



EARTH SYSTEM MONITOR

Internet tools improve access to NOAA environmental data and information

Building on-ramps to the Information Superhighway

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NOAA's data and
information
services

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U.S. DEPARTMENT
OF COMMERCE
National Oceanic
and Atmospheric
Administration

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Using the newest, most advanced Internet tools such as Gopher and Mosaic, NOAA is currently building what can be described as on-ramps to the Information Superhighway. In most scientific and academic disciplines the Internet—the worldwide “network of networks”—has become indispensable for communicating with colleagues, transmitting data files, and accessing a rich trove of information resources. The rapid growth of the Internet continues to astound: the number of machines with direct connections has doubled every year since 1988.

Within NOAA the use of the Internet to provide users with access to environmental data and information began as the initiative of individual groups and offices. But now, as use of the Internet has become more widespread throughout NOAA, these efforts are beginning to coalesce into a more coordinated, unified approach to making NOAA's vast environmental data and information resources available to the global Internet community. Because these developments are happening so rapidly, some of the NOAA resources now on the Internet are incomplete or only prototypes. Others, however, are already well-developed and usable today.

One reason for the growing usefulness of the Internet is the development of a suite of Internet tools, software packages that support the enterprise of providing and find-

ing information over the Internet. With names ranging from the prosaic—WAIS (for Wide Area Information Server)—to the whimsical—Gopher—these tools are now in use by many groups both within and outside of NOAA to make NOAA data and information products just an Internet connection away. One of the first steps to tapping into the Internet world is understanding the various Internet tools and their capabilities (see box).

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SOME INTERNET TOOLS AND TERMS

Telnet An Internet protocol providing connection (“remote login”) to a remote computer. Also, the name of the program implementing the telnet protocol.

FTP (File Transfer Protocol) Protocol that enables files to be moved from one computer to another over the Internet. Anonymous FTP is a feature that allows users to transfer files from a remote host without a local login. Anonymous FTP sites are established by organizations wishing to make certain files publicly available over the Internet. Information on the contents of FTP sites is available through the search capabilities of a database and a suite of related programs called *Archie*.

WAIS (Wide Area Information Server) An Internet protocol and service that provides full text search and retrieval capabilities for Internet information resources.

Gopher Software developed at the University of Minnesota (home of the “Golden Gophers”) that provides flexible, menu-driven access to primarily textual information resources on the Internet. *Veronica* helps users find Gophers covering specific subjects by providing keyword searches of Gopher menus.

Mosaic Software for implementing and browsing hypermedia information resources on the Internet. The opening screen of a Mosaic document is called a Mosaic home page. Mosaic documents are multimedia and may include graphics, animation, and sound, as well as text. Mosaic was developed by a group at the National Center for Supercomputing Applications (NCSA) of the University of Illinois in cooperation with CERN, the European Laboratory for Particle Physics.

World Wide Web (WWW) The collective universe of Internet resources that can be navigated using hypermedia links. Much of the power of the Internet comes from the ability to move back and forth between different kinds of Internet resources, for example, between Mosaic and Gopher servers.

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*Internet tools, from page 1***NOAA Gophers**

The NOAA Environmental Information Services office has established the NOAA Environmental Information Gopher, which provides access to many NOAA data and information resources. Gopher servers have also been developed by the National Geophysical Data Center, and the National Oceanographic Data Center. Because the menus on each of these Gopher systems provide links to the others, users can access any of these systems through any of the others.

Menu selections on the NOAA Environmental Information Gopher were based on the frequency of user requests for different types of information from the old NOAA Directory. Among the menu items, for example, are "Weather information and images" and "NOAA satellite information," two topics of great user interest. Since the Gopher was put online, inquiries about these topics to the NOAA Environmental Information Services office have declined, indicating that the Gopher is successfully meeting user needs.

The NOAA Environmental Information Gopher also provides access to systems outside of NOAA that contain NOAA data or are part of the Global Change Program. Menu selections of the NOAA Environmental Information Gopher allow users to connect to the CIESIN (Consortium for International Earth Science Information Network) Gopher, search the U.S. Geological Survey Earth System Data Directory, or view satellite images and other meteorological data put online by Purdue University, Michigan State University, and the University of Michigan. In addition, it also provides links to many other related environmental data and information Gophers at institutions around the world.

One of the resources that can now be accessed via the NOAA Environmental Information Gopher is the NOAA Environmental Services Data Directory (NOAADIR). Part of an ongoing project to describe data sets available from NOAA for global change and other earth system studies, the NOAADIR now holds over 3,000 data set descriptions. On Gopher, the NOAA Directory can be searched using different options. Users

may choose keyword or range searching using two different versions of NASA's Master Directory software or the full text search capabilities of WAIS.

The Gopher servers of the NOAA national data centers provide a wide range of information about their data holdings, products, and services. There are descriptions of available data sets, databases, and CD-ROM data products; lists of data center contact points; announcements of new products and services; and information on how to obtain data products. The Gopher servers at the National Geophysical Data Center and National Oceanographic Data Center have already been registered with the Gopher development team at the University of Minnesota. This means that the two centers are listed in the menus that provide a geographical or alphabetical index to Gopher servers in the United States.

Mosaic and World Wide Web

Developed by a group at the National Center for Supercomputing Applications (NCSA) of the University of Illinois at Urbana-Champaign, Mosaic is one of the client software implementations of the larger project called World Wide Web (WWW). WWW was created to allow information sharing within internationally dispersed research teams. Initiated at CERN, the European Laboratory for Particle Physics located on the French-Swiss border near Geneva, it was originally aimed at the high energy physics community. But it has since been adopted as a more general tool and has attracted support from other development groups around the world such as the one at NCSA.

In addition to their Gopher servers, the NOAA Environmental Information Services office and the NOAA national data centers have also installed Mosaic home pages. After the plain text of Gopher documents, Mosaic brings graphic images and a richer typographic look. Mosaic home pages in fact begin to look like high quality publications. But to the linear printed page they also bring the nonlinear links of hypermedia. Any underlined or highlighted words or images on a Mosaic page can be clicked with a mouse to immediately bring up an image, sound, video or a sub-page on that topic. A central NOAA Mosaic

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EARTH SYSTEM MONITOR

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**U.S. DEPARTMENT OF COMMERCE**

Ronald H. Brown, Secretary

National Oceanic and Atmospheric Administration

D. James Baker,
Under Secretary and Administrator

Historical bathymetric data

Collection to be acquired by NGDC

In December 1993 NOAA Corps Lt. Cdr. Maureen Kenny of the National Geophysical Data Center met in New York with Ms. Marie Tharp to discuss the transfer to NGDC of a unique collection of bathymetric data. Marie Tharp, co-author with Dr. Bruce C. Heezen of physiographic maps of the world oceans and discoverer of the system of rifts in the mid-ocean ridges, is donating the Heezen and Tharp collection of bathymetric sheets to the NGDC for archiving and future use. This collection—probably the most complete compilation of pre-1970 bathymetric plotting sheets in the world—contains high-quality bathymetric data from remote ocean areas. The collection is currently being organized and inventoried and is expected to be transferred to NGDC by the end of 1994.

New NCDC facility nearing completion

The National Climatic Data Center (NCDC), the world's largest active archive for climate data, will begin moving to a new building in May 1994. NCDC will be the major tenant of the 177,000 square-foot facility located in downtown Asheville, N.C. Now 80 percent complete, the building will enable the Center to manage its holdings more efficiently by providing better security and environmental conditions for long-term data storage. Federal regulations established by the National Archives and Records Administration and the National Institute of Standards and Technology pertaining to comprehensive magnetic tape and microforms management were followed in the design of the state-of-the-art facility which is scheduled to be completed in July 1994.

Space has been set aside in the new facility to establish a Climate and Weather Science Museum. Through a combination of visual and interactive displays, the Museum will present a historical perspective of the evolution of the science of climatology. Utilizing a theme of "Our Climate... Past, Present, and Future," the technological advances in the field of climatology over this century will be exhibited. From early instrumentation to modern electronic sensors and communications systems, innovative exhibits will be designed to demonstrate how weather data are collected, analyzed, and used for the benefit of mankind. Donations and ideas are

News briefs

still being sought for the Museum. Information or ideas on donations and exhibits should be directed to John Hughes (Telephone: 704-271-4475 or Internet: jhughes@ncdc.noaa.gov).

The 4-year move plan established in 1990 is exactly on schedule. Planning for the physical move has been completed and contracts have been awarded for modular furniture and new shelving for the archives. Proposals for a LAN and fiber optics are still being evaluated. An evaluation of material hazards and possible reactions will be undertaken prior to moving. The move will be in phases with the installation of the LAN, furniture, and telephone cable set to begin in May. NCDC personnel will begin moving in July through August. The new building is scheduled to be dedicated in August or early September.

Ocean data archaeology workshop for western Pacific nations

Sydney Levitus and Robert Gelfeld represented the National Oceanographic Data Center and collocated World Data Center A for Oceanography at the Second Regional Workshop of the Intergovernmental Oceanographic Commission's Global Oceanographic Data Archaeology and Rescue (GODAR) Project. Held March 8-11, 1994, this workshop for western Pacific rim countries was organized and hosted by World Data Center D for Oceanography in Tianjin, People's Republic of China.

Like the first GODAR workshop held in Obninsk, Russia in May 1993, the purpose of the Tianjin workshop was to bring together scientists, administrators, and data managers from nations of a specific geographic region to focus on problems of historical oceanographic data preservation and access. The overall objective of the GODAR project, which is headed by the U.S. NODC/WDC-A, is to augment available global ocean databases in support of climate and global change research and other applications.

