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EARTH SYSTEM MONITOR

A guide to NOAA's data and information services

INSIDE

U.S. Department of Commerce
National Oceanic and Atmospheric Administration

Integrated Ocean Observing System – New Program at NOAA

Zdenka Willis, Director for the Integrated Ocean Observing System, and Timi Vann, Strategic Planning and Communications

▲ Zdenka S. Willis

> The U.S. Integrated Ocean Observing System (IOOS) is a coordinated network of people and technology that work together to generate and disseminate continuous data on our coastal waters, Great Lakes, and oceans. IOOS is our Nation's ocean contribution to an international effort called the Global Earth Observation System of Systems (GEOSS), which is designed to continuously and comprehensively monitor Earth and transmit observations globally. IOOS supports both a coastal and global component of ocean observing.

Having information about our environment is key to sustaining our planet, our way of life, and future generations. In 1990, 23 percent (or 1.2 billion people) of the world's population lived both within a 100 kilometer distance and 100 meter elevation of the coast, at densities about three times higher than the global average.[1] By 2010, 20 out of 30 megacities will be along the coast with many low-lying locations threatened by sea-level rise.[2] Coastal storms account for over 70 percent of recent U.S. disaster losses annually. Twenty five percent of Earth's biological productivity and an estimated 80 to 90 percent of global commercial fish catch is concentrated in coastal zones. Enhanced observations and data integration will improve our early warning and forecasting abilities, allowing our coastal communities to better prepare and respond to potential danger.

The Integrated Ocean Observing System (IOOS) is important to these efforts because it will provide integrated environmental and climatological information about coastal and ocean ecosystems, which is critical for the safety of future populations and for sustaining the environment. Integrating observations and services will expand information for people, communities, states, nations, and global populations as public health, global commerce, and environmental conditions are better understood. Greater access to data and services is a significant contribution to future accomplishments.

NOAA has been involved with the United States IOOS since its inception, and in order to take IOOS to the next step, VADM Conrad C. Lautenbacher, Under Secretary of Commerce for Oceans and Atmosphere and Administrator of NOAA, has established a new NOAA IOOS Program within NOAA. NOAA recognizes the importance of having an infrastructure in place to characterize, understand, predict, and monitor changes in coastal-ocean environments and ecosystems, helping states and regions manage resources more efficiently and effectively. This infrastructure is also critical to understanding and mitigating the effects of severe weather, global-to-regional climate variability, and natural hazards. NOAA's IOOS Program will build on the vast planning and capacity that has been established so an initial operational capability for IOOS can begin.

Jack Dunnigan, Assistant Administrator for the NOAA National Ocean Service (NOS), will lead NOAA's effort to deploy IOOS. Zdenka Willis, Director of the National Oceanographic Data Center (NODC), became the Director for the Integrated Ocean Observing System (IOOS) on February 18, 2007. Ms. Willis has stepped down as the Director of NODC. The NOAA IOOS Program resides within NOAA's NOS Assistant Administrator's office. NOAA is in the process of proposing that this program become a new office within NOS, but this requires the Department of Commerce's (DOC's) approval.

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Letter from the Acting Director Terrance Tielking

After reporting to the National Oceanographic Data Center (NODC) in September 2006 as the Deputy Director, I currently find myself temporarily assigned to the position of Acting Director. The former Director, Zdenka Willis, has stepped down from NODC to assume new duties as the Director for the United States Integrated Ocean Observing System (IOOS) Program. Her experience as the Director of NODC provides her the background required in data and program management to tackle the challenges associated with the IOOS Program. The NODC organization wishes her the best and plans to work closely with her in her new capacity as the Director of the IOOS Program.

▲ Terrance Tielking

As for my background, I reported to NODC from the Staff of the Oceanographer of the Navy (Chief of Naval Operations [N84]) where I was the Joint Meteorology and Oceanography (METOC) Integration Officer. I identified and initiated actions to integrate Department of Defense (DoD), international, and interagency efforts involving sensors, environmental models, and decision support systems. I am truly honored to be given the opportunity to lead NODC, even if only for a short time, through what I think are some of the most challenging times for the organization. As limited resources continue to impact the future of NODC, we must forge new partnerships and rejuvenate old partnerships with other Federal agencies, academia, industry, and international organizations to leverage efforts and techniques in data management.

In the short time I have been here, I have gained an appreciation for the amount of work required to quality control and archive the data to provide satisfactory data stewardship and maintain updated oceanographic databases. As scientists continue to conduct climatic analyses and ecosystem assessments, critical time-series records of all types of environmental data are required to provide the most accurate results that can be integrated into products for the public and decision makers.

The focus of this issue of the *Earth System Monitor (ESM)* is the United States IOOS Program including the establishment of a new IOOS organization, the near- term objectives, and the program plans for the future. The importance of the IOOS Program to NOAA, the United States, and the world cannot be over emphasized, as it will provide integrated environmental and climatological information about coastal and ocean ecosystems that is critical for future population safety and the successful sustainment of the environment. Integrating all the IOOS observations will not be an easy task, but it is required for analyses that will generate the products necessary for decision making.

I welcome any feedback on this *ESM* issue or any of the previous issues. The intent of the *ESM* is to share NOAA Earth science and environmental program information with our colleagues and the public. ■

Cheers,
Terry

EARTH SYSTEM MONITOR

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(*New Program continued from page 1*)

The NOAA IOOS Program will coordinate the NOAA plan with other Federal agencies and regional partners. A large-scale enterprise such as this requires careful preparation across the entire agency for each component of the plan. In addition, the operational complexity demands a high-level management perspective within the agency. The new NOAA IOOS Program will improve IOOS because it will enable a focused communication path with participants and supporters of IOOS. Timely solutions to concerns will have direct impact on the program during the initial and sustaining phases of IOOS.

