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EARTH SYSTEM MONITOR

NCDC's Environmental Satellite Database

The National Climatic Data Center offers users unique environmental data

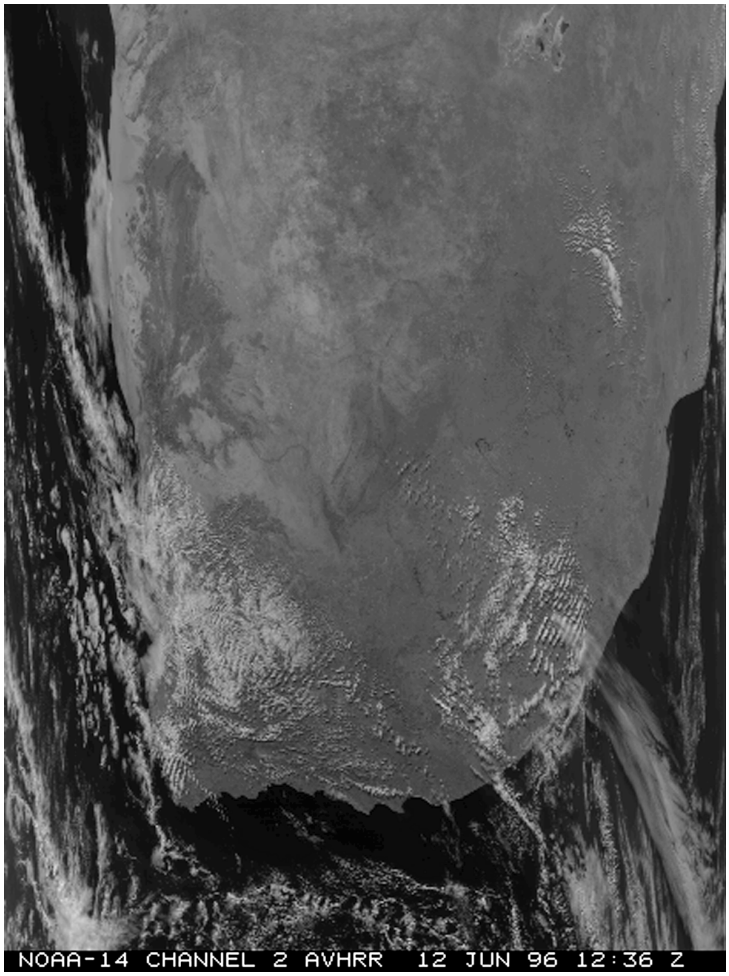
A guide to NOAA's data and information services

INSIDE

Robert Boreman
Satellite Data Services Group
National Climatic Data Center
NOAA/NESDIS

The National Climatic Data Center (NCDC) is the world's largest active archive of weather and environmental satellite data, and the National Archives and Records Administration has designated NCDC as the U.S. Department of Commerce's only Agency Records Center. The weather data are obtained from the National Weather Service (NWS), military services, the U.S. Coast Guard, the Federal Aviation Administration, and voluntary cooperative observers. Satellite data are obtained from the NOAA National Environmental, Satellite, Data, and Information Service (NESDIS), from the Department of Defense, and from the National Aeronautical and Space Administration (NASA).

The Center has more than 150 years of data on hand and maintains 544 different data sets. NCDC archives contain 99 percent of all NOAA data holdings, including observations from NWS surface stations, upper air stations, NEXRAD radar sites, cooperative stations, ship and buoy reports, DOD installations, and environmental satellites. The archive contains 460 terabytes of data and is growing at the rate of about 10 terabytes each month. There are 320 million paper records, 1.2 million microfiche records, 510,000 tape cartridges and magnetic tapes, and approximately 175,000 hardcopy satellite images (Figure 1) stored at the Center.



▲ **Figure 1.** NOAA satellite imagery depicting a weather system which initially formed in the Atlantic Ocean and moved to the Indian Ocean, affecting Cape Town, South Africa along the way.

NCDC responds to nearly 175,000 off-line, and over 1 million online customer requests for climatic data and information each year. Monthly and annual publications are prepared for the more frequently requested data, and nearly 2 million copies are provided to subscribers and intermittent users annually.

NCDC's environmental satellite database accounts for almost 230 terabytes, or 50 percent of the total current archive. This includes 40 terabytes of polar orbiter satellite data, and 190 terabytes of geostationary satellite data. The physical location of these data are: Asheville, North Carolina; Suitland, Maryland; and the Space Science and Engineering Center at the University of Wisconsin. Most of the servicing functions are provided by NCDC's Satellite Data Services Group at Asheville, North Carolina.

The environmental satellite data base, an element of the overall NESDIS database, is a

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Satellite Data Services Group
National Climatic Data Center
151 Patton Avenue
Asheville, NC 28801-5001
E-mail: satorder@ncdc.noaa.gov

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Satellite imagery, *from page 1*

unique source of data and information. It contains film imagery and digital data collected by a number of environmental satellites from 1960 to the present. These satellites include the National Oceanic and Atmospheric Administration operational environmental satellites, various NASA research satellites, and the Department of Defense Meteorological Satellite Program (DMSP). Data are available from the TIROS Series beginning with TIROS-1 (June 1960) through TIROS-10 (April 1966), ESSA, ITOS, GEOS-3, SEASAT, NIMBUS-7, DMSP F-8 through F-13, NOAA-1 through NOAA-14, and the geostationary satellites ATS-1 launched in 1966 through GOES-9 launched in May 1995.

In the future, data from the Canadian satellite, RADARSAT, will be made available on a limited basis to NCDC. While many of the collected data are meteorological (Figure 2), the data have been of considerable interest to agronomists, oceanographers, hydrologists, and geologists as well.

There are two basic types of environmental satellites: polar orbiting and geostationary. The instruments aboard the Polar Orbiting Environmental Satellites (POES) and the Geostationary Orbiting Environmental Satellites (GOES) are presently collecting data which are available in image form and digital format.

The polar orbiting satellites operate in relatively low orbits, ranging from 700 to 1,700 km above the earth, and circle the earth 12 to 14 times per day (orbital periods from 99 to 115 minutes). The orbits are timed to allow complete global coverage twice per day (normally a daytime and a nighttime view of the earth) in swaths of about 2,000 km in width. Because of the polar orbiting nature of the POES series satellites, these satellites are able to collect global data on a daily basis for a variety of land, ocean, and atmospheric applications.

Data from the POES series supports a broad range of environmental monitoring applications including weather analysis and forecasting, climate research and prediction, global sea surface temperature measurements, atmospheric soundings of temperature and humidity, ocean dynamics research, volcanic eruption monitoring, forest fire detection, global vegetation analysis, and many other applications.

High resolution (1 km) data are

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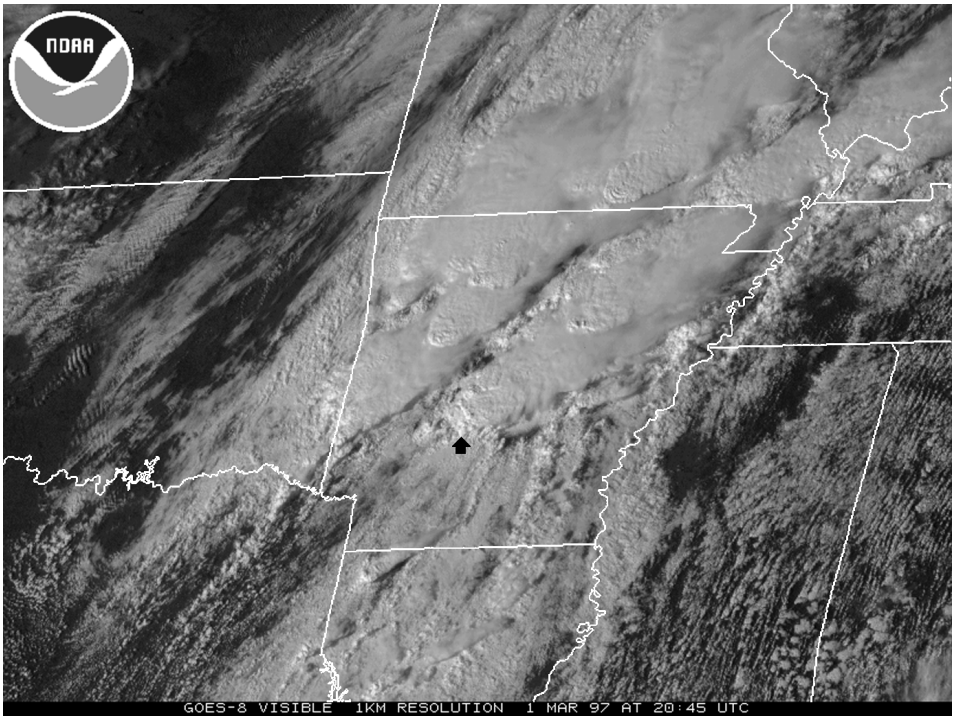

▲ **Figure 2.** This satellite image depicts a stationary front stretching from Texas to West Virginia that spawned several tornados, one of which destroyed sections of Arkadelphia, Arkansas (arrow points to Arkadelphia).