Thirty participants from 15 countries gathered in Tianjin to assess the state of oceanographic data holdings in the region, to identify common goals and problems concerning data preservation, and to recommend steps and approaches to solve these problems. During the four days of

lectures, reports, and round table discussions, all objectives of the workshop were achieved. The workshop also helped lay the groundwork for a major upgrading and modernization of the ocean data management system for the entire region.

Chinese scientists arrive at NCDC for cooperative marine project

Mr. Guo Fengyi, Deputy Chief of the Data Processing Division of National Marine Data and Information Service, State Oceanic Administration (NMDIS/SOA), People's Republic of China, and Mr. Zhang Dongsheng, a data processing expert in that Division, have arrived at NCDC for a two-week visit to help establish procedures for digitizing the Maury Collection of ship observations collected primarily in the early to mid-1800s. The data are for inclusion in the NCDC digital archive and the Comprehensive Ocean Atmosphere Data Set (COADS). The work is being performed under the terms of the U.S.-PRC Protocol on Cooperation in the Field of Marine and Fishery Science and Technology.

Update on global warming presented at annual AMS meeting

At the 74th Annual Meeting of the American Meteorological Society, Senior Scientist Thomas R. Karl of the National Climatic Data Center gave an invited presentation titled "Global Warming Update." Recent data given during this presentation show that there has been an overall increase in global temperatures since the late 1970s. Global mean surface temperatures during 1993, however, were virtually unchanged from their 1992 levels, as they remained about 0.2°C above the 1951-1980 average.

The sulfate aerosols injected into the stratosphere by the 1991 Mt. Pinatubo volcanic eruption had settled out of the atmosphere by the end of 1993. For 1994 this means that the direct surface cooling effects of Mt. Pinatubo should be small and may indicate a resumption of the global warming trend (0.3-0.6°C since the late 19th century).

On a global scale, 1993 was relatively cool both at the surface and through the troposphere compared to the last 15 years. In the lower stratosphere, 1993 was extremely cold—the coldest temperatures on record. Colder than normal temperatures occurred throughout much of the globe.

GeoVu: A new technique for integrated data access

NGDC software for data browsing, access, and visualization

Allen M. Hittelman and
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Could you use a data management tool to help . . .

- Perform quality control and generate metadata?
- Graphically browse and extract data?
- Access data from many CD-ROMs, as well as your own data?
- Integrate data with metadata and documentation?
- Provide a data description facility that frees you from the need to deal with the intricacies of importing and exporting data in multiple formats?

If so, you may wish to learn about GeoVu and its FreeForm data management component, public domain software developed by the NOAA National Geophysical Data Center (NGDC).

For almost a decade NOAA has provided integrated data collections to the earth science community. Recently, many of these collections have been distributed on CD-ROM, filling an important need by making significant data sets (and derived products) available on a convenient, inexpensive storage and distribution medium. Data without easy-to-use access software, however, serves only part of the needs of the research community. Scientists need a versatile data access system to browse, compare, and make selections quickly and easily from large data sets. GeoVu, developed at NGDC, was designed to meet this broader information requirement.

GeoVu functions

NOAA manages one of the largest and most diverse collections of digital environmental

data in the world. These data exist in many different locations, on many different computer systems, and in many different formats. This diversity makes accessing the data difficult for all but the most computer literate data users. The GeoVu project was initiated at NGDC to simplify access to diverse data. Developed with funding support from NOAA's Environmental Science Data and Information Management (ESDIM) Program, GeoVu overcomes several barriers to data access. Among its functions, GeoVu:

- provides access to many different types of data (including spatial, temporal, *in situ*, and satellite data sets) in many different formats without requiring data reformatting,
- provides direct and intuitive access to metadata and documentation,
- provides a common user-friendly

interface to many data collections published by NOAA and others.

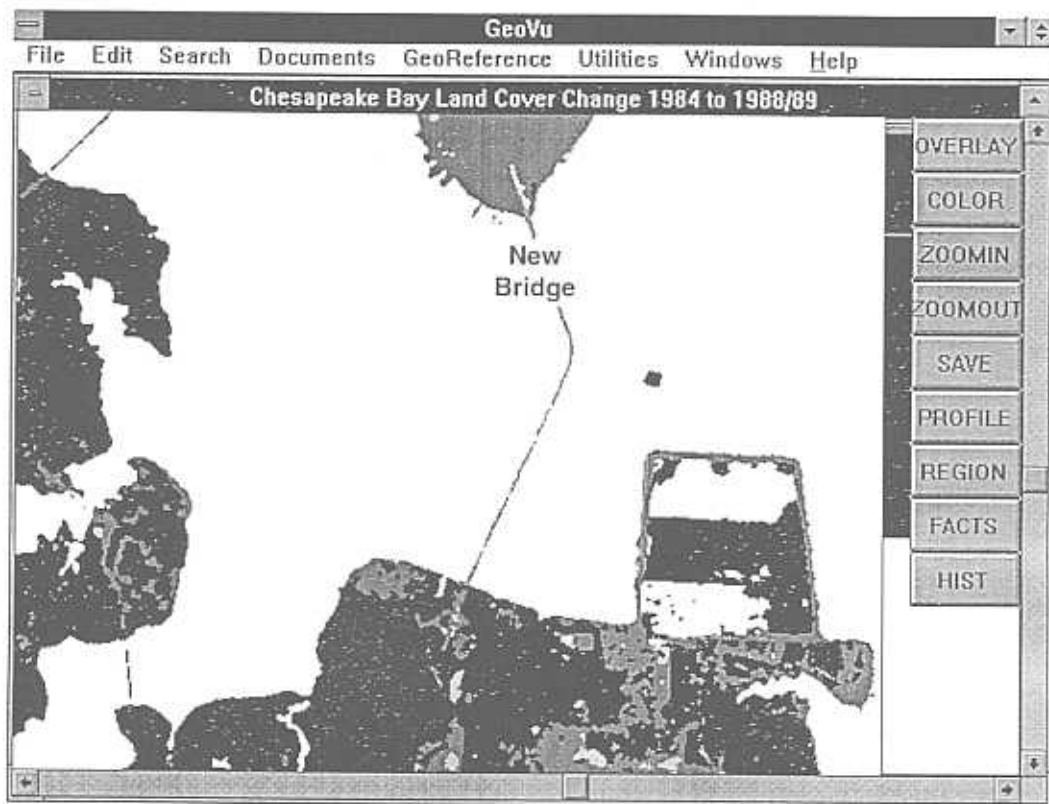
The initial version of GeoVu is designed to operate with Microsoft Windows. Other versions of GeoVu for UNIX and Macintosh platforms are under development.

GeoVu components

GeoVu comprises three main components:

1. FreeForm: The data description layer

A modern approach to accessing data in many formats involves the use of flexible data description languages that delineate the format of data and facilitate access by applications programs. GeoVu is based on the FreeForm data description language developed at NGDC. Within GeoVu proper, there is not one line of code that references the specific format of the data.



▲ Figure 1. Area around the entrance to Chesapeake Bay showing changes between 1984 and 1988-1989. In this view undeveloped land is shown as black, water as white, and land that has changed classification during the study period as gray shades (colors in the original). The gray areas include the new Chesapeake Bay Bridge-Tunnel (a class change from water to developed) and recently-developed land at both ends of the bridge access (formerly cropland/grassland). Image from NOAA CoastWatch Change Analysis Project data.

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When a user requests data, GeoVu searches for a format description using the FreeForm layer. If descriptions exist within the data compilation (in the form of format files designated by the extension ".FMT"), the user need not be burdened with format information. For data not previously defined, the user is prompted for format information. A companion data dictionary is linked to FreeForm, providing users with a clear definition of all field names and their respective code translation tables.

2. Menu Guide: The data navigation and metadata access layer

Data are often placed on CD-ROMs in ways that leave users to guess the exact meaning of a cryptic file name. The "Menu Guide" abolishes this obstacle by providing understandable navigation throughout the data compilation. Often this navigation is hierarchical and based on data type, or spatial or temporal distribution. The Menu Guide is driven by a simple ASCII file that GeoVu translates into screen dialogues with companion help panels.

Using the Menu Guide, data producers can integrate data documentation with the data itself and data users are rewarded with context-sensitive help and information. A spin-off benefit of the Menu Guide is improved navigation, through hierarchical metadata descriptions, to data sets of interest in online environment (such as Mosaic on the Internet).

3. GeoVu: The data browse and retrieval layer

The browse and retrieval capabilities of GeoVu were designed to provide users with quick-look and data extraction capabilities. It was not designed to provide GIS-level or sophisticated analysis-level features since numerous commercial products serve this function well. Rather, GeoVu was conceived of as a link between data compilations and the researcher's analytic application of choice. GeoVu features are numerous:

- Display grids and images—with pan, zoom, profile, value look-up, color manipulation, and histogram support,
- Display tabular data sets—as two-dimensional plots of any combination

of parameters or as tabular lists,

- Display correlative documentation—in the form of scrollable text boxes,
- Extract data in multiplatform representations—with choices of data content and structure.

