BUDGET ACTIVITY: CLIMATE SERVICE (Proposed)

For FY 2012 NOAA requests a net decrease of $3,010,000 and an increase of 27 FTE over the FY 2010 enacted level for a total of $346,218,000 and 610 FTE for NOAA's Climate Service. This includes $4,096,000 in inflationary adjustments. The Climate Service is proposed as a new operating unit within NOAA that will operate at the same level of organization as the other NOAA line offices. Existing resources from the Office of Oceanic and Atmospheric Research, the National Weather Service, and National Environmental Satellite Service (proposed name change for National Environmental Satellite, Data, and Information Service) are proposed for consolidation to establish this new operating unit. A full justification for this proposed reorganization is provided in the reorganization section of the budget entitled, "NOAA's Reorganization Proposal for a Climate Service and Other Purposes."

Base Justification for FY 2012:

The base programs and resources presented here for the proposed Climate Service are derived by proposed transfers of selected programs appropriated to other line offices in the Consolidated Appropriations Act, 2010. There are no new programs or activities in the base identified for the Climate Service. The reorganization was carefully designed to be budget neutral.

NOAA's Climate Service Operations, Facilities, and Research base ($316,899,000 and 583 FTE) includes the following subactivities:

- Climate Research ($137,497,000 and 252 FTE) includes the ongoing research to better understand the earth system, climate variability, and climate change.
- Integrated Climate Services ($29,017,000 and 7 FTE) includes the National Integrated Drought Information System (NIDIS), assessment services, and regional climate services.
- Climate Observations and Monitoring ($141,440,000 and 324 FTE) includes NOAA's ocean observing assets, and data centers.

NOAA's Climate Service Procurement, Acquisition, and Construction base ($36,425,000 and 0 FTE) includes the following subactivities:

- Climate Research ($10,379,000 and 0 FTE) includes NOAA's investments in Research High Performance Computing
- Climate Observations and Monitoring ($26,046,000 and 0 FTE) includes CLASS, Data Center Modernization, and the Regional US Historical Climatology Network.

The Climate Service (CS) is being created through a proposed reorganization of existing resources. NOAA carefully took into consideration the recommendations of the National Academy of Public Administration (NAPA) study for effective and efficient organizational design and implementation of a Climate Service Line Office and worked to ensure the size of the administrative functions necessary to administer the programs and activities of the CS are commensurate with comparable overhead requirements of the other line offices. The proposed reorganization does not increase or decrease the NOAA Full-Time Equivalent (FTE) or billet allocation, and the current facilities will accommodate this reorganization.

The proposed CS will identify, produce, and deliver authoritative and timely information about climate variations, trends, and their impacts on built and natural systems. This information informs and is informed by decision-making, risk management, and resource management concerns for a variety of public and private users acting on regional, national, and international scales. The CS will bring together NOAA's unique set of capabilities and experience in the provision of atmospheric and oceanographic science and services to work with others in meeting the need for climate services on regional to national to global scales. The CS will build upon and continue NOAA's achievements gained over decades of performing world-class, preeminent climate science, and the engagement with interagency, academic, and private sector partners.

NOAA will maintain the continuity and integrity of existing programs that move from the current to the proposed Line Office structure, as evidenced by the continuing activities described in this base budget narrative. The reorganization to create a CS will allow NOAA to integrate its existing climate research, observations, monitoring, modeling, information product development and delivery, and decision support functions to meet the demand for climate information for an informed society capable of anticipating and responding to climate change and its impacts.

The local-to-regional-to-global-scale impacts of climate variability and change have fueled a growing public demand for climate products and services, easily accessible and timely scientific data and information about climate that helps people make informed decisions in their lives, businesses, and communities. NOAA will work collaboratively with decision-makers and partners in the public and private sectors to achieve four interdependent strategic objectives:

- Improved understanding of the changing climate system and its impacts;
- Assessments integrating across current and future states of the climate system that identify potential impacts and inform science, services, and decisions;
- Mitigation and adaptation choices supported by sustained, reliable, and timely climate services; and
- A climate-literate public that understands its vulnerabilities to a changing climate and makes informed decisions.

***** THE FOLLOWING CS STRUCTURE IS NOTIONAL AND CONTINGENT UPON CONGRESSIONAL APPROVAL. *****

The CS operates through a network of CS laboratories, CS programs, and university-based research partnership programs. The CS budget is executed through three core programs: (1) Climate Research Program, (2) Integrated Climate Services, and (3) Observations and Monitoring.

Climate Service Laboratories and Cooperative Institutes

The Climate Research Program provides credible and authoritative science to meet the needs of NOAA and the Nation and to advance the understanding and prediction of climate variability and change. It will also provide essential information for mitigating human influence on climate and for adapting to climate change.

This program pursues a process-level understanding of the changing climate system, to develop a predictive understanding of climate variability and change on time scales of weeks to a century, on geographic scales from global to regional, and applies this knowledge in the development, testing and applications of coupled earth system models. Research includes quantifying, with uncertainty ranges, the roles of natural variability and climate forcing by greenhouse gases, aerosols, clouds, land use, and their interactions, as well as influences of a changing climate on atmospheric constituents and oceanic composition.

The outcome of this capability is to provide a comprehensive understanding and description of the current and future state of the climate system with assessed uncertainties and impacts.

The Climate Research Program capabilities are conducted through four research laboratories, multiple cooperative institutes, and two support programs.

Research Laboratories

Chemical Sciences Laboratory (CSL) in Boulder, CO, provides the chemical-process measurements, analyses, and understanding that are needed to address NOAA's Climate adaptation and mitigation requirements, studying topics such as climate forcing and air quality, to improve NOAA's ability to: (1) predict changes in climate, the stratospheric ozone layer, and air quality and (2) deliver related science information products that address societal and policy needs. More information about CSL is available at: http://www.esrl.noaa.gov/csd/

Geophysical Fluid Dynamics Laboratory (GFDL) in Princeton, NJ, conducts the cutting-edge research necessary to understand, project and predict Earth's climate on a range of space and timescales. Research at GFDL addresses many topics through advanced mathematical modeling of the climate and Earth system, including natural climate variability, anthropogenic climate change, weather and hurricane forecasts, El Niño prediction, and stratospheric ozone depletion. The research conducted at GFDL can be developed and transitioned to NOAA operations for the prediction of short-term atmospheric phenomena and into climate understanding and informational products to support policy decision making. More information about GFDL is available at: http://www.gfdl.noaa.gov/

Global Monitoring and Research Laboratory (GML) in Boulder, CO, ESRL's Global Monitoring Division conducts sustained observations and research related to global distributions, trends, sources and sinks of atmospheric constituents that are capable of forcing

change in the climate of the Earth. This research will advance climate projections and provide scientific policy-relevant, decision support information to enhance society's ability to plan and respond. GML continuously monitors atmospheric gases, particles, and radiation across the globe to determine trends influencing climate change, ozone depletion, and baseline air quality, and communicates its findings in usable and understandable forms. More information about GML is available at: http://www.esrl.noaa.gov/gmd/

Physical Science Laboratory (PSL) in Boulder, CO, addresses physical science questions with short- and long-term societal and policy relevance within NOAA's Climate and Weather and Water Goals. This division conducts the physical process research needed to provide a seamless suite of information and forecast products, ranging from short-term weather forecasts to longer-term climate forecasts and assessments. PSL's scientific goal is to provide the observation, analysis, and diagnosis of weather and climate physical processes necessary to increase understanding of Earth's physical environment, including the atmosphere, ocean, cryosphere, and land, and to enable improved weather and climate predictions on global-to-local scales. More information about PSL is available at: http://www.esrl.noaa.gov/psd/

Cooperative Institutes

The CS has competitively awarded cooperative institute partnerships with academic and scientific institutions to foster long-term collaborations dedicated to advancing oceanic and atmospheric research. These cooperative institutes are collocated with one or more NOAA facilities to promote scientific exchange and technology transfer, and provide valuable capabilities and expertise to supplement CS laboratory work.

The primary purpose of each institute is to create a mechanism to bring together the resources of a research-oriented university or institution, the CS, and other branches of NOAA in order to develop and maintain a center of excellence in research. Each Cooperative Institute represents a synergy that has brought together NOAA and premier academic and scientific institutions in a mutually beneficial arrangement to address issues of national and international significance unique to these partnerships. Among the broad range of topics that Cooperative Institutes address are climate processes impacting the Earth's oceans, the Great Lakes, inland waters, Arctic regions, the intermountain West, and the atmosphere. These partners pool resources to produce state-of-the-art interdisciplinary scientific research and outreach. The institutes associated primarily with the CS are:

- **The Cooperative Institute for Climate Applications and Research** (CICAR), located at the Lamont-Doherty Earth Observatory Campus of Columbia University in Palisades, NY, conducts research on earth system modeling, modern and paleo-climate observations, and climate variability and change applications. CICAR collaborates primarily with the CS Line Office and GFDL.
- **The Cooperative Institute for Climate Science** (CICS), located at Princeton University's Forrestal Campus in Princeton, NJ, conducts research on earth system modeling development and analysis, earth system modeling applications, and data assimilation. CICS collaborates primarily with the CS Line Office and GFDL.
- **The Cooperative Institute for Research in Environmental Sciences** (CIRES), at the University of Colorado, in Boulder, CO, conducts research on advanced modeling and observing systems, climate system variability, geodynamics, integrative activities, planetary metabolism, and regional processes. CIRES collaborates primarily with the CS Line Office, CSL, GML, PSL, and NESS.

- **The Cooperative Institute on Marine Ecosystems and Climate** (CIMEC), located at Scripps Institution of Oceanography (SIO) at the University of California-San Diego, conducts research on climate and coastal observations, analysis, and prediction, research on biological systems, research in extreme environments, and R&D on observations systems. CIMEC collaborates primarily with the CS Line Office and Southwest Fisheries Science Center.
- **The Cooperative Institute for the North Atlantic Region** (CINAR), is located at Woods Hole Oceanographic Institution, Woods Hole, MA. CINAR conducts research on ecosystem forecasting, ecosystem monitoring, ecosystem management, protection and restoration of resources, and sustained ocean observations and climate research. CINAR collaborates primarily with the CS Line Office and North East Fisheries Science Center.
- **The Joint Institute for Marine and Atmospheric Research** (JIMAR), located at the University of Hawaii in Honolulu, HI, conducts research on tsunamis and other long-period ocean waves, equatorial oceanography, climate, fisheries oceanography, tropical meteorology, and coastal research. JIMAR collaborates primarily with the Global Monitoring and Research Laboratory and National Marine Fisheries Service programs.

More information on the CS's Cooperative Institutes is available at: http://www.nrc.noaa.gov/ci

Competitive Research Program The CS Line Office manages the competitive research program in which NOAA funds high-priority climate science to advance understanding of the Earth's climate system and its atmospheric, oceanic, land, and snow and ice components. This science contributes to knowledge about how climate variability and change affect our health, economy, and well-being and supports research that is conducted in regions across the United States, at national and international scales, as well as globally. The competitive research program coordinates climate activities with other line offices (including NESS, NWS, NMFS, and NOS) and works with many external partners. More information about the Competitive Research Program is available at: http://www.climate.noaa.gov/cpo_pa/

Research Super Computing The CS manages a high-performance computing system, which provides a key platform to characterize and quantify climate variations and change through the following leveraged research activities: long-term simulations using better and improved global climate models that include interactive atmospheric chemistry and aerosols; Earth System modeling to determine the fate of the anthropogenic carbon in the land and oceans; research on decadal predictability of the unforced and forced climate system including dependence on initialization and assimilation techniques; and progressively higher resolution atmospheric and oceanic modeling for regional climate change information.

National Data Centers

- **National Climatic Data Center** (NCDC), found in Asheville, NC, is the world's largest active archive of weather data. NCDC produces numerous climate publications and responds to data requests from all over the world. The Center also operates the World Data Center for Meteorology, and the World Data Center for Paleoclimatology. NCDC supports a three tier national climate services support program – the partners include: NCDC, Regional Climate Centers, and State Climatologists. More information about NCDC is available at: http://www.ncdc.noaa.gov/oa/about/about.html

- **National Geophysical Data Center** (NGDC), located in Boulder, CO, provides long-term scientific data stewardship for the Nation's geophysical data, ensuring quality,

integrity, and accessibility. NGDC's data holdings currently contain more than 400 digital and analog databases, some of which are very large. As technology advances, so does the search for more efficient ways of preserving these data. The Center also works closely with contributors of scientific data to prepare documented, reliable data sets. They welcome cooperative projects with other government agencies, nonprofit organizations, and universities, and encourage data exchange. More information about NGDC is available at: http://www.ngdc.noaa.gov/ngdcinfo/aboutngdc.html

- **National Oceanographic Data Center** (NODC), located in Silver Spring, MD, is an organization that provides scientific and public stewardship for national and international marine environmental and ecosystem data and information. With its regional branch assets and divisions, NODC is integrated to provide access to the world's most comprehensive sources of marine environmental data and information. NODC maintains and updates a national ocean archive with environmental data acquired from domestic and foreign activities and produces products and research from these data which help monitor global environmental changes. More information about NODC is available at: http://www.nodc.noaa.gov/General/NODC-About/index.html

Observations and Monitoring Support Programs

NOAA currently maintains most of the nation's sustained climate observing networks. Ocean Observations and Atmospheric Observations are the two main types of in-situ networks providing integrated observations. The information provided by the observation networks are archived and used for research and product development in Environmental Services.

- **Ocean Observations:** The main component of Ocean Observations is the Global Ocean Observing System (GOOS). GOOS is a permanent global system for observations, modeling and analysis of marine and ocean variables to support operational ocean services worldwide. GOOS provides accurate descriptions of the present state of the oceans, including living resources; continuous forecasts of the future conditions of the sea for as far ahead as possible, and the basis for forecasts of climate change.

- **Atmospheric Observations:** NOAA's Atmospheric Observations program manages the resource of global climate in-situ and remotely sensed data and information to promote global environmental stewardship; to describe, monitor, and assess the climate; and to support efforts to predict changes in the Earth environment. Components of the Atmospheric Observation include the NOAA Atmospheric Baseline Observatories and U.S. Climate Reference Network (USCRN) efforts.

- **Environmental Services:** The goal of Environmental Services is to provide increased access and utility to environmental data, information, products, and services through the use of innovative technologies and techniques. The suite of functions include (1) sustain and operate timely/convenient access to the full range of data in the CLASS Operations System, (2) sustain and operate non-CLASS IT infrastructure that supports customer services and data management functions, (3) improve the integrity and fidelity of the historical climate record, and (4) integrate data across observing systems for easier and more timely access by customers.

Proposed Reorganization to Establish a Climate Service Line Office:

The Climate Service is proposed as a new operating unit within NOAA that will operate at the same level of organization as the other NOAA line offices. Existing resources from the Office of Oceanic and Atmospheric Research, the National Weather Service, and National Environmental Satellite Service (proposed name change for National Environmental Satellite, Data, and Information Service) are proposed for consolidation to establish this new operating unit. A full justification for this proposed reorganization is provided in the reorganization section of the budget "NOAA's Reorganization Proposal for a Climate Service and Other Purposes."

Research and Development:

The NOAA FY 2012 Budget estimates for its activities, including research and development programs, are the result of an integrated requirements-based strategic planning process. This process provides the structure to link NOAA's strategic vision with programmatic detail and budget development, with the goal of maximizing resources while optimizing capabilities. CS requests $ 246,599,000 for investments in R&D and infrastructure to support R&D in the FY 2012 Budget.

NOAA's strategic planning process makes specific reference to the objectives and milestones outlined in the NOAA 5-Year Research Plan for 2008-2012. The strict management of planning against these investment criteria, objectives, and milestones leads to NOAA budget proposals that reflect the research and development needs of the organization. The NOAA Research Council - an internal body composed of senior scientific personnel from every line office in the agency - is tasked with developing the 5-Year Research Plan, and provides corporate oversight to ensure that NOAA's research activities are of the highest quality, meet long-range societal needs, take advantage of emerging scientific and technological opportunities, and shape a forward-looking research agenda.

Significant Adjustments-to-Base (ATBs):

NOAA requests a net increase of 2 FTE and $4,096,000 to fund adjustments to current programs for Climate Service activities. The increase will provide inflationary increases for non-labor activities, including service contracts, utilities, field office lease payments, and rent charges from the General Service Administration (GSA).

To establish the base operational unit, Climate Service, the following transfers from other NOAA line offices are proposed for a net change of $0:

Transfer Office	Line	Recipient Office	Line	Amount ($K)/FTE
OAR	Climate Labs & Coop. Institutes	Climate Service	Climate Research – Modeling	$14,877/ 53 FTE
OAR	Climate Labs & Coop. Institutes	Climate Service	Climate Research - Physical Sciences	$2,993/ 25 FTE
OAR	Climate Labs & Coop. Institutes	Climate Service	Climate Research - Chemical Sciences	$9,203/ 36 FTE
OAR	Climate Labs & Coop. Institutes	Climate Service	Climate Research - Global Monitoring &	$6,240/ 25 FTE

			Research	
OAR	Competitive Research Program	Climate Service	Climate Research – Modeling	$4,832/ 15 FTE
OAR	Competitive Research Program	Climate Service	Climate Research - Physical Sciences	$301/ 5 FTE
OAR	Competitive Research Program	Climate Service	Climate Research - Chemical Sciences	$4,828/ 4 FTE
OAR	Competitive Research Program	Climate Service	Climate Research - Global Monitoring & Research	$7,365/ 15 FTE
OAR	Competitive Research Program	Climate Service	Climate Research - Competitive Research Program	$68,595/ 44 FTE
OAR	Competitive Research Program	Climate Service	Integrated Climate Service - NIDIS	$9,762/ 1 FTE
OAR	Competitive Research Program	Climate Service	Integrated Climate Service - Regional Services	$788/ 3 FTE
OAR	Competitive Research Program	Climate Service	Integrated Climate Service - Communication & Education	$1,400/ 0 FTE
OAR	Competitive Research Program	Climate Service	Observations & Monitoring - Ocean Observations	$40,378/ 19 FTE
OAR	Competitive Research Program	Climate Service	Observations & Monitoring - Climate Data & Information Services	$1,014/ 0 FTE
OAR	Competitive Research Program	Climate Service	Observations & Monitoring - Environmental Sciences	$483/ 0 FTE
OAR	Competitive Research Program	Climate Service	Observations & Monitoring - Atmospheric Observations	$453/ 1 FTE
OAR	Regional Climate Assessment	Climate Service	Integrated Climate Service - Assessment Services	$9,000/ 0 FTE
OAR	Climate Data & Information	Climate Service	Climate Research - Competitive Research Program	$1,133/ 1 FTE
OAR	Climate Data & Information	Climate Service	Integrated Climate Service - NIDIS	$3,753/ 0 FTE
OAR	Climate Data & Information	Climate Service	Observations & Monitoring - Climate Data & Information Services	$2,395/ 0 FTE

OAR	Climate Data & Information	Climate Service	Observations & Monitoring - Ocean Data & Information Services	$12/ 0 FTE
OAR	Climate Data & Information	Climate Service	Observations & Monitoring - Atmospheric Observations	$4,787/ 2 FTE
OAR	Climate Operations	Climate Service	Climate Research - Modeling	$320/ 0 FTE
OAR	Climate Operations	Climate Service	Integrated Climate Service - Regional Services	$593/ 0 FTE
OAR	Climate Other Partnership Programs	Climate Service	Climate Research - Chemical Sciences	$350/ 0 FTE
OAR	Climate Other Partnership Programs	Climate Service	Climate Research - Global Monitoring & Research	$100/ 0 FTE
OAR	Climate Other Partnership Programs	Climate Service	Climate Research - Competitive Research Program	$645/ 0 FTE
OAR	Climate Other Partnership Programs	Climate Service	Integrated Climate Service - Regional Services	$3,000/ 0 FTE
OAR	W&AQ Labs & Coop. Institutes	Climate Service	Climate Research - Modeling	$3,456/ 4 FTE
OAR	W&AQ Labs & Coop. Institutes	Climate Service	Climate Research - Physical Sciences	$7,472/ 22 FTE
OAR	W&AQ Labs & Coop. Institutes	Climate Service	Climate Research - Chemical Sciences	$3,800/ 0 FTE
OAR	W&AQ Labs & Coop. Institutes	Climate Service	Climate Research - Global Monitoring & Research	$192/ 1 FTE
OAR	W&AQ Other Partnership Programs	Climate Service	Climate Research - Physical Sciences	$500/ 0 FTE
OAR	W&AQ Other Partnership Programs	Climate Service	Climate Research - Chemical Sciences	$500/ 0 FTE
OAR	Research Super-computing	Climate Service	Climate Research - Research Super-computing (PAC)	$10,379/ 0 FTE
NWS	Local Warnings & Forecasts	Climate Service	Observations & Monitoring - Ocean Observations	$4,300/ 0 FTE
NWS	Central Forecast Guidance	Climate Service	Observations & Monitoring – Observations, Monitoring & Prediction	$6,930/ 47 FTE
NWS	Cooperative Observer Network Mod.	Climate Service	Observations & Monitoring - Historical	$3,734/ 0 FTE

	(NERON)		Climatology Network Modernization (PAC)	
NESS	Archive, Access, & Assessment	Climate Service	Observations & Monitoring - Climate Data & Information Services	$28,189/ 119 FTE
NESS	Archive, Access, & Assessment	Climate Service	Observations & Monitoring - Ocean Data & Information Services	$9,319/ 39 FTE
NESS	Archive, Access, & Assessment	Climate Service	Observations & Monitoring - Geophysical Data & Information Services	$5,946/ 48 FTE
NESS	Archive, Access, & Assessment	Climate Service	Integrated Climate Service - Regional Services	$0/ 3 FTE
NESS	Climate Data Base Modernization	Climate Service	Observations & Monitoring - Climate Data & Information Services	$21,179/ 10 FTE
NESS	Coastal Data Development	Climate Service	Observations & Monitoring - Ocean Data & Information Services	$4,559/ 16 FTE
NESS	Regional Climate Centers	Climate Service	Integrated Climate Service - Regional Services	$3,500/ 0 FTE
NESS	Environmental Data Systems Modernization	Climate Service	Observations & Monitoring - Environmental Sciences	$9,511/ 0 FTE
NESS	Environmental Data Systems Modernization	Climate Service	Observations & Monitoring - Climate Data & Information Services	$0/ 23 FTE
NESS	Integrated Environ Applications & Info Ctr	Climate Service	Observations & Monitoring - Environmental Sciences	$3,000/ 0 FTE
NESS	NOAA Regional Climate Center program	Climate Service	Observations & Monitoring - Environmental Sciences	$850/ 0 FTE
NESS	GOES- N (PAC)	Climate Service	Observations & Monitoring – Data Center Modernization (PAC)	$2,846/ 0 FTE

NESS	CLASS (PAC)	Climate Service	Observations & Monitoring - CLASS (PAC)	$18,476/ 0 FTE
NESS	EOS & Advanced Polar Data Processing, Distribution & Archiving Systems (PAC)	Climate Service	Observations & Monitoring – EOS & Advanced Polar Data Processing, Distribution, & Archiving Systems (PAC)	$990/ 0 FTE
Total Climate Service				**$349,228/ 581 FTE**

Climate Service requests a technical adjustment to move $225,899,000 from OAR to CS. These funds will be used to support the formation of the new CS line office.

Climate Service requests a technical adjustment to move $108,365,000 from NESS to CS. These funds will be used to support the formation of the new CS line office.

Climate Service requests a technical adjustment to move $14,964,000 from NWS to CS. These funds will be used to support the formation of the new CS line office.

PPA level detail on these requested technical adjustments can be found in the table above.

Administrative Cost Savings:

The Administration is pursuing an aggressive government-wide effort to curb non-essential administrative spending called the Administrative Efficiency Initiative (AEI). In order to be good stewards of taxpayer money the Federal Government should continue to seek ways to improve the efficiency of programs without reducing their effectiveness. As such, the President directed each agency to analyze its administrative costs and identify savings where possible. After reviewing its administrative costs, the Climate Service (CS) has identified $4,564,000 in administrative savings. CS has targeted a number of areas to achieve these savings. Using NOAALink, CS anticipates saving money through more strategic sourcing of products and services. Consolidation of products will enable buying in bulk to reduce prices. Consolidation of services will also result in dollar savings by reducing the number of contracts to be managed. In the area of human capital, CS expects to reduce its costs by increasing the lapse rate between hires, buyouts, and attrition to reduce its worker compensation costs. Administrative savings in the areas of logistics plans and in general administrative support have been identified by eliminating non-essential relocation expenses, decreasing shipping costs for observational equipment, reducing printing costs by publishing more assessments and booklets on-line and on-demand, lowering supply stocks, and reducing travel associated with training and management conferences. CS has also identified savings tied to IT related items by decreasing the computer refresh rate and other equipment in general. Acquisition reform initiatives also include reducing contract labor where feasible. The $4,564,000 in administrative savings identified above represent real reductions to the CS funding level and will help reduce overall spending by the Federal government.

Headquarters Administrative Costs:

In FY 2012, CS headquarters will use $9,000,000 in funds to support general management activities, legal, financial and budgeting, and IT related expenses, as well as supporting facilities and other general operating costs. These funds also include support for service contracts, utilities, field office lease payments, and rent charges from the General Services Administration. The overhead for the Climate Service line office will be distributed from the overhead of existing line offices contributing to the creation of Climate Services: OAR and NESDIS/NESS. This is a reorganization of existing resources to create the headquarters and does not represent growth in overhead costs for NOAA.

Although the CS will incorporate savings as per the AEI above throughout the organization, the organization as proposed in this budget was already established in a streamlined fashion, and the $9,000,000 reflects this already lean cost structure. Specifically, CS will use headquarters administrative funds to support the following:

Headquarters Program Support Type	**Description**	**FY12 Amount**	**FY 2012 FTE associated with CS Line Office HQ**
General Management & Direction	Includes Assistant Administrator's office, public affairs, information services	$5,396,500	32.5
CFO Operations	Includes Budget, Finance and Accounting	$1,583,000	10.0
CIO Operations	Includes IT-related expenses and other CIO related activities	$1,050,000	7.0
CAO Operations	Includes Facilities and Security costs, as well as other CAO related activities	$450,000	0
Human Resources	All HR services, including EEO	$85,500	0.5
Procurement services, Acquisitions, and Grants Management Operations		$435,000	0
Total, both pre and post AEI		**$9,000,000**	**50**

NOAA recognizes the need to improve the transparency of the policies and procedures used by its line office headquarters to bill component programs for management and administrative services. NOAA is currently re-evaluating, standardizing, and documenting these policies and procedures for each line office. Prior to the beginning of FY 2012, NOAA will publish its policies and procedures for assessing headquarters and administrative costs within the line offices on the NOAA CFO public website along with other budget and finance documents. NOAA looks forward to working with the Congress and other interested parties to increase the transparency and confidence in NOAA's financial management.

APPROPRIATION: OPERATIONS, RESEARCH, AND FACILITIES

SUBACTIVITY: CLIMATE RESEARCH PROGRAMS

The objectives of the Climate Research Programs subactivity are:

- Describe and understand the state of the climate through sustained atmospheric observations and research related to global distributions, trends, sources and sinks of atmospheric constituents that are capable of forcing change in the climate of the Earth;
- Understand and predict climate variability and change from weeks to decades to centennial timescales;
- Conduct advanced mathematical modeling of the climate and Earth systems, including natural climate variability, anthropogenic climate change, weather and hurricane forecasts, El Niño prediction, and stratospheric ozone depletion to improve the prediction of climate phenomena;
- Conduct physical process research to provide a seamless suite of information and forecast products, ranging from short-term weather forecasts to longer-term climate forecasts and assessments; and
- Understand how decision makers use climate information to improve the ability of society to plan for and respond to climate variability and change.

