

National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service
NOAA National Data Centers (NNDC)
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Operational Analysis
FY 2010

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Executive Summary

This Operations Analysis (OA) for the NNDC Exhibit 300 focuses on the operational state of the umbrella program as of September 30, 2010. It is a review of the data centers' information technology infrastructure, Customer Results, Strategic and Business Results, Financial Performance, and Innovation. The programs directly facilitate the NOAA Strategic Goals, Climate, Weather & Water, Ecosystems and Commerce and Transportation. The current steady state programs meet established cost, schedule, and performance parameters. Future analysis will be conducted by each individual office beginning with fiscal year 2011.

The NOAA National Data Centers (NNDC) directly support the NOAA strategic goals of Climate, Support, Weather & Water, Ecosystems, Commerce and Transportation

NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) are responsible for establishing and administering funding for the NOAA National Data Centers (NNDC). The NNDC consists of four data centers: the National Climatic Data Center (NCDC) located in Asheville, North Carolina; the National Geophysical Data Center (NGDC) located in Boulder, Colorado; the National Oceanographic Data Center (NODC) located in Silver Spring, Maryland; and the National Coastal Data Development Center (NCDDC) at Stennis Space Center, Mississippi, which is administered by NODC. The NNDC is an umbrella Exhibit 300 and includes three programs in addition to data center support activities: the NOAA Virtual Data System (NVDS) is jointly supported by NCDC, NGDC, and NODC; the Climate Database Modernization Program (CDMP) is managed by NCDC. FY10 will be the final year for the NNDC. Beginning in October 2010 each data center will maintain their own individual exhibit 300 and will report accordingly.

NOAA has statutory responsibility for long-term archive and management of the nation's collection of environmental data, and it is through the NNDC that this responsibility is managed. The economic contributions of the NNDC to the Nation are significant and details can be found at the following site <http://www.economics.noaa.gov/>.

FY10 notable achievements include:

- The NOAA data centers distributed large volumes of environmental data to its customers increasing from just over 900 terabytes in FY09 to more than 1400 terabytes in FY10. Over 2.5 petabytes of data are now accessible online from the NNDCs. Demand for data and products are high due to the environmental issues facing the world and media interest in these issues.
- NODC has undergone reaccreditation of C&A in FY10. A number of documents were generated or updated including: Business Impact Analysis; Business Continuity Plan; FIPS 199, Standards for Security Categorization of Federal Information and Information Systems; FIPS 200, Minimum Security Requirements for Federal Information and Information Systems; E-Authentication, Threshold Analysis; Privacy Threshold Analysis; Risk Assessment; and Security Assessment Review. In addition, complete vulnerability and

security control testing was conducted by independent auditors. NODC did complete the re-certification process for its computer and “Approval to Operate” (ATO) was granted on 7 September 2010.

- In FY10, NODC Sets Up New Powerful Windows Terminal Server to allow more NODC staff the option of a remotely accessible Windows PC in the NODC internal network.
- NODC/NCDDC EcoWatch’s integration with NOAA’s Environmental Research Division Data Access Program (ERDDAP) was extended to include distributed searches. Users can search geospatially and with respect to time from one EcoWatch interface and retrieve data sets from many sources. ERDDAP’s linkage to NOAA’s Unified Access Framework (UAF) allows EcoWatch search and directly access data from across NOAA. Both EcoWatch and ERDDAP’s use of web services makes attributes of both technologies highly compatible.
- NODC/NCDDC produced and expanded the NOAA Extreme Weather Information Sheet (NEWIS) for the 2010 Atlantic hurricane season. Laminated and waterproof, NEWIS provides coastal residents with a “one stop” ready reference containing important contact phone numbers and internet web sites for emergency information in the state and local area. New for 2010; Georgia, South Carolina, and North Carolina NEWIS; Florida NEWIS revised to cover the entire state.
- NODC/NCDDC integrated the World Ocean Database for several Google Map applications. Contoured values of monthly mean water temperatures at various depths are accessible from the Flower Garden Bank Google Map. In addition to the contours, vertical profiles are generated on-the-fly from user-specified locations.
- NODC/NCDDC expanded the EcoWatch portal to integrate both WOD data and Gulf of Mexico fisheries-independent data (SEAMAP) for the first time and provides access on-line.
- DEEPWATER HORIZON support in FY 10 included; Support to the National Marine Fisheries Service – Southeast Regional Office with morning review maps of oil spill trajectory information with trajectory initialization information and satellite analysis; Provided support to the interagency Joint Analysis Group (JAG) which included maps concerning fluorescence and dissolved oxygen analysis as well as scatter plots of this information. In addition worked on making a web mapping service (WMS) available for use within the NOS Environmental Response Management Application (ERMA).
- NODC/NCDDC designed, developed, deployed, and executed a technical solution that resulted in the automatic generation of FGDC compliant metadata for all of the primary sensors on the //Okeanos Explorer/ during the Bi-National Cruise in Indonesia (INDEX-1). Initialization of the developmental NOAA National Operational Model
- Archive and Distribution System (NOMADS). OceanNOMADS is a NOMADS node dedicated to ocean-model data, with a focus on operational ocean models from NOAA and the U.S. Navy. This data is provided via the Thematic Real-Time Environmental Data Distribution Services (THREDDS) a version of OPenDAP that supports interoperability with the collection service HDF 5-based architecture. A THREDDS server is deployed at the Northern Gulf Institute with an initial catalog to include Navy’s Global NCOM and Intra Americas Seas models (from NAVOCEANO and Naval Research Lab, respectively), and NOAA’s Real-Time Ocean Forecast System (RTOFS) http://edac-dap2.northerngulfinstitute.org/ocean_nomads/
- NGDC completed IT Security C&A (Certification and Accreditation) on January 22, 2010, and was granted full authority to operate for the next three years.

- NGDC released the World Magnetic Model for 2010-2015. The WMM2010 incorporates the latest magnetic information from satellite and ground observatories to provide a high-quality model of the Earth's magnetic field for use in both military and civilian navigation systems.
- NGDC's Earth Observations Group has completed development of a technique for mapping populations that have no access (or limited access) to electric power. Using nighttime lights and a population grid from DOE, NGDC produced the first global map of population density in areas that lack electric power.
- NGDC released a new web services interface to its Solar Physics Interactive Data Repository (SPIDR) that provides end users simplified access to high quality space physics data.
- NGDC Developed 8 new Tsunami Inundation Digital Elevation Models (DEMs). The DEMs and other tsunami data archived by NGDC provide information essential for coastal hazard assessment and research related to past hazardous events for monitoring and mitigating the socio-economic impact of coastal hazards.
- NGDC provided coastal models to support DEEPWATER HORIZON Response and Recovery.
NGDC built and distributed 10-meter resolution, digital elevation models (DEMs) covering the U.S. Coastal area around New Orleans, LA; Biloxi, MS; and Mobile Bay, AL. These DEMs will also be used to evaluate the utility of NOAA's vertical datum transformation tool, VDatum.
- NGDC hosts Solar Xray Imager (SXI) Radiation Dose Software Tool. This tool will utilize NGDC's archived image data to generate an estimate of accumulated radiation dose level for the SXI instrument. NASA and NOAA Instrument scientist will use this tool to monitor dose levels to prevent further damage to the imager.
- NGDC is now archiving and providing GOES 13 and 14 space environment sensor data to the public. This data, provided by the Space Weather Prediction Center, is used to forecast and predict geomagnetic storms and solar xray events.
- New CDMP tasks were also initiated for the NODC Metadata Task, the NGDC Multi-Lens Film Scanning, and the National Marine Fisheries Service Northeast Fisheries Project
- The Cooperative Institute for Climate and Satellites-North Carolina (CICS-NC) was formed in FY2009. The primary focus of the institute will be a collaborative research into the use of satellite observations in climate research and applications
- NCDC released the International Best Track Archive for Climate Stewardship (IBTrACS) global tropical cyclone dataset Version 2 of the dataset was in July 2009
- NCDC has assembled over 20 years of remotely sensed data from multiple satellite-based instruments from national and international partners
- NCDC released version 2 of the bias-adjusted temperature data from the U.S. Historical Climatology Network.
- NCDC was a key participant in the NOAA Climate Services Portal effort in FY2010, and is hosting the portal on its servers. The Portal was released to the public in February 2010.
- NCDC ingested, archived, and implemented online access to Climate Forecast System Reanalysis (CFSR) data during FY10, and over 400 terabytes of model data (including CFSR) were downloaded by users during the year.

More detail about the above and other accomplishments from FY2010 can be found in Section 4.2.

1.0 Customer Results

The NNDC impacts all economic sectors of the nation and is instrumental in the preserving of long-term data records of environmental conditions.

NNDC provides essential information to key decision makers in multiple industries (construction, agriculture, etc) contributing to an estimated cost savings of billions of dollars annually (<http://www.economics.noaa.gov/>).

NCDC led the development of a NOAA Economics website with its NOAA partners. The website covers economic data and analyses across many subject areas. This site is the one-stop source of information on the economic value and real-world application of NOAA's data products in decision-making and the economic costs of environmental extreme events to society. The information is organized by the NOAA mission goals supported by the NNDCs (Climate, Weather & Water, Ecosystems, and Commerce & Transportation).

The NOAA National Data Centers fully meet the customer's needs and delivers the services and products as outlined in the NOAA and NESDIS operational plans.

1.1 Customer Requirements and Costs

The NNDC program is fully meeting the customers' needs and the data centers are delivering the data, services, and products as outlined in the NOAA and NESDIS operational plans. The value of these centers has been well documented and mandates a continued need for this investment. The NNDC program continues to provide its customers with on-line data free of charge. The data centers also provide value added products for a nominal fee. These products can be ordered on-line or by phone. Phone support is made available to ensure that customers find the right product.

1.2 Performance Measures

Table 1 summarizes the customer results performance measures.

Table 1: NOAA National Data Centers Performance Measures

Measurement Area	Indicator	FY2010 Baseline	FY2010 Actual Result
Customer Results	NCDC - New Climate Records	0	3
Customer Results	NNDC - volume of data archived. Unit of measure will be TB/yr	3.8 PB Base Add 600 TBs	Added 610 TBs.
Customer Results	NNDC Data Delivered to Customers. Units of measure PB/yr	Deliver 1 petabyte	Delivered 1.4 PBs

NNDC supports many types of NOAA customers and products in addition to the core mission of ingest and archive of climate, geophysical, and oceanographic data. NNDC projects continue to exceed their goals and objectives in the number of products produced and data made available on-line.

Many individual users visited the NNDC exhibits at large scientific conferences including the American Geophysical Union and the American Meteorological Society annual meetings and the comments were typically, “You have a great web site; I use your data and information all the time.”

Figure 1 shows data delivered on-line through the NNDC to customers through FY10.

