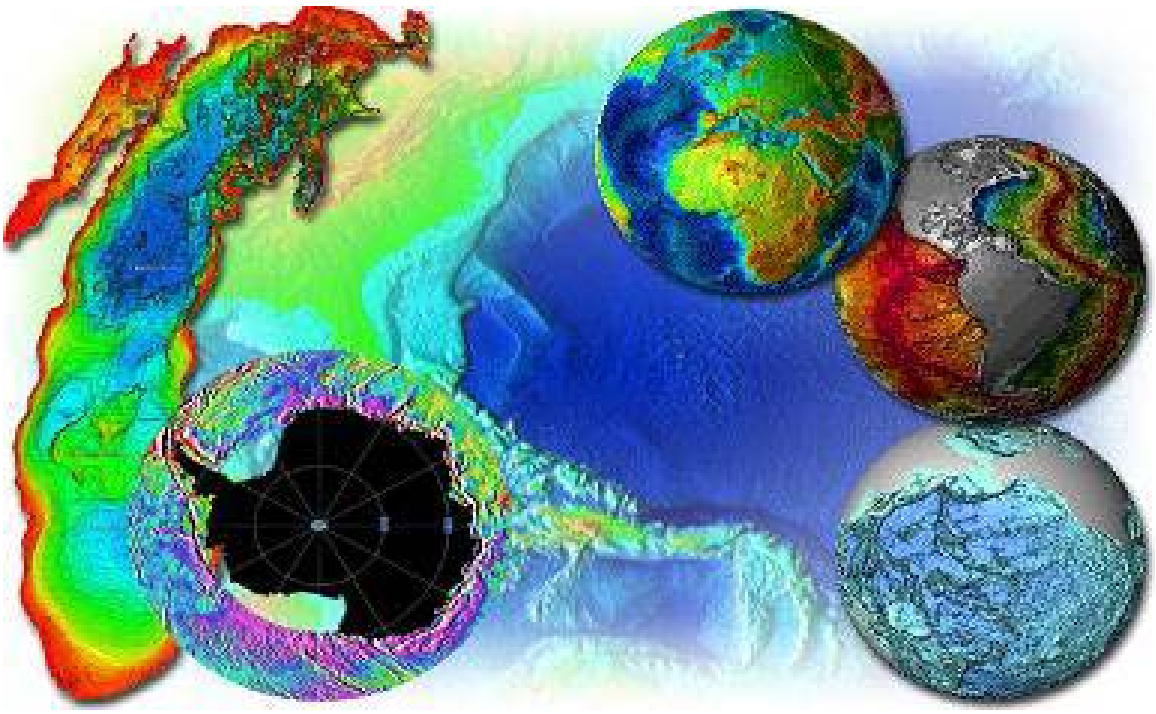
NESDIS Data Users' Workshop

June 11-12, 2003
Boulder, Colorado

Workshop Report



U.S. Department of Commerce (DOC)
National Oceanic and Atmospheric Administration (NOAA)
National Environmental Satellite, Data, and Information Service (NESDIS)

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FOREWORD

NOAA strives to provide the best available data and customer service to our users. The NOAA Data Users' Workshop, held June 11-12, 2003, in Boulder, Colorado, provided a forum for scientists, researchers, managers, and technicians from NOAA to meet with the data user community. A total of 375 individuals were in attendance. Users from academia, the private sector, the research community, and the government worked with NOAA to plan for the future of data and data delivery.

NOAA operates National Data Centers for Climate, Geophysics, Oceans, and Coasts. Through these data centers and the Office of Satellite Data Processing and Distribution, NOAA strives to provide timely access to global environmental data, information services, and science products.

The goals of the workshop were to:

- Assess users' needs and societal benefits.
- Review and update users' needs for new products, data archiving and access to stored data, and plans.
- Improve communication and rapport with users.
- Solicit users' opinions on current data and information products and services.
- Inform users of future capabilities, plans, and data sets.

NOAA considers this workshop an important step in a continuing dialog with its constituents. The workshop Web page (http://www.osd.noaa.gov/datausers/index.htm) contains the presentations and lists recommendations from the breakout groups. Approximately 600 recommendations and comments were received from the six workshop breakout groups. These were consolidated into 188 unique recommendations. The three mentioned most frequently were: ensuring that user communities have input into decisions affecting them; integrating multiple data sets into a seamless environmental database; and maintaining human customer interface. This report documents these and other recommendations and provides information on the presentations, panel discussions, and poster sessions. NOAA will evaluate and follow through on each recommendation. The workshop report will be posted to the Web page, and all registered participants will receive e-mail notifications. These open forums will continue and strengthen the NOAA/ Commercial/ Academia/ Research partnerships.

NOAA would like to thank all workshop participants, especially the invited speakers, all those who provided valuable suggestions for improving data management, access, and delivery, and the National Institute of Standards and Technology for providing the meeting facilities in Boulder. The Workshop Program Committee provided a highly successful workshop, and is continuing to work toward implementing the recommendations received and achieving the workshop goals.

Gregory W. Withee
NOAA Assistant Administrator
for Satellite and Information Services

TABLE OF CONTENTS

1. WORKSHOP OVERVIEW

1.1 GOALS OF THE WORKSHOP

The Data Users' Workshop, held June 11-12, 2003, in Boulder, Colorado, brought together scientists, researchers, managers, and technicians from NOAA with representatives of the data user community. This included users from NOAA, other government agencies, academia, the private sector, researchers, and others.

The goals of the workshop were to:

- Assess users' needs and societal benefits.
- Review and update users' needs for: new products; data archiving and access to stored data; future plans.
- Improve communication and rapport with users.
- Solicit users' opinions on current NESDIS data and information products and services
- Inform users of future capabilities, plans, and data sets.

The workshop addressed the current and future capabilities of NOAA data distributors, economic benefits, and customer satisfaction. Questions asked of the data users were:

- What can we do to improve?
- What new products and services should we plan for?
- What benefits do our customers derive from the data?
- What are the most important issues from a users' perspective?
- How can NESDIS improve services and data?
- How can NESDIS best provide for customer feedback?
- Technology of the future: How can it help?
- New data acquisitions: What data should be archived?
- What other issues do we need to address?

Sessions and panel discussions featured these topics, and the attendees provided feedback. Panel discussions included a Commercial Panel Discussion and a Government/Research/Academia Panel Discussion. A customer breakout session focused on new products, data distribution, and methodologies. Attendees chose sessions based on their affiliations (commercial value added, commercial user, government, or academia).

In this report, Section 2 provides an overview of presentations and speeches. Section 3 provides a summary of panel discussions and the panel reports. Section 4 provides a summary on the current and future capabilities of the NESDIS data distributors. Section 5 provides the breakout session discussions and recommendations.

Appendix I provides the Workshop Agenda listing the overall workshop topics, panels, and breakout sessions; Appendix II provides attendee representation, goals accomplished, and results; Appendix III provides workshop attendee feedback; Appendix IV presents the Breakout Sessions; Appendix V provides poster abstracts; Appendix VI lists the workshop committee members; Appendix VII is a glossary that contains Internet addresses.

1.2 BACKGROUND ON NOAA'S NATIONAL DATA CENTERS AND OFFICE OF SATELLITE DATA PROCESSING AND DISTRIBUTION (OSDPD)

NESDIS manages global databases for meteorology, oceanography, solid earth geophysics, and solar-terrestrial sciences. From these sources, it develops and provides environmental data and information products and services. NESDIS gathers global data about the oceans, Earth, air, space, and sun and their interactions to describe and predict the state of the physical environment. Many other agencies, organizations, and individuals, both domestic and foreign, collect similar data for particular uses and missions.

Once the data have been collected, they are sent to the national data centers. These centers provide the data stewardship necessary to assist scientists in fully understanding Earth systems and long-term climatic, oceanographic and geophysical effects on the environment. The data centers are:

- National Climatic Data Center (NCDC), Asheville, North Carolina
- National Geophysical Data Center (NGDC), Boulder, Colorado
- National Oceanographic Data Center (NODC), Silver Spring, Maryland
- National Coastal Data Development Center (NDDC, part of NODC), Stennis Space Center, Mississippi.

NESDIS' Office of Satellite Data Processing and Distribution (OSDPD) in Suitland, Maryland, manages and directs the operation of the central ground facilities that ingest, process, and distribute environmental satellite data and derived products to domestic and foreign users to support time-critical mission requirements. OSDPD is the primary operating level interface for civil and military users of data from environmental satellites. OSDPD supports and assists in the planning, management, and operations related to long-term data access.

Workshop attendees in the NIST auditorium. Gregory Withee, NOAA Assistant Administrator, is in the foreground, seated.

2. OVERVIEW PRESENTATIONS

2.1 OPENING SPEAKER

Gregory W. Withee, NOAA Assistant Administrator for Satellite and Information Services

Mr. Withee provided an overview of NESDIS data, information, and distribution. He described the goals of the workshop and the relationships of observations, data, the user community, and the benefits derived from the data and products. NESDIS fully supports the NOAA mission objectives of describing and predicting changes in the Earth's environment, and conserving and managing the nation's coastal and marine resources to ensure sustainable economic opportunities. Mr. Withee described NESDIS' role in supporting NOAA's operational services, including weather, climate, ocean, coastal, and fisheries. NOAA data are essential for forecasting and monitoring weather and hazards, climate, and oceans, for the defense of the nation, and for supporting industries such as agriculture and transportation.

Mr. Withee outlined NESDIS' major programs including Geostationary Operational Environmental Satellites (GOES); Polar-orbiting Operational Environmental Satellites (POES), the National Polar-orbiting Operational Environmental Satellite System (NPOESS), environmental satellite observing services, and environmental data management. He encouraged attendees to provide feedback and recommendations for the future.

2.2 KEYNOTE ADDRESS

Vice Admiral Conrad C. Lautenbacher, Jr., U.S. Navy (Ret.), Undersecretary of Commerce for Oceans and Atmosphere and NOAA Administrator

Admiral Lautenbacher's presentation on advancing the use of Earth data and information described NOAA's unique mission of understanding and predicting the environment while managing our nation's resources in order to protect lives and property, enhance commerce, and provide information that serves as the basis for a healthy economy. With a $3.2 billion budget, and more than 12,500 employees, NOAA aids decision-making at all levels of society.

Admiral Lautenbacher described NOAA's new strategic process, in which all aspects of planning, programming, and budgeting are in place before proceeding to the next step in the process. The process involves identifying resources required for sustaining and building data management programs, and getting resources into users' hands to make efficient use of tax dollars. The four main goals of the strategic plan are: ecosystem based management; understanding climate variability and change; serving society's need for weather and water information; and supporting commerce and transportation.

Admiral Lautenbacher described the challenges of integrating data from multiple and diverse sources. The integration of data, and data sharing, are essential for bridging understanding of the ecosystem level to describe complexities of the Earth system. NOAA data are essential for improved weather and climate forecasting, including longer lead times, and for improved space weather forecasts. The Admiral said that weather and climate sensitive industries account for one-third of the nation's Gross Domestic Product, or $3 trillion of the nation's economy. Severe weather causes $11 billion in damages annually, he noted.

NOAA's information, products, and services are essential for commerce and transportation: for the safe and efficient transport of goods and people at sea, in the air, and on land and waterways.

The end goal of data systems is to have a fully wired, networked and integrated system that provides for data processing, distribution, and archiving. The system must be accessible and affordable to meet decision-makers' and resource managers' needs. End-to-end data systems allow users to get information along any point of the information continuum. There must be more relevant, tailored data collection and product generation across all time scales.

By 2004 NOAA will ingest and process more new data in one year than were contained in the total digital archive in 1998. A new weather and climate supercomputer has been installed in the Bowie Computer Center in Maryland. It will help improve weather and climate predictions. The Admiral described the Integrated Earth Observing System, which would include 99 observation systems measuring 521 environmental parameters.

The Admiral said that our goal is to achieve more complex and better data to understand Earth's complex systems. Stronger partnerships among government, academia, and the private sector are essential. NOAA must continue its active ongoing discussions with the data users to "take the pulse of the planet."

2.3 GUEST SPEAKERS

2.3.1 Dr. Ronald D. McPherson, Executive Director, American Meteorological Society

Dr. McPherson's presentation, "Enhancing the Value of Weather and Climate Data to Society," described our understanding over past years, and looked to the future. Scientists have made three assumptions for 3,000 years: climate doesn't change; weather is unpredictable; and the environment can absorb insults infinitely.

During the 20th Century, we learned: climate can and does change; weather can be predicted; and our environment's capacity to absorb our insults is limited. Our sensitivity to weather and climate is increasing, Dr. McPherson said. In the 21st Century we now understand that society must become more resilient with respect to weather and climate variations. We must recognize that many of our decisions have economic impacts and environmental consequences. Environmental data can help make us more resilient and make wiser decisions.

