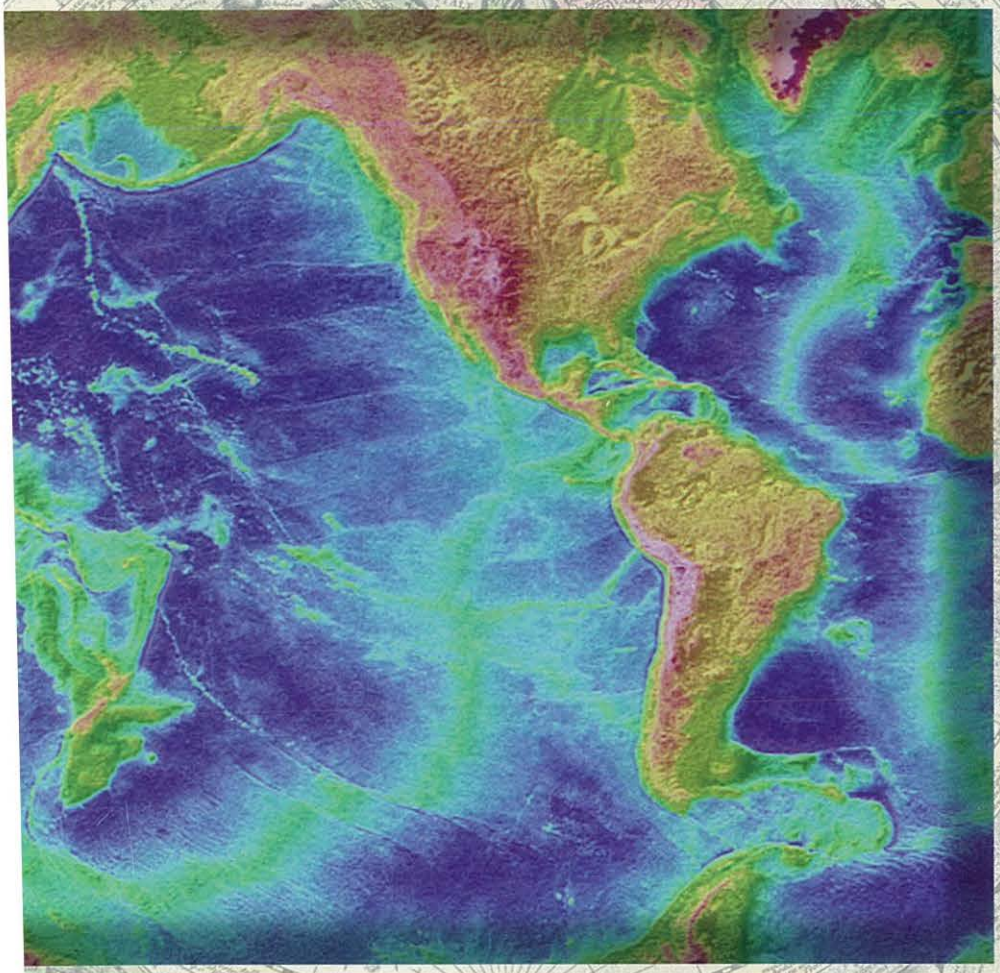
National Environmental Satellite, Data, and Information Service

1996-97



Highlights of 1996-97

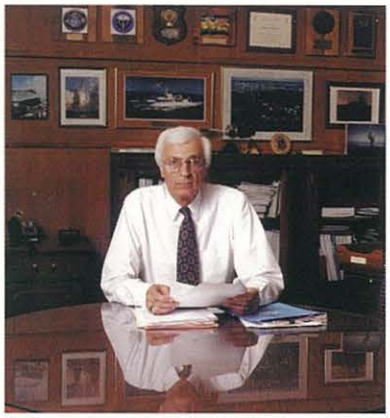
On the cover:

Map of the World's sea floors produced using data from satellites in addition to depth sounding from ships. Further information and images available at: http://www.noaa.gov/mgg/image/seafloor.html

U.S. Department of Commerce
William M. Daley, Secretary

National Oceanic and Atmospheric Administration
D. James Baker, Under Secretary

National Environmental Satellite, Data, and Information Service
Robert S. Winokur, Assistant Administrator



Foreword

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL ENVIRONMENTAL SATELLITE, DATA,
AND INFORMATION SERVICE
Washington, D.C. 20233

During 1996 and 1997, with the support of our parent organizations, the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of Commerce, the National Environmental Satellite, Data, and Information Service (NESDIS) met or exceeded all of the milestones we set for ourselves. These milestones were based on providing better services and products to our broad-based constituency and to ensure that we continue to play an important role in public safety, protection of property, national security, sustainable development, and environmental security.

Examples of NESDIS accomplishments include the successful launch of the GOES-10 satellite and recovery after its tracking ability unexpectedly ceased operation, the transition of DMSP operations from the Air Force to NOAA, and guiding an interagency task force to assess the feasibility of establishing a Global Disaster Information Network for the Office of the Vice President. NESDIS also developed, and significantly expanded, NOAA's role in an interagency program to use data from all satellite sources (domestic and foreign) for detecting and monitoring wildfires and volcanic eruptions. New antennas were procured to provide improved POES and DMSP operations and a new GOES antenna backup site was selected.

The three National Data Centers continued to set records for the number of users they served and the number of data they archived. The first National Data Center Business Plan to guide NOAA's Virtual Data System (NVDS) was completed and the development of NVDS continues. Numerous new products were introduced such as satellite-derived precipitation estimates, snow cover, high-density winds, drought index, moisture soundings, sea-surface winds, ice cover and oil spill detection, on-line access for the Coastal Ocean Forecasting System and beach water temperature, as well as pilot projects for fisheries applications.

In this report you will find a brief description of NESDIS today, our efforts in partnership building, a select list of new products, and a brief enumeration of future plans. You will also find many photographs of our most valuable asset--our employees. Without these hard-working, dedicated employees none of the above accomplishments would have been possible. I hope you will find this report interesting and informative.

Robert S. Winokur
Assistant Administrator for
Satellite and Information Services

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Part I.

Introduction

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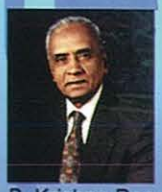
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FY 1997

NESDIS Today

The National Environmental Satellite, Data, and Information Service (NESDIS) is the world's largest civil operational, environmental space organization. We operate the Nation's civil geostationary and polar-orbiting environmental satellites and manage the largest collection of atmospheric, geophysical, and oceanographic data in the world. From these sources, we develop and provide environmental data and information products and services critical to the provision of weather warnings and forecasts, protection of life and property, the national economy, energy development and distribution, global food supplies, and the development and management of natural resources.

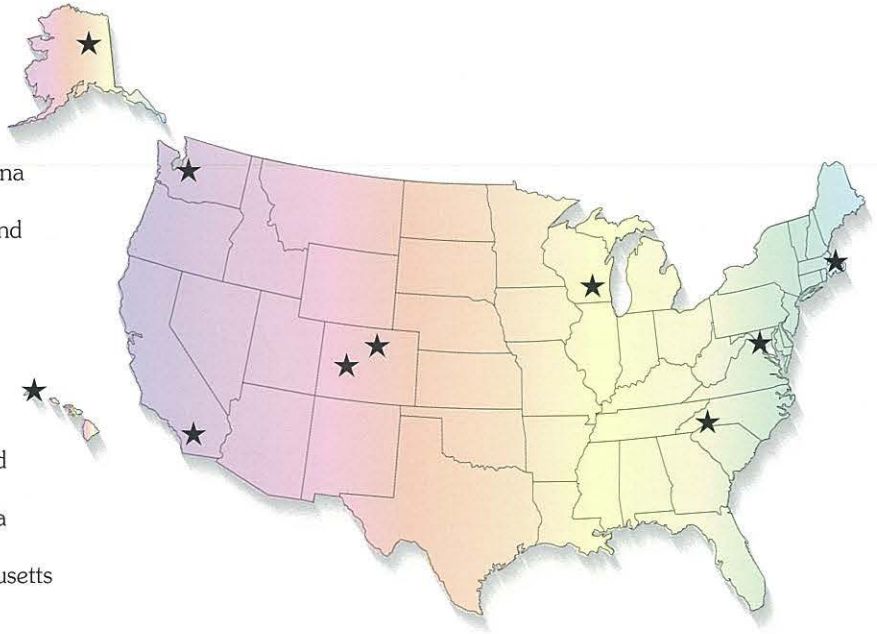
In the world of satellites, NESDIS maintains a robust geostationary (GOES) and polar (POES) program: GOES 8 and 9 with 10 as a spare for the geostationary and NOAA 14 and 11 with pieces of 9 and 12 for the polar.

In the world of data centers, all three (National Climatic Data Center, National Geophysical Data Center, and National Oceanographic Data Center) continue to make record number of users, and are adding a record number of data each year. NCDC, NGDC, and NODC together maintain over 400 terabytes of data and over 3 million satellite images.

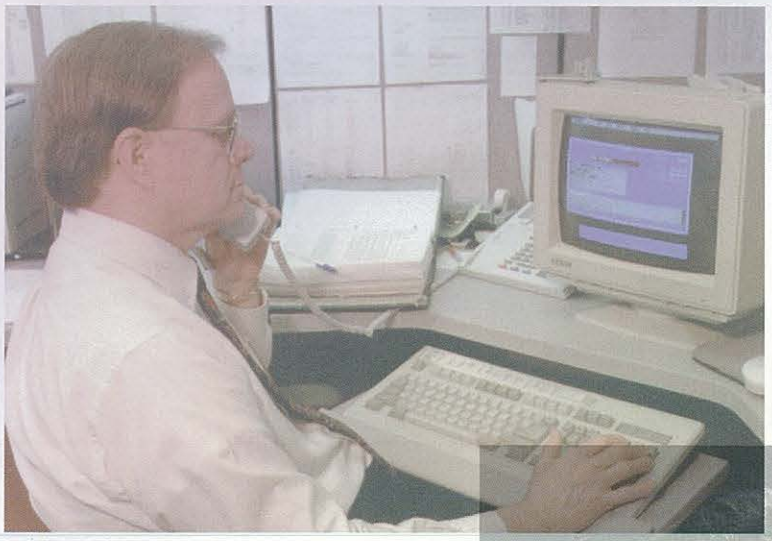
With these satellite and data center capabilities, NESDIS is truly proud to be a significant contributor to the Nation's information age.

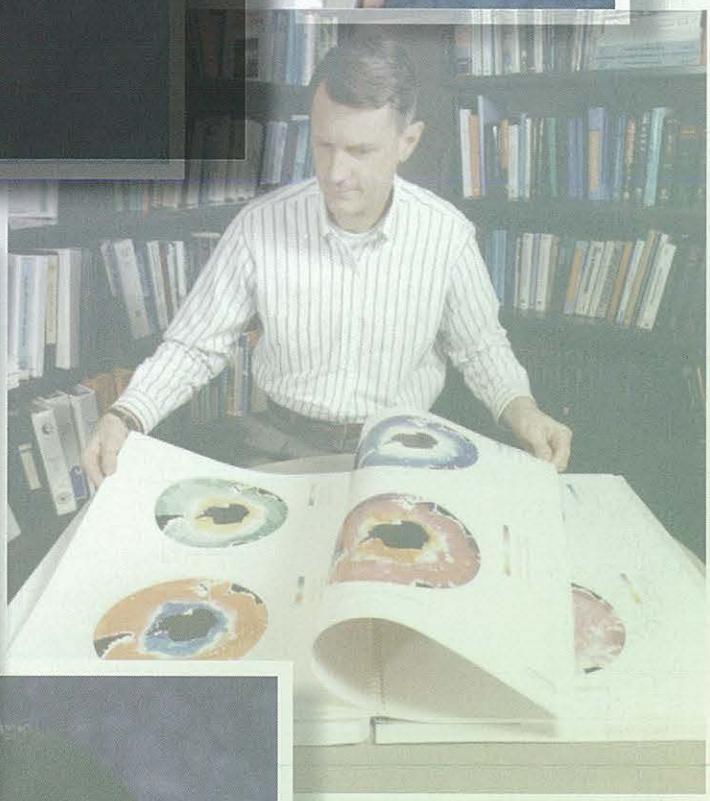
NESDIS Locations

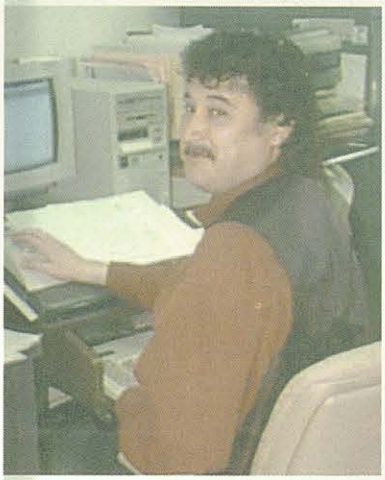
Asheville, North Carolina
Boulder, Colorado
Camp Springs, Maryland
Fairbanks, Alaska
Fort Collins, Colorado
Honolulu, Hawaii
La Jolla, California
Madison, Wisconsin
Miami, Florida
Seattle, Washington
Silver Spring, Maryland
Suitland, Maryland
Wallops Island, Virginia
Washington, DC
Woods Hole, Massachusetts



Part II.
Highlights of 1996-97





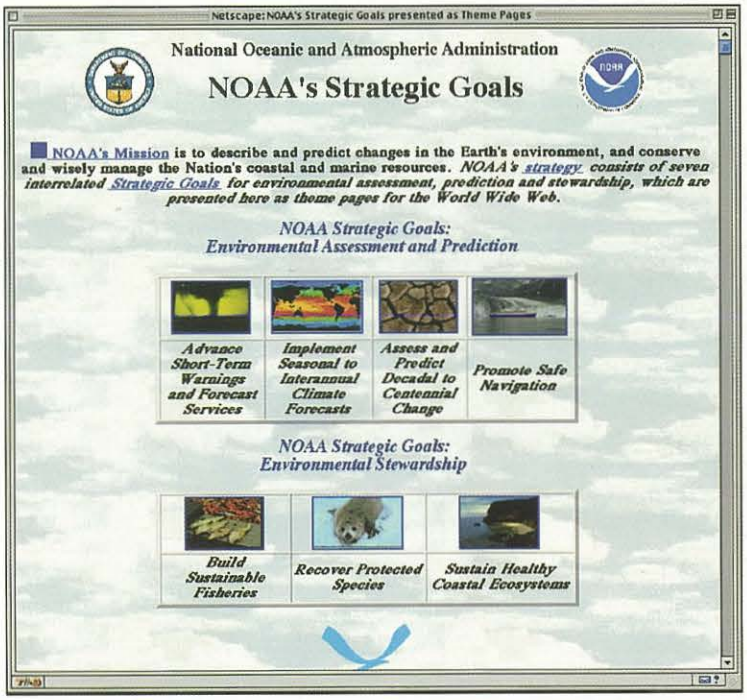


NOAA's Strategic Plan

The National Oceanic and Atmospheric Administration's (NOAA) Strategic Plan sets forth seven interrelated goals grouped into two primary missions:

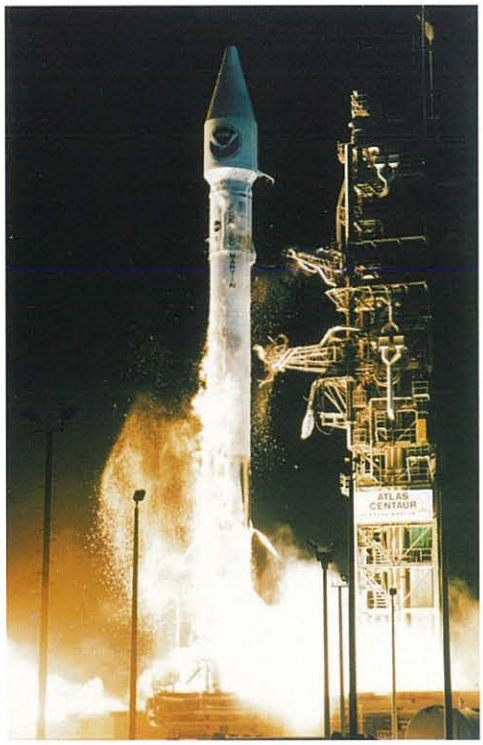
- Environmental Assessment and Prediction Mission
  - Advance Short-Term Warning and Forecast Services
  - Implement Seasonal to Interannual Climate Forecasts
  - Predict and Assess Decadal to Centennial Change
  - Promote Safe Navigation
- Environmental Stewardship Mission
  - Build Sustainable Fisheries
  - Recover Protected Species
  - Sustain Healthy Coasts

Execution of this goal-based strategy depends strongly on the underlying capabilities of the agency as a national resource for observing systems, research, and environmental data and information services. As operator of the Nation's civil operational environmental satellite system, NESDIS is an essential partner in the accomplishment of NOAA's strategic goals. NESDIS' services as archivist for the Nation's oceanographic, geophysical, and climatic data holdings provide a solid foundation for NOAA's goal-oriented activities. Research activities within NESDIS yield new applications for environmental observations and improved understanding of our environment drawn from both historical and contemporary data and observations.



Geostationary Operational Environmental Satellites

GOES Accomplishments



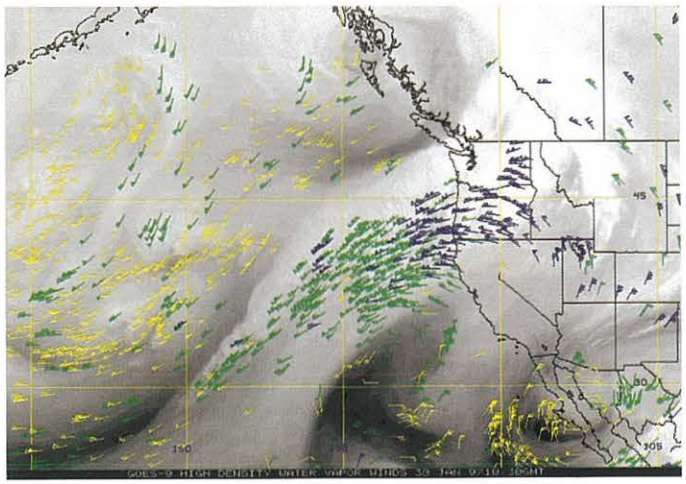
GOES-10 launch April 25, 1997.

GOES-8, stationed over the equator at 75 degrees West longitude, and GOES-9, stationed over the equator at 135 degrees West longitude, provide meteorologists with simultaneous imaging and sounding stretching from the west coast of Africa in the East to beyond the International Date Line in the West. Armed with this vast array of information, the meteorological community continues to devise and NESDIS implements any one of several diverse operational schemes to aide in the tracking of tropical systems, rapidly developing east coast storms, damaging thunderstorms and accompanying tornadic activity, and Pacific winter storms. Despite the growing complexity of the operation, the Office of Satellite Operations continued to deliver over 99.7 percent of all available data.

The GOES-10 spacecraft was launched in April 1997 and entered into the activation, characterization, and test phase at 105° W. During the early part of this checkout, the Solar Array began to hesitate and finally stopped moving. Without the array's ability to track the Sun, the satellite would be useless as an Imaging/Sounding platform. NOAA, National Aeronautics and Space Administration (NASA), and Space System/Loral (SS/L) engineers spent countless hours first analyzing then developing and testing the inverted mode of operating the satellite. In this mode, the Solar Array's ability to move unencumbered in the reverse direction actually tracks the Sun in the new inverted orientation. Having solved the power question, engineers next tackled the complex problem of scanning in the inverted orientation, then processing and retransmitting GVAR data in such a way that they could be utilized at the user location without impacts as a result of the inverted operating mode.

Improvements in Quantitative GOES Products

GOES-8/9 imager and sounder data are being used to derive high-density atmospheric winds. These data are invaluable over data-sparse oceanic regions in weather analysis and forecasting. During the 1996 hurricane season, use of the "high-density winds" was shown to improve the forecasts of storm movement and landfall in several cases. This has the potential of reducing the size of the coastal area evacuations, resulting in significant cost savings to the public.

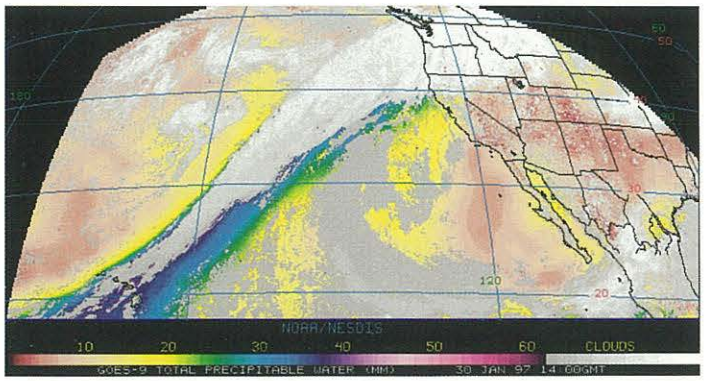


High density winds derived from GOES-9 water vapor imagery.

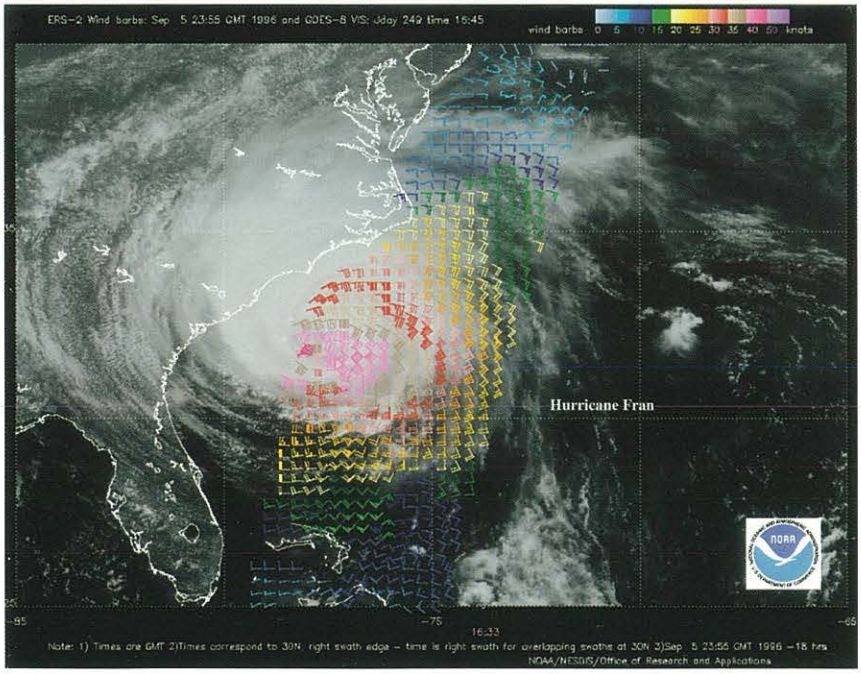
GOES-8/9 atmospheric soundings of temperature and humidity are now available every hour over the continental United States and adjacent ocean areas. The use of GOES-8/9 humidity measurements was shown to improve the skill of computer precipitation forecasts over the United States. Atmospheric stability parameters derived from soundings are expected to improve the analysis and forecasting of severe thunderstorms and tornadoes over the United States.

False color images of atmospheric parameters, including moisture, stability and surface temperature, are produced hourly from GOES-8/9 data. These "derived product images" (DPI) depict fine-scale atmospheric and surface features unavailable from traditional observing systems, and used to fine tune local weather forecasts. A special study investigating "lake effect" snow events over the Great Lakes is making use of the high-resolution moisture information available from the GOES-8 DPI product.

Cloud height and amount information is produced hourly from the GOES-8/9 sounder data over the United States. This product is used to supplement the Automated Surface Observing System (ASOS) by providing cloud information above 12,000 feet. Hourly cloud information also is used for verification of numerical weather forecasts.



False color depiction of atmospheric humidity from GOES-9.

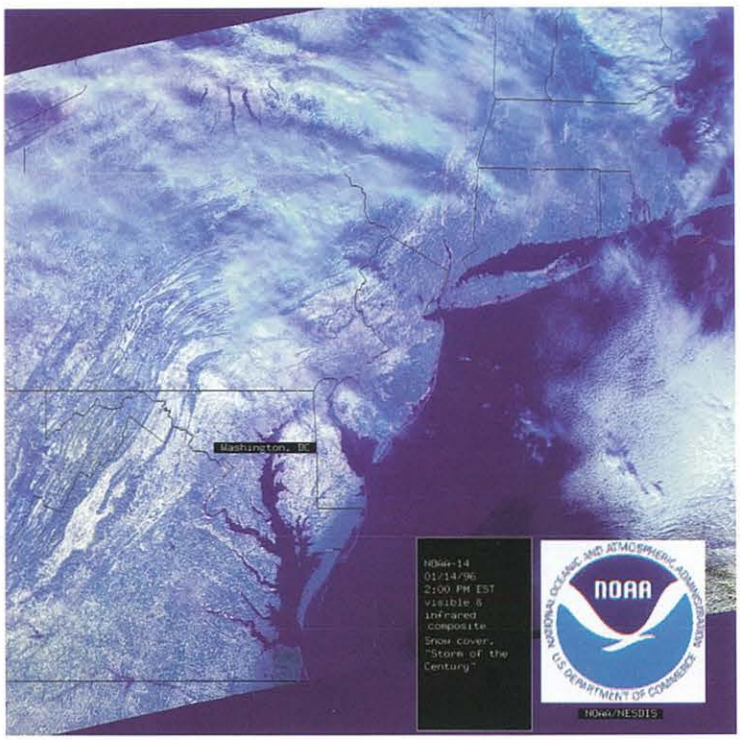


ESA ERS-2 scatterometer ocean surface winds overlayed on a visible image obtained from GOES-8.

Polar-Orbiting Operational Environmental Satellites

POES Accomplishments

Degradation to the NOAA-12 High Resolution Infrared Radiation Sounder necessitated returning NOAA-11 to an operational status and combining NOAA-11 HIRS data with the remainder of the NOAA-12 instrument suite to support the AM Orbit. Along with NOAA-14, supporting the PM Orbit, the trio of satellites continue to provide the meteorological community global weather information. In addition, these satellites continue to provide invaluable scientific data to assess ozone distribution and forecast the effects of solar activity on communication and electric power systems. The value of the satellite's search and rescue systems cannot be overstated. Older satellites (NOAA-9, NOAA-10, and NOAA-11) are still providing essential, although limited, measurements of longwave and shortwave radiation from the Earth and the total radiation from the Sun, support real-time search and rescue operations, and backup the collection of ozone data by the primary satellite. The Office of Satellite Operations continues to enjoy a greater than 99.7 percent success rate of all scheduled data.



NOAA-14 image showing snow cover.

POES Plans

NESDIS is preparing for the launch of NOAA-K in the spring of 1998. NOAA-K is the first POES satellite to utilize an S-Band Command Link and a larger Standard Computer Processor.

Polar-Orbiting Satellite Convergence

The National Polar-Orbiting Operational Environmental Satellite System (NPOESS) is a Presidentially directed tri-agency program that must satisfy both civil and national security needs for space-based, remotely-sensed environmental data. It resulted from the recommendations contained in the Vice President's National Performance Review (NPR) and is a centerpiece for the Department of Commerce's efforts in support of the NPR.

During fiscal year 1996, the Integrated Program Office proposed the Optimized Convergence System approach. The overall life cycle cost of this program has been reduced further, resulting in an additional $450 million in savings which is significantly in excess of the NPR target of $1.3 billion. The proposed system will achieve significant cost reduction and future cost avoidance to the government by developing a strategy to better use existing and planned assets, modify existing assets, emphasize early risk reduction on only the critical aspects (sensors and algorithms), and better leverage technology developments of NASA, the Department of Defense (DOD), and industry to meet NPOESS needs.

During fiscal year 1997, the Integrated Program Office gained approval from the NPOESS Executive Committee (EXCOM) for a rebaselined plan for NPOESS that delays the need date for the first converged satellite by 25 months, makes better use of existing and planned assets, provides NPOESS-like data to users earlier and yields substantial additional savings in program outlays. The IPO initiated this optimized plan in fiscal year 1997 with modest system architectural studies and a robust sensor risk reduction effort focusing on early development of the critical sensor suites and algorithms necessary to support NPOESS. The EXCOM approved the achievement of Acquisition Milestone 1 and the release of Request for Proposals to industry for development of five of the critical sensors for NPOESS in March 1997. The IPO successfully conducted a source selection from interested offerors and awarded multiple risk reduction contracts for the five instruments on July 31, 1997. These contracts have a potential value of $149 million.

Operational science algorithm teams were established to review industry algorithm approaches, thus providing a quality assurance process. The teams represent a diverse spectrum of talent from both government and academia.

In addition, plans are well on track to combine the command, control, and communications responsibilities for the Defense Meteorological Satellite Program (DMSP) with POES under NOAA operation at Suitland, Maryland, in September 1998. In addition, three new 12-meter antennas, capable of supporting POES, DMSP, and NPOESS are currently under contract and being installed by the Integrated Program Office (IPO) at NOAA's Fairbanks, Alaska, Command and Data Acquisition (CDA). Dedication and operational use of these antennas will occur in June 1998.

Ground Systems

Command and Data Acquisition Stations

CDA Station at Wallops, Virginia.

The Wallops Command and Data Acquisition backup station for GOES support in the event of a catastrophic occurrence is well underway. The Goddard Space Flight Center will house this vital link, assuring continued satellite imagery in the event either Wallops or the Satellite Operation Control Center (SOCC) are inoperable for an extended period of time. The communication link study is complete and procurement of government furnished equipment is underway. The NASA Facilities Study completion has cleared the way for the award of the installation and integration contract.

Antennas at Wallops CDA.

SATAN at Wallops, Virginia.

CDA Station at Fairbanks, Alaska.