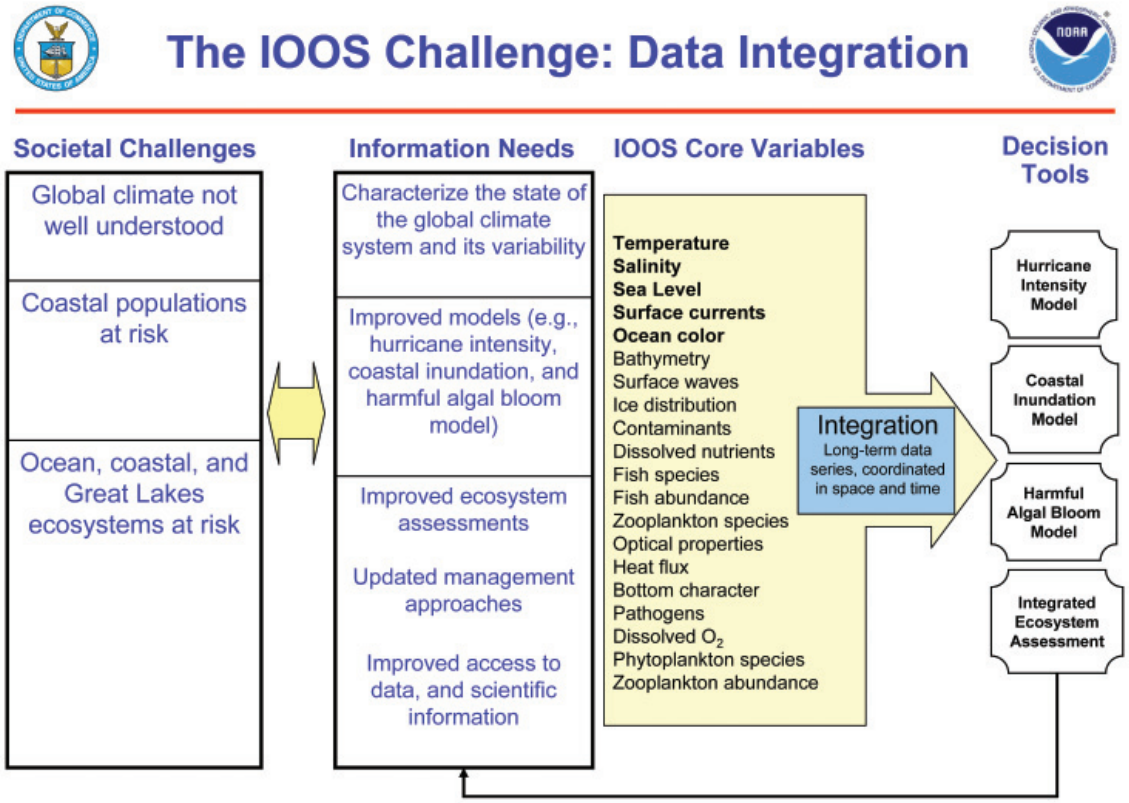
Conceptually, anyone interested in ocean observing or using ocean observations is a part of IOOS. Structurally, members include Federal agencies, state agencies, academic institutions, regional associations, trade associations, professional societies, business interests, public interest groups, and interested individuals. The IOOS model is assembling observations from diverse sponsors, thereby insuring innovation from independent perspectives and yet establishing a foundation for all the diverse components to share data.

Why is IOOS important to the United States? Due to population growth along U.S. coasts, as well as the strong connection of coastal communities to the national economy through maritime commerce and tourism and the environmental and climatological importance of coastal and ocean ecosystems, the physical and ecological states of these communities have disproportional effects on the safety and well being of human populations.[3] The indirect impacts of disruptions in these areas due to natural hazards, for example, can be far-reaching if infrastructure and services, such as ports, oil refineries, wastewater treatment facilities, agriculture, and power plants, are disrupted or disabled.

The figure identifies the problems and needs that NOAA's IOOS Program will address. NOAA must join other Federal and non-Federal partners to implement a comprehensive plan for IOOS. The NOAA IOOS Program will initially concentrate on delivering five of the twenty core variables listed in the figure. These variables are derived from the IOOS Development Plan, published by Ocean.US, and represent a collective effort across interagency partners to determine the top twenty variables that are most important to integrate. The NOAA IOOS Program will concentrate on five variables—Temperature, Salinity, Sea Level, Surface Currents, and Ocean Color—from this plan. The NOAA IOOS Program has proposed a functional model for the first year to understand, integrate, and answer the critical questions asked by the Nation, states, and communities. Initially, this new office will focus on four theme areas—Hurricane Intensity Model, Coastal Inundation Model, Harmful Algal Bloom Model, and Integrated Ecosystem Assessment.

The NOAA IOOS Program has set a 12-month goal to create the framework necessary to integrate these five core IOOS variables for routine access and use. The 18-month goal is to place these integrated variables into four specific theme areas—Hurricane Intensity Model, Coastal Inundation Model,

(*continued on page 4*)



▲ NOAA IOOS will start to address the problems above.

(*New Program continued from page 3*)
Harmful Algal Bloom Model, and Integrated Ecosystem Assessment. The 24-month goal is to test and evaluate these products, and by 36 months, the benchmarked products will be improved for operational use. Establishing the IOOS Initial Operating Capability for the Data Integration Framework will require extensive work and coordination within NOAA and among our partners in the United States oceanographic community and across the globe, ensuring compatibility within newly established infrastructures, such as the Global Ocean Observing System (GOOS).

At the National level, the U.S. IOOS is a coordinated network of people, organizations, and technology that generate and disseminate continuous data about our coastal waters, Great Lakes, and oceans. U.S. IOOS is our Nation's ocean contribution to the Global Earth Observation Systems of Systems (GEOSS) effort because U.S. IOOS supports domestic and global observations. The power of IOOS is synergy. By working together to integrate data to provide a broad, detailed, and synoptic view of our coastal, Great Lakes, and ocean environments, IOOS increases knowledge and enables better and smarter coastal- and ocean-related management decisions. This coordinated data network will allow the scientist, farmer, teacher, emergency responder, environmental resource manager, and many others rapid access to comprehensive information on demand and in formats that are useful for making everyday decisions and improving our overall quality of life. By creating the NOAA IOOS Program, NOAA will work with our Federal and non-Federal partners to ensure that all of this critical data is organized and accessible to the United States and the world. ■

[1] Small, C. and Nicholls, R.J. "A Global Analysis of Human Settlement, in Coastal Zones." *Journal of Coastal Research*, 19(3), p. 584-599 (2003).
[2] Nicholls, R.J. "Coastal Megacities and Climate Change." *Geojournal*, 37(3), p. 369-379 (1995).
[3] IGOS. "A Coastal Theme for the IGOS Partnership—For the Monitoring of Our Environment from Space and from Earth." IOC Information Document No. 1220. UNESCO, Paris, p. 60 (2006).