The Climate Research Programs subactivity is the primary center for climate Research & Development (R&D) within NOAA. CS Climate Research supports the climate R&D needs of NOAA, the Department of Commerce, other Federal agencies, states and localities, industry, and the general public for a greater understanding of, and ability to predict climate variability and change to enhance society's ability to plan and respond. NOAA's Climate Research Program is an integral part of the U.S. Global Change Research Program, as mandated by the U.S. Global Change Research Act. The CS operates through a network of CS laboratories and other CS and university-based research programs. The CS research budget is managed through five program, project and activity components: Modeling, Physical Sciences, Chemical Sciences, Global Monitoring and Research, and the Competitive Research Program. These components enable CS to provide innovative and critical leadership in support of NOAA's Strategic Plan Mission Goals: (1) An informed society anticipating and responding to a changing climate and its impacts; (2) Society prepares for and responds to weather-related events; (3) Marine fisheries, habitats, and biodiversity sustained within healthy and productive ecosystems; (4) Coastal and Great Lakes communities that are environmentally and economically sustainable.

Support for this program currently comes primarily from the three Divisions of the Earth System Research Laboratory (ESRL) in Boulder, CO*, the Geophysical Fluid Dynamics Laboratory (GFDL) in Princeton, NJ, and the Climate Program Office in Silver Spring, MD. More information is provided at the following URLs:

- http://www.esrl.noaa.gov/csd
- http://www.esrl.noaa.gov/psd/
- http://www.esrl.noaa.gov/gmd/
- http://www.gfdl.noaa.gov
- http://www.climate.noaa.gov

*The three divisions of ESRL will become independent laboratories under the CS reorganization.

MODELING

CS modeling research aims to better understand natural climate variability and anthropogenic climate changes via the development and improvement of global Earth System models. Research is conducted at GFDL with the Cooperative Institute for Climate Sciences and a range of national and international partners. Modeling research also includes working cooperatively in NOAA to provide expert assessments of changes to regional, national, and global climate. Research efforts are focused on comprehensive long lead-time climate research fundamental to expanding the scientific understanding of the physical and biogeochemical processes governing the behavior of the atmosphere and oceans and their ecosystems. This research leads to state-of-art global Earth System models, which provide a suite of climate products for decision support by policy makers. To maintain its climate modeling capability, this effort supports a scalable high performance computer system that provides critical computing, storage, and analysis capabilities, as well as model development infrastructure support and data services. This computing program allows NOAA to leverage the world-class research staff at GFDL to advance the Nation's climate program and provide the best possible information and reliable products on climate variability and change to policy-makers and the public.

The Nation's need for short-term warning and forecast products covers a broad spectrum of environmental events, which have lifetimes ranging from several minutes to several months. Modeling efforts also focus on the development of comprehensive numerical global climate models and the frameworks in which the models are embedded. These numerical models are used in the prediction of short-term atmospheric phenomena such as hurricanes and coastal storms, and may also be used to study longer-term events such as the climatology of storm tracks over the oceans and the prediction of developing El Niño Southern Oscillation (ENSO) cycles. The research is developed and transitioned to NOAA operations for the prediction of short-term atmospheric phenomena, including hurricanes, and coastal storms, and El Niño.

PHYSICAL SCIENCES

The Physical Sciences Laboratory provides NOAA with the essential core capability to conduct physical science research across time and space scales. In so doing, the program advances NOAA's abilities to observe, understand and improve the prediction of the behavior of atmosphere, ocean, cryosphere, hydrosphere, land, and related impacts on global-to-local and climate-to-weather scales. The research infrastructure within the program provides the foundation for executing focused observational programs, analyzing physical processes and improving their representation in numerical models, and developing diagnostic and predictive tools required to advance climate, weather and water science. In support of NOAA's mission, the Physical Sciences activity has identified five major strategic goals: 1) Improve observations and understanding of Earth system processes; 2) Integrate climate, weather and water research; 3) Understand, attribute and predict extremes in a variable and changing climate; 4) Advance understanding of regional processes and develop applications related to climate variability and change; and 5) Conduct research and develop prototypes to improve NOAA environmental information and services. To identify user needs for science-based information, the program works closely with its internal partners and a broad external user community. For example, the program interacts and collaborates extensively with external user groups through the NOAA Regional Integrated Sciences and Assessments (RISA) and National Integrated Drought Information System (NIDIS) programs, and through NOAA's Hydrometeorology Testbed (HMT). This research is conducted at the Physical Sciences Laboratory in Boulder, CO

with additional support from CIRES. Physical Sciences research is organized around three primary research activities: Climate Analysis, Water Cycle, and Weather and Climate Physics.

CHEMICAL SCIENCES

The Climate Research Program's Chemical Sciences Laboratory conducts studies that are fundamental to our understanding and prediction of the Earth's climate, the air quality in the United States, and the stratosphere, including the ozone layer. This research is conducted out of the Chemical Sciences Laboratory in Boulder, CO with additional support from CIRES. The goal of the Chemical Sciences research is to understand and quantify the chemical processes responsible for the changes and transformations in the atmosphere related to climate, the stratosphere, and air quality; closely related meteorological, dynamical, and radiative processes are also addressed when necessary. These goals are met through studies in the laboratory, extensive measurements in the atmosphere in focused field studies, diagnostic analyses, representation of these processes in models (in collaboration with others in NOAA and the extramural community), and interpreting the results to elucidate the roles of these processes. The Chemical Sciences Laboratory provides information to NOAA's information customers in government, industry, and the public through the preparation of assessments and evaluation of the current and future states of the Earth's stratosphere (ozone layer), climate, and air quality, including the processes that link them.

GLOBAL MONITORING AND RESEARCH

NOAA's Global Monitoring and Research Laboratory conducts sustained observations and research related to global distributions, trends, sources and sinks of atmospheric constituents that are capable of forcing change in Earth's climate. This research advances climate projections and provides scientific policy-relevant, decision support information to enhance society's ability to plan and respond by providing the best possible information on atmospheric constituents that drive climate change, stratospheric ozone depletion, and baseline air quality. This research is conducted with additional support from CIRES. Sustained observations are conducted at seven manned Global Atmospheric Baseline Observatories, where up to 250 different atmospheric parameters relevant to the study of climate change and ozone depletion are measured. They provide valuable information on (1) the state and recovery of the ozone layer, (2) global carbon dioxide and other greenhouse gases impacting the global climate, and (3) the quality of the air entering and departing the U.S. Measurement of $^{14}CO_2$ at selected sites is an integral part of GMD's program and has allowed scientists to more accurately interpret atmospheric trends and distributions of GHGs. This laboratory supports several components of the US Global Change Research Program (USGCRP), much of the WMO Global Atmospheric Watch program, which aims to coordinate long term, climate relevant measurements worldwide, and other international programs, including the Global Climate Observing System, the Baseline Surface Radiation Network, and the Global Earth Observing System of Systems. The U.S. scientific community coordinates its carbon cycle activities through the USGCRP North American Carbon Program, which aims to quantify, understand, and project the evolution of global carbon sources and sinks in order to better predict future climate. With input from other agencies, the CarbonTracker analysis tool forms the foundation for routine spatial carbon maps and is essential for other USGCRP reports and products, such as periodic "State of the Carbon Cycle" reports and assessments that keep scientists and policy-makers abreast of progress in understanding the North American carbon cycle.

COMPETITIVE RESEARCH PROGRAM

The Competitive Research Program is proposed to be managed out of the CS Line Office in Silver Spring, MD, which funds high-priority climate science within NOAA and with our academic

partners to advance understanding of Earth's climate system and its atmospheric, oceanic, land, and snow and ice components. This science contributes to knowledge about how climate variability and change affect our health, economy, and well-being. The program supports research that is conducted in regions across the United States, at national and international scales, and globally. The program also provides strategic guidance and oversight for the agency's climate science and services programs.

The grant activities are organized within four program activities:

Climate Monitoring

The Climate Monitoring (CM) activity contributes to the development of continuous records and analyses of a range of ocean and atmosphere parameters. CM ensures that the data sets researchers need to understand the climate system are available for analysis. CM supports projects that document and study variations in climate on time scales ranging from less than one year to periods of 100 years and longer, i.e., both instrumental and paleoclimate eras. CM also provides data and information management support for national and international climate assessment projects. Analysis products support other program efforts in modeling of the climate system and development of targeted services to better inform society about climate impacts and response options.

CM comprises the following focus areas:

1. Develop and maintain long time-series indicators of climate variability and change
2. Develop and maintain standard data sets for initialization and evaluation of climate forecast models, assessments of climate change, and informed risk management
3. Perform diagnostic studies of observed patterns of climate variability and change on global to regional scales

Earth System Science

The Earth System Science (ESS) activity provides the process-level understanding of the climate system through observation, modeling, research analysis and field studies to support the development of improved climate models and predictions in support of NOAA's mission. Major activities include:

1. Identifying and interpreting the physical climate mechanisms involving land-atmosphere-ocean-ice interactions responsible for intraseasonal to multi-centennial climate variability, including abrupt climate change
2. Identifying the location, magnitude, dynamics, and variability of global carbon sources and sinks; understanding how ecosystems are impacted by changes in carbon cycling and associated changes in climate
3. Improving understanding of the role of aerosols and chemically-active greenhouse gases in the global climate system

ESS-sponsored research is carried out at NOAA and other Federal laboratories, NOAA Cooperative Institutes, and academic institutions and is coordinated with major national and international scientific bodies including the World Climate Research Programme, the International Geosphere-Biosphere Programme, and the U.S. Global Change Research Program.

Modeling, Analysis, Predictions, and Projections

The mission of the Modeling, Analysis, Predictions, and Projections (MAPP) activity is to enhance the Nation's capability to predict variability and changes in Earth's climate system. MAPP focuses on the coupling, integration, and application of Earth system models and analyses across NOAA, among partner agencies, and with the external research community. Primary objectives include 1) improving Earth system models, 2) supporting an Earth System Integrated Analysis capability, 3) improving methodologies for global and regional-scale analysis, predictions, and projections, and 4) developing integrated assessment and prediction capabilities relevant to decision makers based on climate analyses, predictions, and projections. MAPP includes targeted infrastructure support, competitive grants programs, and mechanisms to support transferring research findings into NOAA's operations.

Climate and Societal Interactions

The NOAA Climate and Societal Interactions (CSI) activity provides national leadership in developing interdisciplinary science and services, including assessments, for application in climate-sensitive sectors and regions. The goals of CSI are: 1) identification and articulation of user-community requirements in multiple sectors, initially with regard to water resources and the coastal zone then branching to related sectors; 2) research and development of innovative and broadly applicable approaches to support decision-making, especially for risk characterization, both through a broad network of regionally scoped, long-term efforts and stakeholder-specific efforts; and 3) promotion of the transfer of knowledge, tools, and products across climate service development efforts (within NOAA, across the Federal government, nationally, and internationally).

In addition, several of CSI's initiatives support the Coping with Drought initiative of the National Integrated Drought Information System (NIDIS) by supporting regions threatened by drought. CSI's focus areas are:

1. CSI-Regions supports regional, multi-sectoral research primarily supported by the Regional Integrated Sciences and Assessments (RISA) teams.
2. CSI-Water addresses the needs of a specific stakeholder or set of stakeholders grappling with pressing climate-related water resource challenges.
3. CSI-Coasts addresses the needs of a specific stakeholder or set of stakeholders grappling with pressing climate-related issues in the coastal zone.
4. CSI-International supports decision-making and stakeholder networks internationally through the International Research Institute for Climate and Society (IRI), and several smaller scale projects undertaken through the CSI-Regions, Water and Coasts initiatives.
5. CSI-Transitions builds operational and quasi-operational capacity by transitioning the knowledge, tools, and products developed by CSI funded efforts and by the community-at-large to government entities and partners.

Information and data from the above activities are used to assess climate forcing, climate feedbacks, climate response, ozone depletion and baseline, urban, and regional air quality, to develop and test diagnostic and predictive models, and to keep the public, policy makers, and scientists abreast of the current state of our atmosphere. This program addresses the NOAA Next Generation Strategic Plan goal: Long Term Climate Adaptation and Mitigation objectives of (1) Improved scientific understanding of the causes and effects of climate variability and change, (2) Authoritative Assessments of the state of the climate, the likely impacts of climate change, and Needs for future climate science and services, (3) Mitigation and adaption efforts supported by climate services and of climate risks integrated into decision-making processes,

and (4) A climate-literate public that understands its vulnerabilities to a changing climate and makes informed decisions.

Deliverables

Modeling

Schedule/ Milestones	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
National and International Assessment Products	Complete model runs to be submitted to IPCC AR5; IPCC lead authors commence work	Submit papers for inclusion in IPCC AR5 report; IPCC lead author work continues	IPCC AR5 Working Group I report completed and released.	Use ESM to conduct suite of regional climate change projections	Develop quarter degree model for reduction in tropical uncertainties of climate projections	Continuing ESM development
Experimental Decadal Forecasts	Decadal Predictability studies	Decadal Predictability studies continue	Develop capability for nowcasting of Atlantic MOC	Extend decadal predictions to applications: drought and hurricanes	Decadal projections using higher resolution coupled model	Decadal Predictability studies continue

- Improved understanding decadal-to-centennial climate change, variability and predictability, and increasing confidence in climate projections, using coupled-climate model (CM2.5) at 4 times the resolution of recent IPCC-class coupled climate models.
- Robust simulations of regional climate change around the world (including tropical storms) using 25-km resolution global atmospheric model.
- Improved realism of the NOAA Earth System Models by closing the nitrogen cycle, and major feedback on the global carbon cycle.
- Reduction in percentage uncertainty in possible twenty-first century sea level rise
- Development of initial physical formulations to incorporate soot and dust aerosol impacts on snow and ice albedo in climate models, essential to developing a predictive understanding of Arctic climate change.

Physical Sciences

Climate Analysis

Schedule/Milestones	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
Increase skill of medium range forecasts of tropical temperature (Number of forecasts with increases /year)	8	9	10	12	16	18

Increase skill of medium range forecasts of tropical precipitation (Number of forecasts with increases /year)	1	1	2	3	8	9
% skill score improvement in experimental U.S. Seasonal forecasts	20	21	22	23	24	25
Number of new experimental climate products and services developed (Number/year)	1	1	1	2	2	3
Number of experimental products introduced in operational setting (Number/year)	1	1	1	1	2	2

- Produce an assessment of the importance of tropical intra-seasonal variability on the forcing of global climate variability.
- Implement a next generation historic reanalyses at higher resolution using an updated multi-model ensemble approach, improved methods for assimilating surface variables, and better representation of forcing uncertainties.
- Prototype a probabilistic prediction system for North American drought based on antecedent conditions and remote forcings.
- Assess the causes for recent variations in U.S. national and regional seasonal temperature, precipitation and drought.
- Deliver a global EnKF system to operational forecast centers for pre-operational testing.

Water Cycle

- Assess and document the ability of gap filling radars to augment legacy observing systems (e.g. NEXRAD) in the west to provide better precipitation and water supply information.
- Conduct field experiments (HMT & CalWater) focused on extreme precipitation events and their role in the water cycle - required for better climate projections and forecasts for flood and water supply.
- Couple ensemble precipitation forcing to hydrological models for two key watersheds.
- Deliver a preliminary report on quality of precipitation and runoff forecasts.
- Document and coordinate model development and operations plan to increase number of communities served by stream and river forecasts for the CERIS region.

Weather and Climate Physics

- Archive 12-months climate data SEARCH observatories at Alert and Eureka.
- Bring SEARCH Tiksi observatory to 30% capacity.
- Make public version 10 of the PSD hurricane flux algorithm.
- Generate data archive of ship and aircraft observations from participation in the NOAA/NSF DYNAMO field program in the Indian Ocean.
- Test the PSD W-band radar on a NOAA P-3 in flight; produce report on the results.

Chemical Sciences

Schedule/ Milestones	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
Climate-Air Quality field campaigns	Analyses of California climate and air quality study	Climate and air quality study in the eastern USA	Analyses of eastern USA climate and air quality study	To be based on earlier findings		To be based on earlier findings
Field campaigns on aerosol-cloud interactions	Continue analysis of cirrus cloud data; Model validation on aerosol-cloud interactions	Continue model validation on aerosol-cloud interactions	To be based on earlier findings		To be based on earlier findings	
Field campaigns on upper tropospheric water vapor and cirrus	Evaluate performance of prototype water vapor instrument	Deploy new water vapor instrument	Analyze measurements of water vapor	To be based on earlier findings		To be based on earlier findings
Climate research on upper tropospheric water vapor to improve models that provide a predictive understanding of the physical processes	Conduct analyses to determine role of upper tropospheric water vapor in climate	Continue analyses	To be based on earlier findings	Continue analyses	To be based on earlier findings	Continue analyses
Laboratory study of climate agents	Initiate study of compound #1 to address key uncertainties	Continuing	Initiate study of compound #2 to address key uncertainties	Continuing	Initiate study of compound #3 to address key uncertainties	Continuing
Modeling study of climate processes and agents	Initiate study #1 to address key uncertainties	Continuing	Initiate study #2 to address key uncertainties	Continuing	Initiate study #3 to address key uncertainties	Continuing
Laboratory studies related to air quality	Initiate kinetic study of compound #1 to address key uncertainties	Continuing	Initiate kinetic study of compound #2 to address key uncertainties	Continuing	Initiate kinetic study of compound #3 to address key uncertainties	Continuing

- Top-down evaluation of greenhouse emission inventories using data from the California field campaign (CalNex).
- Assessment of climate/air quality interactions in California using ship, aircraft (WP3 and Twin otter), and ground station data from California field campaign (CalNex).
- Independent assessment of measurement techniques and sensors used to quantify water vapor concentrations throughout the atmosphere and a new, fully automated, instrument to measure water vapor concentrations on board high-altitude research aircraft

- Analyses of models and data to quantify the role of ozone, water, and other forcing agents on climate and stratospheric ozone.
- Assessment of the impact of aerosols on cloud systems using data from the SE Pacific, the Caribbean, and the California Coast
- Regional assessment of black carbon emissions – California.
- Laboratory assessment of one chemical reaction relevant to stratospheric ozone chemistry and climate-chemistry coupling.
- Evaluation of climate-related properties of one compound proposed as a replacement for ozone-depleting substances.
- An evaluation of the role of boundary layer transport and processes in complex terrain, such as in California, using field measurements and modeling.

Global Monitoring and Research

Schedule/Milestones	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
High quality, calibrated, traceable measurements of atmospheric species (~250) climate & radiatively important species at each of the 5 baseline observatories (Total #/yr/site)	250	250	250	250	250	250
NOAA Annual Greenhouse Gas Index (AGGI) Indicator: Number of Updates Unit of Measure: Cumulative number of updates	7	8	9	10	11	12
NOAA Ozone Depleting Gas Index (ODGI) Indicator: Number of Updates Unit of Measure: Cumulative number of updates	6	7	8	9	10	11
# Within NOAA GHG Collaborations Funded	3	3	3	3	3	3
# Non-NOAA GHG Collaborations Funded	5	5	5	5	5	5
Tall Towers Installed (Cum Total #)	8	8	8	8	8	8
Aircraft Sites Operational (Total #/yr)	14	14	14	14	14	14
Surface Sampling Sites (Cum Total #)	14	14	14	14	14	14
Aircraft Profile Sample Frequency (% to meet GPRA requirement)	35%	35%	35%	35%	35%	35%
Programmable Flask Package (PFP) Sample Frequency (current/100% req.)	.2	.2	.2	.2	.2	.2
Carbon Uptake Regions Defined (Carbon Tracker)	1	1	1	1	1	1

- Continue to conduct sustained observations and research related to global distributions, trends, sources and sinks of atmospheric constituents that are capable of forcing change in

the climate of the Earth. Continue to advance climate projections and provide scientific policy-relevant, decision support information to enhance society's ability to plan and respond. Continue research of improving instruments, reducing uncertainty values, economies of scale, calibration techniques, and statistical analysis of data.

- Updates to Daily/Monthly/Annual GHGP Products suite as appropriate (http://www.esrl.noaa.gov/gmd/dv/).
- Publish Annual Greenhouse Gas Index (http://www.esrl.noaa.gov/gmd/aggi/) and Ozone Depleting Gas Index Update (http://www.esrl.noaa.gov/gmd/odgi/).
- Updates and refinement to CarbonTracker (http://www.esrl.noaa.gov/gmd/ccgg/carbontracker/)
- Maintain Carbon and Atmospheric Observing System at current capacity of 8 Tall Towers and 14 Aircraft sites.
- Leverage existing capabilities into the Climate Service.
- Maintain current Arctic observation capability in support of Arctic science as directed by the AGM/NGSP
  - Establish cooperative methane monitoring site in central Alaska.
  - Expand black carbon (BC) measurements at all stations surrounding and in the Arctic. Black carbon monitoring is becoming a focus for NOAA climate studies as it may be second only to carbon dioxide in climate warming potential in the Arctic.
  - Develop a BC “SootSonde” deployable from UAVs. UAV monitoring of the Arctic atmosphere is a high priority in the NOAA mission and black carbon a priority within that mission.
  - Establish equipment and procedures for measuring black carbon profiles from balloons.

Competitive Research

Climate Monitoring

Schedule/Milestones	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
Grants awarded in support of the development and delivery of climate analysis products, such as climate indices, USGCRP deliverables, Climate Data Records, etc. (number per year)	16	16	16	16	16	16
Research climate data sets transitioned to operations (number per year)	1	1	1	1	1	1
Paleoclimate reconstructions (number per year)	4	4	4	4	4	4

FY 2011-16: The Climate Program Office will solicit annual calls for proposals for competitive awards. These awards will address priority research topics in the areas of climate monitoring; earth system science; modeling, analysis, predictions, and projections; and climate and societal interactions.

The deliverables for the competitive grants program are based upon the call for proposals in FY 2011; most of these projects will span 2-3 years. Priorities targeted for the FY 2011 call for research proposals include:

- Climate Monitoring- Climate data set development and diagnostics to identify climate variability and change; Climate change detection and attribution with a focus on regional scales; and paleoclimatology with a focus on reconstructions of the late Holocene
- Earth System Science- Decadal climate variability and predictability, including identification of climate signals such as the Atlantic Meridional Overturning Circulation; Understanding and improving prediction of Tropical convection, with a focus on climate processes being studied as part of the Dynamics of the Madden-Julian Oscillation (DYNAMO) field campaign; Improving the understanding and modeling of land surface processes/interactions; Global carbon cycle, including variability of carbon sources and sinks and carbon cycle/ecosystem interactions; aerosols, atmospheric chemistry and climate with a focus on understanding indirect effect of aerosols on clouds and transformation of ice nuclei.
- Modeling, Analysis, Predictions, and Projections- Development of next-generation global climate models and evaluate uncertainties in regional-scale climate predictions/projections; Develop an integrated drought capability incorporating research advances in climate prediction, land-surface and hydrologic modeling, and data assimilation; Evaluate reanalysis data sets.
- Climate and Societal Interactions- Initiate three new RISA programs and advance regional assessment services; Climate impacts on urban water resource planning and drought; Coastal resource management in a changing climate, with a focus on coastal ecosystems and sea level rise; transition of water resource and coastal information products into operational settings, Integration of climate information into resource management and planning models and processes; White papers on climate impacts and adaptation issues for resource managers and planners; Analyses and communication of uncertainties surrounding climate predictions and projections; Improvements to climate impacts models; Peer-reviewed science papers related to climate impacts and adaptation issues; Newsletters containing climate impacts/prediction information and articles on climate impact issues of significance to the region; Presentations on research results to resource managers, planners and scientists; Workshops, surveys, focus groups, and ongoing dialogue with decision makers in the region.
- Climate Services in the Coastal Zone- Integrated research, from observations and modeling to decision support, focused on coastal inundation and sea level rise at regional scales on multi-year to multi-decadal time scales.

Performance Goals and Measurement Data

Modeling

Performance Measure:	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
Cumulative number of new decadal prototype forecasts and predictions made with high-resolution coupled climate models	1	2	3	4	5	6
Description: One of the goals of this activity is to develop new prototype forecasts and predictions on decade time-scales for climate changes and impacts such as sea level rise, Arctic climate impacts, and rapid climate change. These forecasts and predictions are						

dependent on the development of state-of-the-art climate models.

Physical Sciences

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Skill score improvement in experimental U.S. Seasonal forecasts (*% improved skill score*)	22	23	24	25	26	27

Description: Accurate temperature forecasts are critical to many sectors of the national economy. This measure compares actual observed temperatures with forecasted temperatures from areas around the U.S. The skill of seasonal prediction for surface temperature over the U.S. is quantified based on Heidke Skill Score (HSS). The computation of HSS is only for the locations where a seasonal forecast is made. Heidke skill score is one of several accepted standards of forecasting in the scientific community.

Chemical Sciences

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Atmospheric emissions characterized and air quality impacts quantified for potential biofuels (e.g., switchgrass). Number of potential biofuels characterized.	0	0	1	1	2	2

Description: The identification and quantification of atmospheric emissions from proposed biofuels will be used to assess the integrated impacts of these crops and the efficacy of these fuels as replacements for fossil fuels. These assessments will be documented in peer-reviewed publications.

Global Monitoring and Research

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Reduced uncertainty in the magnitude of the North American Carbon Sink (million tons Carbon/year) (16b)	400	400	400	400	400	400

Competitive Research Program

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Number of regionally and sectorally focused climate impacts and adaptation studies communicated to decision makers.	41	41	41	41	41	41

Description: Number of peer-reviewed publications and reports published and released in one fiscal year. The publications/reports are developed through interaction with and/or communication to stakeholders. Publications and reports are collected from investigators

conducting climate impacts and adaptation research in cooperation with stakeholders. The goal of this research is to better understand and enhance the use of NOAA products and information to meet user requirements for natural resource management information in various sectors (e.g. drought and water resources, fire risk, ecosystem and coastal impacts, sea-level rise, human health, agriculture, etc.)

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Program Changes for FY 2012:

Modeling: Earth System Modeling: Urgent Climate Issues (Base Funding: 4 FTE and $2,600,000; +10 FTE and +$6,980,000): NOAA requests an increase of 10 FTE and $6,980,000 for a total of 14 FTE and $9,580,000 to enable continued development and use of state-of-the-art Earth System Models to address urgent climate issues, including sea level rise and Arctic climate change.

Proposed Actions

NOAA will use this funding to expand capacity with a combination of 10 FTE, post-doctoral researchers, contracts and grants managed primarily by its Geophysical Fluid Dynamics Laboratory with assistance from the Earth System Research Laboratory. The Climate Program Office's Climate Variability and Predictability Program will manage the grants for this request. This will allow NOAA to continue development of Earth System Models to:

Reduce uncertainties in sea level rise projections ($2,580K) including: an ice sheet dynamics model, ocean-ice shelf and ocean-iceberg interactions, ice shelf cavity circulations and regional variations in sea level rise. This includes the development of an interoperable global ocean modeling capability for climate based on community standards, with routine global ocean data assimilation capabilities linked to Global Ocean Observing System observations and a nesting capability for coastal ecosystem models to assess the impact of climate change on ocean and coastal ocean ecosystems.

