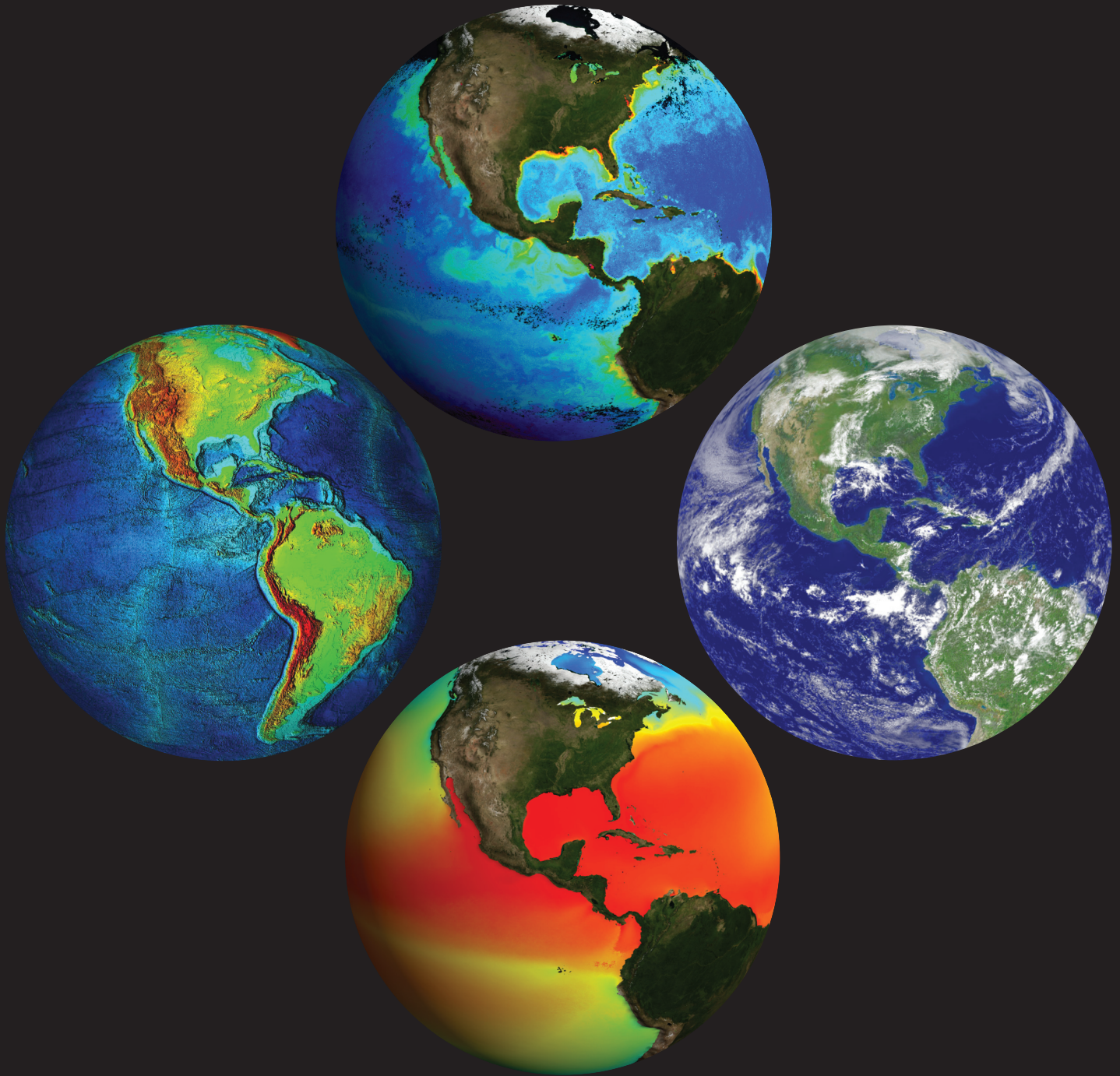


NOAA Satellite and Information Service
2008 Accomplishments Report



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



NOAA SATELLITE AND INFORMATION SERVICE

NOAA Satellite and Information Service's Mission is to deliver accurate, timely, and reliable satellite observations and integrated products and to provide long-term stewardship for global environmental data in support of the NOAA Mission.

ON THE WEB

To learn more about NOAA products and services, please visit the following links:

National Oceanic and Atmospheric Administration: www.noaa.gov

NOAA Satellite and Information Service: www.nesdis.noaa.gov

Data and Information: www.nesdis.noaa.gov/datainfo.html

Satellites: www.nesdis.noaa.gov/satellites.html

Education and Outreach: www.nesdis.noaa.gov/outreach_edu.html

Products: www.nesdis.noaa.gov/sat-products.html

Research: www.nesdis.noaa.gov/star/index.php

EEO and Diversity: www.nesdis.noaa.gov/About/Diversity/diversity.html

Library Services: www.lib.noaa.gov

Search and Rescue Beacon Registration: www.sarsat.noaa.gov

Front Cover Graphics:

Top center: Using data from the SeaWiFS satellite, NOAA scientists monitor ocean color and algal blooms.

Right center: Merging NOAA's geostationary and polar-orbiting satellite data provides global coverage of cloud cover.

Bottom center: The National Oceanographic Data Center generates ocean climatologies from the POES Pathfinder sea surface temperature data.

Left center: A product of the National Geophysical Data Center, showing land and undersea topography on the Earth.

Back Cover Graphic:

The nighttime lights of the World imagery depicts the lights from cities, fires, gas flares, and fishing boats, each in a separate color.

FROM THE ASSISTANT ADMINISTRATOR

Dear Colleagues and Friends:

NOAA Satellite and Information Service is dedicated to enhancing public safety, economic vitality, and environmental sustainability by gathering, processing, archiving, and distributing vast amounts of environmental data. These data are essential to everyone from research scientists to weather forecasters to the public. Through this mission, we touch the lives of millions of people every day. During fiscal year 2008, we continued this mission and made great strides in both U.S. and international Earth observations. Just a few of these highlights for 2008 include:



NOAA installed the last 9 of the 114 U.S. Climate Reference Network (USCRN) stations. These stations track temperature and precipitation trends across the Nation. NOAA's geostationary satellites relay the data from these ground-based stations to NOAA's National Climatic Data Center, which posts the observations online.

On June 20, 2008, the Ocean Surface Topography Mission (OSTM)/Jason-2 spacecraft was launched. This international effort is helping scientists monitor sea-level rise and predict short-term, severe weather events such as hurricanes and tropical storms. NOAA is now operating OSTM/Jason-2; this is the first time we are operating an international satellite.

New and existing partnerships with national and international organizations allowed NOAA to continue to bring critical data to our users. Using data from the Infrared Atmospheric Sounding Interferometer (IASI) aboard the European Metop-A satellite, NOAA developed the first operational greenhouse gas products from hyperspectral sounding. These products, which became operational in August 2008, will provide accurate mid-troposphere greenhouse gas concentrations well into the next decade and beyond. In April 2008, NOAA installed an antenna in Alaska to allow real-time Global Positioning System Radio Occultation (GPSRO) satellite data to be operationally downlinked from the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) satellites. The ground station support NOAA provides to the COSMIC program is a partnership with the National Aeronautics and Space Administration, who gave NOAA the antenna, the National Science Foundation, and the University Corporation for Atmospheric Research.

The strides we have made this year, and every year, were possible because of the dedication, drive, and outstanding service of NOAA Satellite and Information Service's employees and team members. We also appreciate the support and partnership of our constituents and international colleagues. I am proud to be part of this organization and am excited about the possibilities of the year ahead.

Mary E. Kicza
Assistant Administrator for Satellite and Information Services

Supporting the NOAA Mission

Preparing for Future Launches

NOAA Management Keeps Satellite Programs on Track

In fiscal year (FY) 2008, management teams from NOAA's Office of Systems Development (OSD) worked closely with contractors for the polar-orbiting NOAA-N Prime and geostationary GOES N-P series spacecraft to keep these complex programs on track. In particular, the N Prime team's oversight during environmental testing allowed this spacecraft to move into storage 29 days ahead of schedule. NOAA-N Prime is the final Polar-orbiting Operational Environmental Satellite (POES) and will bridge the gap to the next generation National Polar-orbiting Operational Environmental Satellite System. Polar-orbiting satellites are able to monitor the entire planet and provide data for long-range weather and climate forecasts while geostationary satellites provide the kind of continuous monitoring necessary for intensive data analysis by circling the Earth in a geosynchronous orbit.

In addition, the Geostationary Operational Environmental Satellite (GOES) program team completed and delivered the contractor-furnished GOES N-P series ground system, giving NOAA the capability to operate the new spacecraft. Geostationary satellites remain the weather sentinels for NOAA—tracking hurricanes, severe storms, and other severe weather. GOES-13, designated GOES-N before its launch in May 2006, is the first satellite of the GOES N-P series. Two anomalies occurred during the on-orbit check out of GOES-13. One anomaly was a failure of the X-Ray Sensor (XRS), and the second anomaly was damage to the Solar X-Ray Imager (SXI) as result of a large solar flare. The team completed the investigation of the two anomalies that occurred and implemented appropriate corrective action. GOES-13 presently serves



Photo by: Carleton Bailie

as NOAA's on-orbit spare spacecraft serving as a backup to the operational GOES-East and GOES-West.

NOAA Manifests Space Weather Instrument on Metop-3

On July 2, 2008, NOAA signed an agreement with the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) that allows NOAA to place a Space Environment Monitor (SEM) on the Metop-3 satellite. This SEM will ensure continuity of critical space weather data in the mid-morning orbit, starting in 2015. This agreement builds upon NOAA and EUMETSAT's cooperation in polar-orbiting satellites.

Space weather refers to conditions on the sun and in the solar wind that can influence the performance and reliability of space-borne and ground-based technologies and can endanger human life or health. Government and private sector organizations concerned with communications, satellite operations, electric power grids, human space flight, and navigation all use NOAA space weather information.

Climate Sensors Restored on Next Generation Polar-orbiting Environmental Satellites

In fiscal year (FY) 2008, the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Integrated Program Office (IPO) completed several key tasks toward the launch of the NPOESS Preparatory Project (NPP).