NESDIS Installed ADEOS and RADARSAT Ground Communications Network

Two dedicated T1-class communications circuits were installed between NOAA's Washington, DC, processing center and the two U.S. ground stations: the Alaska Synthetic Aperture Radar (SAR) Facility (ASF) at the University of Alaska, Fairbanks, and the NASA Wallops Flight Facility (WFF) in Wallops Island, Virginia. The ASF, RADARSAT SAR imagery is transmitted to NOAA's central facility. NOAA is connected to the Jet Propulsion Laboratory (JPL), Goddard Space Flight Center (GSFC), and the Japanese Space Agency (NASDA), via NASA's EOSDIS Backbone Network (EBNet).

Commercial Remote Sensing

Increase in Licensing

Activity in the licensing of commercial remote sensing systems continued to grow in 1996-97 with the issuance of 2 new licenses bringing the total to 11. As licensees realized their development plans and moved closer to launch, NOAA approved numerous license amendments and agreements.

The goal of this program is to support and enhance the competitiveness of U.S. remote sensing space capabilities while at the same time protecting U.S. national security and foreign policy interests. Another goal is to assist the defense industry in finding new commercial applications for defense technologies.

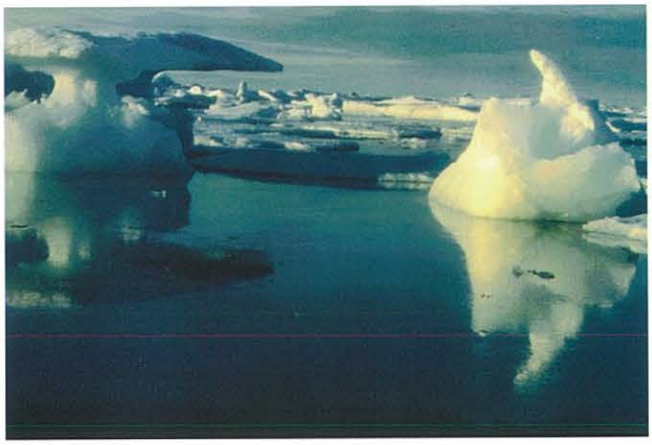
License requests are reviewed on a case-by-case basis with national security and international obligations protected by specific conditions listed in the license itself. In an effort to update government regulations, NOAA held a public meeting with industry in 1996 to discuss issues which insure that oversight is simple, transparent, and predictable. With the input from this meeting, NOAA began drafting new licensing regulations. A NOAA-Commerce Department Task Force developed new proposed regulations to address these issues, and submitted them for interagency review in mid-1997. On November 3, 1997, the proposed regulations were published in the *Federal Register* for public comment. NOAA also worked with the administration and Congress on a new Space Commercialization Bill introduced in 1997 which contained a title devoted to NOAA's licensing functions.

Real-Time Products and Services

Ocean Remote Sensing

On August 17, 1996, (Japan time), NSCAT was successfully launched aboard the Japanese Advanced Earth Observing Satellite (ADEOS). After ADEOS was declared operational, NESDIS began distribution of NSCAT products to operational meteorological centers, beginning April 15. However, ADEOS ceased operations on the morning of June 30, Japan time, due to a suspected failure of the satellite's solar array. Before the ADEOS failure, NSCAT data were acquired by NOAA within 2.5 hours of observation, processed to vector winds, and distributed to meteorologists at National Weather Service Marine Prediction Center and Weather Field Offices with marine responsibilities to aid in storm prediction. In addition, efforts were underway to incorporate NSCAT wind data into the National Weather Service's weather prediction models to enhance global and regional analysis and forecasting of oceanic weather systems. These data were also being provided to meteorological agencies in Europe and Japan for their use.

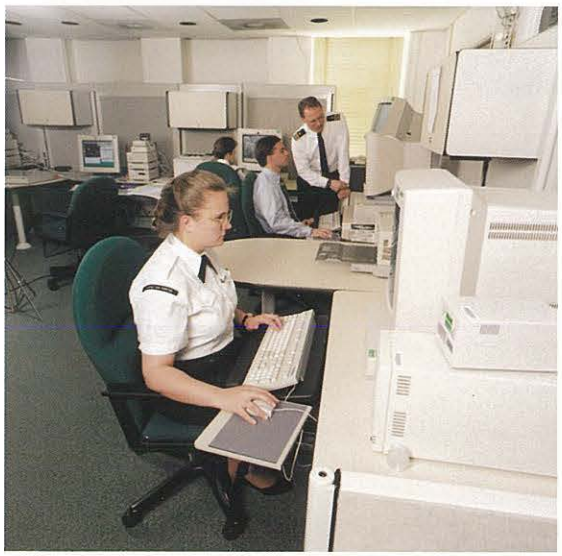
Ocean color data from Japan's Ocean Color and Temperature Scanner (OCTS) instrument on ADEOS were provided to NOAA within 11 hours of observation for use in NOAA's coastal environmental monitoring efforts. NESDIS was on track to begin operational use of ocean color data by fall 1997. NESDIS will continue with plans to use ocean color data from NASA's SeaWIFs instrument, launched in September 1997, to support NOAA coastal ocean research activities.



While planning continued for the scheduled launch of ADEOS II in 1999, NOAA was assessing opportunities to mitigate the loss of ADEOS to its operations. ADEOS II will carry the NASA scatterometer (SeaWinds) and Japan's new Ocean Color and Land Imager, (GLI). NESDIS will focus its attention on using alternative ocean remote sensing instruments such as those on ERS, RADARSAT, etc., to continue ocean remote sensing operations and development.

Synthetic Aperture Radar Data for Operational Near Real-Time Applications

NESDIS, in partnership with the National Ice Center (NIC), operates a near real-time processing, communications, and access system for Synthetic Aperture RADAR (SAR) data from the Canadian RADARSAT satellite. SAR data are high-resolution (10-100 meter) active microwave backscatter measurements presently being used for both operational and research applications that are of interest to U.S. Government. NIC has found SAR data to be extremely useful in determining ice edge location, ice concentration, the frequency/orientation of leads/polynyas, and in classifying ice type or stage of development.



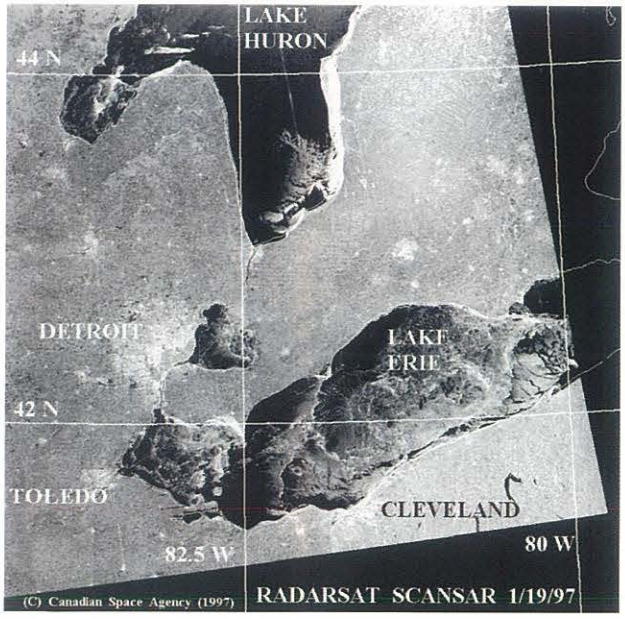
National Ice Center.

Ongoing SAR research being funded to enhance the use of these data in NIC operational products includes the development of an automated knowledge-based ice classification system, a multiyear ice detection algorithm, an automated ice/no ice detection algorithm, and an ice motion tracking system.

SARSAT Rescues

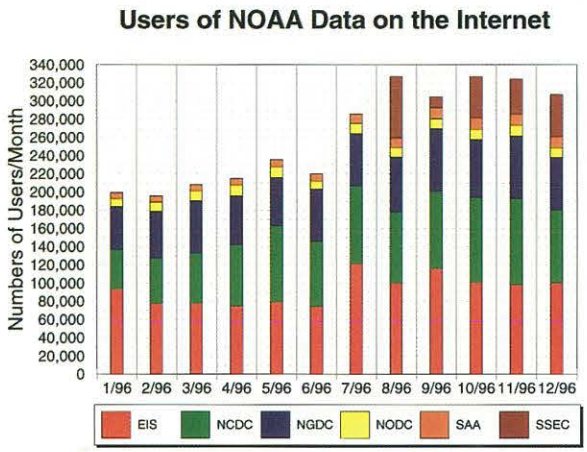
The SARSAT system was credited with facilitating 527 rescues in 1996 and 520 rescues in 1997 of which 80 percent were maritime, 16 percent aviation, and 4 percent terrestrial. Two new Mission Control Centers (MCC) were commissioned by the U.S. MCC in 1996, one each in Chile and Peru. In 1997, new MCCs were commissioned in Brazil, China (PRC), Taipei, and Japan.

Sign at FOB-4 in Suitland, Maryland.

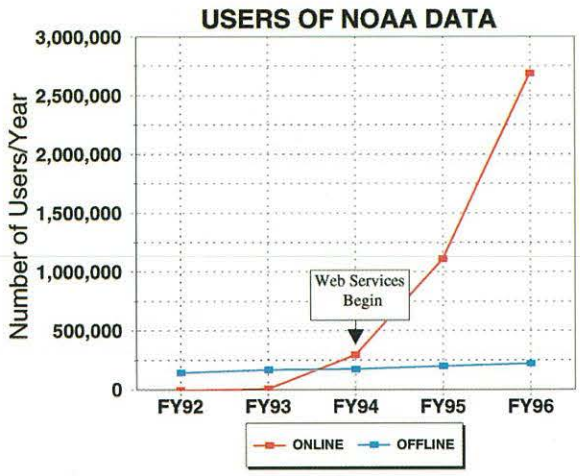


The SAR image shown was acquired by RADARSAT on January 19, 1997, for the NIC, and depicts ice on the Great Lakes. This image is only a portion of the 500 km X 500 km image generated by the ScanSAR mode of the RADARSAT satellite. This wide-swath mode provides data at 100-meter resolution. The image shows ice covering almost all of Lake Erie and the bays of Lake Huron. At this resolution, major metropolitan areas, highways, and river systems also are evident. SAR images like the one shown, which provide all-weather, day/night, high-resolution coverage, are the primary remote sensing data used by the NIC in producing their Great Lakes ice products. In this image, rough ice with large radar backscatter are shown as bright region. Smooth ice and calm open water with small backscatter are dark. Also bright are metropolitan areas with large concentrations of buildings which serve as good radar reflectors.

Environmental Information Services



The Environmental Information Service (EIS) awards for information services integration across NESDIS, and coordinates and administers a $10-million program targeted at applying technological means to improve the user's ability to access NOAA's databases, securing for the long term the integrity of NOAA's databases, and establishing and coordinating policies on data archival and distribution.



Among the major activities supported by the program are: application of World Wide Web technologies to provide universal access to NOAA data, development of the NOAA Data Directory to document NOAA's vast data holdings, rescue of more than 100 terabytes of data from loss due to media deterioration, publication of more than 100 CD-ROMs for data products, development of infrastructure to support data access, and workshops to promote information technology interchange.

EIS conducted an assessment of the state of data management in NOAA and produced the report "Progress & Challenges—A Report to Congress on NOAA Data Management" to fulfill Congressional requirements for a biennial assessment of the status of NOAA-wide data management. This report chronicled the progress NOAA has made over the past 5 years to revitalize its data management infrastructure, improve the quality of its data holdings, and prepare for the data management challenges of the 21st century.

The Environmental Information Services Office functions as the Department of Commerce Secretariat for Federal Geographic Data Committee (FGDC) activities in the Department of Commerce and NOAA. The office has been instrumental in establishing the FGDC metadata standard in NOAA and throughout the Federal Government. In 1996, The Federal Geographic Data Committee and participating agencies were awarded the National Performance Review "Hammer" Award. Led by Vice President Al Gore, the National Performance Review recognizes those federal organizations that contribute to building an efficient government that works better and costs less in serving the public.

The Environmental Services Data and Information Management (ESDIM) Office planned and executed two major conferences in 1996 each of which attracted more than 400 participants from NOAA and other organizations across the Nation. NOAA WebShops '96 and NOAA WebShops '97 brought together World Wide Web information services developers and managers in a common forum to exchange information on Internet information services. The IEEE Metadata Workshop attracted participants from government, industry, and academia to discuss metadata needs, practices, and technologies.

NOAAServer is a nationally distributed group of NOAA information systems accessible through the Web and providing a common navigation, visualization, and data retrieval mechanism. The NOAAServer System now supports unified user electronic searches of 13 environmental databases and sets the stage for development of a NOAA virtual data system (NVDS). NOAAServer is accessible on the Web at http://www.esdim.noaa.gov/NOAAServer.

Data Rescue

The ESDIM Office administers a major multimillion-dollar program for NOAA aimed

at securing the Nation's historical environmental data and developing the technological means for providing public access to these data through electronic media. Projects at the National Data Centers sponsored by ESDIM have helped to ensure that the Nation's environmental record, which provides the underpinnings for scientific, engineering, and economic decisions, is preserved for current and future generations.

NESDIS awarded a $4.2 million contract to rescue NOAA's deteriorating microfilm climate records. This contract will initiate the rescue of approximately 100,000 rolls of 35-mm and 16-mm film held at NOAA's National Data Centers. This film is in imminent danger of being unreadable due to acetate-based film degradation; it is estimated that much of the film has less than 3 years of remaining life.

At the National Climatic Data Center, the collection contains most of the irreplaceable observation record forms created by the historical U.S. climate network prior to the 1960s. At the National Geophysical Data Center, the collection contains ionospheric observations dating back to the 1950s. Similar mission-critical data exist at the National Oceanographic Data Center.

NESDIS successfully demonstrated the use of electronic scanning and natural handwriting recognition (NHR) software to convert manuscript climate records to electronic ASCII format. We will award a contract for conversion of 28 million pages of manuscript. This data rescue effort will convert records containing handwritten environmental observations to electronically accessible images, develop and provide the necessary document management systems to permit access by multiple network users, develop and provide an inventory of the scanned images, compare existing inventories of digital data to scanned inventories, and prepare a station-by-station list of the additional data available for conversion to ASCII.

The National Geophysical Data Center (NGDC) completed a joint NOAA-NASA data rescue effort by digitizing and quality controlling several long-term solar activity databases available only in analog form. Daily solar radio flux data from 55 solar observatories covering the years 1949 to 1991, solar calcium plage data from 1942 to 1964, and auroral event data for the last 1,000 years are now available via file transfer protocol (FTP). These data are part of the Solar Databases for Global Change Models archives.

NOAA'S Virtual Data System

The Virtual Data System (NVDS) is being developed to provide seamless access to NOAA's environmental data and information without regard to physical or organizational location, underlying discipline, or storage format.

The Customer Order Management Processing System (COMPS) is being developed in a phased approach to accommodate the common needs of the three data centers for processing requests, to provide management information regarding customers and types of products requested, and finally to provide online processing via the NOAA National Data Centers. The primary goal of COMPS is to migrate the independent systems currently in use at the National Climatic Data Center (NCDC), the National Oceanographic Data Center (NODC), and the National Geophysical Data Center (NGDC) used to perform inventory, automated order entry and tracking, maintenance of customer lists, billing of customers, and management information systems support into a single enterprise information system. When fully deployed, COMPS will support an interface to the Internet, allowing users to place product orders online.

The final Migration Options and Implementation Plan Document was completed and delivered. This completes the final step in the Standards Based Architecture approach to development of the NVDS. This document addresses the final design including the costing out of some benefits of the new system.

National Climatic Data Center

NCDC Director, Dr. Kenneth Hadeen, Retires

Dr. Kenneth D. Hadeen.

After completing 44 years of federal service, NCDC's Director, Dr. Kenneth D. Hadeen, decided to "hang up his spurs" for a more relaxing lifestyle. Dr. Hadeen spent the first 23 years of federal service with the U.S. Air Force (USAF) serving duty tours in Europe, Vietnam, and in a number of states in the United States In 1970, he was awarded the prestigious Merewether Award for his development and implementation of the world's first operational numerical boundary-layer model. He retired from the USAF holding the rank of Colonel and began his tenure with NOAA in 1977. His first assignment with NOAA was as the Deputy Director of the Assessment and Information Services Center. He was selected to head the National Climatic Data Center in 1984. Dr. Hadeen held the position of Director, NCDC, for 13 years, a longer period than any pervious director. He led the center through the computer revolution from main frames and minis to LANS and workstations. He was instrumental in acquiring necessary agreements, funding, and overseeing the completion of NCDC's beautiful facility. His greatest achievement was that he positioned the center for success in the next century. Kenneth D. Davidson is currently Acting Director for the Center.

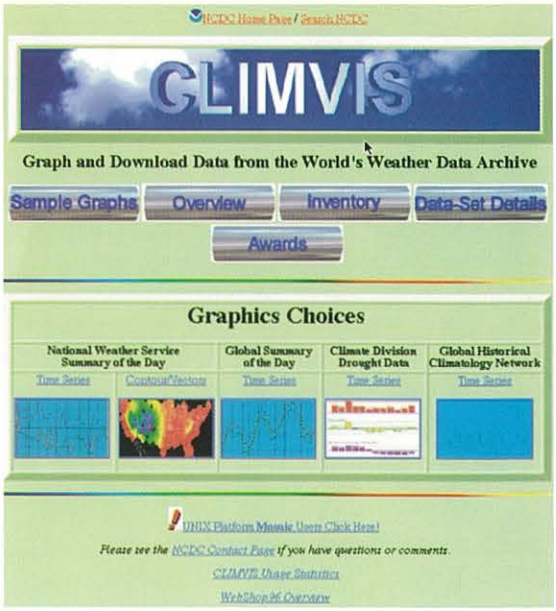
Data cartridges stored at NCDC.

Climate Data Services

The demand for basic climatic data and information services continues to increase. NCDC serviced over 177,000 requests for data and information during fiscal 1997, a 3.5 percent increase from fiscal year 1996. Phone calls increased by 2 percent to 90,000. E-mail contacts showed a whopping 35 percent increase from last year. In addition, there were over 1.3 million accesses to online data and information with customers downloading 636 GB of data. Currently, over 30 climate data sets are accessible online. This number is expected to increase significantly during fiscal year 1998 as NCDC is making a concerted effort to service more requests automatically through the Internet. A new online ordering system was recently implemented allowing customers to browse data products and place orders online.

NCDC Places New World Wide Web (WWW) Home Page Online

On September 24, 1997, the National Climatic Data Center (NCDC) went online with its new home page system. The new system has been designed to highlight NCDC's resources, to make it much easier for



Climatological data available on the NCDC Home Page.

customers to find the climate data they are looking for, and to provide more information about NCDC. The system provides initial home page access to climate, satellite, and radar resources. Within each of these three subsystems, the user is directed to several areas, such as "get/view online data," "products and publications," and "data inventories." Each of the three subsystems has the same "look and feel," and includes tabs at the top of each page for quick access to other Web pages.

Selected feature pages on new NCDC home page:

- NOAA National Data Centers' Online Store
- New Global Historical Climate Network Module added to Climate Visualization (CLIMVIS)
- Animated NEXRAD National Mosaic Reflectivity Images
- Comparative Climatological Data Publication
- Satellite's Eye Art Galleries
- Severe and Extreme Weather—Climatological Maps and Tables
- National Drought Atlas
- Maximum and Minimum Temperature Trends for the Globe
- Predict and Assess Decadal-to-Centennial Climate Change

NCDC's new Web site may be accessed at the following URL address: *http://www.ncdc.noaa.gov.*

Fourteen Months of GOES Full Earth Imagery Added to Historical GOES Browse Server

Data holdings for National Climatic Data Center (NCDC) Historical GOES Browse Server (HGBS) have been expanded to include 14 months of GOES Full-Earth imagery. These 24-km resolution imagery date from October 28, 1995, to December 14, 1996, and include daily (18:00 Universal Time Code, UTC) visible and infrared scenes for both the GOES East and West satellites. The Full Earth imagery are in addition to the existing Northern Hemisphere browse imagery dating from December 14, 1996, to the present. Future plans for the server include the addition of GOES Full Earth imagery dating back to mid-1992. During October, the National Climatic Data Center (NCDC) serviced its first Geostationary Operational Environmental Satellite (GOES) data requests onsite, using the new Geostationary Satellite Archive System (GSAS) software.

International Workshop on Indices and Indicators for Climate Extremes

NCDC building lobby.

The National Oceanic and Atmospheric Administration's National Climatic Data Center hosted the International Workshop on Indices and Indicators for Climate Extremes, June 4-5, 1997. NOAA Deputy Under Secretary Diana Josephson opened the meeting attended by approximately 100 international scientists from 34 countries and a dozen insurance representatives. The goal of the workshop was to produce time series of global and regional indicators and indices of climate extremes by exploiting daily weather data, understanding their limitations, and developing a mechanism to update these indicators and indices on a regular basis.

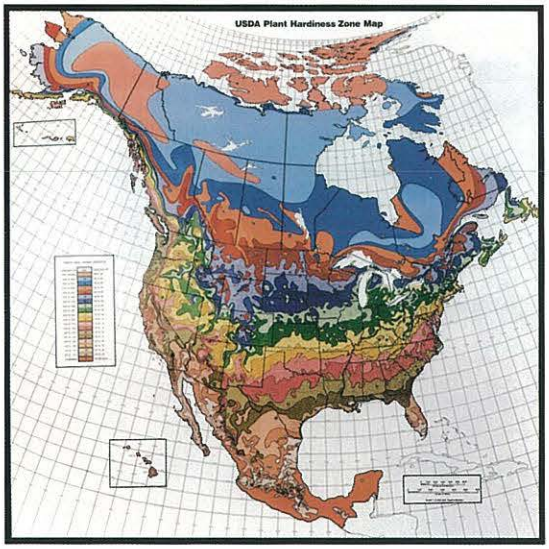
Snowfall Extreme Statistics for Federal Emergency Management Agency (FEMA)

The NCDC has produced extreme snowfall statistics to be used by FEMA beginning the winter of 1997 in the declaration of disaster areas. The statistics are derived from daily data collected by the National Weather Service via their Cooperative Data Observation

1996 Summer Olympics torch passes by in front of NCDC.

Program and date from 1948 to 1996. These data, from approximately 7,000 volunteer observing sites, have been processed and archived monthly at the NCDC. The statistics include: greatest snowfall in 24 hours and snowfall amounts for return periods of 100, 50, 25, and 10 years for the snowfall season and 1-, 2-, and 3-day periods. FEMA will distribute this product to be used by each state to determine disastrous snowfall events down to the county-area level.

Defense Meteorological Satellite Program (DMSP) Data Distribution



Plant hardiness zone map.

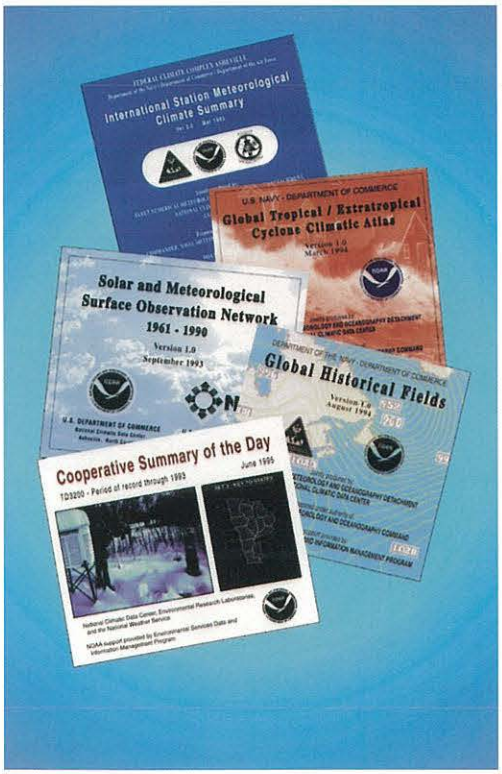
On April 1, 1997, NCDC and Office of Satellite Data Processing and Distribution (OSDPD) officially took over the distribution of Defense Meteorological Satellite Program (DMSP) data from the Marshall Space Flight Center DAAC. NCDC handles requests for both subscription and ad hoc orders for DMSP data and provides help desk support for users of these data and support of the Satellite Active Archive. The first shipment of tapes was successfully delivered to customers in April.

Online Ordering System Completes First Order

April 1997 brought an historical event to NCDC. The first automated order was placed and paid for by credit card through the NCDC Online Ordering System (NOLOS) via the World Wide Web.

DOC Partners in Quality Contracting Award

The National Climatic Data Center's services contractor, the Orkand Corporation, has been awarded top honors for an unprecedented third year in a row, in the Department of Commerce (DOC) Partners in Quality Contracting nationwide competition.

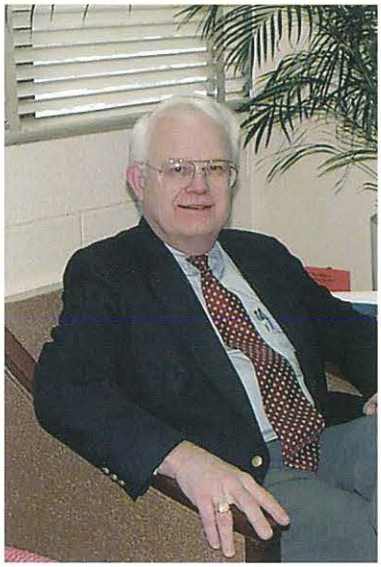


NCDC publications.

National Geophysical Data Center

New Director

The National Geophysical Data Center welcomed a new Director in 1996, Dr. Michael Loughridge. Dr. Loughridge first joined NGDC in 1977 as Chief of the Marine Geology and Geophysics Division and has always been heavily involved in Marine Sciences during his tenure at NOAA. Prior to 1977 he was with the U.S. Naval Oceanographic Office.



Dr. Michael Loughridge.

Global Land One-km Base Elevation (GLOBE)

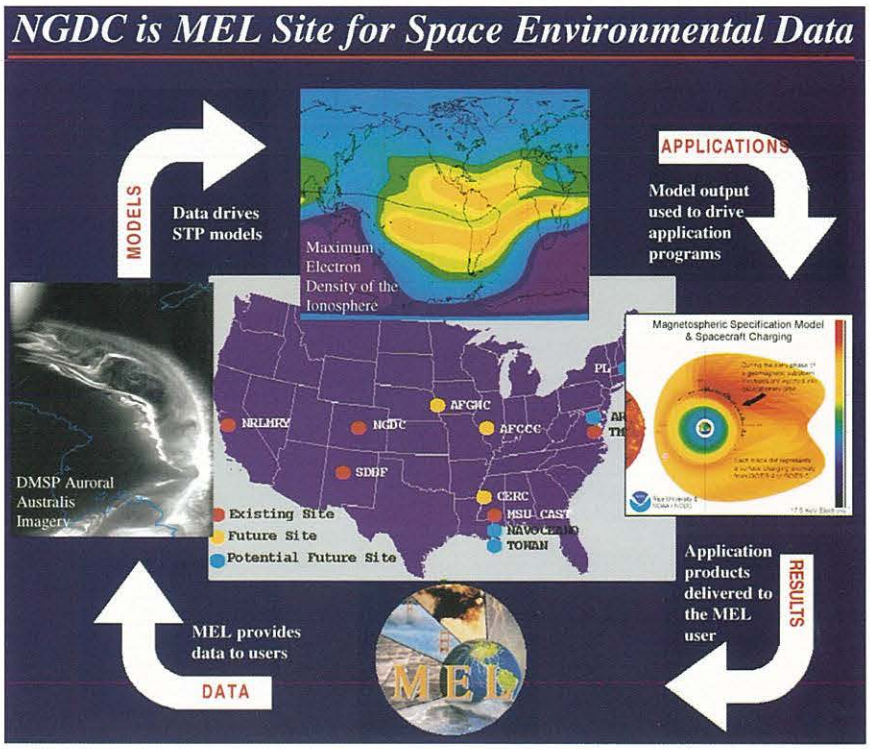
The Global Land One-km Base Elevation (GLOBE) project progressed in 1996. Several hundred prototype versions on CD-ROM were distributed by the National Geophysical Data Center. The GLOBE Web site (http://www.ngdc.noaa.gov/seg/globsys/globe.html/seg/globsys/globe.html) now leads to online prototype data from three major sources. Allied-Signal Aerospace released terrain avoidance equipment, considered a solution to one of the remaining major flight-safety issues.

Space Physics Interactive Data Resource (SPIDR)

The NGDC staff designed and implemented this innovative, technically advanced, online data management and analysis system. The unique features of SPIDR include the use of a relational database management system for storage and retrieval of space weather and DMSP data; common applications programs for internal and external users; search and browse over the World Wide Web; and on-the-fly image generation distributed via the Web. The system is designed to be cost effective and user friendly and to provide timely access to the archives.

DMSP Imagery Online

Defense Meteorological Satellite Program (DMSP) imagery is available online from NGDC's innovative SPIDR. Images are available approximately 2 weeks after the data are received at NGDC. Images from the DMSP Operational Linescan System (OLS) and Microwave Imager (SSM/I) are retrieved by the customer using the Internet, World Wide Web, and SPIDR. The user specifies the date, time, satellite, and location. SPIDR returns visible, infrared and/or microwave images, and a coverage map for the 1/8th orbit of the satellite that includes the specified parameters. The customer may then choose to analyze other images using the satellite navigation tool



DOD's Master Environmental Library (MEL).

provided at the bottom of the form. The average customer spends 1 hour logged into SPIDR doing data analysis.