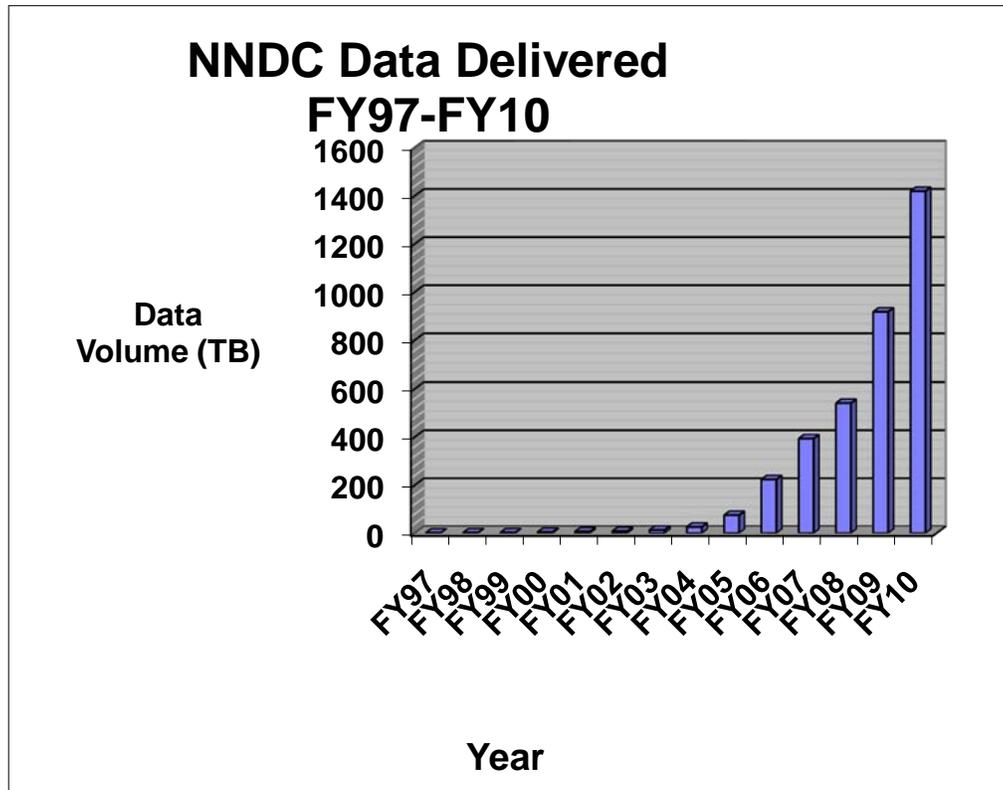
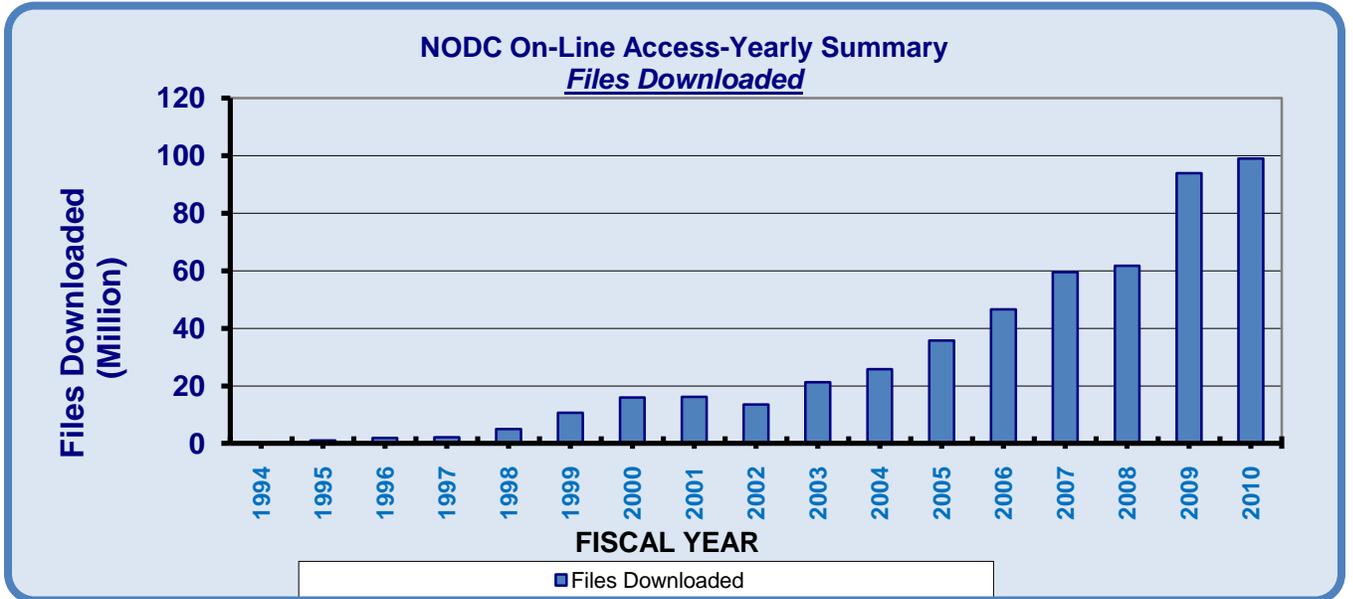
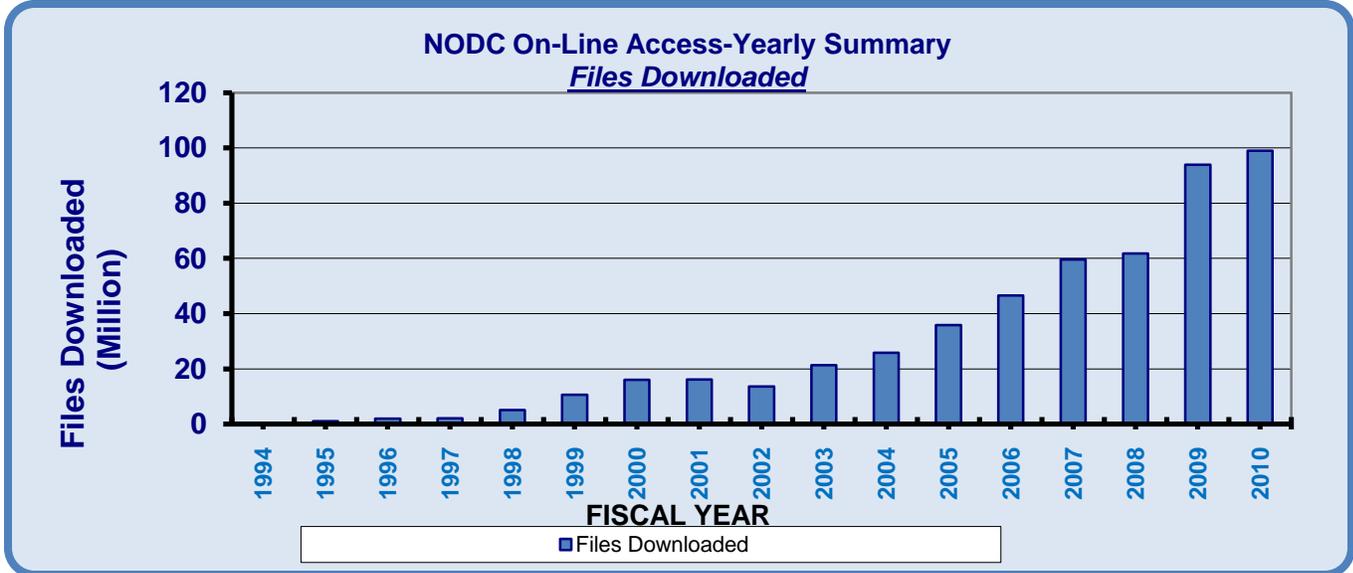


Figure 1. NNDC Data Delivered Online FY97-FY10

Figure 2 shows customer support at NODC by the increase in the number of Unique Host connectivity, files downloaded, and amount of ocean data delivered via the NODC on-line access system. In the last 15 years the number of requests from the Unique Monthly Hosts has increased from 94,013 in 1995 to 1,873,994 in 2010. The number of files delivered has increased from 207,745 in 1995 to 96,058,446 in 2010. The amount of data delivered to customers has increased from 27 GB in 1995 to 47 TB in 2010.



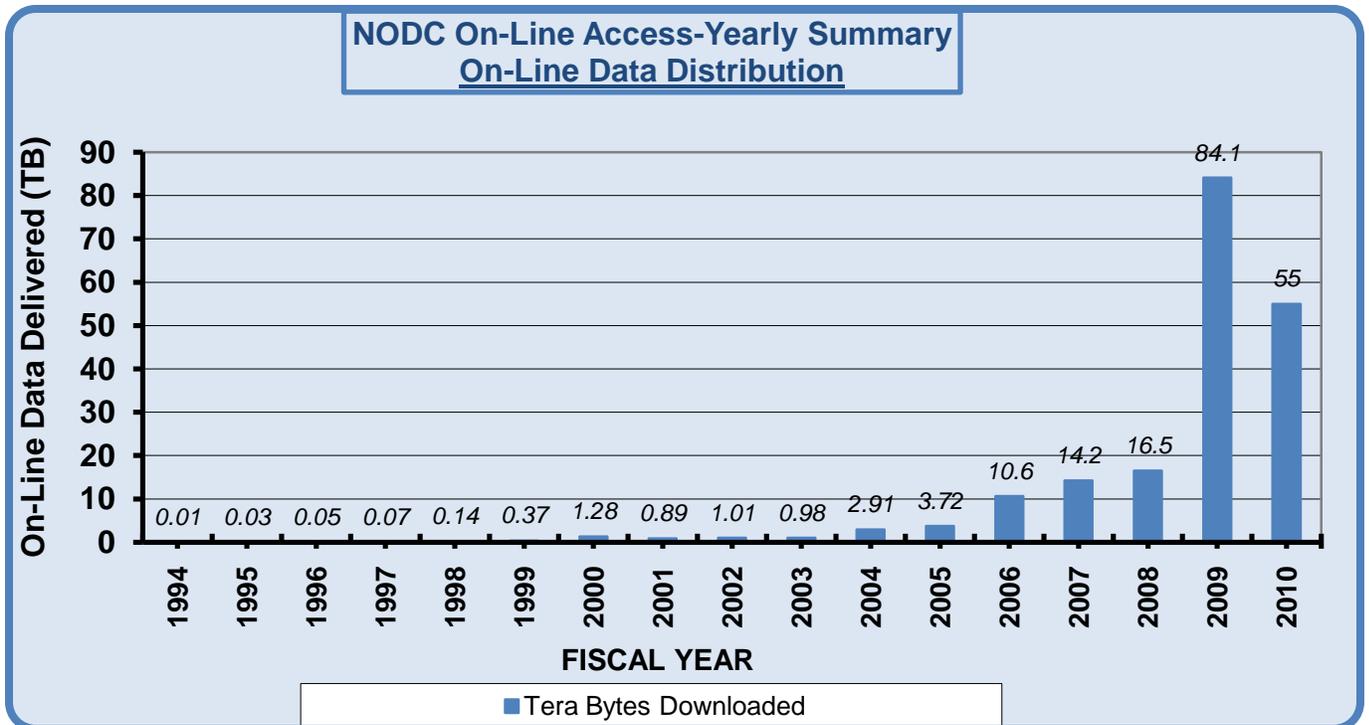


Figure 2. NODC On-Line Data Access Summaries

Figure 3 shows data that was made available to customers through NGDC. The number of distinct hosts has been reduced but data available has increased by 25% over this past year.

