracellular T. cruzi correlated with the intensity of staining for iNOS. iNOS is greatly increased in areas of inflammation in acute Chagasic myocarditis, suggesting that it plays a role (by generating NO) in inducing apoptosis in T. cruzi and host cells.</p>	1.8	2.0	Supporting	Other	
Subtotal, NHLBI	9.6	10.3			
<b>NIAID</b>					
<b>Vector Borne Diseases</b>					
<p>Including malaria, arboviral diseases, filariasis, leishmaniasis, Lyme disease, schistosomiasis, trypanosomiasis, plague, rickettsial diseases</p>	224.0	252.6	Supporting	other	
<b>Water Borne Diseases</b>					
<p>Including cholera</p>	33.2	39.0	Supporting		
<b>Subtotal, NIAID</b>	257.2	291.6			

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>NEI</b>					
The National Eye Institute (NEI) conducts and supports research on blinding eye diseases and visual disorders. The NEI is supporting research on the effects of UV light on the eye and the potential link between UV exposure and diseases such as cataract and macular degeneration.	15.5	16.6	Core - GCRP	Other	
<b>NIEHS</b>					
<b>Vector or parasite induced disease states</b>					
Research related to health effects induced by vectors or parasites whose range or activities might change due to altered climate and global change	0.9	1.0	Supporting	Other	
<b>Health effects of altered infrastructure and diminished resource supply</b>					
Research relating to health effects of due to adverse impacts on economy, infrastructure and resource supply	0.3	0.3	Supporting	Other	
<b>Respiratory disorders and deaths related to air quality</b>					
Research relating to acute and chronic respiratory disorders (e.g., asthma) related to increased air pollution	20.2	21.8	Supporting	Other	
<b>Health effects of ozone-depleting chemicals</b>					
Research related to health effects induced ozone depleting chemicals	0.1	0.1	Core - GCRP	Other	
<b>UV related health effects</b>					
Research related to health effects of UV radiation	4.3	4.7	Core - GCRP	Other	
<b>Pesticide exposure and human health</b>					
Research related to health effects of pesticide exposure	29.7	31.9	Supporting	Other	
Subtotal, NIEHS	55.5	59.8			
<b>NIA</b>					
<b>Stress &amp; Aging Program Contact: David Conrad, NIA Budget Office, (301) 496-9147</b>					
NIA supports research in (3) projects related to climate & global change; cellular responses to stress in normal and aged cells, Aging and gender effects on responses to cold in rats, and heat shock protein regulation with stress and aging	1.9	2.1	Supporting	Other	Results of this research could lead to the design of new therapies to protect the elderly against situations involving physiological stress.

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>NIAMS</b>					
<b>Effects of UV Radiation on the Skin and Skin Diseases</b> Program Contact: Alan Moshell, NIAMS, 301-594-5017, moshella@mail.nih.gov					
Basic and clinical research that studies the cause and effect of exposure to radiant energy and the prevention and protection from adverse effects of UV radiation on the skin. Research may also involve examining direct and indirect health consequences of climate and global change.	3.0	3.5	Core - GCRP	Other	
<b>FIC</b>					
<b>Emerging Infectious Diseases: Training grants in this program include Actions for Building Capacity (ABC), Malaria, and an International Training and Research program in Emerging Infectious Diseases (ITREID).</b> Primary: Dr. Kenneth Bridbord, Division Chief of International Training and Research; (301) 496-1653; bridbork@mail.nih.gov Secondary: Dr. Josh Rosenthal, Division Deputy of International Training and Research; (301) 496-2516; rosenthaj@mail.nih.gov					
The ABC program supports current and future collaborative training-related research on disease that is mostly endemic in or impacts on tropical countries. The Malaria program was developed to train/expand the capabilities of scientists and health professionals from malaria endemic developing countries, and to engage in malaria research. The ITREID program enables universities and non-profit research institutions to support international training and research programs for foreign scientists and public health workers from developing nations in research and control and prevention strategies related to emerging and re-emerging infectious diseases.	0.4	0.4	Supporting	Other	
<b>Ecology of Infectious Diseases: Research grants in this program are a joint NIH-NSF initiative</b> Primary: Dr. Kenneth Bridbord, Division Chief of International Training and Research; (301) 496-1653; bridbork@mail.nih.gov; Secondary: Dr. Josh Rosenthal, Division Deputy of International Training and Research; (301) 496-2516; rosenthaj@mail.nih.gov					
This program supports efforts to understand the underlying ecological and biological mechanisms that govern relationships between human-induced environmental changes and the emergence and transmission of infectious diseases. The focus of this program is on the development of predictive models for the emergence and transmission of diseases in humans and other animals, and ultimately the development of strategies to prevent or control them.	0.7	0.8	Supporting	Other	
Subtotal, FIC	1.1	1.2			
Total, NIH	380.9	428.2			

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>NIST Agency Representative: Hratch Semerjian, (301) 975-8300, hratch@nist.gov</b>					
<b>National Standards for Physical Measurements Program Contact: James Whetstone, NIST, Chemical Science and Technology Laboratory, (301) 975-2609, james.whetstone@nist.gov</b>					
NIST develops physical standards that enable researchers to more accurately monitor the Earth's atmosphere, oceans, and climate for a wide range of physical parameters including temperature, air speed, pressure and vacuum, and humidity. NIST maintains formal international collaborations to assure international recognition of its standards to facilitate global decision making.	1.5	1.5	Directly Related	Observation and Monitoring Systems	Improved physical measurements and standards for environmental monitoring that are recognized and accepted in the global community.
<b>Measurements and Standards for Chemical Composition of the Atmosphere Program Contact:Willie May, NIST Chemical Science and Technology Laboratory, (301) 975-3108, willie.may@nist.gov</b>					
NIST develops a wide range of standards for atmospheric monitoring and global warming to ensure the accuracy of chemical composition measurements worldwide. These include primary gas standards for GWGs and VOCs, standards for aerosol characterization and transport, and CO2 isotopic standards for source apportionment of all carbonaceous gases. NIST's SRP provides an accuracy base for ozone monitoring in EPA's ozone network laboratories, as well as environmental laboratories worldwide.	1.6	1.8	Directly Related	Atmospheric Composition	Improved chemical measurements and standards for atmospheric composition studies that are recognized and accepted in the global community.
<b>Measurements and Standards for Remote Sensing Program Contact: Albert Parr, NIST Physics Laboratory, (301) 975-2316, albert.parr@nist.gov</b>					
NIST provides measurements and standards that support accurate and reliable climate observations. NIST also maintains formal collaborations internationally, thus assuring worldwide acceptance of its measurements and standards. NIST performs calibrations and special tests of a wide range of instruments and measurement techniques for accurate measurement of absorption and emission spectra from the x-ray through the microwave region. For example, NIST provides direct calibration support for numerous monitoring systems including NASA EOS, SeaWiFS, NOAA/GOES, Scripps-NIST instrument on Triana. NIST also develops microarray sensor technologies for atmospheric monitoring applications.	2.3	2.3	Directly Related	Observation and Monitoring Systems	Improved remote sensing accuracy and reliability, and framework for international comparability of measurements.
<b>Evaluated Reference Data Program Contact:W. Mickey Haynes, NIST Chemical Science and Technology Laboratory, (303) 497-3247, whaynes@nist.gov</b>					
NIST provides a wide array of data and modeling tools that provide key support to developers and users of complex climate prediction models. NIST collaborates with NASA on atmospheric lifetimes and chemical kinetics of GWGs, and with DOE on the properties of alternative refrigerants. NIST also provides spectral data, such as FT-IR, for GWGs, and transport data for membrane separations of CO2 and other combustion gases, and other data applicable to carbon management including CO2 solubility data as well as thermophysical property data required for CO2 sequestration studies.	1.6	1.7	Directly Related	Climate Models and Simulation	Evaluated high quality data on physical and chemical properties of GWGs for climate change models
<b>National Biomonitoring Specimen Bank Program Contact:Willie May, NIST Chemical Science and Technology Laboratory, (301) 975-3108, willie.may@nist.gov</b>					
NIST collaborates with NOAA to maintain a cryogenic specimen bank where marine tissue samples are frozen for retrospective studies. This effort will be expanded in FY 03 to include marine blood samples. The specimen bank also contains human liver samples provided by the EPA, and food samples provided by Dept. of Agriculture.	1.0	1.0	Directly Related	Carbon Cycle	Tools for retrospective studies of preserved biological tissue samples to assess the impact of environmental change
<b>Total, NIST</b>	8.0	8.3			

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>NOAA Agency Representative: David L. Evans, (301) 713-2458, david.evans@noaa.gov</b>					
<b>Aerosol-Climate Interaction Program (ACIP) Program Contact: Joel Levy, NOAA OGP</b>					
<p>The Aerosol-Climate Interaction Program (ACIP) element seeks to contribute a better predictive understanding of the role of anthropogenic aerosols in climate forcing through reduced uncertainty in the magnitude and distribution of the radiative forcing attributable to the aerosols. The Program's goal closely parallels the aerosol-related aims of the International Geosphere-Biosphere Program's (IGBP) International Global Atmospheric Chemistry (IGAC) Project, while its research foci reflect the priorities and objectives of the National Aerosol-Climate Interaction Program. To achieve its goal, ACIP supports a multipartite, multi-agency, internationally-oriented research strategy, employing field characterization studies, process studies, laboratory studies, and theoretical modeling.</p>	1.1	1.1	Core - GCRP	Climate Variability & Change	<p>Analyses of datasets gathered in the ACE-Asia field deployment; Development of state-of-the-art methodologies for in-situ sampling and analyses of aerosols; Development of an observational database of aerosol properties in climatically important regions of the world; Establishment of observationally-constrained bounds on black carbon radiative forcing.</p>
<b>Atmospheric Chemistry Program Contact: Dan Albritton, NOAA AL</b>					
<p>The Atmospheric Chemistry program element pursues two overall research objectives: to improve the predictive understanding of (i) the radiative forcing of the climate system by chemically-active atmospheric species (such as tropospheric ozone) and (ii) the recovery of the stratospheric ozone layer (such as the role of climate change). Chemical transformation and meteorological transport research involves integrated global observations, laboratory studies, and theoretical modeling of NOAA and extramural partnerships. The Project supports and carries out these national and international collaborative activities as part of the International Global Atmospheric Chemistry (IGAC) project and the Stratospheric Processes and their Role in Climate (SPARC).</p>	6.8	6.8	Core - GCRP	Atmospheric Composition	<p>Understanding the recovery of the stratospheric ozone layer and the factors that influence it, such as aviation and climate change; Characterizing the atmospheric processes that determine the ozone depletion and radiative forcing of the substitutes for the now-banned ozone-depleting compounds; Quantify the radiative forcing of the short-lived atmospheric species, such as tropospheric ozone, thereby providing option-related links of surface pollutant emissions to climate change.</p>
<b>Climate Change Data and Detection (CCDD) Program Contact: Bill Murray, NOAA OGP</b>					
<p>The Climate Change Data and Detection (CCDD) program element ensures that the data needed to understand the climate system is available for analysis. The data and resultant products extend the existing long-term climate record and serve as essential input to predictive models. In addition, CCDD provides support for documenting variations in climate on time scales ranging from less than one year to periods of 100 years and longer. Support is also provided for the analysis of observed climate variations and changes to identify causes that are consistent with Earth's long-term climate history.</p>	6.9	6.9	Core - GCRP	Climate Variability & Change	<p>Produce data sets needed to understand the climate system and ensure these data sets are available for analysis.</p>

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Climate Dynamics and Experimental Prediction (CDEP) Program Contact:Anjali Bamzai, NOAA OGP</b>					
The Climate Dynamics and Experimental Prediction (CDEP) program element supports NOAA's efforts towards improved global climate predictions on time scales of seasonal to interannual through the Applied Research Centers (ARCs). The ARCs comprise a set of centers committed through a critical mass of technical and intellectual resources, to tackle in a sustained manner, problems inherent in implementing climate services for the Nation. The ARCs help develop and support climate services through a program of basic and applied research, development and experimental applications, leading to a coordinated suite of critical contributions to the predictions and assessments of climate variability produced by NOAA's Climate Prediction Center (CPC), the International Research Institute for Climate Prediction (IRI), as well as regional assessment and applications.	18.0	18.0	Core - GCRP	Climate Variability & Change	Improved capability for predictions of global climate variability; Decision support tools for quantitative assessments of regional implications of global climate variability on time scales ranging from seasonal to centennial.
<b>Climate Variability and Predictability (CLIVAR) Program Contact:Ming Ji, NOAA OGP</b>					
NOAA Climate Variability and Predictability (CLIVAR) program element is to develop skillful predictions of climate variability and change on seasonal to multi-decadal time scales and regional spatial scales for optimal use in resource planning and policy decision making. The scientific objective of the NOAA CLIVAR program is to understand the mechanisms of major patterns of climate variability and change on seasonal to decadal and longer time scales and to develop the predictive capability for these patterns of climate variability.	23.3	23.3	Core - GCRP	Climate Variability & Change	Improved climate prediction and projection capability for global climate variability and change on seasonal, interannual, decadal and centennial time scales.
<b>Global Energy and Water Cycle Experiment (GEWEX) Americas Prediction Program (GAPP) Program Contact:Rick Lawford, NOAA OGP</b>					
The Global Energy and Water Cycle Experiment (GEWEX) Americas Prediction Program (GAPP) element objectives are to make monthly to seasonal predictions of the hydrological cycle and to use these improved predictions for better water resources management. The first objective largely involves improving the land surface, hydrology, and boundary layer representations of models used for climate prediction through improved understanding of the hydrological processes, feedbacks between the land and atmosphere, orographic processes, the role of land in monsoon systems model transferability, and development of a comprehensive modeling system. The second objective involves scaling the climate model output to make it useful for water resource managers, improved understanding of the links between hydrologic predictions and water resources management.	5.8	5.8	Core - GCRP	Water cycle	Development of improved monthly to seasonal predictive capability for the hydrological cycle and applications of the improved predictions for improved water resources management.
<b>Global Carbon Cycle Program Contact:Lisa Dilling, NOAA OGP</b>					
The Global Carbon Cycle (GCC) program element seeks to improve our ability to predict the fate of anthropogenic carbon dioxide (CO2) and future atmospheric CO2 concentrations using a combination of atmospheric and oceanic global observations, process-oriented field studies, analysis, and modeling. The GCC program is a part of the interagency Carbon Cycle Science initiative of the U.S. Global Change Research Program (USGCRP). Background information on the scientific justification for the integrated carbon cycle program can be found in the Carbon Cycle Science Plan (1999) and the North American Carbon Plan (2001).	4.8	4.8	Core - GCRP	Carbon cycle	The global carbon cycle program seeks to improve our ability to predict the fate of anthropogenic carbon dioxide (CO2) and future atmospheric CO2 concentrations using a combination of atmospheric and oceanic global observations, process-oriented field studies and modeling.