Implementing the Global Component

Mike Johnson, Chief, Climate Observation Division

The Climate Observation Division of NOAA's Climate Program Office will soon be co-located with NOAA's new IOOS Program, providing a mechanism for close coordination between the Climate and Ocean programs in NOAA. Later this year, these two offices will co-locate with the United States National Office for Integrated and Sustained Ocean Observations (Ocean.US), enhancing cooperation with NOAA and the other United States ocean agencies. These three groups will collaborate on program planning and implementation and promoting improvements to address other Federal agencies', academic researchers', and community users' needs.

The Climate Observation Division's mission is to build and sustain a global climate observing system that will respond to the long-term observational requirements of the operational forecast centers, international research programs, and major scientific assessments. The focus of the Division is on integrating global *in situ* ocean data into the climate observing system. This data includes long-term trends in sea level change; ocean carbon sources and sinks; the ocean's storage and global transport of heat and fresh water; and the ocean-atmosphere exchange of heat and fresh water.

Across the United States, the Climate Observation Division works with 19 centers of expertise—NOAA laboratories, centers, cooperative institutes, and university partners—that deploy instruments and collect global ocean data. This effort represents the major U.S. *in situ* contribution to the global component of IOOS and the Global Ocean Observing System (GOOS). GOOS depends on both satellite and *in situ* platforms, such as moored and drifting data buoys, tide gauge stations, profiling floats and gliders, and bottom-mounted and ship-based systems, together with the essential data and modeling systems needed for total system integration.

A global observing system by definition crosses international boundaries with the potential for both benefits and responsibilities to be shared by many nations. The World Meteorological Organization (WMO) and the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) have established the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) to provide an intergovernmental framework for coordinating the global ocean system implementation. All of NOAA's *in situ* ocean contributions to the global observing system are managed in cooperation with JCOMM.

The roadmap that guides NOAA's implementation plan is the same roadmap that is being used by JCOMM. Although designed especially to meet climate requirements, the initial system also supports weather prediction, global and coastal ocean prediction, marine transportation, marine hazard warnings, marine environmental and ecosystem monitoring, naval applications, and many other non-climate applications. NOAA presently operates nearly half of the globally distributed ocean networks. Based on the initial implementation targets from the roadmap used by JCOMM, the international effort has now reached about 57 percent of what will ultimately be needed to complete the sustained GOOS for climate. ■

NODC's Role as an IOOS Archive Center

Steven Rutz, Oceanographer

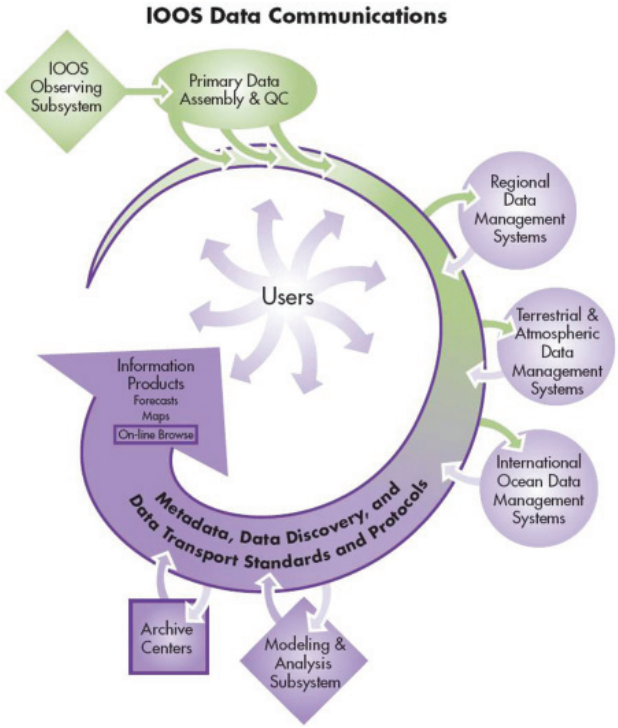
The Integrated Ocean Observing System (IOOS) is evolving from a series of disconnected data management subsystems to a network where users can access data and data products from various nodes. One primary node on this network, described in the Data Management and Communications Plan for Research and Operational Integrated Ocean Observing Systems, also known as the IOOS DMAC Plan, is the Archive Center. Archive Centers are places where IOOS will store and disseminate important, irreplaceable data and data products for the long term (see the figure below). Following the recommendations in the IOOS DMAC Plan for the Archive Centers, the National Oceanographic Data Center (NODC) implemented several applications including the Ocean Archive System (OAS), the Metadata Enterprise Resource Management Aid (MERMAid), and the Open-source Project for a Network Data Access Protocol (OPeNDAP).

OAS allows NODC to accession, archive, and disseminate datasets in a web-enabled, browser-based environment. NODC manages over 30,000 unique datasets with OAS. NODC is providing a rigorous archive service to ensure that irreplaceable datasets will be available in the future. This service is compliant with the Open Archival Information System, allowing the information to be easily stored among a wide range of storing systems.

MERMAid allows IOOS and other data providers to author and organize metadata records that are compliant with the IOOS DMAC Plan recommended by the Federal Geographic Data Committee (FGDC) metadata standard. Complying with this comprehensive standard can be cumbersome for data providers, however MERMAid allows data providers to easily generate and organize FGDC metadata standard in a web-enabled, browser-based environment. Data providers can then export and include these FGDC metadata records with their archival data. This saves time and effort and tracks the identity of each dataset in the system for data providers.

The IOOS DMAC Plan recommends OPeNDAP, a set of rules that governs the transfer of data between computers on the Internet. NODC is disseminating with OPeNDAP data from several ocean observing systems, including data from the National Marine Sanctuary Program's West Coast Observing System, the Global Ocean Data Assimilation Experiment High-Resolution Sea Surface Temperature project, and the Argo project. These ocean observing systems will be components of the IOOS Observing Subsystem.