EARTH SYSTEM MONITOR

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The mailing address for the *Earth System Monitor* is:

National Oceanographic Data Center
NOAA/NESDIS E/OC1
SSMC3, 4th Floor
1315 East-West Highway
Silver Spring, MD 20910-3282

EDITOR

Sheri Phillips
Telephone: 301-713-3279 ext.127
Fax: 301-713-3302
E-mail: sphillips@nodc.noaa.gov

U.S. DEPARTMENT OF COMMERCE
William M. Daley, Secretary

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

NCDC's 1997 State Climatologist Exchange Program

Scientists from six states will participate in the National Climatic Data Center's (NCDC) State Climatologist Exchange Program during 1997. These participants include:

- Dr. Steve Qi Hu, a Missouri State Climatologist, will investigate pre-1982 soil temperature data for Missouri and its surrounding states and develop an inventory designed to make the data more usable;
- Dr. Patricia A. Bresnahan, Assistant Connecticut State climatologist, will develop sampling and format conversion algorithms for various NCDC datasets. The algorithms will allow the datasets to be compatible with the scale surface transport models at local and landscape levels.
- Mr. Dwight D. Pollard, Alaska State Climatologist, will review the processing and quality control of hourly precipitation data at NCDC and develop similar procedures for Alaska stations.
- Mr. John Purvis, a South Carolina Assistant State Climatologist, plans to accomplish a NEXRAD precipitation storm accumulation study for the Santee Cooper lakes in South Carolina. In addition, Mr. Milton Brown, South Carolina Assistant State Climatologist, plans to work with NCDC staff to develop a better understanding of the interconnections between the ocean and atmosphere which may affect major events in the southeast, such as drought and heavy precipitation. A correlation will be developed between El Niño and southeast droughts.
- Dr. Donald T. Jensen, Utah State Climatologist, will gather and digitize additional station data from NCDC archives. He also plans to share techniques and technologies developed from Utah's spatial and temporal distribution methods.
- Dr. John F. Griffiths, Utah State Climatologist, will continue research on the cold outbreak which occurred east of the Rockies in the year 1843. The research should yield information on the basic synoptic patterns that assailed the region by identifying the onset and speed of the cold fronts.

NGDC scientists attend Rim of the Gulf conference

Scientists from the National Geophysical Data Center (NGDC) recently attended the "Rim of the Gulf: Restoring Estuaries and Resources Conference", held in Portland, Maine. The conference was dedicated to improving scientific understanding and management of the Gulf of Maine and was cosponsored by NOAA. Dr. Elvidge and Mr. Dietz of NGDC are analyzing land cover change along the central coast of Maine using Landsat data as part of the NOAA/NESDIS Government Applications Task Force project. In addition, they are investigating the use of high tide/low tide aerial photography for mapping and characterizing the intertidal zone for portions of the central coast of Maine. For more information, please see the NGDC home page at *http://www.ngdc.noaa.gov.*

News briefs

Ocean data symposium to be held in Ireland

A Symposium on Ocean Data for Scientists will be held on October 15-18, 1997 at Dublin Castle, Dublin, Ireland. The Symposium objective is to assess the data management requirements of ocean scientists and to investigate the application of technological advances in order to increase the efficiency and effectiveness of present data management methods. The Symposium is being sponsored by the National Oceanic and Atmospheric Administration, the Intergovernmental Oceanographic Commission, EU Marine Science and Technology, and the Marine Institute, Ireland. Themes of the Symposium are:

1) the data and metadata requirements of scientists in order to support ocean research;
2) the benefits modern technology offers to scientists and the facilities available for the analysis and exchange of ocean data;
3) developing the use of advanced technology for data collection, analysis and exchange; also the implication of these developments on ocean studies worldwide;
4) advances in the development of information and data management tools for policy and decision makers.

The Symposium format includes paper presentation sessions, workshops, panel discussions (with rapporteurs), demonstrations, poster displays, and exhibition by service and technology suppliers. A reception hosted by the Minister for the Marine will be held on Oct 15, and there will be a review of the work of the symposium in a final day plenary session (offering conclusions to the ocean science community, policy makers and to ocean data managers). Meeting attendees will include scientists working in all aspects of ocean climate studies, data managers responsible for all types of ocean information, and persons involved in ocean monitoring and prediction.

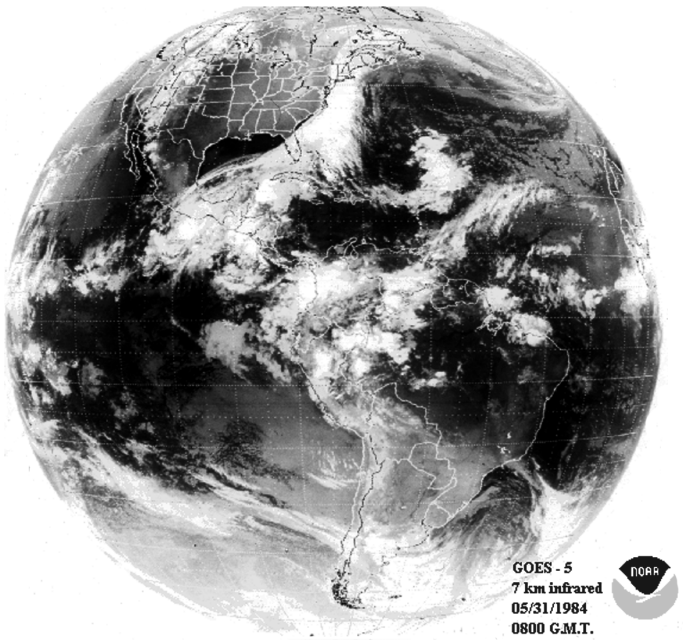
Some of the topics anticipated to be addressed by the presenters include :

- the role of the ocean in climate change;
- statistics and data for ocean scientists;
- implications of ocean color research;
- data precision and quality;
- how to preserve data for future use;
- GOOS - what are the needs for global programs?
- data archaeology;
- problems associated with integrated data sets;
- case studies from both large and small scale projects;
- the importance of metadata to science and data management;
- advances in IT (Information Technology);
- requirements for modelling;
- lessons that can be learned from past science programs;
- data management decision support tools; and
- and visualization and management of ocean data, as well as telecommunications and data exchange systems. In addition, the organizers would be happy to receive contributions on related material.

The exhibition of services, hardware and software and related products will form an integral part of the symposium, with hands-on demonstrations of products. Persons wishing to demonstrate IT packages are invited to submit a short description of their proposed demonstration. Abstracts were due May 30, 1997; notice of acceptance is due June 27, 1997. Full papers and early registration are due August 1, 1997.

Send information requests, posters, and abstracts to:

OD Conference Desk
Irish Marine Data Centre
80 Harcourt Street
Dublin 2
Ireland
Phone: +353-1-475-7100
Fax: +353-1-475-7104
E-mail: *data.centre@marine.ie*



▲ **Figure 3.** GOES full disk image of a 1984 storm that caused the sinking of the British barque *Marques*, resulting in the deaths of 19 crewmen.

Satellite imagery, *from page 2*
continuously transmitted from the satellites and can be collected in real-time mode only when the satellites are within range of a receiving center. However, recorders on board the satellites constantly store reduced resolution (4 km) data, which are then transmitted to the receiving stations on later orbits. NCDC archives both the Global Area Coverage (4 km), and the Local Area Coverage (1 km.) Only a limited amount of this 1 km resolution data can be stored on command and downloaded when the satellites are within range.

Each of the two current polar satellites, NOAA-12 and NOAA-14, makes nearly polar orbits roughly 14 times a day. The satellite system includes the AVHRR (Advanced Very High Resolution Radiometer) and the TOVS (TIROS Operational Vertical Sounder). The AVHRR instrument is equipped with five spectral channels with a near infrared channel to help monitor global vegetation, and higher spatial resolution (i.e., 1.1 km at nadir) throughout the infrared channels. Complete details are provided in a document entitled *Polar Orbiter Data User's Guide*, which is available from the NCDC.

With the closing of the Marshall Space Flight Center Distributed Active Archive Center, NCDC has taken over the responsibilities for distributing data from the DMSP satellites to the Earth Observing Satellite Data and Information System (EOSDIS) scientists. NCDC has been collecting data from this polar orbiting satellite series for their own users since 1987.

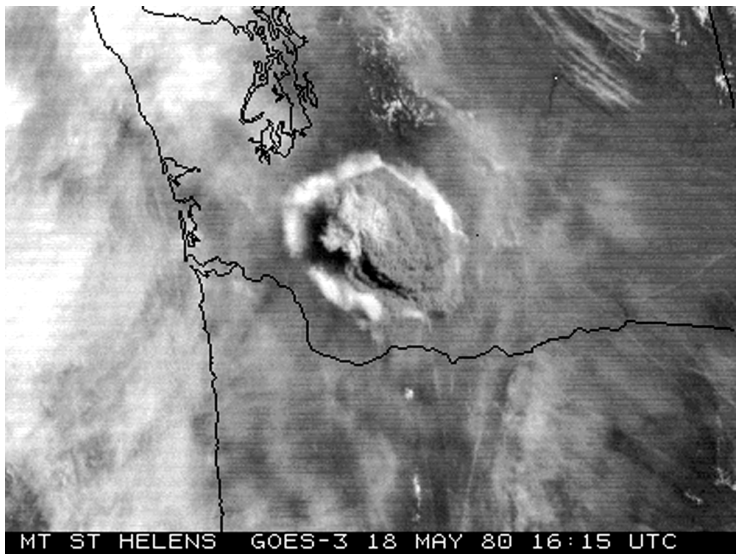
DMSP satellite instrumentation includes the Special Sensor Microwave/Imager (SSM/I), a seven channel, four frequency, linearly polarized, passive microwave radiometric system which measures atmospheric, ocean, and terrain microwave brightness temperatures. These data are available from December 12, 1989 to June 6, 1996 in level 1B format, or as Environmental Data Records (EDR), Temperature Data Records (TDR), and Sensor Data Records (SDR) from June 1987 to the present.

Data from the Special Sensor Microwave/Temperature Sounder (SSM/T), a seven channel microwave sounder designed to provide global, synoptic scale soundings of temperature throughout the troposphere and lower stratosphere is available from the beginning of August 1987 to the present. Data from the Special Sensor Microwave/Water Vapor Profiler (SSM/T2), a five channel, total power, microwave radiometer with three channel situated symmetrically about the 183.31 GHz water vapor resonance line and two window channels, is available from the beginning of June 1994 to the present.