Space Weather Data

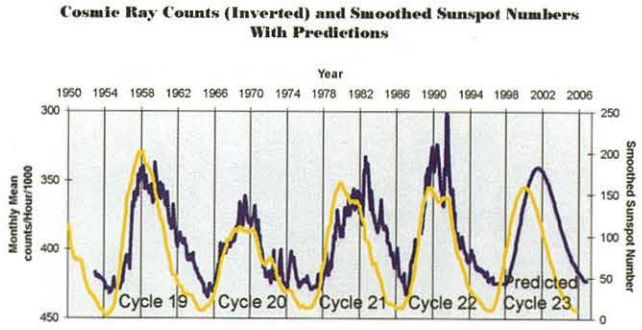
The Department of Defense's (DOD) Master Environmental Library (MEL) will add space weather data and services from NGDC. The Master Environmental Library (MEL) is an Internet-based data discovery and retrieval system providing access to geographically distributed oceanographic, meteorological, terrain, and near-space databases. The MEL is sponsored by the Defense Modeling and Simulation Office to provide real-time, scenario, historical, and climatological data sets for simulations, mission planning, scene modeling, and battlefield simulations. NGDC's SPIDR will allow DOD users to search, access, browse, and analyze data and information over the Web in support of DOD requirements for modeling and simulation.

Ice-Core Data Rescue

The NOAA/NGDC Paleoclimatology Group has joined with the National Center for Snow and Ice Data Center to begin a major ice-core data rescue project. NGDC's Paleoclimatology Program and the National Snow and Ice Data Center took the lead role in organizing and producing a new database of environmental information from ice cores. The first focus of this work has been on integrating data recently collected by the American (GISP2) and European (GRIP) ice-core drilling teams on the summit of Greenland. Ice core data include measurements of the composition of atmospheric gases trapped in the bubbles, and measurements of physical properties and composition of the ice that yield clues of past Earth environment and rates of environmental change.

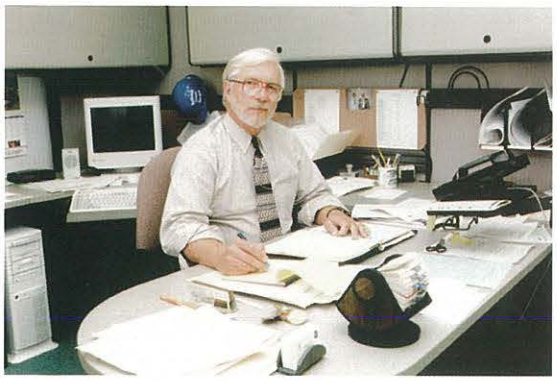
Bathymetric Data

The International Hydrographic Organization Data Center for Digital Bathymetry (IHODCDB) operated by NGDC completed compilation of a digital listing and plots of all new bathymetric data assimilated during the past year. This information, plots, and the corresponding nearly 500 MB of data were provided to the International Hydrographic Bureau (IHB) on CD-ROM for their globally distributed publication series. This is the first time that the entire package is available in digital form from the IHB.



This prediction of the next cycle 23 activity is shown for smoothed sunspot numbers and *inverted* cosmic ray neutron monitor monthly counts. We estimate a 1.5 year delay in the cosmic ray cycle similar to previous odd cycles 19 and 21.

National Oceanographic Data Center



Dr. Henry R. Frey.

The years 1996-97 brought change and renewal to the National Oceanographic Data Center (NODC). The Center welcomed a new director, moved to new office spaces, and celebrated its 35th anniversary. The NODC also launched a new initiative to revitalize its commitment to coastal ocean data management.

New NODC Director

In July, Dr. Henry R. Frey was named director of the National Oceanographic Data Center. His professional experience is broad in scope, including private industry, academia, nonprofit research institutions, domestic and foreign consulting, and the Federal Government. He has served NOAA for 9 years.

Move to Silver Spring

In February 1996, the NODC moved from offices in the Dupont Circle neighborhood in Washington, DC, to the NOAA Silver Spring Metro Center complex in Silver Spring, MD. Previously, in 1993, the NOAA Central Library had moved from Rockville, MD, to Silver Spring. This long-planned move has consolidated the NODC in a modern, conveniently located facility that houses many other NOAA offices.

Sculpture at the Silver Spring Metro Center Complex.

On January 16, 1961, the Honorable James H. Wakelin, Jr., Assistant Secretary of the Navy for Research and Development, delivered the dedication address for the National Oceanographic Data Center. Representatives of the original sponsoring agencies included heads of two agencies that later joined NODC as part of NOAA, Dr. F. W. Reichelderfer, Chief of the U.S. Weather Bureau (third from left) and Rear Admiral H. Arnold Karo, Director, Coast and Geodetic Survey (second from right).

35th Anniversary

In 1996, the National Oceanographic Data Center celebrated its 35th anniversary. The NODC was formally dedicated on January 16, 1961, at its first home at the Washington Navy Yard. The NODC was the world's first national oceanographic data center, and it has

NODC

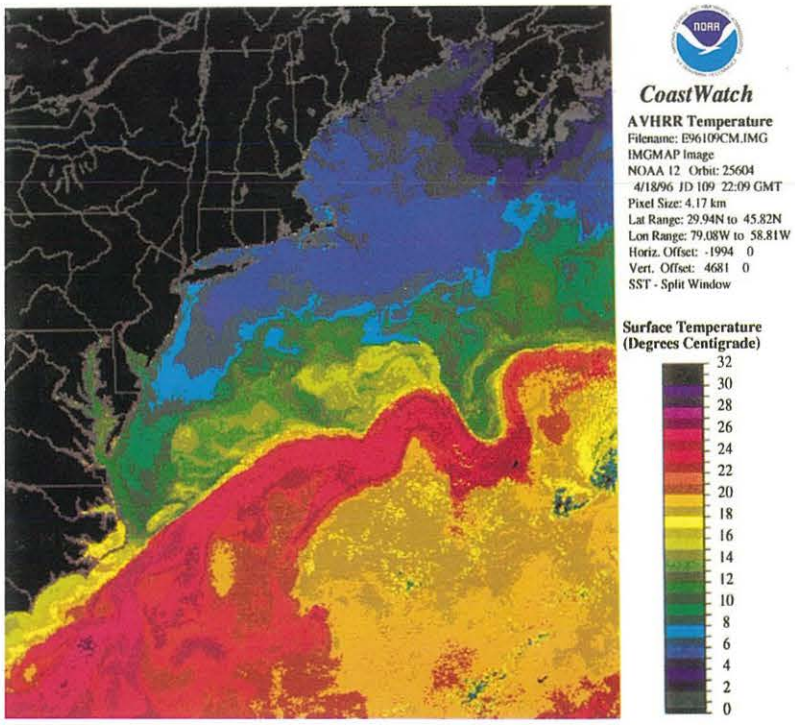
35 YEARS • 1961-1996

National Oceanographic Data Center

pursued its mission of acquiring, preserving, and distributing oceanographic data through its history both before and after becoming a part of NOAA .

NODC Ocean Profile Database Goes Online

NODC reached a major goal in June 1997 when online access to the NODC Oceanographic Profile Database (OPDB) was established on the NODC Web site. A prototype user interface enables users to search, select, and download data on ocean temperature, salinity, oxygen, nutrients, and other parameters.



East Coast Sea Surface Temperature.

GODAR Enriches NODC Data Holdings

The NODC Oceanographic Profile Database grew substantially in 1997 with the addition of over 2.3 million ocean profiles received via the Global Oceanographic Data Archaeology and Rescue (GODAR) Project. This brings the total NODC holdings to 5.45 million profiles. GODAR was initiated to conduct a global search for ocean profile data not yet accessible to the marine science community in digital databases. As a result of this project, previously unavailable historical ocean data sets were submitted by countries including Russia, China, France, Germany, Argentina, Japan, and South Korea. The improved temporal and spatial coverage provided by the wealth of additional historical data will make possible the production of a new version of the NODC *World Ocean Atlas* planned for release in 1998.

Workshop on Coastal Ocean Data Management

The NODC was a principal sponsor of the NOAA Coastal Ocean Data Workshop held at Harbor Branch Oceanographic Institution, Ft. Pierce, FL, March 11-13, 1997. The NOAA Coastal Services Center in Charleston, SC, and the Graduate School of Oceanography of the University of Rhode Island were cosponsors. Over 100 scientists and managers from U.S. coastal states and territories, and the Great Lakes participated in the workshop. The goals were to increase NOAA's responsiveness to stakeholders in the coastal ocean community and promote formation of additional partnerships and joint ventures to support coastal ocean data management.

Three Coastal Ocean Data Working Groups were formed in response to Workshop recommendations. The three areas addressed were Coastal Ocean Data Acquisition, Quality Assurance, and Data and Information Products.

NODC Adds Laboratory for Satellite Altimetry and Creates Coastal Ocean Laboratory

In August 1997, the Laboratory for Satellite Altimetry was transferred from NOAA's National Ocean Service to NESDIS/NODC. This group has earned an international scientific reputation for applying satellite altimetry measurements to research in physical oceanography and marine geophysics.

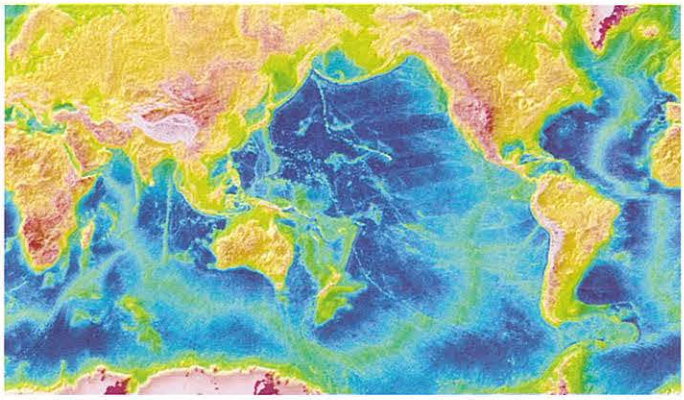
New Global Sea Floor Topography Map and Southern Ocean Gravity Analysis (Cover Image)

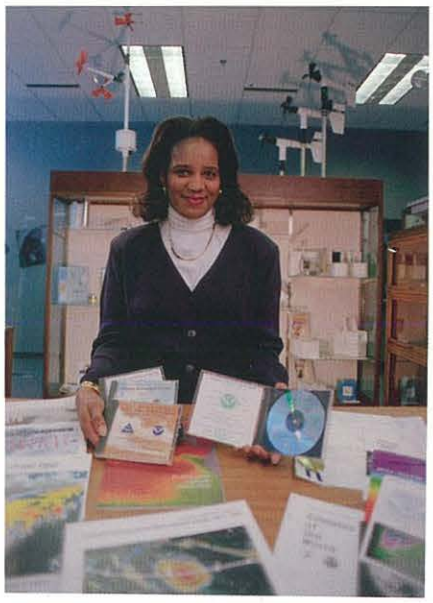
The most complete and accurate map of the sea floor available was released in September and featured as the cover story of the September 26, 1997, issue of *Science*. The new map was a joint effort of Dr. Walter Smith of the NODC Laboratory for Satellite Altimetry and Dr. David Sandwell of the Scripps Institution of Oceanography.

A high-resolution gravity field covering all of the Southern Ocean was derived from data collected by the ERS-1 satellite. This marine gravity field includes areas that are seasonally—or even perpetually—covered by sea ice, which has precluded shipboard surveys. The new gravity map shows tectonic details such as gravity lineations that are expressions of fracture zones left by early (65 to 83 million years ago) Pacific-Antarctic Sea floor spreading. This work was conducted by Dr. Dave McAdoo of NODC in collaboration with Dr. Seymour Laxon of the Mullard Space Science Laboratory, University College London and published in *Science* (April 25, 1997).

New Archive for Coastal Ocean Forecast Model Output

In January 1997, in cooperation with scientists at the NOAA National Centers for Environmental Prediction (NCEP), the NODC began to receive and archive output from the NCEP Coastal Ocean Forecasting System (COFS). Developed in collaboration with researchers at Princeton University and the U.S. Navy, COFS provides predictions of the 3-dimensional temperature, salinity, current, and sea level structure of the coastal ocean off the U.S. East Coast (out to 50° W). These data are currently available only to selected NOAA users, but will eventually be accessible to outside users as well. The NODC receives the 24-hour forecasts of the model fields each day and stores data from the three most recent months online. Earlier data are migrated to near-line storage for permanent retention. A Web based user access tool is being developed to provide easier access when the data are made available to the public.





New Taxonomic System Becomes Operational

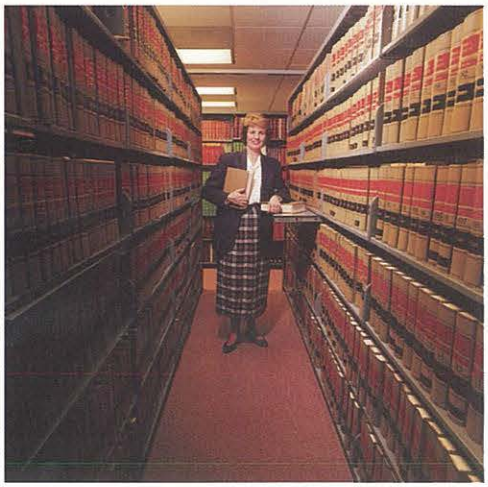
In cooperation with other federal agencies, the NODC helped develop the Integrated Taxonomic Information System (ITIS), a database of scientific and common names and numerical codes of plants and animals of North America and its surrounding waters. ITIS builds on and incorporates the earlier NODC Taxonomic Code, as well as taxonomic databases of other participating agencies. Version 8.0 of the NODC Taxonomic Code was released on CD-ROM in 1996 to help users convert from the older NODC codes to the new Taxonomic Serial Numbers used in ITIS. At the end of 1997, ITIS contained about 262,000 taxonomic names and associated numerical codes. ITIS can be accessed on the Web at http://www.itis.usda.gov/itis/.

Library Services

An important achievement was the conversion of the NOAA libraries' bibliographic records into one interactive collection (NOAALINC) available on the Web (http://www.lib.noaa.gov). Twenty-three NOAA libraries cooperated in this project which was jointly funded through a number of NOAA programs. The NOAA Central Library, the Miami and Seattle Regional Libraries, and the Center for Coastal Services are primary nodes to the system.

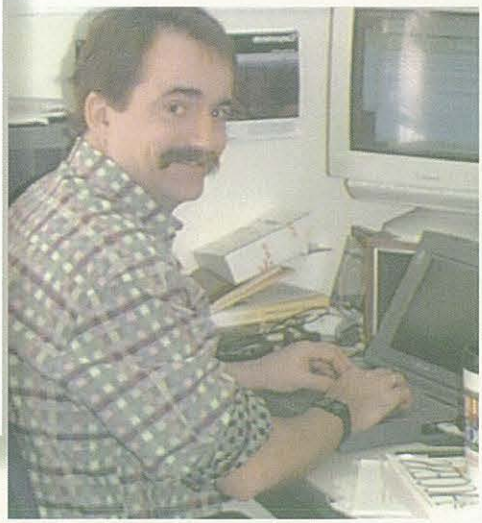
NOAA Central Library rare book collection.

In October 1995, the NOAA's photo collection of over 18,000 photographs and slides were transferred to the NOAA Central Library, thereby increasing the availability and access to this material. In 1997, over 200 of the most frequently used photographs were scanned and made available on the Web through the NOAA and Central Library's home pages.



Part III.

Feature Articles



Ocean Remote Sensing

A Comprehensive Program to Observe Oceanographic Phenomena From Space

Robert H. Feden

Introduction

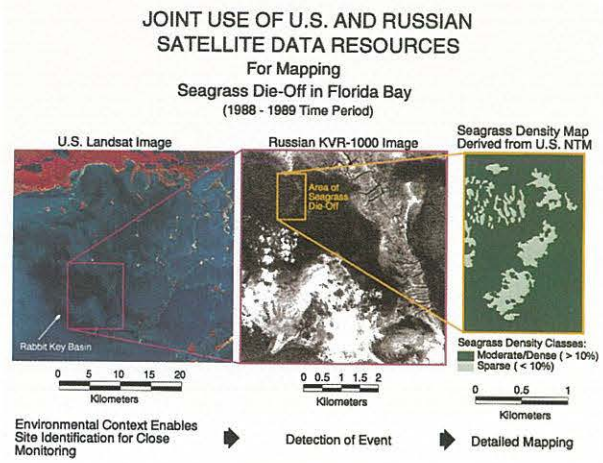
Satellite remote sensing, by its very nature, provides both the spatial and temporal observational density required to properly characterize the state of the atmosphere and oceans. The observations also are required to understand the natural processes occurring in both. Satellite remote sensing meets several critical criteria for observational systems designed to provide global observations on a regular basis: it covers large geographic areas, it has a relatively high frequency of observations, and it operates for extended periods of time.

Spaceborne instruments used for ocean sensing have grown in both number and sophistication since the first thermal imagers. These include sensors that can measure the height of the ocean, the wind patterns near the ocean surface, and the amount of chlorophyll in the surface waters. To enhance our knowledge and understanding of the ocean and its natural processes, NOAA intends to develop a comprehensive system to acquire, manipulate, and exploit data from existing and planned ocean sensing satellites.

Background

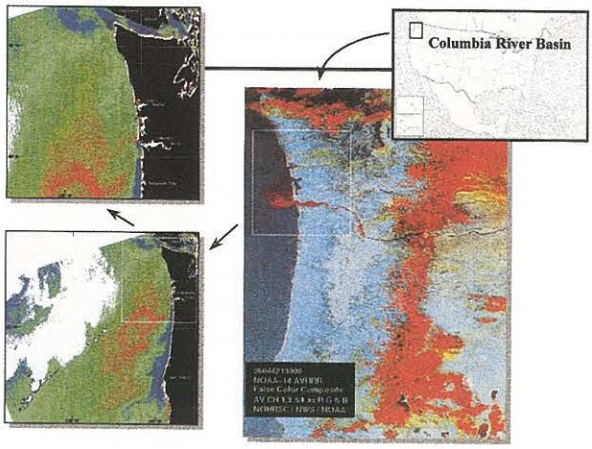
NOAA currently operates the world's largest constellation of operational environmental sensing satellites. To complement the existing satellite data, NOAA has, through the National Environmental Satellite, Data, and Information Service (NESDIS), collaborated with other space agencies to acquire satellite data. Among these collaborations is the sharing of data with the Department of Defense (DOD). The key elements of this cooperation are receiving observations from the Special Sensor—Microwave Imager (SSMI) installed on the operational Defense Meteorological Satellite Program (DMSP) polar orbiting satellites as well as providing Multi-Channel Sea Surface Temperatures (MCSST) derived from the NOAA TIROS series satellites. NOAA and the DOD are currently developing plans to merge their respective polar orbiting environmental satellites into a single, integrated system.

In addition, NESDIS, working with the National Aeronautics and Space Administration (NASA), the European Space Agency (ESA), the Canadian Space Agency (CSA), and Japan's National Space Development Agency (NASDA), has engaged in cooperative agreements which permit access to data from ESA's ERS-1 and ERS-2, Canada's RADARSAT, and NASDA's Advanced Earth Observing Satellite System (ADEOS). While these satellites are predominantly research satellites, experience with ERS-1 has shown that research satellites can provide invaluable data to support the generation of operational products. The prime example of this is the use of Synthetic Aperture Radar (SAR) data in the operational production of sea ice analyses and forecasts at the National Ice Center.



U.S. and Russia have collaborated on remote sensing of an endangered habitat in Florida Bay.

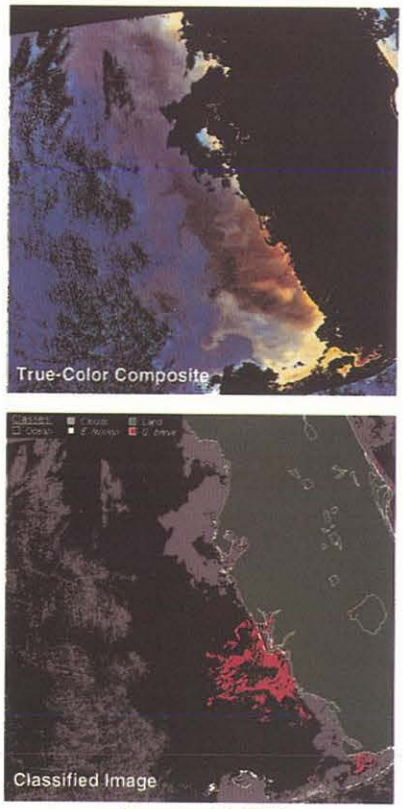
In addition to the ERS-2, ADEOS, and RADARSAT satellites, a wide range of research satellites, both domestic and foreign, have been recently launched or are planned to be launched in the next 5 years. These satellites represent a substantial capital investment by the United States and other nations. Through a far more modest investment in communications and data handling infrastructure, NESDIS will be able to acquire data from these satellite systems, significantly enhancing our national capability to observe the ocean.



Example of real-time monitoring of sediment plume off Oregon coast during Columbia River flood stage.

Objective, Goals, and Strategy

***Gymnodinium breve* "Red Tide" off Southwestern Florida**



November 14, 1978
Coastal Zone Color Scanner

Prototype "Red Tide" algorithm applied to Coastal Zone Color Scanner (CZCS) data.

To achieve the goals outlined in NOAA's Strategic Plan, NESDIS has initiated the Ocean Remote Sensing Program which will provide continuous, sustainable, global observations of both the atmosphere and the oceans. The Earth's environment is a fully coupled, complementary system. To adequately understand what is occurring in the United States and its adjacent waters, we must be aware of, and understand the phenomena that are occurring globally. For example, we now know that anomalies in the sea surface temperature of the Pacific Ocean can have profound effects upon the weather in the continental United States. We have also learned that, with adequate data, we can make skillful predictions of the consequences of the occurrence of these anomalies. In addition, because of their thermal capacity and circulation patterns, the oceans exert the single largest influence on global climate. For this reason, the oceans are considered to be an accurate barometer of global climate change. Long-term monitoring of ocean structure and dynamics may foretell changes in the Earth's climate.

The primary goal of the Ocean Remote Sensing Program is to develop a system that will provide a robust national capability to observe, assess and monitor the oceans. The system will provide accurate observations and assessments based on sound scientific principles and provide user-friendly access for both the public and private sector. The Ocean Remote Sensing Program will focus on the following:

- Continued access, processing, and distribution of data and products from NOAA's present system of environmental satellites
- Obtain additional non-NOAA satellite data
- Provide data and products in common formats
- Provide the ability to fuse satellite data with in situ, historical, and other remotely sensed data
- Develop a robust science base to support the development of assessment techniques and products

The strategy that has been pursued in developing the program has three basic elements:

- Leverage existing worldwide investment in ocean sensing satellites
- Maintain partnerships with federal agencies, foreign, state, and local governments as well as academia and the private sector
- Develop an end-to-end system for data and product acquisition and access

Approach and Plan of Action

In keeping with the overall strategy of leveraging the existing worldwide capital investment in remote sensing satellites through cooperative agreements and partnerships,
the approach will have three main thrusts:
(1) develop the necessary infrastructure,
(2) conduct demonstration projects, and
(3) build a sustainable, critical mass. These actions are necessary to ensure the proper implementation of the Ocean Remote Sensing Program plan.

Develop Necessary Infrastructure

Despite the fact that other agencies and countries have spent billions of dollars developing, launching, and operating remote sensing satellites, there is a certain minimum capital investment that must be made to permit ready access to useable data. A communications capability that provides sufficient bandwidth to ensure near-real-time and error-free transmission of the satellite data from the data capture points to the processing centers is essential. Data processing and archival equipment with sufficient throughput and storage capacity are required to ensure that products derived from the satellite data are not only accurate, but are generated in a timely manner. A third seg-

ment of infrastructure that is required is the communications infrastructure that supports the rapid distribution of both data and derived products to users.

Conduct Demonstration Projects

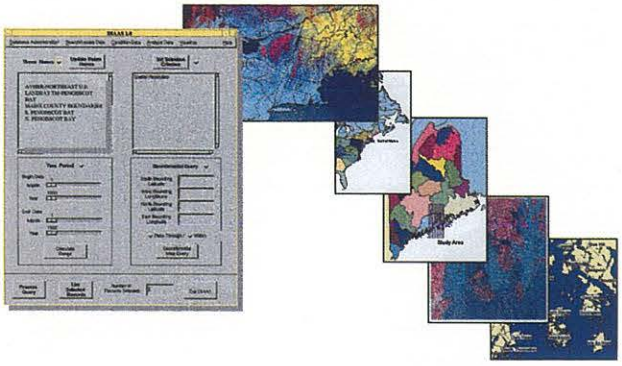
As new types of satellite data become available, projects designed to demonstrate and confirm the viability and utility of the data or product will be conducted. These projects will not only confirm the scientific validity of the data or product, but, more importantly, they will verify the usefulness of the data or product to an operational or user need. Aspects of product utility include the resolution and timeliness of the product or data as well as the format and presentation of the information. These demonstration projects will also explore new uses for existing data as well as new products developed through the fusion of one or more types of data. Development continues on the use of SAR data and was begun on the use of ocean color data.

Build a Sustainable, Operational Critical Mass

One of the key reasons to pursue this initiative is to provide the Nation with a consistent and continuous suite of products that are vital to the preservation, protection, and management of our marine resources. For example, we have come to rely upon the complete and continuous visible and infrared imagery coverage for weather forecasting. In a similar manner, once data sets or products are deemed to be useful and necessary, they must be incorporated into the daily operational flow of satellite data.

Robert H. Feden.

INTERACTIVE GIS

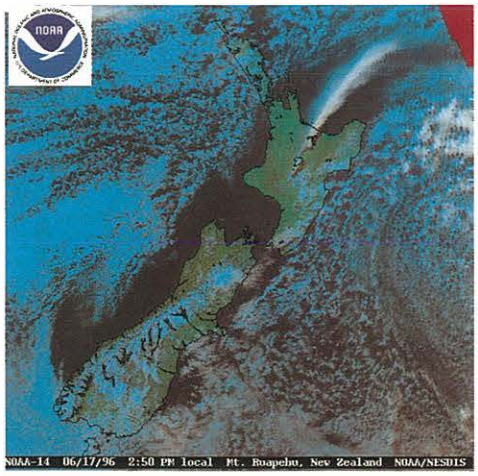


Remotely sensed data can be added as a layer in a geographical information system allowing researchers to collaborate interactively.

Disasters

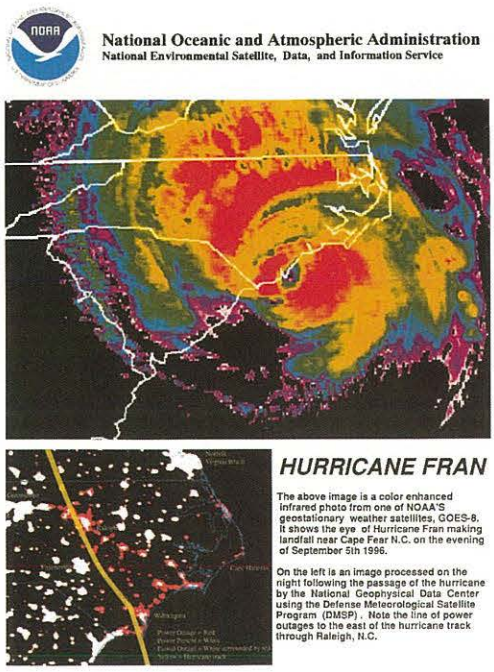
Jane D'Aguanno

Introduction



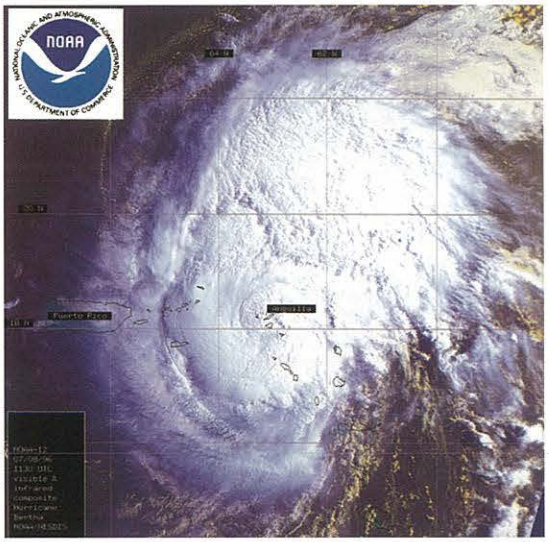
NOAA-14 image of the ash plume from an eruption of Soufriere Hills, Montserrat, West Indies.

The New Year, 1996, started with record snowfall totals blanketing the eastern United States, from Virginia through the New England region. The "blizzard of 1996" dumped several feet of snow, paralyzing activities up and down the mid-Atlantic coasts for 2 to 3 days. The southern Midwestern states, particularly Texas and Oklahoma, experienced drought conditions during the spring growing season causing problems for farmers and livestock needing grain for food. During the summer of 1996, thousands of acres of forest burned through the western United States. Particularly hard hit were California, Utah, and Nevada. Parks, rangeland, and communities were touched by this disaster. In Maine, it was a man-made event that captured the evening news reports. A tanker hit the "million dollar bridge" near Portland, ME, spilling oil and fouling usually pristine waters. Sadly the year ended with devastating floods in the West. Airports were closed, people were left homeless, and livestock were stranded.



Disasters are the common thread that ties these events together nationally and globally. It is not uncommon for the daily news to report that tornadoes have struck in the south, extreme rainfall has caused flooding to occur in Western states, a volcanic eruption has been detected in Indonesia, or a ship has run aground and is spilling oil along a coastline.

Natural and man-made disasters are occurring around the world almost daily. The location, size, and intensity of each event can be overwhelming and prediction just as difficult. Add to the equation the population growth. When a disaster occurs in a densely populated area, costs of property and lives are significant. In less populated areas the threat is just as great. Disasters such as wild fires may spread quickly and limited resources in the vicinity could hamper containment and allow extensive damage, even threatening smaller communities.