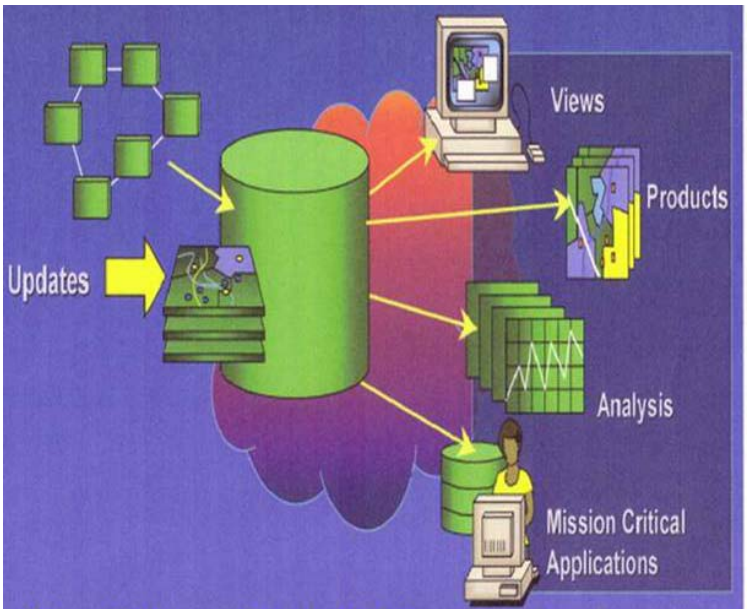
It is important for scientists and data users to inform decision makers in industry and government and individual citizens of the growing availability and utility of our data, its importance to the bottom line; and the importance of making environmentally conscious decisions.

The AMS is reaching beyond our immediate community. Some of the outreach activities include: users' conference at the AMS annual meeting; "Weather, Climate, and National Priorities" series by the AMS Policy Program; certified broadcast meteorologist program; AMS K-13 education program; and a new Commission on the Weather and Climate Enterprise.

A dialogue between users and providers of environmental data is essential. This forum is one part of the dialogue and part of a series planned by NOAA. AMS is pleased to partner with NOAA in this enterprise.

2.3.2 S. J. Camarata, Jr., Director, Corporate Strategies, Environmental Systems Research Institute, Inc.

Mr. Camarata presented information on "Bridging the gap among government, academia, and commercial users: how does technology contribute?" He described the GIS platform as a geospatial database, with desktop and server applications, modular software components (engines), geographic information services – a complete geospatial information system, not just a spatial database or tool. GIS is an information system for creating, maintaining, managing, and using spatial information. It is a generic platform for working with geographic information. This includes editing, data management, mapping spatial analysis, and visualization.



GIS is an information system for creating, maintaining, managing, and using spatial information – a generic platform for working with geographic information – editing, data management, mapping, spatial analysis, and visualization.

GIS has evolved into a core part of enterprise information systems. Data are the key to GIS and IT interoperability. GIS and other systems must interoperate through data sharing and exchange with other GIS systems. Interoperability means better integration with mainstream IT. Interoperability is the capacity to combine information and functionality from different systems. Mr. Camarata's company believes that interoperability is best achieved using a loosely coupled system architecture.

Investments favor information-based GIS technology and services that are: high performance, multi-purpose, able to manage large and flexible databases, maintained, have simple, minimal structure, vertically integrated, standard models, documented, and open or shared.

The future is headed toward: distributed GIS management, statistics, visualization (texture mapping), dynamic modeling, and Internet platforms. The correct infrastructure allows for complete scalability and diversity. The vision for the future: There will be a global spatial data infrastructure that facilitates collaboration of data collection and sharing—a kind of infrastructure for GIS.

Mr. Camarata described the next steps in data, including large data sets and visualization. He described areas of cooperation for private, government, and academic sectors such as metadata, statistics and geostats, GIS on the Internet, data management, and usability. "As leaders you have a unique opportunity to change the course of cooperation between government, academia, and the private sector in an incredibly positive and effective way," he said.

2.3.3 Dr. Elbert W. ("Joe") Friday, President, American Meteorological Society (AMS)

As our Workshop banquet speaker Dr. Friday gave a moving and motivating address to our banquet attendees. He described the changes that have occurred over the past decades in retaining, providing and recognizing the importance of environmental data. Dr. Friday noted that for many years in which the importance of environmental data was not appreciated to the extent that it is currently, the data center leaders played a critical role in protecting and retaining this important resource. These data are now fully recognized for their critical role in climate change analysis, prediction and national environmental policymaking.

Maria Pirone, President of Commercial Weather Services Association, Dr. "Joe" Friday, center, and Sam McCown, Workshop Chair, share some good times at dinner.

3. PANEL DISCUSSIONS: CUSTOMERS SPEAK TO THE GOVERNMENT

Panel discussions were presented in which customers spoke to the government on economic benefits and customer satisfaction. Dr. Tom Karl described the 2003 NESDIS customer satisfaction survey as a baseline measure. Dr. Karl said that the survey response period was from February through April 2003. The population size was 25,000 customers who placed orders from January through December 2002. The response rate was 25 percent, with 6,300 respondents. On a scale of 1 to 5 with 5 being extremely satisfied, overall customer satisfaction received an average score of 4.3. Sixty-nine percent of respondents said locating data online was easy or very easy; 26 percent said it was difficult or very difficult. Eighty-two percent of users were satisfied with the data costs; 9 percent were not satisfied or not satisfied at all.

Two panel discussions were held: a Commercial Panel and a Government/ Research/Academia Panel. Panel questions were: What can NESDIS do to improve? What new products should NESDIS plan for? What benefits do you derive from NESDIS data? What are the most important issues from your user class perspective?

3.1 COMMERCIAL PANEL DISCUSSION

Dr. George Frederick, Past President of American Meteorological Society, and Chair of the AMS Economic Development Committee, served as Chair. Members were: Dr. Harold D. Palmer, Senior Marine Scientist, Veridian Systems; William S. ("Bill") Bradbury, President, Weather Factor; Maria Pirone, Chair of the AMS Board of Private Sector Meteorology, and President of Commercial Weather Services Association (CWSA); Simon Evans**,** Environmental Systems Research Institute (ESRI); and Dr. Gregory S. Wilson, President, Baron's Advanced Meteorological System, L.L.C.

Dr. Harold D. Palmer, a senior marine scientist with Veridian Systems (which has since been acquired by General Dynamics), told attendees that his products are information and technical analyses related to the ocean and maritime activity. "We deal with clients who want to put things in the ocean, and need to understand the hazards and impacts associated with their endeavors," he said. Dr. Palmer said his company uses data from all three NESDIS data centers. From NCDC, the company collects meteorological data such as wind speed and direction, cloud cover, visibility fog, and other information. For several years, NGDC has been the company's main source of bathymetric data, sediment type, thickness, and distribution, and geohazards data. These data are crucial for route planning for pipelines, cables, flowlines, and outfalls. From NODC the company obtains physical oceanographic data such as salinity, temperature, waves, currents, and tides. Dr. Palmer noted that the CD format has proven to be the most popular to date, but new GIS applications continue to add to the capabilities of data utilization.

William S. Bradbury, President, Weather Factor, discussed Weather Factor's business of consulting meteorology. Many private companies need to know which of their marketing programs are working and which are not. Success in this area can be determined by business factors, unless weather is a determining factor. If weather is a determining factor, this will override other marketing efforts. Weather data can, therefore, be used to factor out weather's impact on sales to determine more accurately the success of a company's marketing programs. Weather Factor uses mostly "daytime precipitation data" in its analyses, as most consumer activity takes place between 8:00 a.m. and 8:00 p.m. Weather Factor performs analyses that quantify the relationships between changes in the weather and changes in consumer behavior and sales volume of products. Mr. Bradbury said that credibility is one of the most important issues. The data must be accurate and internally consistent, and must be available in near real-time or short term.

Maria Pirone, Chair of the AMS Board of Private Sector Meteorology, and President of Commercial Weather Services Association, responded to the question: "What is NESDIS doing right?" by stating that NESDIS' use of the Internet for access and distribution of data is more efficient than previous means. She said that the Web sites link to archives and to real-time information. NESDIS has a broad spectrum of data sets. NESDIS has provided a quicker turnaround time for WSR-88D Level II data. NESDIS is moving more toward standard formats for its data and trying to be more customer-driven.

To the question: "What can NESDIS do to improve?" Ms. Pirone described three areas: transparency, ease of access, and partnering more with users. In the area of transparency, NESDIS needs to continue to strive to make its information more accessible via COTS software, and should lead an effort to convert to standard GIS compatible formats for all data sets. Concerning ease of access, Ms. Pirone said that NESDIS' Web sites are almost too filled with information. This can be overwhelming and work against itself. She said that better design is needed, and noted that it is underway. Concerning partnering with users, Ms. Pirone urged NESDIS to plan after the user meeting, not before, so that users' voices are heard.

To the question: "What new products and services should NESDIS plan for?" Ms. Pirone recommended faster access to climate data for the financial markets; quality controlled data sets; environmental data to reconstruct events related to Homeland Security; and improvements to coastal observations.

To the question: "What benefits do you derive from the data?" Ms. Pirone said that cleaned-up data are becoming more valuable to the growing risk management industry. She said that coastal information is becoming more critical as the threat of terrorist attacks continues. She said there is a need for more information for scenario-building exercises for disaster mitigation.

To the question "What are the most important issues from your user class perspective?" Ms. Pirone listed collaboration with partners; interoperability among data centers; and responsiveness to changing market needs.

Simon Evans, Environmental Systems Research Institute (ESRI), described how technology contributes to bridging the gap among government, academia, and commercial users. He described the future in data, including large data sets and visualization. He discussed areas of cooperation for private, government, and academic sectors such as metadata, statistics and geostats, GIS on the Internet, data management, and usability.

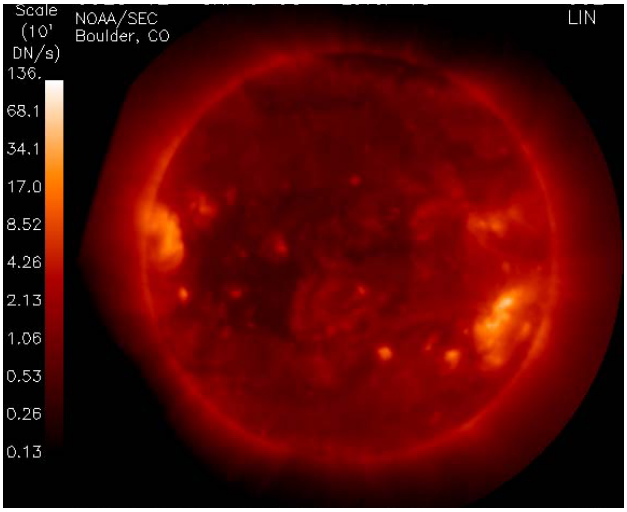
Dr. Gregory S. Wilson, President, Baron's Advanced Meteorological Systems, L.L.C., said that he views government, academia, and commercial partnerships as business partnerships. Partnerships can enable central processes and standardized methodology. Dr. Wilson said that the private sector relies on partnerships. Baron's depends on the timeliness and quality of data, and that weather data are key to profits and business success in many areas. Dr. Wilson recommended that the private sector be involved in the government planning process and that enhanced real-time quality control systems be developed.

3.2 GOVERNMENT/RESEARCH/ACADEMIA PANEL DISCUSSION

Prof. Gary Rottman, Associate Director of the Laboratory for Atmospheric and Space Physics at the University of Colorado, was Chair. Members were: Dr. David A. Robinson, Department Chair, Rutgers University, and N.J. State Climatologist; Steven J. Worley, National Center for Atmospheric Research; Dr. Laura Kong, Director, NOAA/NWS International Tsunami Information Center; Dr. Kenneth E. Kunkel, Illinois State Water Survey, and Former Director Midwest Regional Climate Center and N.M. State Climatologist; Todd A. Doehring, Centrec Consulting Group; and Dr. Robert B. Dunbar, Department of Geological and Environmental Sciences, Stanford University.

Prof. Rottman, of the University of Colorado, described the Solar Radiation and Climate Experiment (SORCE), launched January 25, 2003.