The Ozone Mapping and Profiler Suite (OMPS) successfully completed environmental testing in August and is preparing for shipment to be integrated with the NPP satellite. This sensor suite will protect the public by monitoring the depletion of ozone in the stratosphere, which can result in a number of negative health effects including an increase in skin cancer.

The IPO's Ground Systems Division (GSD) celebrated four key milestones on the path to supporting satellite launch and data processing. GSD successfully tested the ability of ground systems to communicate with the NPP spacecraft and to generate raw data records. They completed an upgrade to the satellite communications at McMurdo Base, Antarctica, in partnership with the National Science Foundation (NSF) ahead of schedule.



Illustration of the Metop satellite

Completing this upgrade early allowed operations to transition early after the NSF legacy system failed. Integrated Data Processing System (IDPS) hardware and software was installed at two locations in preparation for NPP. Finally, the very first ground-breaking for an international, non-polar NPOESS SafetyNet™ site occurred in Torrejon, Spain, as announced recently by the host National Institute for Aerospace Technology (INTA).

Finally, in 2008, the NPOESS IPO added two sensors to the program. The Total Solar Irradiance Sensor (TSIS) will be flown on the NPOESS C1 spacecraft slated for launch in 2013. TSIS measurements address long-term climate change, natural variability and enhanced climate prediction, and atmospheric ozone and UV-B radiation. These measurements are critical to studies of the Sun; its effect on our Earth system; and its influence on humankind. Additionally, the Clouds and the Earth's Radiant Energy System (CERES) instrument originally scheduled for a 2013 flight on NPOESS C1 has been accelerated to also fly in 2010 on NASA's NPOESS NPP mission. Scientists use CERES data to study the ways in which clouds affect the Earth's climate.

Acquisition and Operations Phase Begins for the Next Generation Geostationary Satellites

On January 4, 2008, the Under Secretary for Oceans and Atmosphere approved the next generation geostationary satellite series, called GOES-R, to proceed with the Acquisition and Operations phase. This key decision point, which signaled successful completion of the Program Definition and Risk Reduction phase, cleared the way for requests for proposals for both the spacecraft and ground segment contracts to be released to industry. This new generation of Geostationary Operational Environmental Satellites (GOES) will improve hurricane tracking and severe weather forecasts by scanning the Earth nearly five times faster than the current GOES.

Design and development also began on a new GOES-R instrument, the Geostationary Lightning Mapper (GLM). Lightning is the second highest storm-related killer in the United States and causes \$4 to \$5 billion in losses each year in the civilian sector. Lightning costs about \$2 billion annually in airline operating expenses and passenger delays and is a frequent cause of wildfires. Today's ground-based national lightning detection networks are designed to locate mostly cloud-to-ground lightning—a small fraction of the total lightning. The GLM instrument will detect lightning flashes, including the cloud-to-ground, cloud-to-ocean, and in-cloud lightning, occurring anytime and anywhere in the Western Hemisphere, and detect patterns in lightning flashes that are early indicators of severe thunderstorms and tornadoes.

Current Spacecraft

Critical Satellite Instrument Successfully Recovered

On May 22, 2008, a motor on the NOAA-18 Solar Backscatter Ultraviolet Spectral Radiometer (SBUV/2) instrument became stuck, rendering it unable to take measurements. After following the standard procedures, NOAA, the National Aeronautics and Space Administration (NASA), and contract engineers developed an innovative solution to perform a daily sequence of unique operations in an attempt to move the motor. On July 20, the effort ultimately freed the motor, and the instrument was able to continue collecting data. After a period of follow-up testing, normal daily operational ozone measurements and product processing resumed on July 29.

The SBUV instrument maps total ozone concentrations and the vertical distribution of ozone in the Earth's atmosphere on a global scale. Ozone is an important greenhouse gas in the lower atmosphere. These data are essential to scientists and forecasters, especially during the critical period for ozone monitoring, from late August through September.

NOAA Leads Effort to Produce U.S. Group on Earth Observations (USGEO) Strategic Assessment Group (SAG) Report

The Executive Office of the President through the National Science and Technology Council (NSTC) and the Committee for Environment and Natural Resources (CENR) commissioned the USGEO SAG to produce the first-ever Federal assessment of Earth observing requirements and capabilities to ensure cross agency consistency in evaluating and procuring Earth observing capacity. This report will provide the first real assessment of the Nation's capability and needs for Earth observation as a consolidated effort. NOAA led the effort as a Co-Chair and as Executive Secretariat.

One of the co-chairs of the USGEO SAG was the Program Manager of the Technology, Planning and Integration Program (TPIO) in the Office of System Development for NESDIS. TPIO produces investment analyses for the NOAA Observing Systems Council (NOSC). The NOSC and TPIO sustain one of the most mature process of defined requirements and analysis tools within the Federal government.

The TPIO staff led the planning and the execution of a government-wide two-day workshop to initiate the dialog between Federal agencies with similar Earth observing needs. They developed the process for completing the initial report and defined a more robust analytical framework for future analysis. The result was the first real cross-cutting assessment of requirements needed to successfully plan and execute future Earth observation investments.

Climate Change and Variability was chosen as the unifying theme for the USGEO SAG report as Earth observation priorities supporting climate also have many other benefits. This overarching theme will facilitate an assessment of the impact of Earth observations on preparing for and mitigating climate change.

Jason-2 Launched from Vandenberg Air Force Base

On June 20, 2008, the Ocean Surface Topography Mission (OSTM)/Jason-2 spacecraft launched from the Vandenberg Air Force Base (VAFB). OSTM/Jason-2 is an international effort between NOAA, the National Aeronautics and Space Administration (NASA), France's Centre National d'Etudes Spatiales (CNES), and the European Organisation for the Exploitation of Meteorological Satellites.

The OSTM/Jason-2 satellite monitors the rate of sea-level rise and helps measure ocean conditions that contribute to the strength of hurricanes. NOAA uses data from the OSTM/Jason-2 to extend a 15-year record from its predecessor missions TOPEX/Poseidon and Jason-1, which shows that sea level is rising at a rate of 3.4 millimeters per year—nearly twice as fast as the previous 100 years. If this rate of sea-level rise continues, it will have a large impact on coastal regions, causing more erosion and flooding. OSTM/Jason-2 will also be used to help scientists predict short-term, severe weather events such as hurricanes and tropical storms that are fueled by heat energy stored in the upper layer of the ocean.

NOAA is working with CNES to provide ground system support for OSTM/Jason-2. This function includes commanding all the satellite's maneuvers, downloading all the satellite's data, and distributing it to weather and climate forecasters, who are monitoring ocean-born storms and phenomena such as El Niño/La Niña and global sea-level rise. NOAA's National Oceanographic Data Center, using the Comprehensive Large Array-data Steward-

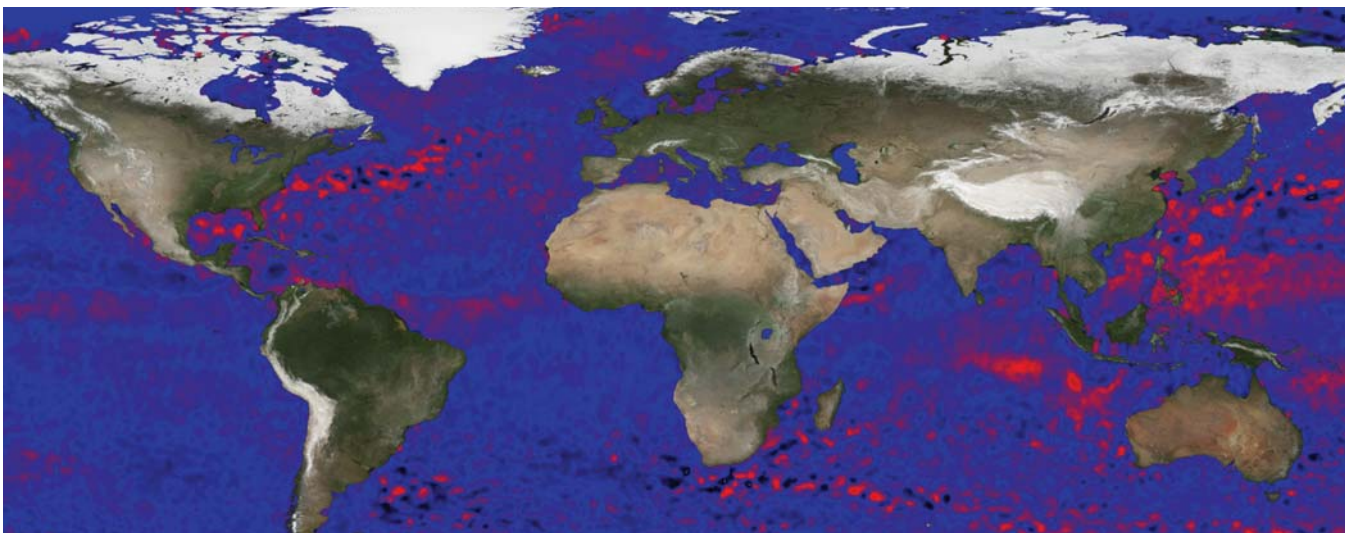
ship System (CLASS), provides long-term archive and data stewardship for the mission. OSTM/Jason-2 is the first international satellite to receive ground support at the NOAA Satellite Operations Facility in Suitland, Maryland.

10th Anniversary of the Transfer of Satellite Control Authority from the U.S. Air Force to NOAA

For the past 10 years, NOAA's Office of Satellite Operations (OSO) has operated the polar orbiting satellites in the Defense Meteorological Satellite Program (DMSP) under a May 1998 agreement between the U.S. Air Force and NOAA. NOAA also manages the processing and distribution of the data and images the satellites produce each day. The data from the DMSP satellites are received and used at operational centers continuously. Currently, data from four satellites (3 day/night, 1 dawn/dusk) are archived each day.

Having NOAA operate the DMSP satellite constellation has saved over \$120 million over the past 10 years for the American taxpayer. The savings have come primarily from personnel reductions by the Air Force.