NOAA-12 image of Hurricane Bertha.

Through the years, disaster workers, weather forecasters, and scientists worldwide have worked together. They detected events early, dispatched warnings, acquired appropriate resources to alleviate the impacts, and monitored the events. This increases lead time to issue alerts to the public and to take steps to evacuate an area, if necessary.

Over the past 30 years much support for meteorological events like hurricanes, typhoons, tornadoes, and other severe weather, has been provided by the NOAA series of geostationary and polar-orbiting satellites. These satellites have been carrying out a continuous, operational mission to provide meteorological data for forecasts and

warnings. However, a secondary mission has evolved from these satellite programs, one of disaster detection and monitoring. Scientists and other users of the data have been able to identify disasters beyond weather; natural or man-made hazards like volcanoes, forest fires, flooding, drought conditions, and oil spills. This space-based perspective has greatly enhanced the ability of forecasters, and emergency relief workers to assess the scope of the event and to better deal with the disaster at hand.

NOAA's Satellite Programs Provide Solutions

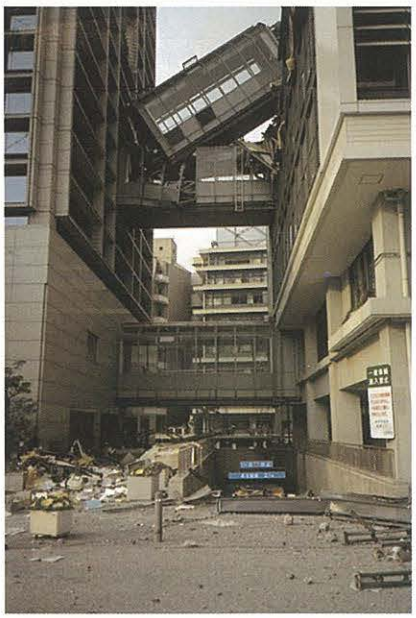
NOAA currently operates two types of Earth observing satellites: geostationary (Geostationary Operational Environmental Satellite, GOES) and polar-orbiting (Polar-Orbiting Operational Environmental Satellite, POES). The original, and still primary, mission of these satellites is to provide meteorological data (imagery and soundings) for forecasts and warnings to protect lives and property. Both programs started in the early 1960s and have evolved into today's state-of-the-art system routinely providing high-resolution spatial and temporal data.

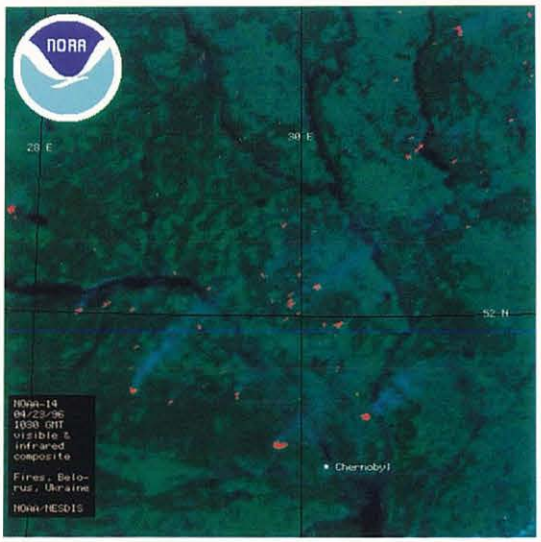
The NOAA GOES and polar satellites use portions of the electromagnetic spectrum which, though originally selected to view clouds, severe weather, and atmospheric moisture, are ideally suited for detecting characteristic signatures of disasters and furnishing necessary coverage to monitor, track, and assess devastating events. For example, using the visible and near-infrared channels (.58 to .68 um and .725 to 1.10 um, respectively) on the polar satellite Advanced Very High Resolution Radiometer, a vegetation index algorithm is used to calculate the condition of vegetation. This indicates whether vegetation is in a state of vigor or is highly stressed. A stressed vegetation signature combined with other data such as climatological parameters can warn of drought conditions or the opposite extreme such as flooding.

For detection of fires, both the GOES and POES imagers have a middle infrared channel (approximately 3.9 to 3.11 um) which is excellent for detection of very high temperature, subpicture element (pixel) resolution (less than 1 km) hot spots such as fires. Visible channel data confirms such findings by showing smoke. This is also true for the recognition of volcanoes. Often noticed first are the dangerous ash clouds which rise into the upper atmosphere endangering air traffic. NOAA scientists use satellite data along with ash cloud dispersion models to determine the trajectory and height of an ash plume. This type of data are given to the Federal Aviation Administration (FAA) for issuance of warnings to U.S. aircraft operating in the vicinity of volcanic activity. FAA and NOAA coordinate this information internationally as well so that aviation organizations globally can provide guidance for safe operations in their area of responsibility. Use of satellite data for volcanic events has proven so successful that a global network of centers (volcano ash advisory centers) employ NOAA satellite data as part of their monitoring responsibilities.

NOAA polar satellite image of fires in Oregon.

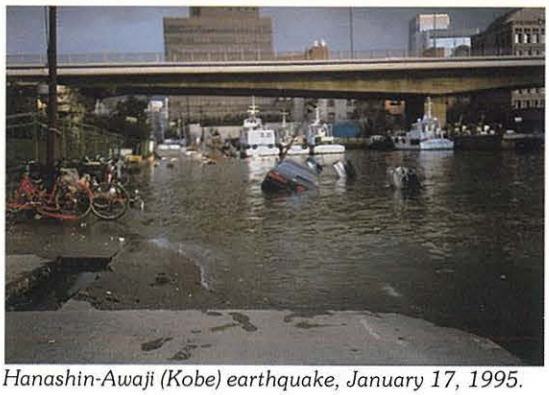
For the detection, monitoring, and tracking of oil spills, NOAA, through its international partnerships, acquires synthetic aperture radar (SAR) data. Very different in appearance than visible and infrared data, SAR data discriminates surface roughness to formulate an image of the surface. In an oil spill situation, oil tends to


Earthquake damage.



Satellite image of fires in Belorus, Ukraine.

Collapsed first and second stories, Kobe, January 1995.



Hanashin-Awaji (Kobe) earthquake, January 17, 1995.

hamper the formation of wave activity and therefore creates a flat appearance in the image. SAR is very good for identification of an oil spill and the spread of oil. NOAA experts in hazardous materials are beginning to use satellite images along with traditional tools and models to help in defining the affected area and working toward containment. SAR systems are flown on the European satellites ERS-1 and ERS-2, Canadian RADARSAT, and the Japanese JERS-1 spacecraft.

Ocean remote sensing is critical to the early detection and monitoring of disasters in the coastal and ocean environment. This aids in rapidly addressing near-term impacts of an event which could pollute fishing grounds, and the longer-term implications of the effect on the delicate balance within coastal ecosystems.

Within NOAA, a program for ocean remote sensing has been initiated and is designed to address environmental problems and apply satellite technology to find solutions. Key to this is the incorporation of data from systems

Forest fire.

within NOAA and outside. For example, in August 1996, Japan launched the Advanced Earth Observing Satellite, ADEOS, which carried a sensor specifically designed for investigation of the ocean. Unfortunately, ADEOS experienced problems in July 1997 and was not able to return to normal operations. Valuable information was collected in the year that it was operational. Japan plans to fly a second satellite, ADEOS II, in 1999. ADEOS carried an ocean color sensor that gave scientists a picture of ocean productivity which can be an indicator of a stressed or healthy ocean environment, and a scatterometer to assist with investigation of ocean winds (speed and direction) to enhance scientists and forecasters understanding of storms such as hurricanes and typhoons.

Getting the Nation's House in Order

Recognizing a growing need for coordinated efforts during disaster situations, at least in the United States, the Clinton Administration, under the direction of the Office of the Vice President, called together Federal Government entities with responsibilities for disaster/emergency assistants and those with assets and expertise which could support these events. NOAA has begun to work with other U.S. agencies in an effort to better organize resources and information dissemination during these emergencies. A number of national agencies with unique responsibilities are being pooled into a Global Disaster

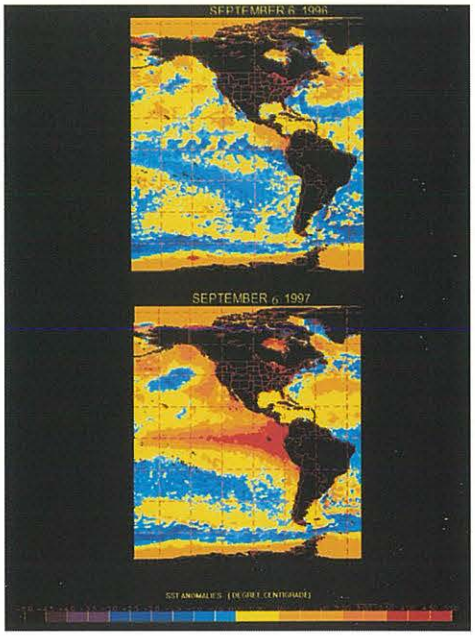
Mount Saint Helens eruption, May 18, 1980.

Information Network as identified by the Vice President. Agencies represented in this new network include Department of Interior (in particular U.S. Geological Survey), Department of Defense, Federal Emergency Management Agency, National Aeronautics and Space Administration, the Department of Commerce (through NOAA), and the Office of Management and Budget. During 1996, these agencies made great strides in defining and implementing steps toward this global network. Decision on customer needs, agency resources, and a common facility for centralization of data for processing and distribution links are just a few of the items initiated.

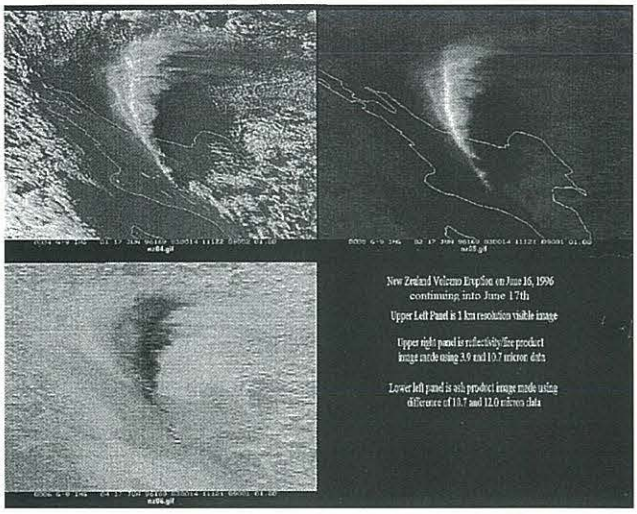
NOAA partnerships are key to the successful execution of a disaster monitoring program. NOAA operational satellites provide an excellent starting point as they are constant sentinels of the environment. Sensor suites onboard both the geostationary and polar-orbiting satellites allow for the discrimination of many types of disasters. But no one organization can achieve a complete program alone. Disasters do not just happen when the satellite is passing overhead. And costs of flying every necessary sensor is prohibitive. By forming alliances with foreign nations, NOAA is able to complement its data with data from sensors not currently onboard NOAA satellites. NOAA also obtains additional coverage to supplement between NOAA satellite orbits.

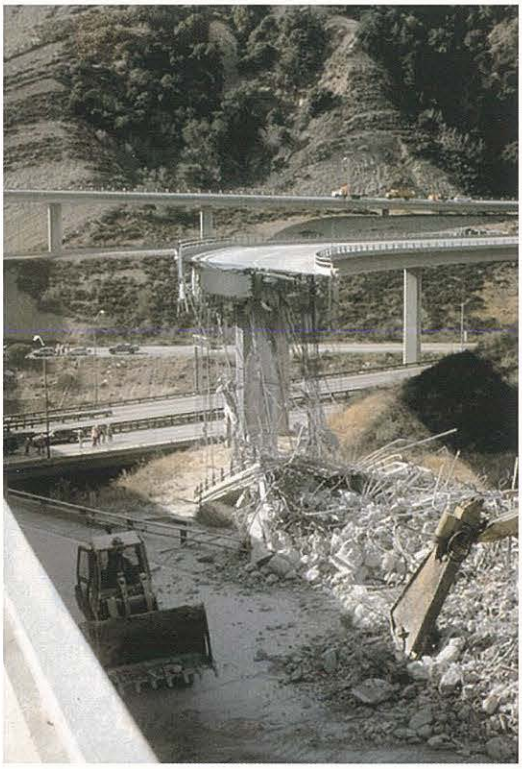
Bottom Line

As 1996 closed, severe snowstorms crippled the upper Midwest bringing just about everything to a standstill, and rain was still falling in the West flooding many parts of California. In 1997, the sea surface temperature anomaly El Niño was detected via satellite data. NOAA quickly began forecasting the impacts for the United States and working with emergency resource managers to prepare for predicted increased precipitation in the western states of California, Oregon, and Washington and the Gulf coast states of Texas, Louisiana, and Mississippi. Globally, dry seasons turned into drought conditions as El Niño delayed the onset of monsoon rains. This was particularly evident in Indonesia where seasonal agricultural and industrial burning to clear land was protracted and exacerbated by the late onset of monsoonal rains. This caused the fires to burn longer and with less control, putting hazardous smoke into the air, with no rain to wash it away. This situation persisted for several months before enough consistent rain fell to alleviate the pollution. Disasters don't stop, they don't discriminate. Disasters touch everyone everywhere.



El Niño SST comparison.





Earthquake damage to freeway at Northridge, California, January 17, 1994.

NOAA, through its geostationary and polar-orbiting operational satellite programs, continue to provide the best data available in real or near-real-time to users (scientists, emergency relief workers, forecasters) to assist with warnings, to track the extent and longevity of natural or manmade events, and to assess the damage. Programmatically, NOAA is central to the formation and successful execution of the Global Disaster Information Network because of its assets and decades of experience in providing critical satellite data. As other nations undertake their own space-based Earth observation programs, NOAA will evaluate the type and quality of the new data that these systems offer as potential sources of data which might reinforce and enhance its current robust role in disaster monitoring.

Tsunami engulfs Hawaii beach, 1957.

As disasters happen, the watchful eyes of the NOAA satellites will be there to detect, monitor, track, and disseminate critical data to all users, at all times, for many kinds of disasters to aid in the protection of life and property.

Jane D'Aguanno, Technical Assistant.

The National Polar-Orbiting Operational Environmental Satellite System (NPOESS)

Overview of Polar Satellite Programs

Donald Blersch

Background

On May 5, 1994, President Clinton made the landmark decision to merge the Nation's military and civil operational meteorological satellite systems into a single, national system capable of satisfying both civil and national security requirements for space-based remotely sensed environmental data. Convergence of these programs is the most significant change in U.S. operational remote sensing since the launching of the first weather satellite in April 1960. It marks a significant departure from eight previous attempts over the last 20 years to combine these separate programs. For the first time, the U.S. Government is taking an integrated approach to identifying and meeting the operational satellite needs of both the civil and national security communities. The joint program formed at President Clinton's direction is known as the National Polar-Orbiting Operational Environmental Satellite System (NPOESS), and is expected to provide more than $450 million in savings through 2003, and $1.7 billion over the life of the program compared to the cost of continuing the planned separate satellite systems within Department of Defense and Department of Commerce.

NPOESS Integrated Program Office staff members.

The U.S. Government has traditionally maintained two operational weather satellite systems, each with a 30-plus-year heritage of successful service: the NOAA Polar-Orbiting Operational Environmental Satellites (POES), and the Defense Meteorological Satellite Program (DMSP). Recent changes in world political events and declining agency budgets prompted a reexamination of combining the two systems. In 1993, influenced by increased congressional interest and following recommendations contained in the National Performance Review, NOAA, DOD, and NASA began studying how to converge the two systems. The completed study revealed that a converged system could reduce duplication and bureaucracy, substantially reduce costs, and satisfy both civil and military requirements for operational environmental data. This tri-agency study formed the basis for the development of the "Implementation Plan for a Converged Polar-Orbiting Environmental Satellite System," issued in conjunction with the Presidential decision directive.

DMSP satellite.

On October 3, 1994, NOAA, DOD, and NASA created an Integrated Program Office (IPO) to develop, manage, acquire and operate NPOESS. As indicated in Figure 1, the IPO is located within NOAA and is headed by a system program director responsible to the NPOESS Executive Committee. This committee, which includes senior representatives from the three agencies, serves as a board of directors to ensure that the overall program plans meet the needs of the three participating agencies.

Figure 1.

NPOESS Organizational Relationships

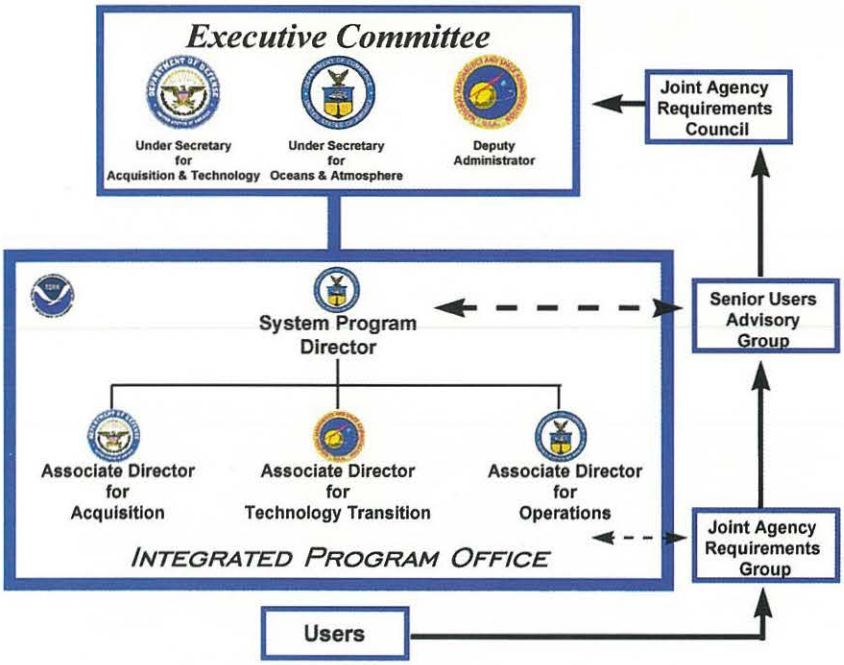


Figure 1. The Integrated Program Office concept provides participating agencies with lead responsibility in its functional area, while maintaining an integrated approach.

Converged System

As detailed in Figure 1, the Integrated Program Office concept provides each of the participating agencies with lead responsibility for one of three primary functional areas. NOAA has overall responsibility for the converged system and is also responsible for satellite operations. NOAA is also the primary interface with the international and civil user communities. DOD is responsible to support the IPO for major systems acquisitions including launch support. NASA has a primary responsibility for facilitating the development and incorporating new cost-effective technologies into the converged system. Although each agency provides certain key personnel in their lead role, each functional division is staffed by tri-agency work teams to maintain the integrated approach.

As an early step in the convergence process, the command, control, and communications function for DOD's existing DMSP satellites will be combined with the control for NOAA's POES satellites in Suitland, Maryland, in 1998. This combination of control functions will coincide with the planned closure of the U.S. Air Force Satellite Operational Control Centers at Fairchild Air Force Base in Washington and Offutt Air Force Base in Nebraska. This early convergence of command, control, and communications functions for existing satellites is expected to yield additional cost savings and further promote integration of existing programs.

The first converged satellite is expected to be available sometime toward the middle to latter half of the next decade depending on when the current NOAA and DMSP programmed satellite assets are exhausted. Figure 2 details the current national system architecture for the NPOESS program. As presented in figure 2, NPOESS will provide standard meteorological, oceanographic, environmental, climatic, space environmental remote sensing information, and continue to provide surface data collection and search and rescue capability. The IPO, in consultation with the NOAA and DMSP program offices, is also studying additional potential cost effective approaches to maximize user satisfaction during the transition to NPOESS while guaranteeing continued noninterrupted data services.

Figure 2.

NPOESS System Architecture

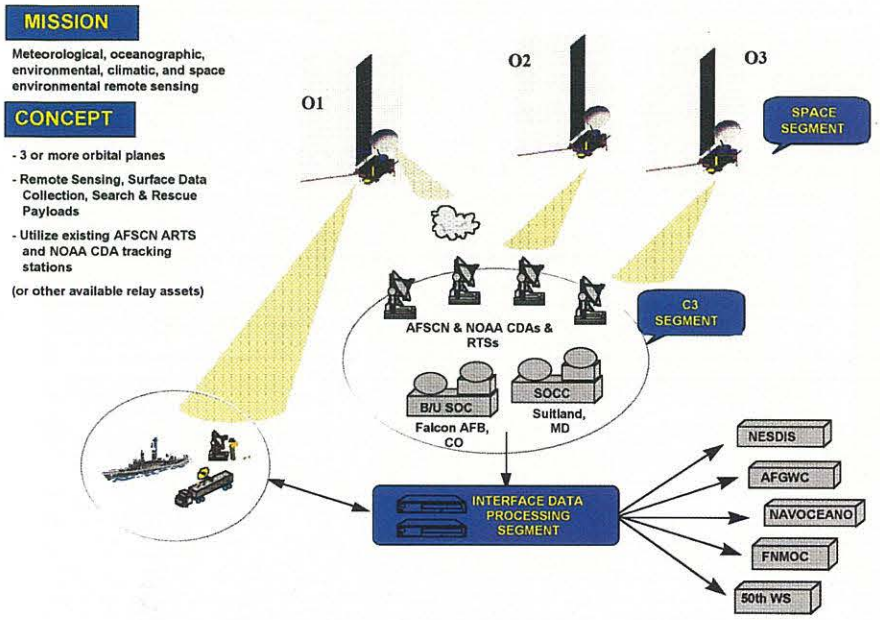


Figure 2. The NPOESS national system architecture concept is designed to employ three or more orbital planes (O1-O3) and integrate remote sensing, surface data collection, and search and rescue payloads. NPOESS will utilize existing Air Force Satellite Control Network Automated Remote Tracking Stations, NOAA Command and Data Acquisition (CDA) tracking stations, and other available relay assets.

Savings

From a resource perspective, the convergence of civil and military polar-orbiting operational environmental satellites is expected to yield over $450 million in savings through 2003 and additional savings throughout the life of the system. By combining missions, it is anticipated that under NPOESS the total number of satellites required and their associated ground systems will be significantly reduced. Increased system performance capability over today's system is also expected from the synergistic effects of combining the now separate polar programs, and through expeditious insertion of new technology. Savings will accrue in the following primary areas:

- **Development:** Only one system development effort is required for NPOESS. Continuance of the DMSP and POES programs would have required two parallel development efforts to design two new, unique systems (spacecraft, instruments, and ground command and control systems).
- **Number of satellites and launches**: The previously planned follow-on programs to the current DMSP and POES programs were expected to require three U.S. satellites on orbit at any given time to fulfill their operational missions over their operational lifetimes. Thus, 10 satellites were planned to be procured and launched. NPOESS is expected to require only two U.S. satellites on orbit at any given time which necessitates procuring only five satellites over a comparable period.

- **Ground systems/operations**: Currently, the DMSP and POES programs are operated from two completely separate ground facilities, or Satellite Operation Control Centers (SOCC). DMSP operations are conducted primarily from the Multi-Purpose Satellite Operations Center (MPSOC), located at Offutt AFB, Nebraska, with additional dedicated backup facilities at Fairchild AFB, Washington. POES operations are conducted at the single NOAA SOCC located in Suitland, Maryland. "Early Convergence" of the DMSP and POES Operations will occur in the 1998 time period, by consolidating DMSP and POES operations at the NOAA SOCC in Suitland, Maryland, including the establishment of a backup SOCC facility at Falcon AFB, Colorado. This consolidation will be in concert with the planned closures of the MPSOC and Fairchild facilities. Additional savings may result from taking advantage of the economies of collocation of the primary DMSP, POES, and GOES satellite operations at Suitland, post 1998.

NPOESS Integrated Program Office staff members.

Additional savings will also accrue throughout other phases of the program, as described below:

- **European participation**: The NPOESS program will continue and build upon the international cooperation with the European Organization for Meteorological Satellites (EUMETSAT). In the period preceding NPOESS, the POES program plans to provide instrumentation for flight on the EUMETSAT Meteorological Operational Program (METOP-1,-2) satellites and receive European instrumentation for flight on NOAA satellites as part of the Initial Joint Polar-Orbiting Operational Satellite program (IJPS). Under the NPOESS program, a similar subset of the NPOESS instruments are envisioned for flight on METOP-3 and beyond. The possibility of European instrumentation being provided for flight on NPOESS series satellites is also under consideration. Use of the METOP-3 satellite series will increase the coverage and refresh rate of the U.S. weather satellite system at minimal cost. In addition, the European meteorological community will receive valuable data from the U.S. instruments on both the METOP and U.S. satellites.
- **Capability**: By combining the DMSP and POES programs, not only will the capability of the current systems be preserved, but the Integrated Program Office (IPO) will be able to increase the total satellite system performance through synergism which enables adding capabilities which were not affordable by either the DMSP or POES programs on their own.

Management

NPOESS is managed under the tri-agency IPO. As such, the government/contractor program management staff required is approximately half of what would be required for two separate program offices under the old DMSP and POES programs. Furthermore, the System Program Director (SPD) can influence the utilization of existing assets (DMSP and POES satellites) to achieve additional cost savings.

Tri-agency Executive Committee (EXCOM) approval was granted in mid-March 1997, to proceed with the next phase (Phase 1) which includes the optimization of the NPOESS acquisition to make best use of production and on-orbit assets, to reduce risk on critical sensor payloads and algorithms, and to provide satisfaction to users while better leveraging civil, government, and international payload and spacecraft developments.

The merger of the NOAA and DMSP meteorological satellite systems into a single, national system capable of satisfying both civil and national security requirements for space-based remotely sensed environmental data represents a significant and exciting change in the way the United States acquires, manages, and operates environmental satellites. The United States and international community will continue to benefit from this new way of doing business well into the next century. The agencies and other associated participants involved are well on their way to creating a system that will cost less and be more responsive to user demands.

James T. Mannon, Director, Integrated Program Office.

IPO staff.

NOAA's Virtual Data System

Environmental System Data in the 21st Century

Mark McCloy

Objective

The NOAA National Data Centers are a national resource for oceanographic, geophysical, and atmospheric data and information that are used in every economic and social sector of the Nation. The NOAA National Data Centers are planning and implementing major changes in an effort to meet evolving national mission requirements and to cope with exponentially increasing volumes of new data and numbers of users with serious budget constraints which affect our operating environment.

The goal of NESDIS is to develop an efficient NOAA customer-oriented Virtual Data System that provides seamless access to environmental data and information without regard to its physical or organizational location, underlying discipline, or storage format. To meet this goal, the Virtual Data System is being developed by NESDIS that initially encompasses the three National Data Centers: the National Climatic Data Center (NCDC) in Asheville, NC; the National Geophysical Data Center (NGDC) in Boulder, CO; and the National Oceanographic Data Center (NODC) in Silver Spring, MD.

Introduction

The conduct of the Nation's industry and commerce depends on high-quality, readily accessible atmospheric, oceanic, and geophysical environmental data and information which will be referred to as environmental data in this document. Every sector of the Nation's economy uses environmental data and information for planning and contingencies (design, engineering requirements, research, risk analysis, alternative scenarios, etc.). No planes fly, no crops are planted, no fishing fleet is put to sea, no satellites are launched, no large capital investments are made, and no construction projects are undertaken without some use of past and present environmental data. NOAA's global environmental data and information services are the heart of this process and are a major contributor to the health of the economy.

The future holds even greater responsibilities for NOAA's services as the international dimensions of global trade expand and the potential of conflict between economic development and environmental goals grows. Increasing world population will continue to put more stress on social problems brought about by shortages of water and food supplies and because of vector borne health diseases. NOAA's data and information products will continue to increase in value as a critical national resource to those involved in making national policy and by individuals making day-to-day business and social decisions.

Through a large measure of entrepreneurship and the creative use of new Information Technology (IT), the three NOAA National Data Centers, as currently structured, have been able to survive rapidly increasing user demands. Without major changes in how the NOAA National Data Centers operate, they will not be able to honor their mission requirement to serve as the Nation's archive of environmental data and to meet the burgeoning national demand for environmental data and information.

The NOAA National Data Centers have taken the lead in adapting rapidly developing new technology to improve data management and data availability. They have been among the first to adapt to or develop capable search and retrieval software, pioneer in the adaptation to high density media, and broadly implement online access to inventories and data.

The three National Data Centers are the National Oceanographic Data Center with associated NOAA Library activity located in Silver Spring, MD; the National Geophysical Data Center located in Boulder, CO, with associated Snow and Ice Data Center operated through the Cooperative Institute for Research in Environmental Science (CIRES) at the University of Colorado; and the National Climatic Data Center located in Asheville, NC, with associated Satellite Active Archive (SAA) operated by the Office of Satellite Data Processing and Distribution in Camp Springs,

MD, and associated Geostationary Satellite Archive System (GSAS) operated through a Cooperative Institute for Meteorological Satellite Studies (CIMSS) with the University of Wisconsin at Madison, WI.

The Virtual Data System Initiative is a critical phase of the modernization plan for the Data Centers that must be implemented to minimize long term costs and to position the centers for the challenges and demands of the 21st century.

Benefits

The Nation has seen the conflicts take shape on the issues of ozone depletion, tropical deforestation, acid deposition, natural hazard assessment and increased concentrations of atmospheric gases that may warm the global climate. NOAA's information services provide the data from which each side makes their case. NOAA's data are neutral but critical to the debate. Business leaders, environmentalists, and policy makers all rely upon NOAA's environmental data to understand the issues and lead them to make wise choices that balance the needs of industry, jobs, and the Planet. Sustainable development is the necessary path for the 21st Century. The challenge for the Nation is to formulate informed and responsive policies and the challenge for NOAA is to ensure that it makes available the quality comprehensive environmental data and information the Nation needs.