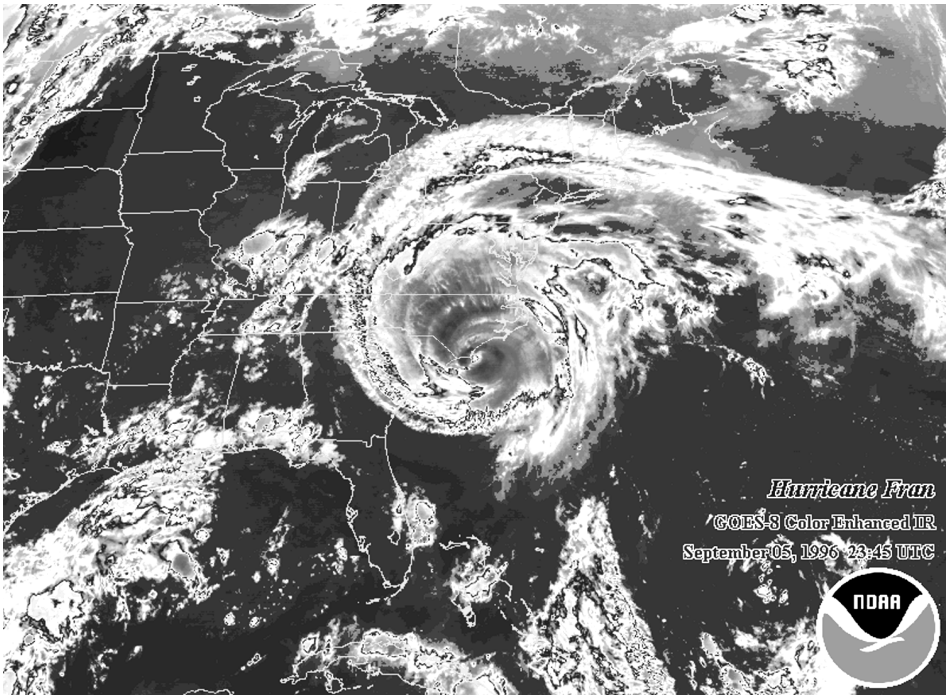
The GOES satellite system provides continuous monitoring necessary for intensive data analyses required by operational meteorologists and hydrologists. Each of the GOES satellites scans predetermined areas of the earth, including the continental United States, at least four times every hour. In times of severe weather (Figure 3) the GOES satellites are capable of one minute interval imaging over the affected area. NOAA maintains a two satellite configuration, GOES-West and GOES-East, which enables total coverage from the central Pacific Ocean eastward to the west African coast.

Currently, GOES-8 and GOES-9 are positioned at 75° and 135° west longitude, respectively, each orbiting the earth geosychronously along the earth's equatorial plane at a distance of 35,800 km from the earth's surface. A variety of products are produced in real-time mode and are directly incorporated into the daily computer model runs. A number of operational and experimental image products are also created and disseminated hourly to various government users. All of the data and the operational derived products are archived at the NCDC.

The Satellite Data Services Group of NCDC receives approximately 300 customer contacts each month from users



▲ **Figure 4.** Mount St. Helen eruption as viewed by the GOES-3 satellite May 18, 1980.



▲ **Figure 5.** GOES-8 color-enhanced image of Hurricane Fran on September 5, 1996 23:45 UTC.

of satellite data and products. Often, these requests go beyond simply filling an order, but require information about the satellite, instrumentation, dataset format, or just general information about usages of the data. Some of the more common uses are: aircraft accident investigation, hurricane and thunderstorm studies, training for National Weather Service forecasters, studies of flooding events, and lake effect snow evaluation.

Volcano eruption images from satellites are another popular item available from NCDC. The eruption of Montserrat in the West Indies early in 1997 initiated GOES image requests from scientists studying that particular event. The Government Information Service reported the pyroclastic flows reached the sea, and ash clouds were as high as 20,000 feet. Because of the falling ash, traveling conditions on parts of the island were very difficult, with some roads closed; under these conditions satellite imagery is an invaluable research tool.

The GOES-3 image of the May 1980 eruption of Mount St. Helens offers an extraordinary view of the ash cloud as it begins to rise into the atmosphere (Figure 4). An MPEG video loop of this event can be found online at *http://www.ncdc.noaa.gov/pub/data/images/olimages.html*.

Images of hurricanes (Figure 5) and tropical storms have been used in feature films, short documentaries, television productions, educational releases, magazines, and on the nightly news. Many of the best images, and some MPEGs, are found on the NCDC home page (*http://www.ncdc.noaa.gov*) as well. Timely reports, such as the March 1997 tornadoes and flooding information, are also accessible online with accompanying satellite images.

To obtain further information and up-to-date pricing schedules on the NOAA satellite data products and services presented in this article please contact:
Satellite Data Services Group
National Climatic Data Center
Room 120
151 Patton Avenue
Asheville, NC 28801-5001
Telephone: 704-271-4850
Fax: 704-271-4876
E-mail: *satorder@ncdc.noaa.gov*
or visit our web site at: *www.ncdc.noaa.gov/psguide/satellite/sathome.html*.

The National Climatic Data Center archives digital data, as well as non-digital satellite data, including miscellaneous slides, prints, film, and VHS tapes of special events too numerous to list. Please contact the Satellite Data Services Group for availability of specific images. We also recommend contacting us to confirm prices, ordering procedures, and digital formats.

Digital orders

Media type:
- — Round Tapes-1600/6250bpi
- — 4mm DAT Tapes
- — 8mm Exabyte Tapes
- — 3480 IBM Cartridges
- — CD-ROM

Processing fees:
- — $75.00 per tape mount ($80.00 per GOES dataset)
- — $11.00 per output unit
- — $100.00 per CD-ROM output
- — $11.00 service & handling per domestic order; $21.00 per foreign order

File Transfer Protocol (FTP) Services —

GOES data in McIDAS area format:
$45.00 per scene (all channels)

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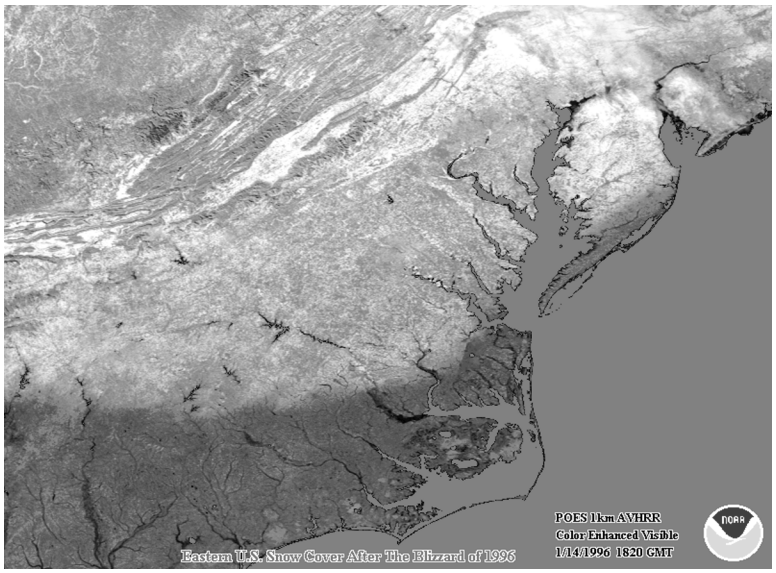


▲ **Figure 6.** Snow cover of eastern United States after the 1996 blizzard (POES 1 km image January 14, 1996, 18:20 UTC).

The NSIDC EASE-Grid

Addressing the need for a common, flexible, mapping and gridding scheme

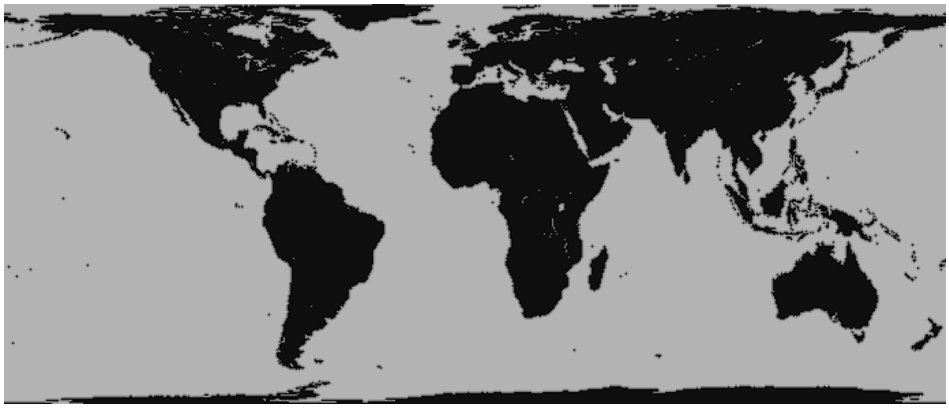
Richard Armstrong
Principal Investigator,
SSM/I Polar Pathfinder with
M. J. Brodzik and A. Varani
NOAA/National Snow and Ice Data Center

The world of geophysical study entered a golden age with the advent of remote sensing. Data resources, once dependent on manual acquisition, intrepid personalities and field excursions, are now large and luxuriating with each orbit of the many sensors scanning heavens and Earth. An abundance of data, at a variety of resolutions, in every kind of mapping scheme, and in all manner of formats, is now available virtually at the touch of a keyboard.

And therein lies the problem. Scientists wishing to compare parameters for a particular region have no trouble finding data. But the researcher expecting to find two data sets coinciding in temporal and spatial resolution, projection, grid size, and data format, suffers from impractical optimism. Instead, geophysical data analysis usually demands that the required information first be freed from its original organization, then painstakingly refitted to a common plan. Only after computationally intensive sessions can the comparisons be quantified and visualized, so that the work of scientific analysis can at last begin.

For example, researchers at the National Snow and Ice Data Center (NSIDC) in Boulder, Colorado recently sought to facilitate studies of seasonal fluctuations of snow cover and sea ice extent by providing a single data set combining snow and ice data. But the data selected as the best combination were unavailable in a common projection, let alone a common grid or resolution. It was not the first time the need for a standard, flexible data package, allowing direct comparison of remote sensing products, had been realized at NSIDC.

NOAA/National Snow and Ice Data Center
CIRES, Campus Box 449
University of Colorado
Boulder, Colorado 80309
Phone: 303-492-6199
Fax: 303-492-2468
E-mail: nsidc@kryos.colorado.edu
WWW: http://www-nsidc.colorado.edu



▲ **Figure 1.** The cylindrical, equal-area projection used in NSIDC's EASE-Grid family of projections. This projection supports full global and mid- to low-latitude studies.