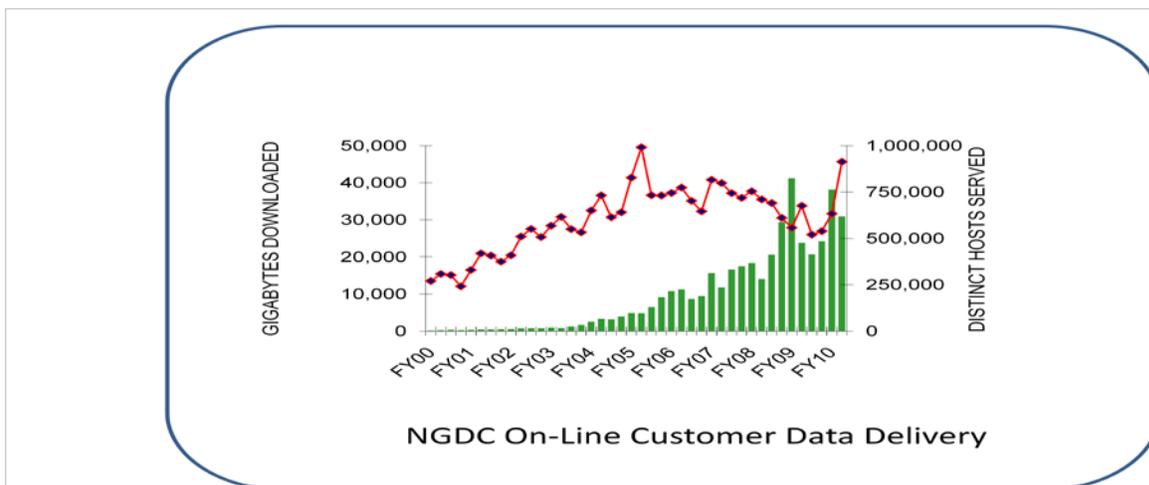


Figure 3. NGDC on-line data available to customers

Building on last year's successful efforts to provide data integration, discovery, access and mapping tools, the NCDDC has overseen the continued evolution of the EcoWatch system (formerly the Regional Ecosystem Data Management), which provides access to data and information through the cataloging, formatting, archiving, and dissemination of data streams in collaboration with federal and state agencies, regional observing system observing system associations, academic researchers, and non-governmental organizations.

Of particular interest is the EcoWatch set of complementary services utilizing controlled vocabularies to provide semantic context to a search that facilitate discovery and access for a range of users, from an individual scientist seeking to create a custom data feed for a web application. Combined with EcoWatch data services, the system allows users to create customer data "channels," or groups of data sets, that can be delivered over the web directly to browsers, Google-based mapping tools, GIS, and other web-aware software.

With a design goal of system interoperability with other NOAA and non-NOAA data systems, beginning in 2009, EcoWatch is able to leverage NOAA's Environmental Research Division Data Access Program (ERDDAP) to extract and create products from gridded data from satellites and models using Google Earth as a data visualization tool displayed in a 3D environment. System interoperability is enhanced by leveraging community-controlled vocabularies (e.g. Global Change Master Directory, Coastal/Marine Ecological Classification Standard) to refine data discovery, access, integration, and visualization.

In addition to EcoWatch, NODC and NCDDC produced and expanded the NOAA Extreme Weather Information Sheet ((NEWIS) for the 2009 Atlantic hurricane season. Laminated and waterproof, NEWIS provides coastal residents with a "one stop" ready reference containing important contact phone numbers and internet web sites for emergency information in the state and local area. In addition to unique NEWIS products for Texas, Louisiana, Mississippi, Florida and Alabama, a NEWIS was developed for the U.S. Virgin Islands, as well as a second for Louisiana, and four new areas for Florida's Atlantic Coast (now totaling eight for Florida). PDC versions of NEWIS are available on NCDDC's NEWIS website.

2.0 Strategic and Business Results

The NOAA National Data Centers Information Technology (IT) infrastructures are configured to accommodate the e-Government initiative by focusing on the storage, access, and delivery of data and information from the nation's environmental archives. These data are available to the global community by Internet access, phone calls, and written request. Data and products are available in various forms to include CD-ROM, DVD, posters, publications, subscriptions and on-line access. All data interactions are now capable of being performed without human intervention using e-Commerce conventions. Development and improvement of end-to-end system resources and systems management is handled through oversight of contractor support.

2.1 Achieving NOAA Strategic Goals

The NNDC supports the Commerce Department, and Line Office goals and strategy found in current strategic and planning documents (such as the Strategic IT Plan, Enterprise Architecture, Operational IT Plan, Annual Operating Plan, and other documents). Specifically the NNDC supports the four NOAA Mission Goals: Ecosystems, Climate, Weather and Water, and Commerce and Transportation by providing data, information, and products in support of understanding climate variability, weather and water information, and information for safe and environmentally sound transportation.

Below are samples of how the NNDC supports each NOAA mission goal.

NCDDC is aligned with NOAA's Ecosystem mission goal. In 2009, NCDDC expanded the EcoWatch portal, enhancing both data discovery and access to coastal data used to provide the NOAA Ecosystem Goal, Ecosystem Observation Program, and the other NOAA Mission Goals a comprehensive data exploitation tool to help scientists and researchers evaluate the effects of different management strategies and their interactions with ecosystem resources, encouraging the integration of information across a wide domain of databases, application systems, data warehouses, and more, and directly supports EGT/EOP activities that depend inherently upon integrated data initiatives (e.g., Integrated Ecosystem Assessments, Marine Spatial Planning). Additionally, NCDDC continued to support the Commerce and Transportation goal with the operation and maintenance of the Marine Debris web site, and in 2009 partnered with the National Marine Fisheries Service (NMFS) and Flower garden Banks National Marine Sanctuary in developing program supporting websites.

NODC provides critical support for all the NOAA's mission goals by operating NOAA's Central and Regional Libraries which currently serves as the official archive for NOAA documents. NODC also supports the NOAA mission goals of Ecosystems and Climate by ingesting, archiving, and providing on-line access to ocean data and by the development of the Coral Reef Information System (CoRIS).

NGDC provides continuous support to NOAA's Commerce and Transportation as well as the Weather and Water mission goals. This years upgrade of the World Magnetic Model allows the model to continue as the standard for navigation, attitude and heading referencing systems using the geomagnetic field.

NGDC's development of digital elevation models supported regional storm surge and tsunami inundation forecasting, coastal hazard assessments, sea level rise studies and DEEPWATER HORIZON disaster recovery efforts. And the growing data holdings at NGDC continue to support research toward improved weather forecasts and models.

NCDC focuses on two primary NOAA mission goals: Climate, and Weather and Water. NCDC provides quality climate and weather data, information, decision support products and services that improve business, government, and personal decisions related to planning, operations, and assessments. Support research leading to improved weather and climate forecasts and models. Provide information on the varying changing states of the national and global climate.

As demonstrated above, the NNDC supports all NOAA mission goals by being good stewards of the data that is archived and made available to its customers.

2.2 Business Results

2.2.1 Program Management and Controls

The NNDC program is guided by the Office of Management and Budget (OMB), DOC, and NOAA guidelines and policies. Oversight is provided by NESDIS, including the NESDIS Information Resource Management Team (IRMT) and the NESDIS Chief Information Officer (CIO).

A baseline of annual activity is contained in the Annual Operating Plan (AOP) which is approved by the line office. Each center submits their AOP Performance Measures (PMs) and Milestones chart as part of their annual planning process. These plans contain mission goals and performance measures for the individual centers and the programs and systems within their domain.

The NNDC IT management process begins with out-year planning and a development of a spend plan broken out by month. Each data center is responsible for their individual spend plan. Once plans are approved and Operations, Research & Facilities (ORF) funds are made available, the systems-support and finance managers begin the acquisition for products and services. Recommendations must be compliant with Section 508, the DOC Enterprise Architecture, and the Federal Enterprise initiatives. Prior to IT purchases, the IRMT reviews the purchase for best business practices. NOAA-wide contracts such as NOAA IT Electronic Store (NITES) and Blanket Purchase Orders are queried for product availability. If not found, other existing government contracts are reviewed for product availability. Sole source purchases are made only when no other option is available. IT purchases follow the capital asset planning process and are incorporated into the NNDC Exhibit 300. NNDC IT support comes from integrated teams consisting of contractors and federal employees. Details of the support contracts can be found in the individual data center yearly acquisition plans. All IT purchases over \$25K but less than a 100K is reviewed by the NESDIS Deputy CIO and all purchases over a \$100K are reviewed by the NESDIS CIO to ensure the planning and budgeting process has been followed.

2.2.2 Monitoring Cost, Schedule and Performance

Cost: The cost for NNDC programs is monitored in monthly reports submitted to the data centers' financial officers containing financial information such as estimated and actual costs versus projected cost. Monthly budget reviews are held with the program manager, Contracting Officer's Representatives (CORs), and contract managers to ensure contracts are within cost and on schedule. The NNDC IT Dashboard (ITDB) exhibit 300 was developed during FY09 and tracks ongoing cost, schedule, and performance.

Schedule: The data centers' annual operating plans are used to track key milestones. A plan is currently in effect to reflect the final appropriation and allotment decisions. NESDIS continues to conduct monthly reviews.

Performance: Performance management is addressed at the individual data centers through their internal reviews and then briefed by the center directors to the NESDIS director and staff. Specific performance measures listed in the NNDC Exhibit 300 are reviewed and updated.

2.3 Reviews

As part of the NOAA program structure, the NNDC program is reviewed continuously throughout the year. Each data center and project manager is responsible for monitoring their individual monthly spending and reporting to NESDIS Headquarters Financial Officer unacceptable deviations, along with explanations and a plan to correct. The NNDC program manager provides monthly updates to the NNDC dashboard (<http://it.usaspending.gov/>).

