

**National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service
NOAA National Data Centers (NNDC)
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Operational Analysis
2007**

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Executive Summary

NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) is 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; and the NOAA Central Library is administered by NODC.

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. There are no alternative sources in the public or private sector that can perform the functions of the NNDC. The economic contributions of the NNDC to the Nation are significant.

This operations analysis (OA) for the NNDC Exhibit 300 focuses on the operational state of the umbrella program as of September 30, 2007, and is based on the Department of Commerce (DOC) guidance "Operational Analysis". The associated link is located at: http://ocio.os.doc.gov/ITPolicyandPrograms/Capital_Planning/dev01_003715

This OA is a review of the data centers' information technology infrastructure.

- Customer Results
- Strategic and Business Results
- Financial Performance
- Innovation

The NNDC supports e-Government initiatives by focusing on deployment of all the features provided through the use of Internet standards, which streamlines the finding, accessing, and delivery of data and information from the nation's environmental archives. The current steady state program meets established cost, schedule, and performance parameters. The NNDC is not a typical program, but an umbrella initiative for planning and management of data center resources.

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. 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, National Aeronautics and Space Administration (NASA), state and local governments, and students from all levels of academia.

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. Details can be found at:

http://www.economics.noaa.gov/library/documents/economic_statistics_and_methodology/NOAAEconomicStatistics-May2006.pdf

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 cost to the customer is as low as it could be for the results delivered. There are no alternative sources in the public or private sector that can perform the functions of the NNDC. 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

Below are examples of customer support throughout this past year.

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. The economic contributions of the NNDC to the nation are significant.

Following lessons learned from the aftermath of Hurricane Katrina, the NCDDC embarked on an effort to provide near-real time coastal warning and weather information through a unique portal called Coastal Studies, Information & Data for the Ecosystem (C-SIDE). C-SIDE provides information from over 400 different sources that is made available over the web to both personal computers as well as low-footprint devices such as cell phones and PDAs. C-SIDE tailors observations and forecasts weather warning information to particular geographic areas such as coastal areas or designated evacuation routes. Feedback from the public and NOAA management has been overwhelmingly positive. A broadcast documentary on C-SIDE by Mississippi Public Broadcasting is currently in production for the 2008 hurricane season. In

2007, the technology behind this C-SIDE application was integrated into other portals focusing on ecosystem applications, particularly shellfish management and near-shore and beach water quality monitoring and includes data feeds from the National Estuarine Research Reserves.

In addition to C-SIDE, NODC and NCDDC produced the NOAA Extreme Weather Information Sheet (NEWIS) for the 2007 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. NCDDC developed one unique NEWIS product for each of the states of Texas, Louisiana, Mississippi, and Alabama. Due to its large coastal area, Florida is divided into four different Gulf Coast NEWIS. In 2007, NCDDC and NODC distributed over 150,000 NEWIS in the five Gulf Coast states. PDF versions of NEWIS are available on the NCDDC’s [C-SIDE](#) website. The NEWIS for 2007 received second place in the prestigious Gulf Guardian Awards.

NCDC’s total number of new products developed and placed on-line in 2007 was 129 – more than double the performance measure/target of 60. This resulted in enhanced electronic access to data by the user community, directly facilitating improved research and better climatology forecasting.

Figure 1 shows data delivered on-line through the NNDC to customers through FY07. 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.”