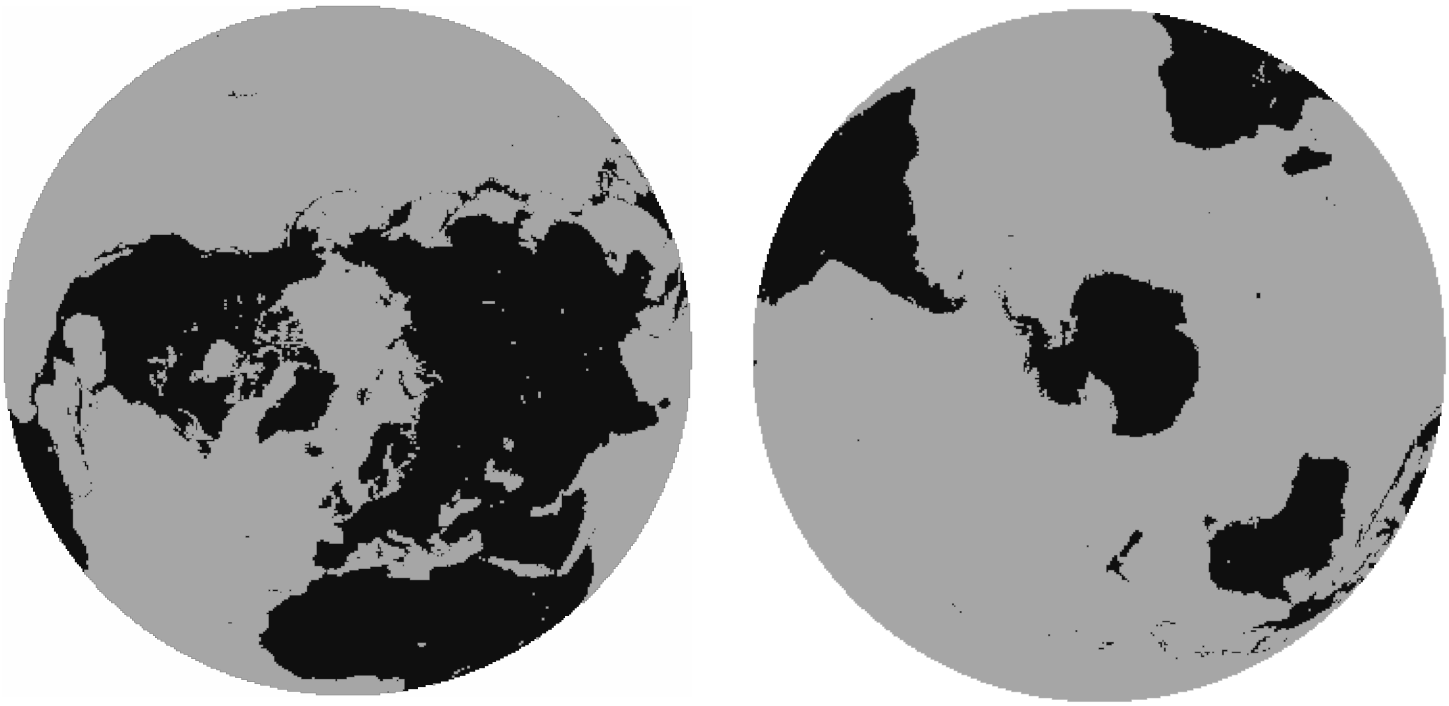
In 1989, NASA Headquarters requested guidance from the scientific community on how to best construct geophysical products over land surfaces for Special Sensor Microwave Imager (SSM/I) data and formed a working group to examine the issue. As a result, a prototype Earth grid was developed through collaboration between NSIDC and the University of Michigan's Radiation Laboratory. The prototype, called the Equal Area SSM/I Earth Grid (EASE-Grid), although specific to the needs of SSM/I data, held potential for general application to any global scale data set.

Since development, the EASE-Grid has proven to be so effective that NSIDC now offers several data sets in this family of formats. Although the specific method used to interpolate from satellite swath coordinates to a fixed earth grid will be unique to each sensor, the fundamental projection and gridding concept of the EASE-Grid provides the basis for a standard, flexible gridding method. While the original EASE-Grid concept comprised two fundamental parts: 1) a grid and projection scheme and, 2) a specific method to interpolate SSM/I data from swath space to earth gridded coordinates, the term "EASE-Grid" is now applied to the projection and gridding scheme alone, independent of the satellite sensor or data type.

Currently, EASE-Grid is provided in a cylindrical equal area projection (supporting full global and mid- to low-latitude studies; see Figure 1) and in separate azimuthal equal area projections (Figure 2) for the Northern and Southern Hemispheres (supporting high-latitude and polar studies). Its basic equal area cell size, 25 x 25 km, can be easily reproduced at higher and lower resolution multiples (e.g., 50 km, 12.5 km, 1.25 km).

For example, for NASA's Polar Pathfinder projects, the passive microwave brightness temperature cell size for all SSM/I channels is 25 x 25 km with an additional 12.5 X 12.5 km cell size for the 85 GHz channel. For planned Advanced Very High Resolution Radiometer (AVHRR) products, cell size will be 1.25 X 1.25, 5 X 5, and 25 x 25 and for Tiros Operational Vertical Sounder (TOVS), 100 X 100 km.

The NOAA/NASA Pathfinder Program SSM/I Level 3 EASE-Grid Brightness Temperatures, produced on CD-ROM, were the first NSIDC products to benefit from EASE-Grid. The interpolation technique employed to produce the Level 3 EASE-Grid Brightness Temperatures maximizes the radiometric integrity of original brightness temperature values, maintains high spatial and temporal precision, and involves no averaging of original swath data. The interpolation process artificially increases (by 16 times) the density of brightness temperature measurements in the satellite swath



▲ **Figure 2.** The polar projections used in NSIDC's EASE-Grid family of projections: Northern and Southern azimuthal, equal-area projections, with full hemispheric coverage—suitable for high-latitude and polar studies.

reference frame (sample interval of 25.0 km for 19, 22, and 37 GHz and 12.5 km for 85 GHz).

Using actual antenna patterns to create the over-sampled array, the net effect is as if the additional samples had been made by the satellite radiometer itself (i.e., the beam patterns and spatial resolutions of the interpolated data approximate those of the original samples).

Because response to this first application of the EASE-Grid was so positive, NSIDC researchers used it to reconcile the snow and ice extent data discussed above. Funded by the NOAA Climate and Global Change Program and the NOAA/NASA Pathfinder Program, the Northern Hemisphere EASE-Grid Weekly Snow Cover and Sea Ice Extent product (Figure 3) used the digital NOAA/NESDIS Weekly Northern Hemisphere Snow Charts, revised by D. Robinson (Rutgers University). The original NOAA-NESDIS weekly snow charts are derived from the manual interpretation of AVHRR, GOES and other visible-band satellite data. Sea ice extent is based on NSIDC's polar stereographic sea ice concentration grids, derived from SMMR and SSM/I passive microwave brightness temperature data.

Snow cover and sea ice extent from October 1978 through August 1995 are combined in the data set. Snow cover only is given for January 1971 through October 1978. (Sea ice data were not available prior to October 23, 1978.)

This data set also includes monthly climatologies describing average extent, probability of occurrence, and variance. The data are provided in a 25 km grid,

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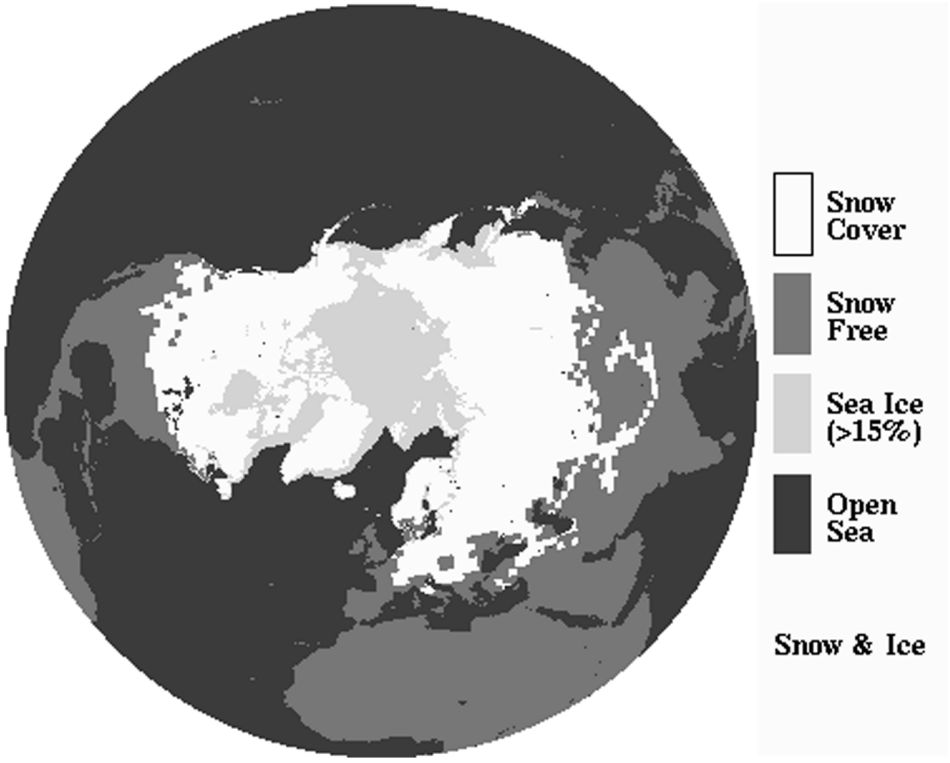


▲ **Figure 3.** An example of the Northern Hemisphere EASE-Grid Weekly Snow Cover and Sea Ice Extent product, showing digitized NOAA/NESDIS weekly snow data combined with sea ice extent derived from SSM/I, for the week January 2-8, 1995

World Wide Web and Java-based remote systems monitoring

Near real-time dynamic systems monitoring at the National Oceanographic Data Center