2.4 Security

All NNDC systems have approved System Security Plans, Risk Assessments, and Contingency Plans in place. Data Centers are classified as Business Essential. Operational and technical security controls are in place to ensure the confidentiality, integrity, and availability of information.

NNDC systems are managed by Information Systems Security Officers (ISSOs) and meet once a month to discuss security issues. The ISSOs ensure that desktop and network security is implemented in accordance with DOC and NOAA guidelines. All NNDC system administrators have taken the required annual security training.

NNDC facilities face all the traditional physical risk and security challenges that go with data operations. Providing on-line access to the public is a risk. NNDC system managers have implemented firewalls to protect these systems against intrusion. To minimize risks, systems security, disaster preparedness, and continuity of operations plans are tested and updated yearly.

During this past year NGDC completed the recertification and accreditation of their computer facility. Approval to operate was granted on January 22, 2010. Annual contingency training and testing were also accomplished this year which included system recovery from backups, complete system rebuilds, and web site switch-over to NGDC's COOP site at NODC.

NODC has undergone reaccreditation of C&A in FY10. A number of documents were generated or updated including: Business Impact Analysis; Business Continuity Plan; FIPS 199, Standards for Security Categorization of Federal Information and Information Systems; FIPS 200, Minimum Security Requirements for Federal Information and Information Systems; E-Authentication, Threshold Analysis; Privacy Threshold Analysis; Risk Assessment; and Security Assessment Review. In addition, complete vulnerability and security control testing was conducted by independent auditors. NODC did complete the re-certification process for its computer and “Approval to Operate “ (ATO) was granted on 7 September 2010.

2.5 Performance Measures

As previously discussed, NNDC has exceeded many of their annual performance measure projections, such as data delivered on-line to customers.

Table 2: NNDC Business Results Performance Measures

Measurement Area	Indicator	FY2010 Baseline	FY2010 Actual Result
Mission and Business Results	Number of Regional Ecosystems Portals sustained (NCDDC)	2	2
Technology	NCDDC – Number of web applications supporting Ecosystem programs/components/observing systems	15	21
Technology	NCDDC – Metadata Catalogs classified, maintained and accessed for the portal	3	3

Figure 4 illustrates the increase in NCDC data delivered on-line for the FY97 through FY10 period.

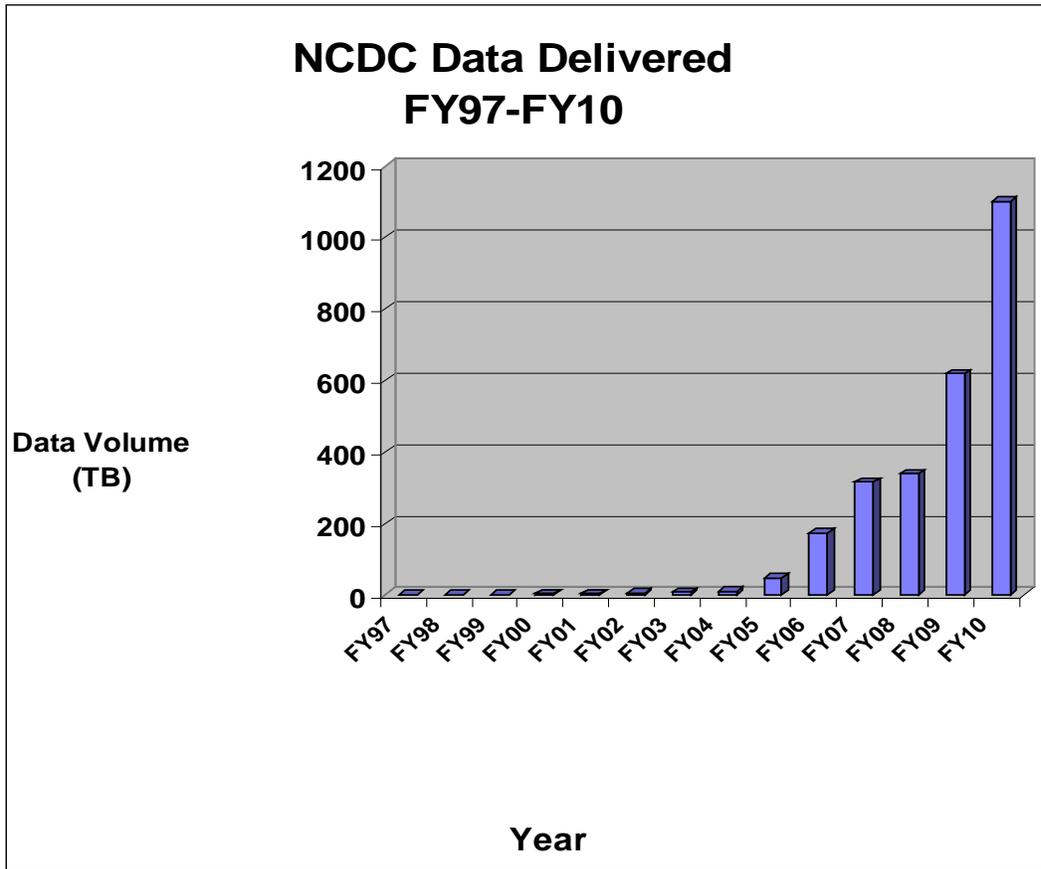


Figure 4. Data delivered on-line

3.0 Financial Performance

More detailed NNDC financial data is documented in the NNDC OMB Exhibit 300

3.1 Current Performance vs. Baseline

Data Center	FY10 Planned Cost	FY10 Actual Cost	Variance
NCDC	\$59,483.4K	59,434.4K	\$48.9K
NODC	\$16,604K	\$16,592K	\$12.6K
NGDC	\$6,455.9K	\$6,221.5K	\$234.4K

The current NNDC financial performance is based on a pre-established cost baseline (e.g., annual spend plan). Program costs are steady state and consist of labor and benefits for full time permanent information technology staff dedicated to the data centers, telecommunication costs, supplies, and information technology equipment such as routers, desktops, and data storage devices. Other planned project costs cover the support and services contracts at each data center. Funding numbers will differ slightly from the Exhibit 300 for the NCDC budgets due to headquarters overhead and small transfers for support task that were found during budget closeout

3.2 Financial Performance Review

The NNDC systems reported that FY10 expenditures were within 98 percent of projections.

The NNDC annual spend plan reports and compares the actual cost of the program compared to a pre-established cost baseline. Program costs consist of labor and benefits for federal and contract employees and financial performance practices vary slightly between project and data center.

The NNDC is a steady state umbrella program that derives its budget from a combination of ORF support accounts for NCDC, NODC, NGDC, NCDDC, NVDS, and CDMP. Each office has a financial staff that reports monthly to NESDIS Headquarters for variances of more than ten percent.

Data centers report monthly to NESDIS headquarters on actual expenditures against planned cost. Also cost from the data centers are combined and reported in a quarterly operations analysis quad chart.

Detailed financial information for the NOAA Library is located in the NODC AMP. The NOAA Virtual Data System (NVDS) funding line items are located in the AMP of NCDC, NGDC and NODC. The Climate Database Modernization Program (CDMP) is also listed in the NCDC AMP.

CDMP is a sizeable financial segment of the NNDC and uses the General Services Administration's (GSA) Federal Supply Schedule Contract Blanket Purchase Agreements (BPAs). The BPA eliminates contracting and open market costs such as the search for sources, the development of technical documents and solicitations, and the evaluation of bids and offers. The BPA further decreases costs, reduces paperwork, and saves time by eliminating the need for repetitive, individual purchases from the schedule contract. Creating a purchasing mechanism that works better and costs less. The contractors issue monthly invoices for all products and services supplied under the contract. Invoices are tracked and evaluated by the CDMP COR as well as each government task manager who is responsible for issuing the task order and monitoring the task for deliverables and for the quality assurance of these products and services. To review each task for its progression quality, and costs progress meetings are conducted. Purchases cannot exceed funds available by using the BPA, thus keeping the program within budget.

The NNDC is a steady state umbrella program that derives its budget from a combination of ORF support accounts for NCDC, NODC, NGDC, NCDDC, NVDS, and CDMP. Each office has a financial staff that reports monthly to NESDIS Headquarters for variances of more than ten percent.

4.0 Innovations to Meet Customer Needs

4.1 Number and Types of Users

Customers include insurance and energy companies, engineers, community planners, public safety providers, farmers, lawyers, and the general public. The nation is a stakeholder; other customers include federal agencies such as the National Aeronautics and Space Administration (NASA), state and local governments, and students from all levels of academia. The NNDC had over 800 million web hits during this past year.

4.2 Projects Addressing Customer Challenges

The following projects demonstrate how the NOAA data centers meet customer needs and to make better use of technology in achieving existing and future requirements

NOAA Virtual Data System (NVDS) “System of Systems”

- “HDSS Access System” (HDSS = tape robotics for the climate data archive, large volume data set access – e.g., NEXRAD, satellite, model data)
- “Climate Data On-line” (in situ data access)
- “Images and Publications System” (serial publications such as *Storm Data*, imaged forms)
- Integrated Surface Data (ISD) (climatic data) developed with NVDS, etc. funding
- Geophysical and Oceanographic data access
- GIS services & GIS-based data discovery
- Web services & FTP services
- Data Visualization (NEXRAD, etc.)
- NESDIS E-government System (includes On-line Store, off-line orders such as DVD, financial transactions, business statistics, etc.)

The NVDS Data, Metadata, and Geospatial Services continue to eliminate dependency on older technology and provide users with improved products and services. For example, at NCDC, the Geographic Information System (GIS) map services interface added a number of new features in FY 2010 and provides a direct interface to major data sets. This interface includes basic and advanced options, depending on level of user sophistication and requirements. Selected data types can be graphed for user-selected stations and period of interest, to allow customers access to data with just a “point and click.”