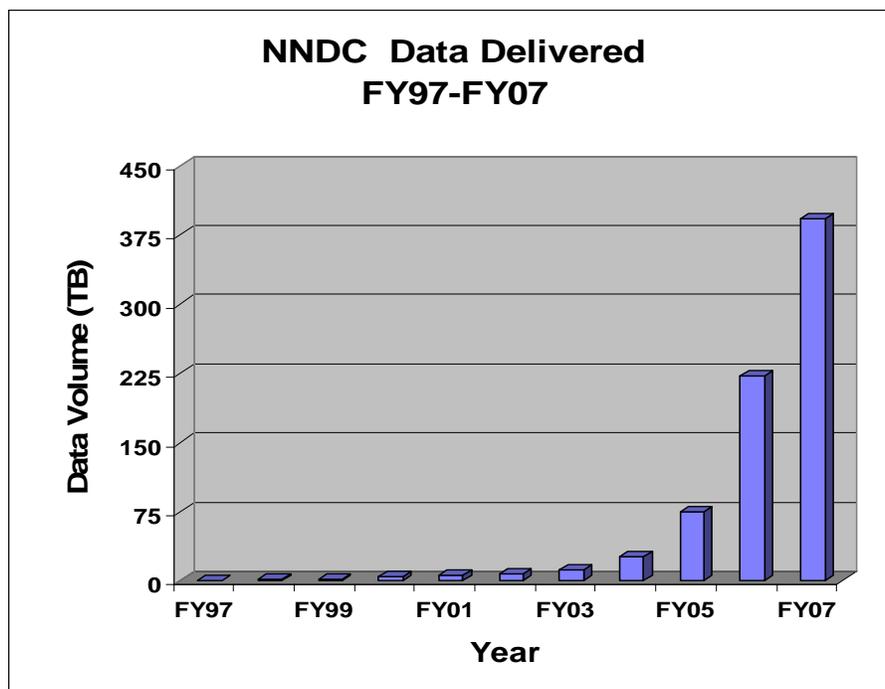


Figure 1. NNDC data delivered to customers

Figure 2 shows customer support at NODC by the increase in the number of Unique Host connectivity, files downloaded, and amount of ocean data downloaded via the NODC on-line access system. In the last 12 years the number of requests from the Unique Monthly Hosts has increased from 94,013 in 1995 to 1,815,743 in 2007. The number of files downloaded has increased from 207,745 in 1995 to 58,736,358 in 2007. The amount of data downloaded has increased from 27 GB in 1995 to 14.234 TB in 2007.

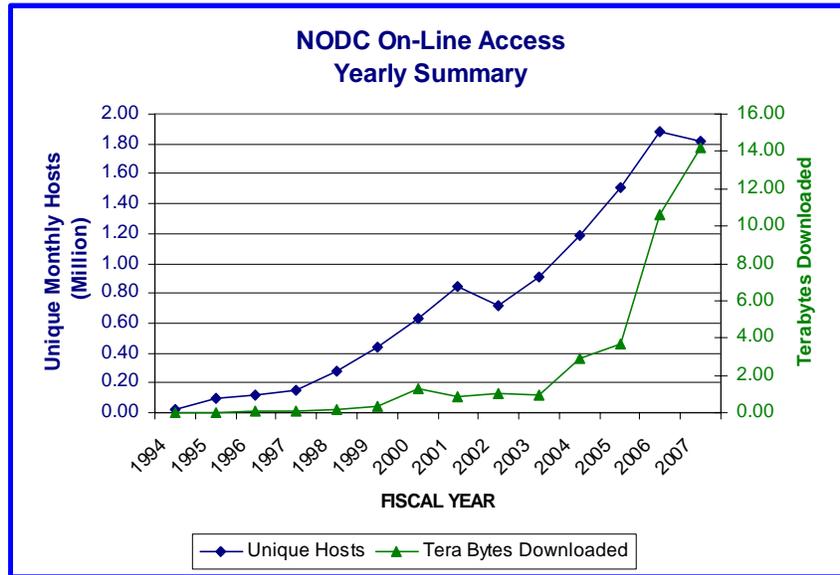


Figure 2. NODC access summary

Figure 3 shows data ingested and made available on-line at NGDC.