Reduce uncertainties in the terrestrial carbon cycle and future biogeochemical feedbacks on climate ($2,150K) through more realistic model treatment of the terrestrial biosphere including: modeling the nitrogen and phosphorous cycles, biomass burning, wetland and freshwater biogeochemistry, and land-use management. This includes data assimilation.

Address gaps in the understanding of the Arctic climate system, including rapid changes and future projections ($900K). The sea ice component of the NOAA's Earth System Model will be enhanced to include ridging of ice sheets and improved radiation treatment. Influences of soot and dust aerosol on ice albedo will be examined. A new modeling framework for Arctic climate change will be developed for assessing various causes of past Arctic changes.

Augment Decadal Climate Predictions and Abrupt Change ($1,350K) to complete decadal prediction model evaluation, assess predictability of high-impact climate extremes (heat waves, flooding, etc.) and assess the causes of past/ongoing decadal climate changes.

Statement of Need and Economic Benefits

Numerical models that simulate the Earth System are the Nation's principal tool for understanding past climate and predicting future climate. The increased demand for projections of climate change at regional scales and understanding of potential climate impacts requires increased modeling resolution and realism, as well as improved scientific understanding of the reliability of models and downscaling techniques for various regional climate applications. This effort to address urgent climate issues by improving Earth System Models, developing decadal prediction systems, and integrating earth system model development with regional ecosystem and coastal process models will be supported directly by recent investments in high performance

computing resources for climate modeling in the American Recovery and Reinvestment Act of 2009. Societal benefits include:

- Sea level rise has the potential to be among the most costly consequences of climate change. Coastal states support 81 percent of the U.S. population and generate approximately 83 percent ($11.4 trillion in 2007) of U.S. gross domestic product (GDP) (National Ocean Economics Program, "State of the U.S. Ocean and Coastal Economies," 2009). The homes and livelihoods of millions of Americans and infrastructure worth billions would be imperiled by sea level rise of a few feet. Improved models to help narrow uncertainty on future global sea level rise, as well as its regional variations, will help decision-makers form mitigation and adaptation responses to mitigate costs to society and harm to near-shore ecosystems.
- Creating links between global ocean models and regional and coastal ocean models and assimilating ocean data into ocean modeling systems for predictions of ecosystem parameters will serve ecosystem managers, because many marine ecosystems are sensitive to changes in ocean conditions associated with climate change.
- Reduced uncertainty in climate change projections will help decision makers consider strategies to mitigate or adapt to the impacts of climate change. For example, the absence of an interactive carbon cycle was a serious limitation in the global climate models used for the Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC AR4), which will be addressed to better understand how the carbon cycle and its feedbacks reduce or amplify anticipated global warming by several degrees by 2100.
- Better prediction of rapid changes in the Arctic will help decision-makers address key impacts on: Arctic citizens and their livelihoods; Arctic ecosystems; shipping; homeland security; fisheries; and strategic energy resources.
- Developing decadal climate predictions of sea surface temperature will lead to skillful decadal predictions of several phenomena of great economic importance, including hurricanes, drought, and heat waves, and ecosystems.

Schedule & Milestones

FY 2012: Develop new modeling capabilities and initiate synthesis efforts for application to Earth System Models.
FY 2013: Further develop and implement new Earth System Modeling capabilities for use in climate change assessments. Perform initial integrations of new Earth System Models. Continue process studies and report results in peer-reviewed publications.
FY 2014-16: Continue long-term development and refinement of Earth System Modeling capabilities for use in future national and international climate change assessments. Simulate 20^{th} and 21^{st} century sea level rise using prototype next-generation models of ice sheet dynamics and other physics. Report on Arctic climate change assessment. Communicate Earth System Modeling research findings to policymakers and other stakeholders through assessments, publications and climate services.

Deliverables

- Sea level rise projections with improved model physics, representation of physical processes, and reduced uncertainty relative to current projections & sea level forecasts of near shore waves/extremes.

- A common global ocean modeling framework based on community standards that incorporates features of several leading ocean models and enables nesting with coastal models and routine global ocean data assimilation.
- State-of-the-art Earth System Models with improved representation of the terrestrial biosphere and reduced uncertainty in future carbon cycle feedbacks.
- Assessments of the causes of recent and ongoing Arctic climate changes through improvements to sea ice modeling and Arctic climate process models. More confident projections of future climate changes in the Arctic.
- A decadal climate prediction system, including an assessment of the level of predictability realizable from the system, in terms of sea surface temperature predictions, and predictions of related changes in extreme events (hurricane activity, drought, heat waves, flooding, etc.).
- Enhanced contributions to assessments of human impacts on climate through inclusion of more realistic physical processes & important feedbacks in climate models; greater confidence in projections of regional climate impacts.

Performance Goals and Measurement Data

Performance Measure: Number of regional scale projections for assessments & decision support (cumulative).	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	0	3	5	7	8	8
Without Increase	0	2	2	2	2	2
Description: Regional scale projections will contribute to international assessments (e.g. IPCC AR5, scheduled for 2013), national assessments under the U.S. Global Climate Research Program, and other assessments as requested. The number of meaningful regional projections possible will increase as NOAA's Earth System Model increases in realism and complexity. Examples of regional scale projections include: regional sea level rise projections that require explicit representation of the global eddy field in the ocean models; projections of parameters essential to ocean and coastal ecosystem forecasting; assessment of regional carbon budgets; and projections of climate change in the Arctic region that require improved sea ice models.						

Performance Measure: Percentage uncertainty in possible 21st century sea level rise (0-1m = 100% uncertainty)	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	75%	74%	65%	55%	50%	40%
Without Increase	75%	74%	73%	72%	71%	70%
Description: This metric is calculated using the IPCC 4th Assessment Report estimates for the range of 21st century global-mean sea level rise. Completion of the proposed effort will reduce the uncertainties by almost half as a result of modeling that better captures the more accurate measurements of ice-sheet discharge, thermal expansion, and regional anomalies due to ocean circulation and heat storage. Reducing the uncertainty in sea level rise will allow government and industry to have better information on projected sea level rise and therefore tailor their planning and actions to address the impacts.						

PROGRAM CHANGE PERSONNEL DETAIL

Activity: Climate Research Programs
Subactivity: Modeling

Title:	Location	Grade	Number of Positions	Annual Salary	Total Salaries
Physical Scientist	Princeton, NJ	ZP IV	10	92,259	922,590
Oceanographer	Princeton, NJ	ZPIII	1	64,729	64,729
Physical Scientist	Boulder, CO	ZP-IV	2	87,815	175,630
Total			13		1,162,949
less Lapse		25%	3		290,737
Total full-time permanent (FTE)			10		872,212
2011 Pay Adjustment (0%)					0
2012 Pay Adjustment (0%)					0
TOTAL					872,212

Personnel Data	Number
Full-Time Equivalent Employment	
Full-time permanent	10
Other than full-time permanent	0
Total	10
Authorized Positions:	
Full-time permanent	13
Other than full-time permanent	0
Total	13

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Climate Research Programs
Subactivity: Modeling

	Object Class	2012 Increase
11	Personnel compensation	
11.1	Full-time permanent	$872
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	872
12	Civilian personnel benefits	201
13	Benefits for former personnel	0
21	Travel and transportation of persons	21
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	360
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	585
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	0
31	Equipment	0
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	4,941
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	6,980

Physical Sciences: Water Resources Research to Operations (Base Funding: 13 FTE and $4,619,000; +0 FTE and +$7,672,000): NOAA requests an increase of $7,672,000 and 0 FTE for a total of $12,291,000 and 13 FTE to research, develop and implement Integrated Water Resource Services, a NOAA Regional Collaboration Priority. CS and OAR laboratories and National Weather Service river and weather forecast centers will partner to develop and transition to operations new precipitation, river, estuary and coastal flood-forecast capabilities. Because of the importance of extreme events in the climate system, this effort will help meet key societal challenges and service delivery needs related to water resources and extreme events for the CS.

Proposed Actions

NOAA seeks to support two projects designed to improve our Nation's water forecasts: (1) The Hydrometeorological Testbed (HMT), which is focused on reducing regional precipitation observation and forecasts errors by 50% for 0-3 day forecasts of extreme precipitation and will support future development of a Hydroclimate Testbed (HCT); (2) Coastal Estuary River Information System (CERIS), which is intended to increase the number of communities for which detailed stream and river forecasts are available. With the projected increases in sea level and sensitivity to storm surges, improved forecast tools are essential for the Nation's coastal rivers and estuaries.

The Hydrometeorology Testbed (HMT) ($6,472,000) focuses on accelerating the development and infusion of new observing technologies and strategies, precipitation forecast model improvements, and new precipitation science into NWS operational forecasts and CS service delivery. Because observing and forecasting precipitation varies by region of the country and by season and is sensitive to short-term climate variability, NOAA has identified both west and east coast areas for investigation. Specifically NOAA will establish representative test-beds in California and the Carolinas. Field experiments are conducted to deploy new observing systems, conduct experimental model forecasts, test new forecasting techniques in concert with operational weather and river forecast offices, and examine observed extremes in their climate context. Subsequently, laboratory studies will analyze and interpret the data collected during field programs to improve understanding of underlying physical processes prototype improved forecasts, observational interpretation algorithms, forecast decision aids, and information products. Finally, NOAA will feed demonstrated advances to NWS and CS operations.

CERIS ($1,200,000) develops and transitions to operations: (1) new river, estuarine, and coastal flood-forecast capabilities and (2) estuarine ecosystem health using the Tar River Basin and Pamlico Sound in North Carolina for operational prototyping. This initiative will seek to quadruple the number of communities receiving stream and river forecasts in Tar River Basin and will be coordinated with Sea-Level rise forecasting efforts in the CS and NWS and ongoing coastal programs in NOS. Because the Tar River Basin is representative of other river basins and NOAA has existing partnerships in the area, it is an ideal location for a pilot project. CERIS is designed to collect data and information related to freshwater supply, coastal watersheds, and flooding (including flash flooding and inland flooding from hurricane rainfall and storm surge) in order to mitigate natural hazards; couple atmospheric, river, and estuarine models to develop information for decision-support tools; and enable outreach and education that gets the outputs of science into the hands of policy makers and the public.

Statement of Need and Economic Benefits

NOAA is the only Federal agency with the legislative mandate to provide surface water forecasts. Such forecasts are currently not provided along our Nation's coasts. To forecast these areas, NOAA must research, develop and deliver water forecasting services for coastal areas. Commerce and populations along the coasts will benefit from these forecasts, especially those associated with extreme events. Population concentrations, drought caused by recent climate changes, and "just-in-time" commerce have made water resource and precipitation monitoring and forecasting critical challenges. At the same time, water can be the most dangerous natural hazard. In most years, flooding causes more deaths and damage than any other type of severe weather. In many years it is common for three-quarters of all Federal declared disaster declarations to be due, at least in part, to flooding. (http://www.weather.gov/oh/hic/flood_stats/index.shtml) Compounding the problem, quantitative precipitation forecasts, particularly for significant rain events (>1 inch of rain) on national average can have an error of 0.5 inch or more and are not well represented in extended range forecasts. Such errors can severely compromise the accuracy of river forecasts and degree of flooding. HMT is focused on reducing regional precipitation observation and forecasts errors by 50% for zero-to- three day forecasts and to extend the science to precipitation at intraseasonal to interannual time scales. CERIS is intended to remedy the fact that stream and river forecasts are provided today for approximately 10% of communities. This initiative will provide receiving stream and river forecasts in the tidal areas of the Tar River Basin. Studies show agriculture can realize a $30 per acre/year yield increase (+20% profit) when irrigated corn production is based on weekly water resource forecasts. Other studies have shown that there is $12 in realized benefits each year for every one-time investment of $1 in river forecast improvements. Increasing the lead times of flash floods and other floods will save lives and mitigate property damage. Another study has shown that with 4 hours of flood mitigation time, the damage to a residential property can be reduced by as much as 72%.

Schedule & Milestones

- Complete processing and delivery of quality controlled precipitation observations from HMT-West field phase for hydrologic modeling; adapt a high-resolution hydrologic model to the Tar River watershed in North Carolina; For HMT-west, set up, run, and verify a high resolution ensemble weather modeling systems and deliver a preliminary report on model verification of Quantitative Precipitation Forecasts (QPF) , moisture flux and snow level (key elements for flood forecasting). Develop plan and coordinate path to operations for HMT observation systems. (FY 2012)
- Assess and document the ability of gap filling radars to augment legacy observing systems (e.g., NEXRAD) in the west. Document and coordinate model development and operations plan to increase number of communities served by stream and river forecasts for CERIS region. Couple ensemble QPF models to CA and Tar River hydrological models & deliver a preliminary report on quality of forecast runoff and probabilities. (FY 2013)
- Deliver algorithms for implementation on the NWS AWIPS systems to assist forecasters in reducing precipitation forecast errors. Prepare and coordinate plan to develop, evaluate and make operational new generation of global uncertainty forecasts for precipitation. Provide a plan for implementing coupled precipitation and hydrological models in operations. (FY 2014)
- Assess and document various observing system strategies used in the HMT eastern region to reduce observing errors by 50%. Deliver final report on new data assimilation methods for global forecasts to address uncertainty in extended precipitation forecasts. Collect and

process atmospheric and river stage data sets suitable for developing and testing coupled models during CERIS. (FY 2015)

Deliverables

- Transition Plan to transition new HMT observation systems to operations. (2012)
- Report documenting utility of gap-filling radars and other new observing systems along the western slopes and coast (2013)
- Report on deterministic and probabilistic verification of Quantitative Precipitation Forecasts (QPF) quality of forecast runoff, and river flow (2013)
- Algorithms for the NWS operational implementation on the AWIPS information technology system for improved analysis and forecasting of western US precipitation (2014)
- New generation global-uncertainty forecasts for precipitation plan (2014).
- HMT eastern region observing system strategies report (used to reduce precipitation errors by 50%) (2015)
- Prototype Extreme Precipitation Information System (EPIS) with regionally specific input and output environmental data sets for atmospheric and river forecast model development and testing in the HMT west region. (2015)
- Transition to operations a new Coastal Estuary River Information System (CERIS) and prototype it in Tar River and Pamlico Sound (2016)

Performance Goals and Measurement Data

Performance Measure: Demonstrate improved Regional River Flood Warning Lead Time and absolute timing error *(change from baseline in hours/hours)*	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	Establish baseline	New baseline	+0.2/-0.2	+0.4/-0.4	+0.6/-0.6	+0.8/-0.8
Without Increase	Establish baseline	New baseline	+0.1/-0.1	+0.2/-0.2	+0.3/-0.3	+0.4/-0.4
Description: NOAA is evaluating possible adoption of a new operational performance measure for "River Flood Warning Lead Time," which focuses on larger rivers and longer-lived flooding that is not currently assessed using the existing "Flash flood warning lead time," which focuses on smaller and short-lived flood events. Baselines for the new performance measures must be established, and the measures shown here are the incremental improvements expected above those baselines.						

Performance Measure: Demonstrate Flash flood lead–time in minutes.	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	49	52	54	56	58	60
Without Increase	49	49	49	49	49	49

Description: The measure "without increase" shown here is the NWS operational GPRA measure for flash warning lead times in minutes. The measure "with increase" is a warning lead-time hypothesis using these new technologies. This research will seek to demonstrate that the current targets can be improved to the amounts shown.

	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Output 1: Number of flood and precipitation forecasting tools transitioned into NWS operations						
With Increase Number of prototype systems transitioned/cumulative		2	3	4	5	6
Without Increase	0	0	0	0	0	0
Output 2: Field projects (#)/S&T Advances						
With Increase Number of field demonstration projects/Number of Science &Technology Advances		2/4	3/4	3/4	3/4	3/4
Without Increase	0	0/0	0/0	0/0	0/0	0/0
Output 3: Prototype improved forecasts of extreme precipitation with one day lead time (change from baseline in CSI%/Absolute error inches)						
With Increase	None	Establish baseline	New baseline	2/-0.1	4/-0.2	6/-0.3
Without Increase	None	Establish baseline	New baseline	1/-0.0	2/-0.1	3/-0.1

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Climate Research Programs
Subactivity: Physical Sciences

	Object Class	2012 Increase
11	Personnel compensation	
11.1	Full-time permanent	$0
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	0
12	Civilian personnel benefits	0
13	Benefits for former personnel	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	1,200
25.2	Other services	0
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	4,200
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	0
31	Equipment	1,522
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	750
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	7,672

Global Monitoring and Research: Carbon $^{14}CO_2$ Measurements to Capture the Distribution of Fossil Fuel Emissions (Base Funding: 2 FTE and $850,000; Program Change: +0 FTE and +$4,700,000): NOAA requests an increase of $4,700,000 and 0 FTE for a total of $5,550,000 and 2 FTE to increase the number of atmospheric samples available for $^{14}CO_2$ measurements and process them for analysis by accelerator mass spectrometry. NOAA will focus funds towards increasing the capacity of university and agency partnerships with a goal of processing over 5,000 measurements per year by 2014.

Proposed Actions

Measuring $^{14}CO_2$ will be critical for capturing the general distribution of fossil fuel emissions across the US, and for separating human from natural emissions in an urban environment. As part of an interagency demonstration project to assess the certainty with which atmospheric measurements can identify and verify regional changes in greenhouse gas (GHG) emissions, NOAA will work with universities and DOE's Lawrence Livermore National Laboratory (LLNL) to increase $^{14}CO_2$ measurements at NOAA sampling sites by a factor of 8 in the next three years. While some of these $^{14}CO_2$ measurements will be disbursed throughout the network, others will focus in and around an intensified study of emissions from an urban setting (Indianapolis). This leverages NOAA's contributions with those of several universities, NIST, and NSF.

NOAA will use a portion of these funds, working through NOAA's existing Cooperative Institute (CIRES), to purchase an accelerator mass spectrometer (AMS) optimized for $^{14}CO_2$ measurements, so that it can increase capacity substantially from the current 700 samples per year to 7,000 per year by 2016. To offset the lead-time for ordering and installing the AMS, NOAA will leverage capacity at LLNL and other universities to analyze additional samples. Many samples collected in FY2012 and 2013 will be archived for analysis once the CIRES system is on line. In 2012 and 2013 NOAA will dramatically increase the number of samples extracted and archived for analysis when full capacity is reached. By extracting and archiving samples in the early years, NOAA can ensure a nearly complete record of 5000 measurements from FY2013 forward. Analysis of the archived samples would increase dramatically once the CIRES system is on line and capacity at LLNL increased.

Because these measurements will be made together with measures of 50+ other tracers of GHG emission sectors (e.g., trace gases associated with specific emission activities), NOAA will develop proxy measurements to help identify specific emission sectors. All of these measurements will be interpreted and evaluated through analyses such as NOAA's CarbonTracker, which constrains continental and large regional scale emissions of GHGs from atmospheric measurements.

Statement of Need and Economic Benefits

Knowledge of the future atmospheric burden and impact of GHGs is limited by (1) our understanding of how the global carbon cycle will respond to climate change and (2) our understanding of which GHG management strategies could be most effective in the future. Such information is extremely important for predictions of how rapidly climate will change and for determining the window of opportunity society has to address future climate change. The measurement of $^{14}CO_2$ is crucial to filling these gaps as it provides the ability to separate human from natural emissions. Without that ability, it will be extremely difficult, if not impossible, to attribute changes in atmospheric CO_2 to specific GHG management strategies.

The 2010 National Research Council report on verifying GHG emissions recommends several courses of action, one of which is to "extend the capability of the CO_2 sampling network to measure atmospheric $^{14}CO_2$". The report specifically recommends that "NOAA, which maintains the CO_2 sampling network and has the facilities and expertise to collect and process the samples," work with universities and DOE to implement this increase. Expanding the number of $^{14}CO_2$ measurements as part of the NOAA monitoring network would provide an unambiguous means to differentiate between the CO_2 from fossil-fuel and non-fossil-fuel sources. These measurements would strengthen UNFCCC and EPA inventories of GHG emissions, improve estimates of biospheric uptake and release of carbon, and provide an independent check on GHG management strategies in various regions.

For decades, NOAA has played a leading role in monitoring atmospheric GHGs. As the need for more information about GHG emissions increases, NOAA's monitoring, modeling and analysis capabilities must include the ability to separate human from natural influences. This point has been recognized by: the U.S. Global Change Research Program (USGCRP); the North American Carbon Program; and the National Research Council of the National Academies.

Addressing climate change and its impacts has become both a national and an international priority. This request is consistent with the Administration's Science and Technology priority to fund research for measuring, reporting, and verifying GHG emissions. According to the latest IPCC Assessments, global climate change is unequivocal. It is driven by GHGs, mainly anthropogenic release of CO_2, and is posing a major threat to agriculture, marine ecosystems and fisheries, human health, the economy, and national security.

Base Resource Assessment

The base resources for this program are described in the Global Monitoring and Research section of the Climate Research base narrative.

Schedule and Milestones

FY 2012

- Issue grant to purchase an accelerator mass spectrometer (AMS) optimized for carbon-14 measurements. Lead-time from order: ~1.5 years.
- Contract construction of 130 automated air sampling packages (proven design, 12 samples in each package) to create the capacity for taking the additional samples from which CO2 will be extracted for carbon-14 measurements.
- Increase sample extraction and processing capacity to prepare samples for AMS measurements.

FY 2013

- Measure or archive a total of 4,000 CO2 extracts per year.
- Increase number of measurements at LLNL by1,500 samples/year.
- Extract and archive a substantial fraction of the early samples (need to do this before the AMS measurement capability has been expanded to be able to handle the load).

FY 2014

- Measure 3,000 samples/year, and archive the rest for a total of 5,000 per year

FY 2015-2016

- Reduce archive of extracted samples and process samples in real time

Deliverables

- Fully operating accelerator mass spectrometer (AMS)
- Expanded number of measurements of $^{14}CO_2$ in atmospheric samples at DOE/LLNL
- On-going $^{14}CO_2$ measurements at 80+ sites
- Comparison of US fossil fuel emission inventory with atmospheric measurements of $^{14}CO_2$
- Determination of fossil fuel contributions to GHGs in at least one urban "dome" in the US
- Improved emission inventories of numerous GHGs through multi-species analyses

Performance Goals and Measurement Data

Performance Measure: Number of sites supporting frequent $^{14}CO_2$ measurements	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	18	18	50	80	80	90
Without Increase	18	18	14	14	14	12

Performance Measure: Number of samples extracted for $^{14}CO_2$ analyses	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	1700	1700	4000	5000	6000	7000
Without Increase	1700	1700	1600	1600	1500	1500

Performance Measure: Number of air samples analyzed by AMS for $^{14}CO_2$	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	700	700	2000	3000	7000	7000
Without Increase	700	600	600	500	300	300

Description: The three output performance measures above fully capture this capacity-building activity. One measure denotes the increased number of sites and reflects a different set of tasks than those for extraction and actual analysis. The ability to increase the number of collection sites and increase capacity for extracting $^{14}CO_2$ from air can move more quickly than expanding capacity to accurately measure $^{14}CO_2$. Nevertheless, by rapidly increasing the number of sites sampled and the extraction capability, NOAA can ensure traceable data records at most sites from FY2013 forward and at all sites from FY2014 forward. With this assurance, NOAA can guarantee the deliverables noted above.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Climate Research Programs
Subactivity: Global Monitoring and Research

	Object Class	2012 Increase
11	Personnel compensation	
11.1	Full-time permanent	$0
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	0
12	Civilian personnel benefits	0
13	Benefits for former personnel	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	2,100
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	0
31	Equipment	0
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	2,600
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	4,700

Global Monitoring and Research: Carbon Observing and Analysis System (Base Funding: 40 FTE and $12,905; +7 FTE and +$8,000,000): NOAA requests an increase of 7 FTE and $8,000,000 for a total of 47 FTE and $20,905,000 to complete and sustain an observation and analysis system to determine uptake and emissions of carbon dioxide and greenhouse gases across North America.

Proposed Actions

The CarbonTracker Observing and Analysis System is an observational and analysis network that measures carbon dioxide (CO_2) and other greenhouse gases (GHG), providing observational data necessary for predicting future climate change and ocean acidification and will serve as the backbone of a system for verifying GHG emission reduction and mitigation efforts in North America. The network collects continuous measurements from tall towers, air sampled in flasks, aircraft profiling, and satellite remote sensing, and needs to be expanded to provide the accuracy and precision to quantify the exchange of GHGs between the atmosphere and terrestrial ecosystem and to characterize the regional distribution of GHG emissions and uptake. With this funding, NOAA will:

1. Install and operate 6 new tall towers (for a total of 14 tall towers) to measure CO_2 and other GHGs at several heights in the atmosphere.
2. Increase frequency of flights at 14 existing sites by a factor of four and begin collecting twice-weekly vertical profiles of GHGs with aircraft up to ~8 km height at 10 additional sites across North America to achieve twice-weekly vertical profiles at a total of 24 sites.
3. Improve modeling for NOAA's CarbonTracker tool by including NOAA forecast data and the latest NOAA transport models.
4. Use results from CarbonTracker observations and direct aircraft profiles to compare, verify, and validate CO_2 satellite retrievals.

This effort builds on NOAA's strong observation, modeling, and analysis capabilities; involves coordination with national and international partners; and serves as a structural, operational, and research backbone in a global effort to understand the carbon cycle and verify reduction and offsets of CO_2 and other GHG emissions. Global Monitoring Laboratory will continue to lead this effort and work in coordination with the Cooperative Institute for Research in Environmental Sciences (CIRES), several Federal agencies, the World Meteorological Organization and other international bodies. The Climate Program Office will manage the grants process. This proposal will fund nine Federal positions (7 FTE).

Statement of Need and Economic Benefits

According to the latest IPCC Assessments, global climate change is unequivocal. It is driven by GHGs, mainly anthropogenic release of CO_2, and is posing a major threat to agriculture, human health, the economy, and national security. The rapid increase of CO_2 is essentially the sole cause of global ocean acidification, which is threatening our marine ecosystem and fisheries.

Addressing climate change and its impacts has become both a national and an international priority. Numerous efforts to reduce CO_2 emissions have already begun both around the world and at the state and local levels within the United States. Additionally, the US government has begun processes to federally regulate GHG emissions. The U.S. EPA is preparing to control atmospheric CO_2 as a pollutant using the Clean Air Act (Federal Register (Volume 74, Number 78) Proposed Rule: Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Clean Air Act, April 24, 2009, and reviewing the potential use of the Clean

Water Act for addressing CO_2 in the oceans (i.e. ocean acidification) (Federal Register (Volume 74, Number 71) Notice of data availability: Ocean Acidification and Marine pH Water Quality Criteria, April 15, 2009).

Regulating CO_2, evaluating mitigation strategies and understanding and predicting future climate change and ocean acidification will require an accurate, reliable and independent system for tracking sources and sinks of CO_2 and other GHGs. No emission reduction effort has ever succeeded without ongoing verification (e.g. acid rain and sulfur emission reduction, ozone recovery, and regional air quality policies). NOAA's CarbonTracker program needs to be expanded to reduce the uncertainties in emissions reporting and estimation that challenge our ability to make informed decisions to limit greenhouse gas levels in the atmosphere, certify tradable permits, measure GHG emission offsets, support and verify treaty negotiations, provide accurate inventories of emitters, and implement reliable GHG policies.