Implementation

The Virtual Data System concept of logically integrated functions and geographically separated centers of expertise will be implemented in three phases. In phase one, distribution of all standard products and some services will be supported from the NCDC. A common customer ordering and tracking system will be implemented at all sites. The data sale receipts will be centralized at the NCDC. Management information reports will be distributed to NGDC and NODC accounting for data sales and data use. Implementation at all sites of a standard directory system of the NOAA National Data Centers holdings will be in operation by the end of phase one. Policy considerations for pricing and distribution of data online will be determined by NESDIS management. This will require upgrades in data servers and communications, software development, and replacement of the "legacy system" UNISYS mainframe at NCDC.

In phase two, many of the activities supported by the Environmental Services Data and Information Management (ESDIM) program will be integrated into the Virtual Data System. These include: establishing standard data transfer standards; browsing and segmenting capabilities for many of the most popular data sets held by the NOAA National Data Centers; establishing Information Technology (IT) security for the network and online systems; developing of specific theme pages on the Web servers for scientists and other users from disciplines not familiar with Environmental System data and information; development of product inventories at each of the nodes; and increasing the core service capabilities at NCDC to allow more scientific development and data research at the NGDC and NODC. Improvements and upgrades of required IT systems will continue using "open system" concepts and commercial off-the-shelf (COTS) software.

In phase three, full implementation will be accomplished; software, hardware, and communications upgrades will be in place; IT security and backup procedures will be fully implemented; the NOAA library activity will be consolidating and providing up-to-date reports on national environmental issues; other NOAA centers of data will be integrated into the system (for example, Northwest NOAA Network in the Seattle area); and new pricing and marketing programs will help offset the increased costs of meeting user demands. Phase three will be completed by 2002 provided adequate capital investment and continued NOAA management support are available to implement this plan.

Operational Approach

The NOAA National Data Centers Virtual Data System concept of operations with logically centralized and distributed hardware and database systems will provide users multiple pathways to access NESDIS' environmental data and information holdings via Internet and dedicated communication links. Interfaces to other external environmental and scientific data systems such as the Earth Observing System Data and Information System (EOSDIS) and the Global Change Data and Information System (GCDIS) also will be an integral part of the NOAA National Data Centers. These systems require network and data access interoperability among NOAA National Data Centers' components and between NOAA National Data Centers and external data systems. Data access and performance goals and objectives require that users such as the public, scientists, researchers, lawyers, students, and many others be able to move transparently throughout NOAA's distributed data repositories.

The Virtual Data System will use the already developed NOAA Data Directory to make available the online holdings of each data center in a uniform way, and leverage on the work of the NOAA Server System to meet customer requirements in a consistent look and feel.

Our customers will experience only one, integrated system. They will no longer need to discover, contact, learn the procedures of, and establish methods for paying for three separate data centers. Eventually, we expect to provide this same level of integration throughout NOAA, nationally, and then globally. The response of our customers to our first efforts along these lines has been overwhelmingly positive.

Mark McCloy,
Senior Information Officer.

Back | Forward | Home | Edit | Reload | Images | Print | Find | Stop

Location: http://www.nndc.noaa/gov/

NOAA NATIONAL DATA CENTERS

NNDC

NNDC Home | User Description | Product | Map Tool | Weather Events | Online Store | Help

Select Data Access Method:

User Description | Products | Map Tool | Weather Events

NNDC Home | User Description | Product | Map Tool | Weather Events | Online Store | Help

The NNDC is designed to provide the public with access to the extensive data holdings of NESDIS (National Environmental Satellite, Data, and Information Service). NESDIS is part of NOAA (National Oceanographic and Atmospheric Administration and is comprised of three data centers: NCDC (National Climatic Data Center), NGDC (National Geophysical Data Center), and NODC (National Oceanographic Data Center). Because of the large volume of data products, we have provided the user with various methods for pinpointing the desired data.

The National Climatic Data Center (NCDC) plans to amend its policy of providing Web based products at no charge to our users. The NCDC is reviewing its Web products to determine appropriate on-line user fees for its major datasets. These fees will be based on actual costs of on-line dissemination and therefore will reflect substantially lower fees than those charged for off-line delivery. Annual on-line subscriptions will also be offered at additional savings to our customers. Implementation of these user fees is projected for the Spring of 1998.

USER DESCRIPTION: By giving us your user description (i.e. lawyer, insurance representative, meteorologist, etc.), we can direct you to the areas of this site in which you would be most interested.

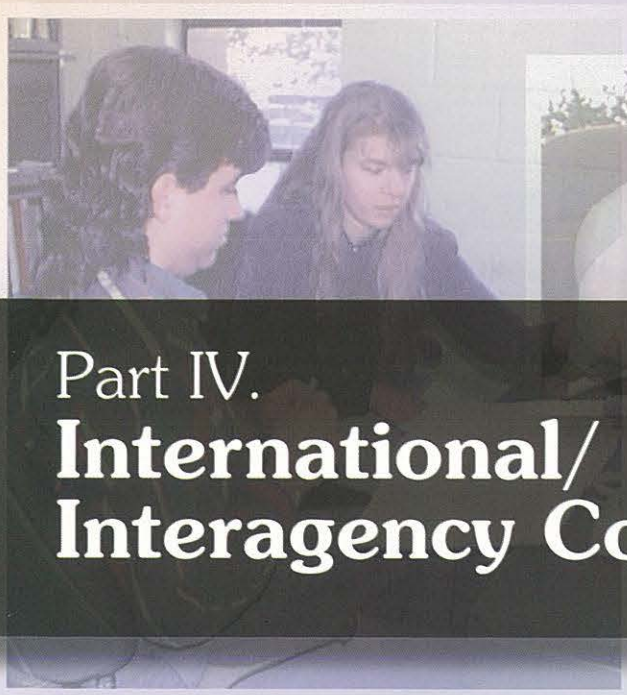
PRODUCTS: From here, you can choose from a list of products available through the NNDC.

MAP TOOL: The Map Tool is a graphical user interface, written in Java, that allows the user to visually select a region of the world and to retrieve Automated Surface Observation System data for that area.

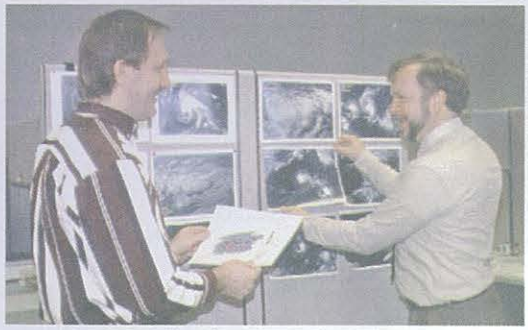
SIGNIFICANT WEATHER EVENTS: Here, you can get information about past significant weather events such as hurricanes, tornadoes, etc..

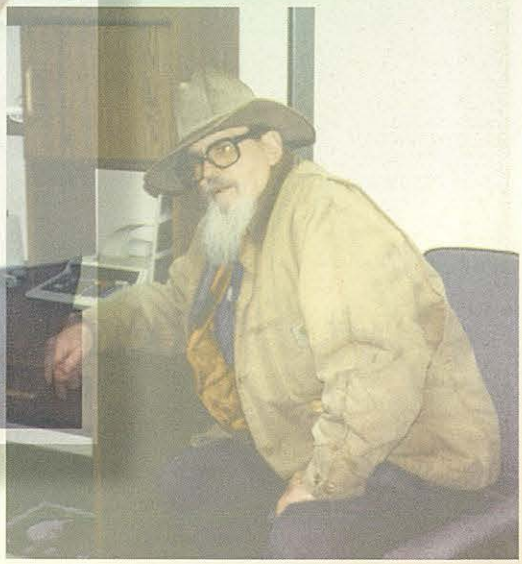
Please use the NNDC Feedback Page for questions or comments about the content of this system.

http://www.nndc.noaa.gov
If you cannot find what you are looking for please visit the NNDC Contact Page.



Part IV.
International/ Interagency Cooperation





International Cooperation

In 1996-97, NESDIS continued to play a leading role in the international coordination of remote sensing missions and environmental data programs. In so doing, NESDIS was able to leverage significant foreign resources in support of NOAA programmatic and U.S. foreign policy goals.

NESDIS has continued its leadership in multilateral fora and international programs. These include the Committee on Earth Observation Satellites (CEOS), the Coordination Group for Meteorological Satellites (CGMS), the Cospas-Sarsat Program for Satellite-Aided Search and Rescue, and the Landsat Ground Station Operators Working Group (LGSOWG).

NESDIS also benefitted from bilateral cooperation with a number of foreign partners. Partner agencies in the United Kingdom, France, and Canada have continued to contribute instruments for flight on NOAA's polar-orbiting satellite series: the Advanced Microwave Sounding Unit-B from the UK Meteorological Office, the Argos Data Collection System and Search and Rescue Receiver-Processor/Memory Units from the French Centre National d'Etudes Spatiales, and the Search and Rescue Repeater from the Canadian National Search and Rescue Secretariat. And in 1996, NESDIS began accessing data from Japan's Advanced Earth Observing Satellite, Canada's RADARSAT satellite, and Europe's ERS-2 satellite.

NESDIS scientists carried out cooperative research projects with numerous foreign partners. NESDIS data centers have led international data management activities, and currently host three national data centers and seven centers in the World Data Center System. NESDIS-provided training has increased foreign nationals' professional experience in satellite operations, data management, and scientific research. These professionals now contribute to our better understanding of how to predict environmental phenomena and protect our natural resources. Highlights of NESDIS international activities are described below.

February 9, 1997, RADARSAT fine resolution mode image of the Washington, DC area. ©Canadian Space Agency, 1997.

Integrated Global Observing Strategy

NOAA and NASA continued discussions with their international partners on the concept of an Integrated Global Observing Strategy (IGOS). The IGOS might be regarded as a blueprint for agencies to use in guiding their internal planning and resource allocations, as well as a basis on which to promote interagency cooperation at bilateral and multilateral levels. It is intended to provide an overall framework for major international users (for example, Global

Space agency representatives met with major international organization users of satellite data at an ad hoc meeting of CEOS in March 1996 to begin discussions on the space component of an integrated global observing strategy.

Climate Observing System (GCOS), International Geosphere-Biosphere Programme, World Climate Research Program) to present observational requirements and for providers to identify opportunities for implementation within the broader context of an integrated effort. IGOS received endorsement from the White House Office of Science and Technology Policy in March 1996.

The Committee on Earth Observation Satellites (CEOS) endorsed the IGOS concept in November 1996 and established a Strategic Implementation Team (SIT) to develop an overall strategy for the stepwise implementation of the IGOS space component. It also established an Analysis Group to determine, along with strong involvement of the GCOS/GTOS/GOOS Space Panel, the extent to which data products form existing and planned satellites meet defined needs of users. The SIT, comprised of senior-level members who can act with authority on behalf of their agency, first met in February 1997 in Irvine, California, where it agreed to develop, in coordination with partners, implementation projects in six initial areas:

- Global Ocean Data Assimilation Experiment
- Upper Air Measurements for Numerical Weather Prediction (NOAA chair)
- Long-term Continuity of Ozone Measurements
- Global Observations of Forest Cover
- Ocean Biology
- Disaster Management Support (NOAA chair)

Implementation projects are intended to demonstrate the benefits of an IGOS and to reflect differing time-scales and levels of difficulty. The SIT next met in Oxford, United Kingdom, in September 1997. It reviewed the status of and assessed CEOS agency support for the six IGOS prototypical projects, all of which received strong support.

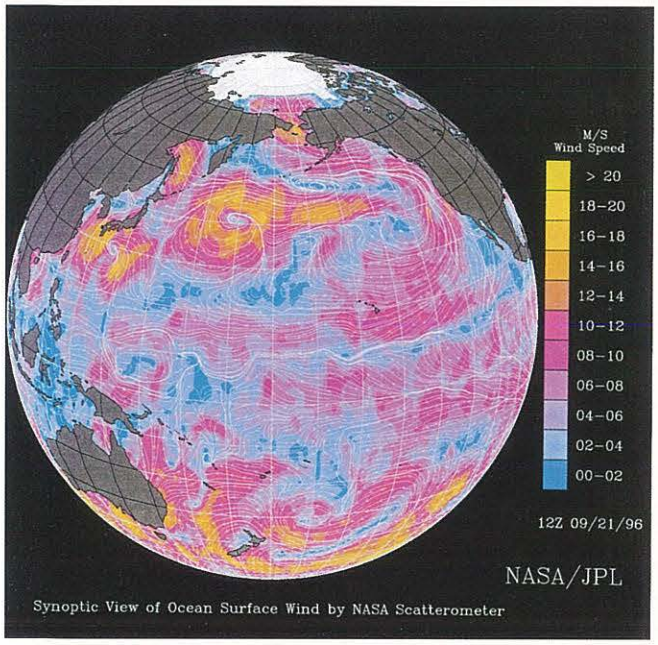
METOP

NOAA plans to provide instruments for inclusion on the European Polar Meteorological Satellites (METOP) being developed for flight early next century by the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) and ESA.

Argos

Since the late 1970s, NESDIS has provided operational data collection and location services contributing greatly to advances in the environmental sciences, technology, and the protection of our natural resources. NESDIS has accomplished this success through a cooperative program with the French Centre National d'etudes Spatiales (CNES) flying the French Argos instrument on NOAA polar-orbiting satellites.

During December 3, 1996 meeting, Japanese Space Agency President Isao Uchida presented to NOAA Administrator D. James Baker imagery from Japan's Advanced Earth Observing Satellite.



September 21, 1996, synoptic view of Pacific Ocean surface winds. Image is based on data obtained from the NASA scatterometer (NSCAT) instrument on board the National Space Development Agency of Japan's Advanced Earth Observing Satellite (ADEOS). Courtesy NASA/JPL.

In 1996-97, NOAA and CNES continued planning for provision of Argos services through the NOAA-N' satellite. NOAA hosted a public meeting bringing together data collection and location service providers and users to address U.S. Government requirements for these services in the near- and long-term. As a result of this public meeting, NOAA published for public comment in the *Federal Register* a proposed NOAA space-based data collections systems access policy.

Japan's Advanced Earth Observing Satellite (ADEOS) Program

NESDIS worked closely with Japan's National Space Development Agency (NASDA) and NASA in efforts to provide new sources of environmental data through NASDA's ADEOS program. In March 1997, NASDA, NASA, and NOAA signed a Memorandum of Understanding (MOU) on the ADEOS-II mission. ADEOS-II will carry three instruments of interest to NOAA and its user community: NASA's Advance Scatterometer (SeaWinds), NASDA's Global Imager (GLI) ocean color instrument, and the French Argos Data Collection System. Under the MOU, NOAA will provide standard scatterometry and ocean color products on an operational basis for enhanced environmental forecasting and monitoring efforts. NOAA will also provide raw Argos DCS data to the U.S. Argos processing center on a near real-time basis.

Cooperation With Russia

NESDIS cooperates with Russia under the Mission to Planet Earth Joint Working Group of the U.S.-Russia Civil Space Agreement and Working Group VIII (Climate Change) of the U.S.-Russia Environment Agreement. NESDIS supported the work of the U.S.-Russia Joint Commission on Economic and Technological Cooperation, co-chaired by Russian Prime Minister Viktor Chernomyrdin and U.S. Vice President Al Gore. The Gore-Chernomyrdin Commission provides a partnership framework between the United States and Russia through a broad range of cooperation, including space, the environment, and science and technology. Under these agreements and through the Commission, NESDIS scientists and data managers cooperate with their Russian partners in fields such as mesoscale remote sensing, the monitoring of large area vegetation stress, land surface temperature retrievals, and digitization and exchange of unique environmental data records belonging to both countries.

Additionally, NOAA Administrator D. James Baker was appointed U.S. chair of the Gore-Chernomyrdin Commission's Environmental Working Group (EWG). The goal of the EWG is to facilitate U.S.-Russian cooperation in the use of high-resolution satellite data for a wide variety of environmental monitoring and remediation efforts. NESDIS Assistant Administrator Robert Winokur was appointed U.S. chair of an EWG subgroup on Global Environ-

mental Disaster Monitoring. The goal of this subgroup is to demonstrate the feasibility of U.S.-Russian cooperation in natural and human-made disaster mitigation (short- and long-term) through the use of United States and Russian civil and national security systems.

Cooperation With the People's Republic of China

NESDIS cooperates with the People's Republic of China as part of the U.S.-China Protocol on Atmospheric Science and Technology and the U.S.-China Protocol on Marine and Fishery Science and Technology. In 1996-97, NESDIS hosted visiting scientists at the Office of Research and Applications, National Climatic Data Center, National Geophysical Data Center, and the Office of Satellite Operations. NESDIS also sent several scientists to China for lecture visits.

The Joint Coordination Panel for Data and Information Cooperation of the Marine and Fishery Protocol met in October 1996 to continue United States-China cooperation, led on the United States side by the National Oceanographic Data Center. In May 1997, the Marine and Fishery Protocol Joint Working Group met at NOAA facilities in Silver Spring, Maryland. Activities in 1996-97 included the continued exchange of oceanographic data, completion of the digitization of the Maury Collection of historical ship weather observations, and personnel exchanges including the 3-month visit of the Chinese aquaculture librarian to the NOAA Central Library.

In 1997, NESDIS sent two scientists to give presentations at the United States-China Workshop on Natural Disaster Reduction, which was co-chaired by the NOAA Administrator and resulted from the Vice President's U.S.-China Environment and Development Forum. NESDIS has been supportive of the Chinese FY-2 geostationary satellite program, which had its first launch in 1997, and is collaborating with China in the exchange and comparison of GOES and FY-2 data.

Committee on Earth Observation Satellites

NOAA is an active participant in and member of the Secretariat of the Committee on Earth Observation Satellites (CEOS), which includes all the satellite and instrument-providing agencies of the world as well as key user organizations. As noted above, IGOS was a major focus of both the 1996 and 1997 CEOS Plenaries. At the 1996 Plenary, CEOS modified its terms of reference to authorize broader participation by Observers and Affiliates, focused on the issue of protecting required Earth observation satellite radio frequencies, and endorsed continuation of projects and activities being carried out by its working groups.

At the 1997 CEOS Plenary, in addition to a refocusing of the IGOS Strategic Implementation Team, CEOS agencies agreed to restructure the CEOS databases of space missions and user requirements. They agreed to act in concert to protect the allocation of important frequency bands for Earth observation satellites. NESDIS contributed to the 1997 Yearbook, *"Towards an Integrated Global Observing Strategy,"* that was published by CEOS.

Coordination Group for Meteorological Satellites

The Coordination Group for Meteorological Satellites(CGMS) continued to provide NESDIS and other satellite operators with a valuable forum to study and discuss various technical and operational aspects of the developing global network of meteorological satellites. CGMS XXV, hosted by the Russian Committee on Hydrometeorology and Environmental Monitoring, included discussions on satellite products, telecommunications issues, cloud motion winds, disaster/environmental monitoring, search and rescue, and global contingency planning.

The International Cospas-Sarsat Program

Unites States Mission Control Center.

Copas-Sarsat now includes participants from six continents. In 1996 and 1997, Algeria, Madagascar, and Peru became associated with the program, bringing the number of participants to 30. NESDIS continued its support of the Cospas-Sarsat Program through provision of satellites, ground stations, and alert data distribution services.

In April 1996, the Cospas-Sarsat Council agreed to a management plan and timetable for the development of Geostationary Earth Orbit Search and Rescue (GEOSAR) satellite systems as a supplement to the existing Cospas-Sarsat polar-orbiting system. Cospas-Sarsat intends to adopt an operational GEOSAR space segment by late 1998. GEOSAR systems will provide instantaneous alerting capability and could significantly decrease rescue times.

The Council also agreed to implement new emergency beacon location protocols to provide precise location within the beacon message. Therefore, by 1998, new Cospas-Sarsat emergency beacons will provide precision location information through systems such as the U.S. Global Positioning System and the Russian Global Navigation Satellite System.

Landsat Ground Station Operators Working Group

NOAA continued its excellent cooperation with the international network of Landsat ground stations on Landsat 5 reception and in planning for the Landsat 7 program, including negotiation of agreements for direct access to Landsat 7 data. In May 1995, the 25th meeting of the LGSOWG was hosted by the South African Satellite Applications Centre in Pretoria, South Africa. In May 1996, the Canada Centre for Remote Sensing welcomed LGSOWG members to Ottawa/Meech Lake for the 26th meeting. Both meetings placed special emphasis on planning for the Landsat 7 mission by NOAA, NASA, and the U.S. Geological Survey's EROS Data Center. The Landsat Technical Working Group convened three times in 1996-97 to discuss Landsat 7 technical issues with ground station representatives. International Landsat ground stations are currently operated in Australia, Brazil, Canada, Argentina, Ecuador, Europe (by the European Space Agency), India, Indonesia, Japan, Pakistan, the People's Republic of China, Saudi Arabia, South Africa, and Thailand.

Global Climate Observing System

In 1996, the primary focus of the Global Climate Observing System (GCOS) moved to the implementation of its plans through cooperation with national, regional, and international mechanisms. NESDIS has been instrumental in promoting this shift in emphasis toward implementation and proposed that GCOS establish an executive panel of implementing agencies to better connect to those agencies that could carry out GCOS proposals.

NESDIS continues to chair the GCOS Data and Information Management Panel, which will now become a joint panel for GCOS, the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS). As a GCOS panel, agreement had been reached to establish a network of data centers agreeing to support GCOS data

management functions and GCOS principles. The panel endorsed the registration of data sets whose accompanying documentation is sufficient to determine the potential value to a user, and it approved initial functional guidelines for access to the GCOS Data and Information System.

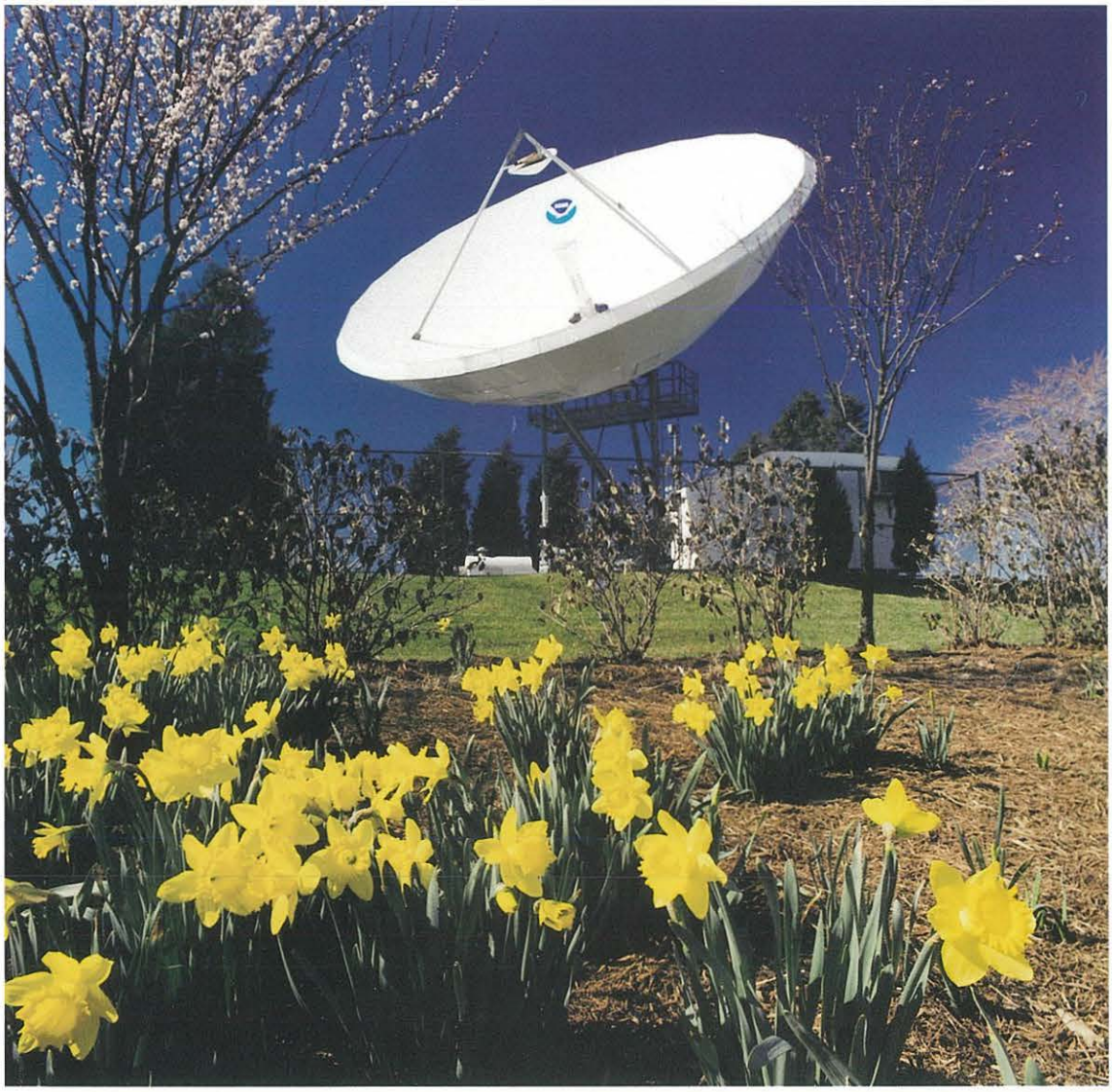
Global Observation Information Network

Established under the U.S.-Japan Common Agenda for Cooperation in Global Perspective, the Global Observation Information Network (GOIN) now enables users to access a wide range of environmental data from various agencies in both countries. GOIN has contributed greatly to the global information infrastructure and improved links among the environmental and natural resources management databases worldwide. GOIN subgroups have developed more than 20 pilot projects for collaboration in oceans and atmosphere, land, space environment, and GOINnet. The United States has established a list server to facilitate pilot project coordination. The proposals were categorized in three areas: data exchange, technology exchange, and outreach. The United States hosted the second GOIN joint technical workshop in Boulder, Colorado, in conjunction with the 1997 Group of Seven Industrialized Nations (G7) Economic Summit. The next steps for GOIN will reflect the decision of the United States and Japan to expand cooperation in Asia, Africa, and Latin America by inviting participation by agencies and institutions from the Asia-Pacific region in the GOIN pilot projects.

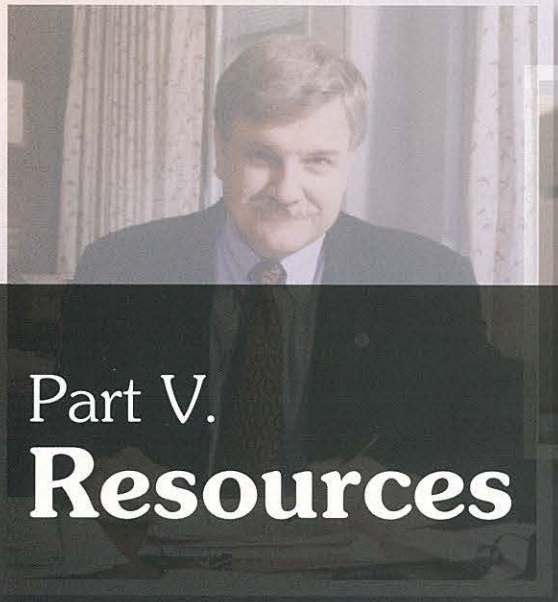
G7 Environment and Natural Resources Management

Environment and Natural Resources Management is 1 of 11 multilateral themes for cooperation adopted by the Group of Seven Industrialized Nations (G7). The United States leads this effort within the G7 and NESDIS coordinates this project for the U.S. Government. The long term goal of this effort is the development of a virtual library of data and information held in globally distributed electronic sites accessible on emerging electronic networks.

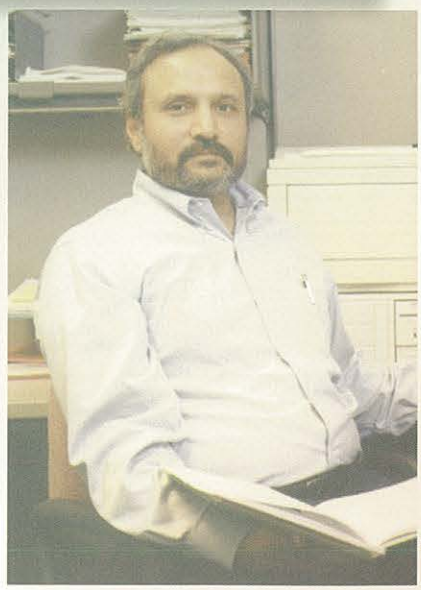
The objective of this G7 joint project is to increase electronic linkage and integration of data sources and information relevant to the environment and natural resources. A group of experts representing each participating body has built on existing international efforts to create a Global Environmental Information Locator Service (GELOS). GELOS has further interconnected catalogues and directories around the world, ensured their accessibility to developed and developing countries, and facilitated the exchange and integration of data and information about the Earth for use in a variety of applications.



Domestic satellite antenna at FOB-4 in Suitland, Maryland, which provides polar and shared processing information.