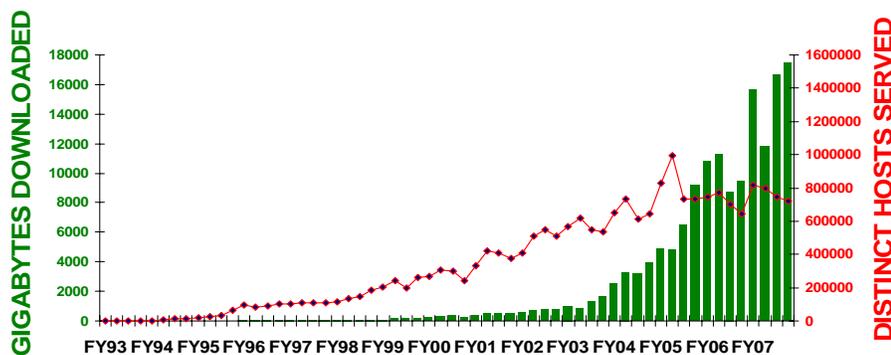


Figure 3. NGDC on-line data available to customers

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 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 2007, NCDDC opened a Regional Ecosystem Data Management (REDM) portal which serves to provide both data discovery and access to coastal data used to develop integrated ecosystem assessments (IEAs). This effort is linked to a research project funded by the Office of Oceanic and Atmospheric Research (OAR) through the Northern Gulf Institute called the Ecosystem Data Assembly Center, which is envisioned by NOAA to become the cornerstone for IEAs commencing in FY 2009. Additionally, NCDDC supports the Commerce and Transportation goal with the development, operation, and maintenance of the Marine Debris web site.

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.
- Development of the Coral Reef Information System (CoRIS).

NGDC has supported the Commerce and Transportation as well as the Weather and Water mission goals by:

- Increasing the volume of the Continuously Operating Reference Station (CORS) Global Positioning System (GPS) data in the archive by five TB.
- Increasing by forty percent the amount of volcanic ash imagery scanned and made available on-line.
- Completing an 11-year archive of space weather climatology and providing access on-line.
- Developing a global tsunami database and making it available on-line.

NCDC focuses on two primary NOAA mission goals: Climate and Weather and Water. NCDC provides quality climate and weather data, information, and 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 Technology Architecture Team (ITAT) 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 ITAT 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 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 NESDIS ITAT also reviews purchase orders for IT assets to ensure compliance with the "to be" architecture and that items purchased are using standard NOAA contracts.

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 program 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.

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 Technology System Security Officers (ITSSOs) and meet once a month to discuss security issues. The ITSSOs ensure that desktop and network security are 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.

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. Figure 4 illustrates the increase in NCDC data delivered on-line from just over 10 GB/quarter in FY 1995 to over 70 TB/quarter in FY 2007. Figure 5 shows the similar increase in data available on-line from FY 1995 through FY 2007, with 1.5 petabytes of data and products now accessible on-line.