The DMSP low, earth-orbiting satellites have provided the military with important environmental information. The DMSP satellites image environmental features such as clouds, bodies of water, snow, fire, and pollution in the visual and infrared spectra. Scanning radiometers record information, which can help determine cloud type and height, land and surface water temperatures, water cur-



Data from OSTM/Jason-2 helps scientists predict severe weather events that are fueled by heat energy stored in the upper layer of the ocean

rents, ocean surface features, ice, and snow. The data are communicated to ground-based terminals, where they are processed, interpreted by military and civil meteorologists, and ultimately used in planning and conducting U.S. military operations worldwide.

Supporting the COSMIC/GPSRO Satellite Program

Since April 2008, real-time Global Positioning System (GPS) Radio Occultation (GPSRO) satellite data have been operationally downlinked from the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) satellites by NOAA's ground stations in Fairbanks, Alaska; Wallops, Virginia; and Tromso, Norway, through agreement with the Norwegian Space Center. To receive these important data, NOAA installed a five meter LEO-T antenna in the Fairbanks Command and Data Acquisition (CDA) station in only two months in unfavorable weather conditions and modified an existing antenna at Wallops. The LEO-T antenna was a National Aeronautics and Space Administration (NASA) asset located in Puerto Rico, which had to be dismantled and shipped to Fairbanks.

The COSMIC GPSRO information is used for meteorological, climate, and space weather monitoring, research, and forecasting applications. The data has been used by NOAA and its international partners in operational nu-

merical weather prediction models since early 2007 and has enabled important measurable improvements in model forecast performance.

Electromagnetic signals transmitted from U.S. GPS satellites are received by the small, inexpensive, low-earth-orbiting COSMIC satellites. As the GPS signal passes through the Earth's atmosphere, it is distorted, and this distortion yields important information about atmospheric characteristics. This allows users to derive vertical profiles of temperature, pressure, moisture, and electron density through the troposphere, stratosphere, and ionosphere.

The ground station support NOAA provides to the COSMIC program is a cost-effective partnership with the National Science Foundation, the University Corporation for Atmospheric Research, and NASA.

Global Earth Observation System of Systems (GEOS) and International Cooperation NOAA GEONETCast Americas Effort Moves Forward

GEONETCast Americas, the NOAA-developed, Western Hemisphere broadcast of the global GEONETCast environmental data broadcast system, moved into its operational phase in April 2008. This low cost information delivery system will improve worldwide access to satellite and *in situ* data, products, and services through the use of communications satellites. With a real-time 24/7 data stream, GEONETCast Americas will provide information critical to a wide array of efforts, including disaster mitigation, high-impact weather forecasting, agriculture management, and professional training. NOAA has been instrumental in facilitating agreement and contributions from GEONETCast's many international partners. GEONETCast is part of a global effort of the intergovernmental Group on Earth Observations (GEO) to collect Earth observational data and distribute it to a variety of end users, including government agencies, private sector, decision makers, academia, and the public.

In fiscal year (FY) 2008, NOAA awarded the GEONETCast Americas commercial services contract to Intelsat General Corporation (IGEN). The contract with IGEN will provide continuous environmental data distribution for



A satellite antenna at the NOAA Satellite Operations Facility (NSOF)

much of North, Central, and South America and the Caribbean for one year, using Digital Video Broadcast-Satellite technology. NOAA staff configure and manage this system remotely from the NOAA Satellite Operations Facility (NSOF) in Suitland, Maryland. In addition, NOAA developed a web portal and interface for users and trusted data providers.



The move to operational status brings GEONETCast coverage to the Western Hemisphere and marks the beginning of the first-ever full-global broadcast of high-quality, standardized, Earth observation information. GEONETCast is already reaping dividends by identifying opportunities and new arenas for the sharing and dissemination of important environmental data. For example, joint initiatives such as the Hazard Mapping System, a fire monitor produced in cooperation by NOAA and CATHALAC (The Panamanian Water Center for the Humid Tropics of Latin America and the Caribbean), are now being broadcast over GEONETCast and other joint dissemination systems. This initiative is giving disaster management and public policy professionals in Central and South America important new prediction and planning tools.

Office of Management and Budget Recognizes Valuable NOAA Observing System Segment Architecture

Each year, the Office of Management and Budget (OMB) evaluates the Enterprise Architecture efforts of each Federal Agency. OMB considers the completeness, usefulness, and results of each architecture, measuring results in dollars saved. This year, the Department of Commerce (DOC) and OMB deemed the NOAA Observing System Architecture (NOSA) as the only mature architecture segment within DOC.

One of the co-chairs of the NOAA Observing System Council, which serves as the oversight to the NOSA segment, is NOAA's Assistant Administrator for Satellite and Information Services. The goal of the NOSC is to provide oversight to all NOAA observing systems activities and to develop investment recommendations for the NOSC to provide to senior NOAA leadership. The NESDIS Technical Planning and Integration Office (TPIO) is the support and analysis staff for the NOSC. While evaluating observing system alternatives on their cost, risk, and performance, the NOSC recommendations are designed to help NOAA leaders make sound observing system investment decisions that further NOAA's strategic objectives and provide the best "return on investment" to NOAA and the Nation. The TPIO team analyzes alternatives against requirements throughout the year, working with other NOAA organizations to understand their performance objectives.

The NOSA segment is key to meeting NOAA's performance outcomes and satisfying public expectations of NOAA and the Federal Government. Observations are fundamental to NOAA's mission to describe, understand, and predict the Earth's environment. As a result, NOAA has built a substantial infrastructure over its 37-year history that allows for the collection, analysis, and archiving of global ocean, atmospheric, space, biological, cryospheric, and land surface data. The NOSA segment not only supports the four NOAA Core Mission Area Segments, but it is also a key contributor to other Federal agencies such as the Federal Aviation Administration, U.S. Geological Service, and the Department of Defense. In addition, other nations around the globe depend on NOAA's observational capabilities to support their own environmental forecasts and warnings. NOAA also collaborates with other agencies and international organizations to build partnerships to share responsibilities and reduce costs.

Global Space-based Intercalibration System Infrastructure Developed

In fiscal year (FY) 2008, NOAA's Center for Satellite Applications and Research (STAR) made major advances to create the necessary infrastructure for the Global Space-based Intercalibration System (GSICS). STAR developed a new website that allows access to products, documentation, and program coordination information. In

addition, STAR created a system to intercalibrate sensors on geostationary and polar-orbiting platforms. This activity improves the use of space-based global observations for weather, climate, and marine ecosystem applications through intercalibration of the space component of the Global Earth Observation System of Systems (GEOSS).

GSICS is a new international initiative to ensure the comparability of satellite measurements provided at different times, by different instruments, under the responsibility of different satellite operators. Sponsored by the World Meteorological Organization and the Coordination Group for Meteorological Satellites, GSICS intercalibrates the instruments of the international constellation of operational polar-orbiting and geostationary environmental satellites and ties the data to common reference standards.

NESDIS Hosts 21st Meeting of the Strategic Implementation Team (SIT-21) of the Committee of Earth Observation Satellites (CEOS)

On April 23-24, 2008, NOAA's Assistant Administrator for Satellite and Information Services, as the SIT Chair, hosted SIT-21 at Woods Hole Oceanographic Institution (WHOI) in Woods Hole, Massachusetts, bringing together senior officials from 21 international space agencies and organizations. This meeting led to the first-ever concrete commitments from the representatives to take actions necessary to implement the Group on Earth Observation (GEO) 2007-2009 work plan. CEOS SIT identified 147 actions, each with a lead SIT agency. The actions are divided by societal benefit area—disasters, health, energy, climate, water, weather, ecosystems, agriculture, and biodiversity—and by cross-cutting themes of architecture, capacity building, and data management. Assistant Administrator Mary E. Kicza obtained commitments at SIT-21 from the lead agencies to complete the 62 high priority actions by the end of 2008.

The Committee on Earth Observation Satellites (CEOS) is dedicated to international collaboration among space systems and Earth observation missions. Comprised of 28 Member and 20 Associate agencies, CEOS is recognized as the major international forum for the coordination of Earth observation satellite programs and for the interaction of these programs with users of satellite data worldwide. The CEOS Strategic Implementation Team

(SIT) plays a central role in the coordination of existing and future missions of CEOS agencies and is responsible for coordinating the Committee's contributions to the GEO space segment of the Global Earth Observation System of Systems (GEOSS).

GEOSS will integrate all space-based, airborne, and *in situ* Earth observation systems worldwide, and provide scientists, government officials, and the public alike with access to a range and depth of environmental and climate data never before available. Space-based observation systems such as those organized by CEOS will play an instrumental role in the overall GEOSS structure.

Four Important International Agreements Signed with Ukraine, Norway, and India

On June 4, 2008, NOAA signed a Memorandum of Agreement for cooperation in Earth observation through the Global Earth Observation System of Systems (GEOSS) with the National Space Agency of Ukraine (NSAU). This marked the first agreement between NESDIS and an agency of the Ukrainian government. The NOAA-Ukraine partnership is geared toward mobilizing Ukraine's contribution to GEOSS and will cover monitoring for environmental degradation, as well as weather-related natural disasters such as flooding and drought. Ukraine also has a long history of producing high-quality *in situ* observation records and observation technologies that will be valuable to both NOAA and GEOSS.

In 2008, NOAA and the Norwegian Space Center amended a 2002 Implementing Agreement to allow NOAA to procure satellite ground support from ground stations on the Norwegian mainland and in Antarctica. This agreement is also the foundation for future expanded cooperation with Norway in satellite tracking and environmental data acquisition. The new Norwegian stations will add flexibility and redundancies to NOAA satellite control, and, through a more expansive ground network, NOAA will be able to obtain valuable satellite data more quickly, increasing the timeliness of weather forecasts.

In early 2008, NOAA signed two agreements with India pledging new cooperative action in Earth observation activities. In January, NOAA and the Indian Space Research Organization (ISRO) signed an Agreement for



Formal signing of the NOAA-Ukraine partnership

Cooperation in Earth Observation and Earth Sciences. This new Agreement reaffirms an organizational basis for bilateral cooperation and documents arrangements and understandings that enable the coordination of activities and programs in Earth observations, operations, and research. In April 2008, NOAA also signed a Memorandum of Understanding with India's Ministry of Earth Sciences (MoES) to facilitate scientific cooperation in "Earth Observations and Earth Sciences." This agreement allows the exchange of scientific resources, personnel, and technical knowledge between NOAA and MoES.