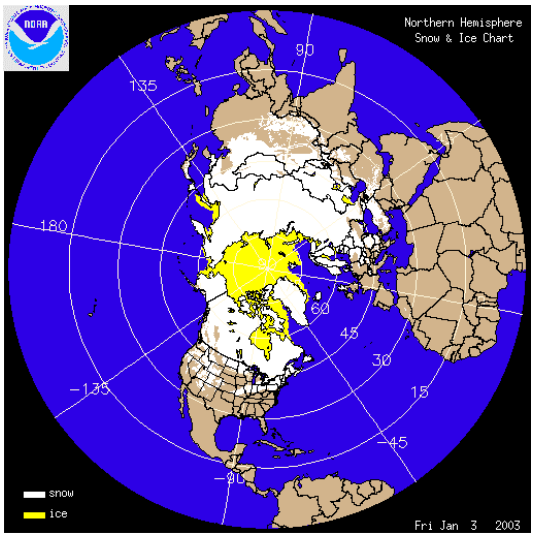
He also noted that the sunspot record is the longest observation related to global climate. This record is based on observations from many different observers, using state-of-the art techniques for their time. The record contains data from Galileo in the 1600s, Herschel in the 1800s, and Schwabe in the 1900s. It is important to have well-documented measurements, and data that span centuries.



At right: GOES-12 SXI image of the sun.

Dr. David Robinson, Department Chair, Rutgers University, and N.J. State Climatologist, described the mission of the Office of the New Jersey State Climatologist to include data management, research, and outreach. He discussed important issues including archiving data, quality control, metadata, and accessibility.

Dr. Robinson presented data and information on climate, including snow cover departure for February 2003 for the Northern Hemisphere, global temperature anomalies for February 2003, Northern Hemisphere snow cover anomalies from November 1966 to April 2003, Northern Hemisphere snow cover from October-April, 1968-2003, NOAA visible snow map for January 2-2002, and a gridded cooperative station snow depth map for January 5, 2002.



At right: Northern Hemisphere Snow and Ice Chart.

Stephen Worley, National Center for Atmospheric Research, said it is important to track all data. Each dataset should have a medadata set describing its history and modifications. He discussed online interfaces and said there needs to be systematic data discovery across and between centers. Web pages should show related data sets and links. In terms of user support, a support professional should be associated with each dataset. The Web site should allow users to subscribe to dataset update notices and updated data. Commercial products derived from NESDIS products should be careful to indicate the source of the historical datasets used.

Dr. Laura Kong, Director, NOAA/NWS International Tsunami Information Center, discussed international tsunami activities. The International Coordination Group for the Tsunami Warning System in the Pacific, formed under UNESCO, recommends and coordinates tsunami programs, including timely international tsunami warnings. The Intergovernmental Oceanographic Commission, hosted by the United States, formed the International Tsunami Information Center (ITIC) in 1965. The International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) has 25 member states. It conducts a successful scientific program and saves lives and property. It monitors the Pacific Basin for seismic activity and sea levels. The mission of ITIC is to monitor international tsunami warning activities; assist member states with technology transfer; recommend improvements in communications, data networks, and information dissemination; improve tsunami preparedness for all Pacific Ocean nations; gather and promulgate knowledge on tsunamis; and encourage research and its application to prevent loss of life and damage to property.

Tsunami damage at Kodiak following 1964 Good Friday Earthquake.

Tsunami data are available at the National Geophysical Data Center, the National Ocean Service, and PMEL. Users of tsunami data include international users, national users in the warning centers, state and local officials, research organizations such as PMEL and universities, and the general public. Dr. Kong said users need historical information that is reliable, accurate, and comprehensive. Users need easy access to the data to include Internet and non-Internet means of delivery. Dr. Kong recommended a stand-alone database and digitization of historical data. New products should feature electronic delivery, graphical delivery, and be available on demand while maintaining human delivery.

Dr. Kenneth E. Kunkel, Illinois State Water Survey, and Former Director Midwest Regional Climate Center and N.M. State Climatologist, presented a state-government agency perspective. The Illinois State Water Survey studies the water and atmospheric resources of Illinois for use by decision-makers. The agency has monitoring, research and service components. The agency's data needs are primarily in the climate monitoring and research areas.

In response to the question "What can NESDIS do to improve?" Dr. Kunkel recommended continued assessments for light- to medium-intensity users. He noted that some users will never come to meetings and conferences, so it is important to make contact in numerous ways. He recommended that NESDIS continue to improve the quality and quantity of near real-time reports of coop data. He recommended a faster turnaround of final quality-controlled data from all cooperative observer stations. He suggested establishing standing advisory boards or committees for ongoing input.

Dr. Kunkel recommended that NESDIS plan for data set merging in the future. He said that data sets now being produced in the Climate Database Modernization Project are viewed as very valuable for better assessments of climate resources and risks. However, research is needed to make these data sets compatible with the modern record. Funding should be provided for this research.

Dr. Kunkel said that the benefits of the data include serving as a basis for accurate assessments of climate resources and risks. He said that the most important issues from his user class are: continuity of long-term climate station records; maintenance of high quality so that climate trends can be detected and changes in climate risks can be accurately accessed; availability of near real-time climate data from a substantial number of stations.

At right: Real-time Precipitation Reporting Frequency in Illinois in January – March 2003 (X=100%: ●=50-99%; ▲=1-49%)

Todd Doehring, Centrec Consulting Group, gave a presentation on "Investigating the Economic Value of NCDC Products to the Energy Industry," describing Centrec Consulting Group's current project. The project objectives are: to develop a searchable database of a subset of NESDIS customers based on visits to the five NESDIS operational units; complete an intensive case study with a private sector firm that uses NESDIS data and information services; and brainstorm with NESDIS personnel regarding prospective analyses employing NESDIS data and information services.

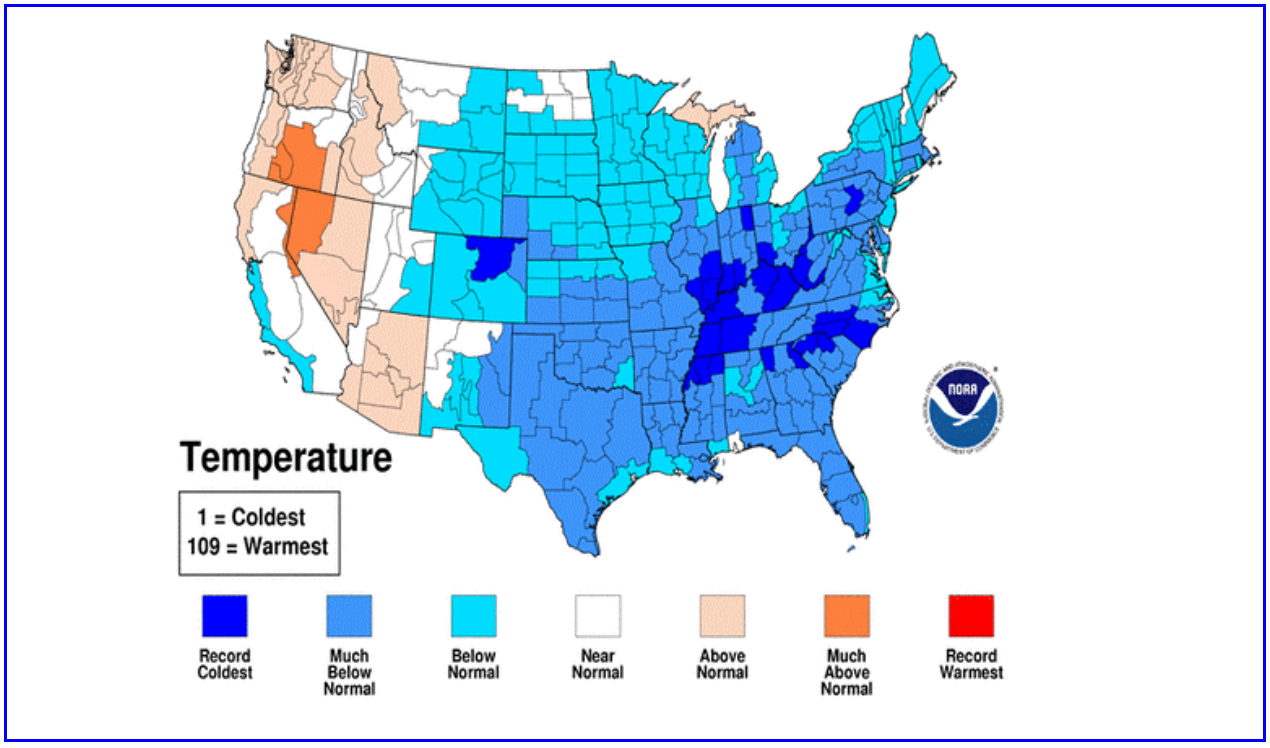
Centrec selected an Energy Company for investigation of their use of NCDC data. Centrec estimated the cost of ingesting, calibrating, validating, archiving, tagging, and cataloguing data. Centrec computed the benefit of NCDC activities to the energy company and the entire energy industry. Centrec found that the company spends about $5,000 per year on NCDC data. The cost of maintaining only the most basic level of NCDC services was estimated at $2.48 million per year. The cost-benefit ratio of 495 ($2,480,000 divided by $5,000) implies $495 of benefit for every $1.00 spent. Extrapolating the benefit to the entire energy industry will result in potential energy industry benefits of about $65 million per year.

4. SESSION REPORTS: CURRENT AMD FUTURE CAPABILITIES OF NESDIS DATA DISTRIBUTORS (INTRODUCED BY GREG WITHEE)

4.1 NATIONAL CLIMATIC DATA CENTER (TOM KARL, DIRECTOR)

The National Climatic Data Center in Asheville, North Carolina, is the world's largest active archive of atmospheric and climate data. NCDC archives data obtained by the National Weather Service, military services, Federal Aviation Administration, and the Coast Guard, as well as data from voluntary cooperative observers. NCDC operates the World Data Center for Meteorology, located at NCDC in Asheville, and the World Data Center for Paleoclimatology, located in Boulder, Colorado. The Center stores information essential to industry, science, agriculture, hydrology, transportation, recreation, and engineering.

NCDC provides access and stewardship to the nation's resource of global climate and weather-related data and information, and assesses and monitors climate variations and change. NCDC supports the national economy by providing data to all disciplines of the national economic infrastructure. NCDC's mission includes acquiring and ingesting data; archiving and providing scientific stewardship of the nation's meteorological data, including worldwide data; providing access to data, metadata, and products; and monitoring and describing the national and global climate. The Center has more than 150 years of data on hand with 224 gigabytes of new information added each day--that is equivalent to 72 million pages a day.

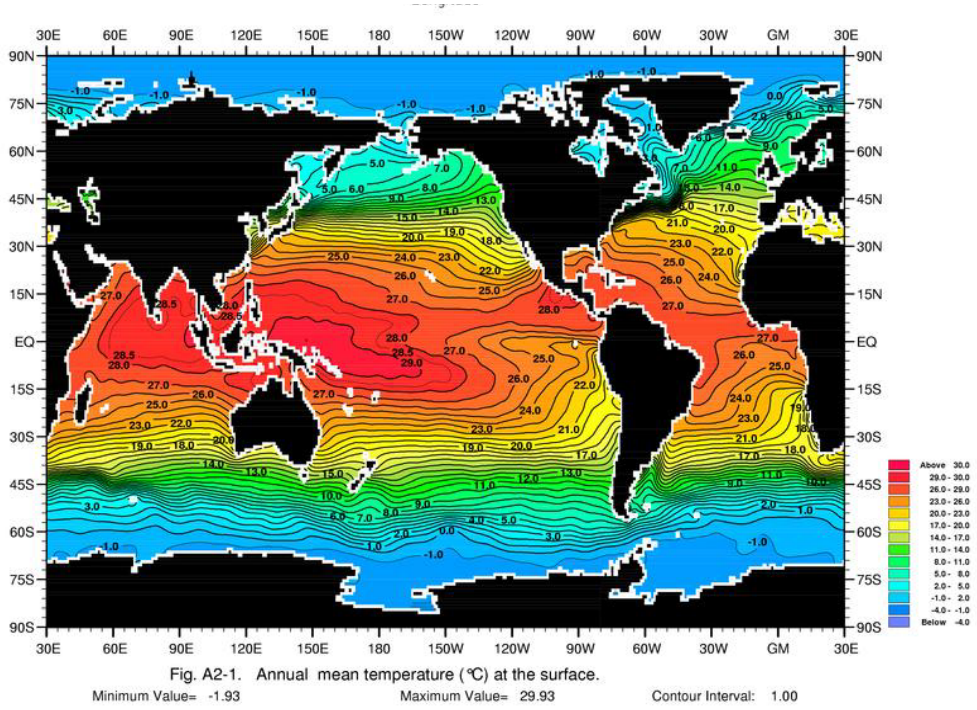


June 2003 temperature ranks by climate division (courtesy NCDC).