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Health and Human Dimensions Program Contact:Nancy Bellers-Simms, NOAA OGP</b>					
The Health and Human Dimensions program aims to (1) improve our understanding of how social and economic systems are currently influenced by fluctuations in short-term climate (seasons to years), and how human behavior can be (or why it may not be) affected based on information about variability in the climate system; and (2) understand the pathways through which climate affects human health and explore opportunities for applying that information for public health policy and decision-making.	1.9	1.9	Core - GCRP	Socio-Economic Analyses	Improve understanding of the role of climate information in public policy and decision making across temporal and spatial scales for enhancing resilience and reducing vulnerability.
<b>Regional Integrated Sciences and Assessments (RISA) Program Contact:Harvey Hill, NOAA OGP</b>					
The RISA program supports research on the status, trends, influencing factors and future projections of evolving interactions between the physical and social environments and on associated decision-making needs over different spatial and temporal scales, within the U.S. The "regional" scale offers an appropriate organizational unit on which to coordinate research on the environment-society interface, and on which socially relevant information can be created and provided cognizant of geophysical and jurisdictional boundaries.	3.2	3.2	Core - GCRP	Socio-Economic Analyses	Currently there are five Regional Integrated Sciences and Assessments activities. The activities are focused on the Pacific Northwest, the Southwest, California, Inter-Mountain West, and the Southeast regions of the United States. Research deliverables are: Identification of climate sensitive issues that are tractable and important to regional decision-makers; Integration of climate forecast information in water resource, wildfire, agriculture, and management; Improvements in climate information delivery.
<b>Environment, Science, and Development (ESD) Program Contact:Lisa Farrow, NOAA OGP</b>					
The ESD program is designed to further the development of innovative, place-based approaches to understanding and enhancing the interactions between humans, climate and the environment, and to link these outcomes and methods to real world challenges associated with natural resource management, vulnerability reduction and sustainable development.	0.6	0.6	Core - GCRP	Socio-Economic Analyses	Improved utility of NOAA science and technology by decision and policy makers; reduced vulnerability to natural disasters and improved quality of life.
<b>Climate Change Research Initiative</b>					
<b>Climate Modeling Center Program Contact:Ants Leetmaa, NOAA GFDL</b>					
A climate modeling center will be established within the Geophysical Fluid Dynamics Laboratory (GFDL) at Princeton, New Jersey, which will focus on model product generation for research, assessment and policy applications as its principal activity. GFDL has played a central role in climate research, pioneering stratospheric modeling, seasonal forecasting, ocean modeling and data assimilation. This core capability will be enhanced to enable product generation and policy related research.	0.0	5.0	Core - CCRI	Climate Variability & Change	Develop a new Earth Model System; Climate Assessment reports; seasonal maps fo carbon sources and sinks at continental scales.



Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Global Climate Atmospheric Observing System Program Contact:Howard Diamond, NOAA/NESDIS, 301-713-1283, Howard.Diamond@noaa.gov</b>					
<p>While the national system has made a start in the design and operation of a climate reference network, developing countries in particular have often been unable to maintain observing schedules or to transmit the information effectively. NOAA will work with other developed countries to reestablish the benchmark upper-air and surface networks, emphasizing data sparse areas, and place new Global Atmosphere Watch stations in priority sites to measure pollutant emissions, aerosols, and ozone in specific regions.</p>	0.0	4.0	Core - CCRI	Climate Variability & Change	Marked improvement in the receipt rate of International Climate Data from the one-third of GCOS Surface Network (GSN) and GCOS Upper Air Network (GUAN) sites currently not reporting data.
<b>Global Ocean Observing System Program Contact:Mike Johnson, NOAA OGP</b>					
<p>An observing system that can accurately document climate-scale changes in ocean heat, carbon, and sea level change is not in place. Some effective subsystems have recently been developed to monitor some aspects of the ocean. However, major issues remain in better determining fields of sea surface temperature and surface fluxes. There is also a crucial need to systematically provide continuous, three-dimensional fields of variables for the ocean: heat content, salinity and currents. The Global Ocean Observing System will provide the U.S. and its international partners with critical information on the role of the ocean in climate and the rate of climate change through changes in heat storage. The ocean data will be used to develop, test, and initialize comprehensive climate models.</p>	0.0	4.0	Core - CCRI	Climate Variability & Change	see COSP Ocean Observing System
<b>Aerosols Program Contact:Lucia Tsaoussi, NOAA OARHQ</b>					
<p>NOAA will contribute to the interagency National Aerosol-Climate Interactions Program (joint with NASA, DOE, NSF) currently under development. Specifically, NOAA will establish new and augment existing in-situ monitoring sites and conduct focused field campaigns to establish aerosol chemical and radiative properties. In collaboration with the NPOESS Integrated Program Office (IPO), NOAA will advance the development of the NPOESS planned satellite measurement capabilities.</p>	0.0	2.0	Core - CCRI	Climate Variability & Change	observations of aerosol chemical and radiative properties
<b>Carbon Monitoring Program Contact: David Hofmann, NOAA CMDL</b>					
<p>NOAA will augment carbon monitoring capabilities in North America as well as observations of globally relevant parameters in key under-sampled oceanic and continental regions around the globe, selected to reduce high uncertainty in current flux estimates.</p>	0.0	2.0	Core - CCRI	Carbon cycle	New carbon vertical profiling stations in North America to determine size and variability of the carbon sink, leading to North American carbon maps in the future
<b>Regional Integrated Sciences and Assessments Program Contact:Jim Buizer, NOAA OGP</b>					
<p>Working with NSF, NOAA will augment its research capability in assessing climate change impacts vulnerability by utilizing the research on “decision making in the face of uncertainties” in the framework of the RISA programs, e.g. Pacific North West.</p>	0.0	1.0	Core - CCRI	Socio-Economic Analyses	

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>NOAA Laboratories</b>					
<b>Aeronomy Laboratory Program Contact: Dan Albritton, NOAA AL, 303 497-5785 and aldiroff@al.noaa.gov</b>					
AL carries out research involving laboratory experiments, field campaigns, and diagnostic modeling to better characterize the chemical, dynamical, and radiative processes of the Earth's atmosphere that are needed to improve the capability to predict climate change and variation. The current research foci include (i) observations of the distributions and radiative properties of gases and aerosols; (ii) the influence of gas and aerosol chemistry on cloud formation and radiative properties; (iii) the impact of ozone-layer depletion on the climate system; and (iv) relating scientific information to information needs via state-of-understanding assessments.	8.1	8.7	Directly Related	Atmospheric Composition	Observation-based description of how the chemical composition of aerosols can influence their effectiveness to serve as seeds for forming ice from liquid water in clouds, thereby testing and improving the current understanding of the aerosol indirect effect on clouds and hence climate.
<b>Air Resources Laboratory Program Contact: Bruce Hicks, NOAA ARL</b>					
ARL studies the biogeochemical cycles of trace substances and their effects and interactions with the radiative regime at the earth's surface. ARL operates research-grade measurement stations at which the exchange of carbon dioxide and water vapor between the air and the biosphere is directly measured, and other stations at which the infrared and ultraviolet as well as visible components of the surface radiation balance are monitored. ARL focuses not only on the development of deterministic models to describe the relevant processes, but also on the often dominant role of random variability that cannot be explained by current understanding. Research in all of these areas involves physical and numerical studies, leading to the development of specialized models.	3.4	3.9	Directly Related	Atmospheric Composition	
<b>Atlantic Oceanographic and Meteorological Laboratory Program Contact: Kristina Katsaros, NOAA AOML</b>					
AOML provides and interprets oceanographic data and conducts research relevant to decadal climate change and coastal ecosystems. This research includes the dynamics of the ocean, its interaction with the atmosphere, and its role in climate and climate change. On a global scale, AOML scientists, in conjunction with the PMEL and CMDL are studying the exchange of CO <sub>2</sub> between the ocean and the atmosphere and its effects on global warming and climate change. This research is conducted through numerous open ocean cruises aboard NOAA's research vessel, the NOAA Ship Ronald H. Brown. AOML hosts NOAA's Global Ocean Observing System Center (GOOS Center).	5.7	6.7	Directly Related	Climate Variability & Change	
<b>Climate Diagnostics Center Program Contact: Randall Dole, NOAA CDC</b>					
CDC develops national capabilities to describe, interpret, and predict climate variations on time scales ranging from a few weeks to centuries. CDC's specific expertise is the development and application of state-of-the-art diagnostic techniques to identify the causes and potential predictability of important climate phenomena such as droughts, floods, El Niño-Southern Oscillation, and decadal-to-centennial climate variations. CDC also performs extensive intercomparisons of observational and climate model data, an activity vital to improving models used for climate research and forecasts.	2.6	2.8	Directly Related	Climate Variability & Change	

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Climate Monitoring and Diagnostics Laboratory Program Contact:David Hofmann, NOAA CMDL</b>					
CMDL conducts climate research related to atmospheric constituents that are capable of forcing change in the climate of the Earth or that may deplete the ozone layer. CMDL monitors greenhouse gases, aerosols, ozone, ozone-depleting gases and solar and terrestrial radiation at global sites including four Baseline Observatories.	6.0	6.8	Directly Related	Atmospheric Composition	Annual reports on atmospheric trends of greenhouse gases, ozon depleting chemicals in the atmosphere, and aerosol climate forcing characteristics.
<b>Geophysical Fluid Dynamics Laboratory Program Contact:Ants Leetmaa, NOAA GFDL</b>					
GFDL's mission is the production of timely and reliable knowledge on natural climate variability and anthropogenic climate changes and in the development of the required earth system models, and to work cooperatively in NOAA to advance its expert assessments of changes in national and global climate. To achieve its mission GFDL conducts comprehensive long lead-time climate research fundamental to expanding the scientific understanding of the physical and chemical processes that govern the behavior of the atmosphere and oceans as complex fluid systems. This research leads to state-of-art earth system models which are systematically utilized to provide a suite of climate products for decision support by policy makers. To enable the research and climate simulations GFDL supports a very large, scalable computer system.	14.2	15.3	Directly Related	Climate Variability & Change	
<b>Great Lakes Environmental Research Laboratory Program Contact:Stephen Brandt NOAA GLERL 734-741-2244 Brandt@glerl.noaa.gov</b>					
GLERL climate research focuses on the potential impacts of climate change and variability on the Great Lakes ecosystem and hydrologic cycle. A mesoscale Climate Model, driven by GCM outputs is being use to assess impacts of long-term climate change on lake levels and potential ecosystem impacts. Climatologies of lake ice cover and lake thermal structure are being used as a basis for statistical forecasts A basin hydrologic model is being used to forecast probabilities of lake levels. Paleoclimatologies are being examined using proxies in lake sediment cores. Products and outreach are being transmitted through an established regional infrastructure.	1.4	1.5	Supporting	Water cycle & Terrestrial and Marine Ecosystems	
<b>Pacific Marine Environmental Laboratory Program Contact:Eddie Bernard, NOAA PMEL</b>					
Current PMEL programs focus on coastal and open ocean observations in support of prediction of the ocean environment on time scales from days to decades. Studies are conducted to improve our understanding of the complex physical and geochemical processes operating in the world oceans, to define the forcing functions and the processes driving ocean circulation and the global climate system, and to improve environmental forecasting capabilities and other supporting services for marine commerce and fisheries. The internationally-known laboratory leads the way in El Niño research that has improved climate forecasts leading to reduced fatalities and property losses.	8.5	9.6	Directly Related	Climate Variability & Change	