Software availability

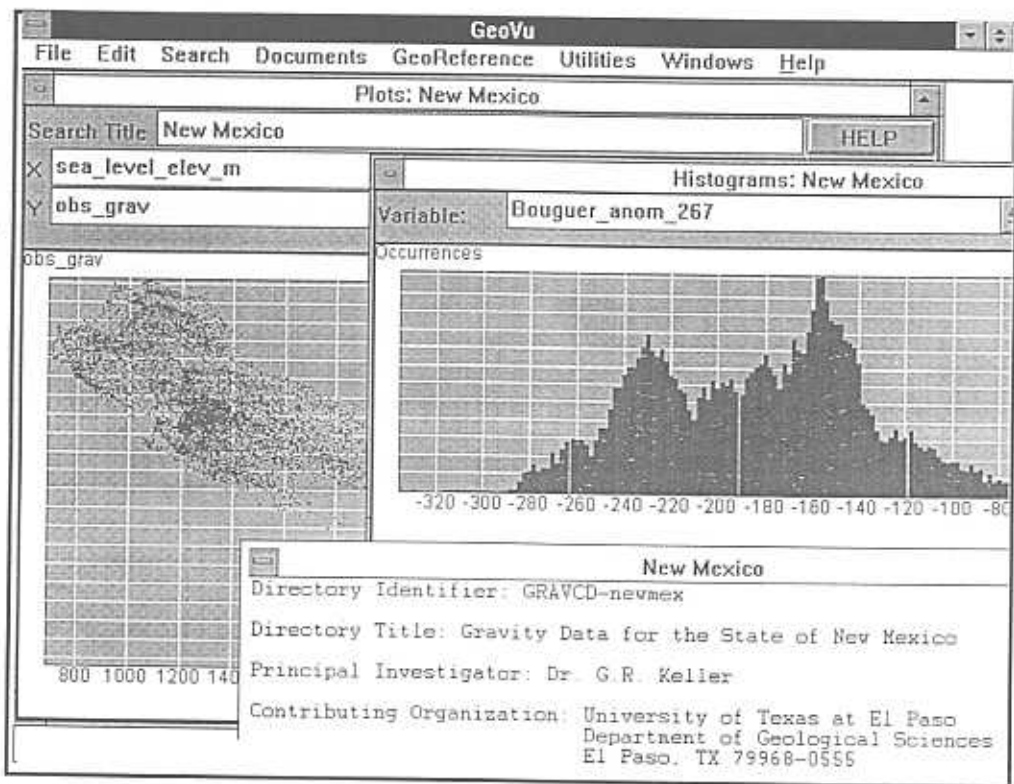
GeoVu for MS-Windows is available in the public domain via anonymous FTP. Downloading these files requires a computer connected to the Internet that supports the FTP command. At the prompt:

- Type: `ftp ftp.ngdc.noaa.gov`
- Login: `anonymous`
- Password: Enter your e-mail address
- Type: `cd Access_Tools`

This directory contains several sub-directories with information about GeoVu and FreeForm. All of these directories contain README files describing their contents.

The GeoVu directory contains the following documentation files:

- (1) gvquick: ASCII, postscript, and Microsoft Word formatted files with GeoVu installation instructions, and
- (2) gvhelp: Postscript and Microsoft Word version of the *GeoVu Users Guide*.



▲ Figure 2. GeoVu enables metadata and documentation to be included with data visualizations. The left window shows a plot of observed gravity versus elevation, the upper right shows frequency distribution of Bouguer anomaly data, and the lower right provides scrollable documentation about the data source. Image from the NGDC Gravity CD-ROM.

The most recent release of MS-Windows GeoVu is in a "PC" subdirectory of GeoVu. The files in this subdirectory comprise a "Windows Setup Disk" for GeoVu. In order to install GeoVu using these files, download all files in binary mode into a temporary directory. Then, with Windows running, execute the program *setup.exe* from that directory by double-clicking on it or using the File/Run menu item.

The GeoVu/Sampler directory contains a number of sample data sets which can be used to become familiar with GeoVu's features and the process of getting your data into GeoVu. Like GeoVu itself, these directories must be downloaded in binary mode into three separate temporary directories and installed using the *setup.exe* program found in the directory DISK1.

UNIX and Macintosh versions of GeoVu are under development. Beta test versions will be available by the end of 1994.

For information about GeoVu, FreeForm, CD-ROM data products implemented using GeoVu, or the

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NGDC Data Products Implemented with GeoVu

INITIAL EXPERIMENTAL RELEASES:

- **Global Ecosystem Data** - produced in cooperation with the Environmental Protection Agency.
- **Earth System Data: Gravity** - produced in cooperation with the NOAA National Ocean Service.
- **Earth System Data: Aeromagnetics** - produced in cooperation with the Minnesota Geologic Survey and the U.S. Geologic Survey.
- **Natural Hazards Data** - produced in cooperation with the National Science Foundation Waditi Conference.
- **Special Sensor Microwave/Imager (SSM/I Data Sampler)** - produced in cooperation with the National Snow and Ice Data Center.
- **AVHRR Data** - produced in cooperation with the NOAA/NESDIS Office of Research and Applications and the National Climatic Data Center.

CURRENT AND PLANNED RELEASES:

- **Geologic Hazard Photos CD-ROMs** - a 2-volume collection produced by the NGDC (December 1993).
- **Gravity CD-ROM (1994 Edition)** - produced in cooperation with the NOAA National Ocean Service (March 1994).
- **GeoVu Data Sampler Diskettes** - a 3-diskette collection of miscellaneous data sets that can be used to experiment with the GeoVu features (expected March 1994).

- **Coastwatch Change Analysis Project (C-CAP) Chesapeake Bay Region CD-ROM** - produced in cooperation with the NOAA National Oceanographic Data Center and the National Marine Fisheries Service (expected April 1994).
- **Global View CD-ROMs** - a 4-volume collection of ecosystem, digital elevation models, and AVHRR data. Produced by the NGDC in support of NOAA's Climate and Global Change Program (expected May 1994).
- **Project MAGNET Aeromagnetic CD-ROM** - produced by the NGDC (expected May 1994).
- **Magnetic Anomalies in the Former Soviet Union CD-ROM** - produced by the NGDC (expected May 1994).
- **Spitak Earthquake CD-ROM** - produced in cooperation with the Russian Academy of Sciences (expected June 1994).

POTENTIAL FUTURE PROJECTS:

- **National Geologic Map Database CD-ROM** - sponsored by the Federal Geographic Data Committee as a Spatial Data Transfer Standard pilot project (late 1994). [Note: See related article on p. 12]
- **TOGA COARE Data Workshop** - produced in support of the World Climate Research Program and sponsored by WMO, ICSU, and UNESCO (August 1994).

GeoVu, from page 5

GeoVu Data Sampler, contact Allen M. Hittelman at the NOAA National Geophysical Data Center. Telephone: 303-497-6591, Fax: 303-497-6513, Internet: amh@ngdc.noaa.gov.

References

- Habermann, R. E. and D.R. Mock, 1992. Common Data Formats: Common Data Problems?, abstract in *Proceedings of the Eighth International Conference on Interactive Information and Processing Systems for Meteorology Oceanography, and Hydrology*, American Meteorological Society.
- Hittelman, A. M., D. T. Dater, R. W. Buhmann, and S. D. Racey, 1994. *Gravity CD-ROM User's Guide (1994 Edition)*, NOAA National Geophysical Data Center.
- Hittelman, A. M., R. E. Habermann, L. Di, and D. Sinay, 1993. GeoVu: A Platform Independent, Data Browse and Selection Application, *Proceedings, 2nd International Conference on Integrating GIS and Environmental Modeling*, Sept. 1993, Breckenridge, CO.
- Hittelman, A. M., and H. Iredale, 1994. A New View for Coastwatch Change Analysis Data, *Proceedings, 2nd Thematic Conference on Remote Sensing for Marine and Coastal Environments*, Jan. 31-Feb. 2, 1994, New Orleans, LA.
- Hittelman, A. M., P. A. Lockridge, and P. J. Hayes, 1993. *Geologic Hazard Photos CD-ROMs User's Manual*, NOAA National Geophysical Data Center. ■

NCDC inventories from page 16

TD3280.TXT

Historical index of stations/periods of record included in TD3280 (Navy, NWS first-order stations) through 1991. Some of the stations that have incomplete periods of record listed here have full periods of record in the DATSAV2 database listed above. TD3280 data receive extensive automated and manual quality control. Data are available through 1993, and the inventory will be updated in the near future.

WBAN.TXT

Historical WBAN index through 1993 (elevations are listed in meters). WBAN's are received at NCDC for NWS and U.S. military stations. This is an index of

these locations, many of which have data in digital form.

WBAN-MSC.TXT

WBAN-AWSMSC-WMO cross reference—the WBAN index and AWSMSC (both listed above) cross-referenced with World Meteorological Organization (WMO) numbers. These are the three numbering systems used by NCDC for national/international locations.

All files are in ASCII text format with a 'TXT' name extension (e.g., COOP.TXT). File names are strictly upper case. The files will be updated periodically as resources and information allow. WordPerfect or any other editor can be used to read the files. In WordPerfect, the 'TEXT IN' command (CTRL-

F5) will read in a large file rather quickly, and the 'SEARCH' command (F2) will locate a character string (e.g., a station name). Of course, Fortran or any other language may be used to access any of the data.

If you have any questions, please contact Neal Lott or Tom Ross. Telephone: 704-271-4995 (N. Lott) or 704-271-4994 (T. Ross). Fax: 704-271-4876. Internet: nlott@ncdc.noaa.gov or tross@ncdc.noaa.gov.

The data to which these inventories pertain (e.g., hourly surface data) are not available online. To place orders for data (on magnetic tape, cartridge tape, or other media), please contact the NCDC Climate Services Branch. Telephone: 704-271-4800. Fax 704-271-4876. Internet: orders@ncdc.noaa.gov. ■

Network connectivity at new NOAA campus

For the first time in its history, NOAA has a shared, universally accessible, integrated network resource for the exchange of data across organizational lines. Thanks to the Silver Spring campus backbone network, all NOAA employees in the Silver Spring Metro Center (SSMC) campus have desktop connectivity to an interoffice network that extends out to other metropolitan area offices and beyond to the Internet.