Part V.
Resources



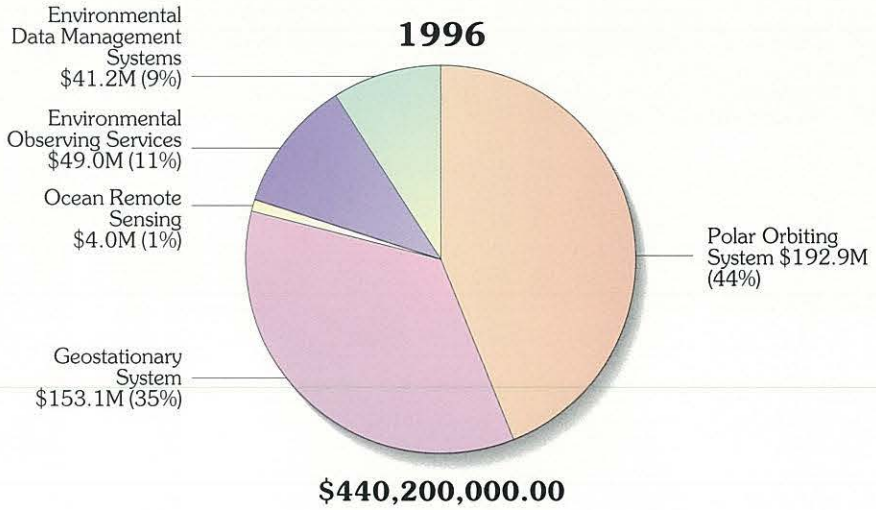
Fiscal Year 1996-97 Funding

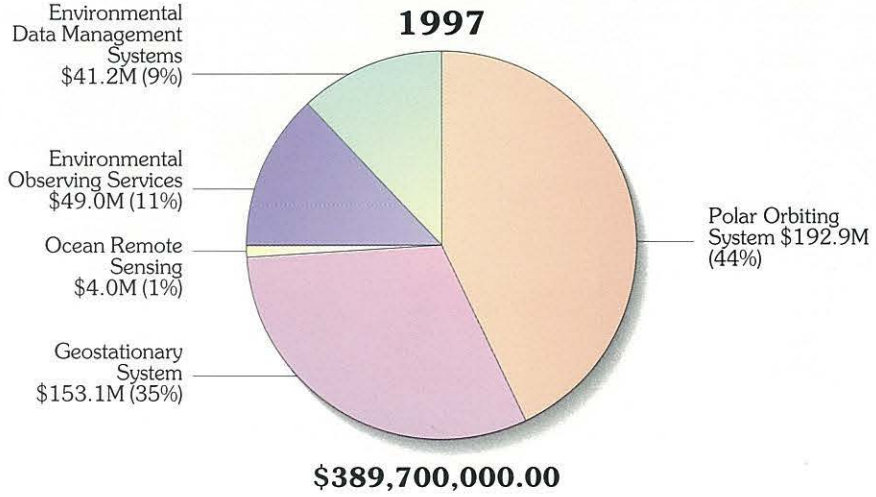
NESDIS satellites are the mainstay of the Nation's weather information system and provide environmental data for federal agencies, state and local governments, and private users. NESDIS' goal includes the procurement, launch, and operation of the satellites required to maintain two environmental satellite systems as well as provide worldwide environmental data and information products and services. NESDIS has two budget subactivities.

The Satellite Observing Systems include the polar-orbiting satellites which obtain global environmental data, and account for 44 percent of the budget. The geostationary satellite system, which provides near-continuous observations of the Earth's Western Hemisphere, accounted for 35 percent of that budget. Monitoring of the Earth's surface and space environmental conditions totaled 12 percent. Monitoring activities included ocean remote sensing; new and improved applications and products; and improved atmospheric, oceanic, and U.S. coastal observations and data distribution. Satellite Observing Systems totaled 91 percent of the budget.

The goal of the Environmental Data Management System (EDMS) is to provide worldwide environmental data and information products and services in the atmospheric, marine, solid Earth, and solar-terrestrial sciences in order to meet the needs of users in commerce, industry, agriculture, science and engineering, the general public, and governments at all levels. The Environmental Data Management System accounted for 9 percent of the NESDIS budget.

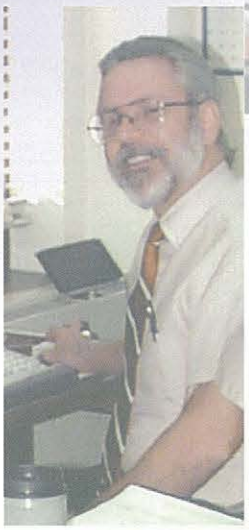
FY 1996-97 NESDIS Budget

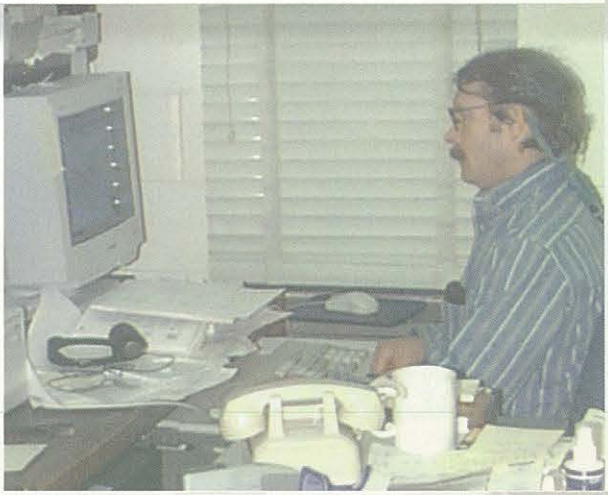


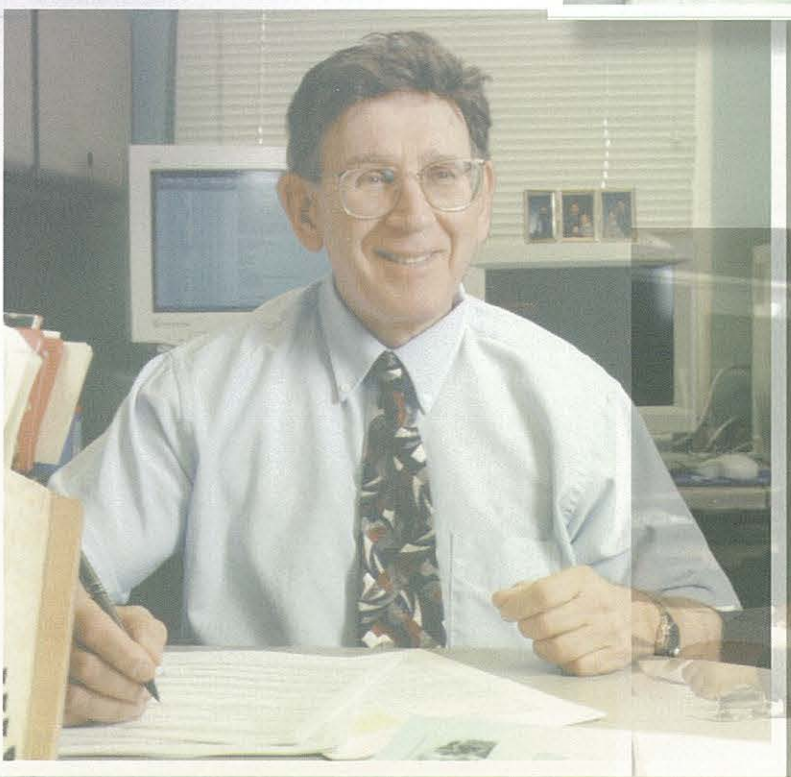


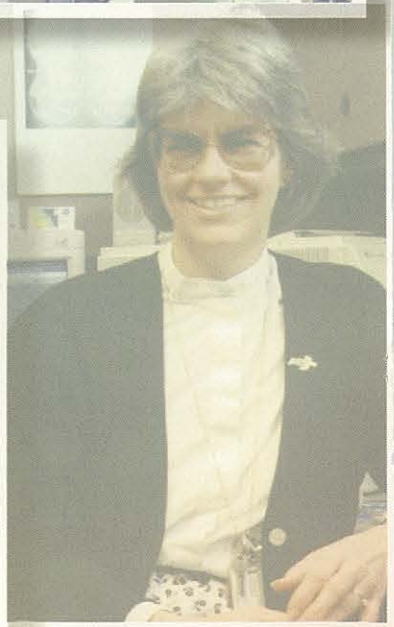
Part VI.

Human Resources









Special Recognition

Every year the Commerce Department and NOAA honor employees who have performed exemplary work with Gold, Silver, and Bronze Medals, and the NOAA Administrator's Award. A list of those NESDIS staffers and their achievements follows.

Gold Medal Awards

Robert E. Cheney, John M. Kuhn, John L. Lillibridge, Laurence L. Miller, C.K. Tai, Ming Ji, David W. Behringer: For improving long-range El Niño forecasts by creating and implementing the NOAA satellite altimeter operational assimilation system.

Helen M. Wood: For leadership in developing the real-time collection and product generation of non-NOAA environmental satellite data.

Silver Medal Awards

Helen E. Coffey, Eric A. Kihn, Daniel C. Wilkinson, Raymond O. Conkright, Leslie D. Morris: For developing the SPIDR system which has revolutionized the management, display, and delivery of space and weather data over the Internet.

Bronze Medal Awards

Lawrence M. G. Enomoto: for leading the G7 information society pilot project on the Environment and Natural Resources Management on behalf of the United States.

Garik Gutman: For developing an original technique using satellite data for reliable analyses on the Earth's vegetation cover and its long term variations.

Felix N. Kogan: For development, validation, and demonstration of a method to monitor large-scale drought from operational weather satallite data.

Susan M. Ladenheim, Antonio R. Irving, Curtis W. Holland: For outstanding contributions in implementing and improving GOES-8 and GOES-9 operational satellite products.

Eugene D. Legg, Lawrence L.W. Enomoto: For providing NOAA and other agencies access to real-time environmental satellite data from the Japanese ADEOS mission.

Daniel J. Manns: For efforts in developing CLIMVIS, an interactive graphics system which greatly enhanced access and use of NOAA's environmental data.

Dan R. Metzger: For authorship and continued enhancement over 20 years of the internationally recognized GEODAS Geophysical Data Management System.

Thomas S. Peterson, David R. Easterling: For developing revolutionary new climatological baseline data sets and statistical techniques that reveal accurate long-term climatic trends.

William G. Pichel, Timothy S. Stryker, Charles T. Wooldridge: For RADARSAT negotiations, development, and implementation of an operational system to acquire, process, and distribute Synthetic Aperture Radar data.

Nickalaus T. Pinkine, John S. Canter, Gordon R. Moiles, William J. Speidel: For engineering excellence in developing new navigation techniques to provide expanded instrument operations during GOES-9 mitigation operations.

James F. Purdom, Debra A. Molenar, Benjamin Watkins: For developing and supporting the RAMM Advanced Meteorological Satellite Demonstration and Interpretation System (RAMSDIS).

Robert F. Summers, Morris H. Cole, Berry K. Coleman, John W. Davis, Jr., Arthur G. DeCotiis, Glenn M. Hyatt, Ernest R. Payne: For effective planning and efficient implementation of a modern digital publication and distribution system at the National Climatic Data Center.

Timothy J. Walsh, Charles J. Fenno, Richard W. Freeman, William Davis Stewart: For outstanding response by the Satellite Operations Control Center operations team in recovery of the GOES-8 spacecraft from a serious failure condition.

NOAA Administrator's Awards

Arthur L. Booth: For leadership and contributions in developing specifications of all NOAA and non-NOAA civil satellite data sources for use in the National Hazards Support System.

Robert H. Feden: For direct support of Global Environmental Disaster Monitoring and management of the NOAA Satellite Ocean Remote Sensing Initiative.

Vicki Horton, Terrinthia Herrion, Linda Hurd, Debra Payne: For outstanding administrative support.

Rusty L. Foley: For contributions in support of Workforce Management for NESDIS' Executive Management.

Thomas Reek: For long-term and continuing contributions to maintaining excellence in data processing and publishing.

Sharon A. Souther: For the design and installation of the NESDIS videoconferencing network.

Diversity and EEO

NESDIS is changing the cultural climate and ensuring career and economic opportunity, by recruiting, retaining, promoting and managing our human resources.

Diversity is the uniqueness of all individuals of different ethnic, social, cultural, religious, and racial backgrounds that encompass different personal attributes and values to work harmoniously towards achieving our organizational roles.

Managing diversity is the process of creating and ensuring a positive attitude and secure environment where all individual differences are recognized, understood and valued. This process will assure that all people can grow and maximize their contributions to the organization mission.

NESDIS has developed a Diversity Plan that values personal differences and rewards individual performance, productivity, and talent. The plan capitalizes on employees' talents to accomplish the organization's mission.

NESDIS is committed to managing diversity because it is critical to the productivity and competitiveness of the organization. Capitalizing on the unique talents of everyone is good for the individual, the organization, and the community.

Education and Community Outreach

The National Environmental Satellite, Data, and Information Service Educational and Community Outreach (ECO) Program enhances the awareness of career opportunities among students and instructors at various institutions. Agency goals are to increase specific ethnic or minority groups participation in the workforce by providing minority students the opportunity to experience a range of professional careers and by providing teachers the opportunity to conduct research and develop school curricula materials. This initiative program directly assists NESDIS in accomplishing its affirmative action mission.

NESDIS continues to establish partnerships with numerous institutions and organizations such as the Hispanic Association of Colleagues and Universities (HACU), the National Association for Federal Equal Opportunity in Higher Education (NAFEO), the American Indian Science and Engineering Society, the Oak Ridge Institute for Science and Engineering (ORISE), the District of Columbia Metropolitan Consortium for Minorities in Science and Engineering (METCON), and the University of Maryland Graduate Fellows Program.

The NESDIS Education and Community Outreach Program objectives are to:

- Create a pool of talented students by providing exposure to research, development, technology, and the government environment.
- Strengthen the relationship between NESDIS and the surrounding community by offering internships and workshops for teachers in satellite and ocean remote sensing.
- Provide internships that merge relationships between academic studies and practical application for students and teachers studying and teaching math, physics, and engineering.
- Assist teachers in developing curricula materials and educational tools for the classroom.
- Continue partnerships with schools (Adopt A School Program).

Through effective and innovative programs such as the educational and community outreach program, NESDIS can enrich its workforce with the diversity and talent these students and teachers represent.

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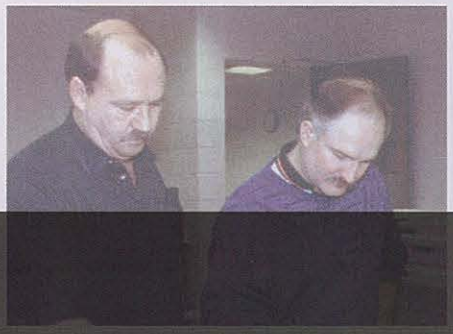
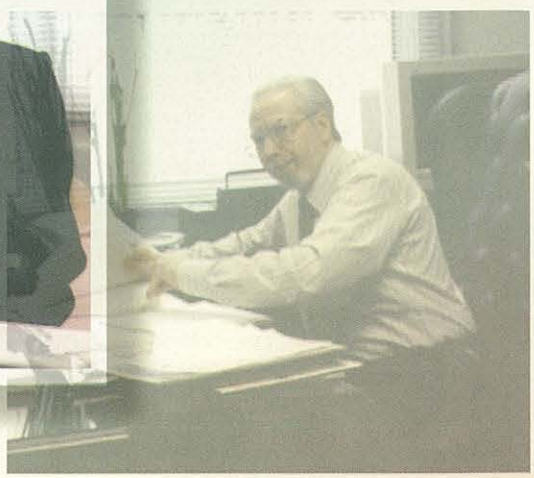


Part VII.

Users of Our Products



Constituents

...we need to know about the trends in the environment, how we can relate the information we do have to our economic decisions, and how we can do a better job of integrating the two. Vice President Al Gore

The NESDIS commitment to better serving its constituents is evidenced by this report and the two which preceded it. These reports are an effort to keep our constituents informed about the evolution of existing products and services as well as the development of new ones. The term "constituents" can be broadly defined as "any individual or organization directly served by NESDIS." This includes the private sector, government at all levels—including the Department of Defense and the National Weather Service, academia, and foreign entities.

NESDIS products and services are vital to our constituents, particularly in the areas of public safety, the protection of property, our national security, sustainable development, and the national economy. Examples of these uses include GOES visible and infrared sensors detecting and tracking hurricanes, flash floods, winter storms, and oceanographic events which enable forecasters to issue timely and accurate warnings and predictions thus reducing loss of life and property.

Polar-orbiting satellites observe global ocean temperatures which make possible seasonal to interannual climate forecasts which have potentially profound economic impact on agriculture, energy production, water resources, and the fishing industry. Climatic data are consulted for the design of airports and water reservoirs. Weather observations have also been studied by the U.S. Navy to design stronger ship hulls. The agriculture industry uses NESDIS data to generate crop freeze warnings and give recommendations for planting, as well as pest and weed control.

NOAA Constituent Affairs Representatives.

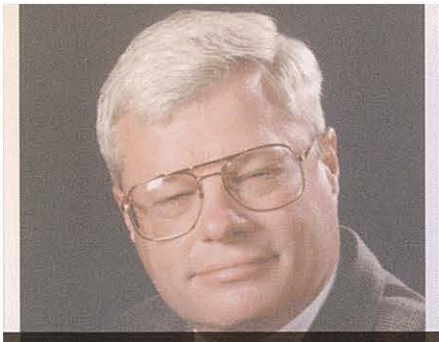
Bob Ryan, Meteorologist, NEWS4. Courtesy of NBC4, WRC-TV, Washington, DC.

With these, and other vital uses of satellite and information services, it is important that we set high standards for ourselves in the areas of quality control, continuity of services, and communication with our users. To know if these standards are being met, we have enhanced access to NESDIS staff members and we measure constituent comments against the set standards. This is done via the Internet, mail, phone, fax, and personal contact with our users at workshops, seminars, professional meetings, as well as on the telephone. The end result is a better quality of products and services, quicker response time to customer requests, and positive dialogue between NESDIS and its constituents.

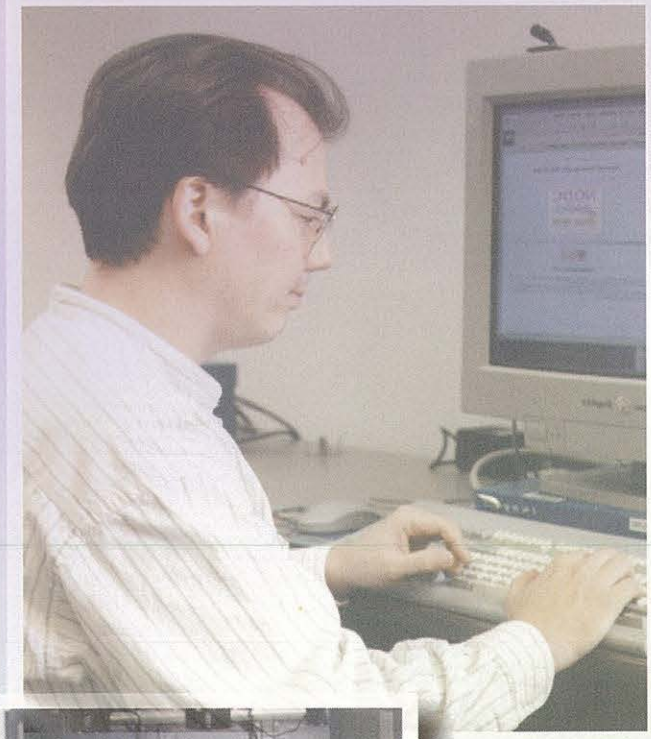
Dr. James Baker (center) hosts a budget briefing for NOAA constituents at the National Press Club.

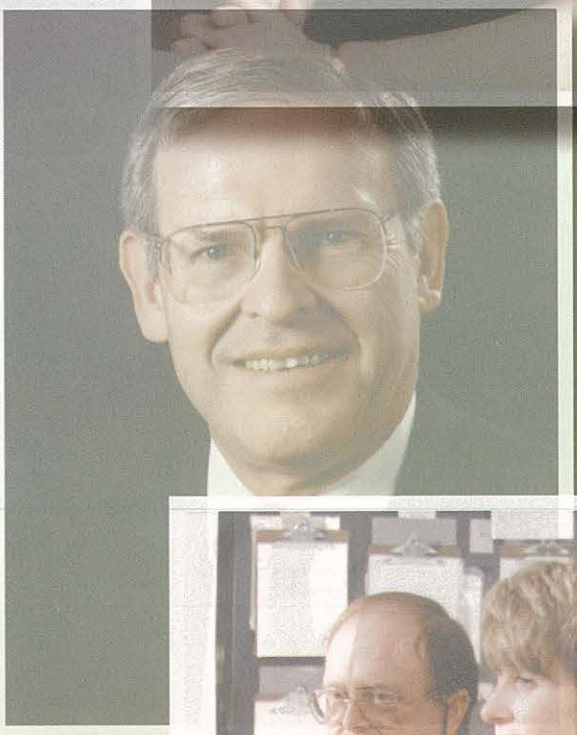
NOAA-wide, each Line Office has designated a Constituent Affairs representative to better coordinate outreach to the constituent community. NESDIS' representative works with other Line Offices on crosscutting issues but also serves targeted NESDIS audiences. Outreach efforts include briefings in the Washington, DC, metropolitan area as well as regional meetings focusing on specific program issues or the NOAA budget. In both 1996 and 1997, there were nearly 20 such meetings held NOAA-wide.

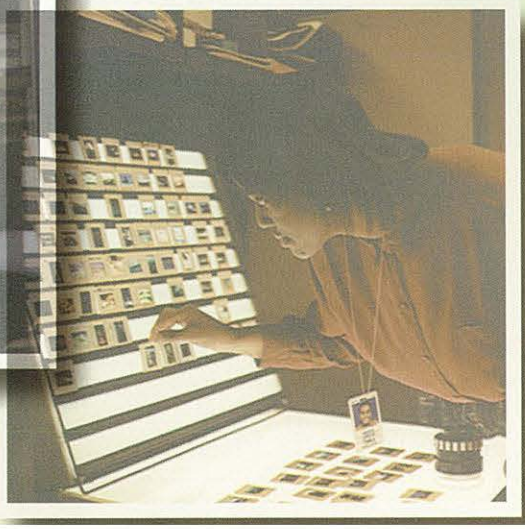
NESDIS Headquarters building, FOB-4, in Suitland, Maryland.

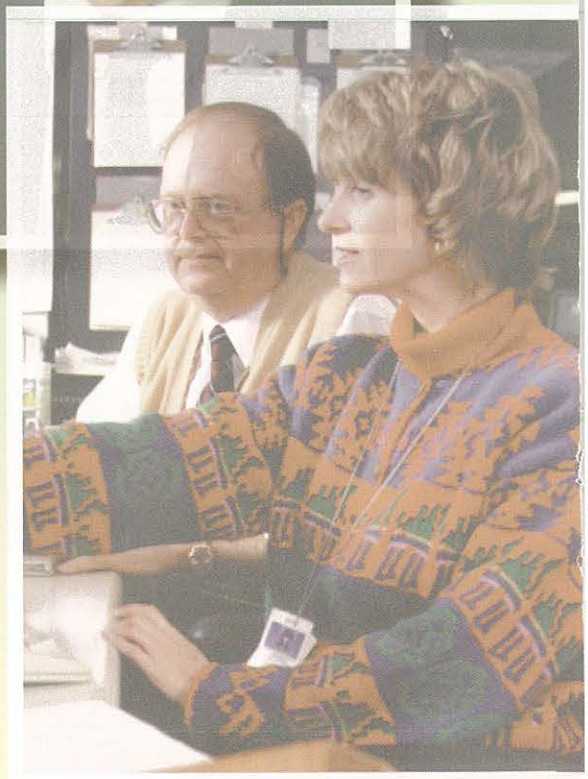


Part VIII.
Future









Next Year and Beyond

For the year 2005, NOAA envisions having integrated environmental observation, assessment, and forecast services that enhance public safety and the Nation's economic and environmental security.

To accomplish this mission, NOAA's strategy includes maintaining continuous operational satellite coverage critical for warnings and forecasts, enhancing global observation and data systems needed to provide data for model predictions of seasonal to interannual climate variations, and ensuring a long-term climate record.

As part of the satellite observing system, NOAA, the Department of Defense, and NASA have agreed to combine resources and expertise to develop a national polar-orbiting environmental satellite capability. This collaborative program is already well underway and will result in significant long-range savings to the U.S. taxpayer through the elimination of redundant efforts and wise leveraging of research and development dollars.

Complementary to this program, significant progress has been made in cooperation with the European Organization for Meteorological Satellites in developing an agreement for an Initial Joint Polar System. This system will support the requirements of the converged system and further reduce U.S. Government costs.

In 1997, NESDIS successfully launched GOES-10, our latest geostationary satellite. GOES-10 will provide an on-orbit spare to the existing two-satellite constellation thereby assuring continued observation of weather systems that affect the United States, including hurricanes and outbreaks of severe storms. Final preparations of the NOAA-K spacecraft are being completed prior to the scheduled spring 1998 launch. The NOAA-K series will refine our observations of the Earth's environment by flying an improved atmospheric sounder and an enhanced visible, IR instrument as well as retaining the complement of ozone solar instruments.

The NESDIS data centers will continue their modernization efforts through the turn of the century. NOAAServer will provide a common entry point for users accessing NOAA data and will deliver seamless access to the data itself.

The United Nations has designated 1998 as the International Year of the Ocean, and the National Oceanographic Data Center will release several major new products as part of its contribution to this celebration. The wealth of additional historical ocean data received by the NODC through its data archaeology and rescue efforts will make possible the release a major new update in the NODC *World Ocean Atlas* series. The NODC will also release a series of CD-ROMs holding all available data sets from the World Ocean Circulation Experiment (WOCE).

As soon as possible after launch of the Geosat Follow-On satellite, the NODC Laboratory for Satellite Altimetry will make global, near-real time sea level analysis available to the National Weather Service. These analyses will be provided for weekly assimilation into the NCEP ocean model.

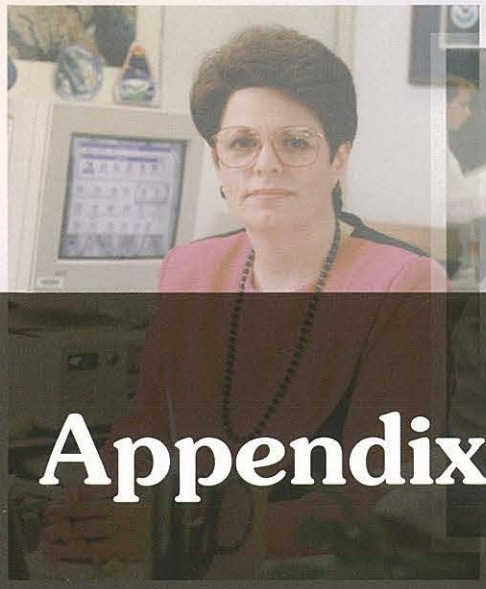
By the year 2005, all NOAA environmental data and information products will be readily available to the Nation. NOAA information will be disseminated by the NOAA National Data Center. Products and services will be made available by nationwide networking connectivity at high data exchange rates using advanced information technology. NOAA's system of environmental information services will form an important link in the chain leading to informed policy decisions.

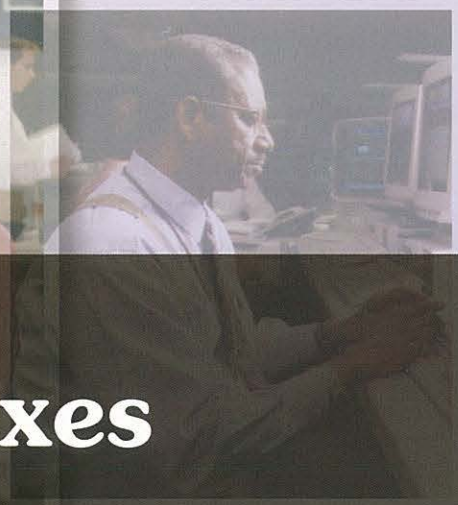
1998 Milestones

In 1998 NESDIS will:

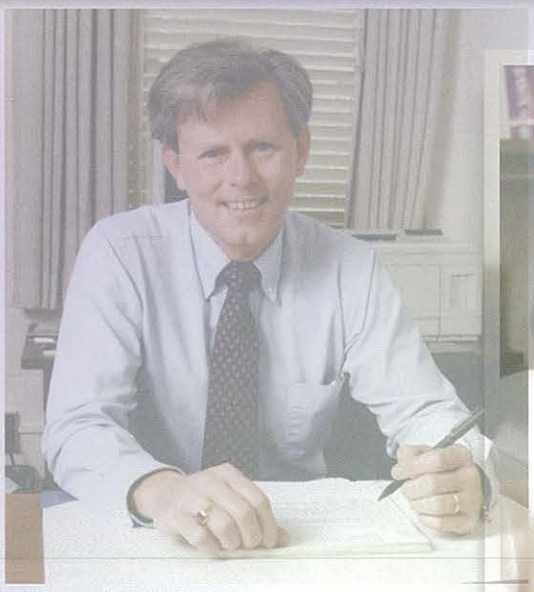
- Acquire and process for the first time, satellite imagery from India's INSAT geostationary environmental satellite, located at 76E longitude. INSAT data became available upon the December 16, 1997, signing of the Memorandum of Understanding between NOAA, NASA, India's Department of Space, and Department of Science and Technology. INSAT will be used by U.S. Government agencies for operational meteorological applications as well as climate studies.
- Launch NOAA-K, to replace the aging NOAA-12 satellite. With the Advanced Microwave Sounding Unit onboard, NOAA-K will provide more accurate temperature and moisture information over the Earth's data-sparse oceans in both clear and cloudy atmospheric conditions.
- Provide civil satellite data for newly established Hazards Support Center in Reston, VA. Under the U.S. Geological Survey, the HSC will provide improved early warning and detection information to support U.S. wildland fire control. HSC will also provide worldwide volcano and volcanic ash alerts to the FAA.
- Implement network computing capability using advanced CORBA and Java technologies in the NOAAServer System.
- Design, develop, and implement highly interactive version of the NOAAServer incorporating advanced Java technologies to support data discovery, access, and fusion.
- Complete implementation of nationally distributed NOAA Data Catalog metadata database incorporating federally-mandated FGDC content standard.
- Release for public access operational Web-based, interagency NEDI system.
- Complete migration of the Global Environmental Information Locator Service software and database resource from the ED to NOAA.
- Carry out a set of prototype activities with national and international partners, to test the Integrated Global Observing Strategy (IGOS) and Global Climate Observing System (GCOS) concepts.
- Complete refurbished Satellite Operations Control Center for assumption of operational capability of DMSP satellites.
- Publish new licensing regulations for commercial remote sensing systems.
- Sign agreement with EUMETSAT for the multinational Joint Polar System.
- Conclude negotiations of Landsat-7 MOUs for foreign ground stations.
- Select a set of IGOS projects for further implementation and develop a framework for IGOS international partnership.
- Implement GOES Day-2 products (moisture soundings, high-density winds, and Automated Surface Observing System (ASOS) imager-based Satellite Cloud Product).
- Implement World Wide Web access to the TOGA COARE Data Information Unit at NCDC.
- Implement NCDC Geostationary Satellite Archive system.
- Install Fairbanks antenna.
- Complete systems requirements reviews for NPOESS instrument contracts.
- Complete NVDS business plan and target architecture.
- Support NASA launch of ADEOS NSCAT replacement—QuikScat (November 1998).
- Transition ASOS online system to operational environment.
- Complete COMPS cost system.
- Place storage media for new data sets in operation.
- Rescue nearly 10,000 tapes of Russian precipitation data. In addition procedures will be developed to extract precipitation data from the data set that will be used to prepare a comprehensive U.S -Russian precipitation baseline data set for climate and global change research.