Reliable verification can only be made from a widespread observation and analysis system greater than what is currently in place. The current sparse network of observation sites across North America give us only a rough estimate of annual continental fluxes of CO_2, while successful mitigation requires fluxes to be resolved within much smaller regions. Ultimately, satellites will be involved in evaluating GHG emission reduction efforts and changes in global emissions. It will be essential to have a ground based and in situ observational network for testing, improving, and ultimately verifying satellite retrievals.

Historically, NOAA has played a leading role in the monitoring of GHGs. As the need for increased information about GHG emissions increases, NOAA's monitoring, modeling and analysis capabilities must also expand. At its June 2008 Summit, the international Group on Earth Observations (GEO) called for the development of a global observation and analysis system for supporting global mitigation of GHG emission. NOAA's improved CarbonTracker network will provide the core atmospheric observations for the combined U.S. contribution to a global system and ultimately serve as the backbone for a system to verify reduction of CO_2 and other GHG emissions at regional scales.

These increasingly urgent improvements cannot be made without additional resources or without compromising other parts of NOAA's critical long-term global monitoring network.

Schedule & Milestones

FY 2012 – 4 sites (1 tall tower & 3 aircraft) installed; begin or continue satellite retrieval comparisons and validations (e.g., GOSAT, AIRS, IASI, OCO-2)

FY 2013 – 4 sites (1 tall tower & 3 aircraft) installed; new lab instrumentation operational; CarbonTracker assimilations to include NOAA transport data along with European data

FY 2014 – 4 sites (2 tall tower & 2 aircraft) installed; Extensive QA/QC and Data management enhancement verified & operational

FY 2015 – 4 sites (2 tall tower & 2 aircraft) installed; Regional Flux Estimates Defined

FY 2016 – Seasonal Estimating Capability in place

Deliverables

- 14 fully operational tall towers (12 NOAA tall towers plus 2 collaborative tall towers), measuring greenhouse gases continuously across North America

- 48 sets of aircraft vertical profiles of ~50 greenhouse gases and tracers across North America each week
- CarbonTracker operating with both NOAA's and European (ECMWF) global meteorology to produce sustained monthly outputs
- Satellite retrieval verification capability in place

Performance Goals and Measurement Data

Performance Measure: Reduce Uncertainty of the North American Carbon Sink (million tons C/y) Measure 16b.	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	400	380	350	300	<300	<<300
Without Increase	400	400	500	500	550	550

PROGRAM CHANGE PERSONNAL DETAIL

Activity: Climate Research Programs
Subactivity: Global Monitoring and Research

Title:	**Location**	**Grade**	**Number of Positions**	**Annual Salary**	**Total Salaries**
Physical Scientist	Boulder, CO	ZP IV	7	87,815	614,705
IT Specialist	Boulder, CO	ZPIII	2	61,612	123,224
Total			9		737,929
less Lapse		25%	2		184,482
Total full-time permanent (FTE)			7		553,447
2011 Pay Adjustment (0%)					0
2012 Pay Adjustment (0%)					0
TOTAL					553,447

Personnel Data	Number
Full-Time Equivalent Employment	
Full-time permanent	7
Other than full-time permanent	0
Total	7
Authorized Positions:	
Full-time permanent	9
Other than full-time permanent	0
Total	9

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Climate Research Programs
Subactivity: Global Monitoring and Research

	Object Class	2012 Increase
11	Personnel compensation	
11.1	Full-time permanent	$553
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	553
12	Civilian personnel benefits	128
13	Benefits for former personnel	0
21	Travel and transportation of persons	33
22	Transportation of things	5
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	1,090
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	4,169
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	0
31	Equipment	0
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	2,022
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	8,000

Competitive Research Program: International Research Institute (Base Funding: 0 FTE and $9,036,000; Program Change: -0 FTE and -$6,060,000: NOAA requests a decrease of $6,060,000 and 0 FTE for a total of 0 FTE and $2,976,000 for the International Research Institute. For fifteen years, NOAA has used these funds to support international activities via a competitive grant to Columbia University's International Research Institute (IRI) for Climate and Society. IRI predicts regional impacts of a changing climate outside the United States and demonstrates the utility of this information in decision making, especially in developing countries. With the emergence of NOAA climate services, the agency has recognized the need to review its international portfolio and restructure its international engagement in order to enable NOAA to be responsive to the increasing number of requests from bilateral partners and multilateral processes within the shifting landscape of societal demands, especially domestically. As such, sufficient funds are provided within the FY 2012 CS request for a restructured international portfolio, and to support competitive research grants to develop NOAA's role the in Emerging Global Framework for Climate Services.

Performance Measure: Increased number of real-time, experimental forecasts for effective international laws, policies, strategies, and incentives for climate adaptation	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
Without Decrease:	12	12	12	12	12	12
With Decrease:	N/A	4	4	4	4	4

Description: NOAA's competitive research program seeks to enhance society's capability to understand, anticipate and manage the impacts of climate in order to improve human welfare and the environment, including developing countries. Forecasts from this program provide a range of current climate prediction information, including global probability forecasts for seasonal temperature and precipitation, the predictions of the individual tools that contribute to the final forecasts, and forecasts of the sea surface temperature, including specifically the ENSO state that strongly influences climate forecasts. The final forecasts are expressed in probabilistic terms (because of their considerable uncertainty), which can be useful information for agricultural, hydrological, public health and food security planning purposes.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Climate Research Programs
Subactivity: Competitive Research Program

	Object Class	2012 Decrease
11	Personnel compensation	
11.1	Full-time permanent	$0
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	0
12	Civilian personnel benefits	0
13	Benefits for former personnel	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	0
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	0
31	Equipment	0
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	-6,060
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	-6,060

Chemical Sciences: Chemistry Climate Research (Base Program 0 FTE and $0; -0 FTE and - $2,200,000): NOAA requests a decrease of $2,200,000 and 0 FTE for chemical climate research for a total of 0 FTE and $0. In the Consolidated Appropriations Act, 2010, Congress provided additional funds for chemical climate research. With these additional funds, NOAA, conducted research which provided fundamental information on the chemical processes that contribute to climate change. The research conducted under this program was focused on using atmospheric observations to evaluate and improve atmospheric emission inventories for climate forcing agents and their precursors; information that was needed by decision makers to evaluate climate change adaptation and mitigation strategies. Atmospheric observations and process modeling were also used within this program to improve understanding of the chemical processes that influence the atmospheric abundances of climate forcing agents (greenhouse gases, aerosols, etc.). This information contributed directly to NOAA's efforts to improve the predictive capability of climate models and provided needed information for federal and regional decision makers as well as industry stakeholders. Additional funds are not required in FY 2012 as requested funding provides for sufficient research to understand and quantify the chemical processes responsible for the changes and transformations in the atmosphere related to climate, the stratosphere, and air quality.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Climate Research Programs
Subactivity: Chemical Sciences

	Object Class	2012 Decrease
11	Personnel compensation	
11.1	Full-time permanent	$0
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	0
12	Civilian personnel benefits	0
13	Benefits for former personnel	0
21	Travel and transportation of persons	-30
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	0
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	-100
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	-150
31	Equipment	-300
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	-1,620
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	-2,200

APPROPRIATION: OPERATIONS, RESEARCH, AND FACILITIES

SUBACTIVITY: INTEGRATED CLIMATE SERVICES

The objectives of the Integrated Climate Services subactivity are:

- Support regional decision making with timely and authoritative climate products and information;
- Improve the Nation's capacity to manage drought-related risks through regionally relevant drought information system products and services;
- Develop, deliver, and apply information on time and space scales relevant to decision-making through a sustained interactive dialogue involving NOAA, partners, and stakeholders to understand information needs and information planning; and
- Develop an assessment services framework for facilitating better connectivity of high resolution data with decision processes and models.
- Improve public climate science literacy and raise public awareness, understanding of, and engagement with NOAA's climate science and services programs

Societal concern about the impacts of climate change is growing. Citizens in public and private sectors want easy access to credible climate science information to help them make informed decisions affecting their lives and livelihoods. Weather and climate influences almost every sector of society, and affects up to 40 percent of the United States' $10 trillion annual economy. (NRC report, 2003 entitled "Satellite Observations of the Earth's Environment: Accelerating the Transition of Research to Operations"). As the leading provider of climate, weather, and water information to the nation and the world, NOAA is a logical source for citizens to turn to for climate information. The Integrated Climate Services Program represents the primary service delivery outlet for the Climate Service, providing sustained services directly to climate-sensitive sectors and stakeholders, to inform better decision making for adaptation and mitigation in the face of future climate-related uncertainties. Because climate impacts are being felt across all regions in the U.S., affecting almost every sector of society, increasing the capacity of NOAA's and its partners' professionals to use climate products and services, particularly at the regional and sub-regional levels, is essential to NOAA's mission. NOAA must also expand and improve the way it communicates, educates, outreaches to, and engages with public stakeholders to better meet the nation's needs for timely, authoritative and understandable climate data and information.

NOAA is targeting the initial suite of climate services in four areas: 1) deploying a National Integrated Drought Information System, 2) initiating a Regional Climate Services Enterprise, 3) sustained Assessment Services, and 4) Communication and Education.

NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM (NIDIS)

The goal of the NIDIS Act of 2006 (Public Law 109-430) is to improve the nation's capacity to proactively manage drought-related risks by providing those affected with the best available information and tools to assess the potential impacts of drought, and to better prepare for and mitigate the effects of drought. Drought is a slow-onset natural phenomenon that is often called "the creeping disaster." Unlike other natural hazards such as hurricanes, floods, and tornadoes, the gradual nature of drought hinders the recognition of the true extent of impacts as they filter through the economy and environment. The National Integrated Drought Information System

(NIDIS) will enable users to determine the risks associated with drought and provide supporting data and tools to inform drought mitigation. (NIDIS Implementation Plan, June 2007). The development of the NIDIS is happening through a coordinated, multi-faceted program of 1) research, 2) observations, 3) forecast improvements, 4) drought early warning systems and 5) a portal to provide access to drought related data and information.

Coping with Drought Research

In FY 2007, NOAA began sponsoring integrated, problem-focused research and research-to-operations transition projects addressing the effects of drought on society and economically productive sectors of the US economy and the expressed needs of regional decision makers as they confront the challenges of drought planning, mitigation and efforts to incorporate climate variability over years to decades into their planning processes. Structured feedback from this research, as well as a defined mechanism for incorporating drought research into operational climate services, are expected to result in more widespread use of climate information and will be critical to building an end to end climate service.

This investment is implemented through the Climate and Societal Interactions (CSI) Program, and draws on collaborations from other parts of NOAA, such as NWS and NESS. Specifically, the initiative: (1) provides the resources for a CSI Regions Drought Initiative to build upon and highlight the experience gained throughout the RISA network of researcher-practitioner collaborations over the last 5+ years of the severe, sustained drought in the western US; (2) identifies, via a sector-based impacts research effort, the economic and social effects of drought (across and outside the US) through methods compatible with the short and long-term data and information needs of policy and decision makers; and (3) meets user requirements for the development of end-stage climate information tailored for specific decision needs associated with operational activities. This provides resources to respond to the challenges of such practical issues as the re-licensing of dams, reservoir management challenges, ecosystem restoration initiatives, and a host of other complex and competing water-resource allocation issues.

Observations—Soil Moisture Sensors

As part of the NIDIS program, NOAA has begun equipping 114 ground based U.S. Climate Reference Network (USCRN) observing stations in the Contiguous U.S. with soil moisture and temperature, and relative humidity (RH) sensors for drought monitoring purposes, which is particularly important for a number of climate sectors including agribusiness. The installation of these soil and RH sensors to existing observational monitoring climate networks was required to turn long-term climatology into information useful to agricultural and other drought risk-sensitive business sectors. Observations from this suite of soil and RH sensors help drought experts accurately analyze drought conditions in the U.S. Drought Monitor, and help with forecasts related to agricultural and water management operational plans and longer term future annual, inter-annual, and even decadal policies. Plans for the possibility of equipping USCRN sites in Alaska (as that network develops) are still in development.

Improving Climate Forecasts

As part of the NIDIS program, NOAA is improving two critical elements of NOAA climate forecast operations and services: (a) improving NOAA's operational intraseasonal to seasonal drought and climate forecast capability by utilizing ensembles of multiple state-of-the-art coupled climate models to better quantify forecast uncertainties and reduce forecast errors, and (b) increasing the scope and applicability of NOAA's operational climate forecasts by developing new and improved drought forecast products to meet the needs of decision makers. These

model and forecast improvements will enable businesses, academia, and government agencies to minimize the impacts of drought.

The delivery of enhanced drought information products for risk management is a critical component of the Drought Early Warning Systems (DEWS). The DEWS includes 1) a real-time drought monitoring system based on National Centers for Environmental Prediction (NCEP) operational global and regional analyses of atmosphere, ocean, and land surface conditions, 2) a state-of-the-art seasonal drought forecasting system based in part on the next generation NCEP fully coupled Climate Forecast System, and 3) an interactive drought information delivery system for drought monitoring and prediction products including an internet portal for forecasts, data, GIS products, etc. The latter will be a collaborative effort with the Climate Prediction Center (CPC) and the National Drought Mitigation Center to provide real-time drought monitoring and forecast products and develop interactive drought maps. These efforts will directly support the development of next generation U.S. Drought Monitor and U.S. Seasonal Drought Outlook products, while contributing to improvements in the skill of the official U.S. 6-10 day, 8-14 day, monthly and seasonal precipitation and temperature forecast products.

Drought Portal

NOAA maintains the U.S. Drought Portal as the public face of NIDIS. Its goal is to improve the access and sharing of drought related data and information among all users regionally, locally, and nationally and can be found at http://www.drought.gov. This system, along with coordinating national drought monitoring and forecasting systems and improving drought preparedness and planning, was authorized in P.L. 109-430, the National Integrated Drought Information System Act of 2006. The U.S. Drought Portal is part of the interactive system to:

- Provide early warning about emerging and anticipated droughts
- Assimilate and quality control data about droughts and models
- Provide information about risk and impact of droughts to different agencies and stakeholders
- Provide information about past droughts for comparison and to understand current conditions
- Explain how to plan for and manage the impacts of droughts
- Provide a forum for different stakeholders to discuss drought-related issues

The U.S. Drought Portal also serves the international community by providing a home for coordination of North American drought monitoring activities and by working with the World Meteorological Organization and the Group on Earth Observations to contribute to, or provide, a global drought monitoring portal.

Drought Early Warning Systems

NOAA has begun developing three early warning systems in the Colorado River Basin, the Southeastern U.S., and California to prototype various approaches for developing early warning and information for proactive drought risk reduction in different water, energy, agricultural, ecosystem management and drought conditions at different geographical resolutions. These diverse areas will generate test cases for the transferability of early warning concepts and products. In addition, the early warning systems will facilitate and enhance the transition of research advances in drought monitoring and prediction and lead to improved NOAA climate forecast products and will result in the development of the first NIDIS early warning systems, a direct implementation requirement of the NIDIS Act of 2006. Specifically, this initiative will

develop Drought Early Warning System prototypes and operational activities that:

- Support and improve drought warning sources at the Federal, state, tribal, and local levels and assess their status and effectiveness;
- Facilitate proactive decisions aimed at minimizing the economic, social and ecosystem losses associated with drought;
- Enable state- and county-level managers to provide more effective public warnings with drought risk indicators, and provide the capacity to develop triggers for decisions;
- Increase coordination and design of effective drought early warning and information systems that mitigate drought-related risks and are transferable to other regions within the U.S.;
- Develop a regional-scale drought information clearinghouse for drought information and risk management practices at a variety of spatial scales (e.g. watershed, state, county) using the drought portal, and facilitate the diffusion of such innovations to other locations.

REGIONAL SERVICES

As part of NOAA's focused investment in the development of an integrated climate services program in FY 2010, NOAA began a transition from a suite of individual climate applications and service programs (*e.g.*, RISAs, RCCs, NWS, National Climatic Data Center, Sea Grant Extension Network, and Coastal Services Center) to an integrated Regional Climate Services Enterprise (Enterprise). As part of an integrated network, the Enterprise will more effectively coordinate the deployment of programs and services in each region. Existing resources will be leveraged to ensure efficiency while enhancing their responsiveness regionally to emerging stakeholder needs and expediting their transition from research to operations and services.

In FY 2010, NOAA established six regional climate directors. These directors will leverage key partners as well as others that contribute program resources toward advancing NOAA's regional climate services. The regional climate directors coordinate climate activities across all of NOAA in each of the six weather service regions. NOAA already has extensive regional climate capabilities and partners with other external groups, and coordinating and enhancing those will be one of the most important outcomes of establishing a Climate Service at NOAA. NOAA regional climate directors are responsible for:

1. Providing leadership in the development of an integrated NOAA program of climate services on a regional scale that responds to the needs of stakeholders and draws upon agency-wide assets and capabilities.
2. Managing the development and execution of a Regional Climate Services Strategic Plan that combines the unique assets and special capabilities of NOAA programs working with regional partners in other Federal agencies, state, local and tribal governments, universities, the private sector and NGOs.

The Regional Climate Service Directors are working with Enterprise partners (e.g. RISAs, Sea Grant, NWS climate focal points, etc.) to develop and deliver operational climate services and products in their region, and to forge and sustain close working relationships with stakeholders. The Pacific Climate Information System (PaCIS) team serves as a prototype for how regional climate services management structure should be organized.

ASSESSMENT SERVICES

The Global Change Research Act of 1990 (GCRA) calls for the President (through a Federal interagency body) to prepare and submit to the Congress, on a periodic basis (not less frequently than every 4 years), an assessment which: 1) integrates, evaluates, and interprets the findings of the Federal interagency research effort and discusses the scientific uncertainties associated with such findings; 2) analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and 3) analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years. The next National Assessment is due in 2013. The demand for climate information at regional to local scales for decision making requires increased resolution of the Nation's mandated assessment product.

NOAA is building permanent capacity for regional climate assessment services, initiated with $9,000,000 provided in the Consolidated Appropriations Act, 2010. This assessment services capability will serve as a cornerstone of NOAA's climate services. NOAA will help staff interagency efforts for directing national assessment activities, and support a Federal Advisory Committee, and support: 1) coordinated regional climate information and access, including working with other agencies in the development of climate impact indices, and beginning to build a framework for comparing and using regional projections, and 2) conduct regional assessments through regional working groups and to build/sustain regional networks. Continuing our efforts to streamline and establish the most efficient use of resources for the national assessment, NOAA will use up to $5 million to support a central assessments office. This office will ensure there is appropriate coordination across federal agencies and with USGCRP. In addition, NOAA will provide 1) centralized regional downscaling expertise and coordination, 2) overall coordination, a technical and scientific support unit for provision of scientific and graphical expertise, web-based data accessibility, stewardship, and visualization for observations and model output, communication expertise, and other scientific and technical support for regional assessments as well as support for GCRP-led sectoral assessments.

These assessment services augment existing regional and sectoral focal points across the agency and with our Federal and non-Federal partners (states, academia, user communities, etc) to begin to integrate, evaluate and interpret climate change related observations, models and projections, and evaluate the effects of climate variability and change for approximately 10 regions and 1 sector (oceans/marine resources) covering the United States and coastal waters. In addition, NOAA will begin to develop a framework for consistent approaches and application of regional projection efforts to support regional decision making, including facilitating better connectivity of high resolution data with decision processes and models. NOAA will also play a supporting role in a USGCRP-led effort, undertaken through other agencies, to assess sectoral climate impacts (e.g. energy, transportation, health, etc.).

COMMUNICATIONS AND EDUCATION

The Climate Service conducts a Communication and Education Program (CommEd) that has missions to improve public climate science literacy, and to raise public awareness, understanding of, and engagement with NOAA's climate science and services programs. A goal is to provide timely access to authoritative climate data and information services that people need to help them make informed decisions in their lives, businesses, and communities. CommEd's work is conducted in close alignment with the agency's overarching Strategic Plans for Communications, Education, and Engagement. The CommEd Program helps lead the U.S. Global Change Research Program's (USGCRP) interagency effort to develop climate education

strategies that are aligned with national education standards. The CommEd Program employs a three-pronged strategy to promoting climate science literacy among its publics: (1) publication of content in the NOAA Climate Services Web Portal (www.climate.gov), (2) direct dialogs with a variety of audiences in live, interactive events such as educator professional development workshops and community conversations on climate hosted in science centers, and (3) internal communications and capacity building to ensure that NOAA's various communications personnel and extension networks (such as Sea Grant, NWS extension agents, and Regional Climate Centers) have the understanding and information resources needed for outreach to public stakeholders on local and regional scales.

NOAA Climate Services Portal
The CommEd team works as a core part of a larger, NOAA-wide effort to manage and maintain the Climate Services's (CS) Portal Prototype. The CS Portal Prototype demonstrates how a single, online point of access to the agency's and its partners' climate data, information resources and educational products could be developed and expanded to serve all of NOAA and the USGCRP. The Portal features customized interfaces for five distinct audiences: (1) Decision makers and policy leaders, (2) Data and services users (scientists, resource managers, business professionals, etc.), (3) Public media (working in concert with the Office of Communications), (4) Educators (both formal and informal), and (5) the climate-interested public, The CS Portal delivers climate science content that is free, readily accessible, and easily understandable—all in flexible formats that maximize utility.

Deliverables

NIDIS

- Monitoring gaps analysis, Improvements in monitoring (e.g. streamflow and snow), Spatial analysis of water demand for the Pilot basins.
- Development and improvement of drought indicators and indices. For example, the NRCS update to the Surface Water Supply Index (SWSI), Improve and utilize low flow impacts database, Custom drought index server, Water demand projections and revised triggering criteria (threshold for making management decisions).
- Develop state, Federal, tribal and private partnerships through workshops to sustain early warning systems after the pilot stage, including development of drought coordinator capacities (NIDIS Implementation Plan, 2007). For example, develop communities through the Drought Portal that can develop drought early warning processes and can provide input to the Drought Monitor.

NIDIS Milestones	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Number of regions with new or improved drought early warning systems	3	4	5	6	6	6
Number of soil moisture sensors reporting in real-time	100	114	114	114	114	114
Number of interoperable drought systems accessible through the US Drought Portal	16	20	24	28	32	36

Number of drought products developed and available	11	14	17	20	22	25

Regional Climate Services Enterprise

- FY 2012: Establishment of a multi-partner Regional Climate Service Enterprise network
- FY 2012: Initial customer engagement and dialogue opportunities to enhance understanding of climate vulnerability and information needs in the region
- FY 2012: Completion of an initial regional climate services Action Plan
- FY 2012: Meaningful performance metrics and mechanisms to evaluate program development and evolution at the regional level
- FY 2012: Definition of and support for regional dimensions of issue-focused information services including drought/water (NIDIS), sea level rise/coastal inundation, marine and coastal ecosystems and resources focusing on providing customers with information on historic context, current conditions and future projections;
- FY 2012/13: Development of a regional component of the Climate Service portal
- FY 2012/13: A joint plan with Department of Interior emerging Regional Climate Science Centers in the context of collaboration in climate science, services, adaptation, mitigation, education and communication

Assessment Services

- FY 2011/12: Suite of workshop reports and guidebooks including an evaluation of appropriate data access and management to support assessments, draft recommendations for regional-scale projection comparison and use, and assessing integrated monitoring systems to support assessments.
- FY 2012/13: Produce regional scale projections of key climate variables for the United States.
- FY 2012/13: First reviewable draft of approximately 10 regional assessments and one sectoral assessment.
- FY 2013: Completion of 10 regional assessments and one sectoral assessment. First reviewable draft of the National Climate Assessment. First reviewable draft of report on evaluation of assessments practices and usability

Communication and Education

• FY 2011/12: Conduct user testing of the Climate Services (CS) Portal interfaces to establish a durable baseline measurement against which we can measure progress annually thereafter

• FY 2012: Deliver educator professional development distance learning modules on climate literacy with a primary focus on adaptation

• FY 2012: Courses, workshops, and training on climate science and adaptation offered for NOAA staff and the international community

Performance Goals and Measurement Data
NIDIS

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Number of regions with new or improved drought early warning systems	3	4	5	6	6	6

Description: NOAA has a goal of establishing, in eight regions, new or improved drought early warning systems (DEWS) that will reduce drought impact risk and enable regions to prepare for and address drought impacts. The regions will incorporating NIDIS information products and services including improved drought preparedness plans and adopting prototype Drought "Early Warning Systems".

Regional Climate Services

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Percentage of new regional products and services provided and used by the public, private sector, and decision support communities for climate related decisions (cumulative per year) (contingent upon new resources in FY 2012)	0	30%	33%	38%	42%	45%

Description: This measure shows the number of new products and services either developed or integrated/expanded to provide users with access to the climate information, products, and services, as well as tools to use for decision-making or management systems in resource management (e.g., water, coastal, ocean, forest, and/or wildlife management).

Assessment Services

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Number of climate-change related impact, vulnerability, adaptation, or mitigation information topics addressed in the Assessments	7	12	12	25	25	25

Description: This performance measure will demonstrate the role of formal climate change assessments in decisions to address climate change impacts by identifying the number of topics addressed in the assessments that are considered by business, government, or the public that affected decisions related to improved climate resilience. Information topics are based on the U.S. GCRP report, "Global Climate Change Impacts in the U.S." This measure will track the extent to which the USGCRP topical information items are used by industry, etc., to inform their key decisions on how to mitigate or adapt to climate change.

Communication and Education

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Percentage improvement in the Quality of Relationship with users in the delivery and communication of climate information and services (Quality of relationship is a formal method of measuring indicators like trust, satisfaction and reliability), Measure 16f	0	0%	10%	15%	20%	25%

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Program Changes for FY 2012:

Regional Services: Regional Climate Services (Base Funding: 6 FTE and $4,888,000; Program Change +0 FTE and -$461,000): NOAA requests a decrease of 0 FTE and $461,000 for a total of 6 FTE and $4,427,000. This decrease reduces Congressionally provided funds for Regional Climate Centers (RCCs), however, due to the high priority the Administration is placing on regional climate services, NOAA retains 6 FTE and $3,000,000 in appropriated funds to provide regionally-tailored climate products and service delivery for a sustained, integrated regional climate services enterprise in six U.S. regions. With the requested funding level, NOAA will be able to continue to focus and align the six RCCs within the regions, allowing for further definition of regional climate service requirements.

Proposed Actions

This request provides support for the Regional Climate Centers (RCCs) as critical partners in NOAA's Regional Climate Services program. The RCCs work will be coordinated with the six Regional Climate Service Directors hired by NOAA in 2010 to lead an integrated program of regional climate services. The Regional Climate Centers will be aligned to coincide with the six NOAA Climate Service Regions and be managed by the newly hired Regional Climate Service Directors to ensure full integration as core components of NOAA's regional climate services partnership. The Regional Climate Services focus is defining climate service requirements, feeding that back into NOAA's core research infrastructure, and translation efforts of emerging research for more accessible and consistent experimental application within each of the regions. Each center will serve as the trans-boundary experts working to identify stakeholder needs and match these needs with the emerging science developed through Climate Service core capabilities with its existing laboratories, centers, and grantees. Initial sectors targeted will include: water resources (including drought), sea level rise and coasts, and living marine resources. Recent and ongoing regional climate assessment and services programs have helped inform this selection of initial priorities. Additional details on approach and priorities can be found in a CS regional services strategic vision and framework document and associated baseline assessment of regional climate information needs and capabilities being developed as part of the CS proposal.