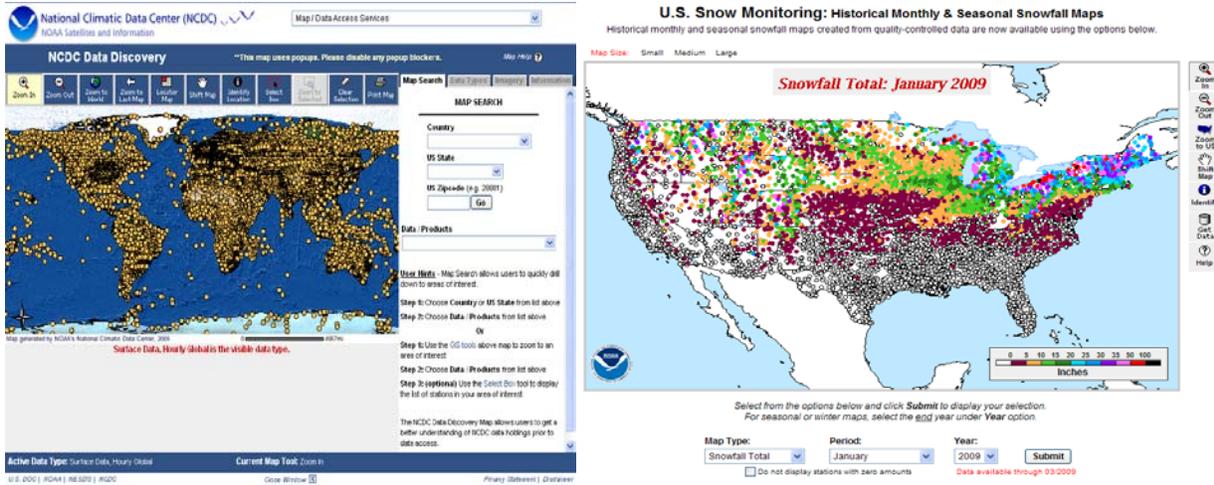


Figure 5. NCDC Data Discovery map interface and sample map of snowfall data

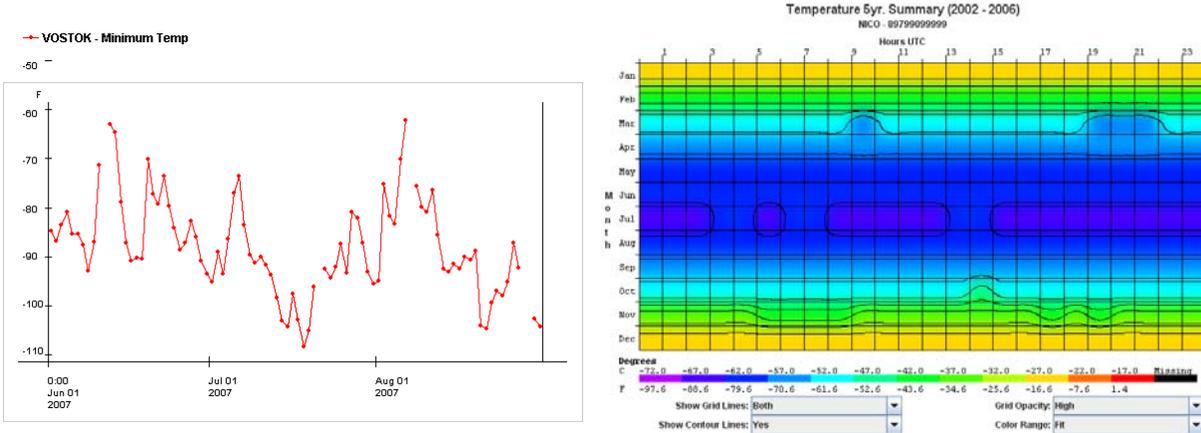


Figure 6. NCDC samples of data visualization

Climate Database Modernization Program (CDMP)

The Climate Database Modernization Program (CDMP) supports the National Oceanic and Atmospheric Administration's (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 are part of the U.S. National Archives and were originally recorded on paper, film, and other fragile media, and then 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 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 manages **97** separate data rescue projects across NOAA.

Many of these are multiyear tasks and the data rescued contribute to the nations need for additional valuable scientific data to address climate and environmental challenges. CDMP has placed online over 54 million weather and environmental images, available to researchers around the world via the Internet. The amount of data online has grown from 1.75 terabytes in 2001 to more than 14 terabytes in 2010. Major progress continues in making this data available through a number of NOAA web sites. In addition, 410 million synoptic weather observations that have been keyed through CDMP will be integrated into NCDC's digital database holdings by the end of 2010, this will extend the period of record for many stations back into the 1890's. Additional daily data records keyed through the CDMP "Forts" project will soon extend this data period back to the 18th Century for several stations.



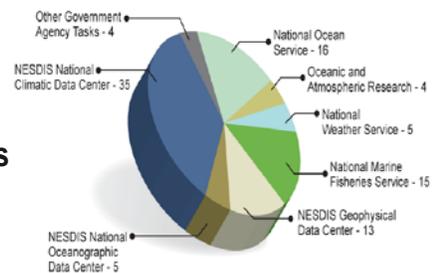
Climate Database Modernization Program: 2000-2010



Over 14 terabytes of climate data now digitized

- ▶ 54 million weather and environmental images online
- ▶ Hundreds of millions of records digitized now online
- ▶ International data access and rescue activities
- ▶ 97 current NOAA climate/environmental rescue projects

2010 Climate Data Modernization Tasks Across NOAA



Meteorological Journal											
Observatory		Washington, D.C.						1842			
Time	Baromet	Thermom	Wind	Cloud	Humid	Dir. Wind	Force	Wind	Wind	Wind	Wind
07:30	30.00	55.0	0	0	0	0	0	0	0	0	0
08:00	30.00	55.0	0	0	0	0	0	0	0	0	0
08:30	30.00	55.0	0	0	0	0	0	0	0	0	0
09:00	30.00	55.0	0	0	0	0	0	0	0	0	0
09:30	30.00	55.0	0	0	0	0	0	0	0	0	0
10:00	30.00	55.0	0	0	0	0	0	0	0	0	0
10:30	30.00	55.0	0	0	0	0	0	0	0	0	0
11:00	30.00	55.0	0	0	0	0	0	0	0	0	0
11:30	30.00	55.0	0	0	0	0	0	0	0	0	0
12:00	30.00	55.0	0	0	0	0	0	0	0	0	0
12:30	30.00	55.0	0	0	0	0	0	0	0	0	0
13:00	30.00	55.0	0	0	0	0	0	0	0	0	0
13:30	30.00	55.0	0	0	0	0	0	0	0	0	0
14:00	30.00	55.0	0	0	0	0	0	0	0	0	0
14:30	30.00	55.0	0	0	0	0	0	0	0	0	0
15:00	30.00	55.0	0	0	0	0	0	0	0	0	0
15:30	30.00	55.0	0	0	0	0	0	0	0	0	0
16:00	30.00	55.0	0	0	0	0	0	0	0	0	0
16:30	30.00	55.0	0	0	0	0	0	0	0	0	0
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19:30	30.00	55.0	0	0	0	0	0	0	0	0	0
20:00	30.00	55.0	0	0	0	0	0	0	0	0	0
20:30	30.00	55.0	0	0	0	0	0	0	0	0	0
21:00	30.00	55.0	0	0	0	0	0	0	0	0	0
21:30	30.00	55.0	0	0	0	0	0	0	0	0	0
22:00	30.00	55.0	0	0	0	0	0	0	0	0	0
22:30	30.00	55.0	0	0	0	0	0	0	0	0	0
23:00	30.00	55.0	0	0	0	0	0	0	0	0	0
23:30	30.00	55.0	0	0	0	0	0	0	0	0	0



Imaged Records Example:
Glacial Pairs – Muir Glacier, Alaska

July 1st, 1842 hourly weather data from Washington, DC, imaged and digitized through the CDMP Program



Figure 7. Climate Database Modernization Program statistics

For more information on CDMP: www.ncdc.noaa.gov/oa/climate/cdmp/

The CDMP program was initiated by Congress to assist NOAA in modernizing and improving access to the Nation's climate data and information. The CDMP could not exist without the extraordinary efforts of people within NOAA and those in the private sector who do the keying, imaging and database development. CDMP projects have created hundreds of new private sector data entry and information management jobs in several economically challenged areas in West Virginia, Kentucky and Maryland. The three prime contractors for CDMP are National Interest Security Company (NISC), Rocket Center, West Virginia; SourceCorp, Mount Vernon, Kentucky; and HOV Services, Beltsville, Maryland. Excellent support is also provided by the NCDC on-site contractor, STG Corporation. Staff prepares many of the data for shipment and performs extensive quality control on the returning data products. With over 97 ongoing NOAA projects, the contractors must remain focused and flexible to meet each project's requirements. CDMP images and digitizes observations collected from numerous platforms and sensors which include the whole biosphere from space weather to ocean core sediment data. This task includes transforming these older observations to a more useful friendly and accessible digital media to 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 this data for predictive modeling. However, the work is far from done. Millions of pieces of data are still waiting to be digitized, the scientific community depends on the on-going work of CDMP to ensure that the hard-earned, irreplaceable research is protected, preserved and made available on-line. The majority of the CDMP tasks are on-going, however the following are the new taskings (13 out of 97) for 2010.

New CDMP Tasks for FY2010

National Ocean Service

Hydrographic Surveys Metadata Project

National Geophysical Data Center

NGDC provided historical vertical incidence measurements of the ionosphere to research scientists at the Space Environment Corporation (SEC) in Logan, Utah. The ionospheric data provided to SEC consisted of "rescued" measurements obtained at Fort Belvoir (Washington D.C.) in the 1950s and 1960s. SEC researchers will use these data to improve the Global Assimilation of Ionospheric Measurements (GAIM) model of the Earth's ionosphere. The GAIM model is used for space weather operations at the Air Force Weather Agency, Offutt AFB, NB.

NGDC has completed a thorough review of digitized nighttime lights imagery data "rescued" through the NOAA Climate Data Modernization Program (CDMP). The original imagery was contained in large-format film scans from the legacy data system within the Defense Meteorological Satellite Program (DMSP). Over 5,000 film-scan files were quality checked as a part of the migration of these data from one tape backup system to another within NGDC. These actions will greatly improve the quality of the nighttime lights dataset within NGDC. The full digital nighttime lights record now extend from the late 1970's (non-contiguous and evolving) to the present including both early original film imagery and later imagery recorded directly in digital form.

National Marine Fisheries Service

OCR/Scan NMS Hawaiian Newspaper Archives

35mm Seal/Cetacean Slide Conversion Project
West Coast/Alaskan Plankton Data Recovery
CalCofi Fish Larval Data Rescue
Historical Menhaden Tagging Data

National Climatic Data Center

Captured German WWII Data Conversion
Simultaneous Meteorological Observations

Other NOAA,. Government

North American Bird Phenological Cards Scanning (USGS)
Hawaiian Island Precipitation Data from Sugarcane Plantations
Project (HI State Climatologist)Digital Tsunami Message Archive (NWS)

National Coastal Data Development Center (NCDDC)

The National Coastal Data Development Center continues to provide support to a broad range of customers through a variety of interfaces and technologies. FY10 has seen the continued evolution and transformation of NCDDC's data discovery and access mechanisms, data visualization and mapping tools, interfaces with Google Earth technologies, and enhanced development of the EcoWatch system. Initially conceived as a limited framework based at NCDDC to support NOAA's Integrated Ecosystem Assessment initiatives, the EcoWatch program has evolved in FY10 into a comprehensive framework for data integration that uses a technological approach that follows NOAA's plan for enterprise data integration (the GEO-IDE, or Global Earth Observation Integrated Data Environment), and is capable of being packaged and installed on other computer systems or run within a computing cloud, supporting data integration for many purposes. It will continue to support NOAA's Next Generation Strategic Plan Goal of Healthy Oceans through the Ecosystem Based Management Priority Objective Team (POT) requirements related to climate impact on ecosystems and sustainability of ecosystems; EcoWatch will also serve as a platform for discovery and access to support Coastal and Marine Spatial Planning efforts.