- Establish an Advanced Weather Interactive Processing System (AWIPS)/NOAAPORT Receive Station (NRS) at NCDC. The NRS is required for NCDC to obtain a single source of near-real time data which will provide superior service to the Center's customers.
- Place the NCAR/NCEP reanalysis data set online for users to access.
- Demonstrate the ingest, archive, and servicing functions of EOSDIS data.
- Award a new NCDC mission support contract.
- Release the *World Ocean Atlas 1998* and the *World Ocean Database 1998*.
- Implement the Interactive Data Access and Retrieval System (IDARS) to provide a consistent user interface to NODC online oceanographic data resources.
- Produce global, near-real-time sea level analyses from Geosat Follow-On mission altimeter data.
- Develop a data archive and access system for shipboard sensor data collected by NOAA ships.
- Assume full operational responsibility for DMSP in June.





Appendixes



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Warm Climate Surprises

Jonathan T. Overpeck

Over the last decade, paleoclimatic data from ice cores and sediments have shown that the climate system is capable of swinging between significantly different modes, suggesting that climatic surprises may be ahead (1). Changes of several degrees in glacial surface air and sea surface temperature over large expanses of the high northern latitudes apparently occurred multiple times within years to decades (2, 3) and have been attributed to abrupt shifts in oceanic thermohaline circulation (4).

These high-latitude events are likely linked to abrupt climatic shifts at low latitudes (5, 6). Most attention in the growing area of abrupt climatic change research continues to be focused on the large changes observed during glacial periods, when large quantities of glacial meltwater were available to influence ocean circulation and climatic change. In contrast, the current warm interglacial climate is often characterized as relatively stable, leaving the impression that climates of the future are likely to be more or less well behaved. There also seems to be a widespread belief that the full range of natural interannual- to centennial-scale climate variability is well represented in the instrumental record of the last century. The weight of the paleoclimatic evidence now being collected, however, suggests that these comforting conclusions of benign warm-climate variability may be incorrect.

Hints of significant decadal to centennial climate variability during the Holocene (that is, the last 10,000 years) have appeared sporadically in the literature over the last 20 years, but efforts to map coherent patterns of this variability, and to define causal mechanisms, have lagged behind similar efforts focused on glacial variability. This dichotomy stems in part from the lower signal-to-noise ratio associated with many warm climate events and from the lack of clearly understood forcing mechanisms in the absence of large Northern Hemisphere ice sheets. Ironically, it was not until recent ice core drilling uncovered evidence for major abrupt changes during the last interglacial (120,000 to 130,000 years ago) that interest in variability during warm climates began increasing (7). Now, as the record of the last interglacial becomes more uncertain owing to apparent stratigraphic complexities in the deep Greenland ice cores (2), attention is returning to the current Holocene interglacial.

The Holocene is a fertile ground for climate research. Advances in geochronology and paleoclimatic reconstruction have aided the generation of an increasing number of well-dated paleoclimatic time series that resolve decade- to century-scale climatic events. It is now clear that climate variability in many regions of the world, including Greenland, was significantly greater during the last 10,000 years than during the last 150 years (5, 8–12). Most Holocene events were smaller in magnitude than their glacial counterparts, but many were still large enough to dwarf changes seen in the instrumentally based climate record of the last 150 years. More importantly, many of these past Holocene events appear to have been large enough that, if they were to occur in the future, they would have major impact on humans.

In contrast with their glacial counterparts, the biggest potential warm-climate surprises are likely to be linked with the continental hydrologic cycle. Major century-scale shifts in monsoon strengths appear to have characterized large parts of Africa during the Holocene (5). Changes in moisture availability were also large in North America. Large areas of the Great Plains were mobilized in the form of eolian dunes during multiple intervals in the Holocene, most likely coincident with changes in ground-water and lake levels in regions now heavily farmed (8). There is little doubt that those episodes of drought were more severe and prominent than any recorded since Europeans came to North America (including the "dust bowl" droughts of the mid-20th century) and that other parts of the continent experienced drought and flood events significantly more extreme than any recorded in the instrumental period (12). Decades- to centuries-long droughts were apparently more common in California before this century (11) but are not well understood. Droughts unprecedented with respect to the last 400 years have also been implicated in the demise of ancient New World civilizations (9).

The paleoclimatic record leaves little doubt that warm interglacial climates are, even in the absence of any human forcing, capable of generating significant decade- to century-scale climatic surprises. We are beginning to be able to map the patterns of these variations, but unravelling their causes remains a major challenge and will require significant advances in the theory of climate change (13). Solar and volcanic forcing may play important roles in driving the observed patterns of change, but their influences (particularly amplifying feedbacks) require further investigation. One clue to the causes of Holocene variability may be that the frequency and magnitude of El Niño–Southern Oscillation events experience long-term variations, both small (14) and large (15). Existing new Holocene data from the North Atlantic also suggest that ocean thermohaline circulation may be capable of significant abrupt warm climate changes (16).

The primary goal of climate research is to enhance our predictive ability. Clearly, this ability must include the capacity to simulate the full range of variability observed in the paleoclimatic record. Even

A pattern of change. Enhanced LANDSAT Thematic Mapper (TM) perspective image developed by processing and presenting data acquired on 12 August and 13 October 1986. Dark parabolic landforms adjacent to the South Platte River in northeastern Colorado are currently stabilized dunes found to have been mobile at least four times during the Holocene. (Courtesy of R. Tufnes and A. Goetz, Center for the Study of Earth from Space (CSES/CIRES), University of Colorado, Boulder, Colorado)

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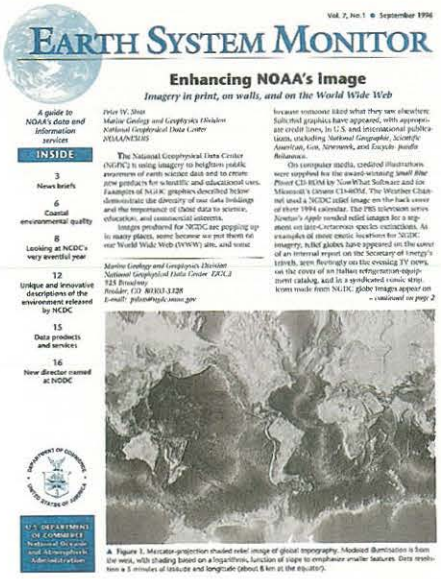

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EARTH SYSTEM MONITOR

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16 New director named at NCDC

Peter W. Sloss
Marine Geology and Geophysics Division
National Geophysical Data Center
NOAA/NESDIS

The National Geophysical Data Center (NGDC) is using imagery to heighten public awareness of earth science data and to create new products for scientific and educational uses. Examples of NGDC graphics described below demonstrate the diversity of our data holdings and the importance of these data to science, education, and commercial interests.

Images produced for NGDC are popping up in many places, some because we put them on our World Wide Web (WWW) site, and some because someone liked what they saw elsewhere. Solicited graphics have appeared, with appropriate credit lines, in U.S. and international publications, including *National Geographic*, *Scientific American*, *Geo*, *Newsweek*, and *Encyclopædia Britannica*.

On computer media, credited illustrations were supplied for the award-winning *Small Blue Planet* CD-ROM by NowWhat Software and for Microsoft's Encarta CD-ROM. The Weather Channel used a NGDC relief image on the back cover of their 1994 calendar. The PBS television series *Newton's Apple* needed relief images for a segment on late-Cretaceous species extinctions. As examples of more exotic locations for NGDC imagery, relief globes have appeared on the cover of an internal report on the Secretary of Energy's Lehrch, seen flashingly on the evening TV news, on the cover of an Italian refrigeration-equipment catalog, and in a syndicated comic strip. Icons made from NGDC globe images appear on

– continued on page 2

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▲ Figure 1. Mercator-projection shaded relief image of global topography. Modeled illumination is from the west, with shading based on a logarithmic function of slope to emphasize smaller features. Data resolution is 2 minutes of latitude and longitude (about 3 km at the equator).

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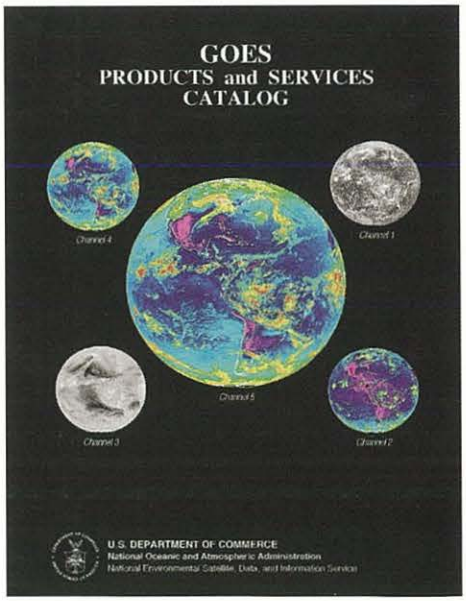

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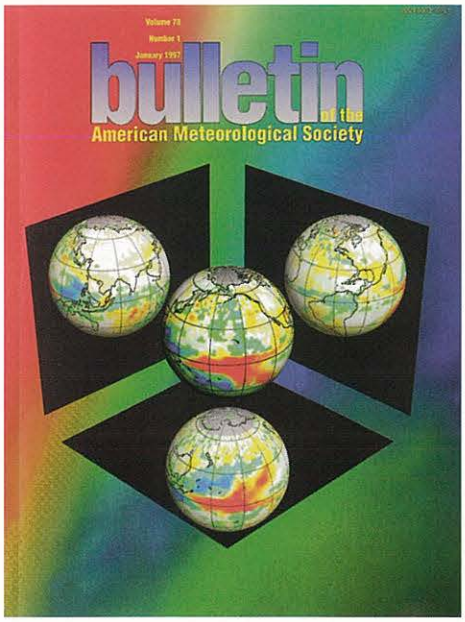

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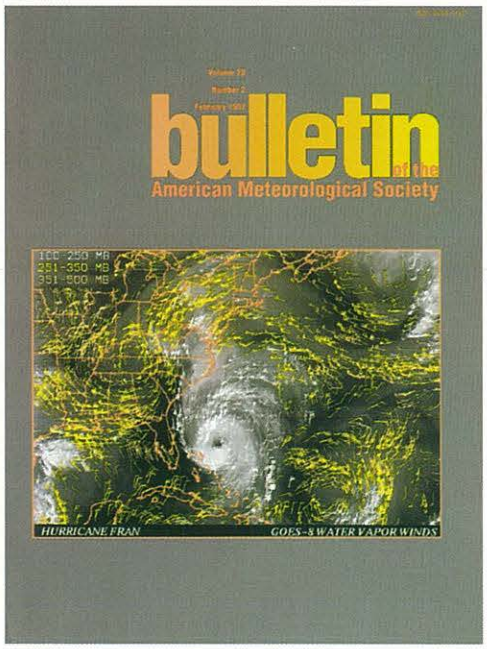

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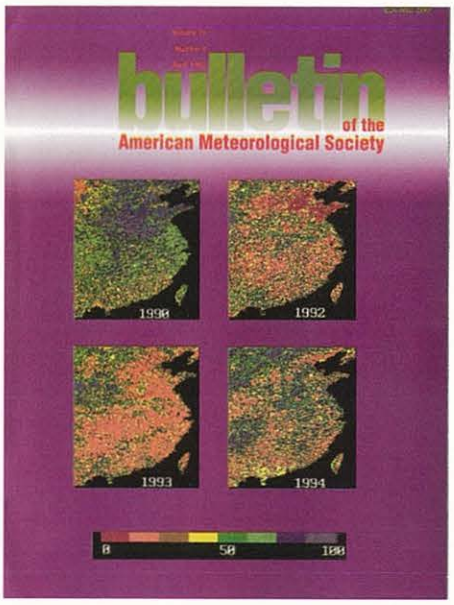

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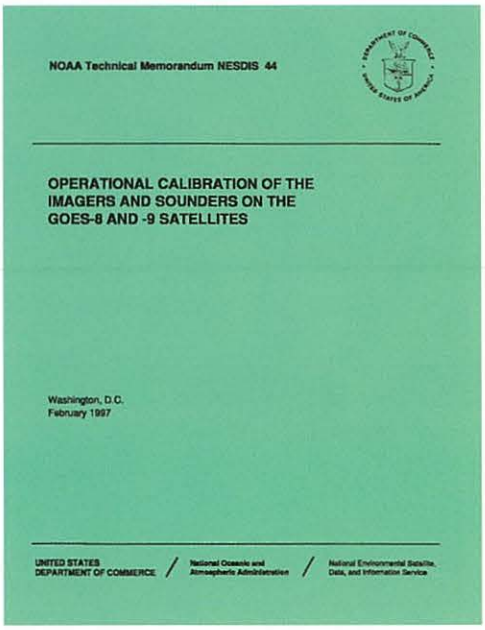
NOAA Technical Memorandum NESDIS 44

OPERATIONAL CALIBRATION OF THE IMAGERS AND SOUNDERS ON THE GOES-8 AND -9 SATELLITES

Washington, D.C.
February 1997

UNITED STATES DEPARTMENT OF COMMERCE / National Oceanic and Atmospheric Administration / National Environmental Satellite, Data, and Information Service

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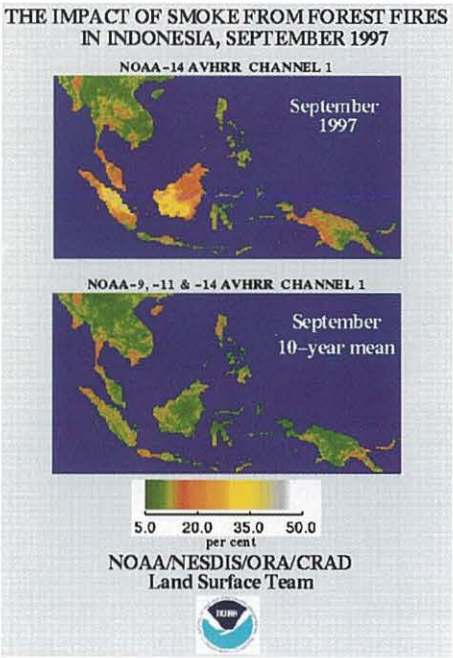
Select New 1996-97 Products

Pathfinder Products on Satellite Active Archive



The NOAA Satellite Active Archive (SAA) commenced electronic distribution of the first NOAA Atmospheric Pathfinder Data Set, TIROS Operational Vertical Sounder (TOVS) Deep Layer Mean Temperature (DLMT) in September, 1996. The DLMT product is among the suite of climate measuring products derived from the reprocessing of NOAA's operational, polar-orbiting satellite data archive. Global fields of deep-layer mean temperatures derived from measurements obtained from the Microwave Sounding Unit (MSU) including maximum contributions centered at 100, 150, 225, 350, 500, 650, and 800 MB are included. The period of record is January 1987 through December 1994. SAA customers may browse imagery representing the derived monthly products and animated time-series imagery, as well as downloading the data to their site. Access provided to DLMT data through the World Wide Web will serve as the SAA data distribution prototype for future NOAA satellite-derived products.

New GOES Web Browser Makes Remapped GOES Data Available

In 1996, NESDIS began providing access to GOES data in near-real-time through a World Wide Web browse server on the Internet. This new home page is called the NOAA Geostationary Satellite Browse Server (NGSBS). NGSBS is located at http://www.goes.noaa.gov and contains GOES-East and GOES-West 8-km resolution sectors, mapped to National Weather Service AWIPS projections over the contiguous United States, Alaska, Hawaii, and Puerto Rico. In addition, NGSBS contains online access to

1 week of past images, special hurricane sectors centered over the Caribbean Sea, and composite images of GOES-East and GOES-West. Tens of thousands of users have accessed NGSBS since its inception and it contains links to hundreds of various home pages on the World Wide Web, including the White House home page.

RADARSAT Data Subscription Services on SAA

The NOAA Satellite Active Archive (SAA) commenced electronic distribution of RADARSAT data to registered subscription customers in September 1996. RADARSAT is a Canadian polar-orbiting satellite equipped with an advanced radar sensor called a Synthetic Aperture Radar (SAR). The SAR is a powerful microwave instrument that sends pulsed signals to the Earth and processes the received reflected pulses or backscatter. Different surface features produce variations in the returned signal, so surface roughness, topography, land/water boundaries, certain manmade features, and moisture content are distinguishable in SAR imagery. Applications include ice reconnaissance, coastal surveillance, oceanography, cartography, geology, environmental monitoring, hydrology, agriculture, and forestry. Data are received at the SAA through telecommunication links with

the Alaska SAR Facility (ASF) and the National Ice Center (NIC). Future RADARSAT development at the SAA will include advanced subscription services with spatial and temporal selections for distribution.

NCDC World Weather Records 1981-90 for North America and Europe Published

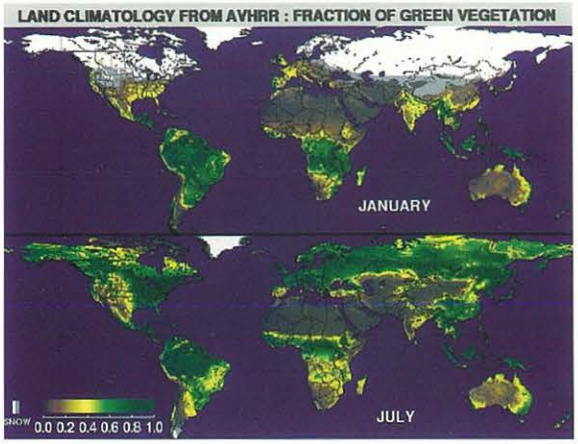
The 1981-90 North American and European volumes of World Weather Records has been completed following procedures established by the Executive Council of the World Meteorological Organization. These volumes contain monthly values of station pressure, sea level pressure, mean temperature, and precipitation for approximately 250 North American and 300 European stations. The digital file contains these four parameters and, for the first time, monthly means of maximum and minimum temperature.

NCDC Table of Snowfall to Meltwater Ratio

A table of snowfall to meltwater ratios at various temperatures has been published in the November 1995 issue of the *American Weather Observer* (AWO). The table, developed for quality control purposes at the National Climatic Data Center by Grant Goodge, has also been adopted by the National Weather Service in the "Weather and Obstructions to Vision" portion of *Federal Meteorological Handbook #7*. Publication of this table in the AWO will, hopefully, aid the several thousand subscribers and observers in making more accurate meltwater determinations.

NOAA Weather Charts

This CD-ROM set (3 per month) is being produced on a monthly basis. The CD-ROMs contain the most user-requested weather charts produced by the National Center for Environmental Prediction and archived at the National Climatic Data Center. These include North American, Northern and Southern Hemispheric surface and upper-air analyses, forecast charts, tropical strip charts, and present weather and radar charts. The set begins with charts for October 1994 and are produced operationally for each calendar month. A new monthly CD-ROM set is available approximately every 5 to 6 weeks after the end of a data month. The CD- ROM set replaces the 35-mm rolls of film previously used to furnish a data month of charts to customers.



NCDC Global Gridded Upper Air Statistics, Version 2.0

This CD-ROM contains ASCII data files of long-term monthly means and standard deviations for the 1980-95 period of record for 15 atmospheric levels on a global 2.5-degree grid. Elements included are air and dew point temperature, height, sea-level pressure, wind, and density. Also included are 8 point wind roses.

New Environmental Information Summary (EIS) Available for Satellite Data and Information

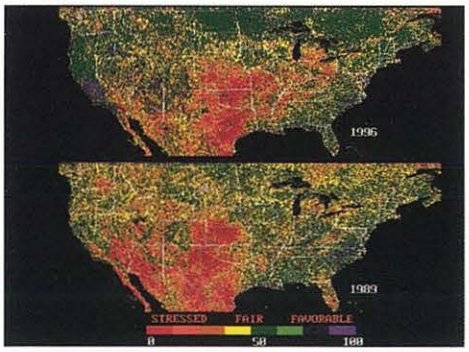
The National Climatic Data Center completed a new EIS entitled Environmental Satellite Data and Information. The EIS updates three documents on National Oceanic and Atmospheric Administra-

tion (NOAA) satellites and NCDC's satellite services. The 15-page document includes background information on the Polar- Orbiting Operational Environmental Satellite (POES), Geostationary Operating Environmental Satellite (GOES), and Defense Meteorological Satellite Program (DMSP) satellites, in addition to Sea Satellite (SEASAT), Radar Satellite (RADARSAT) , Geostationary Earth Observation Satellite (GOES) , and NIMBUS-7 satellites; NCDC services (including a listing of what is online); and a complete list of satellite data and products.

Radiosonde Data of North America CD-ROM

NCDC has produced an update for the CD-ROM entitled Radiosonde Data of North America. The latest disc, produced as a joint effort with ERL, includes data for 1996 and the entire 4 CD product contains all available radiosonde data covering the United States, Canada, Mexico and the Caribbean Region for the period beginning in 1946.

NOAA Global Vegetation Index User's Guide



WINTER WHEAT BELT DROUGHT

These images compare late-April vegetation conditions from two years, 1996 and 1989, as seen by the Advanced Very High Resolution Radiometer (AVHRR) on board NOAA's polar orbiting satellites, NOAA-14 and 11 respectively. Vegetation stress is estimated from radiance measured in the visible, near infrared, and thermal intervals of the solar spectrum. The collected data were converted to a quantity that is a measure of vegetation condition.

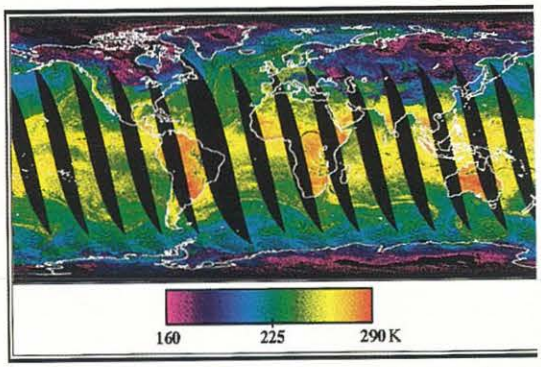
At the end of April 1996, vegetation stress on the U.S. Great Plains, detected one month earlier, intensified and expanded. Data showed that vegetation was most severely affected in Texas, Oklahoma, Kansas, and Missouri. During April, the dry spell expanded to the northern and eastern states as well. The 1996 drought began to surpass the 89 drought-related stress which caused a reduction in winter wheat production.

The NOAA Global Vegetation Index User's Guide (July 1997 version) is a document that describes the Global Vegetation Index (GVI) Product that is archived by the National Climatic Data Center's (NCDC) Satellite Services Branch (SSB). This user's guide includes descriptions of the First Generation version of the product which was produced from May 1982 through March 1985, in addition to the current Second Generation version (produced from April 1985 to the present), and the newly developed Third Generation product. These descriptions include the data formats and the equations that support the various versions. This publication can also be ordered on CD-ROM. Online version available at http://www2.ncdc.noaa.gov/POD/intro.htm.

NOAA Polar Orbiter Data User's Guide

The NOAA Polar Orbiter Data User's Guide (January 1997 version) is a document that describes the orbital and spacecraft characteristics, instruments, data formats, etc. of the TIROS-N, NOAA-6 through NOAA-14 polar orbiter series of satellites. This publication can also be ordered on CD-ROM. Online version available at http://www2.ncdc.noaa.gov/POD/intro.htm

PRODUCT: 85v GHz Channel
DATA FOR JULIAN DATE 97029 SATELLITE F10 IN ASCENDING NODE



Images are dynamically allocated. You may need to hit reload key to ensure images are correct

Daily U.S. Climate Data CD-ROM

The National Climatic Data Center has issued an update to the Cooperative Summary of Day CD-ROM set for the years 1994 and 1995. The original 21 CD set contained data for the mid 1800s to 1993 with a single update for 1994. For this product, data for 1994 and 1995 were consolidated on one CD together with extraction software. The Cooperative CDS contain all available digital data (maximum/minimum temperature, rainfall, snowfall, weather) observed and recorded daily at thousands of cooperative sites across the United States. The CD also includes station history information and a station element inventory.

NCDC C-MAN and Buoy Reports and Summarized Elements, Version 1.0

This two CD-ROM set contains data, summary tables, and access software for 197 buoys and C-MAN sites managed by the National Data Buoy Center. Hourly data, including air/sea temperatures, wind, pressure, wave height/period are for the period of record through 1993. Both volumes contain summary tables for all 197 sites. Volume 1 also contains hourly data for the North Atlantic and Gulf of Mexico sites. Volume 2 also contains hourly data for the North and South Pacific, Gulf of Alaska, and Great Lakes.

Arctic and Antarctic Sea Ice Data 1972-94

This CD-ROM contains ASCII data files of weekly ice data for the Arctic basin (1972-94) and Antarctic basin (1973-94). Data are provided in the international Sea Ice Grid (SIGRID) structure on a 0.25 degree latitude grid, and includes total ice concentration, stage of development (thickness), and form of ice for the complete period of record. Additional ice-related parameters may also be available for the more current years.

NCDC Radiosonde Data of North America 1946-95 (1995 Update)

This CD-ROM contains all available upper-air radiosonde data observed at sites in the United States, Canada, Mexico, and the Caribbean. The data are available in a variety of reporting formats with access software for most user platforms.

NCDC Global Tropical and Extratropical Cyclone Climatic Atlas, Version 2.0

This CD-ROM contains all available tropical storm track data for the global oceans for the period beginning in the 1800s through 1995. Extratropical track data are included for the Northern Hemisphere for 1965-95. Software allows the user to plot specific tracks based on user-defined criteria, to determine the tracks of weather systems passing within a user selected radius of any point on the globe, and to display a variety of basin-wide graphical products. Narratives describing each tropical system are available for most storms beginning in the 1950s. Narratives describing extratropical systems in the Northern Hemisphere are included for the 1981-95 period.

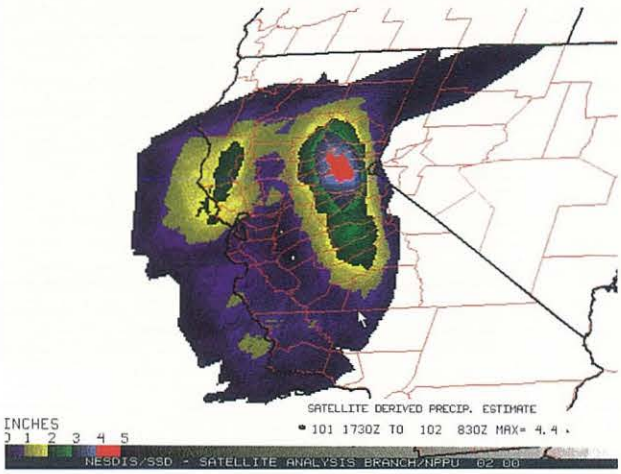
NCDC International Station Meteorological Climate Summary, Version 4.0

This CD-ROM contains detailed climatological summaries for nearly 2,600 global locations and less detailed summaries for an additional 4,000 locations. Included are period of record through 1995 data for most National Weather Service and Navy locations. Specific summary table data can also be graphically represented.

NOAA Marine Environmental Buoy Database: Update Disc 1995

This update disc for NOAA's Marine Environmental Buoy Database CD-ROM series contains marine meteorological, oceanographic, and wave spectra data collected during 1995 by moored buoys and C-MAN (Coastal-Marine Automated Network) stations operated by the NOAA National Buoy Data Center (NBDC). Principal parameters include air temperature and pressure, wind speed and direction, wind gust, wave height and direction, and sea surface temperature.