Sub-Regional Climate Services Infrastructure and Engagement: These resources will enable NOAA to continue to support the Regional Climate Centers (RCCs), which have over 20 years of experience in regional climate observations, data management, applications research, customer support, and partnership as part of NOAA's three-tiered national, regional, and state climate collaboration. The merit-based competitively selected RCCs will ensure effective provision of services, including;

- Weekly input to the *U.S. Drought Monitor &* other contributions to NIDIS;
- Operation of specialized *climate data tools*: *Datzilla*, a NOAA reporting and tracking system for observational errors; and *Weather Coder3*, an operational National Weather Service system to collect and process thousands of daily observations through the Applied Climate Information System (ACIS).
- Contributions to the development of the *NOAA Climate Services Portal*;
- Support *State of the Climate* reports by providing monthly summaries of regional climate anomalies to NCDC;
- Acting as a *regional hub* for State Climatologists for climate information (*e.g.*, support state adaptation programs);

- Supporting *applied climate research* and *service development* programs to support NOAA and other federal agencies (e.g., USDA, Department of the Interior [NPS, BLM], and the Department of Homeland Security);

NOAA's Regional Climate Services program will continue and enhance vital RCC contributions to CS including the Applied Climate Information System (ACIS) and other Enterprise systems to support data service needs of stakeholders at state, local, and tribal levels. Such support includes: climate perspectives and monitoring product delivery, sector-specific engagement, applied climate collaboration on research to applications/applications to operations efforts (including promotion of observational network vitality), and coordination on sub-regional assessment and related impacts reporting. Additionally, the Regional Climate Services will provide hands-on training and technical support for existing CS products and services as well as supporting climate adaptation outreach and services work of sub-regional partners such as State Climatologists, Sea Grant Extension Network, USDA Extension, and NWS climate program managers.

Statement of Need and Economic Benefits

The work at the RCC's supports the Department's Balanced Scorecard Goal, "Promote economically-sound environmental stewardship and science and help drive growth of blue and green businesses" and its objective to "Support climate adaptation and mitigation." The request contributes directly to the objectives of the proposed Climate Service (CS) as announced by Secretary Locke on February 8, 2010. It also facilitates an integrated and comprehensive structure to support NOAA's co-chair role in the Administration's Interagency Climate Change Adaptation Task Force. Regional climate sciences and services through this initiative will provide critical inputs to the Task Force as it works toward the development of a national adaptation strategy, resulting in more resilient and more aware communities and opportunities for greater collaboration both inside and outside government.

Both the Administration and Congress identify delivery of best-available climate science to decision-makers as a national priority. Congress (via the American Clean Energy and Security Act of 2009) and the NRC highlight the importance of regional-scale services delivery, since most adaptation decisions (*e.g.*, resource management, infrastructure, energy services) are made at local, state, and regional levels. Informing decision-making in sectors and regions sensitive to climate change requires reliable, authoritative scientific information and discussion support services. As part of NOAA's focused investment in the development of an integrated climate services program in FY 2010, NOAA began a transition from a suite of individual climate applications and service programs (*e.g.*, RISAs, RCCs, NWS, National Climatic Data Center, Sea Grant Extension Network, Coastal Services Center) to an integrated Regional Climate Services Enterprise. The aforementioned individual programs have made progress in meeting stakeholder needs in the areas they serve. However, these efforts were not integrated such that proven products and services and best practices were readily shared within and among regions, and many regions and sectors remained underserved. Existing resources will be leveraged to ensure efficiency while enhancing their responsiveness regionally to emerging stakeholder needs and expediting their transition from research to operations and services. Such coordination reduces duplication and enhances user access to and trust in NOAA's products and services and inform better decision-making for adaptation and mitigation in the face of future climate-related uncertainties. Because climate impacts are being felt across all regions in the U.S., affecting almost every sector of society, increasing the capacity of NOAA's and its partners' professionals to use climate products and services, particularly at the regional and

sub-regional levels, is essential to NOAA's mission. The following examples demonstrate the economic benefit to the Nation of investing in climate products and information services outlined in this proposal:

- NOAA drought forecast information was estimated to have an economic impact of between $100 and $350 million in the State of Georgia alone in terms of mitigated agricultural losses during a state-declared drought year;
- Coastal states account for roughly 80 percent of U.S. wages and GDP with shoreline adjacent counties subject to sea level rise, coastal inundation and other climate-related hazards account for 40% of the wages and GDP; and
- In 2005, the Multihazard Mitigation Council estimated that a $1 investment in mitigating the impacts of natural disasters saves society an average of $4 with positive cost-benefit rations for mitigation activities related to flooding and wind damage from severe storms, tornadoes, hurricanes and other climate-related extreme events.

Base Resource Assessment

The base resources for this activity are described in the Regional Services base narrative.

Schedule and Milestones

FY 2012 Develop Regional Climate Services Action Plan for all 6 regional networks, incorporating other federal agencies where applicable, including plans to get user feedback to evaluate services

FY 2012-16 Establish and implement a continuous process for characterizing regional customer/partner requirements, starting with an initial baseline assessment of needs for products, services, tools, and capacity building.

FY 2012-16 Develop and implement a continuous system for conducting product and service delivery to the customers/partners of the climate service network.

FY 2012-16 Establish a regionally based process for new product and service development and transition, focusing on closing high priority research gaps, and transitioning science to applications through active engagement with academic, private, and federal research sectors in the regions.

Deliverables

- Integrated tools and outreach that enhance risk management strategies for decision makers, such as GIS-enabled NOAA climate data products focused initially on Sea-level rise and water management.
- Competency-building training sessions for professional development to enhance use of regionally- or sectorally-relevant climate products/services; include rigorous feedback mechanisms (*e.g.*, user evaluations, surveys).
- Updated regional contributions to the Climate Services Portal.

Output:	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
Numbers of customer requirements activities conducted	0	6	9	11	11	11

Numbers of products or tools developed	0	2	5	7	9	16
With Increase	0	8	14	18	20	27
Without Increase	0	0	0	0	0	0

Performance Goals and Measurement Data

Performance Measure: New regional products and services provided and used by the public, private sector, and decision support communities for climate related decisions (cumulative per year)	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	0	6	7	8	9	10
Without Increase*	0	0	0	0	0	0
Description: Measures the number of new regional products and services provided and used by the public, private sector, and decision support communities for climate related decisions (cumulative per year)						

*The baseline for this measure is based upon the current GPRA: Number of Regionally focused climate impacts and adaptation studies communicated to decision makers. During the first year of implementation, the baseline will be recalculated for this measure.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Integrated Climate Services
Subactivity: Regional Services

	Object Class	2012 Decrease
11	Personnel compensation	
11.1	Full-time permanent	$0
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	0
12	Civilian personnel benefits	0
13	Benefits for former personnel	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	-461
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	0
31	Equipment	0
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	0
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	-461

Assessment Services: Assessment Services (Base Funding: 0 FTE and $9,000,000; +3 FTE and +$1,000,000): NOAA requests an increase of 3 FTE and $1,000,000 for a total of 3 FTE and $10,000,000 to support a permanent capability to produce climate assessments at national and regional scales. In particular, this increase will provide staff support and support for regional modeling activities and scenario development for the National Climate Assessment.

Proposed Actions

As part of a sustained assessment process that will provide a critical underpinning of the Climate Service, NOAA requests funding for key positions to lead the National Assessment, and provide Regional and Sectoral leadership and coordination. In addition, NOAA requests additional support for regional modeling activities and scenario development for the National Climate Assessment, particularly. This investment is necessary so that projections and predictions at regional scales become more coherent from region-to-region, and are well-described, relevant, and improved. The assessment effort will provide critical evaluation of regional modeling (or 'downscaling') and a vehicle for contextual access to regional projections. However, this investment will only begin such an effort and will focus primarily on providing some standards for comparison and evaluation of regional projections targeted at non-scientific users and on providing clear and usable access to model results and data. It will build on existing assessment efforts and on allied efforts in the Agency (National Climate Model Portal, and MAPP program).

Statement of Need and Economic Benefits

The Global Change Research Act of 1990 (GCRA) calls for the President (through a Federal interagency body) to prepare and submit to the Congress, on a periodic basis (not less frequently than every 4 years), an assessment which: 1) integrates, evaluates, and interprets the findings of the Federal interagency research effort and discusses the scientific uncertainties associated with such findings; 2) analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and 3) analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years. The last two of these assessments have been completed under existing NOAA scientific leadership. (The next National Assessment is due in 2013).

Understanding and characterizing the nation's vulnerability to climate change and its adaptive capacity to reduce that vulnerability is not only essential for informed, near-term decisions regarding government actions to promote adaptation to committed warming (i.e., unavoidable warming that will occur due to historic emissions of greenhouse gases) but is also an essential input to decisions regarding how aggressively to reduce greenhouse emissions. Regional and national assessments will meet an increasing range of demands for climate change decision support across the Nation. Building on the past two decades of experience, and pairing existing expertise with emerging capacity, NOAA will support a collaborative, participatory assessment process that engages scientists, government officials, businesses, and communities in the investigation of climate impacts and effective mitigation and adaptation. This evolving program of shared learning and joint problem solving will serve as a foundational component of NOAA climate services.

Assessment processes are a proven way to conduct effective dialogue between users and producers of climate change information, as well as to enhance integration among involved

experts of diverse backgrounds spanning academia, government, and private industry; thus assessments support the constructive expert and user-provider partnerships needed for a national climate change enterprise. Assessments provide the critical connection between the research and the development of tools and products that decision makers can apply; they are also critical in communication and education efforts to improve understanding of climate variability and change and its impacts. International scientific and technical assessments by the Intergovernmental Panel on Climate Change provide key inputs to multi-national negotiations, and U.S. scientific participation supports sound, up-to-date information for policy-makers.

Cumulatively, the assessments will contribute to ongoing efforts to understand what climate change means for the United States and what services are necessary to allow for informed decision-making. These assessments will be tied to outreach and education efforts that inform Americans about climate change and its impacts and provide scientific support for end users. This information will provide an objective basis for adaptation and mitigation strategies at a variety of temporal and spatial scales. These assessments will also contribute to the legislatively mandated National Climate Assessment and future international assessments, including those of the Intergovernmental Panel on Climate Change.

Climate assessment services will involve both operational and research elements of NOAA, and will build upon many existing NOAA resources and functions including research in the physical, biological, and social sciences, observing, data management, modeling and forecasting, education and outreach. NOAA will also enhance its capabilities and tailor its products through partnerships with other Federal agencies, and the academic, public and private sectors.

Schedule & Milestones

FY 2012 Conduct regional need analysis and release prototype website for the comparison of regional projections and integrate into the full Assessments website

FY 2013 Fully implement web-based resource for the comparison of regional projections & Begin to use CMIP 5 results to provide new regional projections in a comparative framework

FY 2014 Expand the number of variables and scenarios used in the regional projections

FY 2015 Conduct regional needs analysis to evaluate website and determine future needs for stakeholders

Deliverables

- Web-based resource for the comparison of regional projections and guidance for application of regional projections
- Begin to use CMIP 5 projections to provide new regional projections
- Expand the number of variables used in the regional projections

Performance Goals and Measurement Data

Performance Measure: Number of climate-change related impact, vulnerability, adaptation, or mitigation information topics addressed in the Assessments	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	0	7	12	12	25	25
Without Increase	0	0	0	0	0	0

Description: This performance measure will demonstrate the role of formal climate change assessments in decisions to address climate change impacts by identifying the number of topics addressed in the assessments that are considered by business, government, or the public that affected decisions related to improved climate resilience. Priority topics will be determined by the interaction with stakeholders over the course of 2011

PROGRAM CHANGE PERSONNAL DETAIL

Activity: Integrated Climate Services
Subactivity: Assessment Services

Title:	**Location**	**Grade**	**Number of Positions**	**Annual Salary**	**Total Salaries**
Physical Scientist-	Asheville, NC	ZP V	1	113,735	113,735
Physical Scientist-	Asheville, NC	ZP V	2	113,735	227,470
Technical Writer-Editor	Asheville, NC	ZP V	1	113,735	113,735
Total			4		454,940
less Lapse		25%	1		113,735
Total full-time permanent (FTE			3		341,205
2011 Pay Adjustment (0%)					0
2012 Pay Adjustment (0%)					0
TOTAL					341,205

Personnel Data	Number
Full-Time Equivalent Employm	
Full-time permanent	3
Other than full-time permanent	0
Total	3
Authorized Positions:	
Full-time permanent	4
Other than full-time permanent	0
Total	4

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Integrated Climate Services
Subactivity: Assessment Services

	Object Class	2012 Increase
11	Personnel compensation	
11.1	Full-time permanent	$341
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	341
12	Civilian personnel benefits	113
13	Benefits for former personnel	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	346
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	0
31	Equipment	0
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	200
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	1,000

Communication and Education: NOAA Climate Services Portal (Base Funding: 0 FTE and $0;+2 FTE and +$1,500,000): NOAA requests an increase of 2 FTE and $1,500,000 for a total of 2 FTE and $1,500,000 to support development of a new NOAA Climate Services Portal Program that will provide easy public access to NOAA's climate data, information, and services.

Proposed Actions

Important measures of success for NOAA's climate services will be the ease with which diverse public user communities are able to access and use the data products and information services that NOAA provides, the frequency with which they do so, and the trust they place in NOAA's climate resources. With the funds requested, CS will work with partners across NOAA to build a comprehensive new Climate Services Portal (CS Portal). The CS Portal will be a central component of NOAA's commitment to integration and delivery of climate services by enhancing public access to useful climate data and information. In addition to data and products, the CS Portal will offer a broad array of climate communications, outreach, and educational materials that demonstrate NOAA's leadership in climate science research, observations, modeling, and service to society.

As the public's primary online point of entry into NOAA's Climate Services, the Portal will be a central component in the agency's climate communications, education, extension, and outreach strategy. The CS Portal will have audience-focused sections designed to serve four key segments of society: (1) climate science decision makers and policy leaders; (2) scientists and applications-oriented data users (e.g., resource managers and business leaders); (3) educators; and (4) climate interested and attentive members of the public. The NCS Portal will provide easily accessible, user-friendly climate data and information produced in styles and formats targeted to meet the needs of these four key stakeholder communities. Recent developments in web-based technologies make it possible for NOAA to present both existing data and new products in formats that are readily usable by decision-makers in government agencies and businesses (e.g., geospatial tools that enable resource managers to place information on impacts and affected resources in a place-based context relevant to planning or permitting).

Because the CS Portal is central to NOAA's climate services, development of a Prototype for the CS Portal began in September 2008 and is currently underway courtesy of temporarily donated personnel from four NOAA Line Offices (www.climate.gov). At the end of the Prototyping Phase, the Prototype will contain (1) a main home page as primary point of entry; (2) a nascent climate science magazine for outreach to the public (called "ClimateWatch"); (3) a small subset of NOAA's catalog of climate data and services contained in an initial "Data & Services" section for data users; (4) links to existing climate-related education materials in the Education section; and (5) links to existing, already reviewed factual information about climate for policy leaders.

With the funds requested, NOAA will transition from the Prototype Phase to a phase of active development of the comprehensive Portal that will represent the full breadth and depth of NOAA's climate science and services. Specifically, the funding will include improvements to the Portal's interface, and a more complete build out of the four audience-focused sections of the Portal, along with procurement and integration of the NOAA Climate Portal server system, and hiring full-time administrative personnel to manage the system. Beginning in FY 2012, the Portal will have a dedicated Program Manager to direct and oversee its development. Additionally, this request includes 2 positions to help coordinate the CS Portal's development and to ensure there is a seamless integration of all NOAA's climate-relevant data products, services, and resources into the NCS Portal.

The Portal will be guided by interactive public dialogues, users' requests, and other audience engagements. NOAA will use new Web technologies to serve climate data and products in formats that are readily usable by targeted segments of society. The full Portal's scope, product content, and functionality will evolve based on user needs and expectations for climate data and information. User feedback on products and services available through the CS Portal will also provide important insights into user applications and climate information needs that can help guide the future evolution of NOAA climate services.

Statement of Need and Economic Benefits

Societal concern about the impacts of climate change is growing. Citizens in public and private sectors want easy access to credible climate science information to help them make informed decisions affecting their lives and livelihoods. Weather and climate influences almost every sector of society, and affects up to 40 percent of the United States' $10 trillion annual economy. (NRC report, 2003 entitled "Satellite Observations of the Earth's Environment: Accelerating the Transition of Research to Operations"). As the leading provider of climate, weather, and water information to the nation and the world, NOAA is a logical source for citizens to turn to for climate information. NOAA must expand and improve the way it communicates, educates, reaches out to, and engages with public stakeholders to better meet the nation's needs for timely, authoritative climate data and information.

Citizens are increasingly going online to seek credible, authoritative climate information. However, users report having difficulty locating and using NOAA's online data products and services. Thus, resolving this online accessibility issue will be one of the CS Portal's main benefits. The use of portal technology and emerging data integration and visualization tools provide an opportunity for NOAA to bring together multiple datasets from diverse disciplines and sources to deliver a more comprehensive picture of climate in the context of affected resources, communities and businesses. Additional benefits include wider extension of NOAA's data to other media such as television and free-choice learning venues, thereby increasing public exposure and engagement.

This scalable approach to the Portal development will allow NOAA to centralize access to the agency's climate data and information resources and provide audiences with opportunities to provide feedback to help NOAA make ongoing, iterative refinements in its climate services.

Schedule & Milestones

- Conduct user testing of the CS Portal Prototype interfaces (FY 2012)
- Evolve CS Portal's interface and expand its scope based upon user-driven feedback about its functionality and contents (FY 2013)
- Develop and deliver seamless, user-friendly, map-based tools for browsing and retrieving NOAA's climate data records across the various agency's data centers (FY 2014)
- Develop and deliver online modules for science educator (middle and high school grades) professional development; develop and deliver online modules for students (middle and high school) to conduct inquiry-based, online investigations of the climate system (FY 2015)
- Conduct user-driven refinement of NOAA Climate Portal functionality and interface (FY 2015 and 2016)

Deliverables

- Improved access to NOAA's climate data and information via a single, comprehensive Web portal with four audience-focused interfaces and a comprehensive assessment and evaluation of the Portal's overall impacts on our target audiences.

Performance Goals and Measurement Data:

Performance Measure: Percentage improvement in the Quality of Relationship with users in the delivery and communication of climate information and services (Quality of Relationship is a formal method of measuring indicators like trust, satisfaction and reliability), Measure 16f	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	0	10%	15%	20%	25%	25%
Without Increase	0	0	0	0	0	0

Performance Measure: Percentage growth in number of unique visits to NOAA's Climate Portal over the FY 2010 level.	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	0	0	10%	10%	10%	10%
Without Increase	0	0	0	0	0	0
Description: This performance measure will show the ongoing increase in the average number of unique visits to the Portal among the four target audiences the CS Portal serves.						

PROGRAM CHANGE PERSONNAL DETAIL

Activity: Integrated Climate Services
Subactivity: Communication & Education

Title:	Location	Grade	Number of Positions	Annual Salary	Total Salaries
IT Specialist	Charleston, SC	ZP-IV	1	81,823	81,823
IT Specialist	Asheville, NC	ZP-IV	1	81,823	81,823
Physical Scientist	Camp Springs, MD	ZP-IV	1	89,033	89,033
Total			3		252,679
less Lapse		25%	1		63,170
Total full-time permanent (FTE)			2		189,509
2011 Pay Adjustment (0%)					0
2012 Pay Adjustment (0%)					0
TOTAL					189,509

Personnel Data	Number
Full-Time Equivalent Employment	
Full-time permanent	2
Other than full-time permanent	0
Total	2
Authorized Positions:	
Full-time permanent	3
Other than full-time permanent	0
Total	3

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Integrated Climate Services
Subactivity: Communication & Education

	Object Class	2012 Increase
11	Personnel compensation	
11.1	Full-time permanent	$190
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	190
12	Civilian personnel benefits	57
13	Benefits for former personnel	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	904
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	0
31	Equipment	350
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	0
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	1,500

APPROPRIATION: OPERATIONS, RESEARCH, AND FACILITIES

SUBACTIVITY: CLIMATE OBSERVATIONS AND MONITORING

The objectives of the Climate Observations and Monitoring subactivity are:

- Measure, capture and preserve the historical record of the global environment for continuous climate monitoring and periodic assessments in support of climate services.
- Provide the Nation with the long-term stewardship of past, present and future environmental observations
- Provide access to long time series of environmental data for national needs related to security, the economy, the environment, and public safety

Access to quality observations and science-based analysis of climate data has provided our Nation with unique abilities to minimize climate related risk and maximize climate-related opportunities. The Climate Observations and Monitoring Program measures and monitors the ocean and atmosphere to provide data on essential climate variables (ECVs). Research and programmatic activities are primarily organized and/or carried out in Silver Spring, MD; Asheville, NC; Boulder, CO, Seattle, WA; Miami, FL, Stennis Space Center, MS; and at various universities, including cooperative institutes, throughout the U.S. These data are used for climate research and are assimilated into earth systems models in order to understand the climate of the past, provide attribution to the present and future states of the climate, and optimize observing systems; and to better quantify the information on atmospheric composition and feedbacks that contribute to changes in Earth's Climate.

NOAA environmental data and information form the basis for making decisions that have far-reaching economic effects at local, regional, national, and global levels. These data are summarized into data products and used in scientific assessments that are distributed to hundreds of thousands of researchers in government, commerce, industry, science, engineering, and national defense. As an example of the impact of NOAA data and information, the Department of Commerce's Bureau of Economic Analysis estimates that at least one-third of the U.S. Gross Domestic Product is weather and climate sensitive ($4 trillion in 2005 dollars) ranging from finance, insurance, and real estate to services, retail and wholesale trade and manufacturing. The data and information management activities NOAA provides are critical in enabling decision makers, scientists, and businesses to make more informed assessments and conclusions based upon easily accessible and reliable data and information.

This subactivity provides the core funding for the three NOAA Data Centers: the National Climatic Data Center (NCDC), the National Oceanographic Data Center (NODC), and the National Geophysical Data Center (NGDC). NOAA's three National Data Centers provide the Nation with the long-term preservation (safe storage) and access for current and future generations to the past, present, and future environmental observations and associated data recorded across the United States and globally. Access to long time series of environmental data is critical to satisfying the Nation's wide range of needs related to the national security, the economy, the environment, and public safety.

NOAA's climate observations and monitoring efforts are comprised by: 1) ocean observations, 2) atmospheric observations, 3) climate data and information services, 4) ocean data and

information services, 5) geophysical data and information services, 6) environmental services, and 7) Observations, Monitoring and Prediction.

OCEAN OBSERVATIONS

The Global Ocean Observation System (GOOS) is necessary for climate research and prediction as well as long-term monitoring for climate change detection and attribution. NOAA provides the major U.S. contribution to the Global Component of the Integrated Ocean Observing System (IOOS), as codified in the Integrated Coastal and Ocean Observation System Act of 2009. IOOS is also the U.S. contribution to the GOOS and the ocean baseline of the Global Earth Observation System of Systems (GEOSS). This international observation system is based on measuring a set of core variables (for example: ocean temperature, surface winds, salinity, sea level, carbon dioxide) that have been agreed to nationally and internationally as necessary to provide the information needed by the United States and the other nations to effectively plan for and manage their response to climate variability and change. In addition, GOOS includes Arctic observations as part of the U.S. contribution to the International Arctic Observing Network. The major elements of GOOS are: 1) Argo Profiling Floats, 2) Surface Drifting Buoys, 3) Tide Gauge Stations, 4) Tropical Moored Buoys, 5) Ocean Reference Stations, 6) Ships of Opportunity (SOOP), 7) Ocean Carbon Networks, 8) Arctic Ocean Observing System, 9) Dedicated Ships, 10) Data Management, Data Assimilation, and Analysis. Satellites are also critical elements of this composite system, but they are listed elsewhere in the NOAA and NASA budgets. It must be emphasized that all of these interdependent elements working together provide the needed system.

Argo Profiling Floats

These floats provide the subsurface measurements of ocean temperature and salinity that are necessary, along with the satellite altimeter measurements, to monitor global sea level change and upper ocean heat content. This is an international effort with 22 nations plus the European Union currently maintaining 3,000 floats.

Surface Drifting Buoys

Sea surface temperature is the single most important ocean variable for the global heat, water, and carbon cycles. NOAA maintains with its 14 international partners, a global array of 1,250 surface drifting buoys. This array is used to calibrate satellite observations and reduce errors in global measurement of this critical ocean climate variable. The drifters also measure surface currents globally and provide sea surface data under hurricanes to help improve hurricane intensity and landfall predictions.

Tide Gauge Stations

Sea level rise is one of the most immediate impacts of climate change. NOAA in cooperation with 66 nations is implementing the Global Climate Observing System (GCOS) sea level reference network of 180 tide gauge stations. The stations measure sea level change at the coast and are used to calibrate and validate the satellite altimeter measurements of the deep ocean. They report in near-real-time and are also used for the tsunami warning system, storm surge, navigation, and other coastal marine services.

Tropical Moored Buoys

The Earth’s tropics are the ocean’s major capacity for heat exchange with the atmosphere. The Pacific El Niño influences global climate and weather patterns. Together with international partners, NOAA is working to instrument all three tropical oceans - the Pacific, Atlantic, and Indian Ocean - for continuous real-time measurement of ocean-atmosphere exchanges that affect the way our climate varies from year to year.

Ocean Reference Stations
NOAA, in cooperation with the National Science Foundation and international partners, is implementing a sparse global network of the highest quality ocean reference station moorings, to provide the most accurate long-term climate data records of oceanic and near-surface atmospheric parameters in key ocean regions. The surface and subsurface measurements from these Reference Stations have been a cornerstone of the documentation of long term changes in the ocean and provide "ground truth" for improvement of forecast models. This network also monitors major ocean currents (for example, the Gulf Stream) to identify changes in circulation that could provide possible indications of abrupt climate change.

Ships of Opportunity (SOOP)
The global atmospheric and oceanic data from Ships of Opportunity have been the foundation for understanding long-term changes in marine climate and are essential input to climate and weather forecast models. The Ships of Opportunity are also the system's primary vehicle for deployment of the Drifting Buoys and Argo Floats.

Ocean Carbon Networks
Projecting decadal to centennial global climate change is closely linked to assumptions about feedback effects between the ocean and atmosphere related to sequestering of carbon in the ocean and additional input of carbon dioxide into the atmosphere. The SOOP fleet and NOAA in cooperation with the National Science Foundation and international partners are implementing an ongoing ocean carbon inventory surveying the globe once every ten years, supplemented by autonomous carbon dioxide sampling instruments on the ships and the moored buoys to measure the air-sea exchange of carbon dioxide seasonally.

Arctic Ocean Observing System
Over the past 20 or more years, significant changes have been noted in the Arctic, such as thawing of permafrost, earlier break-up of ice on rivers, and thinning of the ice cover on the Arctic Ocean. NOAA is joining with other Federal agencies and international collaborators to begin a long-term effort to deploy an Arctic Ocean Observing Network. Current NOAA efforts focus on developing quantitative estimates of the transport of heat, salt, nutrients and total water volume through the Bering Strait, periodic characterization of the marine ecosystem in the Chukchi Sea, and pilot deployments of buoys to measure Arctic sea ice.

Dedicated Ships
Ocean research vessels from NOAA and university partners are essential elements of the support infrastructure necessary to sustain the ocean observing system. The dedicated ships provide the highest quality reference data sets, the platforms for the ocean carbon surveys, and platforms for deployment of the Moored and Drifting Buoys and the Argo Floats.