The backbone, a key element of a remarkable grass roots effort, supports peer communication among heterogeneous systems. The backbone also provides shared, high speed access to other NOAA locations in the Washington,

D.C., metropolitan area and ultimately to the Internet, as well as to the NOAA Administrative Wide Area Network. Although access to the Internet and other extramural communications is available using the TCP/IP protocol and communications equipment on the backbone, individual offices still must implement the necessary software applications to affect that access.

The Systems Division of NOAA's Office of Administration (OA) implemented the state-of-the-art campus wiring plant through a variety of technical and administrative initiatives. Among these are:

- establishment of the Silver Spring

Network Council (SSNC),

- development of the system concept and standards for backbone use and connectivity,
- coordination and implementation of an IP addressing scheme,
- configuration of the campus fiber optic cable,
- implementation and management of shared campus routers, and
- coordination among all the campus routers.

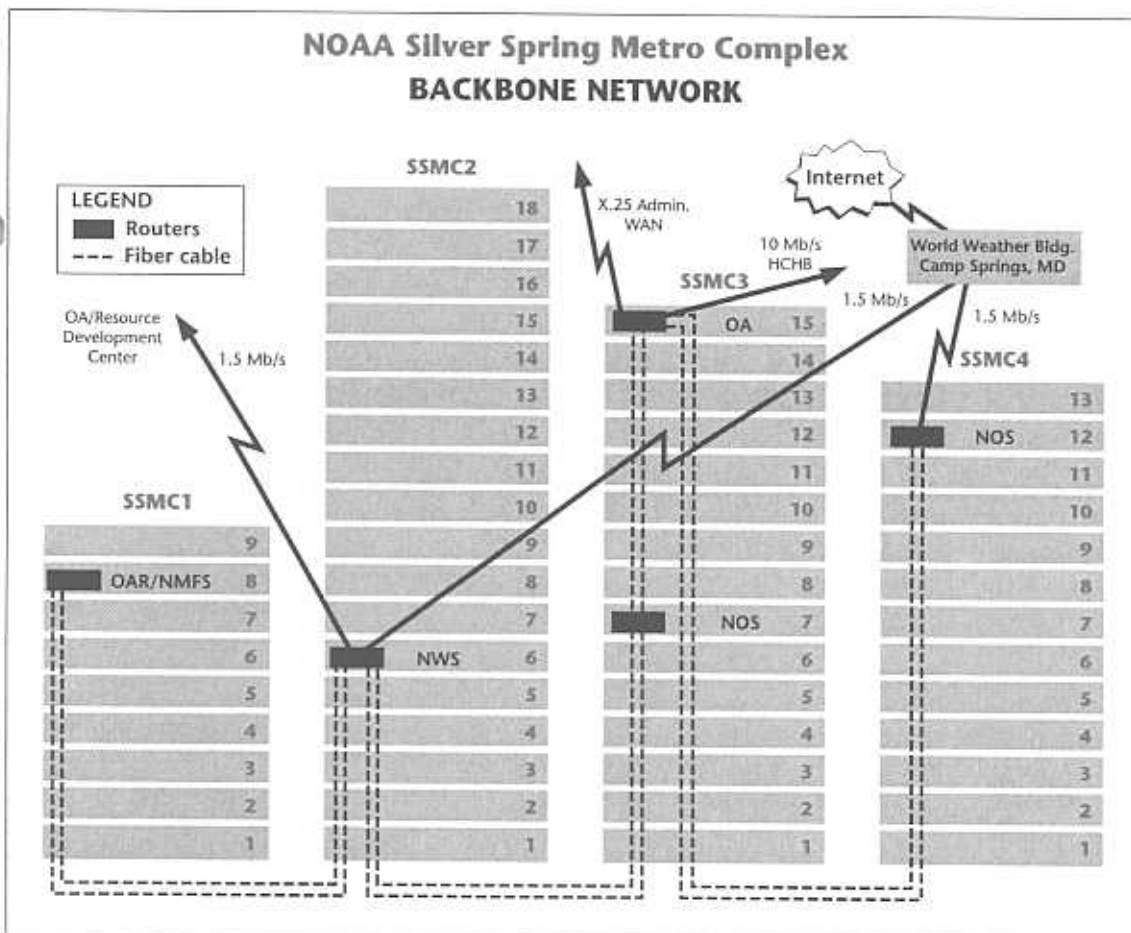
Parallel activities include development of the NOAA Interoperability Profile and coordination with the NOAA NIC.

In the same spirit of grass roots resourcefulness, OA developed the concept and promoted the

establishment of an SSMC Network Operations Center (NOC). The Network Council, under the leadership of Gene McDowell, has worked closely with the OA throughout the process and they will serve as a board of directors for the NOC. The NOC will manage the backbone network—including off-campus links—to maintain the maximum security, availability, and performance of the backbone. NOC functions will include management of the backbone cabling, operation of a help desk function and an automated trouble ticket system, automatic verification of router configurations, real-time tracking of network performance and trend analysis to identify needs for system changes.

In addition, the NOC will serve an important role in NOAA access to the National Information Highway. The NOC will also support the

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▲ **Figure 1.** Topology of the backbone network at the NOAA building complex in Silver Spring, Md. The four office buildings (and the adjoining NOAA Science and History Center) house over 4,000 employees and include elements of all five NOAA line offices: the National Weather Service (NWS), the National Ocean Service (NOS), the National Marine Fisheries Service (NMFS), the National Environmental Satellite, Data, and Information Service (NESDIS); and the Office of Oceanic and Atmospheric Research (OAR). Communications lines link the Silver Spring Metro Center to other NOAA offices, including those in the Department of Commerce's Herbert C. Hoover Building (HCHB) in downtown Washington, D.C. and the World

NODC migrates to client/server computing

First phase of data center modernization completed

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In December 1993 the National Oceanographic Data Center (NODC) shut down the last of its three DEC VAX minicomputers, a major milestone in the NODC computer system modernization effort begun earlier in the year. Like many other organizations facing high maintenance costs on aging hardware, the NODC has migrated to a distributed computer system based on advanced UNIX workstations. The NODC modernization was planned not only to enable the NODC to provide improved data management and data services today, but also to serve the growing data management requirements of international research programs and new global observing systems tomorrow.

Installation of new hardware and an upgraded Ethernet network in 1993 is the first phase of the NODC modernization. During 1994 work will focus on the design, testing, and implementation of new data management systems.

Modernization goals

The primary goal of the NODC's modernization plan is the same as that of other similar restructuring efforts: to provide improved data management and data service capabilities while reducing operating costs. One of the immediate benefits of the new client/server environment is a saving in maintenance costs on the older DEC VAX computers and on leased space for the computer room that previously housed them. After the three DEC VAX machines were retired, the NODC was able to vacate this space and significantly reduce its space requirements with large annual dollar savings. Since the UNIX workstations are physically much smaller and do not have any special space requirements, they are distributed

throughout the NODC's office spaces.

A second goal is to adopt standard technology that is easily portable to more powerful platforms as they become available and as NODC's need for computing power increases. The adoption of a client/server environment using UNIX-based workstations is the key to meeting this goal. In the old configuration, the NODC used a proprietary database server. Migrating the NODC's online database from one such proprietary database device to another, however, would have entailed a non-trivial conversion effort. Instead the NODC decided to use a commercial relational database system (RDBMS) and has begun developing new data management systems using Sybase. For new systems development efforts, the NODC also has adopted C++ as its standard programming language and Motif/X Windows as its standard graphical user interface.

The third major goal of the NODC modernization is to improve network connectivity and provide enhanced online access to NODC data and information resources. Implementing a new Ethernet Local Area Network (LAN) using TCP/IP as the communications protocol provides the NODC with easier access to the vast communications capabilities and resources of the Internet, the worldwide TCP/IP network.

NODC's new computing environment

The new distributed computing environment at the NODC includes over 80 PCs (386- and 486-class machines), 13 Silicon Graphics, Inc. (SGI) workstations, four DEC workstations, several X Terminals, a Sun workstation, and an SGI Challenge L server. In addition, four Macintosh computers used primarily for desktop publishing tasks (including production of the *Earth System Monitor*) are not yet on the network but will be connected soon.

NODC's data archives are still installed on a Unisys mainframe computer at the National Climatic Data Center in Asheville, N.C. This computer also continues to support various database management and user services functions such as running data inventories and

performing certain data retrievals.

NODC's Silicon Graphics Challenge L server is configured with two CPUs, MIPS R4400 RISC microprocessors that run at 150 MHz. One of the most expandable servers available, this machine can support up to 6 CPUs, 24 SCSI-2 channels, and over 2 terabytes of disk storage. The NODC machine is currently configured with 36 gigabytes (GB) of disk storage but expansion to 72 GB is already planned.

The NODC RDBMS uses the technique of mirroring—the continuous recording of an exact mirror image of the database—in order to provide fault tolerant operation. Since the two mirror images are resident in disk storage, the actual usable storage capacity is currently 18 GB and the planned upgrade will increase that to 36 GB.

One of the more challenging aspects of the computer conversion was the transfer of a Sony optical jukebox from one of the VAX computers to the network and the conversion of its data files from the VMS to the UNIX environment. The optical jukebox, which provides over 300 gigabytes of mass storage on 12-inch optical platters, now operates as a stand-alone node on the network via specialized jukebox software running on a Sun workstation.

NODC connectivity

The NODC Ethernet LAN uses the TCP/IP communications protocol and twisted-pair (10base-T) cabling. PCs, workstations, and the database server are connected in a star topology via two intelligent LAN hubs. Dial-in and dial-out access is available via modem at up to 34 kilobits/second. Access to the Internet is provided by a T1 line (1.5 megabits/second).