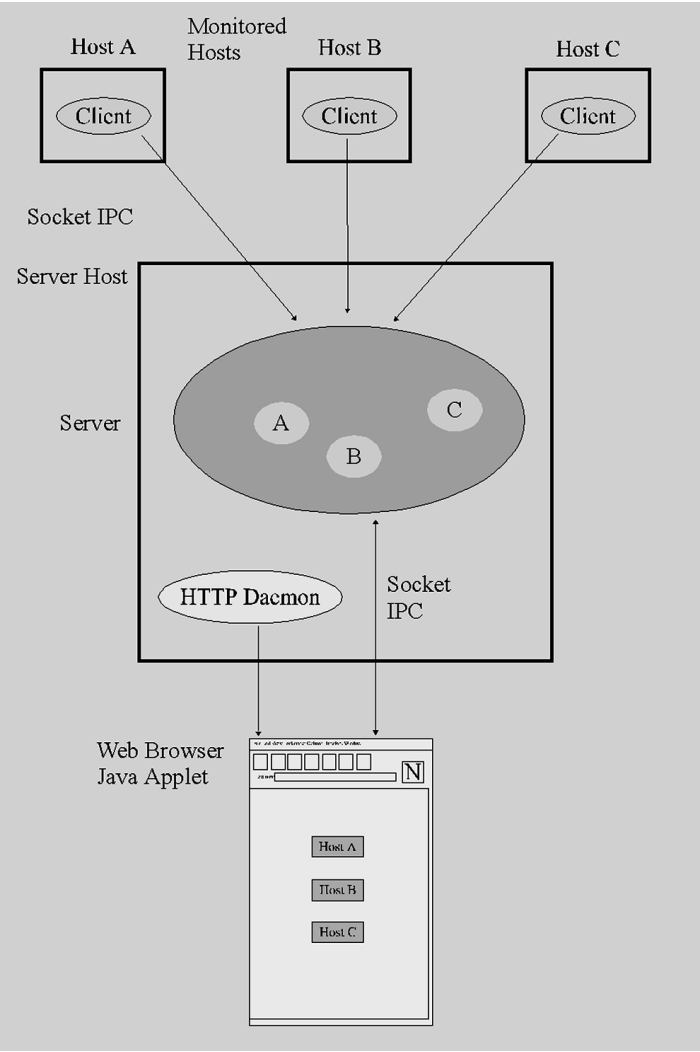
Eric Ogata
ADP Support Division
National Oceanographic Data Center
NOAA/NESDIS

A set of tools has been developed that provide near real-time, dynamic, systems monitoring for critical Automated Data Processing (ADP) equipment at NOAA's National Oceanographic Data Center (NODC). These tools are based on a client/server architecture written in the Java and Perl programming languages, and are linked to a Web-based, architecture-independent user interface written in Java. This allows near real-time, interactive monitoring of systems and network status from any machine that can run a Web browser and is connected to the NODC Intranet. A simple prototype of such a system has been developed at the NODC and is currently being used to provide continuous monitoring of a network of approximately 30 UNIX hosts.

The systems status monitor client programs are designed to support the collection of arbitrary system information and send the information to a server program at regular intervals. Currently, the systems monitors will support monitoring of Silicon Graphics and Sun UNIX workstations. The only software requirement is that the workstation be capable of running Perl 5. In the future, support may be provided for monitoring other network devices such as hubs or routers using Simple Network Management Protocol (SNMP).

The systems status monitor currently collects and displays information about each host's hardware configuration, operating system version, number of users, system load, disk capacity (including the percentage of disk space used on each local file system), and messages in the system error log file. This information is presented in a graphical display that allows the entire network to be scanned to identify any machines that require attention. Various alert states are visually flagged for each machine when a warning or alert condition exists. Some of the conditions being monitored include the following:

1. Machine has not responded for more than 2 minutes (warning), or for more than four minutes (alert).
2. Machine has been up without a reboot for more than 3 weeks (warning), or for more than four weeks (alert).
3. Various keywords indicating system problems are present in the system log file (e.g., error, alert, panic).
4. A filesystem is at greater than 90% full (warning), or greater than 95% full (alert).

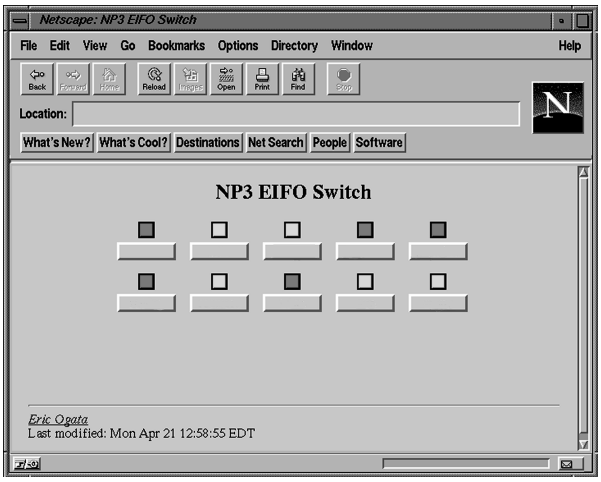


▲ **Figure 1.** Architecture of near real-time dynamic systems monitoring at the NODC.

Further information can be obtained about any error conditions flagged by clicking a button for the machine that has registered an alert. This button brings up a Status Panel for the particular machine in question. The Status Panel indicates the reason for the alert and allows the user to browse items such as the hardware configuration, system load, disk usage, and error log. The user may also bring up a login session on the machine with a menu selection. If there is a problem that requires system administrator intervention, information about how to perform common system administration tasks is available from the same set of Web documents.

The monitor software is implemented using common, open architecture, Internet standards such as Hypertext Markup Language (HTML), and Java. This provides an advantage over proprietary implementations, which often have restrictive licensing or hardware requirements limiting the number of users or network hosts having access. By contrast, the NODC sys-

National Oceanographic Data Center
NOAA/NESDIS
SSMC3, 4th Floor
1315 East-West Highway
Silver Spring, MD 20910-3282
E-mail: eogata@nodc.noaa.gov



▲ **Figure 2.** Grey-scale rendition of the systems status board for a collection of interconnected workstations.

tems monitors can be accessed from any platform connected to the NODC Intranet that can run a Java-capable Web browser, including most common UNIX workstations, PCs, and Macintoshes.

System architecture and operation

The systems monitors are implemented as a set of three basic components. The system components are shown in Figure 1. A client program, written in Perl, is installed on each monitored host. The client program wakes up periodically, collects a set of host information including system load, number of users, disk usage and system error log entries, opens up a network communications channel to a server program and sends the information to the server as an ASCII text message.

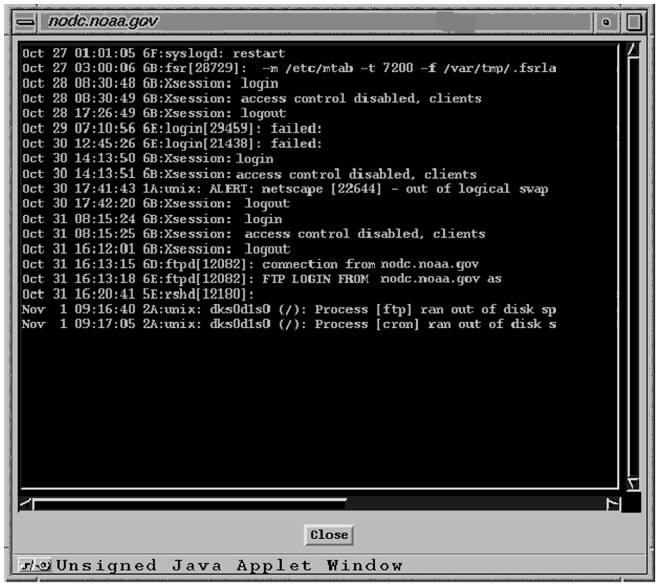
The server program accepts connections from the monitored hosts' client programs and maintains a set of persistent host objects that process the client update reports and maintain information about the host's current status. The host objects parse the client updates into the various components (e.g., system load, disk usage, error log), and checks for the presence of any alarm conditions.

The third component is a Java Applet which can be loaded into a Java-capable Web browser (e.g., Netscape). The applet provides an architecture-independent, highly portable user interface to the systems monitors that can be viewed from any Java-capable Web browser. Multiple servers can be run that listen for client reports on different "ports" (a port is analogous to a "channel" on a radio or television). A set of hosts can be grouped together by assigning them all to a common server on the same port. This could be done to group hosts on a common network or subnet, or they may be grouped together based on some more arbitrary criteria.

Figure 2 shows a top level display of a systems monitor status panel for a collection of workstations that are all connected to the same network hub named NP3. A button and LED represents the status of each host. Green LEDs indicate that there are no problems with the host. A yellow LED indicates that a host has not responded in 2 minutes. A red LED would indicate that a host has not responded for greater than 4 minutes. A magenta LED indicates that the host is responding but that there is some alert condition present.

For example, the button for a given host in Figure 2 indicates that an alert condition has been identified. By clicking the button representing the host, a more detailed display can be obtained. This display is shown in Figure 3. The status window for the host shows alert conditions are registered for system log file errors and disk usage. This window also displays the system load average for the last two hours in the rectangular graph at the left. The Syslog button brings up a display of the system error log file which is shown in Figure 4.

The system logfile indicates that a process (Netscape!) ran out of logical swap space (memory) and that a file transfer (FTP) session and a periodic (cron) job ran out of disk space. Bringing up the disk usage summary shown in Figure 5, shows that the /dev/root filesystem is full. The Login: item from host's Operations menu invokes an X terminal based login session allowing the operator to take corrective action.



▲ **Figure 4.** System error log, accessible through the host status window shown in Figure 3.

▲ **Figure 3.** Host status window, which displays alert conditions for a given workstations.

Other information about this host is available by clicking on the remaining buttons in the host status window (Figure 3). The Config button displays a list of the configuration information including the operating system version, processor type, memory configuration and information about other hardware devices connected to this host. The Uptime button in the host status window (Figure 3) displays a message indicating the number of days up since the last system boot.

Current system load and number of

– continued on page 10

▲ **Figure 5.** Disk usage summary.

System monitoring, *from page 9*

users logged on is available from the Load/Users button in the host status window (Figure 3) and is shown in Figure 6. The system load is also displayed graphically against time in the rectangular area at the left of the host status window (Figure 3). The graph shows system load for the last two hours. The vertical grid indicates 30 minute intervals. The height of the bar indicates the average number of jobs queued. Load can be averaged over intervals of 1 minute, 5 minutes or 15 minutes. The Settings menu allows the averaging to be changed between these settings.