Data Access

Comprehensive Large Array-data Steward System Increases Volume and Improves Access

NOAA's Comprehensive Large Array-data Stewardship System (CLASS) is an online data management system that stores, archives, and provides access to environmental data. CLASS has served more than 35,000 users and delivered more than 25 million files since 2001. Users can search through and order 43 types of atmospheric, coastal, and ocean data products. In fiscal year (FY) 2008, CLASS increased its volume of data by approximately 37 percent, from 615 terabytes (TB) to 841 TB.

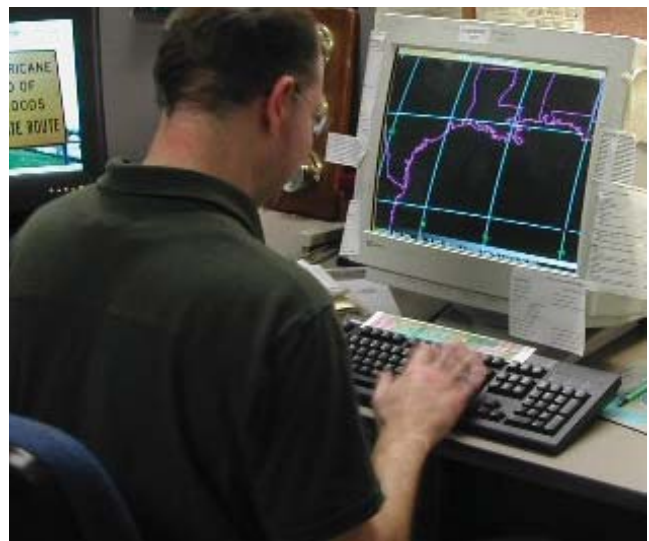
CLASS provides long-term secure storage for this information. In addition, the information technology (IT) features of CLASS provide weather forecasters with quick access to NOAA's archived data, allowing them to compare current and previous storms. CLASS also facili-

tates access to data that will help researchers track climate trends.

To continue this data stewardship effort, NOAA awarded a new CLASS contract in FY 2008 to the Diversified Global Partners Joint Venture, LLC. This organization will provide IT services for the planning, development, and maintenance of CLASS for several years.

In addition, NOAA's National Climatic Data Center and National Geophysical Data Center (NGDC) are expanding CLASS to receive data regularly from NOAA's polar-orbiting and geostationary satellites and the Defense Meteorological Satellite Program. In the future, CLASS will archive data from NOAA's ground-based observing systems, including data buoys and NEXRAD.

Also in FY 2008, a team from NOAA's NGDC developed and demonstrated a software programming interface and web portal called the Simple NOAA Archive Access Portal (SNAAP) that enables users to access diverse NOAA environmental datasets, including those in CLASS, from a single application. The public will now be able to access NOAA's archive holdings through a standard interface minimizing effort spent gathering the data and allowing for the development of custom clients and tools. The SNAAP system will allow for end developers to seamlessly make use of NOAA's vast historical archives thereby maximizing the return on the archive investment. SNAAP integrates different data systems while maintaining a clear functional separation between data archive and



A NOAA data user

access functions. This new tool provides improved web-services based archive access consistent with Global Earth Observation System of Systems (GEOSS) objectives.

Implementation of the Automated Data Delivery and Visual Exploration of Real-time and Historical Coastal Water Temperatures

To respond to thousands of requests per day for water temperatures in U.S. coastal areas, including the Great Lakes, NOAA's National Oceanographic Data Center (NODC) enhanced its most popular web application: the Coastal Water Temperature Guide (CWTG). By using the innovative Google Map interface and Really Simple Syndication (RSS) feeds, NODC allows users to browse simultaneously through hourly water temperatures from NOAA's tidal stations; the Physical Oceanographic Real-Time System (PORTS®); near-real-time moored buoy data; and historical monthly means from NODC's archives. Users can also use RSS feeds to stay informed; these feeds automatically retrieve the latest data, so users do not have to visit multiple sites. The CWTG's RSS allow NODC's customers to keep up with water temperature sites automatically. The CWTG is currently ranked the best website of water temperatures by three major search engines, including Google, Yahoo! Search, and Ask.com.

This web application has expanded the use of a comprehensive coastal water temperature data and related products by a wide community, including the oceanographic research community, coastal resource managers and decision makers, fisherman, beach users, vacationers, and academics. It also enables the translation and integration of data from Earth observation systems into educational materials, such as Internet materials and web links for science textbooks.

Since the Google Map-enabled CWTG website was made public in May of 2008, it has quickly become the primary gateway for providing useful information for planning beach activities such as swimming or fishing via the Internet.

The NOAA Commercial Remote Sensing Regulatory Program

The NOAA Commercial Remote Sensing Regulatory Affairs Office (CRSRAO), on behalf of the Secretary of

Commerce ("the Secretary"), ensures the laws (Land Remote Sensing Policy Act, as amended) and policies of the United States regarding commercial remote sensing space systems are implemented. In order to discharge these responsibilities, the Secretary established and delegated authority to NOAA through CRSRAO to assure compliance with the Act and for the issuance of private earth remote sensing satellite operating licenses. CRSRAO carries out its work through two paths, a licensing function for issuance of the operating licenses, review, and coordination of foreign agreements, and other information for maintaining a viable license and a compliance component for inspection, verification, and validation of licensees to assure they are abiding by appropriate laws, regulations, and license conditions. This year, in addition to reviewing licensing actions, CRSRAO held two Advisory Committee meetings for commercial remote sensing that dealt with international technology growth and the impact on U.S. companies. The CRSRAO compliance team also completed inspections and audits for seven licensed companies, including site visits to 27 foreign and domestic ground stations. Along with fulfilling the regulatory requirement for inspections, CRSRAO staff conducted one prelaunch inspection for a new satellite and two post launch inspections.

Visit NOAA Satellite and Information Service at the Smithsonian's Sant Ocean Hall

The Smithsonian National Museum of Natural History's Sant Ocean Hall, the largest museum exhibit dedicated to ocean science, used major datasets from the NOAA Satellite and Information Service as a major component for the hall. Visitors viewed how oceans circulate and transport heat, the atmosphere interacted with the ocean to form hurricanes, and phytoplankton bloomed across the planet. The Environmental Visualization Lab, part of the Center for Satellite Applications and Research (STAR), supplied the latest data visualizations to the Sant Ocean Hall for the Science on a Sphere (SOS)®, Ocean Today Kiosks, and other exhibits. Also, visitors ran their hands over a bronze relief sculpture of the ocean floor from Nicaragua to the Mid-Atlantic Ridge, and literally felt the undersea mountains and trenches that scientists from the Laboratory for Satellite Altimetry were able to map with incredible detail.



There is
Life
from top
to bottom
throughout
the open
ocean.

**Water, Water Everywhere:
The Open Ocean**

You probably know the ocean from a beach or a boat. The record of it is far from shore and far from sight.

The open ocean stretches beyond the horizon, covering 70% of the Earth's surface. It is a vast, mostly unexplored world. The open ocean is home to a wide variety of life, from tiny organisms to the largest animals on Earth. The open ocean is a dynamic, ever-changing environment.

Who Lives
Near the
Smithsonian

Photo by: Chip Clark, Smithsonian Institution

Managing Our Ecosystems

Improved Access to Data for Ecosystems Management

In fiscal year 2008, NOAA's National Oceanographic Data Center (NODC) developed and enhanced three web portals and rescued surveys for the public of archival images to improve ecosystem management.

The REDM Portal supports the Integrated Ecosystem Assessments (IEA) by integrating disparate (physical, biological, economic, etc.) datasets and increasing access to observing system data from NOAA and Regional Associations. NODC designed, developed, operates, and maintains the web portal. This regional ecosystem information provides additional resources to the public, Federal, State, academic, and nongovernmental organizations. National decision makers now have free access to operational NOAA and partner products via the Internet. In addition, integrating physical, biological, and socioeconomic data has improved management of coastal and marine ecosystems.

In addition, NODC created a new online sea surface temperature (SST) intercomparison framework that provides easy access to a large collection of satellite-based, *in situ*, and blended SST datasets in a standard format. This new tool also has interactive graphics and statistics, facilitating understanding and analysis of a highly diverse collection of SST information.

Finally, the Monterey Bay National Marine Sanctuary (MBNMS) conducted a kelp resource inventory program within its coastal zone in 1999 and 2000. MBNMS surveyed its coasts with 70-mm aerial infrared photography to map kelp canopy coverage. These 8-year-old images are deteriorating and not easily accessible. MBNMS joined NODC to res-

cue the California Current Regional Ecosystem data and make them available to the public via NODC's online Ocean Archive. NODC managed the scanning of these images and published the archival images online. Ecologists need historic ecosystem survey data to assess the current health of an ecosystem; they can use these images to assess the health of the California Current Regional Ecosystem.

Developing the Digital Atlas

The Office of Ocean Exploration and Research's (OER's) Digital Atlas is a Google Maps-based application that geographically represents OER expeditions from 2001 to 2008. Users can filter the expeditions by year and OER-defined themes on the map. In support of this tool, NOAA's National Oceanographic Data Center (NODC) developed an end-to-end data management process necessary to discover, access, and visualize the data through the Digital Atlas. NODC also provided the architecture to transport and archive this data.

Access to any archived datasets at NOAA's National Geophysical Data Center (NGDC), NODC, and the NOAA Central Library (NCL) is available through this same interface. More comprehensive analysis can also be performed for expeditions with datasets that have been integrated into Geographic Information System (GIS) applications that have been linked into the Digital Atlas.

The Digital Atlas allows users to locate surveys carried out by NOAA's Office of Exploration (OE) throughout Large Marine Ecosystems (LME). The Digital Atlas interactive mapping application provides a customized map interface, which includes menus to control mapping options and a set of simple tools for map manipulation. Data collected by these cruises can be viewed with historical information such as bathymetry, sediments, video streams, still photography, and side scan sonar imagery for the area.