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Climate Observations and Services Program (COSP)</b>					
<b>Climate Reference Network Program Contact: Tom Karl, NOAA NCDC</b>					
The vision of the Climate Reference Network is to provide the highest quality information about variations and changes of surface temperature and precipitation across the United States on both the national and regional spatial scales. A network has been identified with adequate spatial coverage to capture most (90%) of the variance of national trends. This network will eventually be expanded internationally in conjunction with other developed nations participating in the Global Climate Observing System. This will ensure long-term and bias-free global monitoring, including validation of NOAA's space-based monitoring capabilities.	3.5	3.5	Core GCRP	Climate Variability & Change	Climate observing network; number of stations to be added: FY02 - 40; FY03 - 0; FY04 - 54
<b>Climate Data &amp; Information Program Contact: David Goodrich, NOAA COSP</b>					
As the observational capabilities increase and the observing networks expand, it is essential that data management and dissemination systems are in place to make the resulting data and information widely and easily accessible to public and private sector decision makers. NOAA must develop the required infrastructure to assemble, develop, and communicate the data, information, and knowledge about the trends, likelihoods, and future expectations of climate and weather events.	1.2	1.2	Core GCRP	Climate Variability & Change	Improved national and global weather, water, and climate guidance, forecasts, warnings, and analyses.. Enhanced NCEP global atmospheric circulation model. Operational monitoring of NOAA and global networks through the development of a variety of performance indicators: Global Climate Observing System Global Surface Network, Volunteer Observing Ships, Climate Reference Network.
<b>Baseline Observatories Program Contact: David Hofmann, NOAA CMDL</b>					
These funds are used to maintain and expand operations at NOAA's manned Global Atmospheric Baseline Observatories, which measure up to 250 different atmospheric parameters relevant to the study of climate change and ozone depletion at: Barrow, Alaska; Mauna Loa, Hawaii (since 1957); Cape Matatula, American Samoa; and South Pole, Antarctica (also since 1957), and for operations at NOAA's Baseline Air Quality station at Trinidad Head, California.	2.9	2.9	Core GCRP	Atmospheric Composition	Improved facilities for monitoring climate-forcing parameters and improved support of other agencies and university cooperative programs.
<b>Regional Integrated Assessments, Education and Outreach Program Contact: Robert Livezey, NOAA CSD</b>					
The impacts of climate variability from season-to-season or year-to-year manifest themselves on regional and local levels. The goal is utilization of climate variability information by regional and local managers and decision-makers to maximize economic gain and mitigate potential harmful impacts from climate variability and change.	2.0	2.0	Core GCRP	Socio-Economic Analyses	Place-based decision support tools and services to increase the utility of climate information for decision-makers. Sector- and region-specific decision calendars. New research methodologies and techniques, providing feedback into research priorities for conducting integrated science. Policy-relevant climate indices. Partnership and training programs.

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Climate Change Assessments Program Contact:Tom Karl, NOAA NCDC</b>					
Environmental assessments have become the primary tool to deliver decadal-centennial related information and knowledge to governments, industry, the scientific community and the general public. NOAA climate scientists have led and contributed to Ozone, IPCC and US National Assessments.	0.8	0.8	Core GCRP	Climate Variability & Change	The 2003 international assessment for the U.N. Montreal Protocol on the protection of the ozone layer - Scientific Assessment of Ozone Depletion; The North American Climate Extremes Assessment; The Arctic Climate Impacts Assessment of the international Arctic Council.
<b>Weather-Climate Connection Program Contact:Randall Dole, NOAA CDC</b>					
This activity seeks to understand the relationship between sub-seasonal tropical variability and changes in the frequency, location and intensity of extreme weather events over the U.S. Observational and modeling efforts document the pattern of variations in tropical rainfall on weekly to monthly time-scales, as well as air-sea interactions in both tropical systems and in mid-latitude oceanic and land-falling storms.	1.1	1.1	Core GCRP	Climate Variability & Change	Improved ability of models to forecast subseasonal variations of rainfall in the tropics, which can have significant impacts on the skill of precipitation forecasts along the West Coast. Datasets to be applied to improving surface temperature and precipitation forecasts in the 5-15 day range over the continental United States.
<b>Carbon Cycle Program Contact:Ken Mooney, NOAA OGP</b>					
The U.S. scientific community recently completed a plan for an integrated carbon cycle science program which aims to quantify, understand and project the evolution of global carbon sources and sinks in order to better predict future climate. As part of a multi-agency effort, NOAA has begun a network of airborne and tall-tower based sampling sites over North America. This sampling program will complement local scale process research managed by other agencies and provide an estimate of the magnitude of regional terrestrial sinks on a continental scale.	2.7	2.7	Core GCRP	Carbon cycle	Global carbon dioxide trends and source/sink information
<b>Ocean Observing System Program Contact:Mike Johnson, NOAA OGP</b>					
NOAA is establishing and maintaining the sustained global observing system necessary for climate research and prediction as well as the long-term monitoring system necessary for climate change detection and attribution. Most of these funds are managed through the National Ocean Partnership Program (NOPP), whose function is to integrate existing and new ocean observational efforts of the NOPP agencies and their partners to facilitate broad user access to ocean knowledge, data, tools and products. This integrated approach to ocean observations enables the U.S. to more effectively meet shared observational and prediction needs covering the wide range of ocean research and operational requirements of the NOPP agencies.	13.4	13.4	Core GCRP	Climate Variability & Change	Improved documentation and analysis of long-term climate variability, aiding in adaptation to change. Accurate documentation and forecasting of sea level change, aiding engineering and land-use decisions in coastal regions. Critical measurements for diagnosing seasonal-to-decadal climate variability and predictability

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>SEARCH (Study of Environmental Arctic Change ) Program Contact:John Calder, NOAA ARO</b></p>					
<p>The NOAA component of the interagency SEARCH program is focused on detection of climate change in the Arctic and on achieving predictive understanding of long-term trends in the ocean, atmosphere, and land surface. The SEARCH Science and Implementation Plans identify several key activities that should be undertaken by NOAA over the long term. NOAA has begun three of the most critical activities whose results will improve forecasts of temperature, precipitation and storminess across the U.S., with potential resulting improvements in forecasting and planning for energy needs, growth seasons, hazardous storm seasons and water resources, as well as provide for better management of Arctic resources.</p>			Supporting	Climate Variability & Change	Data sets and analytic tools
<p><b>NESDIS</b></p>					
<p><b>National Polar-orbiting Operational Environmental Satellite System (NPOESS) Program Contact:John Cunningham, NOAA/NESDIS. 301-427-2070, john.d.cunningham@noaa.gov</b></p>					
<p>NPOESS is a convergence of the nation's two operational weather satellite systems - NOAA's Polar-orbiting Operational Environmental Satellite (POES) (<a href="http://poes2.gsfc.nasa.gov/">http://poes2.gsfc.nasa.gov/</a>), and the DoD's Defense Meteorological Satellite Program (DMSP). In October 1994, NOAA, DoD, and NASA created an Integrated Program Office (IPO) that will develop, manage, acquire, and operate the NPOESS system. The IPO concept provides each of the participating agencies with lead responsibility for one of three primary functional areas. NOAA has overall responsibility for the converged system and is responsible for satellite operations. NOAA is also the primary interface with the international and civil user communities. The DoD is responsible to support the IPO for major systems acquisitions, including launch support, while NASA has the primary responsibility for facilitating the development and incorporation of new cost-effective technologies into the converged system. The first converged NPOESS satellite is expected to be available for launch in the latter half of the decade, approx. (cont.) 2008, depending on when the remaining POES and DMSP program satellite assets are exhausted. Present plans call for the program to r</p>	132.2	199.3	Supporting	Climate Change & Variability	Enhanced Climate Data Sets
<p><b>National Polar-orbiting Operational Environmental Satellite System (NPOESS) Program Contact:John Cunningham, NOAA/NESDIS. 301-427-2070, john.d.cunningham@noaa.gov</b></p>					
<p>NPOESS Continued: The Visible/Infrared Imager Radiometer Suite (VIIRS) on NPOESS (<a href="http://npoesslib.ipnoaa.gov/S_viirs.htm">http://npoesslib.ipnoaa.gov/S_viirs.htm</a>) will collect visible/infrared imagery and radiometric data, including sea surface temperature and ocean color. The VIIRS combines the radiometric accuracy of the AVHRR currently flown on the NOAA polar orbiters with the high spatial resolution (0.65 kilometer) of the operational line-scan system (OLS) flown on DMSP. The VIIRS thus provides the capabilities to produce higher resolution and more accurate measurements of sea surface temperature than currently available from the AVHRR instrument on POES, as well as an operational capability for ocean color observations and a variety of derived ocean color products.</p>	50.4	75.9	Directly related	Climate Change & Variability	Enhanced Climate Data Sets

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>NPOESS Preparatory Project Program Contact:John Cunningham, NOAA/NESDIS. 301-427-2070, john.d.cunningham@noaa.gov</b></p>					
<p>The mission of NPP is to demonstrate advanced technology for atmospheric sounding, providing ongoing observations about global change after EOS-Terra and EOS-Aqua. It will supply data on atmospheric and sea surface temperatures, humidity soundings, land and ocean biological productivity, and cloud and aerosol properties. NPP will contribute to instrument risk reduction by offering early instrument and system level testing, lessons learned for design modifications in time to ensure NPOESS launch readiness, ground system risk reduction, early user evaluation of NPOESS data products, such as algorithms, and instrument verification, and opportunities for instrument calibration.</p>	Funding included in NPOESS Budget	Funding included in NPOESS Budget	Supporting	Climate Change & Variability	Enhanced Climate Data Sets
<p><b>Archive, Access, and Ingest (including GOES Active Archive and IT Mission Support) at National Climatic Data Center Program Contact:Tom Karl, NESDIS/NCDC, 828-271-4476, Thomas.R.Karl@noaa.gov</b></p>					
<p>The National Climatic Data Center (NCDC) serves the Nation with data and information for understanding the climate; related functions related to the archiving (maintain develop and operate the climate archive according to NARA archive guidelines; including the GOES active archive), ingesting (retrieval, quality control, and assembly of climate data and information resources), and the user access to climate data and information. Included are IT operations and program oversight for all climate activities at NCDC.</p>	18.6	18.6	Supporting	Climate Change & Variability	Scientific quality data; in-situ, GOES, POES, NEXRAD, model output, EOS, NPP; on-line delivery for new data and products (including GOES) and assessments.
<p><b>Climate Science Services Program Contact:Tom Karl, NESDIS/NCDC, 828-271-4476, Thomas.R.Karl@noaa.gov</b></p>					
<p>Scientific analysis of climate data, monitoring of climate observational networks, assessments (many joint with national &amp; international partners), applied research for climate, climate impacts. Paleo, remote sensing, in-situ, model data included.</p>	4.9	6.6	Directly related	Climate Change & Variability	Observing system network quality, climate assessment (proxy/paleo with continuous update), observation/model analyses, new remote sensing climate products & assessments
<p><b>Regional Climate Centers Program Contact:Mike Helfert, NCDC,828-271-4680,mike.helfert@noaa.gov</b></p>					
<p>Regional Climate Centers provide climate products &amp; services to users in their respective geographic areas: acquire data; preserve data; analyze data; disseminate data; products &amp; analyses</p>	2.8	1.7	Directly related	Climate Change & Variability	Infrastructure and process in place to assure quality and continuity of critical climate data
<p><b>Climate Database Modernization Program Contact:Steve Doty, NESDIS/NCDC, (828) 271-4688, Stephen.R.Doty@noaa.gov</b></p>					
<p>Climate Data Modernization Program provides climate data in digital and image form through internet access. Much of these data were endangered or of limited value because of the difficulty to acquire</p>	14.9	6.2	Supporting	Climate Change & Variability	Rescue of critical data that is in jeopardy of being lost.



Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Polar-orbiting Operational Environmental Satellite (POES) Program Contact:Michael Mignogno, NESDIS/OSD, (301) 457-5210, mike.mignogno@noaa.gov</b></p>					
<p>The POES series of satellites collect global data on a daily basis for a variety of land, ocean, and atmospheric applications. The data supports a broad range of environmental monitoring applications including weather analysis and forecasting, climate research and prediction, global sea surface temperature measurements, and atmospheric soundings of temperature and humidity.</p>	113.6	100.8	Supporting	Climate Change & Variability	Long-term data sets including the global vegetation index going back to the 1980s, global data sets of AVHRR imagery back to 1978, and derived products of global sea surface temperatures. Microwave data sets to monitor upper troposphere and stratosphere temperature trends.
<p><b>Polar-orbiting Operational Environmental Satellite (POES) Program Contact:Michael Mignogno, NESDIS/OSD, (301) 457-5210, mike.mignogno@noaa.gov</b></p>					
<p>The POES series of satellites collect global data on a daily basis for a variety of land, ocean, and atmospheric applications. The data supports a broad range of environmental monitoring applications including weather analysis and forecasting, climate research and prediction, global sea surface temperature measurements, and atmospheric soundings of temperature and humidity.</p>	24.9	22.1	Directly related	Climate Change & Variability	Long-term data sets including the global vegetation index going back to the 1980s, global data sets of AVHRR imagery back to 1978, and derived products of global sea surface temperatures. Microwave data sets to monitor upper troposphere and stratosphere temperature trends.
<p><b>Geostationary Operational Environmental Satellite (GOES) Program Contact: Steven Kirkner, NESDIS/OSD, (301) 457-5225, steve.kirkner@noaa.gov</b></p>					
<p>The GOES series of satellites provide continuous environmental data of the western hemisphere on hourly and minute basis. These data support observation and prediction of severe weather events - thunderstorms, tornadoes, hurricanes and floods - along with monitoring cloud, atmosphere, land and ocean parameters for climate research and prediction.</p>	47.3	40.9	Directly related	Climate Change & Variability	Long-term data sets associated with clouds, the Global Precipitation Climatology Project, and others
<p><b>Archive, Access, and Assessment National Oceanographic Data Center Program Contact:Lee.Dantzler, NOAA/NESDIS/NODC, 301-713-3270, Lee.Dantzler@noaa.gov</b></p>					
<p>The National Oceanographic Data Center (NODC) serves the Nation with data and information for understanding the ocean and its roles in our lives. NODC archives and provides public access to oceanographic observational data, data products, provides scientific oceanographic data services, and conducts assessments of the ocean environment. Internationally, NODC hosts the World Data Center-Oceanography under the auspices of the International Council of Scientific Unions and the US National Academy of Sciences.</p>	7.5	9.6	Supporting	Climate Change & Variability	World Ocean Database 2004; Global Ocean Heat Content (2003) Global SST Climatology and SST Trends in US EEZ (2003)



Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Coastal Data Development</b> Program Contact:Lee.Dantzler, NOAA/NESDIS/NODC, 301-713-3270, Lee.Dantzler@noaa.gov					
Provides integrated capability for discovery of and access to coastal observations from national and regional observing systems. Develops products to assist coastal resource managers and scientists in applying these observations to their decision support needs.	4.3	4.4	Supporting	Terrestrial and Marine Ecosystems	Coastal Risk Atlas, Hypoxia Warning System, Harmful Algal Blooms Monitoring System
<b>Satellite Research and Applications</b> Program Contact:Marie Colton, NOAA/NESDIS, 301-763-8127, Marie.Colton@noaa.gov					
The Satellite Research and Applications program uses satellite observations to develop data and information products for global and regional climate, weather, and ocean monitoring and prediction. Projects include calibration of satellite instruments, validation of satellite-based products, algorithm development, generation of climate data sets, assimilation of satellite data in numerical weather, climate, and ocean prediction models, and analyses and interpretation of satellite data.	6.4	9.5	Supporting	Climate Change & Variability	Trends in global ozone and the Antarctic ozone hole, atmospheric and ocean temperatures, sea level, and other climate variables.
<b>Satellite Product Processing and Distribution (OSDPD)</b> Program Contact:Helen M. Wood, NOAA/NESDIS, 301-457-5120, Helen.Wood@noaa.gov					
The NESDIS Office of Satellite Data Processing and Distribution manages and directs the operation of the central ground facilities which ingest, process, and distribute environmental satellite data and derived products. As part of its mission, OSDPD supports and assists in planning, management and operations related to access of long term data. Includes work with polar data, geostationary data, the National Ice Center, and the Satellite Active Archive.	17.3	19.9	Supporting	Climate Change & Variability	Atmospheric composition, climate variability and change, carbon cycle, water cycle, terrestrial and marine ecosystems, land use/land cover change, snow, sea ice, and others.
<b>National Weather Service</b>					
<b>NOAA/NWS Monitoring and Prediction of Intraseasonal to Interannual Climate Variability</b> Program Contact:Robert E. Livezey, Climate Services Division, National Weather Service, 301-713-1970 ext 182, Robert.E.Livezey@noaa.gov					
NOAA/NWS's Monitoring and Prediction of Intraseasonal to Interannual Climate Variability program is a core goal of NOAA's Strategic Plan. The program delivers products in the categories of observations and decision support, and includes maintaining the Cooperative Observer Program network of observations (\$9,890,000 for FY02 & FY03), support for the National Centers for Environmental Prediction (NCEP) Climate Prediction Center (\$5,000,000 FY02 & FY03), support for the NCEP Environmental Modeling Center (\$530,000 FY02 & FY03), support for the Advanced Hydrologic Prediction Service (\$470,000 FY03), support for Climate Services (\$975,000), and NCEP Central Operations Climate Supercomputing (\$6,500,000 FY03)	16.4	23.4	Directly Related	Climate Variability & Change	Climate analyses and forecasts for intraseasonal to interannual timescales.

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>NOAA/NWS Global Modeling and Data Assimilation Program Contact:Stephen Lord, Environmental Modeling Center, National Weather Service 301-763-8000 ext 7202 Stephen.Lord@noaa.gov</b></p>					
<p>NOAA/NWS's Global Modeling and Data Assimilation program delivers products in the categories of research and decision support. It includes model development and data assimilation to support large scale operational atmospheric/oceanic prediction.</p>	na	na	Supporting	Climate Variability & Change	Improved weather and climate predictions.
<p><b>NOAA/NWS Automated Surface Observing System (ASOS) Program Contact:Rainer Dombrowsky, Observing Services Division, National Weather Service, 301-713-0154 ext 110, Rainer.Dombrowsky@noaa.gov</b></p>					
<p>The NOAA/NWS ASOS program delivers products in the category of observations and is jointly supported by the Federal Aviation Administration (FAA), and the Department of Defense (DoD). ASOS provides data for climate analysis and assimilation.</p>	na	na	Supporting	Climate Variability & Change	
<p><b>NOAA/NWS Upperair Observations Program Contact:Rainer Dombrowsky, Observing Services Division, National Weather Service, 301-713-0154 ext 110, Rainer.Dombrowsky@noaa.gov</b></p>					
<p>NOAA/NWS Upperair Observations program delivers products in the category of observations. It is a network of 100 in situ stations monitoring atmospheric climate through the release of balloons which measure various meteorological parameters.</p>	na	na	Supporting	Climate Variability & Change	
<p><b>National Ocean Service</b> <b>Tide &amp; Current Data Program Contact:Michael Szabados, NOAA, 301-713-2981, Mike.Szabados@noaa.gov</b></p>					
<p>Provides the national infrastructure, science, and technical expertise to monitor, assess, and distribute tide current, water level, and other coastal oceanographic products and services necessary to support NOAA's mission, including monitoring changes in water levels related to climate change. The program services the needs of oceanographers, climatologists, coastal decision makers, local/regional port authorities, marine pilots, commercial shippers, the National Weather Service, state/Federal coastal zone management programs, and the private and public engineering and surveying communities.</p>	20.3	18.3	Supporting	Land Use/Land Cover Change	
<p><b>Shoreline Mapping Program Contact:Charles Challstrom, NOAA, 301-713-3222, Charlie.Challstrom@noaa.gov</b></p>					
<p>Provides the delineation of the official shoreline of the U.S. domestic waters and territories, including the outer coast, the estuaries, and the Great Lakes. Though the original primary NOAA objective of the program was/is to serve nautical charting requirements, the data collected and information produced is of great value to coastal change analysis, including measuring the impacts of climate change on the shoreline.</p>	8.0	7.0	Supporting	Land Use/Land Cover Change	

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>NMFS</b>					
<b>Fisheries and the Environment (FATE) Program Contact: Ned Cyr, NMFS, 301-713-2363, ned.cyr@noaa.gov</b>					
Program seeks to understand decadal and basin-scale climate variability and its impacts on fisheries productivity. Program aim is to provide the information necessary to effectively adapt management to mitigate the ecological, social and economic impacts of major shifts in the productivity of natural resources in the North Pacific, Bering Sea and Hawaiian Islands.	1.0	1.0	Supporting	Marine Ecosystems (natural resource management)	Leading indicators of ecological and oceanographic change that will be linked to <i>performance indicators</i> that will provide early warnings of major shifts in the productivity of key stocks, as well as monitor current year trends in ocean conditions, fish production, and ecosystem dynamics.
<b>OMAO</b>					
<b>Marine and Aviation Services</b>					
NOAA's fleet of ships and aircraft provides the platforms to aid in conducting climate research.	15.8	17.0	Supporting	Climate Variability & Change	
Total NOAA	656.5	755.5			

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
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**NSF Agency Representative: Margaret Leinen, Phone: (703) 292-8500, E-mail mleinen@nsf.gov**

<p><b>Climate Variability and Change Program Contact: Dr. Jay S. Fein</b>  <b>Climate Dynamics Program (ATM)</b>  <b>Phone: (703) 292-8527</b>  <b>Fax: (703) 292-9022</b>  <b>E-mail: jfein@nsf.gov</b></p>					
<p>This program area includes studies and modeling to extend and improve predictions of climate variability. It encompasses research to determine how and why climate changes, the effects of ocean circulation and periodic natural fluctuations (e.g. El Niño), and the influence of solar activity on climate variability and change.</p>	74.5	71.0	Core - GCRP	Climate Variability and Change	
<p><b>Atmospheric Composition Program Contact: Dr. Anne-Marie Schmoltner</b>  <b>Division of Atmospheric Sciences (ATM)</b>  <b>Phone: (703) 292-8522</b>  <b>Fax: (703) 292-9022</b>  <b>E-mail: aschmolt@nsf.gov</b></p>					
<p>The Atmospheric Composition program area seeks greater understanding of the changing composition and chemistry of the atmosphere. Included are studies of atmospheric gasses and aerosols and how they affect climate. Also included are studies of atmospheric photochemistry and stratospheric ozone production and destruction.</p>	16.6	16.6	Core - GCRP	Atmospheric Composition	
<p><b>Water Cycle Program Contact: Dr. L. Douglas James</b>  <b>Continental Hydrologic Processes (EAR)</b>  <b>Phone: (703) 292-8549</b>  <b>Fax: (703) 292-9025</b>  <b>E-mail: ldjames@nsf.gov</b></p>					
<p>Water is the primary vehicle of energy and nutrient transport linking the biological, Earth and atmospheric components of the climate system. Vegetation is a major conduit of water and energy between hydrologic and atmospheric systems, and a key agent in soil formation. Current thrusts include determining long-term trends in the global water cycle including the character of hydrologic events and their causes; developing the ability to bridge climate and weather modeling; and determining the relationship between the water cycle and biogeochemical / ecological processes.</p>	12.7	12.7	Core - GCRP	Water Cycle	
<p><b>Carbon Cycle Program Contact: Dr. Donald Rice</b>  <b>Chemical Oceanography Program (OCE)</b>  <b>Phone: (703) 292-8582</b>  <b>Fax: (703) 292-9085</b>  <b>E-mail: drice@nsf.gov</b></p>					
<p>Includes studies of how carbon cycles through the Earth system, including identifying and quantifying major carbon sources and sinks, quantifying the main mechanisms resulting in fluxes of carbon between ocean and atmosphere, and land and atmosphere, and producing next-generation model projections of future atmospheric carbon dioxide concentrations and scenarios of future climate change.</p>	22.9	24.6	Core - GCRP	Carbon Cycle	

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Terrestrial &amp; Marine Ecosystems Program Contact:Dr. Phillip R. Taylor</b> <b>Division of Ocean Sciences (OCE)</b> <b>Phone: (703) 292-8582</b> <b>Fax: (703) 292-9085</b> <b>E-mail: prtaylor@nsf.gov</b>					
Often carried out in regional studies, fundamental research to determine ecosystem reaction to change is critical to a comprehensive understanding of the impacts of climate change. NSF programs focus on Arctic and Antarctic Ecosystems, Coastal Ecological Research, Ecological Diversity and Rates of Change and the dynamics of Global Ocean Ecosystems.	30.1	30.4	Core - GCRP	Terrestrial & Marine Ecosystems	
<b>Human Dimensions of Climate Change Program Contact:Dr. Thomas Baerwald</b> <b>Behavioral and Cognitive Sciences Division (SBE)</b> <b>Phone: (703) 292-7301</b> <b>E-mail: tbaerwal@nsf.gov</b>					
This program supports research that is clearly linked to social, psychological, economic, demographic, anthropological, geographic, governmental, legal, institutional, and/or ethical aspects of global change, including the development of statistical methodology and mathematical models. Also included is research on regional or local phenomena where the implications for global effects are clear.	13.7	15.2	Core - GCRP	Socio-Economic Analysis	
This program supports research that is clearly linked to social, psychological, economic, demographic, anthropological, geographic, governmental, legal, institutional, and/or ethical aspects of global change, including the development of statistical methodology and mathematical models. Also included is research on regional or local phenomena where the implications for global effects are clear.	0.0	5.0	Core - CCRI	Socio-Economic Analysis	
<b>Paleoenvironment / Paleoclimate Program Contact:Dr. David Verardo</b> <b>Paleoclimate Program (ATM)</b> <b>Phone: (703) 292-8527</b> <b>Fax: (703) 292-9022</b> <b>E-mail: dverardo@nsf.gov</b>					
This program seeks to encourage research to understand the natural variability of the Earth system through records preserved in geo-biologic archives and to contribute to a comprehensive understanding of climate change with annual to millennial resolution, including the forcing mechanisms, interactions and feedbacks among its components.	17.5	17.5	Core - GCRP	Climate Variability and Change	
<b>Black Carbon Measurement Program Contact:Dr. Clifford Jacobs</b> <b>UCAR &amp; Lower Atmospheric Facilities Oversight Section</b> <b>Phone: (703) 292-8521</b> <b>Fax: (703) 292-9022</b> <b>E-mail: cjacobs@nsf.gov</b>					
With NASA, incorporate aircraft fly-overs to measure black carbon in current field campaigns.	0.0	1.0	Core - CCRI	Atmospheric Composition	Enhanced understanding of the prevalence and role of black carbon in climate