▲ **Figure 6.** Current system load and number of users logged on is displayed through a button in the host status window (shown in Figure 3).

This monitor system, while still very simplistic, was put together in a relatively short period of time and demonstrates the strength of the Java programming language for rapid prototyping of client/server distributed programs. Java's strong set of classes for network and I/O stream programming allowed this system to be built with a relatively small amount of code (approximately 5000 lines of source code). Although there are much more powerful commercial monitoring systems available, they often do not provide the degree of architecture independence available using the web-based approach and they can be much more restrictive in their ability to be observed from any point in the network due to licensing management controls and often, a requirement to be run on a workstation that supports the X Windows system.

By contrast the "quick and dirty" systems monitor described above provides a relatively high degree of architecture independence and can be observed from any host that supports a Java capable web browser. Since the systems monitor applets can be embedded in an HTML document, they can easily be linked directly to online documentation of the NODC Intranet. This allows for rapid transition from the monitors to documentation describing common systems problems, their solutions and in many cases directly to online trouble report forms for those problems that require vendor maintenance. For example, for the case above, the system logfile indicates that a host process ran out of logical swap space. The same set of HTML documents that contains the systems monitor also describes how to add swap space to a system. Had there been a problem that required hardware maintenance, a link is provided to the maintenance provider's web site and a trouble report can be directly submitted.

Error messages from the system logfile can be cut from the Syslog window and pasted directly into the trouble report and also into the logbook for the host that has registered a problem. The Status Window display (Figure 3) can be embedded as a separate applet apart from the Status Board itself. Status Window applets can be embedded directly into an HTML page that documents critical host information such as IP address, serial number, location, and existing maintenance contracts. Traditional "stand-alone" commercial monitoring tools would often be much more difficult to integrate so closely into an in-house document set.

Conclusion

The capabilities of this monitoring system continue to expand as time permits. More sophisticated processing of system error log files is near completion at this time. The system is also being modified to be much more easily configured from a set of editable text files and to be more easily adaptable for arbitrary network architectures. The system now collects information on NODC Intranet hosts but will soon be available for monitoring of hosts outside the NODC firewall.

Emerging World Wide Web technologies such as Java and HTML enable the rapid development of distributed client/server programs. This provides most of the tools required to develop programs, with a minimal amount of coding, that can monitor systems and network status in near real-time and provide graphic display of status information to any network computer.

These technologies provide a high degree of architecture independence and network accessibility. Since monitor applets can be embedded directly into HTML documents, they can be easily linked to system and network documentation. This allows the development of documents that not only display the status of many network hosts, but can also contain explanations of how to solve common system problems that may be observed. ■

The ESDIM Program

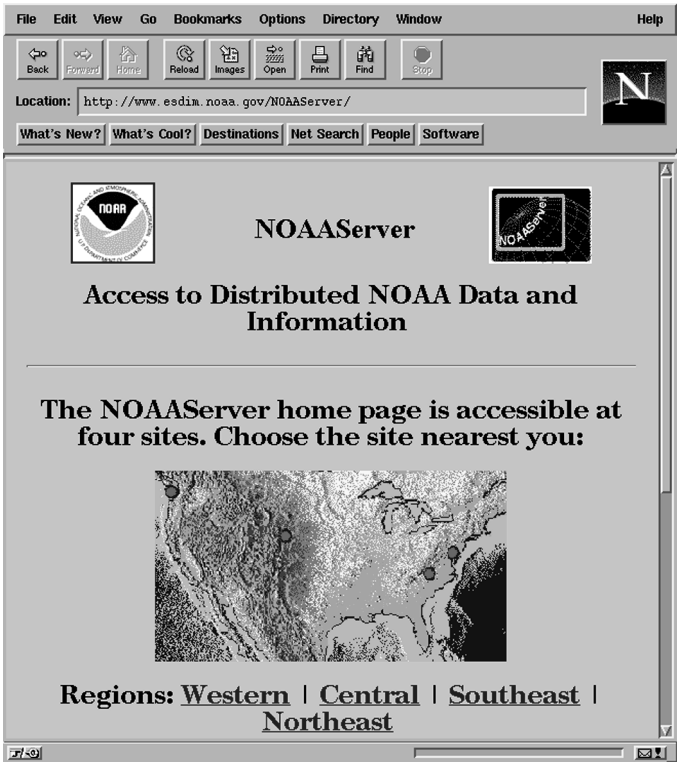
NOAA-wide program aids data centers in the acquisition and protection of valuable data

Eric Davis
Environmental Information Services
NOAA/NESDIS

NOAA is responsible for the collection, management, and stewardship of a rapidly increasing amount of data and information. This data and information encompasses all of NOAA's activities and includes holdings of climatological, geophysical, oceanographic, marine fisheries, hydrographic, and cartographic records. Much of this data is held and archived in NOAA's National Data Centers: the National Climatic Data Center, the National Geophysical Data Center, and the National Oceanographic Data Center. Some of the data is stored by NOAA's Line Offices or by the office or scientist who originally collected it. Data is stored on a variety of media, but is generally considered to be of one of three types: paper, film, or digital.

A NOAA-wide program, the Environmental Services Information and Data Management (ESDIM) Program was created in response to the NOAA Under Secretary for Oceans and Atmosphere's concern about data management in the organization. Data management in NOAA deals with acquiring, quality controlling, preserving, storing, and providing user access to its data holdings. A study by NOAA's Advisory Panel on Climate and Global Change was commissioned in 1989 to review NOAA's data management procedures and to make recommendations for more effective information management. The panel's February 1990 report, along with a November 1990 GAO report, *Environmental Data: Major Effort Needed to Improve NOAA's Data Management and Archiving*, were the catalysts that started NOAA's ESDIM Program in early 1991.

Originally part of the Office of the Chief Scientist, the ESDIM Program was soon transferred to NOAA's National Environmental Satellite, Data, and Information Service (NESDIS), Office of Environmental Information Services (EIS), where it is located today. The ESDIM Program is responsible for selecting and funding data management projects to be accomplished by NOAA. The ESDIM Program has a small permanent staff that runs the day-to- day operations, and a team of advisors from NOAA's Line and Program Offices that reviews data management project proposals and selects projects that the ESDIM Program will support in the upcoming year.



▲ **Figure 1.** NOAAServer is an ESDIM-supported project which provides WWW access to distributed NOAA data and information through a single Web site.

During the early years, the ESDIM Program concentrated on data rescue. Data rescue is the saving or salvaging of data (that would otherwise be lost) held on paper, film, or digital media, converting it to a stable, useable media, and then archiving and/or making it available for access.

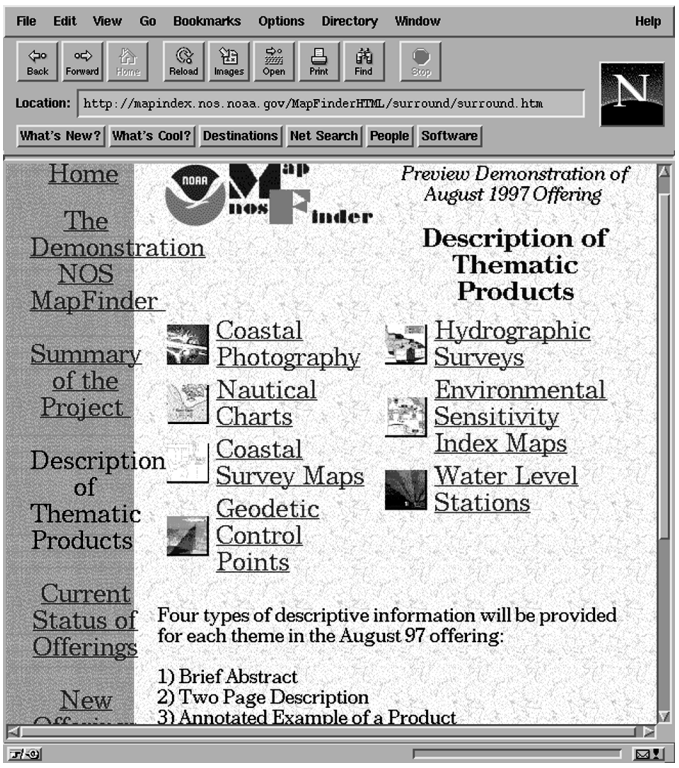
NOAA's data includes paper records from the beginning of our country's history through the present time. Paper deteriorates over time, depending on the physical properties of the paper and the conditions under which it was stored. Microfilm and microfiche, used to rescue deteriorating paper records, are themselves susceptible to deterioration and must be rescued. Digital media is used to rescue paper and film records and to store newly acquired data. Digital media is also susceptible to damage. Data stored on older, less dense magnetic tapes are being rescued to more dense, smaller sized tape cartridges or to optical media. In time, data stored on today's best media will have to be rescued.

The amount of new data to be archived is rapidly increasing as new data collection systems are placed into service. These new systems include satellites and NEXRAD weather radars. To archive this data, it must be converted from the original media, which is particular to the collection system, to the data center's archival media. This conversion is also data rescue.

In recent years access to NOAA's data and information has become a significant area of concentration for the ESDIM Program. Access is the process of making available data and information held by an individual, office, or organization to a much larger audience. To access data it is necessary to know what data is available and where it is located. This is being accomplished by ESDIM with the online NOAA Environmental Services Data Directory (see the *Earth System Monitor*, December 1996, pp 6-8). The NOAA Directory catalogs the

– continued on page 12

Environmental Information Services
NOAA/NESDIS
SSMC3, Room 5509
Silver Spring, MD 20910
E-Mail: edavis@esdim.noaa.gov



▲ **Figure 2.** Part of NOS MapFinder, an ESDIM-sponsored project designed to provide direct Internet access to NOS imagery and data holdings. NOS MapFinder will officially debut in August 1997.

ESDIM, *from page 11*

metadata, or data about the data, for NOAA's data holdings in Federal Geographic Data Committee (FGDC) Metadata Standard format. An online search for locating NOAA data, using any word in the data description, can be performed at the NOAA Directory web site, *http://www.esdim.noaa.gov/NOAA-Catalog/*.