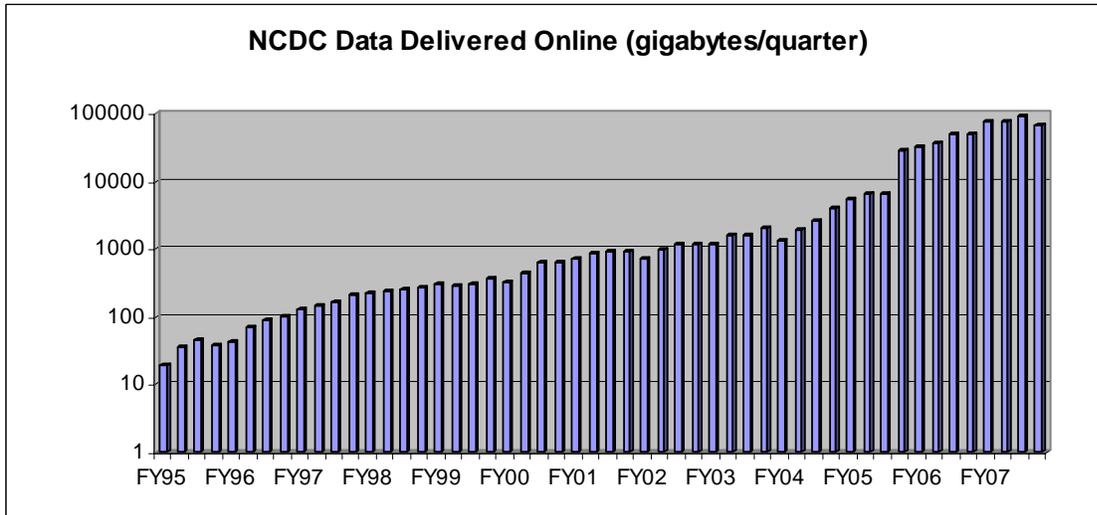


Figure 4. Data delivered on-line

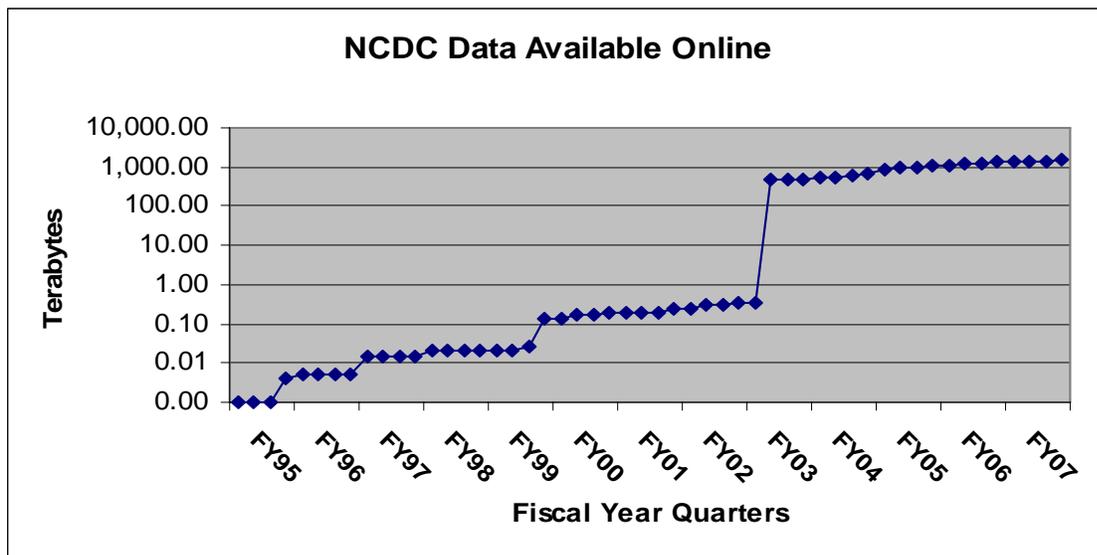


Figure 5. Data available on-line

There are no other organizations capable of doing this work better, more efficiently, or at a lower cost. Details can be found in the NNDC OMB 300 Alternative Analysis section.

3.0 Financial Performance

3.1 Current Performance vs. Baseline

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. During 2007, the data centers consistently stayed within a three percent variance.

3.2 Financial Performance Review

The NNDC funding requirements are listed in each data centers' AMC. All NNDC components produce a yearly Information Technology Financial Report. It is from the consolidation of these financial summaries that the NNDC Exhibit 300 budget line is developed. Detailed financial information for the NOAA Library is located in the NODC AMC. The NOAA Virtual Data System (NVDS) funding line items are located in the AMCs of NCDC, NGDC, and NODC. The Climate Database Modernization Program (CDMP) is also listed in the NCDC AMC.

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.

CDMP, which is a sizeable financial segment of the NNDC, 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. This creates a purchasing mechanism that works better and costs less. The contractors issue monthly invoices for all products and services supplied under the contract. These 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. Progress meetings are conducted to review each task for its progress, quality, and costs. By using the BPA, purchases cannot exceed funds available thus always 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

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

4.1 NOAA Virtual Data System (NVDS)

NVDS provides several major services as a “system of systems” including:

- “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.)

Approximately 1.5 petabytes of data are now accessible on-line from NCDC, with over 2 petabytes accessible from NNDC overall.

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 2007 and provides a direct interface to major data sets. The 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.”