EcoWatch's integration with NOAA's Environmental Research Division Data Access Program (ERDDAP) was extended to include distributed searches. Users can search geospatially and with respect to time from one EcoWatch interface and retrieve data sets from many sources. ERDDAP's linkage to NOAA's Unified Access Framework (UAF) allows EcoWatch search and directly access data from across NOAA. Both EcoWatch and ERDDAP's use of web services makes attributes of both technologies highly compatible. Additionally, NCDDC expanded the EcoWatch portal to integrate both WOD data and Gulf of Mexico fisheries-independent data (SEAMAP) for the first time and provides access on-line.

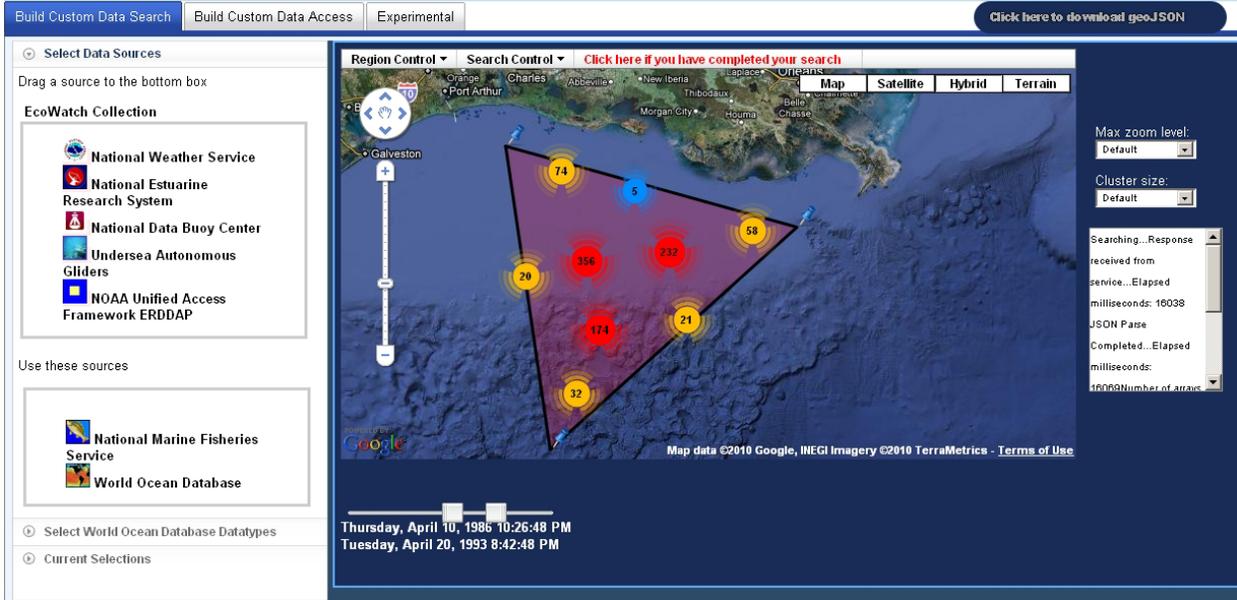


Figure 8. EcoWatch polygon search for fisheries-independent data (SEAMAP) and NODC WOD ocean station data – integrated data search across distributed NOAA databases.

National Oceanographic Data Center (NODC)

The National Oceanographic Data Center (NODC) has developed a strategy for displaying and using environmental data in innovative ways. By leveraging new tools to analyze and visualize complex ocean and ecosystem data and information, the data center has dramatically increased the usage of several online applications. The success of these implementations increases the usability of the ocean data by non-scientific audiences as well as researchers across the globe. It also improves their understanding of the oceans, and assists in developing a workforce that is knowledgeable about weather and climate.

NODC enhanced the overall public Web interface as well as several applications such as the Coastal Water Temperature Guide. NODC developed and implemented a strategy to fulfill its response to tens of thousands of requests per day for the water temperatures off the U.S. coastal areas, including the Great Lakes, in a timely and user-friendly manner. This product has become the primary gateway for providing useful information for planning beach activities such as swimming or fishing via the Internet (Weather and Water). The use of syndicated RSS feeds has been implemented on several projects as well, which will provide real-time notices of data updates. Enhancements also include interactive Google-Map™ applications, which allow users to browse through water observations on map-interfaces.

NODC also deployed an integrated search of the entries in the NOAA Library catalog of interest to the Coral Reef Information System (CoRIS) and the Coral Reef Virtual Library. The Coral Reef Virtual Library is a collection of web sites, journal articles, and other publications which

were not previously available from the NOAA Library. Thus, scientists interested in Coral Reef literature can now find it all in one place. NODC also deployed a Virus Scan System to check Ocean Archive Data during the ingest process. In case of an infection, the system administrators are notified instantly, enabling them to take immediate action. This initiative, which was in response to a coral working group request, will ensure data coming into NODC for archiving, is safe from viruses

NODC provided extensive support to high-level projects such as the Comprehensive Large Array-data Stewardship System (CLASS), NOAA's All-Hazard Monitor (NOAAWatch), and most importantly provided data, climatologies, and map services support to the Deepwater Horizon Incident. NODC's National Coastal Data Development Center (NCDDC) also provided support to Haiti's recovery from a catastrophic 7.0 magnitude earthquake in early January 2010, by loading support data and imagery on a central website for easy access for rescuers and responders.

Working with the international community, NODC operated the Long Term Stewardship and Reanalysis Facility (LTSRF, <http://ghrsst.nodc.noaa.gov>) for the Group for High Resolution SST (GHRSSST, formerly known as the Global Ocean Data Assimilation Experiment High Resolution SST Pilot Project, or GHRSSST-PP). Each day, the NODC LTSRF automatically ingests data from the GHRSSST Global Data Assembly Center at NODC NASA's Jet Propulsion Laboratory. As a partnership satellite operations world-wide, 30 distinct products arrive daily from national and international satellite sensors such as NOAA's Polar Orbiting Satellites instrumented with Advanced Very High Resolution Radiometer (AVHRR) and the NOAA Geostationary Operational Environmental Satellites, NASA's Moderate Resolution Imaging Spectroradiometer (MODIS), Advanced Microwave Scanning Radiometer – EOS (AMSR-E), Tropical Rainfall Measuring Mission's (TRMM) Microwave Imager (TMI), Europe's "Spinning Enhanced Visible and Infrared Imager" (SEVIRI), and Europe's Advanced Along-Track Scanning Radiometer (AATSR). Many new products in 2008 including several new blended analysis products from Remote Sensing Systems, the Danish Meteorological Institute, IFREMER, and the UK. Data from the AVHRR on Europe's Metop-A platform also joined the collections. Overall, the LTSRF archive has grown tremendously during 2008 and now exceeds 15 and nearly 8,400,000 network Common Data Format (netCDF) files.

NOAA's National Oceanographic Data Center (NODC) published the "World Ocean Atlas 2009," one of the most cited works on climate and oceanographic sciences. The internationally distributed "World Ocean Atlas 2009" includes climatological fields (interpolated annual, seasonal, and monthly means) of temperature, salinity, oxygen, and nutrients for the world ocean at selected standard levels. Understanding the role of the ocean as part of Earth's climate system depends critically on the availability of such climatologies, and preceding versions of the "World Ocean Atlas" were cited approximately 400 times per year. NESDIS used oceanographic profile data from the U.S. and from countries around the world for analysis to compile this publication. NODC is the official archive for all U.S. oceanographic data and also acquires data from international sources. The "World Ocean Atlas 2009" is based on the data in the "World Ocean Database 2009," which was released in November 2009. The database is the largest, most comprehensive collection of scientific information about the oceans with records dating as far back as the late 1700s.. The 2009 database, an updated version of the 2005 edition, provides approximately 9.1 million temperature profiles and 3.5 million salinity reports. It also captures 29 categories of scientific information from the oceans,

including oxygen levels and chemical tracers. It includes information on gases and isotopes that can be used to trace the movement of ocean currents. Climate scientists use the World Ocean Database to track changing conditions, which adds to the international science community's understanding of global climate change.

NODC now supplies a clickable list for each oceanographic cruise found in their subset, along with information about that cruise in a tabular format. If the user clicks on the cruise, a full map of the cruise path, as well as information about the cruise and a full listing of position, date/time, and measured variables are supplied for each station occupied by the cruise. If the original cruise report is available, the user can obtain the PDF of this document through a link. Further, in the tabular cruise list, the accession number for each cruise is a clickable link. An accession number is a number assigned to each data submission received at NODC. Clicking on this link will give a geographic distribution and information about the data from the given data submission. One further click will bring the user to the original data stored at NODC. The user now has a tool available for providing more information about the data and more granularities in data searches. The original data and original cruise report (when available) can supply the user with all possible information about a given data request and any problems or special circumstances with these oceanographic data.

National Geophysical Data Center (NGDC)

NGDC's newly released World Magnetic Model, WMM2010, incorporates the latest magnetic information from satellite and ground observatories to provide a high-quality model of the Earth's magnetic field for use in both military and civilian navigation systems. The WMM is the standard model for the U.S. Department of Defense, the U.K. Ministry of Defence, the North Atlantic Treaty Organization (NATO), the International Hydrographic Organization (IHO) and is used by the National Oceanic and Atmospheric Administration for nautical charting. Navigation, attitude and heading referencing systems using the geomagnetic field require a model of Earth's magnetic field. NGDC, in partnership with the British Geological Survey, produced the new WMM models of Earth's main magnetic field and of the annual change in the field. The model, associated software, and documentation are distributed by NGDC on behalf of NGA. Due to the changing nature of Earth's magnetic field, the model is updated at 5-year intervals

NGDC hosted three visitors from two directional drilling companies, Chevron Energy Technology and Schlumberger, April 19, 2010. The visitors met with Dr. Stefan Maus to learn more about the recently released Enhanced Magnetic Model (EMM). Exploration companies are increasingly utilizing directional drilling, drilling on a slant rather than straight down-well, to recover resources. This requires a detailed model of the magnetic field to help guide the drillhead. As part of an effort to improve the accuracy of the navigational standard magnetic field model, the World Magnetic Model (WMM), NGDC recently developed the EMM as a research effort supported by the National Geospatial-Intelligence Agency. The WMM is a global degree 12 model representing the magnetic field to about 2500 km and is a navigational standard for DoD, NOAA, and NATO nautical and aeronautical charting as well as aircraft and shipboard systems. The EMM is a degree 720 model that can more accurately represent the local (down to 56 km) as well as global magnetic fields. As such, the model is of high interest to the oil, gas, water, utility installation, and coal-bed drilling industries. The EMM was recently made available on NOAA's Science on a Sphere and, with over 15,000 views, currently accounts for 20% of all SOS downloads from the YouTube channel. Both the

WMM2010 and the EMM2010 are freely available via the Web with supporting software and documentation.