The NODC and other NOAA offices are increasingly using Internet tools such as anonymous FTP, Gopher, and Mosaic to provide NOAA data and information to the global Internet community. The NODC has established a Gopher server and is now developing a Mosaic server. These new services will continue to grow over the coming months. (See related article on p. 1.)

System development activities

To take advantage of the capabilities of its new hardware, the NODC has begun the process of reengineering its data management systems. One of the first development efforts is the design and implementation of a new system for acquiring, processing, quality controlling, and distributing data from the Global Temperature Salinity Pilot Project (GTSP). GTSP is an international cooperative project for collecting and distributing upper ocean temperature and salinity profile data. These observations taken at sea are transmitted by radio and sent over the Global Telecommunications System in near-real-time. The same observations may also later be submitted to the NODC or another data center in delayed mode. Since the delayed-mode data are of higher quality, when submitted they are available to replace the initial radio-message observations. The new GTSP system provides enhanced data quality control features and serves as a model for other NODC system developments.

Another effort already underway is the design and testing of a new data inventory and data access system. One of the major shortcomings of the current NODC system is that the major archive data files are based on fixed field formats. Data submitted in other formats cannot be accommodated by the present data management system. Data sets that do not fit the present formats are stored "as is" in the submission format and acquire second-class status. To overcome the limitations of this approach, the NODC has designed a new prototype data inventory and data access system that accommodates all data types. This system will undergo further development and testing over the coming months.

Future directions

The NODC's UNIX-based client/server network will provide a stable, portable, flexible computing environment to support NODC operations through the end of the century. The present hardware capacity is expected to meet NODC's needs for several years without major additions or upgrades. When such upgrades become necessary, however, this new technology will provide an easier upward migration path for NODC systems and databases. ■

Internet tools, from page 2

home page that provides links to all the other available NOAA Mosaic and Gopher servers is also now available. As NOAA Internet services continue to grow and develop, this NOAA home page will be updated to provide a single access point for all NOAA services.

Obtaining Internet tools

Gopher and Mosaic work in client/server mode. Although certain public access sites allow remote users to use Gopher and Mosaic via a remote Telnet login, these sites are very busy and the performance may be slow. For example, Gopher can be accessed via:

telnet consultant.micro.umn.edu
Login: *gopher*

For remote access to World Wide Web and general information about Mosaic:

telnet info.cern.ch
Login: *www*

The best way to run Gopher and Mosaic, however, is to obtain the appropriate version of the client software and to install it on your own machine. Public domain versions of the Gopher and Mosaic client software are available for many different platforms and operating systems including PCs running Microsoft Windows, UNIX workstations running the X Window System, and Macintoshes. The various clients can be downloaded using FTP.

Questions and comments about Gopher can be sent to the Gopher development team at the University of Minnesota via Internet address:
gopher@boombox.micro.umn.edu

The most recent releases of the various versions of the Gopher software can be downloaded via anonymous FTP. To initiate this process, enter:

ftp boombox.micro.umn.edu
Login: *anonymous*
Password: your Internet address
Change to the proper directory:
cd /pub/gopher

Within the */pub/gopher* directory are several subdirectories containing the various Gopher clients for different computer platforms and operating systems. The subdirectories also contain README files that can be downloaded and that

NOAA/NESDIS Gopher and Mosaic servers

Listed below are Internet addresses for accessing NOAA data and information using Gopher and Mosaic on the Internet:

NOAA Home Page

Mosaic: *http://www.noaa.gov/*

Environmental Information Services

Gopher: *gopher.esdim.noaa.gov*

Mosaic: *http://www.esdim.noaa.gov/*

National Climatic Data Center

Mosaic: *http://www.ncdc.noaa.gov/*

National Geophysical Data Center

Gopher: *gopher.ngdc.noaa.gov*

Mosaic: *http://www.ngdc.noaa.gov/*

National Oceanographic Data Center

Gopher: *gopher.nodc.noaa.gov*

Mosaic: *http://www.nodc.noaa.gov/*

explain some of the procedures for using the Gopher client software. (Note: When transferring software or executable files using FTP, always set the transfer type to binary mode by typing *bin* at the FTP prompt. This does not have to be done when transferring text files such as the README documentation.)

Commercial versions of the Gopher client software are also available. Information about these is available from the Gopher server at the University of Minnesota. The Gopher server at Minnesota also provides a list of frequently asked questions and other useful background information about Gopher and Gopher services.

In a similar manner, information about Mosaic and the Mosaic software is available from the Mosaic team at NCSA, University of Illinois at Urbana-Champaign. The Internet address for questions and comments is:

mosaic-x@ncsa.uiuc.edu

Current versions of the Mosaic client software for different platforms and operating systems are available via FTP from the directory */Mosaic* at the Internet address *ftp.ncsa.uiuc.edu*. ■

Online access to GEWEX Continental-Scale International Project data

The NOAA National Climatic Data Center (NCDC) has placed data from the GEWEX Continental-Scale International Project (GCIP) on its Online Access and Service Information System (OASIS) for easy access by researchers. In addition to providing online access to data and metadata from the STORM-FEST field experiment (February 1 - March 15, 1992), NCDC has added six weeks of data and metadata from the GCIP area of interest to provide a comprehensive three-month period of atmospheric data.

The Global Energy and Water Cycle Experiment (GEWEX) is being conducted under the auspices of the World Climate Research Program. The GEWEX Continental-Scale International Project (GCIP) was conceived in 1990 and the Science Plan was published in 1992. The objectives of GCIP are:

- to determine the variability of the earth's hydrological cycle and energy exchange budget on a continental scale,
- to develop and validate techniques for coupling atmospheric and surface hydrological processes in climate models, and
- to provide a basis for translating the effects of future climate change to impacts on regional water resources.

The first phase of GCIP is to build up the science base and technical expertise on continental-scale processes and then later to extend this capability to the global scale, using observations that will be available towards the turn of the century from the next generation of earth observing satellite systems. Because it is a continental-scale domain with an excellent observing and data management system, the Mississippi River Basin has been selected for the first continental-scale GCIP study. GCIP-Mississippi will address many issues at the forefront of climate research and water resources management.

The GCIP data now available from the NCDC will enable researchers to perform diagnostics, evaluation, and modeling on GCIP-related topics for the upcoming 1995-1999 experiment in the Mississippi River Basin. These data will also be part of the GCIP Initial Data Set-1 to be used as a GCIP Static Data System

Test. The data on OASIS, plus vegetation data, will be published on a CD-ROM by UCAR's Office of Field Project Support.

OASIS online data include wind profiler data from the experimental Wind Profiler Demonstration Network, plus National Weather Service hourly surface, hourly and 15-minute precipitation, rawinsonde, and cooperative summary of the day data. Station histories and dataset inventories are also available on-line. NCDC plans to place National Meteorological Center model output data online for significant weather events, certain dates of interest, and various campaigns (VORTEX and GIST), and during the GCIP five-year enhanced observing period.

To access OASIS via remote login over the Internet, type:
telnet 192.67.134.72 or
telnet hurricane.ncdc.noaa.gov
 Login ID: *storm*
 Password: *research*

Access to OASIS is also available via the World Wide Web (WWW) using Mosaic. The NCDC Mosaic home page, with information about NCDC products and services, can be accessed at the following WWW address:
<http://www.ncdc.noaa.gov/ncdc.html>

The data are also available via the Comprehensive Online Distributive Interactive Atmospheric Catalog (CODIAC) which links to NCDC. It is accessible by Internet via:
telnet 128.117.90.53 or
telnet storm.ofps.ucar.edu
 Login ID: *storm*
 Password: *research*

Further information about the data or the online systems can be obtained from Tom Ross or Neal Lott of the NCDC Research Customer Service Group. Telephone: 704-271-4994. Internet: tross@ncdc.noaa.gov or nlott@ncdc.noaa.gov.

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 Systems Development Staff
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Network connectivity, from page 7

Domain Name Service (DNS) for the campus. DNS is the basis for directory services on the Internet and a critical tool for Internet access.

The campus backbone uses a wiring plant that connects each workstation and computing device to a central point on each floor via shielded twisted pair cable capable of supporting 500 megabit/second transfer rates. Each floor and each building is connected with industry standard fiber optic cable.

Typical communication rates among nodes on the same network are 10-16 megabits/second. Communications on the backbone is at 100 megabits/second in accordance with the Fiber Distributed Data Interface (FDDI) protocol. At this time communications with off-campus sites are at T1 speeds (1.544 megabits/second). However, the Systems Division is in the process of evaluating alternative technologies for NOAA's Metropolitan Area Network. As of March 1, a prototype 10 megabit/second virtual Ethernet service, based on the Bell Atlantic Fiber Network Services, has been extended to NOAA offices at SSMC, the Department of Commerce's Herbert C. Hoover Building, and Germantown, Md. Plans are in place to expand this service to other NOAA sites in the Washington area.

— Gary Falk
 Chief, Telecommunications
 and ADP Security Branch
 NOAA OA124
 WSC-5, Room 305
 Rockville, MD 20852 ■

CORRECTION

A typographical error resulted in incorrect information being provided in the article *Digitizing Historical Records for the Comprehensive Ocean-Atmosphere Data Set (COADS)* in the December 1993 issue of the *Earth System Monitor*. In Table 1 of this article, the dates for data digitized from the Arctic Ice Dynamics Joint Experiment (AIDJEX) should have been given as:

April 1975 - April 1976

Using GIS technology to map and analyze the benthic habitats of the Florida Keys National Marine Sanctuary

The Strategic Environmental Assessments (SEA) Division of NOAA's Office of Ocean Resources Conservation and Assessment is currently using its GeoCOAST Facility to map over 977,000 square hectares of benthic habitat within the Florida Keys National Marine Sanctuary. The mapping effort, which complements the Division's work in helping to develop the Sanctuary's Draft Environmental Impact Statement/Management Plan, is being conducted as a cooperative effort with the Photogrammetry Branch of NOAA's Coast and Geodetic Survey, the State of Florida's Department of Environmental Protection (FDEP), and NOAA's Sanctuaries and Reserves Division, which is providing funding assistance. It is part of an ongoing project that has combined two

technologies, photogrammetry and GIS, to provide accurate, detailed information on benthic habitat distributions and extents.