4.2 NATIONAL OCEANOGRAPHIC DATA CENTER (H. LEE DANTZLER, DIRECTOR)

The National Oceanographic Data Center in Silver Spring, Maryland, serves to acquire, process, preserve, and disseminate oceanographic data. These data are used for fisheries and habitat management, studying ocean climate variability and change, coastal planning and risk management, and operational oceanographic observations management. NODC houses a wide range of oceanographic data, including temperature, salinity, waves and wind, currents, marine biology, sea level, coastal satellite imagery, and marine carbon, chemistry, and pollution. NODC maintains a world ocean database providing aggregated global ocean profile data and an ongoing assessment of the ocean's heat storage. The center also maintains a digital world ocean atlas, ocean and coastal sea surface temperature data, data from ocean buoys, and others. Data can be accessed online direct via an Internet connection, online indirect via an online store, and offline, working through a customer service specialist.

NODC ensures that global oceanographic data are maintained in a permanent archive that is easily accessible to the world science community and to other users. The NODC holds global physical, chemical, and biological oceanographic data. It receives foreign data from organizations and institutions in dozens of countries around the world. NODC also manages the NOAA Central Library, which holds more than 1 million volumes, including books, journals, data and information CD-ROMs, and audio and video tapes. NODC also operates the National Coastal Data Development Center at the Stennis Space Center, Mississippi. NCDDC's mission is to access and integrate diverse coastal data distributed in multiple repositories and provide these data to users via the Internet using established and emerging technologies.



Annual mean temperature (°C) at the surface of the ocean.
From the World Ocean Atlas, 2001, NODC.

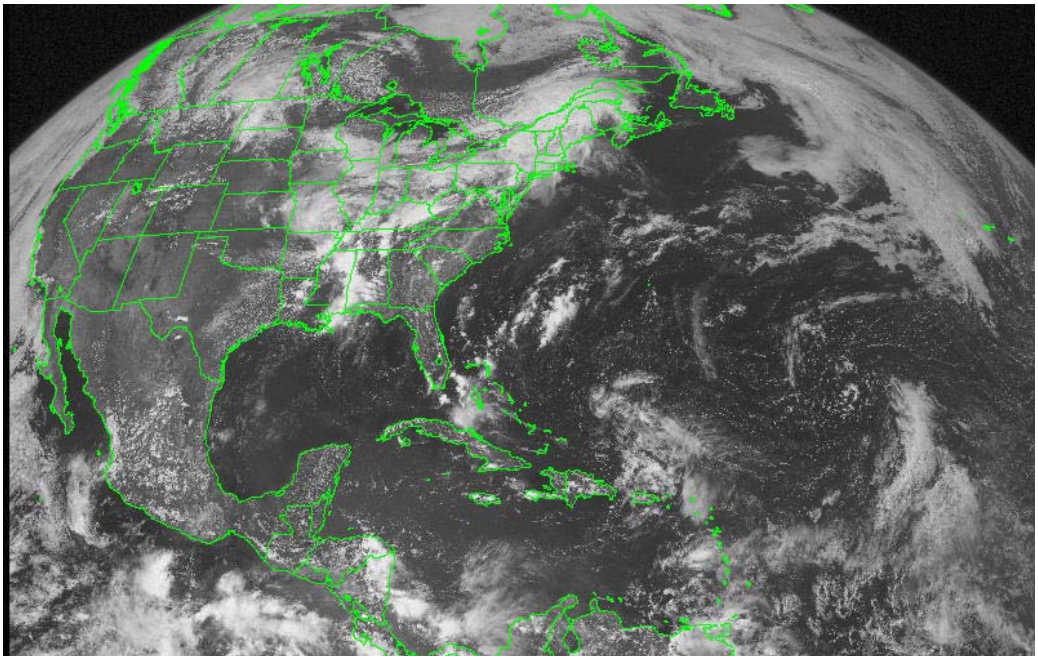
4.3 NATIONAL GEOPHYSICAL DATA CENTER (CHRIS FOX, ACTING DIRECTOR)

The National Geophysical Data Center in Boulder, Colorado, houses activities in the fields of global geophysics, marine geology and geophysics, and solar-terrestrial physics. It has a cooperative agreement with the University of Colorado to handle data services for the National Snow and Ice Data Center. The majority of NGDC data come from the observation programs of other NOAA activities, but a significant amount result from cooperative arrangements with universities, other government agencies, and foreign organizations.

NGDC looks at the environmental spectrum from solar activity, space environment, and the upper atmosphere, to snow and ice data, to the land surface, ocean floor, and Earth's interior. Its customers include academia, foreign, public, industry, and U.S. government agencies. NGDC operates three world data centers: World Data Center for Marine Geology and Geophysics; World Data Center for Solar-terrestrial Physics; and the World Data Center for Solid Earth Geophysics

4.4 OFFICE OF SATELLITE DATA PROCESSING AND DISTRIBUTION (MIKE MATSON, ACTING DIRECTOR)

Mr. Matson's presentation, "Meeting the Needs of Real-time Users," provided insight into the operations of a real-time satellite data processing and distribution system. NESDIS' Office of Satellite Data Processing and Distribution (OSDPD) manages and directs the operation of the central ground facilities that ingest, process, and distribute environmental satellite data and derived products to domestic and foreign users to support time-critical mission requirements. OSDPD is the primary operating level interface for civil and military users of data from environmental satellites.



GOES-12 visible image, June 11, 2003.

OSDPD acquires data from both NOAA and non-NOAA satellites. The NOAA satellites are the Geostationary Operational Environmental Satellite, the Polar-orbiting Operational Environmental Satellite, and Defense Meteorological Satellite Program satellites. The non-NOAA satellites include EOS, Seawifs, Geosat Follow On, Radarsat, Metop, Adeos, Jason, and others. OSDPD produces products

from NOAA satellite data, including soundings, ozone, cloud image, land, earth radiation, winds, aerosol, precipitation, sea surface temperatures, and others.

Data from OSDPD provide benefits to various sectors of the economy and industry. Environmental data can reduce society's risks from weather and water impacts. These data can be useful to fuel savings to commercial aviation and navigation. Certain property damage from hurricanes can be prevented if residents have ample warning time. Hurricane evacuation costs can be reduced, and public safety enhanced. Aviation safety is improved with volcanic ash detection and monitoring.

OSDPD is making a transition from the Satellite Active Archive (SAA) to CLASS, the Comprehensive Large Array-data Stewardship System. The SAA, GOES Active Archive and the CLASS study projects are consolidated into a single project, called CLASS. The goals of CLASS are to provide one-stop shopping and access capability for NOAA and NESDIS environmental data and products. CLASS will provide a common look and feel for the data and products, as well as an efficient architecture for archival and distribution of current and future NOAA and NESDIS environmental data and products. CLASS will reduce implementation costs by using re-engineering, evolutionary effort. The CLASS program is NOAA's principal avenue to meeting the challenges of rapid advances in information technologies and a much more informed and demanding customer.

5. BREAKOUT SESSIONS/SUMMARY OF DISCUSSION AND RECOMMENDATIONS

Workshop attendees chose sessions to attend based on their affiliation (commercial value added, commercial user, government, or academia). Large groups were broken into subgroups for ease of facilitation. At registration each participant indicated his/her choice.

The groups were asked to address the following questions:

- How Can We Improve Our Services and Data?
- How Can NESDIS Centers Best Provide for Customer Feedback?
- Technology of the Future – How Can it Help?
- New Data Acquisitions: What Data Should NESDIS Archive?
- New products and services: What Should We Plan for?

Section 5.1 below contains a summary of recommendations from the breakout sessions. Appendix III provides the common themes that were identified for discussion and recommendation by the attendees and survey respondents, and more detailed feedback. The six breakout sessions were divided by participant affiliation: commercial, academic, and government. Appendix IV provides a report on the breakdown of the sessions, the topics addressed, and recommendations.

In response to the question, *"How can NESDIS improve their services and data?"* users recommended four general areas:

- access
- data management
- data sources
- communication with customers.

In response to *"How can NESDIS Centers best provide for customer feedback?"* users recommended that NESDIS:

- establish and utilize customer/user advisory boards
- archive user issues, questions and answers through listserv and/or users groups
- use a human point of contact
- produce a newsletter
- provide a feedback mechanism on its Web site
- provide follow-up from the Users' Workshop.

In response to: *"How can technology help and what are the implications for the future?"* users recommended:

- improved computing capability
- supercomputing.

In response to the question *"What new data should NESDIS archive?"* users responded:

- All data possible
- Multi-level metadata
- Global environmental data
- Data from international sources
- Pre-operational GOES data
- Older and previously classified data.

In response to the question, *"What new products and services should NESDIS plan for?"* users responded:

- compatible merged or linked data sets from multiple data sources
- enhanced metadata
- visualization tools
- enhanced customer services
- human point of contact for customers/users
- easier data search and discovery.

In response to the question, *"What other issues need to be addressed?"* users responded:

- cross-agency collaboration, i.e. NOAA/NASA/DoD/CDC, etc.;
- partnerships between:
    - NESDIS and customers
    - Data Centers and private sector
    - academic sector
    - public
- standardize data formats and quality control standards among data centers and between data sources
- training for how to use data.

In conclusion, Dr. Tom Karl told the attendees that NOAA considers this workshop an important step in a continuing dialog with its constituents. He noted that the workshop Web page (http://www.osd.noaa.gov/datausers/index.htm) contains the presentations and lists of all recommendations from the breakout groups. The Web page will also contain a link to the Work Plan that addresses the constituent recommendations and the Work Plan Progress.

NOAA will evaluate and follow through on the recommendations. The workshop report will be posted to the Web page, and all registered participants will receive e-mail notifications. Open forums will continue. These will continue to strengthen the NOAA/Commercial/Academia/Research partnerships. Dr. Karl thanked all of the participants and said he is looking forward to future collaboration.

5.1 SUMMARY OF RECOMMENDATIONS

A summary of recommendations follows. The summary was developed from about 600 recommendations and comments that were received from the six breakout groups. The recommendations are presented in descending order with those of the highest frequency of mention listed first. Bullets under each topic are likewise presented in descending order of frequency of mention.

1. **Ensure User Communities have input into decisions affecting them**
    - Ensure overall user community has input into decisions concerning archive data
    - Ensure overall user community has input into decisions concerning data formats and standards
    - Create standing advisory panels
    - Ensure outreach to users is customer driven in regard to new system development and training

2. **Integrate multiple data sets into a seamless environmental database**
   - Integrate multiple data sources (e.g. NEXRAD, satellites, in-situ) so that users can access all data with one entry point
   - Provide seamless access to terabytes of data and related metadata ranging from real-time to high-quality archive along with associated climatology products
   - Link data centers across NOAA and other agencies for central data discovery
   - Improve data discovery by cataloging data with multiple search keys
   - Create a comprehensive integrated observing system

3. **Maintain human customer interface**
   - Maintain human customer interface
   - Identify data expert/help desk for major data bases or subjects
   - Identify data expert for major databases or subjects for each Web page

4. **Shorten the time the data become available to the user**
   - Shorten data-to-user cycle time
   - Shorten data-to-user cycle time for COOP data through modernization efforts
   - Post a summary of changes/additions to Web sites at periodic intervals (e.g., What's New or What's Coming Up)
   - Develop real-time data QC for real time data
   - Create online subscription service to notify users of data and metadata updates

5. **Continue User Workshops**
   - Continue user workshops
   - Continue user workshops at professional meetings (AMS, AGU, Oceans, etc.)
   - Continue user workshops with an all NOAA data users workshop

6. **Improve Access to Data**
   - Improve Web interfaces for easier access to data
   - Ensure there is accurate metadata to describe data
   - Create different levels of access available for different levels of users
   - Add GIS parameters to environmental data and products
   - Create online tutorials on how to acquire data
   - Rescue older data (e.g., 19th century and older) and incorporate with existing data sets
   - Establish a rating methodology for similar data sets to allow user to determine the most appropriate data set for their application
   - Subset monthly international surface data into manageable sizes; too large a file
   - Ensure the highest quality and most complete data and metadata are made available
   - Improve metadata with links to journal articles and peer review of data
   - Create "data" button on NOAA homepage and other offices to discover data
   - Develop focused portals for NESDIS data subjects
   - Develop map search capabilities for NESDIS data in addition to lat/lon searches
   - Investigate data warehousing/mining tools that will aid in data discovery
   - Develop multiple versions of data from preliminary to final edited, identifying the level of QC in the metadata
   - Provide online data in different formats
   - Develop an inventory that lists offline data availability and move more data online
   - Investigate natural language search and discovery capabilities

7. Develop effective linkages with partners

- Develop better linkages between NOAA and partners (customers, data centers and private sector, academic sector, public, etc.)
- Create newsletters/listservers to keep user community informed
- Create online, moderated user forums
- Create Web-based customer survey tied to online ordering system
- Create Web-based trouble ticket system with feedback on problem status and Web-based satisfaction survey
- Improve global coordination to increase/enhance global data coverage
- Develop better linkages between NOAA and international partners (e.g., WMO, others)
- Establish partnerships between the government and private sector utilizing the strengths of the each group to solve problems
- Post results of user survey and client comments on the Web
- Create FAQs for Web site
- Partner with library scientists to develop searchable layers of metadata
- Develop better linkages to the Office of the Federal Coordinator for Meteorology (OFCM) to get a cross agency view of data center functions
- Develop role clarification (demarcation line) between the roles of the private sector and government. Third party providers to deliver value added GIS products
- Ensure satisfaction surveys target all users
- Improve global coordination to increase/enhance global data coverage

8. Ensure data stewardship

- Ensure data stewardship for NESDIS data; investigate the Open Archival Information System (OAIS) as a reference model
- Ensure that NESDIS has sufficient budget to perform its mission
- Ensure back-up systems are in place to maintain near real-time access to NESDIS data streams
- Ensure that existing standards are used for metadata, downloading files and archiving

9. Adopt common data formats and standards

- Determine whether the data centers should move toward common formats for archived data
- Develop data format converters/translators in order to make data available in commonly used formats
- Develop a NESDIS position paper on formats and archive plans
- Create cross agency standards (NOAA, USGS, EPA, NASA, etc.)