NOAAServer, an ESDIM supported project (Figure 1) provides Web access to distributed NOAA data and information through a single web site. Participants in the development of NOAAServer include representatives from all of the NOAA Line Offices. A limited but growing portion of NOAA's data and information is presently available through this system at *http://www.esdim.noaa.gov/NOAAServer/*

ESDIM sponsors projects within NOAA that meet the goals of the program in the areas of access, rescue, continuity, and innovation. An example of the projects that were sponsored this year is NOAA's National Ocean Service (NOS) MapFinder (Figure 2). The NOS MapFinder is a major outreach effort, a one-stop Internet service, designed to deliver primary NOS products to public and private-sector coastal resource managers to assist their planning and management activities. NOS MapFinder will officially premiere in August 1997 and will provide direct Internet access to NOS imagery and data holdings including: coastal photography, nautical charts, coastal survey maps, environmental sensitivity index maps, hydrographic surveys, water level stations, and geodetic control points. NOS MapFinder can currently be viewed through the WWW at URL: *http://mapindex.nos.noaa.gov/*.

NOS MapFinder is one of the many successful projects made possible through ESDIM support. Others will be highlighted in future issues of the *Earth System Monitor*. ■

Federal Register notice announces new NESDIS user fee schedule

The NOAA National Environmental Satellite, Data, and Information Service (NESDIS) has published a notice in the Federal Register announcing a new schedule of fees for the sale of its data, information, products, and related services to commercial users. The new fee schedule will be implemented by NESDIS elements including the three NOAA national data centers: the National Oceanographic Data Center (NODC), the National Climatic Data Center (NCDC), and the National Geophysical Data Center (NGDC). The Federal Register notice was published on May 7, 1997, and the new fee schedule for commercial users will go into effect 30 days later, on June 6, 1997.

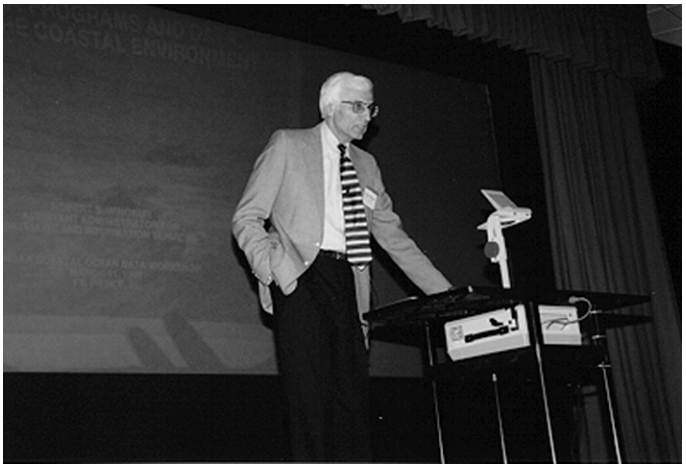
Because NESDIS is responsible for promoting research and education and because these additional fees would hinder these activities by other Governmental entities, universities, nonprofit organizations, and depository libraries, NESDIS has made an exception for these organizations. It will continue to charge its existing fees to these organizations for their noncommercial use.

The schedule also sets forth fees that NESDIS will charge for online access via the Internet. It is anticipated that this online capability will begin to become operational within a year, and once available, will provide the means to satisfy many user requirements at substantially reduced cost. The overall fee schedule anticipates that providing this new access route at lower cost will substantially increase the number of users to help defray the costs.

The complete text of the Federal Register notice and the new fee schedule are available via the National Oceanographic Data Center World Wide Web site (*http://www.nodc.noaa.gov/NODC-WNew/newsfedreg.html*).

—Richard Abram
NODC User Services E/OC1
SSMC3, 4th Floor
1315 East-West Highway
Silver Spring, MD 20910-3282
Phone: 301-713-3279 x159
Fax: 301-713-3302
E-mail: rabram@nodc.noaa.gov ■

NOAA Coastal Ocean Data Workshop



▲ **Figure 1.** Robert S. Winokur, Assistant Administrator for Satellite and Information Services, delivering the welcoming address at the NOAA Coastal Ocean Data Workshop.

The National Oceanographic Data Center (NODC) convened the NOAA Coastal Ocean Data Workshop on March 11-13, 1997, at the Harbor Branch Oceanographic Institution in Fort Pierce, Florida. Over 100 scientists and managers from the U.S. coastal states and territories and the Great Lakes states (Table 1) attended the workshop.

Participants represented Federal, state, territorial, and local government agencies, academia, and the private sector, from areas as far away as the Commonwealth of the Northern Mariana Islands and American Samoa. NOAA's Coastal Services Center, and Coastal Ocean Program, as well as the Graduate School of Oceanography of the University of Rhode Island, joined with the NODC as cosponsors.

▲ **Table 1**. Participants in the NOAA Coastal Ocean Data Workshop.

Total number of participants:	**108**
Invited Participants:	76
NOAA Participants:	30
Others (sponsors):	2
Regional distribution of invited participants:	
East Coast:	23
Great Lakes:	9
Gulf of Mexico:	19
Islands:	10
West Coast:	14

The primary goals were to increase NOAA's responsiveness to customers in the coastal ocean community and to encourage the formation of additional partnerships and joint ventures. Workshop participants received a number of documents to review, as background material for the discussions. Several of these documents were posted on the World Wide Web.

The workshop consisted of a series of facilitated plenary and smaller working group sessions. The opening plenary session included welcoming addresses by Mr. Robert S. Winokur, Assistant Administrator for Satellite and Information Services (Figure 1); Dr. Henry R. Frey, Director of the NODC (Figure 2); and Dr. Donald F. Boesch, President, University of Maryland Center for Environmental and Estuarine Studies. The working group sessions were structured as follows:

- *Working Group Session 1* Identification of data required to address national and regional coastal ocean issues and scientific research priorities. Regional break-out groups: East Coast, Great Lakes, Gulf of Mexico, Islands, and West Coast.
- *Working Group Session 2* Specific data and information requirements. Disciplinary break-out groups: Biological, Chemical, Physical, Geological, and Management.
- *Working Group Session 3* Implementation of the recommendations through partnerships and cooperative ventures. Data source break-out groups: Data and Information Systems, Military Assets and Proprietary Data, Sea Grant, Universities, and Shoe-box Data Sets, and State and Local Governments.

Each working group session was followed by a plenary session in which a representative from each group reported on its discussions and key recommendations. The plenary sessions also provided an opportunity for additional discussion of issues among the group as a whole. Many valuable recommendations came out of the workshop, and rapporteurs took notes during all sessions to assist with preparation of the final workshop report.

Workshop results will be used to:

- increase NODC's responsiveness to coastal ocean customer requirements in the area of data and information management, including customers within other NOAA programs;
- provide additional opportunities for NOAA to form partnerships and joint ventures with its partners in the coastal ocean community;
- increase the knowledge and awareness of NOAA's activities within the coastal ocean community; and
- be responsive to the new Oceanographic Partnership Program.

Participants (Figure 3) were very enthusiastic about the opportunities to network with such a wide range of scientists and managers from the U.S. coastal community and to learn more about NOAA programs and activities. The final report on the NOAA Coastal Ocean Data Workshop was issued in May 1997 and is accessible through the NODC home page (*http://www.nodc.noaa.gov*).

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▲ **Figure 2**. Dr. Henry Frey, Director of NOAA's National Oceanographic Data Center (NODC).

EASE, *from page 7*

in an azimuthal, equal area projection (the NSIDC NL EASE-Grid). Another NSIDC product, the AARI 10-Day Arctic Ocean EASE-Grid Sea Ice Observations, represents a reformatting of information contained in the Russian Arctic and Antarctic Research Institute's (AARI) 10-Day Digital Arctic Sea Ice Charts. Part of a sea ice data archive dating from the 1930s, the source charts describe sea ice concentration, stages of development and ice forms, integrating visual and instrumental ice parameter data with surface condition and dynamic processes information acquired by AARI over approximately 10 day periods. The source charts were originally produced through the assimilation and analysis of visual and instrumental aircraft and satellite observations.

On sea ice charts, ice parameters are represented by symbols and numbers giving actual parameter values. (Formerly, symbology varied according to compiler, but in the 1980s, an international standard for sea ice symbols was developed and approved by WMO, the WMO Egg Code, and now forms the basis for the ice charts coding system.) The original sea ice charts were then digitized and formatted in SIGRID format at AARI, and provided to NSIDC through NOAA/ESDIM funding.

The format makes the data difficult to compare and analyze; it is a code assigning ASCII identifiers to indicate every kind of mapping information, from the country and service providing the data, mesh width of the grid, sea ice parameters, location of the data, time of the record, and on and on, in "layers". AARI data may not be extracted from the SIGRID format without running programs to interpret the code and get a tabular form of output that lists grid point locations and data values. Now processed to the EASE-Grid, the AARI data have been condensed to five layers, and because the EASE-Grid is a standard reference system, it facilitates comparative data analysis.

Analysts can use standard image display tools to read data in EASE-Grid. In general, the projection and grid components of EASE-Grid allow users to easily compare data from different sensors by superimposing grids. The global coverage presented by the EASE-Grid contrasts with the comparatively limited grid area of NSIDC's polar stereographic projection, offering broader possibilities towards the derivation of surface characteristics. With data proliferation, and with the growing sophistication of coupled climate and process models capable of examining many parameters from multiple instruments, the need for a standard such as the EASE-Grid grows ever more acute. Like having a common language, having a common projection and gridding scheme in which to express geophysical information is not only useful in comparative analyses, but is ultimately tied to the fundamental ability to communicate spatial aspects of scientific studies. ■

▲ **Figure 3**. Dan Schwartz of the Harbor Branch Oceanographic Institution facilitates a working group.