As of February 1994, 47,000 square hectares of benthic habitat within the Sanctuary had been mapped, totaling 4.8 percent of the entire area to be assessed. The process involves the use of color aerial photographs (1:48,000 scale, taken at 7,313 meters in altitude) collected during the winter of 1991-92 by NOAA's Photogrammetry Branch to accurately locate the shoreline of the Keys and the southern portion of the Florida mainland. Because each photograph has a 60 percent forward and side overlap with the photographs surrounding it, a controlled color mosaic of the entire Sanctuary can be produced.

delineated habitats are then digitally compiled on stereoplotters, where additional attributes are added. These digital files are converted into ARC/INFO coverages, which are edited to remove extraneous information. Of the habitat digitized to date, only 22 percent has been classified as unmappable. All other benthic areas have been identified as one of the 31 habitat types. The full-color maps produced as part of the project (Figure 1) are output on an E-size electrostatic plotter.

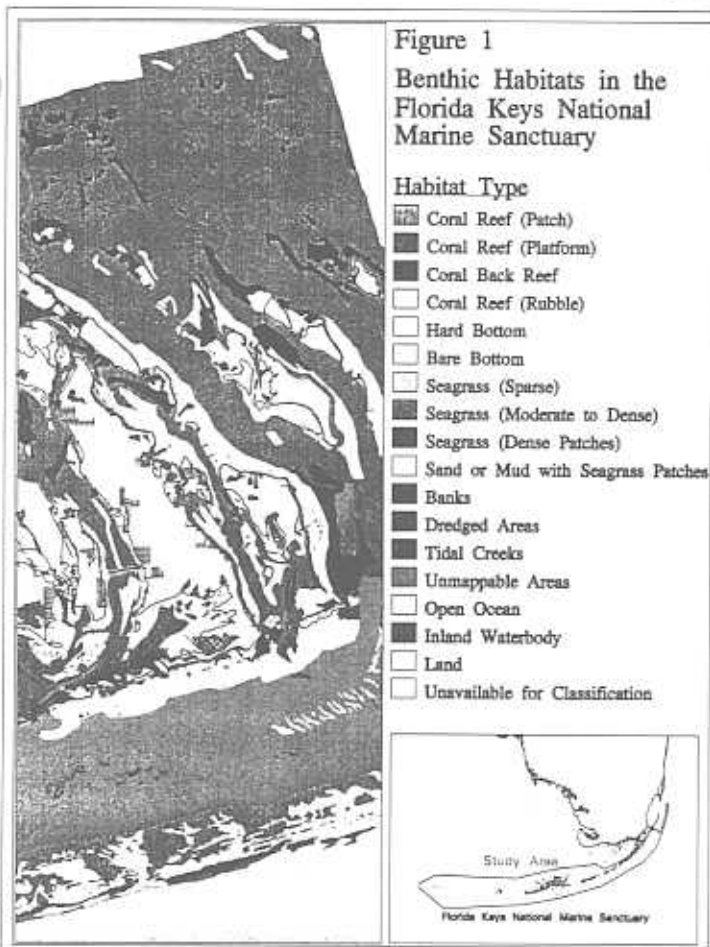
The project represents an example of how information gathered for one purpose (i.e., aerial photographs used to locate the shoreline) can be used for other resource evaluation purposes. The results of the initial phases of the mapping effort were presented at the "Second Thematic Conference on Remote Sensing for Marine and Coastal Environments" in New Orleans, from January 31 to February 2, 1994, and the entire project is scheduled for completion by the spring of 1995.

In addition to mapping benthic habitats in the Florida Keys National Marine Sanctuary, the SEA Division's GeoCOAST Facility is currently supporting projects including assessing and managing the water quality of California's Monterey Bay National Marine Sanctuary. The Facility was also used for digital analysis during the rebuilding of the Metro-Dade, Florida, water and sewage system following Hurricane Andrew.

For more information about benthic mapping or other GeoCOAST projects, contact: Data Management and Geographic Information Systems Group, Strategic Environmental Assessments Division, Office of Ocean Resources Conservation and Assessment, NOAA/NOS, SSMC4, 9th Floor, 1305 East-West Highway, Silver Spring, MD 20910. Telephone: 301-713-3000. Fax: 301-713-4384. Internet: pgrose@seamail.noaa.gov.

— Mitchell Katz

Strategic Environmental
Assessments Division
NOAA/NOS N/ORCA1
1305 East-West Highway
Silver Spring, MD 20910 ■



▲ Figure 1. Gray-scale representation of color analysis of benthic habitats within a selected area of the Florida Keys National Marine Sanctuary.

The benthic habitats identified in the photographs are delineated by specialists associated with the Florida Marine Research Institute, FDEP, and NOAA. Thirty-one benthic habitat types have been established within the following major habitat groups: coral reefs, hard bottom, bare bottom, seagrass, miscellaneous (including dredged areas), and unmappable habitat (usually due to turbidity or water depth). The minimum mapping area is typically 0.5 hectares, and important discrete habitats such as coral heads also are located. The

The Federal Geographic Data Committee and its relationship to the earth system data community

In recent years—at least since about 1985—there has been growing demand for digital data and information from Federal government agencies to serve the needs of the Geographic Information System (GIS) community. Fulfilling this customer demand, however, has been hampered by lack of conformity and standardization among agency missions, mapping application systems, and data management procedures. To improve coordination and reduce these obstacles the Federal Geographic Data Committee (FGDC) was created.

The FGDC's charter derives from the Office of Management and Budget Circular A-16 (revised in 1990). As expressed in the Circular the main objective of the FGDC is: "Coordination of surveying, mapping, and related spatial data activities." (author emphasis) For the purposes of the Circular and its implementation, spatial data are defined as: "... geographically referenced features that are described by geographic positions and attributes in an analog and/or computer-readable form." These are commonly referred to as map or cartographic data.

The goals of the OMB Circular are:

- to develop a national digital geographic information resource,
- to reduce duplication and decrease the expense of producing geographic data,
- to increase the benefits of using available data, and
- to ensure coordination of Federal agency geographic data activities.

A major objective of Circular A-16 is the development of a National Spatial Data infrastructure (NSDI) with the involvement of Federal, state, and local government and the private sector (NRC, 1993). The NSDI currently exists in a fragmented, *ad hoc* manner, encompassing standards and partnerships in various stages of development, large volumes of analog geospatial data (paper maps and records), and numerous collections of non-standardized, incomplete, often out-of-date data. (Tosta, 1994).

Recently, the Clinton Administration included creation of the NSDI among the initiatives necessary to "reinvent government." Vice President

Gore's National Performance Review report identified the development of the NSDI—based on partnerships with non-Federal sectors—as a key to minimizing redundancy in the production of geospatial data and to accessing these data for solving critical problems. The FGDC was recognized as the entity responsible for helping to guide development of the NSDI.

The main objective of the FGDC is: "Coordination of surveying, mapping, and related spatial data activities."

The FGDC is a multi-level, inter-agency organization. Approximately 15 Federal agencies are represented on the FGDC. The Committee is chaired by Secretary of the Interior Bruce Babbitt. Diana Josephson, NOAA's Deputy Under Secretary, represents the Department of Commerce.

The FGDC has subcommittees organized to manage activities related to various categories of spatial data. Each subcommittee establishes procedures for standardizing data content, quality, and transfer; facilitates the exchange of data; and determines requirements for new data collections. Subcommittees are currently organized for:

- Base Cartographic Data,
- Bathymetric Data,
- Cadastral Data,
- Cultural and Demographic Data,
- Geodetic Data,
- Geologic Data,
- Hydrologic Data,
- Transportation Data,
- Vegetation Data,
- Soils Data, and
- Wetlands Data.

Representatives of NOAA organizations chair two of the subcommittees (Geodetic Data and Bathymetric Data) and are active participants on several others.

One of the efforts of the FGDC has been to produce a *Manual of Federal Geographic Data Products* describing a

variety of types of spatial data available from Federal agencies. (FGDC, 1992). In addition FGDC has developed a standard for the exchange of digital data. This Spatial Data Transfer Standard (SDTS) has been issued as Federal Information Processing Standard (FIPS) 173 and is now mandatory for all spatial data activities. Within the Federal government FGDC has been leading the National effort in cataloging data and ensuring its availability through an electronic clearinghouse, and in developing a metadata standard for data cataloging and exchange of spatial data.

The goals of the FGDC are closely related to the goals of the NOAA Environmental Services Data and Information Management (ESDIM) program. Both are directed toward improving access to and sharing of geographically-referenced data. Close coordination and cooperation between the two groups will ensure that the needs of the spatial data community and the earth systems data community are compatible.

For further information about the efforts of the FGDC, contact Millington Lockwood. Telephone: 703-648-6525. Internet: lockwood@oemg.er.usgs.gov.