10. Increase data holdings

- More modeled data (global and regional)
- Data from international sources
- Data to support forensic meteorology
- Satellite products designed for global hydrologic applications; soil moisture, land cover

5.2 THE FUTURE

NESDIS has assembled a team to carefully study and evaluate the 188 constituent recommendations that were received. Those recommendations that can be implemented without substantial cost increases will be implemented. Others will be studied to determine the most cost-effective and efficient ways to implement them. Whenever possible, the recommendations will be implemented in the near term. Those requiring more extensive planning and coordination will be implemented over time.

The recommendations and actions taken will also be posted to the workshop Web page. The Web page will also contain a link to the Action Plan that addresses the recommendations as well as providing updates on the progress that has been made in implementing the actions. The results will also be presented at a data users' workshop that is currently being planned for the near future.

Seated: Robert Raguso, (left) WeatherNews, Inc., and Mark Kramer, MES, Inc.

Peter Steurer (left) and Tom Ross, both of NCDC.

APPENDIX I – WORKSHOP AGENDA

NESDIS Data Users' Workshop
June 11-12, 2003
Boulder, Colorado

Pre-Workshop (Tuesday, June 10, 2003): Millennium Harvest House Hotel

5:30 pm "What's New at the Data Centers: Meet the Directors" Pre-Workshop Icebreaker (Hors d'oeuvres; Cash bar); Data Center Exhibits; Registration Package Distribution

Day 1/Morning (Wednesday, June 11, 2003): NIST Auditorium

7:30 am Registration and Package Distribution
Posters and Exhibits open and staffed until 8:15 AM
8:25 am Introduction (Conf. Logistics, Format, etc.) (Sam McCown /NCDC)
8:30 am Welcome / Opening Remarks / Goals / Overview of NESDIS Data Information and Distribution (Greg Withee / NESDIS)

Session 1: Current and Future Capabilities of NESDIS Data Distributors (Introduced by Greg Withee)

8:50 am National Climatic Data Center (Tom Karl, Director)
9:20 am National Oceanographic Data Center (H. Lee Dantzler, Director)
9:45 am National Geophysical Data Center (Chris Fox, Acting Director)
10:10 am Office of Satellite Data Processing and Distribution (Mike Matson, Acting Director)
10:35 am BREAK (Exhibits and Poster Display open: Not staffed)
10:55 am Keynote Address: VADM Conrad C. Lautenbacher, Jr., U.S. Navy (Ret.) Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator Introduced by Greg Withee)
11:30 am Guest Speaker: Dr. Ronald McPherson, Executive Director, American Meteorological Society
12:00 pm LUNCH (On your own)
12:30 pm Exhibits and Poster Displays (Open and staffed during lunch break)

Day 1 / Afternoon (Wednesday, June 11, 2003: NIST Auditorium)

Session 2: Customers Speak to the Government: Economic Benefits / Customer Satisfaction. Moderator: Dr. Tom Karl

Panel Session Topics:
A) What can NESDIS do to improve?
B) What new products and services should NESDIS plan for?
C) What benefits do you derive from the data?
D) What are the most important issues from your user class perspective?
E) Audience participation: comments and questions to panelists

1:30 pm Overview of Panel Discussions by Dr. Tom Karl

1:45 pm Commercial Panel Discussion
Dr. George Frederick, Chair, Recent President of American Meteorological Society, and Chair of the AMS Economic Development Committee
Members: Dr. Harold D. Palmer Senior Marine Scientist, Veridian Systems; William S. ("Bill") Bradbury President, Weather Factor; Maria Pirone, Chair of the AMS Board of Private Sector Meteorology, and President of Commercial Weather Services Association (CWSA); Simon Evans, Environmental Systems Research Institute (ESRI); Dr. Gregory S. Wilson, Pres., Baron's Advanced Meteorological System, L.L.C.

3:15 pm Special Guest Speaker: S.J. Camarata, Jr., Director, Corporate Strategies, Environmental Systems Research Institute, Inc. "Bridging the gap among Government, academia, and commercial users: how does technology contribute?"

3:35 pm Government / Research / Academia Panel Discussion:
Prof. Gary Rottman, Chair, Associate Director of the Laboratory or Atmospheric and Space Physics at the University of Colorado
Members: Dr. David A. Robinson, Department Chair, Rutgers University, N.J. State Climatologist; Steven J. Worley, National Center for Atmospheric Research; Dr. Laura Kong, Director, NOAA/NWS International Tsunami Information Center; Dr. Kenneth E. Kunkel, Illinois State Water Survey, and Former Director Midwest Regional Climate Center and N.M. State Climatologist; Todd A. Doehring, Centrec Consulting Group; Dr. Robert B. Dunbar, Department of Geological and Environmental Sciences, Stanford University

4:50 pm Highlights and Summary from Panel Sessions
Introduction to Day 2
Jessica Hartung, Integrated Work Strategies

5:00 pm End of Day 1

6:30 pm DINNER Speaker: Dr. Elbert W. ("Joe") Friday, President of AMS, Former Director of National Research Council Board of Atmospheric Sciences and Climate, Former Director of National Weather Service
Location: Millennium Hotel

Day 2 (Thursday, June 12, 2003: Millennium Hotel)

7:30 am Registration and Package Distribution

8:00 am Continental Breakfast

Session 3: Customer Breakout Session: New Products, Data Distribution, and Methodologies

9:00 am Introduction to feedback process (Facilitators)
9:15 am Breakout Sessions Begin: (Facilitators and Technical Leads)
Workshop attendees choose sessions based on their affiliation (commercial value added, commercial user, government, academia). Large groups will be broken into sub-groups for ease of facilitation. At registration each participant indicates his/her choice.
Tentative Breakout Questions:
a) How Can We Improve Our Services and Data?
b) How Can NESDIS Centers Best Provide for Customer Feedback?
c) Technology of the Future - How Can it Help?
d) New Data Acquisitions: What Data Should NESDIS Archive?
e) New products and services: What should we plan for?
10:20 am BREAK
10:50 am Breakout / Audience Participation Continues
11:45 am LUNCH (Provided)
1:05 pm Breakout Sessions resume (Facilitators and Technical Leads)
2:30 pm BREAK
3:00 pm Highlights and Report from Breakout Groups (Technical Leaders)
4:30 pm Closing Remarks (Dr. Tom Karl / NESDIS/NCDC)

Post Workshop Tours (Friday, June 13, 2003): NOAA Offices at David Skaggs Research Center

APPENDIX II – ATTENDEE REPRESENTATION, GOALS ACCOMPLISHED, AND RESULTS

Attendee Representation:

225 registered, 375 in attendance

25 percent each:

- Commercial
- Research
- NESDIS
- Other government

Goals Accomplished and Results:

- Reviewed and updated users' needs for new products, data archiving and access to stored data.
- Enhanced communication process with users
- Updated users on future capabilities, plans, datasets
- Assessed users' and societal benefits
- Documented user recommendations
- Breakout session summaries produced for the Web
- Workshop Web page: http://www.osd.noaa.gov/datausers/

APPENDIX III – WORKSHOP ATTENDEE FEEDBACK

Common Themes – Customer Feedback Sessions

1) How can NESDIS improve their services and data?

Access

- Improve Web interface
- Utilize human-to-human customer support, point of contact
- Provide data in a variety of data formats
- Improve access to real-time as well as archived data
- Make different levels of access available for different levels of users
- Provide access to raw data, offer downloadable data
- Provide access to more data

Data management

- Increase use of metadata
    - Improved data discovery and retrieval
    - Improved data accountability
- Improve data quality control
- Provide end to end data management
- Better documentation

Data sources

- Expand beyond United States
- Link data sources
    - Data centers
    - Data providers, sources
    - Other agencies gathering data, NASA, DoD, CDC, etc.

Communication with customers

- Utilize human point of contact
- Update user community regarding
    - New data sets
    - Updates
    - New products
- Provide Help Desk to assist in troubleshooting technical difficulties
- Online user groups, discussion lists
- Track user problems and respond

2) How can NESDIS Centers best provide for customer feedback?

- Establish and utilize customer/user advisory boards
- Archive user issues and Q & A through listserv and/or users groups
- Utilize human point of contact
- NESDIS Newsletter
- Feedback mechanism on Web site
    - Track users through user login

  - Develop Web-based trouble ticket system or feedback button on Web site users can click to provide feedback
  - Web-delivered survey
- Follow up from Users' Workshop
  - Post Customer Group breakout feedback on Web site
  - Hold future workshops/meetings in conjunction with other workshops such as NOAA, GOES, AMS, etc.

3) How can technology help and what are the implications for the future?

- Improved computing capability, supercomputing
  - Higher resolution, higher quality data
  - Wider bandwidth
- Implications:
  - Greater storage capacity
  - Improved data discovery
  - More comprehensive searches possible
  - Improved communication and data sharing between data providers
  - Increased data reliability
  - Capture and management of increased data volume
  - Diverse sources, increased collection ability
  - Real-time data QC, improved data QC
  - Global data network
  - Lower cost and increased automated data management capability
  - Improvement of data archiving, metadata, modeling
  - Increased importance of user training

4) What new data should NESDIS archive?

- All data possible
- Multi-level metadata
- Global environmental data
- Data from international sources
- Pre-operational GOES data
- Older and previously classified data

5) What new products and services should NESDIS plan for?

- Compatible merged or linked data sets from multiple data sources
- Enhanced metadata
- Visualization tools
- Enhanced customer services
- Human point of contact for customers/users
- Easier data search and discovery
  - Natural language search
  - Linked datasets
  - "One stop shop"

6) What other issues need to be addressed?

- Cross-agency collaboration, i.e. NOAA/NASA/DoD/CDC, etc.
- Partnerships between: NESDIS and Customers, Data Centers and private sector, academic sector, public, etc.
- Standardize data formats and QC standards among Data Centers and between data sources
- Training for how to use data

APPENDIX IV – BREAKOUT SESSIONS

Commercial Breakout

Question #1: Improve Services and Data

- Data availability (faster, complete and updated)
- Accessibility (ease and download times)
- Address needs of spectrum of users/edited vs. unedited data
- Improve historical metadata
- Inform customers of planned updates and new products/data sets

Question #2: Provide for Customer Feedback

- NESDIS communication-what's new, what's coming, FAQs, user forms and newsletters
- Points of contact in an agency for specific issues listed on the Website
- Human contact, not just e-mail
- Respond to every customer's questions
- Provide responses to users' questions from this workshop via the Web

Question #3: How Technology Helps

- Needed data archived, available in or near real-time, quickly accessible
- Wider bandwidth, greater storage capacity to make data available
- Opportunity for doing better
- Use of GIS and other tools

Question #4: New Data Acquisitions

- Links to other databases through NESDIS Website
- Data sets held by states and institutions routinely accessed or integrated; archive it and make it available
- Provide data access by description or focus
- Archive new DMSP data, ocean current speeds and directions below several hundred meters and other data sets transmitted via NOAAPORT

Question #5: New Products and Services

- Data packages containing multiple products should be available for specific locations/time periods. Composite products.
- One-stop shopping: multiple sources, multiple products, multiple locations, multiple time periods without having to make multiple requests.