(NGDC) has released a several new interface features for its Space Physics Interactive Data Resource (SPIDR) on the Web. In 2010, SPIDR was extended to include a representational state transfer (REST) style web service Application Programming Interface (API), through which all its time series data are now accessible. The new API provides direct, synchronous, simple programmatic access to over 200 individual parameters, representing space weather data directly from the NGDC archive. Time series data, plots, and imagery are available from a simple GetData call. And metadata is readily available using a GetMetadata call. To further maximize opportunities for the science community to utilize these resources, several additional wrapper libraries were created in a variety of programming languages. One wrapper example is the SPIDR IDL (Interface Description Language) Client which users can use to readily incorporate Space Weather data and metadata resources directly into an IDL application. This client saves users many hours of conversion time by providing a simple data retrieval interface which returns a convenient, analysis ready IDL structure. The REST API and these wrappers provide interfaces which are well suited to SPIDR's scientific programming user base, allowing them to obtain the data they desire quickly and easily.

NGDC has been the principal archive of U.S. Air Force Defense Meteorological Satellite Program (DMSP) global visible and thermal (infrared) band imagery data since 1992. In response to calls for public access to these data, the NGDC has established a near real time (NRT) web service for the nighttime visible and thermal images. NGDC has processed annual cloud-free composites for each year from 1992 to 2008 and a summary image of the brightest cloud-free light detections for the entire period. The data are useful in estimating the size of fish stocks, enforcement of fishing regulations in protected areas and identification and interdiction of Illegal, Unregulated, and Unreported (IUU) fishing.

NGDC, the Cooperative Institute of Research in the Environmental Sciences, and the Space Environment Corporation (Logan, UT), have implemented a new software product called Expert System for Ionogram Reduction (ESIR). The ESIR provides for the real-time analysis of raw ionogram data from a variety of ionosondes and produces validated ionospheric profiles of electron density. NGDC will use ESIR for processing operational space products used by the NOAA Space Weather Prediction Center and the U.S. Air Force Weather Agency. Additionally, this software will be used in long-term climate change studies by normalizing the methods used for processing historical ionosonde data. NGDC is the first Federal agency to adopt this newly available software package for real time use.

NGDC hosted a three-day NOAA Hydrographic Data Managers Meeting June 8-10, 2010 in Boulder, CO. Representatives from the National Ocean Service's (NOS) Office of Coast Survey (OCS) Atlantic Hydrographic Branch, Pacific Hydrographic Branch, Data Acquisition and Control Branch, and Chief of the Hydrographic Survey Division joined NGDC data managers to discuss improvements in data, metadata, and product management from ship to hydrographic processing centers and to NGDC. NGDC provides the long-term stewardship, discovery, dissemination, and Continuity of Operations (COOP) services for OCS hydrographic data, the largest data stream in the NGDC archive. The meeting resulted in new or improved procedures to handle the increasing volume of hydrographic survey data, more economical and efficient data delivery practices, and steps to update the OCS data submission agreement. In addition to these outcomes, attendees discussed the potential impacts of the recently passed Public Law 111-11 Ocean and Coastal Mapping Integration Act of 2009 and increased demands on the archive due to the University-National Oceanographic

Laboratory System data flow and increases in NOAA ocean and coastal mapping data. The NOAA Integrated Ocean and Coastal Mapping (IOCM) program implements the practice of planning, acquiring, managing, integrating, and disseminating data and derived products in a manner that permits easy access to and use by the greatest range of users. NGDC is responsible for supporting this effort with robust archives, dynamic inventories, and accessible data and products.

On May 20-21, 2010, NGDC hosted representatives from four of the University-National Oceanographic Laboratory System (UNOLS) science centers along with personnel from the NOAA Data Centers and the Integrated Ocean and Coastal Mapping program to discuss implementation of an improved data and information management system for the data collected aboard the UNOLS fleet. UNOLS is an organization of 61 academic institutions and National Laboratories involved in oceanographic research working together for the purpose of coordinating oceanographic ships' schedules and research facilities. NOAA's NGDC and National Oceanographic Data Center are the repositories and long-term archives for most of the data collected by UNOLS. The "R2R" is a system to streamline and ensure delivery of data, information, and products from the ship to the archive. An additional primary function of UNOLS is to ensure the efficient scheduling of scientific cruises aboard the 21 research vessels in the UNOLS organization. This is also a requirement for NOAA under the recently passed Public Law 111-11 Ocean and Coastal Mapping Integration Act of 2009.

NGDC delivered the latest custom bathymetric map on July 14 for Tsunami Buoy Deployment off the coast of Peru.

Deep-Ocean Assessment and Reporting of Tsunamis (DART) buoys allow monitoring of sea-surface height useful for many ocean studies and critical for confirming or cancelling tsunami messages through NOAA's Tsunami Warning System. NGDC produces custom bathymetric maps to assist the National Data Buoy Center in the deployment of DART buoys. NGDC DART buoy placement is a key NOAA effort to reduce the loss of life from tsunami in coastal communities and minimize false alarms, which result in high economic costs for unnecessary evacuations. DART data are also used for long-term tracking of sea-level change and coastal impacts, interannual variability, and analysis of GRACE satellite data. The pre-deployment maps developed by NGDC save costly ship time and reduces the effort of deployment, increasing the efficiency of the operation.

NGDC responded to a request from the New Orleans District's U.S. Army Corps of Engineers (USACE) for high-resolution, geo-referenced sidescan sonar image mosaics from current surveys of Lakes Borgne and Pontchartrain. The USACE's district is working on an ecosystem restoration project that would obtain a significant amount of borrow from Lake Borgne and Lake Pontchartrain for wetland creation. Since part of Lake Pontchartrain and all of Lake Borgne is critical habitat for Gulf sturgeon, USACE needed to identify the hard bottom substrates that they forage over when selecting borrow sites to avoid and minimize USACE impacts to the species and critical habitat.

NGDC provided Coastal Models to the NOAA Response and Recovery team, the Naval Oceanographic Office - Mississippi Tactical Division, and to Google in support of the DEEPWATER HORIZON Response and Recovery. NGDC built and distributed 10-meter resolution, digital elevation models (DEMs) for select regions of the U.S. coast that integrate ocean bathymetry and land topography. Three new DEMs were developed for the Gulf of Mexico, covering the area around New Orleans, LA; Biloxi, MS; and Mobile Bay, AL. These DEM can be used for modeling of coastal processes, including contaminant dispersal, habitat management and research, coastal and marine spatial planning, and community hazard mitigation and preparedness.

NGDC developed and delivered a 9 arc-second topographic/bathymetric digital elevation models (DEM) of the Gulf of Mexico to the National Geographic Magazine. William McNulty, the Director of Maps at National Geographic Magazine, contacted NGDC to request an updated model for use as a background image for a supplementary map in an upcoming issue of the magazine. The new DEM includes the most recent NOAA charting data as well as the most recent VDatum and Tsunami community DEMs for the Gulf along with the existing Gulf of Mexico coastal relief (lower resolution) model. The Generalized Bathymetric Chart of the Ocean (GEBCO) 30-meter bathymetric grid was updated and merged with the more recent bathymetric surveys, pre-built DEMs and the Shuttle Radar Topography Mission (SRTM) data for the land relief. While this DEM of the Gulf of Mexico represents the most up-to-date digital elevation data for the Gulf of Mexico, additional improvements will be made as part of the current re-release of the U.S. Coastal Relief Model series.

National Climatic Data Center

NCDC released version 2 of the bias-adjusted temperature data from the U.S. Historical Climatology Network. These data are used to monitor changes in surface temperatures across the conterminous United States and to place them in historical context. The unadjusted data contain non-climatic artifacts that bias temperature trends, some of which are undocumented in station history archives. These artifacts have resulted from factors that include changes in observing practices, instrumentation, and the station environment. For example, the move of a temperature observing station to a nearby location can result in temperatures that are slightly different than they were in the previous location. Unless the temperature record is adjusted to account for this artificial change, the analysis of temperature trends could result in inaccurate conclusions. Adjustments also are required for other artificial influences such as changes in instrumentation or changes in the station environment (e.g., vegetation growth or urbanization). Such changes are sometimes documented in climate records, but often they are not. This effort provided for the first time a data set of conterminous U.S. temperatures adjusted to account for the influence of documented and undocumented changes in the temperature observing record. It is the source of data from which conclusions have been reached regarding trends and variability in U.S. surface temperature; a key component to the recently released US Global Change Research Program report *Global Climate Change Impacts in the United States* (<http://www.globalchange.gov/>).

All efforts to understand how the Earth's climate is changing begin with the study of observed changes in surface temperature. This data set is the cornerstone for the study of climate change in the United States, providing the source of information which establishes the foundation for climate change research and the scientific understanding of how natural and man-made influences have affected the climate of the conterminous U.S. since the 1800s.

NCDC the authoritative source for climate monitoring produced and released The State of the Climate Report. The report is a collection of monthly summaries recapping climate-related occurrences on both a global and national scale. <http://www.ncdc.noaa.gov/sotc/>

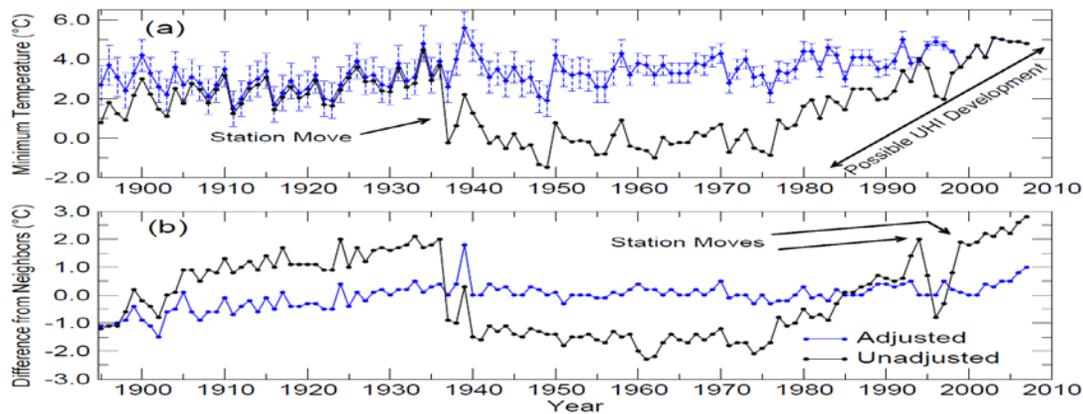


Figure 9. Time series caption

TIME SERIES CAPTION:

- (a) Mean annual unadjusted and fully adjusted minimum temperatures at Reno, Nevada.
- (b) Difference between minimum temperatures at Reno and the mean from its 10 nearest neighbors.