Data Management, Data Assimilation, and Analysis
A robust and scalable Data Management and Communications infrastructure is essential to the vision of a sustained and integrated ocean observing system. Standards and protocols are essential to enable interoperability across all global and coastal ocean observing systems. Data must be retained and made available for analyses and for assimilation into models to understand and forecast climate change, and for efficiently managing observing system operations and improvements. Thus, the advancement of assimilation techniques and the scientific analysis of ocean data are also important elements of the global ocean observing system.

In addition to these major elements, the CS has cooperative institute partnerships with academic and scientific institutions to foster long-term collaborations dedicated to advancing research. These cooperative institutes are co-located with one or more NOAA facilities to promote scientific exchange and technology transfer, and provide valuable capabilities and expertise to supplement laboratory work. The following competitively-awarded cooperative institutes collaborate with Ocean Observations:

The Cooperative Institute on Marine Ecosystems and Climate (CIMEC), located at Scripps Institution of Oceanography (SIO) at the University of California-San Diego, conducts research on climate and coastal observations, analysis, and prediction, research on biological systems, research in extreme environments, and R&D on observations systems. CIMEC collaborates primarily with the CS Line Office and Southwest Fisheries Science Center.

The Cooperative Institute for the North Atlantic Region (CINAR) is located at Woods Hole Oceanographic Institution, Woods Hole, MA. CINAR conducts research on ecosystem forecasting, ecosystem monitoring, ecosystem management, protection and restoration of resources, and sustained ocean observations and climate research. CINAR collaborates primarily with the CS Line Office and North East Fisheries Science Center.

Each of these elements brings unique strengths and limitations to build the whole. For example, the Argo Profiling Floats measure the ocean's heat content, which is directly related to our changing climate and is reflected in sea level change. Global sea level is measured by satellite altimeters, which must be continuously calibrated using the Tide Gauge Stations. The ocean's heat is transferred to the atmosphere at the sea surface (sea surface temperature directly influences the Earth's climate and our daily weather). The sea surface temperature is measured by the Surface Drifting Buoys and Moored Buoys. Ships of Opportunity and Dedicated Ships are necessary to observe the atmosphere over the ocean and deploy the Buoys and Floats at sea. The Argo Float measurements must be calibrated by systematic deep ocean observations from the Dedicated Ships in conjunction with the Ocean Carbon surveys. The entire system must go forward together; none of the elements can do the job by itself. This system was designed to meet climate requirements, but it also provides the global ocean backbone needed to support weather and storm prediction, global and coastal ocean prediction, marine hazards warning, transportation, marine environment and ecosystem monitoring, and naval applications.

ATMOSPHERIC OBSERVATIONS

NOAA's Atmospheric Observations program manages the resource of global climate ground (in situ) and space based data and information to promote global environmental stewardship; to describe, monitor and assess the climate; and to support efforts to predict changes in the Earth's environment. Climate observing networks assemble, develop, and communicate data and information about the trends and variations used to support predictions and projections of climate variation and change and weather to decision makers (e.g. energy, agriculture, national, regional, state and local officials). To this end, NOAA is responsible for infrastructure that addresses: improving climate observations, access, and data management activities associated with large-volume climate databases supplied by satellite and ground-based instruments; implementation of operational updates to NOAA's long-term ocean and atmospheric reference data sets; and improving the performance of the climate focused observational networks. Through the Climate Observations and Monitoring (COM) program, NOAA supports the 1) U.S. Climate Reference Network (USCRN); 2) U.S. Global Climate Observing System (GCOS) and its primary constituent networks; and 3) the U.S. contribution to the global Baseline Surface Radiation Network (BSRN). These three climate benchmark

networks will constitute an Integrated Ensemble of Atmospheric Climate Benchmark Systems to measure atmospheric essential climate variables critical to monitoring and modeling climate variation and change globally, nationally, and regionally. That ensemble represents the U.S. contribution to global climate earth monitoring and modeling activities as envisioned in the internationally vetted Global Framework for Climate Services that was established at the 3rd World Climate Conference in 2009.

U.S. Climate Reference Network (USCRN)
The USCRN Program is designed to address the climate community's requirements regarding long-term (50-100 years) surface air temperature, precipitation, relative humidity, and soil moisture and temperature observations free of biases in order to better monitor climate variation and changes on the national scale. The completed network of 114 sites operates across the contiguous continental U.S. has been operational since the end of 2008. During the period FY 09-16, a total of 29 USCRN stations will be installed in Alaska. Two USCRN stations have been installed in Hawaii to provide information on USCRN performance in unique high elevation and high precipitation climate regimes. Beginning in 2009, soil moisture and temperature, as well as relative humidity sensors are being installed at the 114 USCRN sites across the lower 48 states. A total of 80 sites will have had such sensors installed by the end of FY 2010. This is the first "climate-driven" observing network designed for the specific purpose of acquiring near-real-time and climate-quality observations. USCRN provides baseline, high-quality surface observations of surface air temperature and precipitation used to detect and assess climate variation and change (trends) through a robust long-term climate record. USCRN data will contribute to improved climate and weather model performance (improved confidence) as well as Improved Forecast Skill Scores used by economic sectors. The USCRN also supports the National Integrated Drought Information System (NIDIS) through the inclusion of soil moisture sensors, which provide data critical to understand drought. Observations from the USCRN sites provide benchmark measurements for an improved national climate and weather monitoring network.

U.S. Global Climate Observing System (GCOS)
U.S. GCOS provides U.S. leadership on the global effort to implement a sustained global infrastructure of high-quality, comprehensive ground-based *in-situ* atmospheric climate observations. U.S. GCOS works with regional, national, and international organizations and partners to provide the global observing system and accompanying data management system needed to support the observational data requirements for climate assessments, predictions and projections, and contributes to improved near-term forecasts. GCOS is the formal climate component of the Global Earth Observation System of Systems (GEOSS), and is prominently featured in the U.S. response to the high-level construct of the Global Framework for Climate Services. More information on GCOS can be found at http://gosic.org.

GCOS Upper Air Network (GUAN)
The GUAN is a network of 160 stations [see map at http://www.wmo.int/pages/prog/gcos/documents/GSN_Station_Map_2010.pdf] that take regular upper air observations. These stations are a subset of the World Weather Watch Global Observing System. They have been selected to provide a good spatial distribution of stations that can collect and submit good quality upper air data for the Global Climate Observing System; primarily upper air temperature, humidity, and winds. The GUAN complements the higher quality GRUAN network by giving long-term data at a diverse array of sites around the world.

GCOS Surface Network (GSN)
The GSN is a global network of approximately 1,000 stations [see map at

http://www.wmo.int/pages/prog/gcos/documents/GSN_Station_Map_2010.pdf] selected from the network of many thousands of existing meteorological stations. The GSN is intended to comprise the best possible set of land stations with a spacing of 2.5 to 5 degrees of latitude, thereby allowing coarse-mesh horizontal analyses for some basic parameters that are primarily Temperature and Precipitation. The U.S GCOS contribution to the larger international network is the upgrading of about 75 GSN non-US sites with climate quality sensors.

GCOS Reference Upper Air Network
The GRUAN is a planned international network of 30-40 high climate quality upper air stations [see http://gruan.org] for providing climate quality upper tropospheric/lower stratospheric vertical temperature and water vapor measurements for climate purposes. GRUAN stations (current GUAN sites) will begin with upgrading current sensors and procedures to improve climate monitoring capabilities requirements. When the reference radiosonde becomes operational the GRUAN sites will launch the reference radiosondes. The U.S. component of GRUAN is planned to involve upgrades to seven current U.S. sites: five US Department of Energy's Atmospheric Radiation Measurement (DOE ARM) Program; one at Howard University in Beltsville, MD; and one at NOAA/NCAR station in Boulder, CO. The GRUAN is intended to begin international operations once a number of technical issues have been solved. Implementation of the network has started, involving the identification of eligible measurement sites, development of a data policy and dissemination scheme and the quest for a common mode of operations.

Baseline Surface Radiation Network (BSRN)
The BSRN is the designated global baseline network 40 sites in contrasting climatic zones from 80°N to 90°S (see map at http://www.bsrn.awi.de/en/stations/maps/). Solar and atmospheric radiation is measured at a time resolution of 1-3 minutes. More details available at: http://www.gewex.org/bsrn.html. Solar radiation is a key component driving climate change. The U.S. is the largest contributor to the global BSRN include the aging NOAA surface observing systems [Surface Radiation (SURFRAD) network, NOAA component of the joint Solar and Terrestrial Atmospheric Radiation (STAR) network, and U.S component of the Global Energy and Water Cycle Experiment (GEWEX) network], which are falling short of supplying the extent of information needed by the climate research community.

CLIMATE DATA AND INFORMATION SERVICES

The National Climatic Data Center (NCDC), located in Asheville, North Carolina, is the largest climate data center in the world, and is the Nation's designated Federal Records Center (FRC) for climate data. NCDC is one of two operational sites for NOAA's Comprehensive Large-Array Stewardship System (CLASS). The NCDC receives, processes, archives, provides access, disseminates, and conducts objective assessments of ground based and spaced observations. National and international observing systems provide a regional, national, and global perspective of the State of the Earth's weather and climate. Paleoclimate proxy records, i.e., pre-instruments, such as ice and coral cores, and tree rings are also collected, archived, and made available to the global community of researchers and other interested users. The NCDC is a designated World Data Center (WDC) for Meteorology and WDC for Paleoclimatology.

The NCDC provides data, information, products and climate services to all sectors of the economy, delivering weather and climate data and information to nearly two million customers each year for planning, operations, and minimizing risks associated with weather and climate extremes. NCDC provides access and data retrieval via the worldwide web/Internet and responds to thousands of requests received via e-mail, phone, fax, and the mail. NCDC routinely produces operational products for climate monitoring, such as the weekly and monthly

State of the Climate reports, the U.S. and the North American Drought Monitoring Reports, and the Climatology for the U.S. reports. These and other climate assessments support business and government policy makers and implementers. NCDC also works very closely with various regional, state, and local stakeholders.

Over 2.3 PBs of data are now directly accessible from NCDC's website (www.ncdc.noaa.gov). Approximately 400 TBs of data were delivered on-line during the first half of FY 2010, with over 400 million hits and downloads from NCDC's website during that time; a nearly 50% increase over the same period in FY 2009. Several factors account for this increase, including: Continued infrastructure improvements at NCDC to accommodate user demand, the Climate Services Portal prototype release in the second quarter of FY 2010 (over 15 million hits, www.climate.gov), and access to large volumes of Climate Forecast System Reanalysis data via NOMADS.

NOAA climate data users and per cent data requests-retrievals are placed into four general categories: Business 58%, Public 24%, U.S. Government 8%, and Academia 10%. In FY 2008, over 473 million national and international contacts for NOAA climate data and information were made via the Internet; over 5.7 million unique users visited the NCDC website; and 338 terabytes (TB) of data were downloaded including nearly 22,000 paid orders via the On-line Store. This is an increase over FY07, when 315 terabytes of data were downloaded and NCDC's website received 410 million contacts. NCDC set a new quarterly record for data access during the second quarter of FY 2010 with 263 TB's of data downloaded via on-line systems and 207 million website hits. These figures are approximately 40% above the statistics for the same FY 09 quarter. The introduction of the Climate Services Portal website is a major contributor to increase customer interactions with the center.

The NCDC manages the conversion of historical non-digital data records (paper and microfiche) to electronic format and accessibility via the Internet through the Climate Database Modernization Program (CDMP). The NCDC operates and sustains the new Comprehensive Large Array Storage System (CLASS), a NOAA Enterprise System designed to provide long term preservation (safe storage) and access for the large volumes of data that will be generated by new satellites, upgrades to radars, climate and weather models, and other observing systems. The NCDC, in partnership with NASA scientists, develop long time series satellite derived Climate Data Records (CDRs). The National Climate Model Portal (NCMP) will generate and house model based data records and implement an operational archive and access capability for the next generation, high resolution weather and climate reanalysis datasets. NCDC, in cooperation with scientists and other NOAA activities and federal agencies, has designed and deployed the Nation's first climate quality *in-situ* observing network, the U.S. Climate Reference Network (USCRN). NCDC in partnership with other offices within CS, across NOAA, and with other agencies is developing the National Integrated Drought Information System (NIDIS) portal.

Comprehensive Large Array data Stewardship System (CLASS) - Operations Systems (Data Center Operations)
The Data Centers are utilizing CLASS to ensure the long-term preservation (safe storage) and access for data, information, and metadata, particularly for large data sets. Beginning in FY 2008, components of the CLASS Development design began to transition into the Data Centers' operations and become operationally integrated into the data management and customer servicing operations systems. At this time the Data Centers assumed the responsibility for operating and sustaining these components of the CLASS Operations System. The CLASS Operations and Planning Board (COPB), which consists of the Directors of the three Data

Centers, are responsible for the execution of the CLASS Operations budget (ORF). The COPB also reviews the requirements and provides guidance to the CLASS Development project manager and the associated CLASS PAC budget. The CLASS project manager focus is on the information technology required to ingest, store, access, and maintain the submitted data sets. The Data Centers through the COPB are responsible for the sustain operations of the CLASS Operations System, a critical component of NOAA's Enterprise System supporting information preservation and end-to-end stewardship of the archived data, as well as maintaining access interfaces use to support customer service requests.

Climate Database Modernization Program (CDMP)
CDMP supports the NOAA mission to collect, integrate, assimilate, and effectively manage Earth observations on a global scale ranging from atmospheric, weather, and climate observations to oceanic, coastal, and marine life observations. Many of these holdings, which are part of the U.S. National Archives, were originally recorded on paper, film, and other fragile media, and stored at various NOAA Centers. Prior to CDMP, not only were these valuable data sources mostly unavailable to the scientific community, but storage technology for the archive was becoming obsolete. Without proper preservation of the media, the information they contained was in danger of being lost forever. Today, CDMP has greatly improved the preservation and access to NOAA's holdings by migrating many of these resources to new digital media. CDMP will continue transforming these older observations to a more useful and accessible digital media, which will help meet the predicted demand for additional scientific baseline observations. Many significant decisions on future energy use, climate, and infrastructure issues will depend on the accuracy and availability of these data for predictive modeling. The work is far from done and over the next decade millions of pieces of data will be prioritized and then preserved digitally to meet the needs of the scientific and business communities.

The CDMP program is a partnership with four private sector contractors. CDMP goal is to preserve and make available climate data going back several hundreds of years that range from the bottom of the ocean to the top of the atmosphere. To date over 56 million images have been digitized for on-line access. Over 12 terabytes of data have been keyed and converted to digital format extending the historical climate record back to the early 1800s and in some cases the 1700s. These are now readily accessible via the Internet and other web-based portals. Environmental publications and historical documents are now available in electronic form and can be downloaded to your computer. There remains many more of these National Treasures, the climate history of the U.S. and the world, to be converted to digital formats for easy and convenient access by anyone. A true understanding and appreciation of Climate Change cannot be achieved until the complete history is available to researchers and others.

CDMP also supports the preservation of other important NOAA environmental data, ranging from ocean cores below the seabed floor to the top of the ionosphere. For example, the Tsunami Program has had more than 25,000 photos, slides, negatives, microfiche, and hardcopy images electronically scanned. The Tsunami Warning Centers used these historical data as tools in decision-making for hazard assessment, and in validating tsunami propagation and inundation models. The increase in the accessibility of quality historical data is helping researchers worldwide to improve real-time monitoring and forecasting of environmental, solar, and geophysical events.

Climate Data Records Program (CDR)
The CDR Program's goal is the production of high quality, multi-decadal time series data describing the global atmosphere, oceans, and land surface with a focus on essential climate

variables as identified within GCOS. Building upon the initial successes of the Scientific Data Stewardship (SDS) program, it supports the regular, operational production of CDRs for the atmosphere, oceans, and land surface. CDRs transform raw satellite data into unified and coherent long-term environmental observations and products that are critical to advanced climate change understanding, prediction, mitigation and adaptation. CDRs will be used to detect, assess, model and predict climate change. Climate Data Records (CDRs) and Climate Information Records (CIRs) provide authoritative climate reference sets for use by decision-makers to devise strategies to respond, adapt, and mitigate climate change impacts and trends. The production of CDRs/CIRs requires collaboration between experts in the climate community and experts in data management. It also must be informed by scientific application and associated user feedback on the accessibility and usability of the produced CDRs.

The program is developing three areas for operational and regular production of high-quality CDRs:

- Operational quality assurance of ingested data and regular monitoring of data quality and provenance;
- Generation of authoritative, long-term records through rigorous data analysis and research that will validate and improve these CDRs; and
- Configuration management to ensure the documentation of the product and preservation of the information context to allow future users to understand, modify, and use the CDR.

The CDR Program activities encompass the full range of institutional diversity within the climate community. Scientists NOAA leverages prior U.S. investments by transitioning research products from NASA and other agencies into sustained NOAA operations. A Cooperative Institute for Climate Science (CICS) was established in FY 2010 to draw upon a wide range of expertise from the university research community. The program has adopted approaches that allow organizations producing and archiving CDRs to maintain local autonomy within a context that encourages responsible participation in federations that foster increased data sharing, interdisciplinary data understanding, and improved assessments of data quality. An Announcement of Opportunity was published in FY 2009 to begin a CDR grants program. The CDR Program Office has awarded the FY 2009 and FY 2010 grants and is preparing to incorporate the results of the projects into the CDR framework. The authoritative nature and vitality of the CDRs will be maintained through peer reviews, user recommendations, and independent processing of data describing essential climate variables. Without a CDR processing capability, NOAA's satellite data have significantly less use and value for climate studies.

NOAA's CDR Program is initially focused on critical CDRs that address key societal issues including:

- Water, drought, and floods
- Energy and renewable energy
- Hurricanes and coastal hazards

Major CDR Development and production actions include:

- Algorithm Development, Processing and Re-Processing of Long Term Data Series
- Calibration, Validation and Characterization of Data
- Science and Climate Information Records
- Long Term Stewardship (ensure CDRs are easily understood, accessible and of highest quality)
- Applications for Mitigation and Adaptation, and

- Project Management Support

CDRs address the current state of the climate at the accuracies and resolutions required by users and provide capability to assimilate large and complex data sets into earth systems models. CDRs are distinct from operational weather/hazard satellite products since CDR production:

- Removes/minimizes time dependent biases in satellite data
- Delivers long term seamless homogeneous records characterizing climate change/variation (50+ years)
- Reprocesses the entire period of record as new climate algorithms or sensor knowledge developed

National Climate Model Portal (NCMP)

National Climate Model Portal provides an operational archive and access capability for the next generation, high-resolution weather and climate reanalysis datasets generated by sophisticated coupled ocean, air, and land models running on supercomputers across NOAA and its collaborators (NSF, DOE and others). NCMP is an extension of the National Operational Model Archive and Distribution System (NOMADS). Over 10 TBs of Climate Forecast System Reanalysis (CFSR) data are now accessible via NOMADS. The NCMP leverages existing supercomputer resources to provide a unified and consistent suite of climate information to users at all levels so that they can make better decisions about their specific management needs. Information will be provided on time scales from days to months (forecasts), seasonal to inter-annual (predictions), and decadal to centennial and longer (climate variability and change - projections). These climate model reanalysis products will total over 1PetaByte (PB) (1,000 Terabytes) of data and include:

- Coupled Climate Forecast System Reanalysis and Reforecast (CFSRR) dataset, a modern era reanalysis, a coupled 30 year global reanalysis of the atmosphere, ocean, land, and cryosphere (snow/ ice).
- Climate Prediction Center Reanalysis (CPCR), a long time series historical upper-air reanalysis (1850 to Present).
- Surface Pressure historical reanalysis running at NOAA's Earth System Research Laboratory (ESRL).

NCMP is the users' interface to the system, where they can manage requests, download data, receive user input, and browse the catalog. The Catalog Node is the heart of the system and concentrates on connecting partners, metadata, search and discovery, and peer-to-peer connectivity. It complements the Climate Services Portal helping to remove barriers to data format and system incompatibilities. Decision makers are increasingly seeking information that will help their communities plan and respond to climate variability and change. The NCMP will develop an operational archive and access capability for the next generation, high-resolution weather and climate reanalysis data sets derived from model outputs. Reanalysis output and products will improve our understanding of various climate phenomena, including verification, detection, and determination of drought severity and location; verification and improvements to forecasts of El Niño occurrence and persistence; and verification and improvements to our understanding of the hydrologic cycle and water resources. The Climate Model Portal will be designed to convey key aspects of complex scientific data in a manner accessible to non-specialists and NOAA's climate information user communities. NCMP will also partner with the existing climate model diagnostics community (PCMDI) and collaborate to improve climate

model diagnostics tools, and access to required data sets used by these tools (esp., observations and reanalysis).

The NCMP will provide premiere access to several new key NOAA datasets, and will improve the linkages between research findings and the transfer of those findings into operational capabilities as outlined in the U.S. Weather Research Program (USWRP) Implementation Plan for Research in Quantitative Precipitation Forecasting and Data Assimilation. NCMP will facilitate model and observational data access issues as discussed in such documents as the Intergovernmental Panel on Climate Change, and the U.S. National Assessment, and meets many of the data access goals as outlined in "Fair Weather: Effective Partnerships in Weather and Climate Services," (National Academy Press, 2003).

Finally, NCMP will implement the recommendations by the National Academies, National Research Council (NRC), Board on Atmospheric Sciences and Climate (BADC) recommendation to "…advance the NOMADS archive and capabilities for ensembles based multi-model diagnostics archive, and reforecast datasets to facilitate post-processing" as outlined in "Completing the Forecast: Characterizing and Communicating Uncertainty for Better Decisions Using Weather and Climate Forecasts". (NRC, 2006)

OCEAN DATA AND INFORMATION SERVICES

The National Oceanographic Data Center (NODC), located in Silver Spring, MD, with offices in Stennis, MS; Honolulu, HI; San Diego, CA; Norfolk, VA; and Charleston, SC, is the Nation's permanent archive for oceanographic data, ensuring the public access to and the scientific stewardship of long-term observational records of the global ocean, and U.S. coastal waters and their ecosystems. These holdings document the physical and chemical properties of the oceans, currents, and biota as observed from ships, buoys, satellites and other ocean and coastal platforms extending back nearly 150 years. NODC's division in Stennis, MS provides increased utilization of coastal and oceanographic data using web-based search/access and geographic information system (GIS) techniques to improve the understanding, management and use of coastal areas.

NODC's mission is to ensure that global oceanographic data sets collected at great cost are maintained in a permanent archive that is easily accessible. This is accomplished by: Building scientifically, quality-controlled global oceanographic databases and providing analysis and climatologies of key ocean variables; Supporting ecosystem management by providing access to the Nation's coastal and ocean data resources; and Providing information technology services in a secure, sustainable environment.

The NODC serves more than 800,000 users annually through the Internet and provides a variety of publications including atlases and technical reports published on digital media and paper. Examples of the most requested products include the World Ocean Database and Atlas, the International Atlas of the Ocean series, and sea surface temperature climatology derived from satellites and data sets gathered from operational ocean observing systems worldwide. The user community includes resource managers, researchers, educators, and maritime industry professionals from Federal, state and local agencies as well as academia and the public. NODC is a designated World Data Center for Oceanography and provides leadership for international data exchange programs through the Intergovernmental Oceanographic Commission (IOC).

Ocean Data Stewardship

NODC's Ocean Data Stewardship (ODS) group provides comprehensive scientific stewardship

for national and international marine environmental and ecosystem data and information. The ODS acquires, archives, provides access, and assesses global and coastal marine ecosystem data from domestic and foreign sources. It quality controls and archives ocean data to create a trusted repository of historic data. ODS assesses the physical, biological and chemical conditions derived from in situ oceanographic observations, satellite remote sensing of the oceans, and ocean model simulations to develop and distribute improved products and climate data records. It develops and distributes global and regional, integrated, comprehensive, scientific quality-controlled ocean profile databases and gridded, objectively analyzed fields based on the data in these databases. ODS performs research using historical oceanographic data to determine the role of the world ocean as part of the earth's climate system. It prepares technical publications, atlases, scientific papers/articles for various scientific journals and meetings, and scientific products for dissemination internationally.

Coastal Data Stewardship
NODC's Coastal Data stewardship group supports marine environmental and ecosystems stewardship by providing access to the nation's coastal data resources. CDS accomplishes this mission by using established and emerging technologies to support end-to-end data management for NOAA and NOAA partners in Federal, State, local, academic, and other organizations. CDS products are intended to bring together scientists and coastal managers to act as an important source of coastal ecological and observational data and information for the American public at large.

GEOPHYSICAL DATA AND INFORMATION SERVICES
The National Geophysical Data Center (NGDC), located in Boulder, Colorado, builds and maintains long-term archives of scientific data with a special emphasis on scientific stewardship of data acquired by NOAA observing systems. Data holdings include bathymetry, solar, geophysical, space environment, and earth observing satellite data. The NGDC plays an integral role in the Nation's research into the environment, at the same time providing public domain data to a wide group of users. The NGDC works very closely with NOAA's Space Weather Prediction Center and Office of Coast Survey to provide archive and access of space weather and hydrographic observations. NGDC works with contributors of scientific data to prepare documented reliable data sets, currently maintaining more than 850 digital and analog data sets, and continually developing data management programs that reflect the changing world of geophysics in an era of electronic data access. NGDC provides funding to the National Snow and Ice Data Center (NSIDC) at the University of Colorado for archive services of polar data. NGDC's unique capabilities have attracted other mission-related functions. NGDC is one of two operational sites for NOAA's Comprehensive Large-Array Stewardship System (CLASS) and is the parallel collection site and archive for the Global Positioning System Continuously Operating Reference Stations (GPS CORS). NGDC is responsible for the development and maintenance of the World Magnetic Model for the Department of Defense and also operates World Data Centers for marine geology and geophysics, solar terrestrial physics, and glaciology for the International Council of Science under the auspices of the U.S. National Academy of Sciences.

Through the NOAA Climate Database Modernization Program (CDMP) and other means, the National Geophysical Data Center (NGDC) acquires, stewards and disseminates long-term climate records of the solar and space environments. Solar activity measures, such as the historical sunspot numbers, provide quantitative measures of solar variability that are incorporated into large-scale climate models. Related to this, NGDC works with climate scientists within the local Boulder area to maintain within NOAA an accurate record of total solar irradiance and solar spectral irradiance derived from satellite measurements and to advocate for

measurements of solar irradiance continuity as a primary forcing function in climate modeling. NGDC is also responsible for monitoring the long-term records of anthropogenic nighttime lighting which are used to calculate changes in impervious surface areas and other factors that can influence local climate variability. NGDC maintains the largest collection of ionospheric sounding data stretching back to the 1930's which have been used to infer climate related changes in the upper atmosphere, including the stratosphere and above. Finally, NGDC space weather datasets obtained by sensors on NOAA's fleet of polar and geosynchronous satellites provide a calibrated record of changes in the local space particle environment within the past 30 years.

ENVIRONMENTAL SERVICES

The goal of Environmental Data Systems Modernization (EDSM) is to provide increased access and utility to environmental data, information, products, and services through the use of innovative technologies and techniques. Environmental data and information under the stewardship of NOAA are vital to a wide range of weather sensitive sectors of the economy such as: energy and water resources management, aviation, construction, engineering, utilities, food production (agriculture and aquaculture businesses), multi-modal commerce, tourism, manufacturing, and the insurance industry. Business and government leaders, as well as researchers have critical needs for quality long time-series of historical and recent national and global data to evaluate the current status of the environment, to assess long-term environmental trends, and to predict future environmental conditions and events.