NODC has over forty years of data management experience, providing archival services to many large oceanographic projects. As IOOS evolves, NODC will evolve by continuing to improve its archiving, metadata authoring, and data transport applications to serve as an Archive Center in the IOOS data network. ■



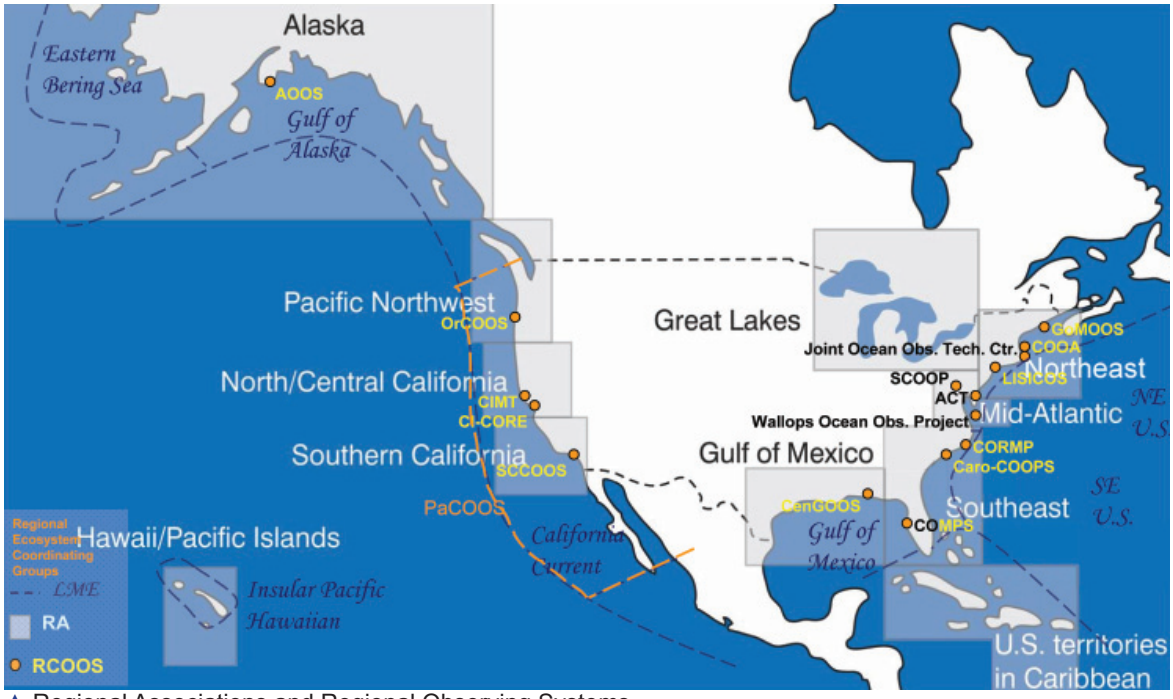
▲ This network diagram, from the IOOS DMAC Plan, shows the flow of data from the IOOS Observing Subsystem to information products.

IOOS DMAC Plan:
http://dmac.ocean.us/dacsc/imp_plan.jsp
Ocean Archive System:
http://www.nodc.noaa.gov/Archive/Search
MERMAid:
http://www.ncddc.noaa.gov/Metadata/tools
OPeNDAP:
http://opendap.org
National Marine Sanctuary Program's West Coast Observing System data via OPeNDAP:
http://data.nodc.noaa.gov/cgi-bin/nph-dods/nmsp/wcos
Global Ocean Data Assimilation Experiment High-Resolution Sea Surface Temperature data via OPeNDAP:
http://data.nodc.noaa.gov/cgi-bin/nph-dods/ghrsst
Archival Argo data via OPeNDAP:
http://data.nodc.noaa.gov/cgi-bin/nph-dods/argo/

Regional Observing Systems

Robin Jamail, NOAA IOOS Program Office Regional Association Liaison, and Geno Olmi, NOAA's Coastal Services Center

Within the layered IOOS framework, the recent Pew Commission report and the U.S. Ocean Commission report introduced the regional observing concept to merge ocean and coastal issues and activities such as climate change impacts, effects of natural hazards, and protecting and restoring healthy coastal ecosystems. From these reports, regionally designed and managed observing activities, such as researchers investigating coastal processes, have been developed. Common data exchange protocols assure compatibility while preserving innovation and regional sensitivity. The data may have different uses for other users, thus data sharing improves the interconnectivity within IOOS.



▲ Regional Associations and Regional Observing Systems.

Regional priorities, such as local water quality observations, are determined by a comprehensive effort to engage local and regional stakeholders, such as businesses, public interest groups, and government. This effort is being led by 11 IOOS Regional Associations (RAs) that address stakeholder needs for data and information products. The IOOS Development Plan distinguishes between those observing and data infrastructure components managed directly by Federal agencies to meet national priorities and those infrastructure components managed at the regional level, called Regional Coastal Ocean Observing Systems (RCOOS). These two levels of operation contribute to the unified operations of IOOS.

RCOOS are designed to complement the observing systems managed directly by Federal agencies. With RA guidance to understand regional priorities, RCOOS provide the types of data, information, and products needed to address the estuarine and coastal issues experienced by the different regions and to leverage the delivery and applicability of data collected by local data network nodes.