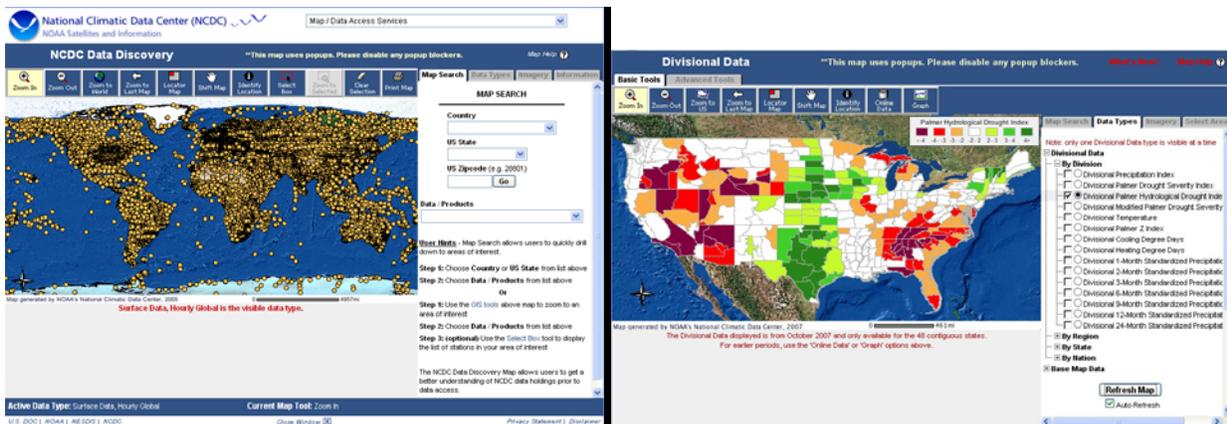


Figure 6. NCDC Data Discovery map interface and sample map of drought data

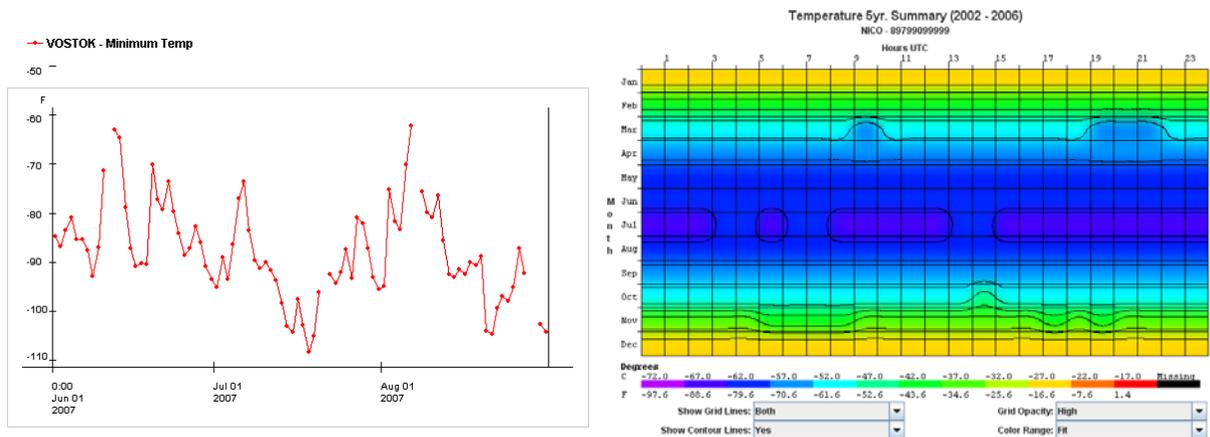


Figure 7. NCDC samples of data visualization

4.2 National Coastal Data Development Center (NCDDC)

The Coastal Data Center continues to provide support to a broad range of customers through a variety of interfaces technologies. The evolution of the Service Oriented Architecture (SOA) continues to focus on a few essential services that support multiple customer applications. In addition, NCDDC also developed a new user-friendly GIS interface to the Phytoplankton Monitoring Network (PMN). PMN is a successful volunteer-based observational program to help identify and catalog harmful algal species as well as link the general public with NOAA and academic institutions. The interface combines photographs of individual plankton to assist the PMN volunteer as well as references, database, and mapping functions. As a part of C-SIDE innovations discussed in section 1.2, NCDDC developers exploited the use of Really Simple Syndication (RSS) services to provide the backbone of data transport. The RSS data stream was enhanced by NCDDC to adhere to a geo-RSS format allowing those data streams to be easily mapped on simple interfaces such as Google Maps. The Google Map capability provided a familiar interface to NOAA data that is already in common use by the public and has been incorporated into the Ocean Exploration project. Additionally, NCDDC provided the necessary GIS coding to translate World Ocean Atlas (WOA) from NODC into ArcGIS format for download to the public.

4.3 National Oceanographic Data Center (NODC)

4.3.1 Enhanced Web site design and Web applications

NODC enhanced the overall public Web interface as well as several applications such as the NODC Ocean Archive System interface. The use of syndicated RSS feeds has been implemented on several projects to provide real-time notices of updates. The process of abstract writing for historical NODC ocean data sets was also streamlined, resulting in a three-to-four fold increase per month.

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 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.

4.3.2 IT Security

NODC's IT Division worked extensively on Certification and Accreditation to document its security posture. A crucial risk-assessment report was completed along with other related IT activities such as encrypting laptops and PDAs, applying critical software upgrades, and updating the business continuity plan (BCP/COOP). Redundant data acquisition was also implemented on NODC's Data Center Critical Backup (DCCB) system at NGDC.