Question #6: Other Issues

- Should Data Centers set standard formats for their products
- Products should not be "tailored" to specific users
- Forum for ongoing dialogue between Data Centers and users
- GIS tools
- Cost vs. Free. If not free, minimize cost

Commercial Value Added Breakout

Question #1: Improve Services and Data

- Integration and Standardization
  - NOAA-wide seamless integration, i.e., NWS / NCDC
  - Format and Metadata consistency
  - Interoperability
- Quality Control and Assurance
  - Contact Information
  - Human Interaction when needed
  - Customer rep assigned
- Access
  - Ease of
  - Improved Web usability
  - Subscription Services
- Broaden scope of datasets
  - Access to International Data
  - Historical Data

Question #2: Provide for Customer Feedback

- "Face to face"
  - Assign a contact person to all online services
  - Increase participation in conferences and forums
- Accountability
  - Acknowledge all feedback
  - Provide a direct response tree for customer service
- Give Users a Stake
  - Advisory Boards
  - Engage them early and often

Question #3: How Technology Helps

- Promising Technologies
- Supercomputing, costs are going down / benefits are going up
- NEXRAD/Satellites – w/more accuracy, precision, resolution
- Military Technology - adapting to other purposes
- Hyper-spectral, more data, broader applications
- Geostationary microwave sounding
- Climate reference network: upgrade? Go global?

- Driving Forces
- Population change
- Quality of life and environment
- Technology leap-frogging
- Increased connectivity
- Constants?
- Key Uncertainties, Complexity and rate of change

Implications from Scenarios

- Improved services
    - A.I. facilitates finding specific data
    - Instrumentation: Bundling QC/QA of data
    - Effective integration for Better and Faster decisions
    - Real time data QC and event monitoring

Overall reliability

Question #4: New Data Acquisitions

- Everything NOAA collects should be archived.
- What level of accessibility?
- Including and Beyond NOAA supervised?
    - What role private observers?
    - Include data from qualified private observers
- Worldwide data?

Question #6: Other Issues

- Paradigm shift in private sector and government interactions.
- Recognition and support for routine data gathering and stewardship.
- Training to improve efficiencies and long term QC/QA
- Affordability
- Consistent pricing policy
- Free via the Web?
- Ongoing role clarification: NESDIS and private sector
- Weather observations for aviation, or for all?

Academia #1 Breakout

Question #1: Improve Services and Data

- Globalization: need to expand beyond from US-centric data collection
- Data discovery: rule-based discovery, improved metadata, linkages to other providers
- User support issues: expert contact; support archive/FAQ; better communication mechanisms
- Data quality: document quality; improve quality
- Gap between real-time and archived data availability

Question #2: Provide for Customer Feedback

- Make it very easy to give feedback
- Login option to facilitate user history for feedback

Question #3: How Technology Helps

- Data discovery integration/interoperability across disciplines and data sources
- Data quality layers: real-time, minimal QC; near real-time some QC; archived, fully QCed
- Higher resolution and quality data
- Implications from Scenarios
- Actively involved in standards: data, metadata, communication between computers
- Increased communication between data providers

Question #4: New Data Acquisitions

- Solar radiation data
- Physical properties of water column
- Hourly or better GOES full disk scans
- Higher resolution global data
- Negotiate access to non-US data sources

Question #5: New Products and Services

- Make it easier for data providers to submit data and metadata to data centers
- Natural language search and discovery w/ options for display
- Spectrums of modes for data access

Question #6: Other Issues

- Better linkage between NOAA and Partners
- What is public MUST work and work reliably

Academia #2 Breakout

Question #1 – Part 1: Improve Services and Data

- Science support of data and products
  - Online documentation
  - Point of contact (personal approach)
  - Rapid response
  - Continual update of documentation and metadata
  - Customer support for finding data sets
- Levels of detail available
  - Searchable layers of metadata
- Data available to users in a variety of popular formats
  - Will change with time

Question #1 – Part 2: Improve Services and Data

- User interface
  - Need HMI/library science expertise
  - Ease of access/use
  - Monitor developments in tools
    - embedded in software, Web-based, other?
  - Responsive to different levels of users
    - smart interface, personnel to assist
  - Different levels of access
    - one data set or "bulk" access
  - Subscription service to notify users of data updates

Question #2: Provide for Customer Feedback

- Human customer interface
- Web-based trouble ticket system, feedback button, problem report form
- Data set users group – archived user issues and question
- Advisory Groups
  - Have to represent wide range of users
  - Must stay focused on user needs
- Customer surveys and conferences
  - Breakout sessions at meetings like AMS

Question #3 – Part 1: Technology Drivers (Academic Perspective)

- Increased data volume
- New sensors, targeted observations
- Cyber-infrastructure
  - Breakdown of geographic boundaries
  - Breakdown of agency boundaries
  - Blurring of discipline boundaries
  - Blurring of data user/provider distinction
- Demand for quicker research results
- Data-, GIS-savvy public (students and citizens)
- Increased demands on natural resources

Question #3 – Part 2: NESDIS Action (Academic Perspective)

- Over-arching data discovery
  - Link data sets, agencies, sources
- Data stewardship (end-to-end)
  - Enhanced metadata
  - Data set accountability
  - Ensuring long-term viability
- Broader public education and outreach
- Impact of pricing policies (make it free)
- Prioritization necessary
  - New vs. established programs
  - Data quality vs. cosmetics

Question #3 – Part 3: Implications

- Benefits
  - Shortened archive availability time
  - Broader user community and applications
  - Increased discovery and access
- Challenges
  - Long-term viability
  - Data quality act
  - Administration/policy/priority changes

Question #4: New Data Acquisitions/Archive Priorities

- High resolution in situ surface data
- Local coastal observing systems
- Nighttime lights derived products
- Water management data (USGS?)
- Data rescue
- Declassified DoD data

Question #5: New Products and Services

- NESDIS should plan for
  - Large user community
  - Enhanced customer services
  - Demand for multiple data formats

Question #6: Other Issues

- Cross-agency standards (NOAA, USGS, EPA, NASA, etc.)

Government #1 Breakout

Question #1: Improve Services and Data

- Improve Web Interface
- Format of data to be downloaded easily
- Make quality control data available
- Improve accessibility of the data
- Provide data descriptions based on capability of users
- Provide a help desk for data information
- Need for near real-time data

Question #2: Provide for Customer Feedback

- Create a users' group for feedback
- Combine this workshop with annual users' conference (i.e. GOES, NOAA)
- Have a human point-of-contact
- Create on-line users' forums
- Create tutorials and test system periodically (new users)

Question #3: Changing Factors in Next 10 Years

- More crisis management (extreme events)
- Terrorism
- Increased coastal development and other environmental management issues
- Demand for more info
- Predictable cycles (e.g. Solar Max)
- More data, but less money, fewer people
- Increased reliance on satellite data
- Globalization
- Privatization
- Partnerships between agencies and with corporations
- Increasing population
- Aging population
- Technology improvements
- Communication technology current
- Uncertainties Next 10 Years
    - Global warming
    - Resource allocation (political, social, cultural)
    - The economy
    - Future work force
    - Energy sources
    - Weather patterns / events
    - Terrorist events
    - Global pandemics / new diseases
    - Food sources

Question #3 Continued: What Can NESDIS do to Prepare?

- Train users on new technology
- Build inter-agency and intra-agency and corporate partnerships
- Data assimilation and modeling
- Improve techniques of data mining, warehousing and discovery tools
- Maintain flexibility and continuity in instrument measurements
- Create backups in case data flow is interrupted
- Interoperability and open source standards
- Focus more on metadata
- Stronger connection between data discovery systems and data access systems
- Close the hydrologic loop by integrating water-related agencies

Question #4: New Data Acquisitions

- Archive commercial imagery
- GOES data before it becomes operational
- Build comprehensive end-to-end integrated observing systems
- Real-time data, QC, processing
- Streaming data mining algorithms
- Prioritize data collection according to strategic themes

Question #5: New Products and Services

- Must reflect customer requirements
- Products related to air quality and water quality and quality of life
- Tutorials to educate users
- Products for educators (standards)
- Develop compatibility between heterogeneous data sets
- Need integration of data across NOAA, especially coast

Question #6: Other Issues

- Next year's workshop: bring all NOAA data users together
- Integrated pilot before workshop using multi-sources
- Forward presentations to participants
- Who decides what data is archived – advisory board?
- Develop partnership among collectors of data, users and archivists

Government #2 Breakout

Question #1: Improve Services and Data

- Data System Integration - One Stop Shop
  - Fundamental Barriers
  - Coordinating Access Internationally
- Providing Tools and Services to the Data User
  - Ease of Navigation
- End to End Data Management
  - From Collection to Access

Question #2: Provide for Customer Feedback

- Data Users Workshop
  - Annually; Alternating Between Centers
- Standing Advisory Committee
- Eliminate or Reduce Anonymous Data Set Accountability
- Provide a Registration Service
- Newsletters
- Information Architect
- Better Use of Web Pages for Updates
- Active Pursuit of Feedback is Essential

Question #3: Implications from Scenarios

- Driving Forces
  - Need for global supply of clean water
  - Entrenched stovepipes competition for budget dollars
  - Positive economic development globally
  - Need for global partnerships – encourage and pursue
  - Economics and size of data forcing government to manage
  - Trend towards automation with less human management of data volume
- Pre-Determined Elements
  - Continued increase in population
  - Budget - continued competition for money
  - Continued increase in data collection
  - Mammoth data volume
- Critical Uncertainties
  - Need for a political miracle for cooperation (bureaucratic inertia) to eliminate stove-pipes – Global Politics

Question #4: New Data Acquisitions
What data should NESDIS archive?

- The data required for scientific research and decision-making for economic resource managers
- Multilevel metadata for all levels of data
  - Water quality and energy types (multi-agency)

- All environmental data (international)
- Archival of value added products

Question #5: New Products and Services

- Improved visualization tools that handle multiple data streams
    - Migrate to GIS
- Receive and incorporate user feedback; establish performance metrics and use those to upgrade data sets
- Maintain in-house expertise
- Satellite oceanographic products from NOAA and non-NOAA satellites
- Integrated products across all data centers
- Real-time data availability and data tracking
- Merged multi-sensor products
- Fully functional globally distributed but centrally access data source

Question #6: Other Issues – How NESDIS can coordinate a "central agency"

- Utilize cross-agency coordinator (OFCM)
- Advisory committees

APPENDIX V – POSTER INFORMATION

1) NOAA's new priorities for the 21st Century. (NESDIS) Presented by Dane Clark

The 21st century poses complex challenges for the National Oceanic and Atmospheric Administration (NOAA). Every aspect of NOAA's mission – ranging from managing coastal and marine resources to predicting changes in the Earth's environment – faces a new urgency, given intensifying national needs related to the economy, the environment, and public safety. NOAA has a new Strategic Plan to respond to these challenges. It forges a path for meeting the needs of America today and addressing the critical issues of tomorrow. One of NOAA's new priorities will be to build an Integrated Global Environmental Observation and Data Management System that will enhance NOAA's ability to protect lives and property, expand economic opportunities, understand climate variability, and promote healthy ecosystems. Since operational environmental satellites provide a wealth of environmental measurements, NOAA is very interested in hearing from national and international satellite data users -- specifically their requirements for new satellite products, data access, data archiving and other future needs.

2) Expanding E-Government. (NCDC) Presented by Pete Steurer

Starting in 1996 under the National Virtual Data Systems (NVDS) initiative, a dramatic shift toward online ordering of environmental data and products has occurred. Currently, 70% of all orders for NESDIS data are placed via the Web replacing the more traditional offline access to information via telephone, letter, e-mail, and fax. By 2005, it is estimated that 95% of all requests will be processed via the Web. It is anticipated that the preference for Web access will continue but not completely replace traditional person-to-person access.

2a) How Climate Data Are Used in Our National Economy. (NCDC) Presented by Pete Steurer

In today's high technological world it is vital for the NCDC to be "wired" to the world's weather and climate observing systems and to the users of climate data. Serving customers, Americans and international users from all walks of life, is a major source of pride among staff at NCDC. Access to weather and climate data is vital to many different sectors of the national and global economy. Some of the sectors that use weather and climate data for various research and development projects include: agriculture, finance, transportation, litigation and insurance, communication and manufacturing, public utilities, housing and natural hazards/mitigation.

2b) Investigating the Economic Value of NCDC Products to the Energy Industry. (NCDC) Presented by Todd A. Doehring, Steven T. Sonka, Sharon K. Bard, and Stanley T. Changnon (Centrec Consulting Corp.)

An extensive case study analysis was conducted of a major energy company. The analysis provides an extremely detailed report of the energy company's use of NCDC resources and the applications of those resources. The absence of such information would curtail the company's effective operations. Indeed, because of the existing regulatory needs, the energy company and similar firms would need to secure other means to obtain that information if it were not available from NESDIS. These resources are made available to the energy company through NCDC at a cost of slightly more than $5,000 per year. An exploratory economic analysis was conducted to provide estimates of the costs that would be required to

provide the information resources now provided by NESDIS. Using relationships based on the energy company's cost of data acquisition and the energy company's relative market share, a cost-benefit ratio of 495 was determined. (For every $1 that the energy company spends in acquiring data, they are receiving a potential benefit from not having to spend $495 to acquire that data on its own.) When extended to the entire industry, the potential benefits are approximately $65 million per year. For purposes of this study the definition of the energy industry relates only to electricity and natural gas providers and not the entire energy industry as broadly defined.