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Sensor Development Program Contact:Dr. Clifford Jacobs</b> <b>UCAR &amp; Lower Atmospheric Facilities Oversight Section</b> <b>Phone: (703) 292-8521</b> <b>Fax: (703) 292-9022</b> <b>E-mail: cjacobs@nsf.gov</b>					
With NOAA, develop sensors to measure carbon dioxide and methane accurately with minimally-trained personnel.	0.0	2.0	Core - CCRI	Atmospheric Composition	Enhanced ability to measure atmospheric carbon dioxide and methane
<b>Carbon Fluxes &amp; Cycle Program Contact:Dr. Donald Rice</b> <b>Chemical Oceanography Program (OCE)</b> <b>Phone: (703) 292-8582</b> <b>Fax: (703) 292-9085</b> <b>E-mail: drice@nsf.gov</b>					
With NOAA, deliver improved understanding of the carbon cycle (particularly regional fluxes of carbon from one area to another) through diagnostic models, and improved understanding of the magnitude of the effect of black carbon on climate.	0.0	7.0	Core - CCRI	Carbon Cycle	Improved understanding of the carbon cycle
<b>Biocomplexity in the Environment Program Contact:Dr. Margaret Cavanaugh</b> <b>Staff Associate, Office of the Director</b> <b>Phone: (703) 292-8002</b> <b>E-mail mcavanau@nsf.gov</b>					
<p>Biocomplexity in the Environment (BE) is designed to respond to the demand for new approaches to investigating the interactivity of biota and the environment. It will result in more complete understanding of natural processes, of human behaviors and decisions in the natural world, and ways to use new technology effectively to sustain life on Earth. Long-term BE goals include:</p> <ul style="list-style-type: none"> <li>· Synthesize environmental knowledge across disciplines, subsystems, time and space;</li> <li>· Discover new methods, theories, and conceptual and computational strategies for understanding complex environmental systems;</li> <li>· Develop new tools and innovative applications of new and existing technologies for crossdisciplinary environmental research;</li> <li>· Integrate human, societal and ecological factors into investigations of the physical environment and environmental engineering;</li> <li>· Improve science-based forecasting capabilities and enhance research on decision-making and human environmental behaviors;</li> </ul>	58.1	79.2	Supporting		
Total	246.1	282.2			

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Smithsonian Institution Agency Representative: Patrick Neale, 443-482-2285, neale@serc.si.edu</b>					
<b>Archaeobiology Program (Human Ecology History) Program Contact: Bruce Smith, National Museum of Natural History, 202-357-1572, smith.bruce@nmnh.si.edu; Melinda Zeder, National Museum of Natural History, 202-786-2503, zeder.melinda@nmnh.si.edu</b>					
Focuses on the initial domestication of plant and animal species, and the environmental and social impact of early agricultural economies based on domesticated species. The domestication of plant and animal species by human societies resulted in one of the most profound ecological transformations in the history of life on earth. The intensification of agriculture that followed the origin of domestication has proven the single most powerful agent in the reduction of biodiversity worldwide.	0.3	0.3	Core - GCRP	Land Use/Land Cover Change	Publications; lectures; scientific data and analysis
<b>Biodiversity of Papua New Guinea Program Contact: Scott Miller, National Museum of Natural History, 202-357-1355, miller.scott@nmnh.si.edu</b>					
Project in Papua New Guinea that effectively melds the gathering of biodiversity information and training of local people in fundamental aspects of collecting, taxonomic identification and insect collections care while benefiting from the local peoples' detailed knowledge of plant/insect relationships. In an October, 2000, paper "Quantifying Biodiversity: Experience with Parataxonomists and Digital Photography in Papua New Guinea and Guyana" as published in BioScience volume 50 no. 10, pp.899-908, participants describe the development of a core of parataxonomists at research sites in Papua New Guinea and Guyana, and demonstrate that ecological research can benefit from collaboration with local people.			Supporting	Terrestrial & Marine Ecosystems	Publications; lectures; training of in-country personnel; scientific data and analysis; discovery of new species.
<b>Caribbean Coral Reef Ecosystems Program Program Contact: Klaus Ruetzler, National Museum of Natural History, 202-786-2130, ruetzler.klaus@nmnh.si.edu</b>					
Program research encompasses reef, mangrove, seagrass meadow, and plankton community studies, and maintains its primary focus on the Carrie Bow Cay, Belize, region. To date, about 50 scientists a year have conducted studies there. In addition, comparative studies in other places in the Caribbean basin have been initiated or are planned. Preliminary results and work in progress are summarized in yearly reports. Research areas include: oceanography and historical development of communities; biodiversity, morphology and evolution; processes, linking species and environment; population dynamics, recruitment and production; species interactions, food chains, and nutrient cycling.			Supporting	Terrestrial & Marine Ecosystems	Publications; lectures; scientific data and analysis; discovery of new species.
<b>Paleoecological Effects of Climate Change, including Evolution of Terrestrial Ecosystems Program Contact: Kay Behrensmeyer, National Museum of Natural History, 202-357-3033, behrensmeyer.kay@nmnh.si.edu</b>					
A consortium based at the National Museum of Natural History, whose purpose is to document and interpret the history of terrestrial ecosystems from 400 million years ago to the present. Program scientists study the effects of environmental changes on the ecology and evolution of land plants and animals.	0.9	0.9	Core - GCRP	Climate Variability and Change	A computerized database that consolidates and organizes the fossil evidence concerning land biotas; scientific data and analysis

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Global Volcanism Program Program Contact: James Luhr, National Museum of Natural History, 202-357-4809, luhr@volcano.si.edu</b>					
GVP is the hub of an international network for monitoring, reporting, and maintaining data related to volcanic activity around the world. The GVP plays a leadership role in global volcano information - tracking events as they happen, building the database of critical information, and using these resources both for our own forefront research projects and for answering of a multitude of questions on volcanology from other scientists, the media, and the public.	0.2	0.2	Core - GCRP	Climate Variability and Change	Database; monthly bulletin; scientific data and analysis.
<b>Human Origins Program (Human Ecological History) Program Contact: Richard Potts, National Museum of Natural History, 202-786-2506, potts.rick@nmnh.si.edu</b>					
Long-term history of ecosystem responses to human pressures and vice versa; focus is to piece together the climatic and ecological conditions that allowed humans to evolve.	0.3	0.3	Core - GCRP	Land Use/Land Cover Change	Publications; lectures; scientific data and analysis
<b>Neotropical Lowlands Research Program Program Contact: Richard Vari, National Museum of Natural History, 202-357-4027, vari.richard@nmnh.si.edu</b>					
Focuses on key groups of organisms in order to understand the functioning of lowland ecosystems in tropical Latin America.			Supporting	Terrestrial & Marine Ecosystems	Publications; lectures; scientific data and analysis; discovery of new species.
<b>Nile Delta Subsidence/Sea Level Rise Program Contact: Daniel Stanley, National Museum of Natural History, 202-357-2310, stanley.daniel@nmnh.si.edu</b>					
A long-term research effort involving 25 specialists from 13 international laboratories, which assesses the speed with which environmental changes are threatening fertile river deltas around the world.	0.2	0.2	Core - GCRP	Climate Variability and Change	Reports/publications; lectures; scientific data and analysis.
<b>Tropical Biodiversity Program Program Contact: Marsha Sitnik, National Museum of Natural History, 202-786-2821, sitnik.marsha@nmnh.si.edu</b>					
NMNH research on biological diversity and ecosystem functions includes studies on tropical biological diversity and ecosystem response to change. The Tropical Biological Diversity Program (TROBID) is geared to 1) inventory biodiversity and document species distribution in tropical forests globally, 2) monitor changes in biodiversity through comparative methods, 3) identify the physical and biological processes of growth and decline, and 4) identify the biotic consequences of human-induced change. TROBID studies build on decades of in-situ observations by the NMNH professional staff equating to tens of thousands of staff-months of research. Natural science collections number over one hundred million and computerized data sets exist for species inventory and long-term comparisons.	0.6	0.6	Core - GCRP	Terrestrial & Marine Ecosystems	Publications; lectures; scientific data and analysis
<b>Ecological effects of ultraviolet radiation Program Contact: Patrick Neale, SERC, 443-482-2285, neale@serc.si.edu</b>					
Spectral UV-B is measured in Maryland (>25 y record), Florida, Arizona and other sites in the U.S. Studies of UV photobiology of aquatic organisms are conducted to assess impact of variation in UV-B.	0.2	0.2	Core - GCRP	Terrestrial & Marine Ecosystems and Atmospheric Composition	Reports/publications; training; lectures; scientific data and analysis.



Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Effects of increasing atmospheric CO2 on ecosystems Program Contact: Bert Drake, SERC, 443-482-2294, drake@serc.si.edu</b></p>					
<p>We have established two sites for studying the impacts of elevated CO2 on plants and ecosystem processes: a wetland study on Chesapeake Bay and a scrub oak site on Merritt Island Wildlife Refuge, Cape Canaveral Florida. The Chesapeake Bay study has been in progress since 1987 while the Florida study has been operational since 1996. In these projects we are examining questions: concerning acclimation of plants to CO2, carbon uptake, nutrient cycling, allocation of C, and build up of C in the soil</p>	0.3	0.3	Core - GCRP	Carbon Cycle	Reports/publications; training; lectures; scientific data and analysis.
<p><b>Invasive Species Program Contact: Greg Ruiz, SERC, 443-482-2227, ruiz@serc.si.edu</b></p>					
<p>Conducts studies in Chesapeake Bay, San Francisco Bay and other marine ecosystems to (1) measure patterns of nonindigenous species transfer, invasion, and impact; (2) test specific and general mechanisms that underlie these patterns; (3) assess the efficacy of management strategies to limit the spread and impact of nonindigenous species.</p>			Supporting	Terrestrial & Marine Ecosystems	Reports/publications; training; lectures; scientific data and analysis.
<p><b>Wetlands Biogeochemistry Program Contact: J. Patrick Megonigal, 443-482-2346, megonigal@serc.si.edu</b></p>					
<p>Studies on wetlands of Chesapeake Bay and other others to determine plant productivity, soil carbon storage, and methane emissions under present and elevated CO2</p>			Supporting	Carbon Cycle	Reports/publications; training; lectures; scientific data and analysis.
<p><b>Temperate and Tropical Forest Canopy Biology Program Contact: Cristian Samper samperc@tivoli.si.edu, Republic of Panama (507) 212-8086</b></p>					
<p>Use of canopy cranes and towers to study exchange of gases between canopy and atmosphere, and physiological responses of canopy trees to light, humidity, water-stress and other climate-related factors</p>	0.4	0.4	Core - GCRP	Terrestrial & Marine Ecosystems	Reports/publications; training; lectures; scientific data and analysis.
<p><b>Paleoecology* Program Contact: Ira Rubinoff rubinoff@tivoli.si.edu, Republic of Panama(507) 212 8000</b></p>					
<p>Studies in tropical geology, biology and archaeology including the rise of the Isthmus of Panama and the profound effects that the emergence of this land bridge had on global climate, including the beginning of the Ice Age; the Miocene through late Quaternary climatic and biotic history of marine communities and lowland tropical flora; and the origins and dispersals of tropical forest agriculture. Approaches include proxy indicators for historical reconstruction include marine invertebrates and microfossils, and pollen, phytoliths, diatoms, and starch grains. The Center for Tropical Paleoecology and Archaeology houses collections of all of these fossils and their modern counterparts. Our records support work on models of ecosystem restoration (e.g. forest management) or collapse, and ecological effects of future climate change (particularly for the tropics) depend heavily on long term records to help decipher long term signals from noise, and to estimate the possible magnitude of biological response.</p>			Supporting	Terrestrial & Marine Ecosystems	Reports/publications; training; lectures; scientific data and analysis.