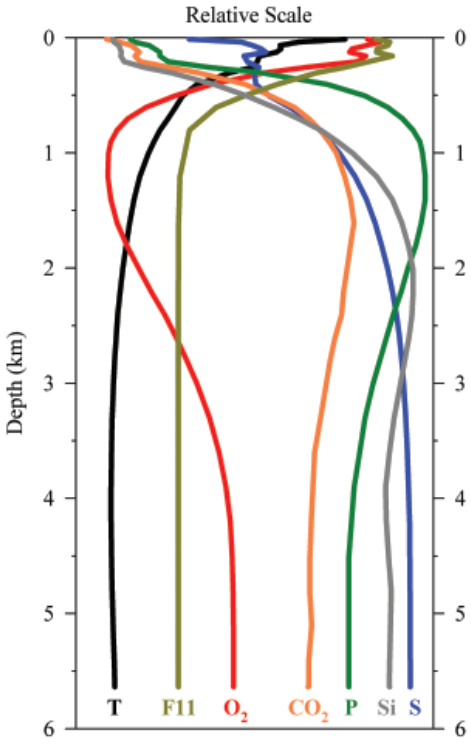
Since 2002, NOAA has been funding the Coastal Observation Technology System (COTS) projects to build regional infrastructure capacity. These Congressionally directed projects address a range of topics and approaches related to IOOS, including sensor technologies, coastal inundation, coastal ecosystem dynamics, harmful algal blooms, maritime navigation, sediment resources, fisheries, and the use of IOOS information in education. In addition, these projects have assumed a key role in developing standards and protocols for IOOS data management and sharing. NOAA has funded 17 projects, ranging from one to five years. These projects are at the center of the regional observing system capacity, which will build the comprehensive RCOOS. Regional connectivity blends together among the associations, the systems, and the community partners for a stronger IOOS Program. ■

For more information on RAs, RCOOS, and COTS, visit www.csc.noaa.gov/ras and www.csc.noaa.gov/cots.

News Briefs

World Ocean Atlas 2005

World Ocean Atlas 2005 (WOA05) consists of objectively analyzed, gridded fields (at a resolution of one degree) of



▲ Examples of Parameter Profiles.

some of the variables included in World Ocean Database 2005. When depth allows, the standard layers may extend to 33 layers between the sea surface and 5500 meters deep. WOA05 helps scientists, policymakers, the public, and others because it is a collection, from 1790 to the present, of global sources compiled into one resource that can be used directly or in models. This data is useful because it provides information such as the status of nutrients in the ocean for resource management and water temperatures for vacation planning.

Analyzed variables include temperature, salinity, oxygen, oxygen saturation, apparent oxygen utilization, phosphate, silicate, and nitrate for various climatological compositing periods. The time period is also set to standard intervals such as monthly, seasonally, or annually.

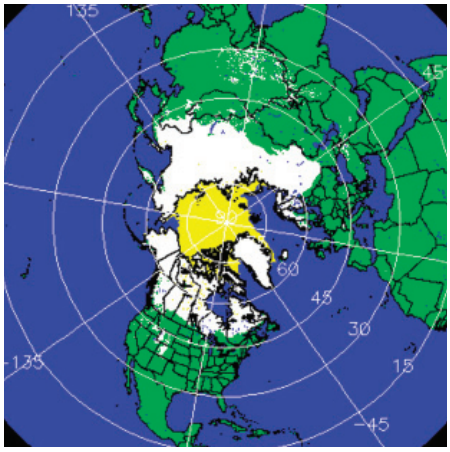
WOA05 also includes various statistics about unanalyzed data at standard depth levels; some of these statistics serve as input to objective analyses. These statistics include the number of observations, mean, standard deviation, and standard error of the mean. There are two levels of resolution, a high resolution at one degree spacing, for more detail, and a lower resolution at 5 degree spacing, for a more broad characterization.

For more information on WOA05, visit www.nodc.noaa.gov.

New Data Show Downward Trend in Arctic Sea Ice

During the past 33 years, the extent of Arctic Sea ice has steadily declined as demonstrated by a new comprehensive analysis of satellite data by experts at the U.S. National Ice Center, a tri-agency team from NOAA, the U.S. Navy, and U.S. Coast Guard. This new climatology dataset is a more useful and accurate tool, which can be applied to improve seasonal and climatological sea-ice-change forecast research in the Arctic.

The dataset, called the New 30-Year Arctic Sea Ice Climatology, is derived from a series of charts from 1972-2004 and provides a close representation of the sea ice extent derived from a combination of satellite observations, measuring instruments on the surface, and model output. This new dataset confirms an overall downward trend in total ice extent. Both winter (maximum) and summer (minimum) sea ice extents are decreasing, and summer shrinkage is more pronounced. The percentage of multiyear ice in the winter is also decreasing significantly.



▲ View of Northern Hemisphere daily snow and ice cover analysis.

For more information on this new dataset, visit http://nsidc.org/data/g02172.html.

First Dart Buoy Station Deployed in Indian Ocean

The launch of the first Deep-ocean Assessment and Reporting of Tsunamis (DART™) buoy station in the Indian Ocean in early December 2006 was an important achievement in the effort to protect the world from the threat of the deadly waves. Tsunamis are the result of a sudden displacement of massive amounts of seawater, usually caused by a large magnitude undersea earthquake, although underwater landslides and volcanic eruptions can also cause tsunamis. During the 2004 Boxing Day Tsunami event in Indonesia, the lack of real-time data made detection and warnings very difficult. The DART II buoy station brings important tsunami wave data to the region.

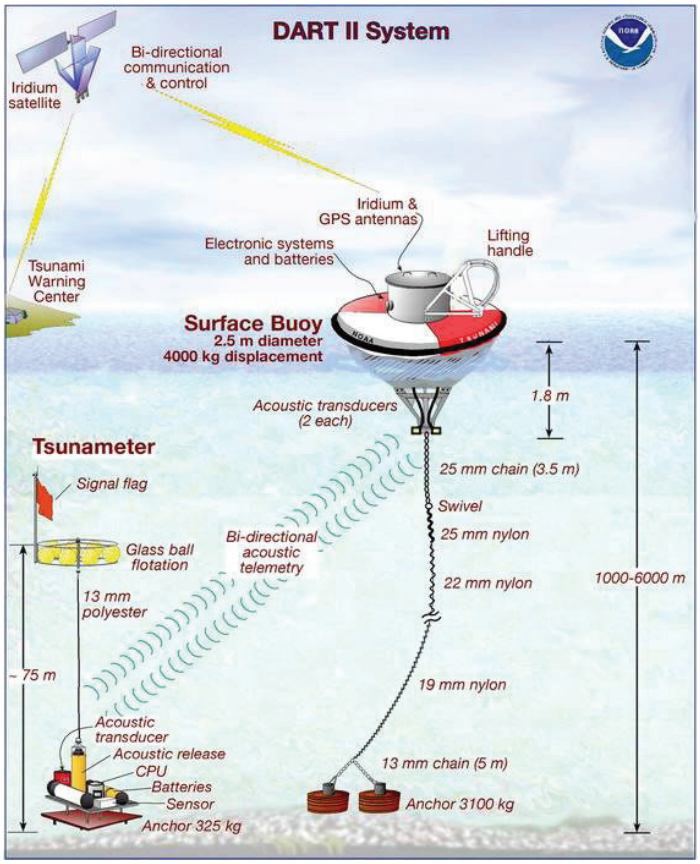
Coastal sea level (tide) gauges and DART stations located near potential source zones provide real-time data that helps scientists at NOAA and international tsunami warning centers determine whether a potentially destructive tsunami has been formed by an earthquake or other undersea event.