NODC Taxonomic Code, Version 8.0



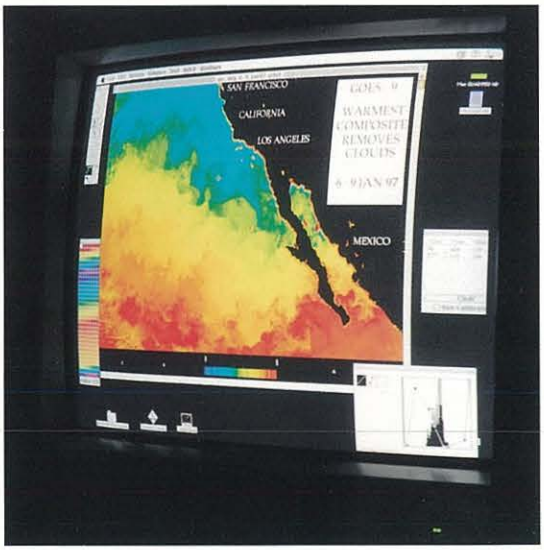
The National Oceanographic Data Center (NODC) Taxonomic Code is the largest and most flexible of various coding schemes that have been developed to adapt the Linnean system of biological nomenclature to computerized data storage and retrieval methods. This version of the NODC Taxonomic Code is designed to serve as a transition to a new coding system. It is the last release of an older system based on a hierarchical numerical codes of up to 12 digits and introduces new codes referred to as taxonomic serial number that are the basis of the Interagency Taxonomic Information System being adopted by NOAA, the U.S. Department of Agriculture, U.S. Geological Survey, and other participating agencies.

NSWC Moor ADCP Data 1994-95

This CD-ROM contains Acoustic Doppler Current Profiler (ADCP) data collected by the U.S. Naval Surface Warfare Center (NSWC) at a fixed site offshore Ft. Lauderdale, Florida. These data are received by NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) as part of a cooperative agreement between NOAA and the NSWC. The CD-ROM includes raw data files, processed data files, and current velocities depicted as color Hovmueller plots.

Gulf of Mexico Hydrographic and Marine Mammal Data

Produced in cooperation with the Department of Oceanography, Texas A&M University, this CD-ROM contains an extensive database of hydrographic (CTD, XBT, bottle) data and processed data parameters collected in the Gulf of Mexico from 1987-95. The disc also includes a database of marine mammal sightings collected as part of the GulfCet Program sponsored by the U.S. Minerals Management Service.



1995 Hurricanes and Typhoons Slide Sets and Poster From DMSP Satellites

The 1995 hurricane season was the most active since 1933. During the 1995 season, 11 tropical cyclones reached the hurricane status, nearly double the average. Twelve Pacific tropical cyclones became typhoons, five of which were super typhoons with winds in excess of 150 mph. This incredible natural display led to the creation of two slide sets consisting of images captured by the Defense Meteorological Satellite Program (DMSP) satellite.

Age of the Ocean Floor

NGDC printed and released a new poster on "Age of the Ocean Floor" in cooperation with scientists in Australia, Canada, France, and the United States.

Ancient Solar and Related Databases

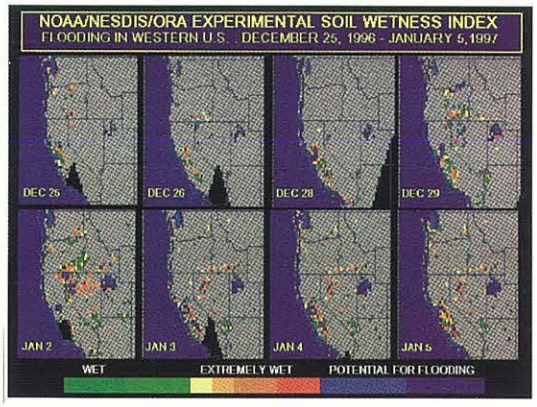
NGDC completed a joint NOAA-NASA data rescue effort by digitizing and quality controlling several long term solar activity databases available only in analog form. The Solar Radio Daily Flux Data from the International Astronomical Union's Quarterly Bulletin on Solar Activity includes 16.6 MB of data from 55 stations covering the years 1949-86 or 722 station-years. Auroral event data for the last 1,000 years (1000-1900) from Northern hemisphere sites at latitudes below N55 were key entered from the world list compiled by L. Krivsky and K. Pejml, Czech Republic. Auroral events at these lower latitudes correlate with solar activity. The McMath Observatory solar calcium plage database 1942-1964 were processed and extensively quality controlled from the original drawings. All of these databases reside on the NGDC FTP archive Solar Databases for Global Change Models. Available from the National Geophysical Data Center.

Bathymetry of Lake Michigan—Map

A new color poster of the bathymetry of Lake Michigan was completed, and a companion CD-ROM containing Lake Michigan bathymetry was created. NGDC applied 3-D viewing technology to graphics of bathymetry and topography for the first time, and colors in the new Lake Michigan poster were optimized to take advantage of this added capability.

Ecological Characterization of Otter Island, South Carolina

A compact disc was created for coastal managers, to illustrate an integrated, digital approach to coastal resource planning. The target area for this prototype was Otter Island, South Carolina, an area of rich natural and historical diversity. The compact disc includes spatial data, metadata, and text, graphics, and video. Available from the Coastal Services Center and the National Geophysical Data Center.



GEODAS Trackline Marine Geophysical Data on CD-ROM

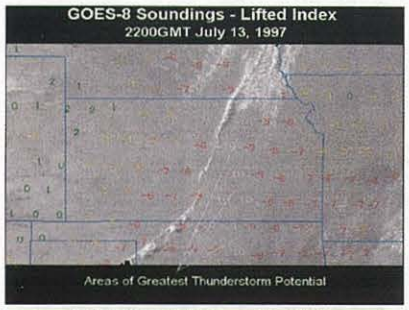
NGDC released version 3.2 of the GEODAS Trackline Marine Geophysical Data on CD-ROM. This latest version consists of four discs, containing all data acquired and assimilated through 1995, including 854,000 kilometers of bathymetry, magnetics, and gravity from 169 surveys. Over 2.4 million new digital records were added in 1995, since the previous release. Version 3.2 includes updated PC-Windows and new UNIX X-Windows access software.

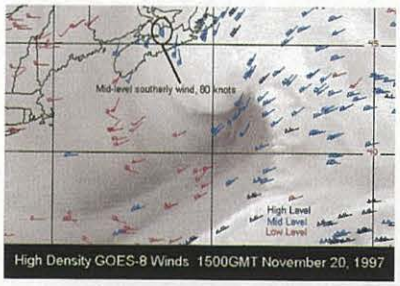
Global NSCAT Ocean Surface Winds

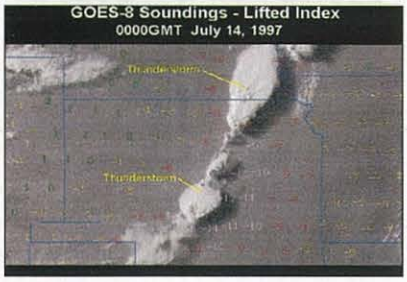
Global NSCAT ocean surface winds were produced operationally from ADEOS from April 15, 197 until the failure of ADEOS on June 30, 1997. They were being implemented into forecast centers around the world to improve global forecast models.

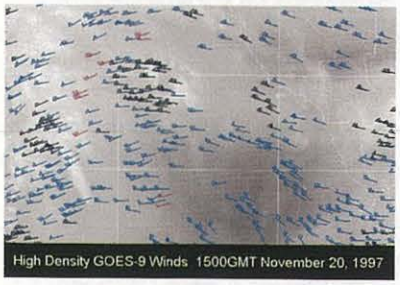
New GOES Products

Four new GOES products were implemented by the National Weather Service in 1997: moisture soundings, GOES high density winds, GOES derived sounding products (for measuring moisture and atmospheric stability), and a global daily snow and ice product. All products are expected to have a major impact on National Weather Service operations: either through improvements to numerical weather prediction or through improved early warning and detection of hazardous weather events.

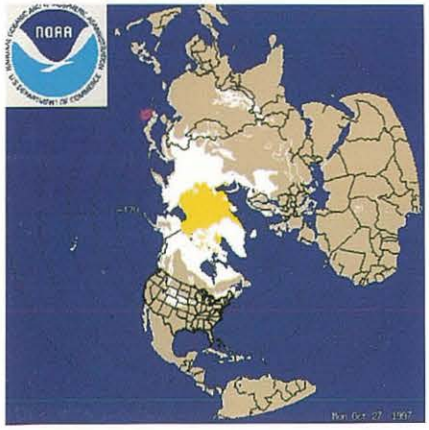








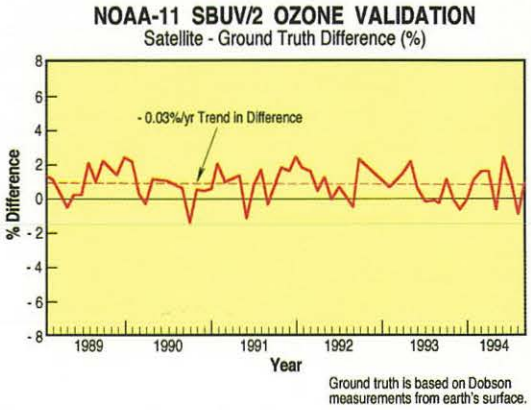
Magnetic Anomaly Data for the Former Soviet Union



This data collection (on CD-ROM) contains a wealth of information useful for studying global tectonic processes and the deep crustal composition of major continental cratons. The data can be used to examine the nature of changes in field intensity over large areas, and to compare the nature of the anomalous magnetic field with geological structures. Available from the National Geophysical Data Center.

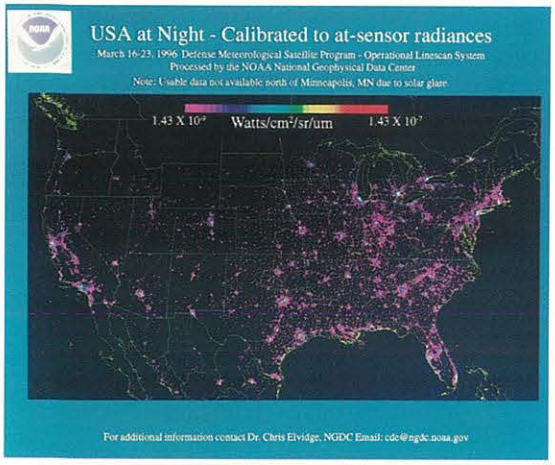
National Ocean Service (NOS) Digital Hydrographic Database

NGDC released a new CD-ROM set containing the complete National Ocean Service (NOS) Digital Hydrographic Database. The database includes over 44 million soundings from 4,961 surveys for a total of 1.7 gigabytes of hydrographic data. The database consists of depths and navigation features digitized from plots of hydrographic surveys completed from 1930 to 1965, and survey data acquired digitally since 1965. The three-disc set includes GEODAS search and retrieval software for both PC-Windows and X-Windows environments. The software features "zoom in" to soundings using UNIX X-Windows software capability.



Natural Hazards Slide Sets

Six new educational slide sets were developed in 1996. One slide set focuses on the Hanshin-Awaji (Kobe) earthquake of January 17, 1995. Three others were informational presentations of geological hazards, including faults, seismic creep, and erosional landforms. In addition, a set of unique DMSP satellite images of the 1995 hurricane and typhoon season proved to be popular. Available from the National Geophysical Data Center.

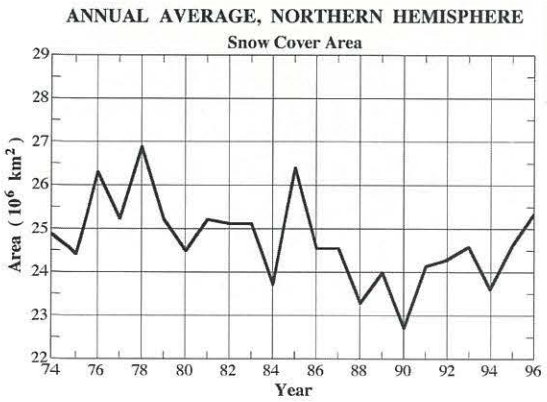


Nighttime Lights of the USA From DMSP Satellites

The image of the "Nighttime Lights of the USA" poster was derived from cloud-free portions of 231 orbits of DMSP OLS data. The majority of the detected features are lights from cities and towns. A set of oil platforms can be observed in the Gulf of Mexico, south of Louisiana. These data are being used by NOAA, NASA, and university scientists to analyze the spatial distribution of population, energy consumption, economic activity, and greenhouse gas emissions.

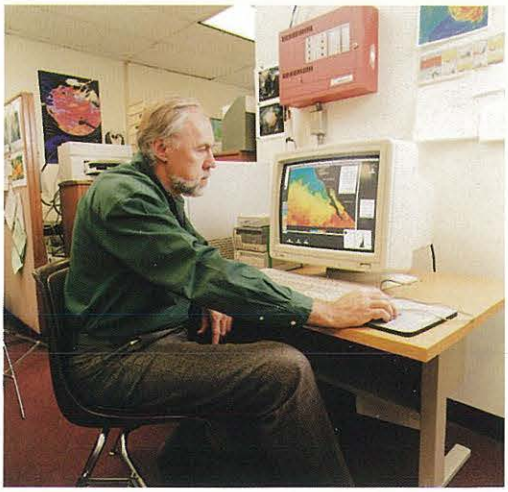
Northern Hemisphere Weekly Snow Cover and Sea Ice Extent 1978-95

NSIDC developed a northern hemisphere cryospheric product which for the first time combines snow cover and sea ice extent at weekly intervals from 1978-95. The data set also includes monthly climatologies describing snow and sea ice extent in terms of average conditions, probability of occurrence, and variance. Funding for this project has been provided by the NOAA Climate and Global Change Program and the NASA Pathfinder Program. Available from the National Geophysical Data Center, National Snow and Ice Data Center.



Project Magnet on CD-ROM

The complete Project Magnet (1951-94) data collection is now available on compact disc. Data consist of flight surveys in binary format, documentation, and metadata (histograms and help files). GeoVu, a multiplatform browse and retrieval software, is included with the CD-ROM. The data on this CD were assembled to simplify the work of scientists performing regional and global geophysical studies, including research into the nature of Earth's magnetic field. Available from the National Geophysical Data Center.

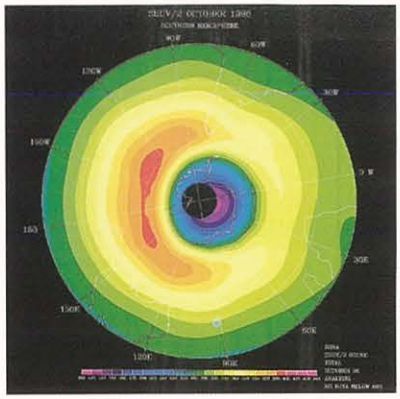


Russian Arctic Ocean Drift Station Data on CD-ROM

NSIDC, in collaboration with the Polar Science Center (PSC), University of Washington, has released a new CD-ROM containing snow, meteorological, and solar radiation data from the then Soviet North Pole drifting stations. Arctic Ocean Snow and Meteorological Observations from Drifting Stations, 1937, 1950-91, Version 1.0, contains: snow depth, snow surface temperature, snow density, snow water equivalent; meteorological data (air temperature, relative humidity, surface pressure, wind speed and direction, U-V components of wind, total and low cloud amounts, precipitation type and amounts); and solar

radiation data. Available from the National Geophysical Data Center, National Snow and Ice Data Center.

Seismicity Catalog



This two-volume CD collection contains data for more than 4 million earthquakes dating from 2100 B.C. to A.D. 1995. The data include information on epicentral time of origin, location, magnitudes, depth, and other earthquake-related parameters. Records have been contributed from various worldwide industrial, academic, governmental, and private sources. The compilation was done in cooperation with the U.S. Geological Survey's National Earthquake Information Center. Available from the National Geophysical Data Center.

Solar-Terrestrial Energy Program (STEP) CD-ROM for 1992

The production of a CD-ROM for the STEP 6.4 geomagnetic network was completed. This CD-ROM contains 1-minute variation data from 43 magnetic observatories. The CD-ROM is a continuation of a series starting in 1990. Available from the National Geophysical Data Center.

Strong Motion Data Catalog

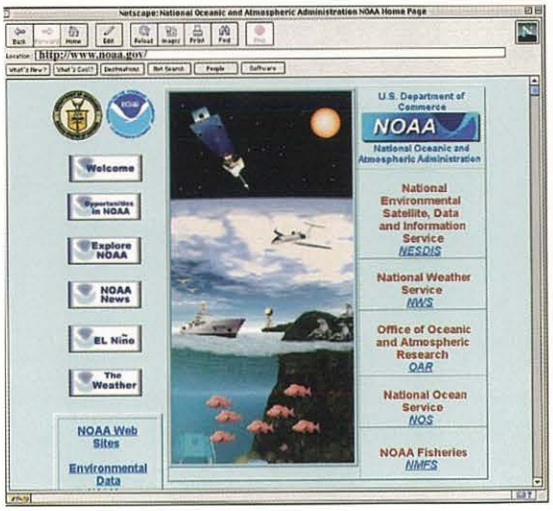
The National Geophysical Data Center's entire strong motion data archive is now available on a three-volume CD collection. It contains more than 15,000 digitized and processed accelerograph records, dating from 1933-94. The data represent a broad range of structural and geologic recording environments. Three types of processed records are included: uncorrected, corrected, and response spectra. Records were contributed to the archive from various worldwide industrial academic and governmental sources. Available from the National Geophysical Data Center.

Tsunamis Affecting Alaska, 1737-1996

This landmark publication, third in a series by James F. Lander, describes all known tsunamis that have affected Alaska in historic time, expanding all catalogs published before it. Detailed description information is included to better characterize the tsunami hazard. Available from the National Geophysical Data Center.

Information-Rich New NOAA Home Page Released to Public

The NOAA Home Page serves as the primary entry point for the public to access information on the environment and on NOAA. This electronic document was totally revamped in 1997 under the management of ESDIM office. The new NOAA Home Page organizes for the public a vast amount of information linking together the agency's Web information resources. Among the features of this expanded service are access to data search engines, NOAA News, and the home pages of each of NOAA's major components.



Contacts

Climate Data

(including satellite archival data, digital tapes, and hard copy prints):

Telephone	828-271-4800
TDD	828-271-4010
Fax	828-271-4876
Intern	orders@ncdc.noaa.gov
World Wide Web	http://www.ncdc.noaa.gov/
FTP inventories/data	ftp.ncdc.noaa.gov
Bulletin Board Access	828-271-4286, 9600 baud or lower, parity no, data bits 8,stop bits 1, echo y or n
Internet (satellite information)	satorder@ncdc.noaa.gov
Mail	Climate Services Division National Climatic Data Center National Environmental Satellite, Data, and Information Service 151 Patton Ave Asheville, NC 28801-5001

Constituency Queries:

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World Wide Web	http://www.ngdc.noaa.gov
FTP Access	ftp.ngdc.noaa.gov
Gopher Access	gopher.ngdc.noaa.gov
Mail	National Geophysical Data Center National Environmental Satellite, Data, and Information Service 325 Broadway Boulder, CO 80303

International and Interagency Policy:

Telephone	301-713-2024
Fax	301-713-2032
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Library Services:

NOAA Central Library:

Telephone	301-713-2600
Reference Desk	Extension 124
Interlibrary Loan	Extension 113
NOAA Photo Collection	Extension 118
Administration	Extension 131
TDD	713-2779
Fax	301-713-4598
Internet	reference@nodc.noaa.gov
World Wide Web	http://www.lib.noaa.gov

NOAA Library and Information Network Catalog (NOAALINC):

Internet	http://www.lib.noaa.gov/uhtbin/cgisirsi/0/1/0
Mail	NOAA Central Library 1315 East-West Highway SSMC 3, 2nd Floor Silver Spring, MD 20910

NOAA Miami Regional Library:

Telephone	305-361-4428
Fax	305-361-4429
Internet	pikula@aoml.noaa.gov
World Wide Web	http://www.aoml.noaa.gov/general/lib
Mail	NOAA Miami Regional Library Atlantic Oceanographic and Meteorological Laboratory and National Hurricane Center 4301 Rickenbacker Causeway Miami, FL 33149

NOAA Seattle Regional Library:

Telephone	206-526-6241
Fax	206-526-4535
Internet	mwoods@columbia.wrc.noaa.gov
World Wide Web	http://www.wrclib.noaa.gov/lib/_
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NOAA Environmental Service Data and Information Management:

Telephone	301-713-3578
Fax	301-713-1249
Internet E-Mail	help@esdim.noaa.gov
World Wide Web	http://WWW.esdim.noaa.gov
Gopher	gopher.noaa.esdim.noaa.gov
Telnet	gopher.esdim.noaa.gov (at "login:"prompt, type "gopher")
Dial up	1-800-722-5511 or 301-713-0566 (at "xplex>"prompt, type "c esdim1,"type at "login:"prompt, "gopher"
Mail	NOAA Environmental Information Services National Environmental Satellite, Data, and Information Service 1315 East-West Highway Suite 15400 Silver Spring, MD 20910

Oceanographic Data:

Telephone	301-713-3277
Fax	301-713-3302
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World Wide Web	http://www.nodc.noaa.gov
FTP	ftp.nodc.noaa.gov
Gopher	gopher.nodc.noaa.gov
Bulletin Board:	
E-mail	ocean_post@ocean.nodc.noaa.gov (to post message) ocean_read@ocean.nodc.noaa.gov (to read message)
Gopher	gopher.nodc.noaa.gov (select "NODC Ocean Bulletin Board Service")
WWW	http://www.nodc.noaa.gov (select "NODC Ocean Bulletin Board Service)
Mail	User Services Group National Oceanographic Data Center National Environmental Satellite, Data, and Information Service SSMC 3, 4th Floor Silver Spring, MD 20910

Polar (APT/HRPT), GOES Data Collection System, GOES-Tap, and Electronic and Internet Bulletin Board (NOAA, SIS) Information:

Telephone	301-457-5681
Fax	301-457-5620
Internet	satinfo@ssd.wwb.noaa.gov
World Wide Web	http://140.90.207.25:8080/noaasis.html
Mail	Direct Services Division Office of Satellite Data Processing & Distribution National Environmental Satellite, Data, and Information Service Federal Building 4, Rm 3320 Code 9909 4700 Silver Hill Road, Washington, DC 20233

Polar Satellite Data (Active Archive):

Telephone	704-271-4800
Fax	704-271-4876
Internet	saainfo@nesdis.noaa.gov
World Wide Web	http://www.saa.noaa.gov
Telnet	saa.noaa.gov
Mail	Information Processing Division Office of Satellite Data Processing and Distribution National Environmental Satellite, Data, and Information Service Federal Building 4, Rm 0301 Stop Code 9909 4700 Silver Hill Road Washington, DC 20233

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Internet	jbailey@nesdis.noaa.gov http://psbsgi1.nesdis.noaa.gov:8080:sarsat/homepage.html
Mail	SARSAT Operations Division Office of Satellite Data Processing and Distribution National Environmental Satellite, Data, and Information Service Federal Building 4, Rm 3320 Code 9909 4700 Silver Hill Road Washington, DC 20233-9909

Satellite Status:

Telephone	301-457-5208
Fax	301-457-5175
Internet	http://www.nnic.noaa.gov/socc/socc_Home.html
Mail	Office of Satellite Operations National Environmental Satellite, Information Service Federal Building 4, Rm 0135 Stop Code 9909 4700 Silver Hill Road Washington, DC 20233-9909

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Technical Reports and Technical Memoranda:

Telephone	301-763-8282
Fax	301-763-8108
Internet	neverson@nesdis.noaa.gov
Mail	Office of Research and Applications National Environmental Satellite, Data, and Information Service NOAA Science Center, Rm 703 Washington, DC 20233

Acronyms

ADCP	Acoustic Doppler Current Profiler
ADEOS	Advanced Earth Observing System
AFGWC	Air Force Global Weather Central
AFSCN	Air Force Satellite Control Network Automated Remote Tracking Stations
AISES	American Indian Science and Engineering Society
AOML	Atlantic Oceanographic and Meteorological Laboratory
ASF	Alaska SAR Facility
ASOS	Automated Surface Observing System
AVHRR	Advanced Very High Resolution Radiometer
AWIPS	Advanced Weather Interactive Processing System
AWO	American Weather Observer
C3	Command, Control, and Communications
CDA	Command and Data Acquisition
CEOS	Committee on Earth Observation Satellites
CGMS	Coordination Group for Meteorological Satellites
CIMSS	Cooperative Institute for Meteorological Satellite Studies
CIRES	Cooperative Institute for Research in Environmental Science
CLIMVIS	Climate Visualization System
CNES	Centre National d'Etudes Spatiales
COARE	Coupled Ocean-Atmosphere Response Experiment
COFS	Coastal Ocean Forecasting System
COMPS	Customer Order Management Processing System
COPUOS	Committee on the Peaceful Uses of Outer Space
Cospas-Sarsat	Space-Based System for the Search of Vessels in Distress
CSA	Canadian Space Agency
DOD	Department of Defense
DLMT	Deep Layer Mean Temperature
DMA	Defense Mapping Agency (now NIMA)
DMSP	Defense Meteorological Satellite Program
DPI	Derived Product Images
DUSD	Deputy Under Secretary of Defense
EASC	Eastern Administrative Support Center
EBNet	EOSDIS Backbone Network
EDMS	Environmental Data Management System
EIS	Environmental Information Service
ENRM	Environment and Natural Resources Management
EOSDIS	Earth Observing System Data and Information System
ERS	Earth Resources Satellite
ESA	European Space Agency
ESDIM	Environmental Services Data and Information Management
EUMETSAT	European Organization for Meteorological Satellites
EWG	Environmental Working Group
EXCOM	Executive Committee

FAA	Federal Aviation Administration
FGDC	Federal Geographic Data Committee
FNMOC	Fleet Numerical and Oceanographic Center
FTP	File Transfer Protocol
GCDIS	Global Change Data and Information System
GCOS	Global Climate Observing System
GELOS	Global Environmental Information Locator Service
GEOSAR	Geostationary Earth Orbit Search and Rescue
GHCN	Global Historical Climate Network
GLI	Ocean Color and Land Imager
GLOBE	Global Land One-km Base Elevation
GODAR	Global Oceanographic Data Archaeology and Rescue
GOES	Geostationary Operational Environmental Satellite
GOIN	Global Observation Information Network
GOOS	Global Ocean Observing System
GSAS	Geostationary Satellite Archive System
GSFC	Goddard Space Flight Center
GTOS	Global Terrestrial Observing System
HACU	Hispanic Association of Colleagues and Universities
HGBS	Historical GOLS Browse Server
HPD	Hourly Precipitation Data
IDARS	Interactive Data Access and Retrieval System
IGOS	Integrated Global Observing Strategy
IHB	International Hydrographic Bureau
IHODCDB	International Hydrographic Organization Data Center for Digital Bathymetry
IJPS	Initial Joint Polar-Orbiting Operational Satellite program
IOC	Intergovernmental Oceanographic Commission
IPCC	Intergovernmental Panel on Climate Change
IPO	Integrated Program Office
ITS	Interagency Taxonomic Information System
IT	Information Technology
ITT	International Telephone and Telegraph
JARC	Joint Agency Requirements Council
JARG	Joint Agency Requirements Group
JPL	Jet Propulsion Laboratory
LGSOWG	Landsat Ground Station Operators Working Group
MCC	Mission Control Center
MCSST	Multi-Channel Sea Surface Temperatures
MEL	Master Environmental Library (DOD)
METOP	Meteorological Operational Program

METCON	District of Columbia Metropolitan Consortium for Minorities in Science and Engineering
MOU	Memorandum of Understanding
MPSOC	Multi-Purpose Satellite Operations Center
MSU	Microwave Sounding Unit
NAFEO	National Association of Federal Equal Opportunity in Higher Education
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NAVOCEANO	Naval Oceanographic Office
NBDC	National Buoy Data Center
NCDC	National Climatic Data Center
NCEP	National Centers for Environmental Protection
NEDI	National Environmental Data Index
NESDIS	National Environmental Satellite, Data, and Information Service
NEXRAD	Next Generation Weather Radar
NGDC	National Geophysical Data Center
NHC	National Hurricane Center
NHR	Natural Handwriting Recognition
NIC	National Ice Center
NIMA	National Imaging and Mapping Agency
NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Center
NOLDS	NCDC Online Ordering System
NOS	National Ocean Service
NPOESS	National Polar-Orbiting Operational Environmental Satellite System
NPR	National Performance Review
NRS	NOAAPORT Receive Station
NSCAT	NASA Scatterometer
NSIDC	National Snow and Ice Data Center
NSWC	U.S. Naval Surface Warfare Center
NVDS	NOAA Virtual Data System
NWS	National Weather Service
OCTS	Ocean Color and Temperature Scanner
OLS	Operational Linescan System
OPDB	Oceanographic Profile Database
ORISE	Oak Ridge Institute for Science and Engineering
OSDPD	Office of Satellite Data Processing and Distribution
POES	Polar-Orbiting Operational Environmental Satellites
PQC	Partners in Quality Contracting
PSC	Polar Science Center
RADARSAT	RADAR Satellite, owned and operated by Canada, flying a Synthetic Aperture RADAR
RTS	Remote Tracking Stations

SAA	Satellite Active Archive
SAR	Synthetic Aperture Radar
SARSAT	Search and Rescue Satellite-Aided Tracking
ScanSAR	Scan Synthetic Aperture Radar
SCP	Stored Command Processor
SIGCAT	Special Interest Group for CD-ROM Applications and Technology
SIGRID	Sea Ice Grid
SIT	Strategic Implementation Team
SOC	Satellite Operations Center
SOCC	Satellite Operation Control Center
SPD	System Program Director
SPIDR	Space Physics Interactive Data Resource
SS/L	Space Systems/Loral
SSM/I	Special Sensor Microwave/Imager
STEP	Solar-Terrestrial Energy Program
SUAG	Senior Users Advisory Group
TOGA	Tropical Ocean and Global Atmosphere
TOVS	Tiros Operational Vertical Sounder
TTS	Tiros Test Simulator
USD	Under Secretary of Defense
USGS	United States Geological Survey
UTC	Universal Time Code
WFF	Wallops Flight Facility
WGISS	Working Group on Information Systems and Services
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
WWW	World Wide Web

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