Coral Reef Watch Advances

NOAA's Coral Reef Watch (CRW) launched a new experimental Seasonal Coral Bleaching Thermal Stress Outlook product and expanded the number of virtual stations for monitoring coral bleaching conditions to include 20 new experimental sites in the Greater Caribbean region, the Philippines, and Tanzania. They also trained

coral reef managers to address coral bleaching and the impacts of climate change on coral reefs.

Coral bleaching is one of the top three threats to coral reefs. This phenomenon, caused by climate change, is a response to environmental stress whereby the colored algae that live in the coral are expelled, leaving the coral looking bleached. This has killed corals and threatens reefs around the world. CRW delivers a variety of cutting-edge satellite-based coral reef near-real-time global monitoring products to managers, scientists, and stakeholders. In 2008, CRW expanded and refined satellite modeling and developed applications to provide timely, accurate, and reliable coral reef information, including early warnings for bleaching events. This product can predict patterns of the thermal stress that could potentially cause coral bleaching up to four months in advance.

NOAA's CRW also launched a new Seasonal Bleaching Outlook product, which has already greatly enhanced managers' ability to plan for mass bleaching events. These efforts, combined with international and nongovernment organization partnerships, bring state-of-the-art satellite tools to coral reef managers, stakeholders, and researchers. Through training and active collaboration, resource man-



A coral reef in Hawaii

agers in the United States, Palau, Papua-New Guinea, and elsewhere have already applied CRW tools to improve their approach to managing coral reefs in the face of climate change. While reef managers cannot stop climate change, they can use NOAA's tools to prepare for anticipated impacts and respond to bleaching events. Now, they can plan for bleaching events well in advance. In the future, this advance knowledge may be used to reduce the damage to coral reefs as well.

Improved Customer Services to NESDIS Users

In 2008, the Office of Satellite Data Processing and Distribution (OSDPD) created a User Services group. This group's mission is to strengthen the link between NOAA and the users of satellite information. The User Services



An image of Hurricane Dolly's eyewall, taken on July 23, 2008

group created a new website and supporting architecture that provides a central access point to the critical satellite data, products, and services. This also makes it easier to navigate the web portal due to the improved layout and organization of products in terms of scientific discipline. An immediate benefit of this group was seen in July 2008, when Hurricane Dolly and Tropical Storm Fay caused a significant increase in the number of public accesses to OSDPD's web servers. The new website and architecture permitted normal operations to continue despite the increase in load to the servers and the network—the web servers and associated web pages performed 100 percent of the time during this event. Work continues on improving these popular webpages, including adding date and time stamps to official Tropical Prediction Center (TPC) forecasts, including buoy winds, and transitioning the tropical animations to the efficient and faster Adobe Flash® platform.

Also in 2008, NOAA began to improve the Environmental Satellite Processing Center (ESPC) Operations Desk. This improvement will result in greater accuracy and decreased response times to user inquiries, product or service outages, or satellite or ground system anomalies that may affect products.

With over 400 operational products and more transitioning from research to operations, OSDPD User Services is also looking into integrating ESPC operational databases with the follow-on to SATPROD, called the Satellite Product End to End Documentation System (SPEEDS) that is being developed at NOAA's National Geophysical Data Center (NGDC). SPEEDS will use international metadata and Federal Geographic Data standards to develop a database detailing the creation, development, transition, operation, and retirement or divestiture of a NESDIS product or service, with detailed dataflow diagrams, contact information, and a complete record of all metadata pertaining to the product or service. This development effort is critical to maintaining an effective information portal for users in the advent of the National Polar-orbiting Operational Environmental Satellite System and Geostationary Operational Environmental Satellite R Series.



Predicting Climate Variability and Change

Expanding Availability of Paleoclimatic Data

Paleoclimatologists use clues from natural sources such as tree rings, ice cores, corals, and ocean and lake sediments to understand natural climate variability. In fiscal year 2008, NOAA's National Climatic Data Center (NCDC) archived 110 new Federal Geographic Data Committee (FGDC) paleoclimatology products and harvested hundreds of dataset descriptions from international partners, responding to customer requests for more data and for one-stop shopping for climate data. NOAA operates the World Data Center for Paleoclimatology and the Applied Research Center for Paleoclimatology, with the goal to provide data and information scientists need to understand natural climate variability as well as future climate change. NOAA archives about a hundred new paleoclimate data records each year, most on high-priority topics such as abrupt climate change, past hurricane and forest fire frequency, and long-term trends in precipitation and temperature.

Newly archived paleoclimatic data and climate reconstructions are important to research on the long-term history of our climate. By improving the availability of these data, NCDC enables scientists to use paleoclimatic information to better understand and model future abrupt climate change, provide a context for today's climate change and variability, and understand biosphere linkages to climate.

NOAA Employing New Tools to Accurately Measure Climate Change

In fiscal year 2008, NOAA installed the last 9 of the 114 stations of the U.S. Climate Reference Network (USCRN). These stations track temperature and

precipitation trends across the Nation. The completion of this new, high-technology climate monitoring network directly supports NOAA's goal to understand climate variability and change to enhance society's ability to plan and respond. The CRN is helping to pinpoint the shifts in America's changing, often unpredictable, climate. Each CRN station is crucial to obtaining accurate information on current—and likely future—conditions. Each CRN station logs real-time measurements of surface temperature, precipitation, wind speed, and solar radiation. NOAA's geostationary satellites relay the data from these ground-based stations to NOAA's National Climatic Data Center, which posts the observations online. NOAA employees oversaw a decade-long process of network design, site selection, installation, commissioning, operational monitoring and maintenance, and product development. The public can have confidence in the observations derived from this network with its emphasis on accuracy and reliability.

Climate Change Science Program Synthesis and Assessment Product 3.3 Released

In June 2008, the U.S. Climate Change Science Program and the Subcommittee on Global Change Research released a scientific assessment that provided the first com-

prehensive analysis of observed and projected changes in weather and climate extremes in North America and U.S. territories. NOAA staff played a key role in producing this assessment; they oversaw the consolidation of scientific research on climate extremes, and they edited and packaged the information.

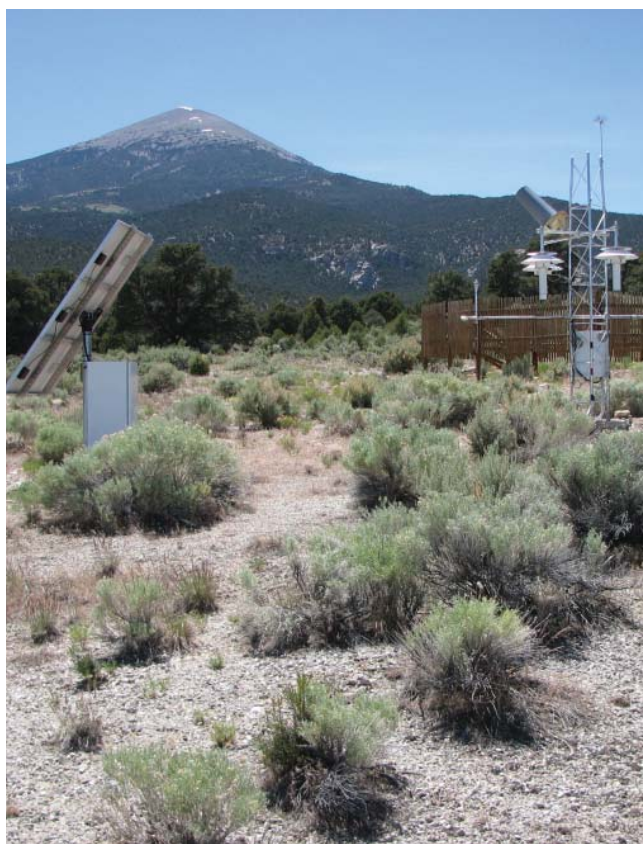
Among the major findings reported in *Weather and Climate Extremes in a Changing Climate* is that droughts, heavy downpours, excessive heat, and intense hurricanes are likely to become more commonplace as humans continue to increase the atmospheric concentrations of heat-trapping greenhouse gases. The report is based on scientific evidence that a warming world will be accompanied by changes in the intensity, duration, frequency, and geographic extent of weather and climate extremes.

Global warming over the past 50 years is due primarily to human-induced increases in heat-trapping gases, according to the report. Many types of extreme weather and climate event changes have been observed during this time and continued changes are projected for this century. An improved ability to understand climate change and variability is essential to provide decision makers with the information they need to plan for these changes.

Expanding the World Ocean Database

NOAA's National Oceanographic Data Center (NODC) increased the amount of historical and modern data in the World Ocean Database (WOD). WOD is a global, comprehensive, quality-controlled compilation of oceanographic vertical profile data. Datasets for this collection are submitted to NODC from ocean researchers around the world. Approximately 400,000 Ocean Station Data (OSD) and Conductivity-Temperature-Depth (CTD) datasets have been processed for inclusion into WOD 2009. NODC has made most of these data available online or will make them available online shortly.

Ocean profile data, and products based on these data, are used widely by the oceanographic, climate, and geodetic scientific communities. These data have been used to document the warming of the world ocean over the past fifty years. The data are frequently used as internal and external boundary conditions in ocean general circulation models



CRN station in Baker, Nevada

and in assimilation studies. In addition, this database provides information about rising sea levels and changing climatic zones, which can affect the incidence of disease and crop success or failure.