References

- FGDC, 1991. A National Geographic Information Resource: The Spatial Foundation of the Information-Based Society. *First Annual Report to the Director of the Office of Management and Budget*. U.S. Geological Survey, Reston, VA, 10 pp. plus appendixes.
- FGDC, 1992. *Manual of Federal Geographic Data Products*. Loose leaf binder. USGS/FGDC, Reston, VA.
- National Research Council, 1993. Toward a Coordinated Spatial Data Infrastructure for the Nation. *Report by the Mapping Sciences Committee*. National Academy Press, Washington, DC. 171 pp.
- Tosta, N., 1994. The National Spatial Data Infrastructure: Where are we now? *Geo Info Systems*, 4/1, 25-28.

— Millington Lockwood
Joint NOAA/USGS Office for
Mapping and Research
915 National Center
Reston, VA 22092 ■

Geologic hazard photographs on 35mm slides and CD-ROMs

Twenty-five unique sets of 35mm slides depicting geologic hazards—earthquakes, volcanoes, and related phenomena—throughout the world are available from the NOAA National Geophysical Data Center. The sets are appropriate for classroom use and presentations to technical and non-technical audiences. Each set consists of 20 slides in color or black-and-white. Included with the slides is documentation proving background material, dates, locations, and descriptions of effects for the depicted hazards.

The NGDC has also released a two-disc set of CD-ROMs holding natural hazard photographs. All images on the CD-ROMs are recorded in both 24-bit TIF and compressed 8-bit PCX format. A caption is included with each image. For the PCX images only, Microsoft Windows-based access software is also provided. A flier/order form for the slide sets and CD-ROMs is available on request.

Contact: NGDC

DMA charts and publications available from NOAA

NOAA's National Ocean Service (NOS), which produces and distributes nautical and aeronautical charts, has since October 1992 also served as the sales agent for nautical and aeronautical charts and related publications of the Defense Mapping Agency (DMA). At that time some 7000 public sale items were physically transferred from DMA to the NOS. Free catalogs of either NOS or DMA products are available on request.

Contact: Distribution Branch, NOAA/NOS, Riverdale, MD 20737. Telephone: 301-436-6990.

Report on Oceanographic Data Archaeology and Rescue Project

A 73-page report on initial results of the Global Oceanographic Data Archaeology and Rescue (GODAR) project has been issued by the National Oceanographic Data Center. Titled *Results of the NODC and IOC Oceanographic Data Archaeology and Rescue Projects: Report 1*, this publication provides station location plots and tables of counts of observations by year for the 1.2 million ocean temperature profiles received by the U.S. NODC and its collocated World Data Center A for Oceanography over the past two years.

Data products and services

These previously unavailable data were received from Australia, China, France, Iceland, India, Japan, Russia, South Korea, the United States, and the International Council for the Exploration of the Sea. The GODAR project was launched to increase the volume and geographic coverage of historical oceanographic data in the NODC/WDC digital archives and to make these data available to researchers. Copies of this report (Key to Oceanographic Records Documentation No. 19) are available free while supplies last.

Contact: NODC

NOAA Central Library Catalog of CD-ROM Holdings

The NOAA Central Library in Silver Spring, Maryland, has published an updated catalog that provides a listing of all CD-ROM titles in its holdings as of September 1993. The catalog includes CD-ROM products produced by Federal government agencies, academic institu-

tions, and private industry. The catalog is arranged alphabetically by CD-ROM title. Each entry includes a general description of the CD-ROM contents and features, source and vendor information, and an illustration of either the disc or selected data from the disc.

Contact: NOAA Central Library

Global daily meteorological data on CD-ROM

The National Climatic Data Center has issued a new CD-ROM that provides access to a 10,000-station data set of daily maximum/minimum temperature, daily precipitation, and 3-hourly present weather for the period 1977-1991. Data can be selected by geographic areas or by a predefined user-selected list of stations. The data set includes element flags for suspected erroneous data. A data inventory contains station name, latitude/longitude, elevation, period of record, and the number of observations of available data. A minimum of 4 MB RAM is required to use the disc and 8 MB is recommended.

Contact: NCDC

New edition of Gravity CD-ROM

The land gravity database of the National Geophysical Data Center has been significantly enhanced and improved by the addition of several new and important contributions. The entire collection, jointly developed with the NOAA National Ocean Service, is now available on the 1994 edition of the Gravity CD-ROM.

The compact disc holds 634 megabytes of data partitioned into 1490 files. Approximately 25 percent of the data are observed values—regional station data collections (separated primarily by contributors) and absolute gravity measurements. Grids and other derived summary data sets represent another 65 percent of the data. The remaining 10 percent of the disc contains geopolitical base map reference data. Accompanying the CD-ROM is access software (for DOS and Microsoft Windows) that allows users to extract the data from the disc.

Most of the gravity data on the Gravity CD-ROM were processed and documented using FreeForm, a format specification system developed at NGDC. For example, there are FreeForm utilities to compute histograms of field values and to reformat data to user specifications.

Contact: NGDC

CONTACT POINTS

National Climatic Data Center (NCDC)

Climate Services:

704-271-4682

Fax: 704-271-4876

Internet: orders@ncdc.noaa.gov

Satellite Services:

301-763-8399

Fax: 301-763-8443

Internet: sdsdreq@ncdc.noaa.gov

National Geophysical Data Center (NGDC)

303-497-6958

Fax: 303-497-6513

Internet: info@ngdc.noaa.gov

National Oceanographic Data Center (NODC)

202-606-4549

Fax: 202-606-4586

Internet: services@nodc.noaa.gov

NOAA Environmental Services

Data Directory

202-606-5012

(Gerald Barton)

Fax: 202-606-0509

Internet: barton@esdim.noaa.gov

NOAA Central Library

Reference Services:

301-713-2600

Fax: 301-713-4599

CD-ROM Data Products of the National Oceanographic Data Center

This summary from the NODC is the third in a series listing CD-ROMs currently available from the NOAA national data centers. They are presented as a sequel to the article on CD-ROM activities at the centers presented in the June 1993 issue of the Earth System Monitor.

• Geosat Wind/Wave Data

This CD-ROM holds global wind/wave data derived from altimeter data collected during the Geodetic Mission of the U.S. Navy Geodetic Satellite (Geosat). The data span the period from March 31, 1985 through September 30, 1986. Although the complete data set from the Geosat Geodetic Mission is classified, in 1988 the Navy released the radar backscatter (from which wind speed is derived) and the significant wave height data. This disc holds these data and includes two wind speed fields that were computed using different algorithms. The README file on this disc also provides three additional wind speed algorithms proposed since 1988 and a bibliography that includes references to papers that discuss the algorithm used to compute significant wave height.

The wind/wave data are recorded as 26-byte binary records in Hewlett-Packard format. A software module to convert the data to binary VAX format is also provided. To fit this entire data set onto one CD-ROM, the files have been compressed. Software to decompress the files is provided on the CD-ROM. 1 disc

• Climatological Atlas of the World Ocean (1982) Data Sets

This write-once CD-ROM holds gridded data sets of major ocean parameters from the *Climatological Atlas of the World Ocean* (Levitus, 1982). Previously available only on magnetic tape, these data sets are now available on one CD-ROM. The CD-ROM holds three data sets:

1. Monthly analyses of temperature;
2. Annual and seasonal analyses of temperature, salinity, oxygen, and oxygen saturation; and
3. Seasonal five-degree square statistics of temperature, salinity, oxygen, oxygen saturation, potential density, and specific

volume. 1 disc

[Note: Later in 1994 the NODC will release on CD-ROM data sets from the *World Ocean Atlas, 1994*. This new atlas by Sydney Levitus updates the earlier atlas and will include analyses of temperature, salinity, oxygen, phosphate, and nitrate.]

• NODC Taxonomic Code, Version 7.0

The NODC Taxonomic Code is a hierarchical system of numerical codes used to represent the scientific names of organisms. The Code links the Linnean system of biological nomenclature to a numerical schema that facilitates modern methods of computerized data storage and retrieval. Each code contains a maximum of 12 digits partitioned into 2-digit couplets. Each couplet represents one or more levels of the taxonomic hierarchy. Version 7.0 of the NODC Taxonomic Code contains approximately 206,000 records.

Data files on the CD-ROM present the Code in several ways. These files include the Code in different sort orders, subsets of the Code, and other versions modified for special uses or applications. The CD-ROM also contains a separate directory in which the Code is divided into 41 files each of which is small enough to be copied to a high density diskette. These files contain members of a single major group of organisms (e.g., protozoans, fishes, birds) or several different groups of more-or-less closely related organisms. 1 disc

• NOAA Marine Environmental Buoy Database

This set of 14 CD-ROMs holds marine meteorological, oceanographic, and wave spectra data collected by moored buoys and C-MAN (Coastal-Marine Automated Network) stations operated by the NOAA National Data Buoy Center (NDBC). C-MAN stations are located at coastal and

nearshore sites on piers, offshore towers, lighthouses, and beaches. The NDBC buoys began reporting in the early 1970s and the NODC archive holds data from October 1972. The first C-MAN stations became operational in March 1983, and the NODC archive of C-MAN data begins in 1985. The data on these discs spans the period through July 1992.

The discs are organized by ocean area and provide data for the Atlantic Ocean (4 discs), Gulf of Mexico (2 discs), Great Lakes (2 discs), central and western Pacific Ocean (1 disc), North Pacific Ocean above 50°N (1 disc), and eastern Pacific Ocean (4 discs).