Workshop, *from page 13*

Reference material

Background and reference material were mailed to participants about three weeks prior to the workshop. Some materials are available over the Internet, including:

Biological Resources Division (U.S. Geological Survey). *National Biological Information Infrastructure Biological Metadata Standard*. http://www.nbs.gov/nbii/current.status.html

Collins, E., Woods, M., Sheifer, I.C., and Beattie, J., 1994. *Bibliography of Selected Synthesis Documents on Selected Coastal Ocean Topics,* NOAA Coastal Ocean Program Decision Analysis Series No. 3. http://hpcc.noaa.gov/cop/pubs/das3.html

Committee on Environment and Natural Resources Research, 1996. *Our Changing Planet—The FY 1997 U.S. Global Change Research Program*. http://grcio.ciesin.org/ocp97/toc.html

Federal Geographic Data Committee Home Page (information on development of national standards for selected types of data and metadata). http://www.fgdc.gov/

Interagency Taxonomic Information System (online database of taxonomic information on flora and fauna from terrestrial and aquatic habitats). http://www.itis.usda.gov/itis/

International Coral Reef Initiative. http://www.nos.noaa.gov/aa/ia/cri.html/

National Oceanographic Data Center Data Submission Guidelines. http://www.nodc.noaa.gov/NODC-Submit/subindex.html

National Research Council, 1994. *Priorities for Coastal Ecosystem Science*. http://www.nap.edu/readingroom/books/coast/index.html

National Research Council, 1995. *Understanding Marine Biodiversity*. http://www.nap.edu/readingroom/enter2.cgi?search (enter search term "marine biodiversity")

Subcommittee on U.S. Coastal Ocean Science, 1995. *Setting a New Course for U.S. Coastal Ocean Science, Final Report*. http://hpcc.noaa.gov/cop/pubs/suscos/title.html

The following report is not available over the Internet:

Inventory of U.S. Coastal Ocean Data: Summaries of Data Sets available from the U.S. National Oceanographic Data Center (in preparation).

— Rosalind Cohen
National Oceanographic Data Center
NOAA/NESDIS
SSMC3, 4th Floor
1315 East-West Highway
Silver Spring, MD 20910-3282
Phone: 301-713-3267 x146
Fax: 301-713-3302
E-mail: rcohen@nodc.noaa.gov ■

Data products and services

NGDC releases first update to NOS Hydrographic Survey Data

The first update to the National Ocean Service (NOS) Hydrographic Survey Data CD-ROM set was issued by the National Geophysical Data Center (NGDC) in May 1997. This two-disc set provides the scientific and commercial communities with easy, economical, access to the complete National Ocean NOS Hydrographic Survey Digital Database. In the last year, an additional 15 million soundings have been added to the database, which now consists of over 58 million soundings from 5,396 surveys.

Included for the first time are subsets of multibeam bathymetry Seabeam data collected by NOS in the 1980s and early 1990s. This dataset provides valuable input to bathymetric basemaps, Geographic Information Systems, geophysical exploration, coastal engineering studies and other research projects.
Contact: NGDC

NOAA libraries provide historical storm information

In late August 1873, a severe storm along the Atlantic Coast devastated parts of Nova Scotia and Newfoundland, and caused an estimated $3.5 million in damage. However, because it did minimal damage to the U.S. coast, it has been referred to as "the forgotten storm." In response to a request from a Canadian investigator, the NOAA Library was able to provide information from rare volumes (less than a dozen are known to exist in the world), and most recently, a summary of the storm was located in the *Annual Report of the Chief Signal Officer* for the year 1873. This summary of the storm was entirely unknown to the investigator. For more information, please contact Elaine Collins of the NOAA Central Library at 301-713-2607 x141.

In addition, as a response to numerous requests from students and educators for hurricane related literature and teaching aids, Linda Pikula, NOAA Miami Regional Librarian and Deborah Fischer, a Dade County school librarian, have compiled three selected lists of hurricane readings for: elementary/middle school, high school/adult, and teachers. A copy of this list has also been given to the National Hurricane Center Public Relations Officer. These lists are available on the Miami Regional Library Home Page at URL: *http://www.aoml.noaa.gov/general/lib/* (or call Linda Pikula, AOML and NHC, 305-361-4429, E-mail: *pikula@aoml.noaa.gov*).
Contact: NOAA Library

Near-real time sample product released by NSIDC

The Near-real time Ice and Snow Extent (NISE) product passed its first milestone on April 25, 1997 with the release of the sample product by the National Snow and Ice Data Center (NSIDC). This global map of sea ice concentrations and snow cover extent is produced from Special Sensor Microwave Imager passive microwave data at 25km spatial resolution. When it becomes fully operational, prior to launch of the NASA Earth Observing System (EOS) AM 1 platform, it will produce a daily map of snow and ice extent on a global basis, which is the first of its kind. Currently, two EOS teams are using the sample product: the Multiangle Imaging SpectroRadiometer (MISR) and the Clouds and the Earth Radiant Energy System (CERES) teams. For more information, please contact the NSIDC User Services' Office at:
NOAA/National Snow and Ice Data Center
CIRES, Campus Box 449
University of Colorado
Boulder, CO 80309
Phone: 303-492-6199
Fax: 303-492-2468
E-mail: *nsidc@kryos.colorado.edu*
Contact: NSIDC

NODC places beach temperatures on the World Wide Web

Before surfing the waves this summer, users can surf the World Wide Web to find out just how cold the ocean water might be. NOAA's National Oceanographic Data Center (NODC) in Silver Spring, Maryland, has placed the average water temperatures for the country's beaches online to provide useful information for planning beach activities such as swimming, fishing, or surfing. Water temperatures are given for beaches along the Atlantic Coast from Eastport, Maine, to Key West, Florida; along the Gulf Coast from Key West to South Padre Island, Texas; and along the Pacific Coast from Seattle, Washington, to Scripps Pier, California. Water temperature data for Puerto Rico, Bermuda, Hawaii, Alaska, American Samoa, Guam, and parts of Mexico are also included.

The water temperatures presented in NODC's online "Water Temperature Guide to Beaches in the United States" are climatological averages based on observations from NOAA's tide stations and data buoys. These average water temperatures were computed from long-period records ranging from several years to several decades, depending on how long observations had been taken at a given station.

"Although ocean conditions vary from year to year, water temperatures are less variable than air temperatures, so these averages can provide useful information for planning beach activities," said Henry Frey, director of the data center. The data can be found on the World Wide Web at *http://www.nodc.noaa.gov/NODC-WNew/wtg.shtml*
Contact: NODC

CONTACT POINTS

National Climatic Data Center (NCDC)
704-271-4800
Fax: 704-271-4876
E-mail: *Climate Services - orders@ncdc.noaa.gov*
Satellite Services - satorder@ncdc.noaa.gov
WWW: *http://www.ncdc.noaa.gov/*

National Geophysical Data Center (NGDC)
303-497-6419
Fax: 303-497-6513
E-mail: *info@ngdc.noaa.gov*
WWW: *http://www.ngdc.noaa.gov/*

National Oceanographic Data Center (NODC)
301-713-3277
Fax: 301-713-3302
E-mail: *services@nodc.noaa.gov*
WWW: *http://www.nodc.noaa.gov*

NOAA Environmental Services Data Directory
301-713-0572
(Gerry Barton)
Fax: 301-713-1249
E-mail: barton@esdim.noaa.gov
WWW: *http://www.esdim.noaa.gov/#data-products*

NOAA Central Library
Reference Services:
301-713-2600
Fax: 301-713-4599
E-mail: *reference@nodc.noaa.gov*
WWW: *http://www.lib.noaa.gov/*

Satellite imagery, *from page 5*

POES-AVHRR and TOVS Level 1b format:
free for subsetted data sets; visit the Satellite Active Archive online for details.

DMSP-SSM/I derived gridded products:
free from the NCDC's home page.

FTP service for many other satellite data and products are available; please contact the Satellite Data Services Group.

Hard copy AVHRR and GOES Images

Custom 8" X 10" prints/transparencies are available at $85.00 per image; reproduction prints/transparencies are $25.00 per image. For slides, add $25.00 to the above fees where appropriate.

Please add $5.00 service and handling fee for orders less than $50.00 and $11.00 service and handling fee for orders equal to or greater than $50.00. Custom images are created for customer defined areas, times, and channels. These images are processed from the original digital files (level 1b from POES and GVAR from GOES) using McIDAS image display and processing software. When ordering please specify satellite, geographic area, feature to be shown, satellite channel (visible or infrared), resolution, map projection, date and UTC time.

There is no additional cost for gridding and mapping GOES images and making standard color enhancements. Highly enhanced images may be created for additional cost. Reproduction images are already available and can be copied from NCDC's image library. The majority of these images include significant events, such as hurricanes, blizzards (Figure 6), volcano eruptions, and forest fires.

Satellite Active Archive

NOAA's Satellite Active Archive (SAA) provides easy access to Polar Orbiting satellite data. The system (available via the WWW at URL: *www.saa.noaa.gov*) allows users to search inventories of selected instrument data, preview representative Earth images of that data, and to download the data via ftp for further processing and analyses.

Data available on the SAA include: POES AVHRR level 1b data from July 1, 1995, to present; POES TOVS level 1b data from July 1,1995, to the present; DMSP SSM/T1 level 1b, SSM/T2 level 1b, and SSM/I TDR, SDR, EDR data from February 17, 1997, to present; and TOVS Deep Layer Mean Temperature Product from January 1, 1987, to December 31, 1994.

Historical GOES Browse Server

Early in 1997, NCDC added the Historical GOES Browse Server online services (see URL: *www.ncdc.noaa.gov/psguide/satellite/goesbrowse/gb.html*). The server is unique compared to other sites offering satellite images, in that it provides a growing archive of online retrospective images. The server is primarily intended to aid researchers performing long term atmospheric studies involving satellite imagery.

Browse imagery at 8 km resolution is available starting as early as December 14, 1996 up to the present, and 24 km images are available from October 28, 1995 to December 13, 1996. These daily browse images cover much of the western northern hemisphere at approximately 0000 UTC (7:00pm EST) and 1200 UTC (7:00am EST) for the infrared channel, and 1800 UTC (1:00pm EST) for the visible channel. Plans include adding full disk GOES visible and infrared images going back to the middle of 1992.

Special Sensor Microwave/Imager Dataset (SSM/I)

This dataset contains 1.0 degree and 2.5 degree time series of the entire SSM/I archive from July 1987 to the present. These monthly average products include precipitation, cloud liquid water, total precipitable water, snow cover, sea-ice cover, and oceanic surface wind speed. The dataset is available online at: *http://www.ncdc.noaa.gov/ssmi/html/ssmi.html.* ■