The DART system was developed by the NOAA Pacific Marine Environmental Laboratory in Seattle, WA. The stations consist of a bottom pressure sensor that is anchored to the seafloor and a companion moored surface buoy. An acoustic link transmits data from the bottom pressure sensor to the surface buoy. Then satellite links relay the data to ground stations, and any tsunami

detection is communicated to forecasters in real-time. At the time of the 2004 Boxing Day Tsunami, the United States had a network of six DART stations in the Pacific. That number has now increased to 19, and the geographic coverage has also been expanded to include the Atlantic, Gulf, and Caribbean.

The Indian Ocean DART was built by NOAA and donated by the United States, and Thailand is responsible for the deployment and long-term maintenance. President Bush recently announced that a second buoy will be donated by the United States and installed in the spring of 2007; Indonesia will operate and maintain it.

The selected deployment sites of the two NOAA buoys will provide most Indian Ocean countries with at least one hour of warning time. NOAA is also providing the region with technical leadership in building an end-to-end system by improving communications systems, establishing modeling and forecasting capabilities, building resilient communities, providing expertise in building regional and national operations centers, and training technical officials on various aspects of tsunami and multi-hazard warning operations. ■



▲ Moored DART II system.

For more information on DART, visit http://www.ndbc.noaa.gov/dart/dart.shtml.

Why is Good Data Management So Hard?

Donald W. Collins, Oceanographer

As books and other informational products became abundant, librarians began focusing on the requirements for organizing collections, maintaining and protecting collections, and providing access to their diverse holdings. Today, as many data and information collections are now digital, librarians, archivists, and data managers alike continue to develop standards and business practices to make information about collections, called metadata, consistent and manageable. Metadata are searchable descriptions of the data such as the types of instruments or analytical techniques used.

Some of the problems associated with data management include:

- Poor planning—It is considered a low priority at the beginning of a data collection project.
- Understaffing—Few staff resources are dedicated to developing good metadata.
- Beginning too late—Many wait too long to address metadata tasks.

Data management is an integral part of the observing and distributing process where basic Earth observations are turned into useful, useable data products and are ultimately used to enhance societal benefits. Data management can be considered "record keeping on a large scale," but it is often described as a "necessary evil." Good data management includes keeping good records, making secure copies, documenting content, and transmitting data and metadata effectively and efficiently. Each task in this process takes time and effort, but the resulting access to data and information is extremely valuable.

Creating and maintaining good, descriptive metadata is a very critical, but often overlooked, task for data managers. When creating metadata, data managers try to provide as much metadata to others as they would like others to provide to them.

Digital data and information collections present unique concerns about data integrity and longevity. At the National Oceanographic Data Center (NODC), as ocean data become more abundant, we must organize large data collections, maintain and protect the content of those collections, and provide access to diverse types of data. If we recognize the importance of data management and focus on the adequacy and accuracy of several types of metadata, long-term management strategies for data as bit-based digital files, and data stewardship tasks, we can provide fast, accurate, and reliable data to the public. ■

Library Services

Janice Beattie, Chief, Library and Information Services Division, and Doria Grimes, Chief, Contract Operations Branch and Technical Services

The NOAA Central Library, Camp Springs Library, and Regional Libraries, located in Miami, FL, and Seattle, WA, provide information and research support to NOAA staff and the public by maintaining the most comprehensive collections on atmospheric and marine sciences in the country and, in some instances, the world. The NOAA Central Library also networks with 27 other NOAA libraries across the Nation, ensuring the most comprehensive service. Disciplines supported include oceanography, ocean engineering, marine resources, ecosystems, coastal studies, atmospheric sciences, geodesy, geophysics, cartography, mathematics, and statistics.

The NOAA Central Library supports IOOS-related resources such as NOAA and other Federal agencies technical reports; the full-text journals dealing with ocean data, global environment, and remote sensing; citation databases such as Aquatic Sciences and Fisheries Abstracts (ASFA), JSTOR (The Scholarly Journal Archive), Meteorological and Geophysical Abstracts (MGA), and Web of Science; oceanographic, meteorological, or satellite-related bibliographies; and government documents, a legal collection, and legislative histories. Additional services include assistance with in-depth research on news, legal, business, and policy information and an interlibrary loan service to obtain articles and reports from other libraries. ■

For more information about the NOAA Central Library and its resources, visit www.lib.noaa.gov or contact the Reference Desk at 301-713-2600, ext. 124.

Ocean.US Office's Perspective on IOOS

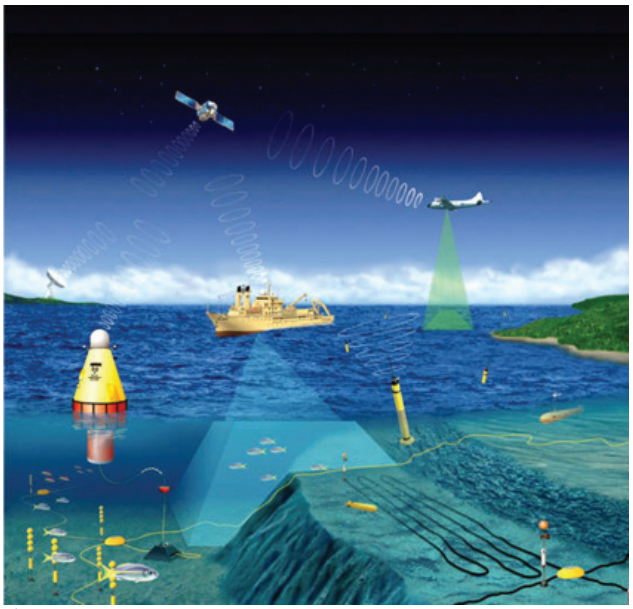
Mary Altalo, Executive Director, Ocean.US

The Federal Government has invested billions of dollars in observing and predicting the global and coastal ocean environment and associated atmospheric processes to produce the valuable warnings, watches, and regulatory policies in place today. The numerous ocean and coastal observing systems must be integrated to provide collaborative solutions to crosscutting societal needs. Emergencies and disasters in recent years have demonstrated the need for integrated, sustained information. Warnings are not always enough, and information on impacts and risks provide important alternative ways for the public to deal with weather warnings and events.