4.3.3 NODC Supports High-level NOAA Projects

NODC provided extensive support to high-level projects such as the Comprehensive Large Array-data Stewardship System (CLASS), the Ocean Explorer Program's Exploration Command Center, NOAA's All-Hazard Monitor (NOAAWatch), and the Coral Reef Information System (CoRIS).

4.3.4 High Resolution Sea Surface Temperature at NODC Exceeds 7 TB

Satellite-based Sea Surface Temperature (SST) data sets, which are fully compliant with the research standard for the Global Ocean Data Assimilation Experiment High Resolution Sea Surface Temperature (GHRSSST) specifications, are being provided to the NASA's Jet Propulsion Laboratory – a Global Data Assembly center – and then automatically archived at the NOAA National Oceanographic Data Center's GHRSSST Long Term Stewardship and Reanalysis Facility (LTSRF, <http://ghrsst.nodc.noaa.gov>). As a partnership from satellite operations worldwide, over 20 distinct products arrive daily from national and international satellite sensors such as NOAA's Polar Orbiting Satellites instrumented with Advanced Very High Resolution Radiometer 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). Several new products were available in 2007, including Remote Sensing Systems' retrospective TMI data back to 1998 and AMSR-E data back to 2002. Also, two new daily Level 4 high resolution analyses from NCDC have entered the system, one using AVHRR and AMSR-E back to 2002, and the other based on AVHRR back to 1985. Overall, the LTSRF archive has grown tremendously during 2007 and now exceeds 7 TB and 400,000 network Common Data Format (netCDF) files.

4.3.5 Improved access to World Ocean Database 2005 (WOD05)

The main access tool for WOD05 is *WODselect*, an on-line selection tool for extracting subsets of the WOD05 based on geographic area, date, type of measurement, depth of measurement, type of instrument, ship, project, institute, primary investigator, specific cruise, or specific data submission. To accommodate users who want to download all or a subset only, *WODselect* has selection tools and data transfer options. 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. Further, 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/special circumstances with these oceanographic data.

4.3.6 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 bandwidth availability issues. The success of the NNDC will depend on the collaborative implementation of new telecommunications and storage solutions.