Environmental Data Systems Modernization (EDSM) supports an integrated suite of functions to preserve and exploit the full scientific value of NOAA's environmental, such as: 1) Sustain and Operate timely/convenient access to the full range of data in the CLASS Operations System (integrated into the Data Center infrastructure), 2) Sustain and Improve non-CLASS IT infrastructure that supports customer services and data management functions, 3) Improving the Integrity and Fidelity of the historical climate record, a function of Scientific Data Stewardship, and 4) Integrate Observing Systems (IOS) activities, such as the Integrated Surface Data (ISD) structure for easier and more timely access to similar data from different observing systems, improved integrate metadata documentation and access, and near real time monitoring of observing systems performance, “Health of the Network – (HON)” to detect and correct potential data problems before they become a part of the long term climate records.

OBSERVATIONS, MONITORING AND PREDICTION

Climate Services provided by the Climate Prediction Center (CPC) (http://www.cpc.noaa.gov/index.php) include a broad range of climate products and services related to climate monitoring, short-term climate fluctuation forecasts, and information on the impacts of climate patterns on the nation. Their product suite spans time scales from a week to seasons, extending into the future as far as technically feasible, and covers the land, the ocean, and the atmosphere, extending into the stratosphere. These climate services are available for users in government, the public and private industry, both in this country and abroad. Applications include the mitigation of weather-related natural disasters and uses for social and economic good in agriculture, energy, transportation, water resources, and health. Continual product improvements are supported through diagnostic research, increasing use of models, and interactions with user groups.

Deliverables/Outputs

Ocean Observations Deliverables

Deliverables	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Tide Gauge Reference Stations w/GPS installed (Cum Total #)	105	110	115	120	125	130
Deep Argo deep floats deployed (Cum Total #)	0	0	0	0	10	20
Ocean Reference Stations deployed (Cum Total)	11	11	11	11	12	12
Drifting Buoy Array deployed (Total #/year-reseeding the array)	1,000	1,000	1,000	1,000	1,000	1,000
Tropical Moored Buoys (TAO/PIRATA/RAMA) installed (Cum Total #)	82	86	86	89	89	89
Tide Gauge Reference Stations	63	63	63	63	63	63
Ice Buoys/Stations Reporting (Cum Total #) Typically 2-yr life-cycle refresh.	4	4	4	4	4	4
Ocean Carbon Surveys conducted (Cum Total #)	13	15	17	18	18	18

Atmospheric Observations

Deliverables	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
USCRN stations installed in Alaska (Cum Total #)	7	11	17	23	29	29 100%
USCRN Data Recovery Rate from all commissioned USCRN sites. (Cum Total %/year)	95	95	95	95	95	95
GCOS: Global Surface Network (GSN) Stations Upgraded or Installed (Cum Total # stations)	4	6	8	10	12	14
GCOS: Global Upper Air Network (GUAN) Stations Upgraded or Installed (Cum Total # stations)	1	3	4	5	6	7

Climate Data Modernization Program (CDMP) Deliverables

CDMP Milestones/Deliverables	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Pages imaged (Number/Year)	150K	150K	150K	150K	150K	150K

Pages Imaged (Cumulative Total Number)	56.0M	56.1M	56.3M	56.5M	56.7M	56.8M
Records keyed (Number/Year)	3M	2M	3M	2M	2M	3M
Records Keyed (Cumulative Total Number)	81M	83M	86M	88M	90M	93M

Climate Data Records (CDR)
Deliverables

- Transition to Operations: Sea Surface Temperature CDR, Atmospheric Temperature Profiles CDR, and Northern Hemisphere Snow Cover CDR bundles
- Initiate Development of Sea Surface Height/Altimetry CDR bundle and Global Precipitation Climatology Project (GPCP) CDR bundle
  (A "bundle" includes a variable number of related geophysical CDRs derived through a common algorithm or retrieval approach.)

National Climate Model Portal (NCMP)

Deliverables

- NOAA Reanalysis Web Page for collection of user requirements and input.
- Ingest, Archive, and Access to the next generation reanalysis datasets (CFSRR, CPCR, and SFC Historical).
- Model-to-Observational inter-comparison capability.
- Prototype Customer Service support capability and a research quality help desk supporting NCMP users.
- A reanalysis clearinghouse to host consensus (satellite, in-situ, and radar) datasets for the next series of NOAA reanalysis.

Environmental Data Services

Deliverables	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
EDSM: Observing systems regularly monitored on an operational basis for nominal system status and for random and time-dependent errors. (Cum Total # of systems monitored)	8	8	9	10	11	12

Climate Data and Information Services (NCDC)

Milestones/Deliverables	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Data ingested annually and placed in NCDC primary archive. (Total PBs/yr)	5.9	7.3	19.0	42.5	66.0	96.3
Data & information added annually to on-line access (in-situ + radar + satellite).(Total PB/yr)	2.0	3.5	8.0	15.0	25.0	40.0

Data/Information available for retrieval via the WWW. (Cum Total PBs)	4.5	8.0	16.0	31.0	56.0	96.0
Volume of data (in-situ + radar + satellite) delivered online to customers. (Total TB/yr)	700	1,200	2,000	3,000	4,500	6,000
Research Climate Data Sets Transitioned to Operations (transferred to ARC) (Cum Total #)	2	2	3	3	4	4
Climate Data Sets Upgraded/ Updated within the Applied Research Center (ARC) (Cum Total #)	43	50	57	64	71	78
Paleoclimate Reconstructions (Cum Total #)	15	18	21	24	27	30
Climate Extremes Indices providing socioeconomic impacts information (Cum Total #)	3	3	3	3	3	3

CLASS *Operations System*

Safe Storage and Access Capability and Capacity (Volume for One Copy/One Site) (Mapped against Aug 09 Satellite "Fly Out" Plan, Radar Upgrades, Model Data, Other Data)						
	FY 2011 Target	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
Annual Increase - New Data/Year (TB/FY)	5,458	5,978	6,237	6,437	8,067	9,859
Cumulative Total Data (Terabytes - TB)	8,839	14,816	21,053	27,490	35,557	45,416

Ocean Data and Information Services Deliverables

- Increased number of climate data and information products recognized as authoritative data records
- Timely, more accurate and reliable ocean data and integrated NOAA products
- Expanded (new climate variables) ocean data bases that are accessible, in standard formats and can be integrated with user applications
- NOAA-wide access to key digital journals and information data bases

Geophysical Data and Information Services (excluding CLASS)

Milestones/Deliverables	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
Cumulative total of data ingested and placed in the archive consisting of onsite and offsite holdings. Unit of measure is Terabytes (TB).	576	634	697	767	843	928

Volume of data and information delivered online to customers. Unit of measure is TB/yr.	133	146	161	177	195	214

Performance Goals and Measurement Data

Ocean Observations

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Reduce percent error in seasonal forecast of Arctic sea ice loss and regrowth	50%	50%	50%	50%	50%	50%
Description: Percent reduction from the FY 2008 baseline in forecast error relative to observations. Current sea ice outlook is based on statistical evaluation of recent past years and is only generated for summer months.						

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Reduce the error in global measurement of sea surface temperature (ºC), Measure 16c	0.50	0.50	0.50	0.50	0.45	0.35

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Increased percentage of global in situ ocean observing system implementation.	61%	61%	61%	61%	61%	61%
Description: This measure tracks the percentage of global coverage of the Global Ocean Observing System. There are eight (8) individual ocean observing systems and one data management system that make up GOOS. The % completion of the eight systems determines the cumulative total % of this PM. A predictive understanding of the Earth's climate is critically dependent on quantitative measurements of ocean parameters - the ocean is second only to the sun in effecting climate change and variability.						

Atmospheric Observations

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Increased percentage of atmospheric, ocean, and select terrestrial climate "state variables" with quantitative analysis reported in NOAA's Annual State of the Climate Reports.	67%	74%	81%	85%	89%	93%
Description: 100% Target: At least 42 atmospheric, oceanic, and select terrestrial climate "state variables" measured and used. (Ref: Strategic Plan U.S. CCSP, App 12.1) Essential atmospheric, ocean, and terrestrial climate variables have been identified by the U.S. and the						

international communities in support of the United Nations Framework Convention on Climate Change, of which NOAA was a part. These 42 climate state-variables are considered critical to advancing the knowledge and understanding of the climate.

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Improved confidence in the monitoring and detection of Alaska climate change using the observed Temperature record produced by commissioned USCRN sites in Alaska. (Cum Total % confidence).	62.9	67.1	71.7	77.7	83.6	93.9

Description: Final Target is 93.9% confidence: At least 42 atmospheric, oceanic, and select terrestrial climate "state variables" measured and used. (Ref: Strategic Plan U.S. CCSP, App 12.1) Essential atmospheric, ocean, and terrestrial climate variables have been identified by the U.S. and the international communities in support of the United Nations Framework Convention on Climate Change, of which NOAA was a part. These 42 climate state-variables are considered critical to advancing the knowledge and understanding of the climate.

CLASS

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
CLASS Ops System - Safe Storage and Access Capability and Capacity (One Copy/One Site) (Cumulative Total Data - TB)	8,839	14,816	21,053	27,490	35,557	45,416

Climate Data Records

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
CDRs in Operational Status (Cum Total #)	8	11	13	13	13	13

Description: CDRs provide long-term product consistency through rigorous reprocessing with advanced algorithms, ancillary data and evolved instrument understanding. This measure identifies the number of satellite-derived Climate Data Records (CDRs) that will be transitioned from research into sustained operational production and stewardship. CDRs integrate data collected over multiple decades into unified and coherent global environmental records using proven scientific practices. They are used by societal sectors and regional users to assess and understand climate change and variability and address issues that help maintain our economic viability and improve the security and well-being of the public.

NOAA Climate Model Portal

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Access to increased reanalysis and data available to operational and research users from the next suite of NOAA's climate weather reanalysis and reforecast datasets in an interoperable Web Service architecture. (Increase TBs/yr)	1,000	1,250	2,000	2,500	4,500	4,500

Description: The goal is to increase the terabytes of data made available to users for the next generation climate analyses by developing and implementing an operational archive and user access capability. Data records will be produced from three main current and planned reanalysis projects and will be uploaded to a user accessible web portal as they are completed.

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Model to observational inter-comparison capability with several data types and formats, e.g., netted, Grab, ASCII, BUFR (Cum Total #)	4	6	8	8	8	8

Description: This PM will prototype a user capability that permits the comparison of several model output forms, with in-situ observational data sets with the end goal of improving both the models, and the observations since each have their own strengths and weaknesses.

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
On-line public and private access to climate model diagnostics capabilities and NCMP data, scientifically vetted partner-coordinated climate model diagnostics tools(i.e., CDAT, NOMADS) (Cum Total Number)	2	3	3	4	6	7

Description: Specialized climate model analysis and diagnostic tools have already been developed within the climate and weather modeling communities that permit advanced statistical and dynamical analysis, sampling, interpolation or extrapolation to find error in models. This goal will advance these existing tools based on advanced models and user preferences, and in collaboration across Agencies and the user community, implement several of these requested tools within the NCMP.

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
NOMADS / NCMP/CLASS long term archive and access capabilities (Cum Total TBs Data Accessible)	-	600	2,000	2,500	4,500	6,500
Description: The goal is to develop NCMP front-end applications that permit access to the CLASS deep archive, both on disk, and on tape.						

Climate Data & Information

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Safe Storage (NCDC Primary and Security archive), climate data from NOAA/other observing systems consistent with NARA standards. (Cum Total PBs)	18.7	33.3	71.3	156.3	288.3	480.9
This measure reflects the amount of data safely stored by NCDC that is derived from NOAA observing systems.						

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
State of the Climate Annual Report 42 Essential Climate Variables (ECVs) (% & Cum # ECVs fully assessed)	67% 28 of 42	74% 30 of 42	81% 34 of 42	90% 38 of 42	100% 42	-
Track the increase in the number of essential climate variables that have a quantitative analysis and assessment of long-term trends and variations in climate performed and published in future annual issues of the Annual State of the Climate Report. The target of 100% is 42 essential climate variables that have a quantitative analysis performed. With adequate observing systems in place under the stewardship of NOAA, a comprehensive and quantitative analysis of atmospheric, ocean, and select terrestrial variables considered essential can be performed.						

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Reduce the number of errors getting into the archived record by early detection of network performance issues. (Cumulative % reduction/year for a given network)	40%	55%	60%	65%	80%	90%
Measures an indicator of the quality of the data by tracking the reduction in the number of errors that are eliminated from the archived record. Reflects efforts to improve processes in data collection and archiving.						

Climate Prediction Center

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
U.S. Temperature Forecasts (Cumulative Skill Score computed over the regions where predictions are made), Measure 16a	21	21	22	23	24	25

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Program Changes for FY 2012:

Ocean Observations: Arctic Watch (Base Funding: 2 FTE and $3,295,000; +1 FTE and +$3,000,000): NOAA requests an increase of 1 FTE and $3,000,000 for a total of 3 FTE and $6,295,000 to make progress toward completing and sustaining Arctic observations as part of the U.S. contribution to the International Arctic Observing Network and the associated Global Ocean Observing System (GOOS). GOOS focuses on the deep marine environment and works with the Integrated Ocean Observing System, which is focused on coastal waters.

Proposed Actions

An expanded, more robust, integrated and coordinated NOAA Arctic program is necessary for addressing immediate and near-term impacts of climate change and supporting NOAA's response capabilities to stakeholders, particularly those in Alaska and the Pan-Arctic region, but also throughout the Nation.

- Enhanced Alaskan and Arctic observations – Establish with international partners an Arctic Observing Network that integrates observations from new and existing atmospheric, coastal, and oceanographic observatories; ocean moorings; ice buoys and stations; and ship transects. These actions will complement other NOAA observations in the region, such as the Carbon Observations and Analysis System and the Climate Reference Network. The additional observations also will feed directly into other NOAA activities, including:
- Modeling and Analysis – Improve and increase representation of Arctic climate processes in global climate models, regional physical-ecological models, and Arctic System Reanalysis and explore development of a predictive capability for Arctic sea ice.
- Provide Alaska/Arctic regional climate and decision-making information and services, user-focused research assessments and projection tools for planners, including data management activities and support for the Alaska RISA.

A coordinated and comprehensive approach, Arctic Watch, will produce the information and applications driven research outputs, such as nowcasts and forecasts tailored to Arctic stakeholder needs, and projections for planning and policy. Many of the necessary components for a NOAA-led Arctic Watch already exist in varying stages of development and execution. However, a greater investment in regional observations and data management are critical for allowing NOAA to serve as a key provider of reliable information, enforce its regulatory responsibilities, and enable effective decision-making across a range of issues affecting or affected by the Arctic. This increase will expand the Nation's Arctic observing capacity and produce data that will allow existing NOAA programs to improve modeling, analysis, and assessment products. The NOAA Climate Program Office will lead this effort and will utilize the capabilities of the NOAA Joint and Cooperative Institutes, such as The Cooperative Institute for Research in Environmental Sciences (CIRES) and the Cooperative Institute for Alaska Research (CIFAR). Other institutions will also play a role, receiving grant support through the Climate Program Office. Due to the complexities of the international collaboration necessary for this program, one new Federal employee position is requested.

Statement of Need and Economic Benefits

The Arctic region is currently undergoing profound atmospheric, terrestrial and oceanic changes related to climate variation and change. In many cases, observed changes far exceed the current model projections. These changes impact human health, infrastructure, fisheries,

ecosystems, coastal communities, international maritime activity, and regional to mid-latitude climate shifts. Diminishing sea ice cover contributes to significant changes in weather patterns both within and surrounding the Arctic, modifies ecosystems, opens new shipping channels, and provides access to previously unobtainable natural resources. Additionally, the current U.S. energy crisis has increased interest in the Arctic region as a source for oil and natural gas exploration/extraction and as part of a national energy policy.

The state of Alaska, academia, Federal agencies with Arctic responsibilities, industry, international partners, and other users have expressed concern that current available climate observations and data are not at the spatial scale necessary for guiding Arctic management decisions. The NOAA Alaska Regional Collaboration Team has completed a comprehensive Integrated Services Plan that identifies current and future capabilities that NOAA must provide in support of Alaskans and regional customers, which includes climate observations, monitoring, and applied research to support economic development and allows for informed adaptation and planning efforts. More broadly, the National Academy of Sciences has called for establishment of an internationally coordinated Arctic Observing Network. NOAA, with the National Science Foundation, co-leads the U.S. effort to fulfill this need.

At a national level, increased understanding of critical environmental thresholds, such as the dramatic reduction in sea ice cover, warming ocean/coastal temperatures, glacial melt/fresh water intrusions, potential release of carbon and methane associated with permafrost thaw, and sea level rise are essential for addressing our environmental, economic, and national security needs. Higher resolution regional models of climate change, sea ice loss and sea level rise are needed for guidance on climate change at scales important for planning, mitigating, and adapting. To achieve these results, it is necessary to better observe the basic physical state of the Arctic. Stakeholders struggle to utilize the information that does exist because there is currently is no cohesive, coordinated clearinghouse or service available. Arctic Watch would fill this niche by providing integrated, scientifically robust, unbiased, and authoritative Arctic climate information necessary for mitigation and adaptation efforts.

The combination of rapid change and increased interest in this region places significant pressure on NOAA to provide support services and information that are required to respond to increased climate change consequences and balance new and existing activities in this region. Additional resources are necessary as NOAA expands and integrates its Arctic observations and services to meet the needs of this rapidly changing environment.

Schedule & Milestones

Milestones/Deliverables	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Ice Buoys/Stations Reporting (Cumulative Total #) *Typically 2-yr life-cycle refresh.*	4	10	16	16	16	16
Sub-surface Moored Buoys deployed (Total #/yr) *Typically replace all each year.*	8 (NSF cost share)	8	10	16	16	16
Ship Transects (Total #/year) *Transects repeated each yr.*	1	2	3	3	3	3
Coastal Observatories Operational (Cum Total #**)**	2	2	3	3	3	3

Deliverables

By FY 2014, NOAA will contribute annually the following to the International Arctic Observing Network (IAON):

- 16 Ice Buoys (30% of US total planned contribution to IAON)
- 16 Moorings (40% of US total planned contribution to IAON)
- 3 Annual Ship Lines (25% of US total planned contribution to IAON)
- 3 International Coastal Observatories with our Canadian, Russian, and Norwegian partners (75% of US total planned contribution to IAON)

Performance Goals and Measurement Data

Performance Measure: Reduce percent error in seasonal forecast of Arctic sea ice loss and regrowth	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	50%	50%	50%	45%	40%	25%
Without Increase	50%	50%	50%	50%	50%	50%
Description: Percent reduction from the FY 2008 baseline in forecast error relative to observations. Current sea ice outlook is based on statistical evaluation of recent past years and is only generated for summer months. Proposed new observations will enable a transition starting in 2013 to model-based, probabilistic forecasts for all seasons based on initial state of sea ice, and real-time observations of ocean heat content, snow cover on ice, surface air temperature, atmospheric circulation patterns, and solar radiation. New experimental forecasts begin in 2014 with a goal of being at least as good as statistical outlooks, with significant improvement over time as experience is gained.						

PROGRAM CHANGE PERSONNAL DETAIL

Activity: Observations & Monitoring
Subactivity: Ocean Observations

Title:	Location	Grade	Number of Positions	Annual Salary	Total Salaries
Oceanographer/Physical	Silver Spring, MD	ZP-IV	1	89,033	89,033
Physical Scientist	Seattle, WA	ZP-IV	1	87,306	87,306
Total			2		176,339
less Lapse		25%	1		44,085
Total full-time permanent (FTE)			1		132,254
2011 Pay Adjustment (0%)					0
2012 Pay Adjustment (0%)					0
TOTAL					132,254

Personnel Data	Number
Full-Time Equivalent Employmen	
Full-time permanent	1
Other than full-time permanent	0
Total	1
Authorized Positions:	
Full-time permanent	2
Other than full-time permanent	0
Total	2

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Observations & Monitoring
Subactivity: Ocean Observations

	Object Class	2012 Increase
11	Personnel compensation	
11.1	Full-time permanent	$132
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	132
12	Civilian personnel benefits	40
13	Benefits for former personnel	0
21	Travel and transportation of persons	9
22	Transportation of things	5
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	0
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	250
31	Equipment	500
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	2,064
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	3,000

Ocean Observations: Global Ocean Observing System (Base Funding: 89 FTE and $62,563; +0 FTEs and +$1,384,000): NOAA requests an increase of 0 FTE and $1,384,000 for a total of 89 FTE and $63,947,000. This includes the $3,295,000 request for Arctic Watch, a component of GOOS. This will continue implementation of the Global Ocean Observing System (GOOS) with an emphasis on improving sea level rise monitoring and understanding. A sustained global observing system is the foundation of all climate research and services. In 2012 incremental advancements across two of the ocean networks will be accomplished, focusing on tracking sources of global sea level rise and storage of heat in the ocean. This will contribute to national preparedness, resilience, and early warning for coastal inundation due to sea level rise coupled with extreme events. This initiative also addresses opportunities identified in NOAA's report to the House of Representatives in 2009, *Implementing the Sustained Global Ocean Observing System for Climate*.

Proposed Actions

Specific enhancements to the global ocean observing system that will advance the FY 2012 priorities of monitoring global sea level rise and its drivers include:

- Tide Gauge Stations ($200 K): Five reference tide gauge stations will be equipped with GPS receivers and real-time reporting transmitters each year to provide measurement of absolute sea level rise and satellite ground truth, and to provide real-time monitoring for tsunami, El Niño, and storm surge events.
- Deep Argo Floats ($800 K): Development and deployment of deep Argo profilers capable of descending to 3000+ meters to measure changes in ocean heat resulting in the expansion of seawater and hence sea level rise.
- Dedicated Ship Time ($384 K): Sixteen days of ship support will be chartered to deploy deep Argo floats in remote ocean regions for measurement of the ocean's heat storage.

Statement of Need and Economic Benefits

Episodes of devastating coastal inundation over the last decade have emphasized the critical importance of fielding an ocean observing system that can continuously monitor for approaching marine hazards and provide early warnings to the coasts for hazard mitigation. Storm surge, El Niño, tsunamis, as well as gradual sea level rise, all originate in the deep ocean well beyond the coastal zone, where much of our observing capacity currently exists. Gradual sea level rise results from an increase in mass due to melting ice and thermal expansion from ocean heating, which causes an increase in the amount of sea water. Recent studies suggest that much of the ocean heat driving sea level rise may be stored in the deep ocean, beyond routine observation by current technology. Emerging technology, such as deep Argo floats, will be able to better track this heat exchange.

More broadly, the global ocean observing system must deliver continuous real-time measurements that will allow the modeling community to improve data assimilation and therefore improve the accuracy of climate model projections. It must also be capable of delivering quantitative ocean indicators at a few strategic reference locations that will alert the nation and the world if and when major changes are occurring.

Economists project that investment in observing system technology will be amplified by orders of magnitude in socio-economic advantage to the nation in planning for impacts and responses to climate change generally and sea level rise, in particular. The coupling of climate related sea level

change with the high water levels due to extreme events such as hurricanes bring billion-dollar socio-economic impacts and dramatic shifts in our coastal marine ecosystems. Over half of the U.S. population resides in a coastal county, and three quarters of the American economy is generated in coastal states. Sea level rise threatens the stability of our coastal communities, economies, and ecosystems. Improving our understanding of and ability to predict sea level rise will allow for improved planning, informed investments, and the development of targeted risk reduction strategies. Further, US contributions to the global system have been historically more than matched by the contributions of international partners.

Schedule & Milestones

SCHEDULE / MILESTONES	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Installation of permanent GPS receivers at climate reference tide gauge stations		X	X	X	X	X
Development of deep diving Argo floats		X	X	X		
Deployment of deep diving Argo floats					X	X
Ship time (Days at Sea)		X	X	X	X	X

Deliverables

Deliverables	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Tide Gauge Reference Stations w/GPS installed (Cum Total #)	105	110	115	120	125	130
Deep Argo deep floats deployed (Cum Total #)	0	0	0	0	10	20
Dedicated ship support (Cum days at sea/year)	492	508	524	540	556	572

Deliverables

Ocean analysis deliverables to be developed and disseminated include observationally-based and model-based products. Observationally-based products (e.g., global maps of observed ocean heat content, salinity, sea level, currents, etc.) will aid in evaluating and improving ocean and climate models, with a view towards providing improved predictions of climate change (e.g., improved predictions of sea level rise). In addition, model-based products (e.g. ocean state estimated from assimilation of ocean data into ocean models) will be queried to produce targeted products on an “as needed” basis in response to emerging climate priorities. Additionally, the supporting data analysis and delivery infrastructure will be enhanced to facilitate extracting the maximum information from observational data.

Performance Measure: Increase percentage of global ocean volume measured for temperature, allowing reductions in uncertainty of ocean warming, which accounts for much of sea level rise.	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
With Increase	48%	48%	48%	49%	50%	51%
Without Increase	48%	48%	48%	48%	48%	48%

Description: This new outcome-based performance measure is under development as a GPRA for FY13 and will provide a quantifiable metric for evaluating the ocean observing system's ability to deliver fundamental climate information, specifically, global measurements of the ocean temperatures that are vital to evaluating sea level rise and the earth's uptake of heat. This measure is connected to the societal benefit of understanding a key contribution (the thermosteric component) to sea level change and documents our ability to measure the dominant heat sink of the planet. Enhanced development of deep ocean instrumentation and implementation of the GOOS, including deep Argo floats and GPS-equipped tide gauge stations, from this increase will enable the delivery of a more robust measure of sea level change.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Observations & Monitoring
Subactivity: Ocean Observations

	Object Class	2012 Increase
11	Personnel compensation	
11.1	Full-time permanent	$0
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	0
12	Civilian personnel benefits	0
13	Benefits for former personnel	0
21	Travel and transportation of persons	32
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	650
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	0
31	Equipment	702
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	0
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	1,384

Climate Data and Information Services: Data Center Operations (Base Funding 0 FTE and $1,500,000; +2 FTE and +$2,000,000): NOAA requests an increase of 2 FTE and $2,000,000 for a total of 2 FTE and $3,500,000 for Data Center Operations to provide NOAA the operational capability to close the gap in long-term safe storage of and access to the Nation's environmental data and information.

Proposed Actions

This request will provide NOAA the operational capability to allow users to search for and acquire the increased amount of archived data. This operational component will address the anticipated increase in data volume of greater than 3,000% over the next several years and ensure environmental observations remain useful and accessible to the widest range of current and future users. It will ensure that environmental observations collected at great expense remain useful and understandable to the widest range of current and future generations. Users will be able to search for and acquire archived data by seamlessly connecting CLASS ingest, storage, and access capabilities with the NOAA Data Center archive management system. This increase also meets emerging requirements associated with implementing NOAA's climate services that include the long-term preservation of the Nation's climate record.

Funding will be used for: two FTEs who will be responsible for coordinating the contractors' efforts, preparing the requirements needed for each major data set and ensuring the objectives are met; communications bandwidth that delivers these large data volumes from the source to the data centers for long term storage (archive and access), required upgrades to software (S/W) and hardware (H/W) to keep the system functional and compatible (integrated), and operators at the data centers for the system S/W and H/W.