Using Federal coordination and partnership building, the Ocean.US Office serves as the national focal point for integrating ocean observing activities. The primary purpose of Ocean.US is to enhance broad user access to ocean knowledge, data, tools, and products. The goal of the interagency Ocean.US is to integrate existing and planned observing elements to establish an ocean observing system federation that will meet common research and operational agency needs in the following areas:

- Detecting and forecasting oceanic components of climate variability
- Facilitating safe and efficient marine operations
- Ensuring national security
- Managing resources for sustainable use
- Preserving and restoring healthy marine ecosystems
- Mitigating natural hazards
- Ensuring public health

Ocean.US, the National Office for Integrated and Sustained Ocean Observations, was established in 2000 by the Congressionally-created National Oceanographic Partnership Program (NOPP). Ocean.US is staffed through detailees and Intergovernmental Personnel Act assignments from several agencies, ensuring those agencies perspectives are included in the development efforts. Ocean.US has catalyzed the coordinated development of an Integrated Ocean Observing System (IOOS). IOOS is intended to bring together existing assets into one "system of systems" to give the Nation new capabilities, enabling a higher state of social and economic security and better stewardship of the environment. IOOS must be standardized, interoperable, functioning routinely with minimal delay, and have sustained funding to transfer information to the public. ■



▲ Ocean.US visualization of observing systems.

Links around the Globe Provide Environmental Data

Helen M. Wood, NOAA GEOSS Integration Manager and Senior Advisor

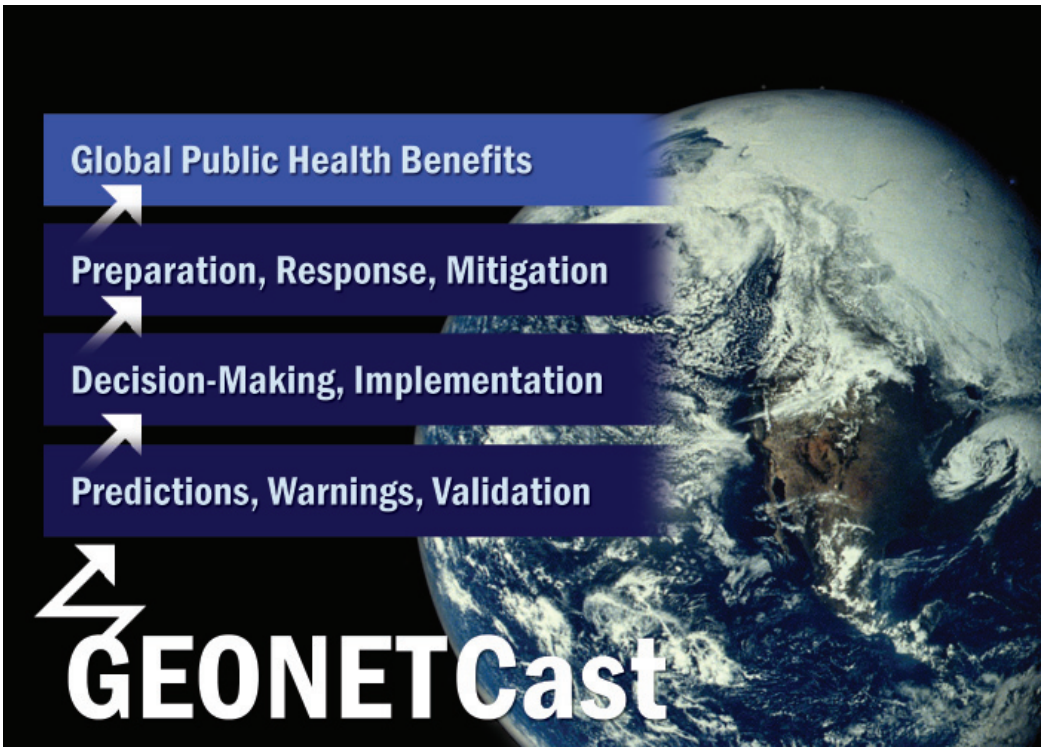
Imagine a world where outbreaks of diseases such as malaria and meningitis can be predicted in advance, stopping a potential epidemic. This would allow schools and villages in the developing world where people need to be vaccinated to be precisely identified, and inoculations would be given to stem the spread of disease. Likewise, decision makers require precise information about water quality and availability to alert the public if the quality is poor or if the quantity is exceptionally high (flood) or exceptionally low (drought).

These scenarios promise to more rapidly become a reality thanks to the efforts of 67 governments and 43 international organizations that now comprise the Group on Earth Observations (GEO). GEO, with its Secretariat located in Geneva, Switzerland, provides a framework for cooperation for the Global Earth Observation Systems of Systems (GEOSS). This "system of systems" builds upon existing national, regional, and international systems of Earth observations, integrating them, filling observational gaps, and ultimately supporting a broad range of societal benefits. These benefits include reducing the loss of life and property from tsunamis, earthquakes, wild fires, hurricanes, and other natural disasters; improved water resource and energy management; and an improved understanding of environmental factors significant to public health.