3) NESDIS Customers: Are They Satisfied? Preliminary Results from the Customer Satisfaction Survey. Presented by Tami Creech

A customer satisfaction survey was sent to users who requested data from the NESDIS Data Centers and the Office of Satellite Data Processing and Distribution in 2002. The survey asked users to rate their satisfaction on topics such as quality of product and service received, accessibility of data, and timeliness of response. The survey also asked users to identify the type of data received, the primary use of the product, as well as the benefit of the data to the user or user's company. Preliminary results indicate that a majority of users are satisfied or extremely satisfied with the products and services they received, while other users mentioned areas for improvement.

4) NCDC's New Web Site--Easier Access to Online Data and Products (NCDC) Presented by Vernell Woldu, Dave Anderson and Dave Smith

NCDC is in the process of revising its Web site, to provide for more user-friendly access to its many online datasets, products, publications, and Web pages. This poster provides a "sneak preview" of the planned new look and feel for the Web site, after several iterations by the NCDC Web design team. We will be soliciting user feedback, and appreciate any comments and suggestions you may have now and in the future.

5) Latest Developments on the Climate Reference Network. (NCDC) Presented by Sharon LeDuc

The U.S. Climate Reference Network (USCRN) is a network of climate stations now being developed as part of a National Oceanic and Atmospheric Administration (NOAA) initiative. Its primary goal is to provide long-term homogeneous observations of temperature and precipitation that can be coupled to long-term historical observations for the detection and attribution of present and future climate change. Data from the USCRN will be used in operational climate monitoring activities and for placing current climate anomalies into an historical perspective. The USCRN will also provide the United States with a reference network that meets the requirements of the Global Climate Observing System (GCOS). If fully implemented, the network will consist of about 300+ stations nationwide.

5a) Climate Monitoring Activities at NCDC. Presented by Dave Easterling

NCDC's Climate Monitoring Branch (CMB) monitors the U.S. and global climate on an ongoing basis to provide historical perspective on current and evolving climate conditions. Analyses are made available through monthly, seasonal and annual State of the Climate reports. The CMB is involved in national and

international climate programs to access weather and climate impact on economies and societies. The State of the Climate reports and other climate monitoring products are available at: http://www.ncdc.noaa.gov/oa/climate/research/monitoring.html

6) NEXRAD Radar Data Services at the National Climatic Data Center. (NCDC) Presented by Steve DelGreco

The National Climatic Data Center (NCDC) currently receives Weather Surveillance Radar – 1988 Doppler (WSR-88D) level II (base) data from 120 National Weather Service (NWS), 12 Federal Aviation Administration (FAA) and 26 Department of Defense (DOD) sites on 8mm tape or online. The NCDC robotic mass storage system warehouses approximately 900 terabytes of Level II data and grows annually at a rate of 60 terabytes a year (120 terabytes with offsite backup). Over the next several years, enhanced radar technologies, such as dual polarization, will be implemented; growth of the radar digital archive may increase by a factor of 26. The NCDC is partnering with the Radar Operations Center, the National Severe Storms Lab, the University of Oklahoma and Unidata on the Collaborative Radar Acquisition Field Test (CRAFT) project. CRAFT started as a grass roots effort to transmit level II data electronically, from 6 WSR-88D sites directly to the NCDC robotic mass storage system. To date, 59 of the 158 WSR-88D sites are transmitting Level II data in real time to NCDC. NCDC has truly become a "One Stop Shop" for WSR-88D radar users. Direct digital access to Level II radar inventories, data, and visualization software are available, at no cost to the user, via the NCDC radar resources Web page, (http://www.ncdc.noaa.gov/oa/radar/radarresources). Large data volume requests that previously took weeks to months to disseminate are accessible in minutes to hours. Plans for future user services include a Web interfaced browsing tool to visualize inventoried radar data and building radar climatologies based on specific weather phenomena.

7) Climate Database Modernization Program Access to Historical Data and Records. (NCDC) Presented by Tom Ross

NOAA's Climate Database Modernization Program (CDMP) has a very simple goal: to make major climate databases available via the World Wide Web. As the CDMP program matured the program grew to include tasks involving five NOAA line offices. The program also grew internationally with data modernization efforts underway in six African countries. The amount of images online in 1992 reached 36 million records totaling over three terabytes of data. Modernization efforts include the keying of observations; the imaging of original records whether on paper, microform, or photographs; the vectorizing of shorelines and the digitizing of analog records. The CDMP program supports over 40 different NOAA tasks. These range from imaging historical photographs of Alaskan glaciers, to keying weather observations from the Forts collection (1820-1895), making the Daily Weather Maps and Monthly Weather Review available via the World Wide Web, and to imaging Defense Meteorological Satellite Program (DMSP) film.

8) Remote Sensing Services and Applications. (NCDC) Presented by John Bates and Axel Graumann

NESDIS' National Climatic Data Center is expanding its activities in the scientific stewardship of satellite and radar data. Scientific stewardship will provide for the long-term care of these remote sensing data sets by helping satisfy user needs in the following areas: 1) providing enhanced near real-time monitoring

of observing system performance, 2) documenting Earth system variability and change on global, regional, and local scales, 3) providing, in collaboration with the user community, algorithms to ensure that the understanding of key climate processes can be derived from combined satellite, radar, and in situ observations, 4) optimizing data and information services to ensure that they are simple, straightforward, direct and responsive to users, and 5) enabling and facilitating future research.

9) NOAA Paleoclimatology: Your Source for Pre-Instrumental Climate Data. (NCDC) Presented by C. Mark Eakin and Mark McCaffrey

Paleoclimatology, the study of past climate variability using natural records, provides important long-term perspectives on the dynamics of the climate system. The Paleoclimatology Branch of the NOAA National Climatic Data Center (NCDC), located on the Department of Commerce's Boulder, Colorado, campus, provides NOAA, the nation, and the world with resources from the global paleoclimatological research community that extend the climate record far beyond the instrumental record. The systematic monitoring and tracking of weather and climate using instruments has been limited to the past 100-150 years. To extend that record, paleoclimatologists use natural "proxy" recorders such as tree rings, cores taken from corals and ice caps, sediments from lakes and oceans, pollen from plants, vegetation fossilized in packrat dung heaps, and many others, to provide data on the Earth's changing climate and environment. NOAA Paleoclimatology serves as a global clearinghouse for paleoclimatogical data and information. In addition to being the World Data Center for Paleoclimatology, the Paleoclimatology Branch supports several international efforts to study past, present and future climate change such as the World Climate Research Programme's project on Climate Variability (CLIVAR), the Earth System History Program at the National Science Foundation (ESH), and the International Geosphere-Biosphere Programme's project on Past Global Changes (PAGES). The Paleoclimatology Branch plans to continue to support the international research community, develop ways to support a "paleo perspective" on environmental literacy, and look for ways to more fully integrate the paleoenvironmental proxies with the modern instrumental record so that people around the world can gain a better understanding of climate changes and their human dimensions.

10) Cryospheric Data for Research and Monitoring. (NSIDC) Presented by Florence Fetterer et al.

The National Snow and Ice Data Center/World Data Center for Glaciology, Boulder (NSIDC/WDC) was established by NOAA as a national information and referral center in support of polar and cryospheric research. Scientific stewardship is central to this role: NSIDC maximizes the value of data for science by developing, documenting, preserving, and widely distributing digital and analog data sets; by conducting research; and through participation in national and international science planning and observation network coordination efforts. NSIDC is engaged in activities designed to improve our understanding of recent changes in the cryosphere. These changes include reductions in snow cover and glacier area, thawing permafrost, disintegration of Antarctic peninsula ice shelves, decline in sea ice extent and changes in the distribution of ice thickness. NSIDC's data products from operational satellites such as ice extent and albedo from the Defense Meteorological Satellite Program and NOAA polar orbiters help quantify these changes. Station data sets of long-term observations, such as snow depth and river freeze/break up dates from the former Soviet Union, put changes in a historical context. New products from instruments on-board NASA Earth Observing System satellites, such as snow cover from the Moderate Resolution Imaging Spectroradiometer, will allow NSIDC and other investigators to monitor snow and ice with improved resolution, frequency, and accuracy.

11) Exposing the U.S. Coastal Zone. (NGDC) Presented by David Divins, Dan Metzger, John Campagnoli, and Matt Kuhn

The Coastal Relief Model developed by the National Geophysical Data Center (NGDC) is an integration of land elevations from the USGS 3 arc-second Digital Elevation Model (DEM) combined with a co-registered 3 arc-second bathymetric model derived from National Ocean Service Hydrographic Data Base (NOSHDB) and multibeam bathymetry surveys, where available. This integration of coastal data represents not only the merger of elevations and depths, but also a merger of different cultures, conventions, datums, and measurement methods. Our intent is to initially develop a product accurate to the 3 arc-second, latitude-longitude grid and then improve and enhance it as data, technologies, and resources permit. The demand for such an integrated product, readily imported into graphics and GIS systems, is large and continues to grow, as those systems proliferate and become much more user friendly. We are providing user-friendly Coastal Data to match.

12) Data for Decision Makers. (NGDC) Presented by Susan McLean and Paula Dunbar

Land geophysics data from the National Geophysical Data Center include discipline areas of topography, natural hazards, geomagnetism, gravity, geothermal, and ecosystems. These data are used by scientists, researchers, civil engineers, and others for land use planning, hazards mitigation, resource exploration, navigation, and numerous other applications. Data products produced include CD-ROMs, posters, slide-sets, publications, and custom Web applications.

13) Enterprise GIS (NGDC) Presented by Ted Haberman, Geospatial Data Services Group

NESDIS manages one of the largest collections of environmental data in the world. The systems used to manage those data have developed over the years in response to specialized needs of data managers and users. This evolution has resulted in a number of "stovepipe" systems that make it difficult or impossible to share data. Geospatial databases and Geographic Information Systems are powerful tools for data sharing and integration. NESDIS is developing data management systems built using these tools and working with other NOAA line offices to build geospatial data foundations for all of NOAA.

14) Space Weather Data at NGDC. (NGDC) Presented by Dan Wilkinson, Helen Coffey, and Ray Conkright

NGDC's Solar-Terrestrial Physics Division archives, analyzes, and distributes space weather data of the environment from the Earth's upper atmosphere to the Sun. NGDC maintains the sole archive of space environment data collected on NOAA, GOES and DMSP satellites. Principal data sets are collected by satellites, used by NOAA's space weather forecast center and received from government and academic observatories and World Data Centers. The SPIDR system facilitates user online access, analysis and display of archival data. Analysis products include the assimilation, testing and evaluation of physical models driven by data in the archives.

15) Land Products from DMSP Data at NGDC. (NGDC) Presented by Chris Elvidge and Ed Erwin

NGDC archives all scientific data recorded on DMSP satellites since March 1992. The Operational Linescan System has the unique capability of routinely imaging visible and infrared emissions (and reflectance) during daytime and nighttime. Analysis of the nighttime lights yield both the location of, and changes in, cities, wildfires, gas flares, and the aurora. The intensity of the lights can be used to estimate a number of socio-economic parameters from population and economic vitality to carbon emissions and urban sprawl.

16) Digital Ice Climatology Data: A New Dataset for Arctic Climate Studies: Presented by: Kim Partington, Tom Flynn, Doug Lamb, Cheryl Bertoia, Kyle Dedrick and Selina Nauman (OSDPD)

Arctic sea ice plays a key role in the climate system, by acting as the interface between a warm ocean and a cold atmosphere in an area where models predict that surface air temperatures are likely to rise more than anywhere else as a result of CO_2-warming (Rind et al., 1995). Establishing the true pattern of behavior of the sea ice in this region over the past few decades is critical to simulating correctly the role of sea ice in models of future climate. Recently released operational ice charts from the U.S. National Ice Center provide significant insight into the late twentieth century behavior of northern hemisphere sea ice. Three modes of variability are observed from empirical orthogonal analysis of these ice charts covering the period 1972-94. These are shown to indicate: (a) the advective response of the sea ice to the North Atlantic Oscillation, (b) the response of the sea ice to freshwater inputs from the Bering Strait and Siberia and (c) the conditioning of summer sea ice coverage in the eastern Arctic by the North Atlantic Oscillation from the previous winter. Evidence is presented that there is an atmospheric response to the ice coverage anomalies, in particular through the generation of cyclones.