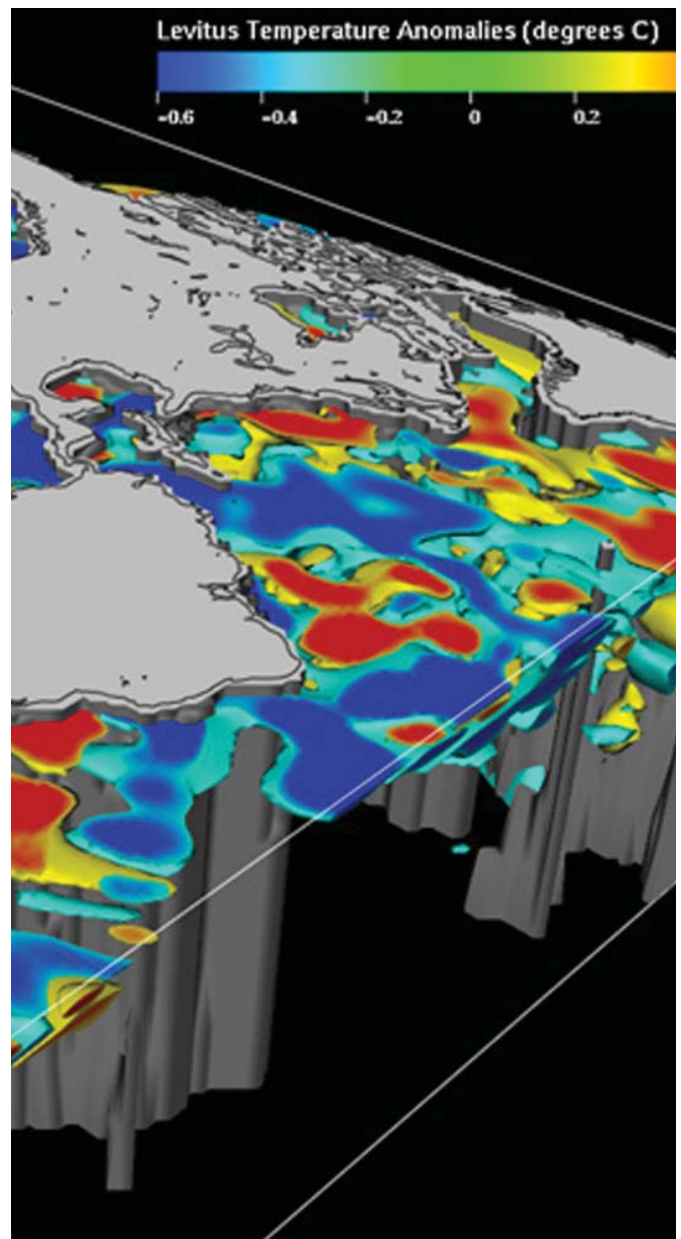
First Operational Greenhouse Gas Products from Satellites

NOAA's Center for Satellite Applications and Research (STAR) developed the first operational greenhouse gas products from hyperspectral sounding. These products, which became operational in August 2008, are derived from data taken by the Infrared Atmospheric Sounding Interferometer (IASI) aboard the European Metop-A satellite. With this information NOAA will be able to provide accurate mid-troposphere greenhouse gas concentrations well into the next decade and beyond. Greenhouse gases are essential to maintaining the temperature of the Earth and in excess can raise temperatures. Measurements include carbon dioxide (CO₂), carbon monoxide (CO), and methane (CH₄).

Anthropogenic and natural processes produce the gases (sources), and there are natural processes that remove these gases (sinks) from the atmosphere. Monitoring these greenhouse gases is essential for understanding sources and sinks and when integrated with ground-based measurements and models will provide better monitoring of regional and global trends. Measurement of atmospheric concentration along with *in situ* measurements and process models can be used to estimate the sizes of the sources and sinks. This new operational product also responds to the Energy Policy Act of 2005. Increasing atmospheric concentrations of heat-trapping greenhouse gases, leads to increasing severe weather conditions, such as droughts and intense hurricanes. Information on the seasonal and geographic distribution of greenhouse gases will provide critical data on the sources of these gases and how best to mitigate the risks.

Extending Hydrological Product Climatology to 21 Years

Through support from the NOAA Office of Global Programs, NOAA's Center for Satellite Applications and Research (STAR) used data from the Special Sensor Microwave/Imager (SSM/I) flown onboard the Defense Meteorological Satellite Program (DMSP) satellite to generate a valuable time series of hydrological products, including rain, snow, ice, cloud liquid water, and total



Ocean temperature data from the World Ocean Database

precipitable water covering 21 years. The extended time series of these environmental data permit NOAA to more accurately monitor and detect change in the amount and pattern of climatically important surface and atmospheric processes, thereby directly supporting NOAA's climate mission and international programs, such as the Global Precipitation Climatology Program.

Reporting Climate Variables in NOAA's State of the Climate Report for 2007: Spearheaded by NOAA's National Climatic Data Center scientists, the *State of the Climate in 2007* report provides a summary of global climate conditions for the year.

Providing Weather and Water Information

Using Advanced Scatterometer for NOAA Ocean Surface Vector Wind Products

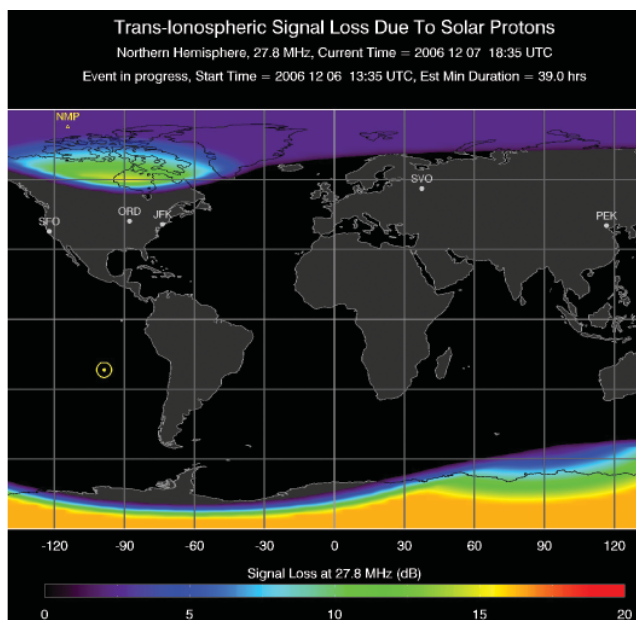
To meet the continuing demand for ocean surface vector wind (OSVW) data by weather forecasters, NOAA's Center for Satellite Applications and Research (STAR) created a new process to capture and process data from the Advanced Scatterometer (ASCAT) aboard the European Metop-A satellite. Currently, the National Aeronautics and Space Administration (NASA) QuikSCAT satellite provides OSVW data used for weather forecasting and warnings. In preparation for the eventual degradation of QuikSCAT, STAR designed the ASCAT processing system to ensure continuity of OSVW information.

Marine weather forecasting and warnings provided by these data benefits the marine transportation system, recreational boating and fishing activities, and coastal regions and islands impacted by marine storms. Global OSVW data improves our knowledge of how the ocean and atmosphere interact, which is important for understanding the longer-term (climate) and shorter-term (weather) changes to the global environment.

Space Weather Product Enables Reliable Air Traffic Communications

Periodic clouds of energetic particles emitted from the Sun during explosive solar activity can affect air transportation by decreasing the effectiveness of air traffic communication. To address this issue, NOAA's National Geophysical Data Center (NGDC) developed a new space weather product, called the D-region absorption product, to quantify





communication signal strength losses based on NOAA Geostationary Operational Environmental Satellite (GOES) particle measurements. In 2008, the D-region absorption product was incorporated into operations into the National Weather Service (NWS) Space Weather Prediction Center (SWPC).

The D-region absorption product is a quantitative tool for airline traffic planners to assess the reliability of their communications infrastructure at high latitudes—the regions most affected by space particle storms. This information can minimize costly re-routing requirements. Airline re-routing due to unplanned space weather events can cost the airline industry several hundred thousand dollars per flight and cause significant delays for passengers and crew. These costs are passed on to consumers as increases in ticket prices, and flight delays can disrupt travel plans. Commercial flight planning now includes the consideration of space weather particularly on polar routes, which are especially affected by D-region radio wave absorption.

GOES Biomass Burning Emissions Product Implemented

On July 16, 2008, the Geostationary Operational Environmental Satellite (GOES) biomass burning (agricultural and forest fires) emissions product for air quality modeling applications became operational. To accomplish this, NOAA's Center for Satellite Research and Applications (STAR) developed new biomass (fuel load), burned area, and fuel moisture algorithms needed to support the emissions product. Biomass burning releases trace gases

and aerosols into the atmosphere that lead to deteriorated air quality in the vicinity and downwind region of fires. Smoke aerosols are harmful to human health and economy. Since most biomass burning events occur with no advance warning, satellite data are the best source of information that can be incorporated into a model to improve forecasts over broad areas.

To create this product, STAR:

- Developed biomass (fuel load) data using the Moderate Resolution Imaging Spectroradiometer (MODIS) land products and validated the product using U.S. Forest Service *in situ* data
- Developed an algorithm to convert GOES instantaneous fire size information into burned area product
- Developed an algorithm to use the Advanced Very High Resolution Radiometer (AVHRR) vegetation products and derived fuel moisture information
- Worked with the Environmental Protection Agency (EPA) and NOAA Air Resource Lab in assimilating GOES biomass burning emissions into models to determine the impact on air quality predictions

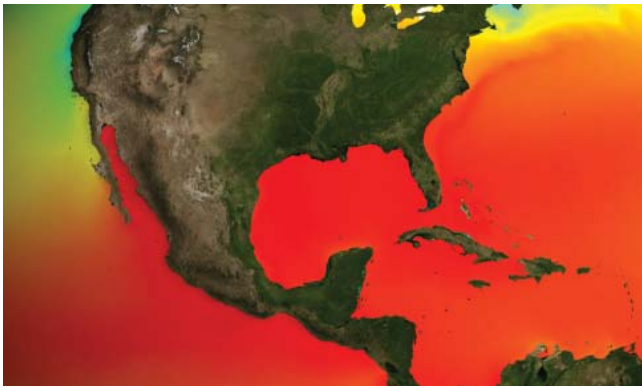
When used in operational air quality forecast models, this product improves air quality forecasts. The public is then able to take precautionary measures based on the forecasts.

Developing the National Integrated Drought Information System (NIDIS) U.S. Drought Portal (drought.gov):

Drought.gov is an up-to-date resource for information about drought conditions and prognoses in the United States.