NCDC released the International Best Track Archive for Climate Stewardship (IBTrACS) (<http://www.ncdc.noaa.gov/oa/ibtracs/>) global tropical cyclone dataset, with Version 3 of the dataset officially released in September 2010. Tropical cyclone best track data are used to monitor the positions and intensities of tropical cyclones using data from numerous sources, and best track data typically include the position, maximum sustained wind and minimum central pressure of a tropical cyclone at six hour intervals. New to version 3 is the inclusion of quadrant wind radii for all storms globally during the satellite era, which were determined from infrared satellite observations at six hour intervals.

IBTrACS combines tropical cyclone best track data from many available sources, including the World Meteorological Organization’s (WMO) officially recognized Regional Specialized Meteorological Centres (RSMCs) and Tropical Cyclone Warning Centres (TCWCs) to one location. The data are provided in numerous formats to support the diverse communities worldwide that are interested in tropical cyclones. Thus, IBTrACS facilitates an improved understanding of global tropical cyclone distribution, frequency and intensity. In addition, IBTrACS is now an “officially” recognized source of global best track data. In FY10, the WMO’s Tropical Cyclone Programme endorsed IBTrACS as an “official archiving and distribution source” for tropical cyclone best track data.

The IBTrACS dataset is the first comprehensive, global dataset of tropical cyclone best tracks, and thus for the first time allows users to compare and analyze differences in best track sources and produce comparisons of the intensity estimates from different forecast centers. Therefore, researchers and interested public users no longer need to contact each center to obtain best track data, nor do they need to write user-defined tools to access and analyze data from each agency. IBTrACS currently has over 100 registered users and many other unregistered users world-wide addressing the following societal impact areas: coastal hazards, weather and water resources, insurance and re-insurance, and climate change.

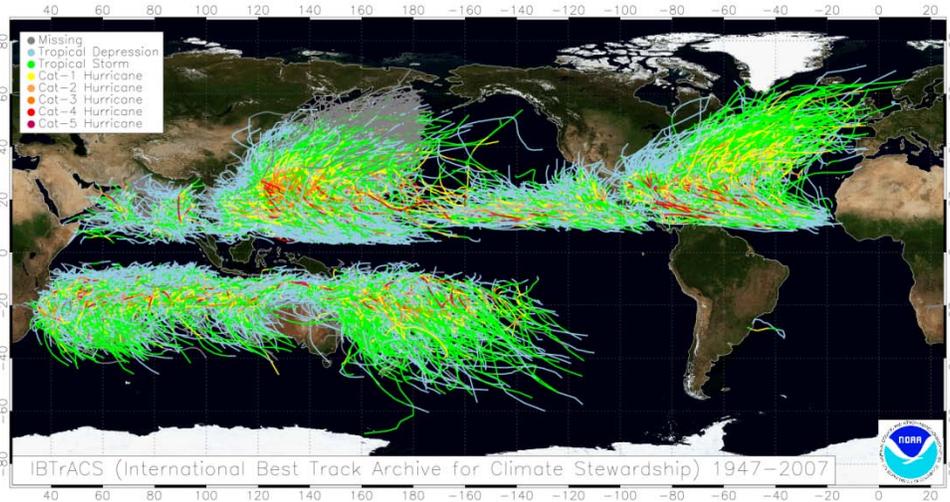


Figure 10. IBTrACS output

NCDC has assembled over 20 years of remotely sensed data from multiple satellite-based instruments from national and international partners; produced a global high resolution sea surface wind product; and distributed this product worldwide to a variety of users that include the offshore energy sector, climate modelers, and the coastal ecosystem community. SeaWinds (<http://www.ncdc.noaa.gov/oa/rsad/seawinds.html>) measurements provide information for several sectors of the public and research communities. SeaWinds provides wind climatologies for the Offshore Wind Energy community; is used by NOAA Coral Reef Watch to predict coral bleaching events; and provides wind stress estimates for the ocean and climate modeling communities, including the coastal ecosystem community to aid in the production of coastal upwelling estimates.

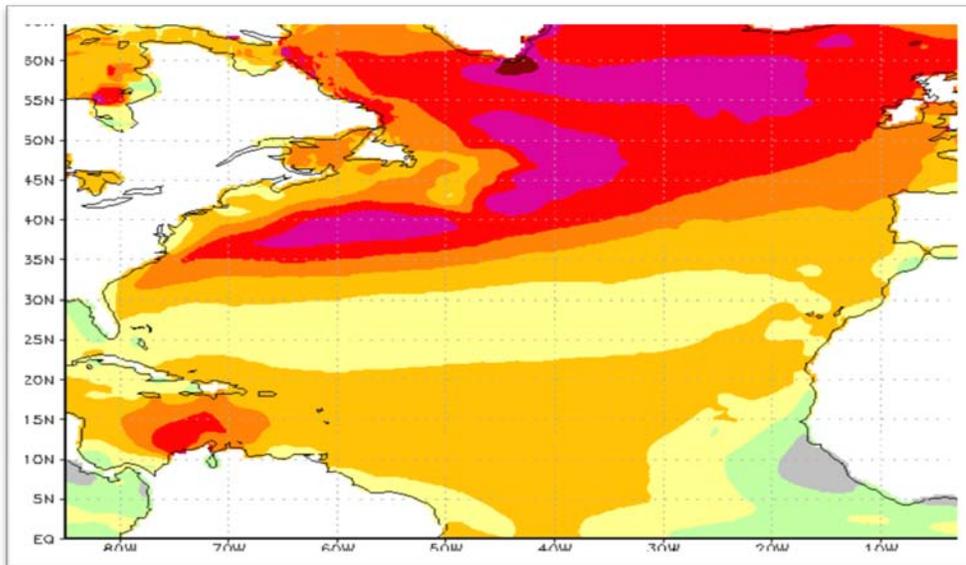


Figure 11. TIME SERIES CAPTION: Wind patterns, determined from NOAA satellite Climate Data Records, play an important role in Wind Energy site selection

NCDC was a key player during FY10 in the NOAA Climate Services Portal effort. The NOAA Climate Services Portal, for its initial prototype, has focused on developing the infrastructure and capacity to showcase a wide breadth of climate information to our users. The process of adding content to this infrastructure is in its early stages and has initially focused on several datasets and products from NOAA's National Climatic Data Center, Coastal Services Center, and Climate Prediction Center, among others. The initial intent is to highlight some of most popular datasets/products based on customer usage of the data. These initial datasets and products represent only a very small fraction of the climate information available across NOAA. Our longer term goal is to present a broader spectrum of climate information as the project matures.



Figure 12. NOAA Climate Services Portal Homepage

Under the new National Climate Model Portal (NCMP), NCDC is the sole provider of the next-generation 30-year analysis (reanalysis) of the coupled earth climate system – the Climate Forecast System Reanalysis (CFSR). This very high volume global analysis is the first major reanalysis generated by NOAA's National Center for Environmental Prediction (NCEP) in over 10 years. NCDC and CLASS ingested/archived over 200 TB's of CFSR data from NCEP during FY10. NCDC used its NOMADS infrastructure to implement a user-friendly suite of tools to allow access to the data – already one of the most requested datasets in NOAA history. Currently NCDC is providing over 70 TBs of CFSR data per month to users.

NOAA Satellite and Information Service
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center
U.S. Department of Commerce

NOAA National Operational Model Archive & Distribution System

Data
[Access](#)
[Inventory](#)

Documentation
[User Guide](#)

NOMADS Project
[About NOMADS](#)
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[Publications & Presentations](#)
[Service Records Retention System](#)
[Plans for the National Climate Model Portal](#)

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The NOAA National Operational Model Archive and Distribution System (NOMADS) is a Web-services based project providing both real-time and retrospective format independent access to climate and weather model data.

Update:
NCEP's Climate Forecast System Reanalysis (CFSR) has new subsets available.
For CFSR data access, please visit [NOMADS](#).
For additional CFSR information, please visit [NCEP](#).

DOC » NOAA » NESDIS » NCDC » NOMADS Search NCDC

Figure 13. CFSR Access via NOMADS

4.3 Innovation in Telecommunications/Technology

As the volumes of NOAA satellite and radar data increase exponentially, telecommunications networks will experience major change. The demands for high bandwidth will require NOAA data centers to utilize some of the networks designed for research, education, and technology development. These networks are consortiums comprised of research and development labs, universities, equipment vendors, and telecommunication network carriers. These include the networks for Internet2/Abilene and National Lambda Rail (NLR).

Additionally, new technologies will be incorporated to distribute critical weather data and products to users throughout academia, research and military environments, as well as businesses and the general public. Some of these technologies will include Multi-Protocol Label Switching (MPLS)-based Internet Protocol (IP), Virtual Private Networks (VPNs), multicasting, grid computing, and shared processing. Multiple data centers and processing centers will be used for processing and archiving data for near-real time access.

Network designs will continue to focus on innovative security arrangements, hardening of the network for Continuity of Operations (COOP) activities, and Critical Infrastructure Protection. Access to the high bandwidth networks will remain a challenge because of on-going cost and band availability issues. The success of the NNDC will depend on the collaborative implementation of new telecommunications and storage solutions.

4.4 Challenges, Risk Ahead, Mitigation Strategies

The data centers continue to mitigate risk through the implementation of tighter security policies and continuous monitoring and code reviews. The use of Virtual Private Networks (VPNs) and the move to servers that support virtual system resource sharing allows for greater utilization of systems and minimizes the computer room footprint. The data centers continue to look for “green” solutions.

With the tentative move of the data centers from NESDIS to the proposed NOAA Climate Service (NCS), the data center managers are prepared for change. An example of a challenge for the data centers will be in the transferring of licenses that were purchased under NESDIS umbrella contracts.

Beginning in FY11 the data centers face the challenge of integration and data migration of the Comprehensive Large Array Storage System (CLASS) into their existing architectures. The data centers are currently working closely with the CLASS teams to help mitigate technical issues addressing tight delivery schedules and heavy workloads.

4.5 Funding Levels

Recent trends in government spending indicate that agencies should not expect significant increases in their budgets. This, coupled with the requirement to accommodate more users and incorporate evolving technology, will force the program to find efficiencies and to do more with the same amount of resources