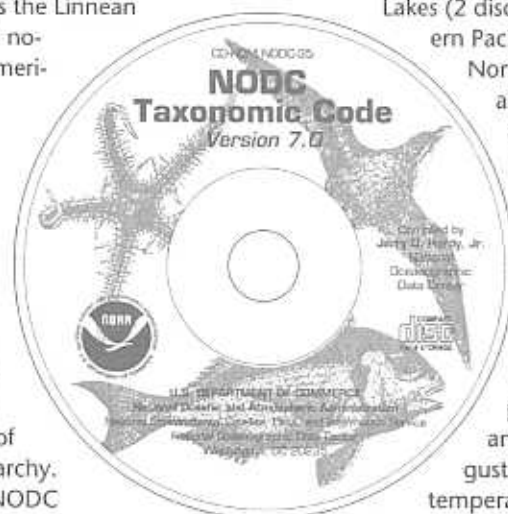
Principal measured parameters reported by both moored buoys and C-MAN stations include air temperature and pressure, wind speed and direction, wind gust, and sea surface temperature. The buoys (and a few C-MAN stations located on offshore platforms) also report wave data, which usually include wave height, wave period, and wave spectra. Since the late 1980s, some buoys have reported directional wave spectra.

The data and information files are recorded in ASCII format. Data files for each buoy or C-MAN station are arranged chronologically in directories by their station identifier. Each file contains data for one month for that buoy or station. 14 discs

[Note: Update discs holding data from August 1992 onward will be issued by the NODC to continue this series of CD-ROMs and make the more recent buoy and C-MAN data available. The NODC expects to release the first of the update discs in mid-1994.]

• Oceanographic Station Profile Time Series

The National Oceanographic Data Center and the World Data Center A for Oceanography have compiled from the



NODC Oceanographic Station Data File a set of oceanographic data having repetitive samples along ocean sections or at fixed stations for long time periods. These oceanographic station time-series include temperature, salinity, density, and nutrient data. The total time-series data set contains: 27 North Pacific sections; 56 North Atlantic sections; sections along coastal California from the California Cooperative Fisheries Investigations (CALCOFI); 19 sections from other ocean regions; and data from the 10 Ocean Weather Stations.

The CD-ROM contains both data and inventory files. Each inventory file is sorted by NODC Reference Number. The data on this disc are stored as ASCII records in the NODC Oceanographic Station Data 2 (SD2) format. Also included on the CD-ROM is a conversion program that enables these data to be used with the ATLAST software. [ATLAST is a software package for accessing and displaying hydrographic and tracer section data. Developed by Dr. Peter Rhines of the University of Washington, it is distributed by the Jet Propulsion Laboratory.] 1 disc.

● Geosat Altimeter Data (GDRs) from the Geodetic Mission, 30°S-72°S

This set of two CD-ROMs contains Geosat geophysical data records (GDRs) collected south of 30°S during the 1985-1986 Geosat Geodetic Mission. Unlike the Geosat Exact Repeat Mission during 1986-1989, the Geodetic Mission was designed to produce a tightly spaced ground track pattern (typically 3 to 4 km at 30°S). Therefore, this data set provides denser data coverage of the ocean surface than that produced by other satellite altimeters.

Data on these CD-ROMs are stored in a binary Hewlett-Packard format, but each disc contains a software module that enables the data to be converted to binary VAX format. Disc 1 contains the data for March 30, 1985-December 31, 1985; Disc 2 contains the data for January 1, 1986-September 30, 1986. [Note: Foreign requesters must follow special procedures when ordering Geosat data. For further information, contact the NODC.] 2 discs

● Geosat Altimeter Crossover Differences from the Geodetic Mission

The first 18 months of Geosat operations (April 1985 to September 1986) were referred to as the Geodetic Mission. Except for data south of 30°S that has

Ordering Information

The National Oceanographic Data Center's User Services Branch distributes NODC CD-ROM data products. For the latest information on availability and pricing, contact the Branch at:

National Oceanographic Data Center
User Services Branch
NOAA/NESDIS E/OC21
1825 Connecticut Avenue, NW
Washington, Dc 20235

Telephone: 202-606-4549
Fax: 202-606-4586
Omnet: NODC.WDCA
Internet: services@nodc.noaa.gov

been declassified and released by the Navy, data from the Geosat Geodetic Mission were collected for military use and are classified. The altimeter crossover differences from the Geodetic Mission are unclassified, however, and are contained on this set of eight CD-ROMs in the form of crossover difference records (XDRs). Although only the 18-month Geodetic Mission data are classified, XDRs were constructed for the first 2.5 years of the Geosat mission, that is, data from the Geodetic Mission plus the first year of the Exact Repeat Mission. This was done to minimize the effect of the 5-week data gap (October 1 to November 8, 1986) between the two missions.

The data are in a binary Hewlett-Packard format, but each disc contains a module that enables the data to be converted to binary VAX format. The Geosat altimeter crossover difference records are documented in a NOAA handbook, a copy of which is provided with each order. [Note: Foreign requesters must follow special procedures when ordering Geosat data. Please contact the NODC for further information.] 8 discs

● Geosat Altimeter Data (T2 GDRs) from the Exact Repeat Mission

These six CD-ROMs contain improved geophysical data records (GDRs) from the U.S. Navy Geodetic Satellite (Geosat) Exact Repeat Mission (ERM), November 1986 through December 1989. The original version of these data released by the NODC on magnetic tape were based on

operational satellite orbits computed by the Naval Astronautics Group (NAG) and are referred to as the "NAG GDRs." A new satellite ephemeris, more precise by an order of magnitude, has since been computed by NASA's Goddard Space Flight Center. These new orbits have been incorporated in the "T2 GDRs" (so called because the orbits are based on the GEM-T2 gravity model). In addition, the T2 GDRs contain other new fields which significantly increase the overall accuracy of the Geosat data. The Geosat T2 data on these CD-ROMs are stored in files containing one day of measurements each. Disc 1 of the set contains data from November 8, 1986 through April 9, 1987. The other CD-ROMs cover succeeding time spans of the Geosat mission.

The data are in the same binary Hewlett-Packard format as the original Geosat GDRs. (A program that converts the data from Hewlett-Packard to VAX format is included on each disc). Each order is accompanied by a copy of the Geosat GDR user handbook. [Note: Foreign requesters must follow special procedures when ordering Geosat data. Please contact the NODC for further information.] 6 discs

● Global Ocean Temperature and Salinity Profiles

This set of two CD-ROMs contains global ocean temperature and salinity profiles derived from six major NODC archive files: (1) Oceanographic Station Data, (2) CTD/STD Data, (3) Expendable Bathythermograph Data, (4) Mechanical Bathythermograph Data, (5) Radio Message Bathythermograph Data, and (6) Selected Level Bathythermograph Data. The data span the period from 1900 to 1990. Disc 1 contains 1.62 million profiles from the Atlantic and Indian Oceans; Disc 2 contains 1.57 million profiles from the Pacific Ocean.

The data are in ASCII format. Data access and display software for DOS-compatible computer is provided on two floppy diskettes. 2 discs

— Andrew Allegra
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User Services Branch
NOAA/NESDIS E/OC21
1825 Connecticut Avenue, NW
Washington, DC 20235 ■

Internet access to NCDC data inventories

NOAA's National Climatic Data Center (NCDC) has a number of climatic data inventories that are available over the Internet using anonymous File Transfer Protocol (FTP). The data inventories reside on an NCDC workstation in a subdirectory called *inventories*. Just follow the instructions below to access any of these inventories.

To access and download the files over the Internet, login to the workstation using FTP (type *ftp* at the system prompt). Please enter commands in lower case letters.

- a) Enter: *open 192.67.134.72* or
open hurricane.ncdc.noaa.gov
- b) Login: *anonymous*
- c) Password: *guest*
- d) You are now logged onto a UNIX workstation at the NCDC. For a like a list of available commands, enter: *help*
- e) To move to the correct subdirectory, enter: *cd /pub/upload/inventories*
- f) To get a copy of the file descriptions, enter: *get README.TXT destination* (where *destination* is your output location and name), e.g.—
get README.TXT c:README.TXT
copies README.TXT to hard drive c:
Note that file names are in all CAPITAL letters.
- g) Then, to get a copy of any of the inventory files, use the same procedure, such as—
get COOP.TXT c:COOP.TXT
- h) To logoff when finished, enter: *bye*
- i) After completing your copy, please send an Internet message to either: *nlott@ncdc.noaa.gov* or *tross@ncdc.noaa.gov*
This will help us to evaluate the usefulness of the system. Your comments and suggestions are welcome.

Information and inventory files currently available from the NCDC workstations are:

README.TXT

This file provides detailed descriptions of the inventory files. The inventory files also contains headers and additional information at the beginning of each file.

COOP.TXT

Historical cooperative station index through 1991 (listed elevations are in tens of feet). Cooperative stations are U.S. stations operated by local observers that generally report max/min temperatures and precipitation. National Weather Service (NWS) data are also included in this dataset. The data receive extensive automated and manual quality control. Data are available through 1993, and the index will be updated in the near future.

COUNTY.TXT

Cooperative station number—county name cross-reference (through 1993)—provides the county location for each of the cooperative stations.

DATSV2.TXT

AWS DATSAV2 Surface (worldwide surface observations) inventory through 1991. There are currently about 10,000 hourly/synoptic stations active worldwide. The data receive extensive automated quality control. This file provides yearly data "counts" for all stations (active and inactive). Data are available through 1993, and the inventory will be updated in the near future.

DAT2USCN.TXT

Same as DATSV2.TXT, but for U.S. and Canada only.

MSC-ABB.TXT

Abbreviated AWS Master Station Catalog (AWSMSC worldwide station list)—a list of active surface and/or upper-air stations with latitude/longitude/elevation included.

NEXRAD.TXT

Inventory of NEXRAD level II data available from NCDC. These data are for non-commissioned stations, and there are numerous periods of missing data indicated in the inventory.

— continued on page 6

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