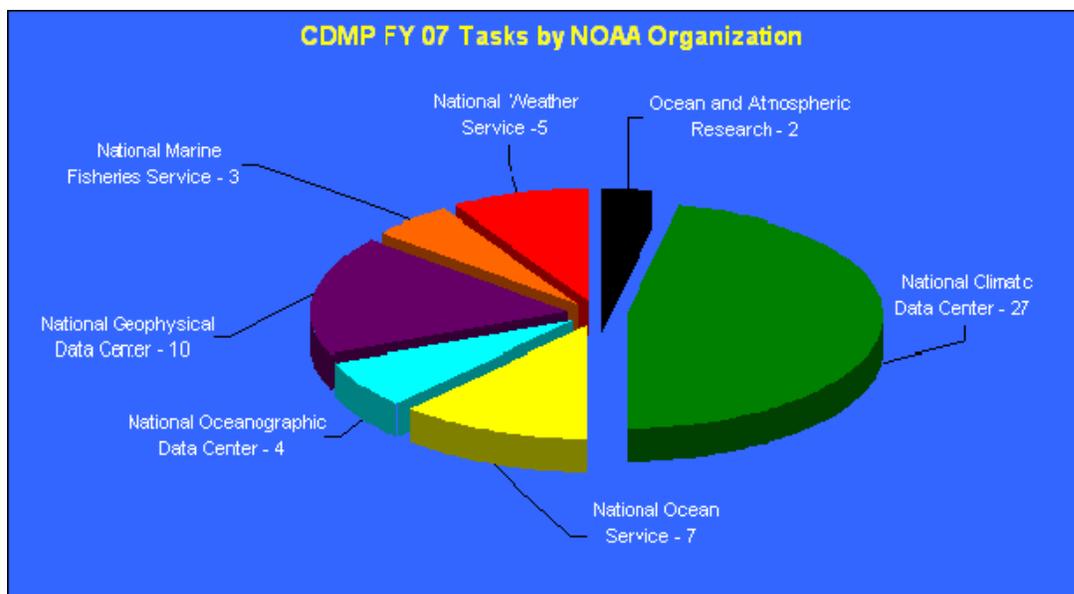
4.4 Climate Database Modernization Program (CDMP)

The Climate Database Modernization Program (CDMP) is managed by NCDC and its main mission is to preserve and provide easy access to NOAA's climate and environmental data. The

establishment of trends of environmental change – their magnitude, direction, and geographic variation – generally requires the ability to detect small changes in the data against a noisy background. This is true whether the subject is atmospheric mean temperature, ocean currents, or marine ecosystems. CDMP supports NOAA’s 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.

CDMP’s investment in technology has paid great dividends allowing NOAA to preserve valuable records (including backups) and make the information readily accessible via the Internet. Through CDMP, NOAA works with conversion contractors to develop ways of utilizing the latest technology for imaging and keying data into its databases. Once converted to a digital format, these records will become even more widely accessible in the future through various search engines on the web.

In 2007, CDMP had 58 separate NOAA data rescue projects that span the full spectrum of NOAA and support all five line offices. Millions of historical data records have been keyed and integrated into NOAA digital databases. These efforts not only benefit NOAA, but researchers and data users across the globe.



4.5 National Geophysical Data Center (NGDC)

The National Geophysical Data Center (NGDC) provided many new and improved data sets and information products during FY 2007 to support NOAA national and international programs to save lives, manage environmental resources, and turn raw data into useable and easily understandable information. Some examples of these accomplishments include the following:

- Bathymetric Maps for Tsunami Buoy Deployment: NGDC has produced 31 custom bathymetric maps for National Data Buoy Center (NDBC) use as a pre-cruise aid in the

deployment of Deep-Ocean Assessment and Reporting of Tsunamis (DART) buoys. DART buoys play a key role in the detection and warning of tsunami, allowing more rapid and accurate issuance and cancellation of warnings.