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Tropical Forest Science Program Contact: Richard Condit (condit@ctfs.si.edu) (507) 212-8145</b>					
Operation of the Center for Tropical Forest Science at STRI which promotes and coordinates long-term biological and socio-economic research within tropical forests and forest-dependent communities, and translates this information into results relevant to conservation, and natural resource policies.	0.9	0.9	Core - GCRP	Terrestrial & Marine Ecosystems	Reports/publications; training; lectures; scientific data and analysis.
<b>Plant Physiology and CO2 Program Contact: Klaus Winter winterk@tivoli.si.edu, (507) 212 8131</b>					
First free air carbon dioxide enhancement experiment (FACE) to study forest regeneration over several years to learn more about the CO2 response of tropical trees.			Supporting	Carbon Cycle	Reports/publications; training; lectures; scientific data and analysis.
<b>Biodynamics of Forest Fragments* Program Contact: William Laurance wfl@inpa.gov.br, Brazil Telephone 55-92-642-2050</b>					
Assesses the impact of forest fragmentation on rainforest animals, plants and ecological and ecosystem processes on a 1000 km2 study area near Manaus, Brazil. Cooperative program with Brazil to train Latin-American scientists	0.1	0.1	Core - GCRP	Terrestrial & Marine Ecosystems	Reports/publications; training; lectures; scientific data and analysis.
<b>Tropical Agroforestry Program Contact: Richard Condit (condit@ctfs.si.edu) (507) 212-8145</b>					
A program of Center for Tropical Forest Science at STRI to determine the biologically sustainable harvest rates for timber and non-timber forest product, and select native tree species for use in plantation forestry, agroforestry and reforestation of degraded areas.	0.2	0.2	Core - GCRP	Land Use/Land Cover Change	Reports/publications; training; lectures; scientific data and analysis.
<b>Migratory Birds Program Contact: Russell Greenberg antwren@erols.com</b>					
Climate change effects on migratory birds including avian response to forest fragmentation and loss of keystone tree species and the decline of migratory birds in eastern United States forests.	0.3	0.3	Core - GCRP	Terrestrial & Marine Ecosystems	Reports/publications; training; lectures; scientific data and analysis.
<b>Predicting Species Responses Program Contact: Chris Wemmer, Phone 540-635-6522; E-mail cwemmer@crc.si.edu.</b>					
Program uses GIS to interpret effects of various perturbations on the landscape and correlate this with changes in animal and plant populations. It is also used to delineate future reserve sites, design migration corridors, and determine minimum habitat size for endangered species of animals.	0.7	0.7	Core - GCRP	Terrestrial & Marine Ecosystems	Reports/publications; training; lectures; scientific data and analysis, recommendations for reserve design

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Monitoring and Assessment of Biodiversity (MAB) Program</b> Program Contact: <b>Dr Francisco Dallmeier</b> <b>Tel: (1.202) 357 4792, E-mail: ic.fgd@ic.si.edu</b>					
MAB's main research goals are to promote biodiversity data collection and to increase knowledge of ecological functions so that decision-makers can reach informed, conservation-based land management decisions. We believe sustainable use of resources is possible if reliable data about changes in ecosystems and the impacts on biodiversity can be brought to bear in considering the consequences of human-caused disturbances such as development. To do this, MAB ensures that findings are disseminated to decision-makers and the scientific community. MAB's integrated approach strengthens partnerships among researchers, research institutions, governments, local communities, national and international organizations and the private sector.	0.1	0.1	Core - GCRP	Terrestrial & Marine Ecosystems	Reports/publications; training; lectures; scientific data and analysis, community outreach
<b>Miscellaneous research</b>					
SI performs a variety of research supporting the goals of the USGCRP.	1.3	1.3	Core - GCRP	Other	
<b>Smithsonian Total</b>	7.0	7.0			

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
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**State Agency Representative: Harlan Watson, Watsonhl@state.gov**

<b>Intergovernmental Panel on Climate Change (IPCC)/UN Framework Convention on Climate Change (UNFCCC) PLEASE SEE EXPLANATION BELOW**** Program</b> <b>Contact: Daniel A. Reifsnyder, Department of State, (202) 647-4069, reifsnyderda@state.gov</b>					
(2) observations -- (IPCC) support for the Second Review of the Adequacy of the Global Climate Observing System; (3) decision support -- support for preparation of IPCC special and technical reports and the Fourth Assessment Report	7.4	5.6	Directly Related	Climate Variability and Change; Carbon Cycle; Land Use/Land Cover Change; Socio-Economic Analyses; Energy System Analyses	1) Second Review of the Adequacy of the Global Climate Observing System; 2) IPCC Technical Paper and Special Reports; 3) IPCC Fourth Assessment Report (2007)

\*\*\*For FY 2002, of the \$7.4 million appropriated for the IPCC and the UNFCCC, we allocated a total of \$2.7 million to the IPCC. These funds were made available from a line item for the IPCC and the UNFCCC Secretariat costs in the International Organizations and Programs (IO&P) foreign assistance account. For FY 2003, we are requesting a total of \$5.6 million for the IPCC and the UN Framework Convention on Climate Change (UNFCCC).

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>USAID Agency Representative: Ko Barrett, 202-712-5445, kbarrett@usaid.gov</b>					
<b>Famine Early Warning System Network (FEWS NET) Program Contact: Will Whelan, USAID, 202-712-5001; wwhelan@usaid.gov</b>					
To provide decision-makers with the information to effectively respond to drought and food insecurity. FEWS NET analyzes remote sensing data and ground-based meteorological, crop, and range-land observations to track progress of rainy seasons in semi-arid regions of Africa to identify early indications of potential famine.	6.0	6.0	Supporting	Climate Variability and Change	
<b>Drought Monitoring Center-Nairobi (DMCN) Program Contact: Harry Proctor, USAID, 202-712-5117; hproctor@usaid.gov</b>					
To improve climate monitoring, prediction and applications, and early warning of climate related disasters in support of regional disaster preparedness and other sustainable development objectives in Greater Horn of Africa (GHA).	0.9	0.7	Supporting	Climate Variability and Change	
<b>Drought Monitoring Center (DMCH) - Harare, and Regional Remote Sensing Unit (RRSU) Program Contact: Harry Proctor, USAID, 202-712-5117; hproctor@usaid.gov</b>					
To improve multi-sector, short- and long-term climate risk management and emergency response to climate variability throughout the Southern Africa region.	0.5	0.4	Supporting	Climate Variability and Change	
<b>Climate Monitoring/Information Dissemination, NOAA Program Contact: Harry Proctor, USAID, 202-712-5117; hproctor@usaid.gov</b>					
To mitigate drought, flood and severe storm disasters through geographically targeted climate-forecasting applications in combination with other climate and sector-specific information such as observations and historical perspectives.	1.0	1.0	Supporting	Climate Variability and Change	
<b>African Center for Meteorological Applications &amp; Development (ACMAD) Niamey Program Contact: Harry Proctor, USAID, 202-712-5117; hproctor@usaid.gov</b>					
Support for ACMAD which coordinates and manages RANET, a program that broadcasts weather-related data via radio and internet to farmers.		0.3	Supporting	Climate Variability and Change	

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Climate Forecast Applications for Disaster Mitigation in Asia Program Contact: David Lillie, USAID 202-712-1091, dlillie@usaid.gov</b>					
To mitigate hydro-meteorological disasters through climate forecast applications in vulnerable countries in Asia.		0.7	Supporting	Climate Variability and Change	
<b>Extreme Climate Events in Asia Program Contact: David Lillie, USAID 202-712-1091, dlillie@usaid.gov</b>					
To improve the understanding of the impacts of extreme climate events in selected Asian countries and to reduce the disastrous impacts of such events through application of climate forecast information.	0.2		Supporting	Climate Variability and Change	
<b>Climate Forecasting and Applications for Bangladesh Program Contact: David Lillie, USAID 202-712-1091, dlillie@usaid.gov</b>					
To develop a comprehensive flood-forecasting methodology for Bangladesh, then to utilize the forecasts for relevant applications.	0.5	0.3	Supporting	Climate Variability and Change	
<b>Development of a Flood Early-Warning System in Vietnam Program Contact: David Lillie, USAID 202-712-1091, dlillie@usaid.gov</b>					
To develop a flood early-warning system in seven flood-prone provinces of central Vietnam.	0.3	0.3	Supporting	Climate Variability and Change	
<b>Development of a Coastal Storm Early-Warning System in Vietnam Program Contact: David Lillie, USAID 202-712-1091, dlillie@usaid.gov</b>					
To implement a radio-and pager-based storm early-warning system for fishing boats at sea in all 25 coastal provinces in Vietnam.	0.5	0.5	Supporting	Climate Variability and Change	
<b>Trans-Boundary River Forum Program Contact: David Lillie, USAID 202-712-1091, dlillie@usaid.gov</b>					
To support a regional forum to share forecasting and flood-related information. This forum brings together decision-makers and technical personnel from countries in South Asia to share information related to flood disasters in the region, and broader trans-boundary water issues.	0.1	0.1	Supporting	Climate Variability and Change	
<b>Community-Based Disaster Preparedness in South Asia Program Contact: David Lillie, USAID 202-712-1091, dlillie@usaid.gov</b>					
To fund flood-related community preparedness programs in flood-prone districts in South Asia.		0.9	Supporting	Climate Variability and Change	

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Development of Flood-Forecasting in the Mekong River Basin Program Contact: David Lillie, USAID 202-712-1091, dlillie@usaid.gov</b>					
To provide technical assistance to enhance flood prediction and dissemination capacity	0.1	0.1	Supporting	Climate Variability and Change	
<b>Idaho Water Resources Research Institute (IWRI) Guatemala Flood Mitigation Program Contact: Eileen Simoes, USAID, 202-712-1136; esimoes@usaid.gov</b>					
To develop long term management strategies by developing hydrologic models of the Villalobos River and Watershed to minimize impacts of future extreme flood events. Development of the models uses hydrologic, climatic, and landscape data of the region from 1988 to 1998 (pre-Hurricane Mitch) to evaluate alternative management scenarios.	0.1		Supporting	Climate Variability and Change	
<b>Bolivia Flood Mitigation* Program Contact: Giselle Zimmerman, USAID, 202-712-5754; gzimmerman@usaid.gov</b>					
To mitigate future flood damage in the La Paz River basin. The project focuses on activities in Rio Abajo, a tributary to Rio La Paz where torrential rains in February, 2002 generated a series of mortal consequences in the capital city and the communities located in the La Paz River basin.	0.2		Supporting	Climate Variability and Change	
<b>Hydro-met Hazard Mitigation Program Contact: David Lillie, USAID 202-712-1091, dlillie@usaid.gov</b>					
This program is an activity under the Natural Hazards Mitigation PASA with NOAA and provides funds for travel to support the Asia team in lending technical assistance to partners in developing monitoring and modeling systems taking advantage of satellite data, GIS, and hydrologic modeling, as well as short term assistance related to specific events.	0.1		Supporting	Climate Variability and Change	
<b>Hydro-met Hazard Mitigation Program Contact: Jim Smith, USAID, 202-712-5697; jsmith@usaid.gov</b>					
This program provides technical assistance for flood early warning, preparedness, response, and mitigation in Asia. It is an activity under the Natural Hazards Mitigation PASA with USGS and provides funds for travel to support the Asia team in lending technical assistance to partners (like the Mekong River Commission) in developing monitoring and modeling systems taking advantage of satellite data, GIS, and hydrologic modeling, as well as short term assistance related to specific events.	0.1		Supporting	Climate Variability and Change	
<b>* Project proposal is under review. NO FUNDS are committed.</b>					
Total	10.6	11.3			

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
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**USDA Agency Representative: William Hohenstein, Whohenst@OCE.USDA.gov**

<b>Agricultural Research Service (ARS)</b>					
<b>Agricultural Research Service Global Carbon Cycle Program Contact: Steve Shafer</b>					
<p>Research to develop technologies and decision support systems to apply the best practices for storing carbon from atmospheric carbon dioxide in natural soil and plant systems to reduce greenhouse gases and enhance soil resources. Focus areas include (among others): cropping systems and tillage; CRP; buffers; irrigation and nutrient management; and measurement/modeling/validation.</p>	1.4	2.4	Core - GCRP	carbon cycle	<p>Estimates of the current carbon stocks, carbon storage potential, and rates of increase in carbon sequestration in crop land and grazing land soils of the U.S.</p> <p>Identification of environmentally and agriculturally sustainable management systems that remove carbon dioxide from the atmosphere and store it in croplands and rangelands.</p> <p>Identification of the relative influence of warm and cool season grasses on carbon sequestration and stabilization of soil structure.</p> <p>A carbon sequestration model for field office use.</p>
<b>Agricultural Research Service Global Water Cycle Program Contact: Steve Shafer</b>					
<p>Research to develop management strategies for farm, ranch, rural community, and natural resource decision-makers to conserve, store, and allocate water resources to address the many diverse demands and impacts on U.S. rural water resources caused by global change. Focus areas include (among others): influence of land use/land cover on water availability; impact of climate and weather variability and extremes on agricultural production and water availability; and use of climate and water information at different scales from field to region.</p>	2.6	2.6	Core - GCRP	water cycle	<p>Models at different scales to assess effects of global change on availability of water for agricultural and rural community uses.</p> <p>Regional, process model-based estimates of the effects of various environmental and management scenarios on productivities, water requirements, and carbon sequestration potentials in cotton production systems.</p>



Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Understanding Atmosphere Composition &amp; Chemistry a/ (ARS) Program Contact: Steve Shafer</b></p> <p>Research to develop environmentally compatible and economically feasible alternatives to the use of methyl bromide as a treatment to control pests, to reduce stratospheric ozone depletion. Focus areas include alternatives to pre-plant soil fumigant uses and treatments for postharvest commodities, including structural uses.</p>	17.5	17.4	Core - GCRP	Atm composition/other	<p>Cultural practices, biological control agents, alternative chemicals, crop resistance that can be used alone or in combination to manage pests without use of methyl bromide.</p> <p>Information of the efficacy of methyl bromide alternatives under commercial production conditions.</p> <p>Technologies to apply heat, cold, radiation, and controlled atmospheres to manage postharvest commodity, structural, and quarantine pests.</p> <p>Methods to apply and confine methyl bromide for critical uses without permitting escape into the atmosphere.</p>
<p><b>Understanding Ecosystem Changes (ARS) Program Contact: Steve Shafer</b></p> <p>Research to provide information necessary to project possible impacts of global change on agricultural ecosystems, and to develop successful strategies and practices to adapt to change and improve productivity.</p>	8.4	9.1	Core - GCRP	ecosystems	<p>Data sets and models to predict how plants respond to multiple interactions of biological and other environmental stresses, including increasing carbon dioxide, global warming, and increased weather extremes and variability.</p> <p>Cost-effective management responses to environmental changes in rangelands.</p> <p>Simulation models that predict the distribution of pest infestations and projected changes in economic yield under different environmental conditions.</p>

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Strengthening Basic Climate Change Technology Research (ARS) Program Contact: Steve Shafer</b>					
Research to develop methods for managing ruminant livestock and pastures that minimize emissions of methane; develop methods to rapidly measure methane emissions from animal production systems; develop methods for managing plants and soils in crop and rangeland systems that minimize emissions of nitrous oxide.	0.0	1.0	directly related	Other	<p>Grazing and feed management practices that reduce methane emissions from cattle and other ruminants.</p> <p>Open-field technologies for measuring gases that contribute to climate change, nitrogen deposition, and odors.</p> <p>Crop management systems, including fertilizer management strategies, that minimize greenhouse gas emissions from crop lands while enhancing carbon sequestration, sustaining production and protecting water quality.</p>
<b>Land Use &amp; Land Mgmt. Impacts on Carbon Sequestration (ARS) Program Contact: Steve Shafer</b>					
Develop a network of 30 coordinated sites on crop lands, pastures, and range lands throughout the U.S. and observe carbon fluxes in agricultural systems on a continental scale. Research to determine the impact of agricultural and rangeland management practices on large-scale carbon fluxes.	0.0	3.0	directly related	Land Use Land Cover Change /Technology	<p>Data and models for describing and predicting how land management practices in different environments, including soil types and vegetation cover types, alter carbon sequestration throughout the high proportion of U.S. land that is under agricultural management.</p> <p>Decision support tools for policy makers that inform implementation of sound farm policies and programs to store carbon while sustaining agricultural productivity and environmental quality.</p>
<b>Measurement, Verification &amp; Modeling of Carbon Storage (ARS) Program Contact: Steve Shafer</b>					
Research to develop inventory methods and models for estimating current carbon stocks and potential changes in carbon stored in U.S. croplands and rangelands under different global change and management scenarios. Research to develop new methods for rapid and accurate measurement of carbon in soil and greenhouse gases in the atmosphere associated with agricultural systems.	0.0	0.5	directly related	Land Use Land Cover Change /Technology	<p>Models to estimate carbon stocks and sequestration rates at different scales (field, farm, region) and under different conditions.</p> <p>New technologies and sampling strategies for rapid and economical field-level measurement of carbon.</p>

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Cooperative State Research, Education, and Extension Service (CSREES)</b>					
<b>National Research Initiative (CSREES) Program Contact: Mark Poth, 202-401-5244, mpoth@reeusda.gov</b>					
Basic science research directed at agricultural applications (1, 3)	8.0	14.0	Core - GCRP	Other	Improved information regarding cycling and production of materials that contribute to GHG and carbon stocks from agricultural production practices
<b>USDA UV-B Monitoring and Research Program (CSREES) Program Contact: Henry Tyrrell, 202-401-5611, htyrrell@reeusda.gov</b>					
To systematically measure UV-B radiation levels to better understand the factors which affect the transmission of UV-B through the atmosphere and to measure the effect of UV-B radiation on plants, animals, humans, and degradation of materials (2, 3)	1.4	1.8	Core - GCRP	Atm composition	Information on how plants respond to increased levels of UV-B radiation and its impact related to climate change
<b>Economic Research Service (ERS)</b>					
<b>Global Carbon Cycle: Economics of Mitigation Options in Agriculture (ERS) Program Contact: Carol A. Jones, 202-694-5505/5500, cjones@ers.usda.gov</b>					
Research and decision support: Overarching objective is to characterize the economics of reducing net emissions of carbon dioxide, nitrous oxide and methane, including carbon sequestration, in the agriculture sector. Initial studies will focus on the US.	0.4	0.4	Core - GCRP	Socia-economic analysis	2002: ERS report focusing on economics of US land management options. 2004: ERS report examining economic implications of alternative policy designs for reducing net emissions.
<b>Understanding Ecosystem Changes: Economic Impacts on Global Agriculture of GHG Accumulation (ERS) Program Contact: Carol A. Jones, 202-694-5505/5500, cjones@ers.usda.gov</b>					
Research and decision support: Objective is to estimate the long-run impacts of GHG accumulation on global agriculture, including effects from carbon dioxide fertilization and climate change.	0.4	0.4	Core - GCRP	Socia-economic analysis	2002: ERS report focusing on economic impacts on global agricultural markets of transient runs of global circulation models. 2004: TBD

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Natural Resources Conservation Service (NRCS)</b>					
<b>Pilot Project (Inventories of carbon biomass) (NRCS) Program Contact: Maury Mausbach</b>					
<p>NRCS will support efforts to sequester carbon and mitigate the emissions of greenhouse gases from agricultural systems through research, technology development, and technical assistance. Areas of emphasis will be soil carbon sequestration, emission reduction via the application of conservation practices, improvement of soil and vegetation models and databases to predict greenhouse gas dynamics in response to land use and management and collaborations to develop new measurement systems.</p>	0.0	0.5	Core - CCRI	Land use/land cover change/Technology	<p>Develop accounting rules and guidelines for sequestration projects as directed by President Bush on 2/14/02. Provide limited support to the development of inventories of soil carbon changes in response to land use and management at the state, regional and national level '02-07. Provide limited support in the development of commercially viable technology for the in situ measurement of soil carbon '04</p>
<b>Forest Service (FS)</b>					
<b>Understanding Ecosystem Changes (FS) Program Contact: Conard/Reaves</b>					
<p>The objectives of ecosystem research is to understand and anticipate the ecosystem changes that will result from altered environmental conditions and to understand the sensitivity of key ecosystem processes and components to different levels of stress. Species migration and ecosystem composition changes will be predicted based on weather and air pollution scenarios derived from general circulation models and other sources. Threshold limits of ecosystem stability and diversity will be determined. Life histories, population dynamics, competitive interactions and community dynamics of plants altered environments are being addressed. Products include scientific publications and assessments.</p>	4.9	4.9	Core - GCRP	Ecosystem	<p>(1) Guidelines for managers to anticipate impacts of climate change on forest vegetation, and to adapt their current management practice to future environmental conditions; (2) Provide crucial input to future regional- and national scale assessments of the impact of climate change on U.S. forest. (3) Improve understanding of causes of changes in productivity, hydrology, and vegetation distribution.</p>
<b>Global Carbon Cycle (FS) Program Contact: Conard/Reaves</b>					
<p>The research on the carbon cycle program is focused on estimating carbon stocks and fluxes from inventory and monitoring data; and experiments to understand and quantify the responses of biogeochemical processes to climate change and air pollution, with particular attention to soil carbon and fire disturbances. This will require understanding of (1) the relationships between land surface processes, including land cover changes and climate, (2) the changing global biochemical cycles of carbon and nitrogen, and (3) the responses of ecosystems to multiple stresses. Products include scientific publications, assessments, and publication of the inventory of carbon stocks and stock changes in U.S. forests and forest products.</p>	10.0	10.0	Core - GCRP	Carbon Cycle	<p>(1) Input on the forestry sector for USDA and EPA "inventory of greenhouse gases and sinks"; (2) reduction of uncertainty in continental-scale carbon monitoring; (3) Ability to separate the effects of natural from human-induced changes in vegetation; (4) guidance on how to manage forests and wood product processes to maintain or increase carbon sequestration</p>

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<b>Global Water Cycle (FS) Program Contact: Conard/Reaves</b>					
The health of our forested watersheds has significant impacts on the quality of our drinking water, water yield and natural resource use. The Forest Service will focus on long-term monitoring of hydrology and nutrient cycling, and develop and apply process models to relate site-specific observations to watershed scales for quantifying and understanding how physical and chemical climate change will affect forest processes.	2.0	2.0	Core - GCRP	Water Cycle	(1) Modeling the watershed approach will provide estimates of productivity, hydrology and N outputs from watersheds under different scenarios of N deposition, precipitation, climate change and forest management, which will help provide a basis for making policy. (2) Forest sensitivity to acid deposition will be evaluated and mapped.
<b>Carbon Measurements and Accounting (FS) Program Contact: Conard/Reaves</b>					
This research will establish a common carbon monitoring and accounting framework for forest lands. Such protocols are needed to reduce risks and facilitate private investment in sequestration projects. Products include estimates of benefits from carbon sequestration projects; technical guidelines for project-level carbon measurements; and software for calculating emissions and sequestration.	0.0	0.5	Directly related. Technology development	Carbon Cycle (technology)	This research will contribute to development of accounting rules and guidelines for carbon sequestration projects.
<b>Sequestration Technology Demonstration Projects (FS) Program Contact: Conard/Reaves</b>					
The Forest Service will develop and demonstrate techniques to increase carbon sequestration through forest management. A series of projects to develop and demonstrate forest management for carbon sequestration will be implemented through public-private partnerships. Projects may be designed to include environmental co-benefits such as improved soil quality and wildlife habitat. Products include demonstration sites; research reports; educational materials.	0.0	1.0	Directly related. Technology development	Carbon Cycle (technology)	Demonstration projects will facilitate implementation of the Administration's voluntary program to increase carbon sequestration.
<b>Inventories of Carbon Biomass (FS) Program Contact: Conard/Reaves</b>					
The National Climate Change Research Initiative will reduce uncertainties in National land-based carbon monitoring; improve the timeliness of reporting; facilitate integration of monitoring programs among USDA, DOE, NASA, and NOAA; and provide a strong scientific foundation for the Administration to include carbon sequestration in international negotiations on emissions. Products include research papers on monitoring and estimation methods, and improvements in estimates of past and projected carbon stocks in U.S. forest.	0.0	0.5	Core - CCRI	Carbon Cycle	This research will contribute to the interagency inventory of greenhouse gas emissions and sinks, and to analyses of the potential of U.S. forests to sequester carbon.
Total	57.0	72.0			

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
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**USGS Agency Representative: Janet Hren, (703) 648-4480, jhren@usgs.gov**

<p><b>Land Characterization Research and Applications</b> Program Contact: Dave Kirtland, USGS, 703-648-4712, dakirtland@usgs.gov</p>					
<p>Land surface characterization includes research, development, and application of techniques to monitor, analyze, describe, and predict land use, land cover, and other earth surface characteristics. These data are used to characterize and map the Earth's surface, model land surface processes, detect changes over time, project the response of the land surface to changes in climate and other environmental influences, investigate the impact of land-cover changes on the environment, and inform decision making. Research to understand the causes and consequences of land-cover change is also conducted, in part, to improve model development and application. Specific goals are to 1) understand the response of the land surface to natural and human forcing, 2) understand the impact of land surface change on carbon and other nutrient cycling, 3) understand the impact of land surface change on ecosystem health, and 4) understand the impact of land surface change on human health.</p>	3.1	3.1	Core GCRP	Land Use/Cover Change	Time series of multi-resolution data bases of land use/cover data and related, ancillary information; trend analyses of changes in land use/cover from the 1970s; analytic tools for processing, analyzing, and disseminating land use/cover information
<p><b>Satellite Data Management and Dissemination</b> Program Contact: John Faundeen, USGS, (605) 594-6092, faundeen@usgs.gov</p>					
<p>The National Satellite Land Remote Sensing Data Archive is the only permanent comprehensive repository of global remotely-sensed land data. NSLRSDA includes the Landsat 7 satellite program which provides recurring, high-resolution land surface monitoring data for global change studies. Emphasis areas of applied development activities include an understanding of the temporally-dependent information content of remotely sensed data as they describe processes affecting the Earth's land surface.</p>	4.0	4.0	Core CGRP	Carbon cycle, Water cycle, Terrestrial and Marine Ecosystems, Land Use/Land Cover Changes	The National Satellite Land Remote Sensing Data Archive (NSLRSDA) represents a diverse 40-year data record from which scientists and policy-makers document Earth processes and human-induced changes to the Earth's land surface. While these time-series data themselves are not directly used for making policy, they are the raw material from which others derive a variety of important policy-relevant information.