17) Satellite Products and Services of the NOAA/NESDIS Satellite Services Division for Support of Near Real-Time Environmental Applications. (OSDPD) Presented by Brian Hughes

The Satellite Services Division serves a diverse community of customers by providing real-time and near real-time access to high quality remote sensing environmental data, products, and services. The Division operates a system that provides real-time global geostationary and polar orbiting satellite data to users. The Division is made up of two branches, the Interactive Processing Branch (IPB) and the Satellite Analysis Branch (SAB). IPB produces automated real-time products from geostationary and polar orbiting environmental satellites to support global weather forecast models and the research community. SAB produces interpretive real-time and near real-time analyses of global geostationary and polar orbiting satellite data to support disaster mitigation and warning services for U.S. federal agencies and the international community.

18) Applications of NOAA MODIS Near Real Time Data (OSDPD) Presented by Gene Legg, (NOAA), Paul Haggerty and Kristina Sprietzer, Science and Technology Corporation

The NOAA/NESDIS MODIS Near Real Time system was designed under Computer Sciences Corporation's (CSC) Central Satellite Data Processing (CSDP) contract. The system processes data globally, with 10 product suites for the MODIS instrument data on both the TERRA and AQUA satellites.

This poster presents the highlights and applications of MODIS near real-time data such as monitoring smoke dispersion of forest fires, and the performance of a near real-time system in terms of data transfer and product generation.

19) NOAA Polar Instrument Data Processing for Level 1B Data Users (OSDPD) Presented by Emily D. Harrod and Arlington R. Morgan

National Oceanic and Atmospheric Administration's (NOAA) Information Processing Division(IPD) receives and formats its raw polar spacecraft instrument data into a user friendly level 1B format for distribution to the data user community. This poster display illustrates the NOAA Polar Instrument data processing system, the Quality Control monitoring and trending analysis system, and sample products such as Sea Surface Temperature, Vegetation Index, Soundings, Moisture Profiles, Ozone, Aerosol and Radiation Budget. The goal of IPD is to provide the polar data user community with timely, accurate, and complete information in the polar satellite level 1B data.

20) Ocean Climate. (NODC) Presented by Syd Levitus

The World Ocean Database 2001 (WOD01) CD-ROMs, containing observed and standard level profile, plankton and surface data, represent an update of the World Ocean Database products first released as World Ocean Atlas 1994 (WOA94), and followed by World Ocean Database 1998 (WOD98). WOD01 expands on WOD98 by including new variables and data types. During the past three years, the number of data sets received at NODC/WDC, Silver Spring (National Oceanographic Data Center / World Data Center for Oceanography, Silver Spring) has increased, from over 5 million to 7 million stations, as a result of projects such as the Intergovernmental Oceanographic Commission (IOC) / NODC Global Oceanographic Data Archaeology and Rescue project (GODAR), NODC Global Ocean Database project, IOC World Ocean Database project, Global Temperature-Salinity Profile Project (GTSPP), World Ocean Circulation Experiment (WOCE), Joint Global Ocean Flux Studies (JGOFS), Ocean Margin Experiment (OMEX), and many others. The World Ocean Atlas 2001 (WOA01) contains statistics and objectively analyzed fields for one-degree and five-degree squares generated from World Ocean Database 2001 observed and standard level flagged data. The ocean variables included in the atlas are: in-situ temperature, salinity, dissolved oxygen, apparent oxygen utilization, percent oxygen saturation, dissolved inorganic nutrients (phosphate, nitrate, and silicate), chlorophyll at standard depth levels, and plankton biomass integrated from 0 - 200 meters. The data and analyzed fields presented in WOD01 and WOA01 are critical for understanding changes in the distribution of these variables over the past decades and for initiation and validation of biogeochemical numerical models.

21) Sea Surface Temperature Climatologies. (NODC) Presented by Ken Casey and Ed Kearns

A new reprocessing of the Advanced Very High Resolution Radiometer (AVHRR) data stream developed by the University of Miami's Rosenstiel School of Marine and Atmospheric Science and the National Oceanographic Data Center is now available. This reprocessing uses an improved version of the Pathfinder algorithm and processing steps to produce twice-daily global sea surface temperature (SST) and related parameters back to 1985, at a resolution of approximately 4 km, the highest possible for a global AVHRR data set. Current key improvements over the original 9 km Pathfinder SST data set include a more accurate, consistent land mask, higher spatial resolution, and inclusion of sea ice information. Additional improvements including better flagging of aerosol-contaminated retrievals will

be implemented in future reprocessings of the satellite data. These improvements, example data and applications, and data access techniques will be presented.

22) Coral Reef Information System. (NODC) Presented by Anthony Picciolo

The National Oceanic and Atmospheric Administration's (NOAA) Coral Reef Information System (CoRIS) is the official NOAA system for managing access to its coral reef data and information. CoRIS is a Web-enabled, GIS-enhanced, state-of-the-art information system using a single Web portal to gain access to NOAA's coral reef data and information holdings, activities, and library services. CoRIS supports NOAA's contribution to the U.S. Coral Reef Task Force National Action Plan and provides a rich offering of search tools to aid in the discovery and interpretation of NOAA data and information on coral reef ecosystems and adjacent interrelated habitats and communities. For many years NOAA has conducted many coral reef - related activities that have deepened scientific knowledge about coral reefs and produced a broad array of data types and products. Data from projects such as coral reef mapping, biological diversity studies, population surveys, climate studies, coral reef monitoring programs, and coral reef bleaching forecasts are available through CoRIS. NOAA's continuing research and monitoring activities through the NOAA Coral Reef Program are producing new data and data products that also will be available on CoRIS.

23) Coastal Risk Atlas. (NCDDC) Presented by Russ Beard

U.S. natural disaster losses are estimated to be between $10 billion and $50 billion annually, much of which are a result of coastal storms. Communities that have undertaken hazard vulnerability assessments and implemented mitigation measures have experienced significant economic, environmental and quality of life benefits. The Coastal Risk Atlas (CRA) is a project developed by the National Coastal Data Development Center in collaboration with the NOAA Coastal Services Center. The CRA provides a methodology and access to required hazards data via the internet so that resource managers, emergency managers, and the public can assess their community's vulnerability to coastal storms. The location of critical facilities, infrastructure and sources of toxic release relative to high-risk storm surge, wind and flood areas are assessed. The distribution of vulnerable populations such as the elderly and poor, significant environmental resources, and the vulnerability of primary economic sectors are also included as issues in the assessment. Users have the option of viewing the data through an internet map server or downloading data for analysis using their own Geographical Information System (GIS) aided by analysis tools available through the CRA website. The effort was initiated for the Mississippi Gulf Coast as a pilot project and will expand to remaining areas of the Gulf Coast through the remainder of 2003.

24) Coastal Data for the Integrated Ocean Observing System. (NCDDC) Presented by Joe Stinus

Data that describes the interaction between land and sea along America's coasts are extremely diverse. Coastal data are collected, processed, and maintained by a variety of organizations located throughout the United States. These data sets exist in many different formats, have different levels of quality assurance and vary substantially in accessibility. The diverse and distributed nature of coastal data, together with the advent of Internet and computer technologies, has made the concept of a central coastal data repository impractical. Yet, the need for access to local data for regional, national, and global studies has increased as we have recognized that most coastal problems extend far beyond traditional natural and jurisdictional boundaries. To meet these challenges and take advantage of new information technologies,

the National Coastal Data Development Center (NCDDC) employs a "gateway" concept to provide access to coastal data that can be transmitted over the Internet. A "gateway" is a software link between the data provider's server and the NCDDC coastal data "portal." Data consumers, employing the NCDDC web portal and gateways can quickly bring together many types of data, from many sources, to answer specific questions. One example of this technology in action can be found in the Integrated Ocean Observing System (IOOS) Gulf of Mexico node. Within the scope of this project, Gulf of Mexico coastal oceanographic data have been “backbone enabled” to provide single point access to historical and real-time buoy data from several different networks, along with Gulf-wide biological data. This example shows how ready access to the coastal data network will support decision-making policy, analysis of long-term change, post-event assessment, monitoring, and prediction of coastal phenomena.

APPENDIX VI – WORKSHOP COMMITTEE

DOC/NOAA/NESDIS

Sam McCown, Chair	National Climatic Data Center
Alfreda Carter	Office of Satellite Data Processing and Distribution
Dave Clark	National Geophysical Data Center
James Gurka	Office of Systems Development
Dan Herlihy	National Geophysical Data Center
Pat Kirk	National Oceanographic Data Center
Kathy Martin	National Geophysical Data Center
Mark McCaffrey	National Climatic Data Center
Selina Nauman	Office of Satellite Data Processing and Distribution
Tom Ross	National Climatic Data Center
Peter Steurer	National Climatic Data Center
Robin Warnken	National Geophysical Data Center
Vernell Woldu	National Climatic Data Center

DOC/NIST

Wendy McBride	National Institute of Standards and Technology

NESDIS Support

Dick Reynolds	Short & Associates, Inc.
Steve Short	Short & Associates, Inc.
Pete Topoly	Short & Associates, Inc.

APPENDIX VII – GLOSSARY WITH INTERNET ADDRESSES

AVHRR Advanced Very High Resolution Radiometer
http://www.ngdc.noaa.gov/seg/globsys/avhrr.shtml

AMS American Meteorological Society
http://www.ametsoc.org/

CDMP Climate Database Modernization Program
http://lwf.ncdc.noaa.gov/oa/climate/cdmp/cdmp.html

CLASS Comprehensive Large Array-data Stewardship System
http://www.eis.noaa.gov/eis_workshop/CLASS.html

CLIVAR Climate Variability project
http://www.clivar.org/

CMB Climate Monitoring Branch
http://www.bbsr.edu/rpi/meetpart/2001/oct01/jlawrimore/

CoRIS Coral Reef Information System
http://www.coris.noaa.gov/

COTS Commercial Off-the-Shelf Software

CRA Coastal Risk Atlas
http://www.ncddc.noaa.gov/cra

CRAFT Collaborative Radar Acquisition Field Test
http://www.caps.ou.edu/CAPS/craft.html

CWSA Commercial Weather Services Association
http://www.weatherindustry.org/

DEM Digital Elevation Model
http://pubs.usgs.gov/of/of00-503/reports/Metadata/ngdcmeta.html

DMSP Defense Meteorological Satellite Program
http://dmsp.ngdc.noaa.gov/html/redirect.html

DOC Department of Commerce
http://www.doc.gov

ESRI Environmental Systems Research Institute
http://www.esri.com/

GCOS Global Climate Observing System
http://www.wmo.ch/web/gcos/gcoshome.html

GIS Geographic Information System

IOC	Intergovernmental Oceanographic Commission http://ioc.unesco.org/iocweb/
IOOS	Integrated Ocean Observing System http://www.bom.gov.au/bmrc/ocean/GODAE/Symposium/Harrison.ppt
ITIC	International Tsunami Information Center http://www.shoa.cl/oceano/itic/frontpage.html
NCAR	National Center for Atmospheric Research http://www.ncar.ucar.edu/ncar/
NCDDC	National Coastal Data Development Center http://www.ncddc.noaa.gov/
NCDC	National Climatic Data Center http://www.ncdc.noaa.gov/oa/ncdc.html
NESDIS	National Environmental Satellite, Data, and Information Service http://www.nesdis.noaa.gov/
NGDC	National Geophysical Data Center http://www.ngdc.noaa.gov/
NOAA	National Oceanic and Atmospheric Administration http://www.noaa.gov/
NODC	National Oceanographic Data Center http://www.nodc.noaa.gov/
NOSHDB	National Ocean Service Hydrographic Data Base http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html
NSIDC	National Snow and Ice Data Center http://nsidc.org/
NVDS	National Virtual Data System http://www.nvds.noaa.gov/
NWS	National Weather Service http://www.nws.noaa.gov/
ONJSC	Office of the New Jersey State Climatologist http://climate.rutgers.edu/stateclim
OSDPD	Office of Satellite Data Processing and Distribution http://www.osdpd.noaa.gov/
PAGES	Past Global Changes http://www.pages.unibe.ch/

PMEL Pacific Marine Environmental Laboratory
http://www.pmel.noaa.gov/

RCC Regional Climate Center
http://www.ncdc.noaa.gov/oa/climate/regionalclimatecenters.html

SST Sea Surface Temperature
http://www.emc.ncep.noaa.gov/research/cmb/sst_analysis/

UNESCO United Nations Educational, Scientific, and Cultural Organization
http://www.unesco.org/

USCRN U.S. Climate Reference Network
http://www.ncdc.noaa.gov/oa/climate/uscrn/

WOD World Ocean Database
http://www.nodc.noaa.gov/OC5/indprod.html