- **Tsunami Inundation Digital Elevation Models (DEMs):** NGDC compiled 21 new DEMs from the best available digital data obtained from U.S federal, state, and local agencies, and will increase the accuracy of NOAA's tsunami modeling efforts and inundation forecasts. Although infrequent, tsunami waves have caused considerable damage and loss of life in U.S. coastal areas. The NOAA/NGDC development of coastal digital elevation models is an integral part of NOAA's effort to forecast tsunamis and deliver accurate and timely warnings.
- **Gas Flaring Study:** NGDC produced the first globally consistent survey of natural gas flaring volumes using low-light imaging data from the Defense Meteorological Satellite Program Operational Linescan System. The flaring is used to dispose of natural gas in remote oil producing locations where there is no infrastructure to make use of the gas or bring it to market. NGDC's results indicate that in 2006 global gas flaring totaled 168 billion cubic meters – this is more natural gas than the combined use of Japan, China, and India. Using satellite data, NGDC was able to triple the number of countries with gas flaring estimates and discovered that Russia – not Nigeria – is the number one gas flaring country in the world.
- **Marine Geology Data to Help Characterize the Extended Continental Shelf:** NGDC staff are working with the University of Colorado's Institute for Arctic and Alpine Research (INSTAAR) to develop marine geology science products describing the sea bottom that will help the U.S. characterize the Extended Continental Shelf (ECS FY 2008 interagency initiative) and related ecosystem products. NOAA generates a wealth of data describing sea floor sediment composition during its hydrographic surveys and other research operations. NGDC and INSTAAR propose to gather, organize, augment, and integrate these data into geospatially-enabled data layers and to produce derived information products for evaluation of the extended continental shelf around Alaska.
- **Solar Cycle Prediction Report:** An NGDC scientist served on the Solar Cycle 24 Prediction Panel chaired by NOAA. The panel of scientists from NOAA, NASA, and the International Space Environment Services (ISES) is charged with arriving at the official prediction for the next solar cycle (Cycle 24) including the dates for the upcoming solar minimum and maximum as well as the magnitude of the maximum in the approximate 11-year solar cycle. The panel has 12 voting members, including international representatives.
- **North American Impervious Surface Areas Spatial Distribution & Surface Density:** NGDC's Earth Observation Group recently completed a global map of impervious surface areas based on nighttime lights data from DMSP and population data from the Oak Ridge National Laboratory Landsat Data set.

- Animation on National Geographic Channel: An animated dive through the Mariana Trench, produced by NGDC, was included in two episodes in the National Geographic Channel program series “Amazing Planet.” Digital bathymetric data underlying the rendered animation were the newly released NGDC 2-minute world elevation grid. Digital elevation data support a broad range of research and educational activities.
- High-Resolution Crustal Geomagnetic Field Model Released: NGDC released a high-resolution crustal geomagnetic field model with 15-minute angular resolution. An 8-fold increase in resolution of the new model was achieved by combining the latest magnetic measurements of the German CHAMP satellite with NGDC’s extensive holdings of marine and aeromagnetic data. Combining these data (collected over the past 50 years) into a consistent global magnetic model proved to be a challenging task due to the continually changing main core field and large variations in data quality and coverage. The model can be used to predict the crustal magnetic field vector at any given point at or above the Earth’s surface.
- New World Digital Elevation Model On-line: NGDC released Earth TOPOgraphy (ETOPO2v2), a new-and-improved 2-minute database of world elevations (bathymetry and topography). This new release contains data from higher-resolution sources for coastal U.S. waters and new data for the U.S. Great Lakes and the Caspian Sea. Two new shaded color relief globe posters and an updated color relief slide set derived from the spectral-color images are also available. Digital elevation data support a broad range of research and educational activities.
- New Volcanic Eruptions Database Released: NGDC released the Significant Volcanic Eruptions Database as part of its ongoing effort to develop an integrated natural hazards database. The integrated database links earthquakes, tsunamis, and volcanic eruptions providing death and damage information. The NOAA/NGDC and co-located World Data Center long-term integrated hazards archive provides data essential for hazard assessment, improved data for research, and assured access to data related to past hazardous events.

5.0 NNDC Summary

This annual review of the NNDC program has demonstrated that the NNDC have exceeded their performance measures for 2007, surpassed projections for new products, and continued to ingest, archive, and make accessible data and products that are timely for the customer(s) within their planned 2007 budgets.