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Earth Surface Dynamics</b> Program Contact: Richard Reynolds, U.S. Geological Survey, 303-236-1303; rreynolds@usgs.gov</p>					
<p>Research: (A) Anticipate the environmental effects of climate variability: (i) climate records of recent past; (ii) monitoring, modeling, forecasting. (B) Understand interactions among physical, chemical, ecologic, and human systems applied to regions and ecosystems. <b>Observations:</b> Climate records (e.g., drought/flood histories); regional impacts of climatic variability on landscapes and ecosystems (e.g., vegetation change, erosion of soil by wind and water, sea-level rise); carbon burial and release; permafrost melting; arctic temperature change during last 20 years; melting glaciers. <b>Decision Support:</b> Forecasts of (i) permafrost melting and arctic temperature change; (ii) carbon storage and release in terrestrial ecosystems; ecologic change (invasive species; fire potential) related to future climate and atmospheric composition; drought duration; arid-land erosion and dust generation; wetland loss from sea-level rise.</p>	10.1	10.1	Core GCRP	Climate Variability and Change, Terrestrial and Marine Ecosystems, Carbon cycle, Water cycle	(1) Maps and atlases showing likely changes in vegetation across Nation related to changing atmospheric CO2 content. (2) Initial results from monitoring permafrost melting (North Slope, AK) and rate of regional (Alaskan arctic) temperature increase. (3) Forecasts of the effects of expectable short-term climatic change (e.g., ENSO and other climatic variations causing drought or flooding) on landslide potential; dust-storm frequency and related soil erosion and atmospheric transport of pathogens producing disease outbreak; atmospheric particulate matter (causing air pollution) that is produced by wind erosion of the Nation's arid lands; stream erosion and sediment discharge that damages ecosystems and infrastructure such as reservoirs; sand-dune reactivation affecting agricultural and grazing lands; spread of invasive plants. (4) Analyses of regional carbon sources and sinks (fluxes and feedbacks) in uncertain areas of the arctic, S & N river basins and wetlands.
<p><b>Gas Hydrate Project</b> Program Contact: John Haines, U.S Geological Survey, 703-648-6422, jhaines@usgs.gov</p>					
<p>Gas Hydrate Project. <b>Research:</b> Investigations of methane hydrate formation, stability, and release in near shore environments. <b>Observations:</b> Determine natural hydrate distributions and the amount of methane present in gas hydrate; estimate amount of methane in gas hydrate for Nation and world.</p>	1.4	1.4	Directly Related	Energy System Analysis	1) field and analytical tools to improve assessments of gas hydrate occurrence and concentration. 2) analytical tools and model simulations to improve assessments of the potential for release of marine gas hydrates and to better understand the role of marine gas hydrates in global change.

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Global Change Hydrology (Hydroclimatology)</b>      <b>Program Contact: William Kirby,</b>  <b>USGS-WRD, (703) 648-5315 wkirby@usgs.gov</b></p>					
<p>Hydroclimatology focuses on the spatial and temporal variability of present and past hydrologic condition in relation to atmospheric circulation and other climate indices, and on developing predictive methods related to the hydroclimatology of North America, including: 1) seasonal and interannual variations in regional streamflow in relation to atmospheric circulation; 2) monitoring accumulation and dissipation of snow and ice stored in selected U.S. benchmark glaciers and seasonal snowpacks in relation to atmospheric circulation; 3) physical and chemical variability in riverine and estuarine environments in relation to large-scale atmospheric and oceanic conditions (to discriminate natural from human-induced effects on such systems); 4) documentation of long-term behavior of hydrologic systems in response to past climatic variations and changes to more recent (decadal) hydrologic trends; 5) improved representations of terrestrial hydrologic processes, including field studies of regional evaporation, greenhouse gas transfer between the Earth surface and atmosphere, and sequestration and release of carbon by geological deposition and erosion, for use in general circulation and regional climate models.</p>	2.6	2.6	Core GCRP	Climate Variability and Change; Water Cycle.	Products will include -- data sets documenting past and present temporal and regional fluctuations of hydrologic variables (such as glacier ice volumes, streamflow, and streamflow indices); estimates and predictions of variability and trends in regional hydrologic conditions; peer-reviewed scientific publications and reports that -- a) describe and explain hydrologic variability and change and their relations to climatic and atmospheric indices, b) assess and evaluate potential impacts of climate variability and change on hydrologic conditions, and c) describe and evaluate methodologies for estimation and prediction of hydrologic conditions.
<p><b>Carbon Cycling and Sequestration (PROPOSED PROGRAM FOR FY 2004)</b>  <b>Program Contact:David J. Shultz, USGS-WRD, (703) 648-5729 djshultz@usgs.gov</b></p>					
<p>The Carbon program will be based on the North American Carbon Program (NACP) and will focus on critical issues in managing lands important to the Nation and Federal agencies. Proposed activities will include: 1) field studies and modeling of plant and soil carbon dynamics, upland soil erosion, carbon sequestration in sediment deposits and wetlands, 2) research on effects of fire, including fire control, encroachment of woody shrubs, and post-fire erosion, to determine how carbon storage changes through fire-regrowth cycles, 3) assessment of agricultural and wetland restoration activities to identify optimal carbon sequestration strategies, 4) field and greenhouse experiments and modeling to evaluate the response of wetland processes to projected increases in atmospheric carbon dioxide, altered precipitation patterns, and sea-level rise, 5) work in high-latitude regions where methane hydrates are associated with permafrost and therefore sensitive to climate change, 6) provision of policy-relevant interpretations of the geologic record of past natural carbon-climate interactions, focusing on the influence of carbon cycling on</p>	0.0	0.0	Core CCRI	Carbon Cycle	Products will include-- --1) Explanation of how the carbon cycle works; --2) emissions estimates and trends; --3) regional-scale carbon inventories and flux estimates; --4) assessment of the potential of carbon-management strategies; --5) evaluation of stability of carbon storage; --6) key data sets and information needed by DOI bureaus in their efforts with the private sector to restore and manage wetlands, forestlands, and rangelands for carbon sequestration.



Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Water Energy and Biogeochemical Budgets (WEBB) Program Contact: Mary Jo Baedecker, USGS, 703-648-5041, mjbaedec@usgs.gov</b></p>					
<p>Research - Results are designed to gain an understanding of watershed processes responsible for hydrologic spatial variation and decadal scale trends related to atmospheric deposition, regional and global climate variations, changes in atmospheric composition, anthropogenic disturbances, and non-point source pollution. Studies, done in collaboration with scientists from other government agencies and universities, are focused on identifying and delineating the sources, flow paths, and interactions of ground water and surface water, on the cycling of nutrients, and on the transport of sediment and solutes in five small watersheds with different hydrology and climate.</p>	2.7	2.7	Core GCRP	Water Cycle	<p>Through meetings and peer-reviewed scientific publications, the following information will be available to water resources managers: A comparison of watersheds impacted and not impacted by humans; results from studies showing a correlation between particulate organic carbon and mercury; knowledge about groundwater recharge and flow paths developed from using chlorofluorocarbons to date ground water; data from studies looking at groundwater response to streamwater and precipitation in riparian vs. hillslope locations; results from applying isotopes to obtain information about the effects of atmospheric deposition on alpine/subalpine aquatic ecosystems; documentation of a watershed model to enable water-resources managers to obtain information about how watersheds that have different physiographic settings, hydrologic processes, atmospheric inputs, and weathering reactions respond to natural and human-induced changes</p>
<p><b>Water Energy and Biogeochemical Budgets (WEBB)</b></p>					
<p>Observations - Available long-term data include precipitation and discharge data, plus data on sediment and concentrations of major ions entering and exiting five small watersheds. Although the WEBB program began in 1991, some of the data are available for longer periods since one of the original criteria in selecting the sites was the availability of existing long-term data sets.</p>				Water Cycle	
<p><b>Water Energy and Biogeochemical Budgets (WEBB)</b></p>					
<p>Decision support - A watershed model that is being developed incorporates temperature and precipitation distribution, canopy interception, evapotranspiration, one-dimensional transport with inflow and storage, and geochemistry. When complete, it will provide water-resources managers with information about how watersheds that have different physiographic settings, hydrologic processes, atmospheric inputs, and weathering reactions respond to natural and human-induced changes.</p>				Water Cycle	

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>National Streamflow Information Program</b> Program Contact: Michael Norris, USGS-WRD, (703) 648-5304 mnorris@usgs.gov</p>					
<p>The National Streamflow Information Program (NSIP) provides information on the quantity and timing of the streamflow in the Nation's rivers and streams that is needed in order to safeguard lives and property and to ensure adequate water resources for a healthy environment and economy. The U.S. Geological Survey operates and maintains approximately 7,000 streamgages which provide long-term, accurate, and unbiased information that meets the needs of many diverse users. The USGS's National Streamgaging Network consists of a core of USGS funded and operated streamgages, streamgages operated by the USGS but funded in cooperation with other agencies, and streamgages funded and operated by other agencies that provide data appropriate to meet NSIP goals. Although the National Streamgage Network is operated primarily by the USGS, it is funded by a partnership of 800 agencies at the Federal, State, Tribal and local levels.</p>	--	--	Supporting	Climate Variability and Change; Water Cycle	Data sets of observed (gaged) streamflow available to the public on the world-wide web; data reports and compilations; procedures for estimating streamflow statistical characteristics at ungaged sites.
<p><b>National Atmospheric Deposition Program / National Trends Network (NADP/NTN)</b> Program Contact: Mark Nilles, USGS-WRD, (303) 236-1875 manilles@usgs.gov</p>					
<p>The interagency National Atmospheric Deposition Program monitors wet atmospheric deposition (chemicals deposited in precipitation to the earth's surface) at 240 National Trends Network sites throughout the United States. As the lead federal agency in this effort, the USGS supports 74 of the 240 NADP/NTN sites. A fundamental NADP program objective is to provide scientific investigators worldwide with a long-term, high-quality database of atmospheric deposition for research support in the areas of air quality, water quality, agricultural effects, forest productivity, materials effects, ecosystem studies, watershed studies and human health.</p>	--	--	Supporting	Energy System Analysis; Terrestrial and Marine Ecosystems; Atmospheric Composition.	Scientific research reports, data sets, and assessments to gauge the impact of national emission control policies and evaluate the effects of atmospheric deposition on aquatic and terrestrial ecosystems.

Program Description (including expected products in the categories of research, observations, and/or decision support)	FY02 Est. (\$ M)	FY03 Req. (\$ M)	Category	Relevant Theme	Policy-relevant deliverables expected during next 1-4 years
<p><b>Terrestrial and Coastal Ecosystem Changes</b> Program Contact: Stan Coloff, USGS, Biological Resources Discipline, 703-648-4083, stan_coloff@usgs.gov</p>					
<p>USGS ecosystem studies focus on the influence of climate change on Department of Interior lands and their ability to adapt to multiple environmental factors at the local, landscape and regional scale. Program goals are to 1) determine sensitivity and response of natural systems to climate and environmental factors at the local, landscape and regional levels; 2) predict future global change impacts on the structure, function and viability of natural systems; and 3) provide scientific information and assistance for resource management. Studies include: influence of multiple stressors in National Parks and other protected areas, affects climate change on restoration of rangeland and grasslands, fire-climate interactions on public lands, sea-level rise and impact on coastal wetlands, carbon and nutrient cycling in in-land wetlands.</p>	5.5	5.5	Core GCRP	Terrestrial and Marine Ecosystems	<ul style="list-style-type: none"> <li>· Documentation of the decline of glaciers and vegetation change in Glacier NP and Cascades NP,</li> <li>· Long-term fire-climate history and affects on forest dynamics in Sequoia-Kings Canyon NP,</li> <li>· Documentation of climate change effects in the Colorado Rockies (Rocky Mountain NP)</li> <li>· Develop decision support tools and predictive models for resource managers to assess desired future rangeland conditions, and plan restoration projects</li> <li>· Establish standard measurements to determine sea-level change</li> <li>· Determine how certain coastal wetlands “keep up” with sea-level rise</li> <li>· Determine how climate and fire interact to enhance spread of invasive plants and alter fire regimes in native vegetation</li> </ul>
Total	29.4	29.4			