POES-GOES Blended Analysis Becomes Operational

NOAA's Center for Satellite Applications and Research (STAR) scientists and operations personnel, collaborating with domestic and international academic partners, developed and implemented a new class of sea surface temperature (SST) analysis. These new operational ocean remote sensing products blend SST measurements from NOAA's polar-orbiting and geostationary satellites and are available via NOAA CoastWatch. Under development for a number of years, these new products bring



Sea Surface Temperatures

improved geographic measurements of the world oceans and better temporal coverage. Future improvements will include geostationary satellites from other nations and data from microwave instruments.

Better SST measurements throughout the global ocean will improve numerical weather predictions and ecosystem management efforts. In addition, this single global product satisfies all four of the NOAA strategic goals, which directly support the public:

- Ecosystems – Coral reefs will have global SST coverage on a high temporal scale. There are many vulnerable coral reef systems in the Indian Ocean.
- Climate Variability – Climate users will have one consistent standard product. Variability of SST may play an important role in monsoon dynamics and other important basin-scale and regional processes and phenomena.
- Weather and Water – Allow for better forecasting with products such as SST, solar radiation cloud drift winds, atmospheric soundings, cloud types, and heights and amounts.
- Safe and Efficient Transportation – The SST information will enhance transportation safety in the Gulf regions for Naval and commercial operations.

NOAA Expands Tsunami Data, Information, and Activities

NOAA's National Geophysical Data Center (NGDC) compiles, archives, and makes accessible data and information about tsunamis worldwide. NGDC stewards tsunami information such as coastal and deep-ocean water level data; tsunami event and impact data; imagery; and bathymetric, topographic, and shoreline data. NGDC's

tsunami information archive supports hazard evaluation and mitigation efforts. This year, the archive grew by over 700 percent, from 12 to 100 gigabytes. The data is used by a broad range of scientists, emergency managers, disaster relief agencies, land use planners, utility and transportation companies, engineers and surveyors, insurance companies, educators, the public, and federal, state, and local governments.

Also in fiscal year 2008, NGDC significantly improved NOAA's capability to forecast, warn, and mitigate the impacts of tsunamis on U.S. coastal communities by: developing six new high-resolution digital elevation models (DEMs); supporting the rapid deployment of Deep-ocean Assessment and Reporting of Tsunami (DART™) buoys by routinely creating reconnaissance, pre-deployment bathymetric maps; and greatly expanding (by over 400%) the digital data archive for historical tsunami event and impact data, DART™ data, coastal bathymetric and LIDAR data, and, for the first time, high-resolution coastal tide gauge data. NGDC also provided 42 custom-made, reconnaissance, sighting maps for the deployment of DART® buoys. NOAA satellites collect and transmit DART® buoy data to the NOAA Tsunami Warning Centers and the NOAA National Data Buoy Center in real time to enable early detection, measurement, and real-time reporting of tsunamis in the open ocean.

NGDC's support of NOAA's Tsunami Program is significant in preparing coastal communities to be resilient in the face of low probability but high impact tsunamis. Improved forecast, warning, and mitigation capability saves lives and increases a community's ability to recover from unavoidable tsunami hazards. By developing the coastal DEMs and improving NOAA's capability to successfully and rapidly deploy DART™ buoys, NOAA's NGDC is saving lives by improving the lead-time for warnings and reducing the number of unnecessary coastal evacuations.

Transition of Interactive Multi-sensor Snow and Ice Mapping System (IMS):

The Office of Satellite Data Processing and Distribution transitioned the Interactive Multi-sensor Snow and Ice Mapping System from the Satellite Services Division to the National Ice Center with no interruption of service to primary customers.



Supporting Commerce and Transportation

The COSPAS-SARSAT System

In fiscal year (FY) 2008, the international Search and Rescue Satellite-Aided Tracking (SARSAT) System assisted in the rescue of 308 people throughout the United States and its surrounding waters. This high-tech system uses a network of international satellites, including NOAA's geostationary and polar-orbiting satellites, and ground stations to quickly detect and locate distress signals from emergency beacons onboard boats and planes and from handheld personal locator beacons. Also in FY 2008, NOAA reached a milestone with the 200,000th emergency beacon registered in the National 406 megahertz (MHz) Beacon Registration Database. The 406 MHz Beacon Registration Database allows users to register their beacons with contact information and a description of the vehicle if applicable. The Search and Rescue (SAR) authorities use this information to expedite rescues as well as cancel false alerts, both of which make the system more efficient.

One of the more notable SARSAT rescues in FY 2008 took place on April 10, 2008, when the SARSAT system helped the U.S. Coast Guard respond to a major engine room fire aboard the merchant vessel *M/V Sea Venus*, which was about 1,200 miles east of Cape Cod, Massachusetts, at the time. The 577 foot Panamanian-flagged vessel, with a crew of 23, was en route from Rhode Island to Belgium when the fire broke out. At about 7:30 a.m., NOAA's satellites detected a distress signal from an emergency position indicating radio beacon (EPIRB) onboard the vessel and relayed the ship's location to search and rescue personnel at the Coast

Guard's Rescue Coordination Center (RCC) in Norfolk, Virginia. The Canadian Navy, and two other merchant vessels in the area, also provided critical coordination. After gaining control and finally extinguishing the fire, 14 of the 23 crew members were then safely transferred from the *Sea Venus* to its sister ship, the *Olympian Highway*. Nine crew members remained onboard to await a tug from Halifax, Nova Scotia, which towed the disabled vessel safely to port.

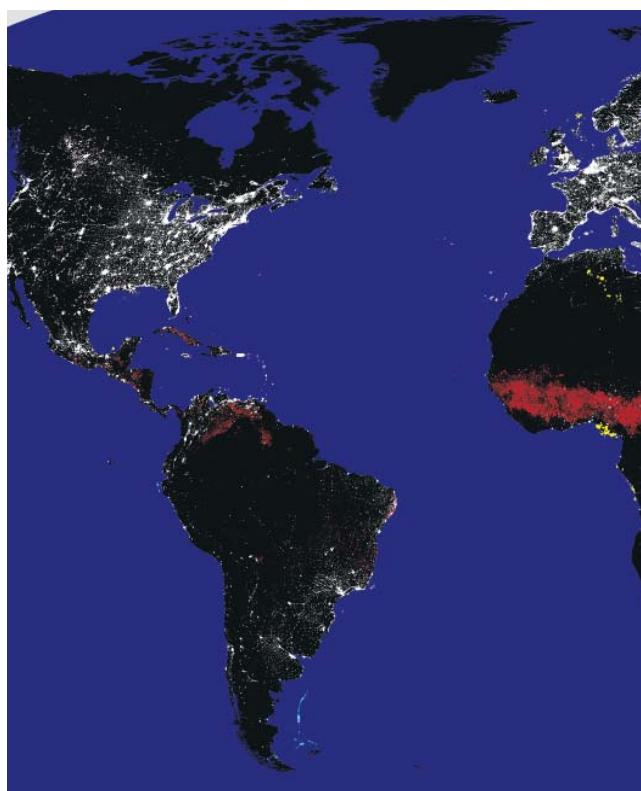
Arctic Buoy Network Expanded

In response to drastic changes in the sea ice extent and distribution in the Arctic Ocean, NOAA, through the National Ice Center (NIC), expanded the Arctic buoy network. NIC deployed prototypes of new seasonal ice buoys capable of surviving melting and refreezing cycles and being air- or ship-deployed on ice or open water. Also, in partnership with the U.S. Navy, U.S. Coast Guard, and other NOAA offices, NIC deployed open ocean drifters with barometric sensors. This improved network will provide operational weather agencies with needed air pressure and temperature information over areas that are now void of data. This new approach will have a major impact on the availability of key environmental information over the Arctic Ocean basin. Specifically it will provide operational weather agencies with needed air pressure and temperature information over areas that are now void of data, helping improve regional and global model forecast.

In addition to improving modeling and forecasting, these buoys will enhance the quality and quantity of the information provided each year to vessels navigating in icy waters. Vessels such as NOAA ships, U.S. Coast Guard Icebreakers, and National Science Foundation research vessels rely on data from the buoys. Annotated imagery and measurements help these vessels plan routes and navigate through potentially hazardous ice conditions.

Nighttime Lights Earth Imagery Supports Hazard Response

Each year, catastrophic environmental events affect millions of people worldwide. To help communities recover from these hazards, NOAA's National Geophysical Data Center (NGDC) provides timely satellite images and analysis of changes in nighttime lights using data from the Defense Meteorological Satellite Program (DMSP). These observations can be used to assess the extent and



Nighttime lights of the world

impact of these events on communities because artificial lighting is a reliable indicator of community health and stability. Decision makers can use observed changes in nighttime lights to guide response and restoration efforts and to ensure those efforts are effective and efficient.

During fiscal year (FY) 2008, NGDC supported assessments of power outages resulting from the severe Pacific storms in January; monitored the local nighttime light conditions in the affected Sichuan province following the devastating May earthquake in China; provided similar products during the Midwest flooding in June; monitored power outages in the Gaza strip; and provided synoptic imagery of Iraq.

By monitoring transient changes in nighttime artificial lighting, NGDC provides excellent indicators of socioeconomic impacts on local commerce and transportation, the effects of which can be felt worldwide.

Improved Magnetic Field Model for Safe Navigation

NOAA's National Geophysical Data Center (NGDC) significantly improved the accuracy and resolution of the standard main magnetic field navigational model by incorporating several years of high-quality satellite, airborne,

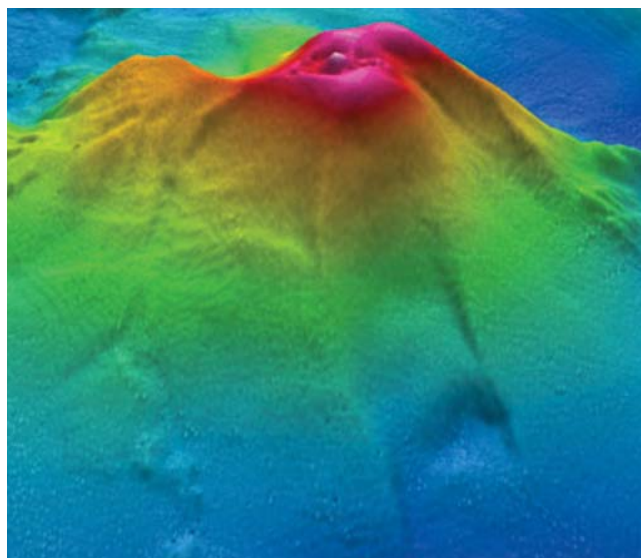
and shipborne magnetic field data. Magnetic variations in the rock of the Earth's crust can cause significant issues for navigation via magnetic compass. In a continuing effort to address this issue, NGDC developed a method to model the magnetic field to a degree never before accomplished. NGDC then worked with government and nongovernment agencies worldwide to acquire as much magnetic field data as possible. Using these data, NGDC developed a new magnetic field model that captures both the field generated within Earth's core and the field generated in the near-surface rocks of the crust.