Statement of Need and Economic Benefits

A 3,000% increase in data volume, generated from NOAA's investment in observations such as NPPOES Preporatory Project and the Joint Polar Satellite System (formerly NPOESS), requires additional support for operational capabilities to archive and access data. This increase will enable users to search for and acquire the increased amount of archived data by seamlessly connecting the CLASS IT infrastructure capabilities with the Data Center archive management system.

This funding will allow for sustaining the data archiving capability once the increased data comes on line. Operational costs continue to grow as data volumes increase, such as the projected 3,000% increase in data volume in FY 2011 and projected increases in the climate model outputs. This will be followed by an additional projected 3,000% increase in data volume due to the availability of Joint Polar Satellite System data. To fill the gap in NOAA's archive capability and capacity, NOAA will incrementally develop and then transition reliable storage components from CLASS to the NOAA Data Centers. This capability will seamlessly link the CLASS enterprise with the National Climatic Data Center, National Geophysical Data Center, and the National Oceanographic Data Center archive and access management systems.

Schedule & Milestones

	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Introduce CLASS **Capability** at Data Centers		X	X	X	X	X
Expand/Operate & Maintain CLASS **Capacity**		X	X	X	X	X
Major Data Generating Programs						
NPOESS Preparatory Program (NPP) – 3,000% increase in data volume		X	X	X	X	X
Joint Polar Satellite System– additional 3,000% increase in data					X	X
GOES-R					X	X
NOAA NEXRAD (operational and enhanced – FY 12 Dual Polarized/Phased Array)			X	X	X	X
JASON-2 and-3	X	X	X	X	X	X
NOAA POES/DOD DMSP (operational: historical and new data)	X	X	X	X	X	X
NOAA GOES (operational: historical and new data)	X	X	X	X	X	X
EUMETSAT MetOp (operational: historical and new data)	X	X	X	X	X	X
NCEP Models/Reanalysis Products (operational: historical and new data)		X	X	X	X	X

Deliverables

FY 2012: CLASS Operational **Capability** – CLASS system components integrated into Data Centers' archival/access management systems.
FY 2013-2016+: CLASS Operational **Capacity** – Expand CLASS safe storage/access capacity to meet introduction of NOAA observational investments and sustain operations and maintenance of CLASS operational components at the Data Centers.

Establishing initial operational capabilities (IOC) at Data Centers – hardware (storage/access), software (OS, processing, and metadata), IT security, communications, and training, and introducing future development components, upgrades, as well as expanded storage/access capacities as each major NOAA observational campaign is deployed.

Performance Goals and Measurement Data

Performance Measure: Ensure the long-term preservation and access to NOAA's environmental observations from new data streams with information on provenance, content, and quality, hence increasing the value and utility of the	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target

data to its maximum potential. (Cumulative total number of data streams)						
With Increase	N/A	1	2	3	5	9
Without Increase	0	0	0	0	0	0

PROGRAM CHANGE PERSONNAL DETAIL

Activity: Observations & Monitoring
Subactivity: Climate Data & Information Services

Title:	Location	Grade	Number of Positions	Annual Salary	Total Salaries
Physical Scientist	Silver Spring, MD	ZP-IV	1	89,033	89,033
Physical Scientist	Boulder, CO	ZP-IV	1	87,815	87,815
Physical Scientist	Asheville, NC	ZP-IV	1	81,823	81,823
Total			3		258,671
less Lapse		25%	1		64,668
Total full-time permanent (FTE)			2		194,003
2011 Pay Adjustment (0%)					0
2012 Pay Adjustment (0%)					0
TOTAL					194,003

Personnel Data	Number
Full-Time Equivalent Employment	
Full-time permanent	2
Other than full-time permanent	0
Total	2
Authorized Positions:	
Full-time permanent	3
Other than full-time permanent	0
Total	3

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Observations & Monitoring
Subactivity: Climate Data and Information Services

	Object Class	2012 Increase
11	Personnel compensation	
11.1	Full-time permanent	$194
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	194
12	Civilian personnel benefits	58
13	Benefits for former personnel	0
21	Travel and transportation of persons	105
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	318
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	396
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	654
31	Equipment	275
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	0
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	2,000

Climate Data and Information Services: Climate Data Records (Base Funding: 0 FTE and $10,000,000; +2 FTE and +$8,000,000): NOAA requests an increase of 2 FTE and $8,000,000 for a total of 2 FTE and $18,000,000 for Climate Data Records (CDRs) to transform raw satellite data into unified and coherent long-term environmental observations and products that are critical to climate modelers and decision makers concerned with advancing climate change understanding, prediction, mitigation and adaptation strategies, policies, and science.

Proposed Actions

This change funds 2 critical activities needed to support the Nation's climate science and services:

1. POES & GOES Multi-satellite CDRs - Builds multi-decadal, historical climate information records required by scientists to detect, assess, model and predict climate change, and by decision-makers to devise effective strategies to respond, adapt, and mitigate the impacts of climate change.

2. JPSS Climate Raw Data Records (C-RDRs) – Assures quality and repackages raw JPSS data for climate re-use (e.g., ocean color and temperature, clouds, sea ice, aerosols, ozone) to ensure NOAA archives capture and disseminate credible information to support private/public decision-makers and scientists.

Major CDR development and production actions include:

- Algorithm Development, Processing and Re-Processing of POES/GOES/NPP/JPSS/Jason-series Data
- Calibration, Validation and Characterization of Data
- Science and Climate Information Records
- Long-term Stewardship (ensure CDRs are easily understood, accessible and of highest quality possible)
- Applications for Climate Change Mitigation and Adaptation, and
- Project Management Support

The Program is primarily executed through competitive grants, NOAA Cooperative Institutes, and contracts. Competitive grants are utilized to capture the best community algorithms and adapt them for all past/future data sets. NOAA Cooperative Institutes are used to provide scientific research expertise in support of CDR development. Contracts are utilized for product processing and maintenance. The budget request includes essential IT infrastructure and labor costs for two FTE in FY 2012 The Program leverages prior U.S. investments by transitioning research products from NASA and other agencies into sustained NOAA operations.

Statement of Need and Economic Benefits

The CDR Program addresses NOAA's Strategic Goal to "Understand climate variability and change," and the NOAA Climate Goal's mandate to "provide comprehensive observations, data and analysis systems, climate data records …which can address the current state of the climate at the accuracies and resolution required by the users; [and] to provide capability to assimilate large and complex data sets into Earth systems models..."

CDRs are distinct from operational weather/hazard satellite products since CDR production:

- Removes/minimizes time dependent errors and biases in satellite data

- Delivers long term, seamless, homogeneous records (50+ years) characterizing climate change/variation
- Reprocesses the entire period of record as new climate algorithms or sensor knowledge is developed

NOAA's CDR processing capability enhances satellite data to have significant use and value for climate studies because they provide the long-term data series needed to study climate variability. The US GEO/GEOSS, USGCRP/CCSP (2003), WMO/GCOS (2003), and National Academy of Sciences (2004; 2006) have called for a sustained CDR program. The IPCC's 4th Assessment Report (2007) underscores the urgent need for these data. Key NOAA constituents, including national defense entities and major private sector industries such as insurance, agriculture, energy and transportation have increasingly called for authoritative climate reference data upon which to base investments and strategic plans (e.g., NOAA Data and Information for a Changing Climate: A Conference for Public and Private Sector Users, Asheville, 2007).

NOAA's CDR Program is initially focused on critical CDRs that address key societal issues including:

- Water, drought, floods
- Energy, renewable energy
- Hurricanes, coastal hazards

Improved knowledge in these areas translates into lives and property protected or saved.

Deliverables

Execution requires incremental CDR starts over a long period due to the large work volume. Major annual milestones are:

FY 2010: 3 CDRs produced operationally and 7 CDRs in development

FY 2011: 8 CDRs produced operationally and 8 CDRs in development

FY 2012: 14 CDRs produced operationally, 4 CDRs in development, start transitioning to NPP satellite

FY 2013: 18 CDRs produced operationally, and continue transitioning to NPP satellite input

FY 2014: 20 CDRs produced operationally, and start transitioning to Joint Polar Satellite System satellite and GCOM-W inputs

FY 2015: 22 CDRs produced operationally and continue transitioning to Joint Polar Satellite System satellite, TSIS free-flyer and GCOM-W inputs

FY 2016: 24 CDRs produced operationally and begin transitioning to GOES-R satellite input

Performance Goals and Measurement Data

Performance Measure: # of CDRs transitioned to NOAA Operations (Cumulative)	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
With Increase	8	14	18	20	22	24
Without Increase	8	11	13	13	13	13
Description: The increase will continue transforming raw satellite data into unified and coherent long-term environmental observations and products that are critical to climate modelers and decisions makers concerned with advancing climate change understanding, prediction, mitigation and adaptation strategies, policies, and science.						

PROGRAM CHANGE PERSONNAL DETAIL

Activity: Observations & Monitoring
Subactivity: Climate Data & Information Services

Title:	Location	Grade	Number of Positions	Annual Salary	Total Salaries
IT Specialist	Asheville, NC	ZP-III	1	57,408	57,408
Physical Scientist	Asheville, NC	ZP-IV	1	81,823	81,823
Management & Program	Asheville, NC	ZP-IV	1	81,823	81,823
Total			3		221,054
less Lapse		25%	1		55,264
Total full-time permanent (FTI			2		165,791
2011 Pay Adjustment (0%)					0
2012 Pay Adjustment (0%)					0
TOTAL					165,791

Personnel Data	Number
Full-Time Equivalent Employr	
Full-time permanent	2
Other than full-time permanent	0
Total	2
Authorized Positions:	
Full-time permanent	3
Other than full-time permanent	0
Total	3

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Observations & Monitoring
Subactivity: Climate Data and Information Services

	Object Class	2012 Increase
11	Personnel compensation	
11.1	Full-time permanent	$166
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	166
12	Civilian personnel benefits	52
13	Benefits for former personnel	0
21	Travel and transportation of persons	31
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	544
24	Printing and reproduction	0
25.1	Advisory and assistance services	1,659
25.2	Other services	1,150
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	72
31	Equipment	365
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	3,961
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	8,000

Ocean Data and Information Services: Coastal Data Development (0 FTE and + $38,000):
NOAA requests an increase of 0 FTE and $38,000. This increase is requested to support existing program requirements within this subactivity that were not provided for in the Consolidated Appropriations Act, 2010. Specifically, NOAA requests funds to support increased utilization of coastal and oceanographic data using web-based search/access and geographic information system (GIS) techniques to improve the understanding, management and use of coastal areas.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Observations & Monitoring
Subactivity: Climate Data and Information Services

	Object Class	2012 Increase
11	Personnel compensation	
11.1	Full-time permanent	$0
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	0
12	Civilian personnel benefits	0
13	Benefits for former personnel	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	38
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	0
31	Equipment	0
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	0
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	38

Climate Data and Information Services: Climate Database Modernization Program (Base Program 10 FTE and $4,063,000; -0 FTE and -$17,116,000): NOAA requests a decrease of $17,116,000 and 0 FTE for a total of $4,063,000. In the Consolidated Appropriations Act, 2010, Congress provided additional funds for State specific projects in West Virginia, Kentucky, and Maryland to preserve, image and digitize historic climate records from paper, microfilm and other sources. With these additional funds NOAA accomplished the following: the printing and distributing of the NCDC serial climate publications, imaging and keying incoming records, hosting and maintaining online images, and rescued and preserved historic climate data essential to improving real-time monitoring and forecasting of environmental, solar, and geophysical events. This additional amount is not required in FY 2012 because the requested funding level is sufficient to continue to preserve and make available the highest priority data needed by the scientific and business communities.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Observations and Monitoring
Subactivity: Climate Database Modernization Program

	Object Class	2012 Decrease
11	Personnel compensation	
11.1	Full-time permanent	$0
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	0
12	Civilian personnel benefits	0
13	Benefits for former personnel	0
21	Travel and transportation of persons	0
22	Transportation of things	-14
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	-17,102
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	0
31	Equipment	0
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	0
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	-17,116

Congressionally Directed Projects (Base Funding: 0 FTE and $8,945,000; Program Change: -0 FTE and -$8,945,000): NOAA requests a decrease of $8,945,000 to terminate the funding level that would continue under an annualized FY 2011 continuing resolution associated with the Congressionally directed projects identified in the Conference Report that accompanied the Consolidated Appropriations Act. 2010.

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Observations and Monitoring
Subactivity: Climate Database Modernization Program

	Object Class	2012 Decrease
11	Personnel compensation	
11.1	Full-time permanent	$0
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	0
12	Civilian personnel benefits	0
13	Benefits for former personnel	0
21	Travel and transportation of persons	-51
22	Transportation of things	-2
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	-186
24	Printing and reproduction	0
25.1	Advisory and assistance services	-616
25.2	Other services	-1,516
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	-1,957
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	-210
31	Equipment	-800
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	-3,607
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	-8,945

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APPROPRIATION: PROCUREMENT, ACQUISITION, AND CONSTRUCTION

SUBACTIVITY: CLIMATE RESEARCH PROGRAMS

The objective of this subactivity is:

- To provide sustained capability of the NOAA Research and Development High Performance Computing System to advance climate science and accelerate the development of regional and sub-regional information products and services..

NOAA's Research &Development High Performance Computing System (R&D HPCS) provides computational resources to support advances in environmental modeling crucial for understanding some of the most critical climate issues of today. This investment includes the supercomputing systems, associated storage devices, advanced data communications, security, and necessary data center space. NOAA's R&D HPCS leverages world-class research staff and modeling capabilities now in place at NOAA to address important research problems in climate and weather research. NOAA's on-going model development is advancing the climate research program through NOAA computational research and collaboration with the inter-agency and academic climate research community. The American Recovery and Reinvestment Act funding enhanced NOAA's R&D HPCS, accelerating NOAA's capabilities to provide climate information to decision-makers at regional and state levels.

Deliverables/Outputs:

- Sustained high availability of the NOAA R&D High Performance Computing system
- Improved credibility of projections of changes of important climatic quantities, such as regional climate change and extreme events, to allow society to efficiently plan for and adapt to climate change.
- Major contributions of model data to the Program for Climate Model Diagnosis and Intercomparison, in support of national and international climate assessments.
- Capability to develop and provide decadal prototype forecasts and predictions made with high-resolution coupled climate model.

Performance Goals and Measurement Data

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Cumulative number of new decadal prototype forecasts and predictions made with high-resolution coupled climate models	1	2	3	4	5	6
Description: One of the goals of this activity is to develop new prototype forecasts and predictions on decade time-scales for climate changes and impacts such as sea level rise, Arctic climate impacts, and rapid climate change. These forecasts and predictions are dependent on the development of state-of-the-art climate models.						

Research Supercomputing	FY 2011 & Prior**	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	CTC	Total
Change from FY 2012 Base								
Total Request	274,402	10,379	TBD	TBD	TBD	TBD	TBD	TBD

Program Changes for FY 2012:

No program changes for this subactivity.

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APPROPRIATION: PROCUREMENT, ACQUISITION, AND CONSTRUCTION

SUBACTIVITY: CLIMATE OBSERVATIONS AND MONITORING

The objectives of this subactivitiy are:

- Improved confidence in the monitoring and detection of national and regional climate variation and change.
- Comprehensive documentation of the State of the Climate.
- Enable policy makers and resource managers to make informed policy and business decisions using integrated climate observations, information, products, and other services.
- Easy and convenient access by NOAA and its customers to new and historical national and global observations and climate data and information records that meet rigorous scientific standards for quality.

REGIONAL U.S. HISTORICAL CLIMATOLOGY NETWORK (RUSHCN)

The Regional U.S. Historical Climatology Network (RUSHCN) will sustain the Nation's climate record of surface atmospheric measurements essential to monitor and assess regional climate variation and change. The desired outcome is to reduce the uncertainty in the measurement of regional climate variation and change, and provide a more reliable, maintainable and expandable surface observing network to meet future needs. The modern, state of the art, RUSHCN will also provide expansion capability to allow the collection of other data in the future, such as soil temperature, soil moisture, relative humidity, and snow measurements. The National Weather Service (NWS) reviewed the current ~1,200 COOP Historical Climatology Network sites for the appropriateness for climate purposes and determined that only 70 of the 1,200 sites meet the Climate Observing Classification Scheme Criteria for rating a station's adequacy for monitoring climate.

Data from this network will contribute to programs across NOAA and is an integral contribution to the National Integrated Drought Information System (NIDIS) requirements. In addition, the network will contribute to U.S. Integrated Earth Observation System (IEOS) and the Global Earth Observation System of Systems (GEOSS) concept of operations by improving the design and integration of regional climate observation stations.

RUSHCN data will extend the historical U.S. Historical Climatology Network data record into the future preserving the Nation's long term climate record (extends back at least 80 years and more). At a time when quality climate data is becoming increasingly important for understanding climate variability and change, the continuity of the existing regional data set is threatened due to degraded siting, equipment obsolescence, data quality, and reporting vulnerabilities. Much of the USHCN, currently used for regional and local climate monitoring, relies on manual observations and reporting subjecting the Nation's climate record to error, reporting delays, and potential loss.

The NRC 1998 and 1999 reports, "Future of the NWS Cooperative Observer Network" and "Adequacy of Climate Observing Systems," along with national media reports underscore the need for a network of modern equipped stations to record and report an accurate regional climate signal. The Regional Climate Centers (RCCs) and state Climatologists have reported a significant increase in requests for Regional climate products. RUSHCN will provide the ability to scientifically measure, monitor, and assess regional climate change.

EOS ADVANCED POLAR DATA PROCESSING, DISTRIBUTION, AND ARCHIVING

NOAA is committed to preserve the NASA Earth Observing System (EOS) data per NOAA's long-term management agreement with NASA. The Earth Observing System (EOS) & Advanced Polar Data Processing, Distribution and Archiving System support is directed toward the NOAA CLASS Development project. It takes the NASA EOS data requirements for archive and access and provides funding to ensure the CLASS Development team designs and engineers the appropriate capabilities and capacities into the CLASS Operating System. The EOS Advanced Polar Data Processing, Distribution and Archiving System data requirements for archive and access funding is used by the CLASS Development team to ensure the appropriate design and engineering capabilities and capacities are incorporated into the CLASS Operating System. NOAA is currently responsible for the stewardship of over three petabytes of environmental data and information, which is expected to grow to well over 14 PBs in FY 2012. NOAA spends more than one billion dollars each year collecting environmental data in support of its mission. NOAA is scheduled to launch the NPOESS Preparatory Project (NPP) satellite in FY 2011 followed by the first launch of Joint Polar Satellite System satellite scheduled in FY 2016. The environmental data generated will be a 100-fold increase in data volume per satellite. NOAA will use the funds to procure additional media storage hardware and telecommunications to safely store and provide access to NASA EOS data.

DATA CENTER MODERNIZATION

This activity is associated with the Information Technology Facilities and Infrastructure Refresh activities at the three NOAA Data Centers. This support is critical to keep the NOAA Data Centers' access and customer services management IT infrastructure compatible with the CLASS Operations System that has been integrated into the data centers' infrastructure and operations.

COMPREHENSIVE LARGE ARRAY DATA STEWARDSHIP SYSTEM (CLASS) – DEVELOPMENT

CLASS is the NOAA Enterprise System IT capability for the Data Centers, acting as a web-based data storage and distribution system for NOAA's environmental data. It is currently utilized by the CS Data Centers for the distribution of operational environmental satellite data from NOAA's Geostationary and Polar (GOES and POES) operational satellites and derived data products. CLASS is under development to support additional satellite data streams, such as GOES-R, NPP, and JPSS. In addition, NEXRAD and modeled data are planned for inclusion in CLASS and the system is being evolved to provide a configurable set of tools for data ingest to allow rapid response to new requirements, additional tools for data management and stewardship by data center experts, and generalized access interfaces to allow tailored tools for data access. In the near term, efforts will focus upon operations and maintenance of CLASS components that have transitioned from development to operational status. Longer-term plans for CLASS include expanding the safe storage/access capacity to meet the data influx expected from the operational introduction of data from radar, models, and new satellites. The current CLASS configuration can provide services for approximately four PBs of data, so significant hardware investments will be necessary in the coming years to accommodate the increase in observational data and model outputs. Management of these data can be accomplished only through rapidly expanding storage capacity at the Data Centers and automating the means of data ingest, quality control, and access through phased systems procurement. The early implementation of this archive and access system has paved the way to accommodate additional massive data volumes from the Earth Observing System Satellites.

Data Center Modernization
Deliverables

- Sustained operations and maintenance of Data Center IT infrastructure systems to ensure compatibility with CLASS operational components at the Data Centers including: operating systems, processing, metadata systems, customer services systems (web access, browse, retrieval data), information technology security, communications, and training. Introduction of future IT infrastructure components and upgrades.
- Improved/ensure user access to the current and future generations of NOAA data and information.

CLASS Development
Deliverables

- Safe Storage and Access Capability/Capacities "just in time" ready to meet phased-in introduction of new major observing systems (Satellites, Radars, Model Data, Other)
- Long-term, safe storage that meets the NOAA Data Centers' legislative requirements.

Performance Goals and Measurement Data

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Number of regions with all RUSHCN stations installed. (Cumulative Total Regions out of 9)	1 of 9	1 of 9	1 of 9	2 of 9	2 of 9	2 of 9
Description: The performance measure indicates the improved ability to detect regional trends in annual precipitation as small as (10%/century) and annual average surface air temperature as small as (0.5 degrees C/century) with 90% or greater confidence. (Cumulative Total Regions out of 9). RUSCHN represents the second phase of a U.S. climate observing modernization program that expands the Nation's capability to provide accurate and reliable U. S. regional climate monitoring. This program ensures improved confidence in U. S. regional climate trend analysis of temperature and precipitation, while also contributing to global climate monitoring and weather forecasting.						

Performance Measure:	FY 2011 Target	FY 2012 Target	FY 2013 Target	FY 2014 Target	FY 2015 Target	FY 2016 Target
Measure 1: CLASS Development System components integrated into the Data Centers' operational architecture (CLASS Operations System) ready to support NEW Satellite Launches/RADAR DP and PH Upgrades, Model Data, etc. (Cum # systems CLASS Ops System ready to support)	7 NPP	7	7	8 JPSS	9 GOES-R	9+
Measure 2: Annual Increase - New Data/Year (TB/FY)*	5,458	5,978	6,237	6,437	8,067	9,859
Measure 3: Cumulative Total Data (Terabytes - TB)*	8,839	14,816	21,053	27,490	35,557	45,416

Description: Measure 1 measures the cumulative number of systems ready to be supported by the CLASS Ops System. Measure 2 measures the annual increase of new data measured in terabytes per year. Measure 3 measures the cumulative total data measured in terabytes.

* Safe Storage and Access Capability and Capacity (Volumes are only for One Copy/One Site) Mapped against Aug 09 Satellite "Fly Out" Plan, Radar Upgrades, Model Data, Other Data

Data Center Modernization	FY 2011 & Prior**	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	CTC	Total
Change from FY 2012 Base								
Total Request	17,076	2,846	TBD	TBD	TBD	TBD	TBD	TBD

EOS & Advanced Polar Data Processing, Distribution, & Archiving Systems (PAC)	FY 2011 & Prior**	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	CTC	Total
Change from FY 2012 Base								
Total Request	13,342	990	TBD	TBD	TBD	TBD	TBD	TBD

Program Changes for FY 2012:

Regional Historical Climatology Network Modernization (Base Funding: 0 FTE and $3,734,000; Program Change: 0 FTE and -$34,000): NOAA requests a decrease of -$34,000 and 0 FTE from the FY 2012 base funding level for the Regional U.S. Historical Climatology Network (RUSHCN) Modernization project. The RUSHCN base funding supports NOAA's ability to know with confidence how climate is changing regionally in the US. NOAA has found internal contract and equipment efficiencies to offset this decrease.

Performance Goals and Measurement Data

Performance Measure: Number of regions with all RUSHCN stations installed. (Cumulative Total Regions out of 9)	**FY 2011 Target**	**FY 2012 Target**	**FY 2013 Target**	**FY 2014 Target**	**FY 2015 Target**	**FY 2016 Target**
Without Decrease:	1 of 9	1 of 9	1 of 9	2 of 9	2 of 9	2 of 9
With Decrease:	1 of 9	1 of 9	1 of 9	2 of 9	2 of 9	2 of 9

Description: The performance measure indicates the improved ability to detect regional trends in annual precipitation as small as (10%/century) and annual average surface air temperature as small as (0.5 degrees C/century) with 90% or greater confidence. (Cumulative Total Regions out of 9). RUSCHN represents the second phase of a U.S. climate observing modernization program that expands the Nation's capability to provide accurate and reliable U. S. regional climate monitoring. This program ensures improved confidence in U. S. regional climate trend analysis of temperature and precipitation, while also contributing to global climate monitoring and weather forecasting.

RUSHCN	**FY 2011 & Prior****	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**CTC**	**Total**
Change from FY 2012 Base		(34)						
Total Request	23,927	3,700	TBD	TBD	TBD	TBD	TBD	TBD

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Observations and Monitoring
Subactivity: Historical Climatology Network Modernization

	Object Class	2012 Decrease
11	Personnel compensation	
11.1	Full-time permanent	$0
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	0
12	Civilian personnel benefits	0
13	Benefits for former personnel	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	0
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	0
31	Equipment	-34
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	0
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	-34

Comprehensive Large Array Data Stewardship System (Base Program 0 FTE and $6,476,000; -0 FTE and - $12,000,000): NOAA requests a decrease of $12,000,000 and 0 FTE, for a total of $6,476,000 and 0 FTE, for CLASS development. In the Consolidated Appropriations Act, 2010, Congress provided $18,476,000 for the CLASS system including $5,500,000 for system maintenance and operations, and $12,976,000 for contracted development activities. With these funds NOAA supported the first major release of next-generation CLASS software. It allowed NOAA to implement a capability to integrated climate model data into CLASS, and supported software and hardware development, testing and transition of components from development to operations. NOAA proposes to reduce the level of contracted activity in FY 2012. Additional funding is not required because requested FY 2012 funding is sufficient for safe storage and access capability/capacities ready to meet phased-in introduction of new major observing systems (satellites, radars, model data, and others) and long-term, safe storage needs.

CLASS	FY 2011 & Prior**	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	CTC	Total
Change from FY 2012 Base		(12,000)						
Total Request	81,295	6,476	TBD	TBD	TBD	TBD	TBD	TBD

PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollar amounts in thousands)

Activity: Observations and Monitoring
Subactivity: CLASS

	Object Class	2012 Decrease
11	Personnel compensation	
11.1	Full-time permanent	$0
11.3	Other than full-time permanent	0
11.5	Other personnel compensation	0
11.8	Special personnel services payments	0
11.9	Total personnel compensation	0
12	Civilian personnel benefits	0
13	Benefits for former personnel	0
21	Travel and transportation of persons	0
22	Transportation of things	0
23.1	Rental payments to GSA	0
23.2	Rental Payments to others	0
23.3	Communications, utilities and miscellaneous charges	0
24	Printing and reproduction	0
25.1	Advisory and assistance services	0
25.2	Other services	-11,930
25.3	Purchases of goods & services from Gov't accounts	0
25.4	Operation and maintenance of facilities	0
25.5	Research and development contracts	0
25.6	Medical care	0
25.7	Operation and maintenance of equipment	0
25.8	Subsistence and support of persons	0
26	Supplies and materials	-70
31	Equipment	0
32	Lands and structures	0
33	Investments and loans	0
41	Grants, subsidies and contributions	0
42	Insurance claims and indemnities	0
43	Interest and dividends	0
44	Refunds	0
99	Total obligations	-12,000