Due to a new GEOSS capability, called GEONETCast, essential environmental information can be at the fingertips of decision makers and others around the world that might not have ready-access to these data. Introduced at the GEO III plenary meeting in Bonn, Germany, last November, GEONETCast will become an interconnected global network of regional, broadcast satellite-based dissemination systems that link GEOSS data, products, and service providers with users around the globe. Each regional system will focus on supporting the needs of a specific sector of the world. For instance, the GEONETCast presentation in Bonn demonstrated how South Africa could receive precise data about vegetation activity across the country. This information is critical to food security and drought, wildland fire, and flood mitigation and can aid in monitoring both air and water quality.

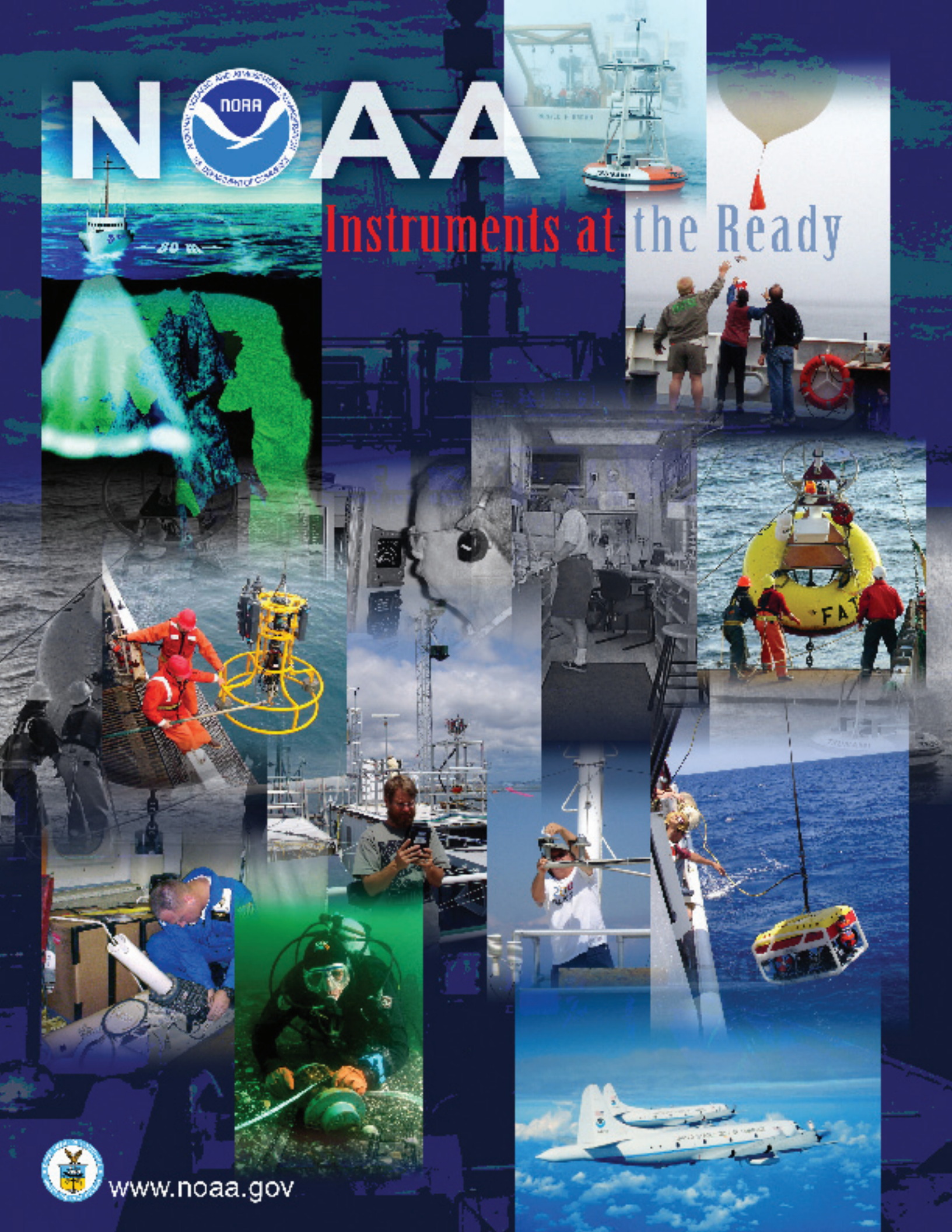
NOAA is developing, managing, and operating an initial GEONETCast capability, known as "GEONETCast Americas," within the Americas and adjacent ocean areas to improve timely access to Earth observation data, products, and services across the GEOSS-identified nine societal benefit areas—agriculture, weather, water, climate, energy, health, disaster, ecosystems, and biodiversity. The European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) has been using this capability to transmit meteorological information to users in Africa and beyond. GEONETCast Americas includes data and products from agencies involved in the U.S. GEO Subcommittee, such as the Environmental Protection Agency, NASA, Department of Energy, NOAA, and others.

By including underserved GEOSS societal benefit areas like ecology, biodiversity, and human health; permitting user needs to drive the data, products, and services provided; and using the most appropriate, cost-effective dissemination technologies, GEONETCast is a highly visible project that demonstrates the value of GEOSS and may serve as a launching pad for other GEO initiatives. ■



▲ GEONETCast is the data dissemination system; it does not create the products that would be disseminated via this system.

Page 11: Barbara Ambrose, Graphic Artist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Science On a Sphere® User Group Workshop

John McLaughlin, Education Program Specialist

NOAA's Office of Education held a workshop for the user's group of NOAA's Science On a Sphere (SOS)® system. The workshop, which took place in Baltimore, MD, on January 22 to 24, allowed institutions that have public displays of SOS and groups that work with the technology to discuss best practices and plans for advancing the SOS program. The 62 participants represented 24 different organizations, including informal science centers, Federal agencies, universities, and exhibit and visualization specialists.

The workshop included demonstrations at two exhibits that feature SOS. The first demonstration was at the Maryland Science Center, where the meeting was held, and the second demonstration was at the NASA Goddard Visitor's Center, the destination of the afternoon visit. The workshop generated some exciting ideas and substantial plans for advancing the SOS system and the content available for the system. ■

▲ Workshop participants discuss new content for Science On a Sphere®.

You can learn more about Science On a Sphere® by visiting www.sos.noaa.gov.

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