Many small boats and all aircraft rely on magnetic field navigation as either a primary or a backup system. Surveyors and landowners rely on NOAA's magnetic field calculators to survey or re-survey property lines. Resource exploration, directional drilling, satellite orientation, and basic research all rely on magnetic field models. Improving this model improved capabilities in all of these areas.

NOAA's National Geophysical Data Center Named Primary Steward for Extended Continental Shelf Data Management

NOAA's National Geophysical Data Center (NGDC) stepped forward to lead the data management and data integration efforts necessary for the U.S. Government to determine the outer limits of its extended continental shelf (ECS). Data management is essential for the United States to confirm our exclusive sovereign rights over our continental shelf and to manage the natural resources on and below the ocean floor. The value of the natural resources within the U.S. ECS is estimated to be at least \$1 trillion.¹ To take advantage of this opportunity, the United States initiated a program to confirm its exclusive sovereign rights over its continental shelf and to manage the natural resources on and under that area of at least one million square kilometers. In this capacity, NGDC will establish and maintain a central database and metadata repository for ECS data, lead construction and maintenance of the ECS data management system, and help to develop systems to preserve critical ECS analyses and decisions.

In fiscal year (FY) 2008, NGDC has drafted a data management guide to support the analysis of our offshore areas and substantiate any submission to the United Nations. In addition, in June 2008, NGDC brought



This NOAA bathymetric data shows Giggenbach Submarine Volcano

together marine data and metadata experts to develop detailed metadata templates, based on the International Standards Organization (ISO) metadata standard, for marine seismic and bathymetric data. These templates are now being tested and refined and will soon be in use as the ECS metadata standard by academic and Federal Government partners such as NOAA's Office of Ocean Exploration and Research, the U.S. Geological Survey and Minerals Management Service, and the U.S. Department of State.

Under the United Nations Convention on the Law of the Sea (UNCLOS), countries are entitled to an Exclusive Economic Zone (EEZ) extending 200 nautical miles from the coastline, and they may also exercise sovereign rights over the physical continental shelf in areas beyond the EEZ. As many as 80 countries can expand their EEZs under Article 76 of UNCLOS, based on a complex set of criteria that define the water depth, including the 2,500 meter isobath, seafloor geology, sediment thickness, and distance from the coastline.

¹ Murton, B.J., et al. *Global Non-Living Resources on the Extended Continental Shelf: Prospects at the Year 2000*. International Seabed Authority Technical Report No. 1. 2001.

Hosted NOAA Data and Information for a Changing

Climax Conference: NESDIS employees hosted NOAA Data and Information for a Changing Climate conference where data users from the energy, insurance, and transportation sectors directly influenced the development of emerging products and services.

NESDIS Community

Introducing Young Scientists to NOAA

Each year NOAA's Center for Satellite Applications and Research (STAR) partners with the Thomas Jefferson High School for Science and Technology (TJHSST) in Alexandria, Virginia, to introduce young scientists to the world of studying live data from satellites. Each student selected for this mentorship program chooses a topic, researches the topic, prepares a paper, and presents a seminar to STAR scientists and their classmates. To date, four students have participated in this program; STAR expects to invite at least two students next year.

This mentorship program provides high school students the opportunity to apply interests, knowledge, and aptitude in a professional setting. Completion of the mentorship program fulfills the senior science research requirement for graduation at TJHSST. The mentorship program also supports NOAA's cross-cutting priority of Environmental Literacy, Outreach, and Education. By exposing talented students to the rigors of professional science, NOAA hopes to inspire them to pursue this discipline, inspire their peers, and possibly return to NOAA after college.

NESDIS Mentors Students from Scholarship Programs

In fiscal year 2008, NESDIS mentored students—Christopher Amante, Sara Mohon, Ethan Peck, Alexander Davies, Bethany Norris, Meghan Purdy, David Young, Anthony Reisinger, Kamau Mbalia, and Kathryn Tippet—as interns from the Hollings Scholarship Program and Undergraduate Scholars Program.

The National Oceanic and Atmospheric Administration (NOAA) Ernest F. Hollings scholarship program is designed to: increase undergraduate



training in oceanic and atmospheric science, research, technology, and education; foster multidisciplinary training opportunities; increase public understanding and support for stewardship of the ocean and atmosphere; improve environmental literacy; recruit and prepare students for public service careers with NOAA and other natural resource and science agencies at the Federal, State, and local levels of government; recruit and prepare students for careers as teachers and educators in oceanic and atmospheric science; and to improve scientific and environmental education in the United States.

The goal of the Undergraduate Scholars Program is to increase the number of students who undertake course work and graduate with degrees in targeted academic fields integral to NOAA's mission. This program provides an opportunity for rising junior and senior students to study disciplines relating to NOAA's mission.

Unprecedented Access to NOAA Information: The public, researchers, and academia captured over 10,641,000 online photos from July 2007 through 2008. Access NOAA's online Photo Library at www.photolib.noaa.gov.

Cooperative Remote Sensing Science and Technology Center (CREST)

One of the major goals of NOAA-CREST is to recruit, mentor, and train graduate students in science, engineering, and technology areas of relevance to NOAA, with a special emphasis on traditionally underrepresented groups. Since the inception of NOAA-CREST in 2001, the center has been successful in developing a strong pipeline of students from high school through college level. It has increased the number of students pursuing graduate studies in NOAA-related science, engineering, and technology areas by introducing education and outreach programs at CREST institutions and communities. CREST, led by the City College of the City University of New York (CUNY), has trained and graduated about 150 students in NOAA-related sciences, and currently 75 students are being trained at CREST and its partner institutions.

Dr. Leona Charles graduated with honors when she was awarded her Bachelors degree in Computer Science in 2004. Dr. Charles enrolled in the Electrical Engineering PhD program at the CUNY Graduate Center, special-

izing in Remote Sensing Application in Climate and Air Quality. Throughout her graduate studies, Dr. Charles was strongly supported by various NOAA-CREST assistantships and fellowships. The opportunities at CREST set her on a bright career pathway, which helped her focus on her career interest, and at the same time exposed her to the advances of science and technology enabling her to apply her interest to real-world applications, through her close interactions and mentoring by experienced CREST faculty members. CREST also provided her with many opportunities to showcase her research at other institutions, industry, prestigious conferences, and CREST sponsored seminars and symposiums throughout the United States. In August 2007, Dr. Charles was honored with Research Excellence Award supported by Newport for her excellent research presentations at the SPIE International Society of Optical Engineering.

Dr. Charles was awarded a Doctor of Philosophy degree in February of 2007, and she defended her doctoral thesis in January 2008. Because of her enormous experience gained through CREST research and training, Dr. Charles was offered a position as a Space Systems Engineer with Northrop Grumman in March 2008.



Participants of the 2008 NOAA Hollings Scholarship Program

International Polar Years 2007-2008 Library Update:

The NOAA Central Library enhanced the online bibliography *International Polar Year 2007-2008: Resources on Polar Research in the NOAA Central Library Network: A Selected Bibliography* as well as developed a website, presented papers, and more.

The Science on a Sphere (SOS)[®] exhibit at the new Smithsonian Sant Ocean Hall. Some visualizations featured on the sphere were created by the NOAA Satellite and Information Service.





What Does the Ocean Floor Look Like?

Underneath Earth's most sacred mountains and continents, but it's a very different world.

How did it get there?

STILLWATER SUMMIT CO.

Photo by: John Steiner/Smithsonian Institution

2008 NOAA Gold Medals

NESDIS Nomination

Felix Kogan, ORA

For developing a vegetation health monitoring and drought early warning system and for transferring the capability to more than ten nations.

2008 NOAA Silver Medals

NESDIS Nomination

Lisa Taylor, NGDC

Paula Dunbar, NGDC

Robin Warnken, NGDC

Kelly Stroker, NGDC

John Campagnoli, NGDC

Joy Ikelman, NGDC

Susan McLean, NGDC

For creating new digital elevation models, reconnaissance maps, assessments, and databases that provide information for tsunami forecasts and warnings.

2008 Administrator's Awards

NESDIS Nominations

Axel Graumann, NCDC

For chairing the EEO/Diversity Committee for NCDC and for developing programs that help employees understand diversity and allow NOAA to attract and maintain a diverse workforce.

Jennifer Heyob, WFMO

For providing outstanding and quality service to the NOAA Line and Corporate Offices in implementing performance management and awards policy.

Menghua Wang, ORA

For scientific excellence and innovation in developing improved coastal ocean color products and their transition from research into applications.

Nominations submitted by other offices

Jay Lawrimore, NCDC

This is an Office of the Under Secretary group nomination. For leadership in effectively, creatively, and in record time

depicting the accomplishments of NOAA and the U.S. Group on Earth Observations for a global summit of 73 governments.

Thomas Karl, NCDC

This is an Office of the Deputy Under Secretary group nomination. For outstanding leadership in and dedication to developing U.S. CCSP Synthesis & Assessment Products integrating climate research for decision support.

David H. Levinson, NCDC

David M. Anderson, NCDC

David R. Easterling, NCDC

Eileen Shea, NCDC

This is an Office of the Deputy Under Secretary group nomination. For outstanding dedication to developing U.S. CCSP Synthesis & Assessment Products integrating climate research for decision support.

Thomas C. Peterson, NCDC

This is an Office of the Deputy Under Secretary group nomination. For outstanding leadership in and dedication to developing U.S. CCSP Synthesis & Assessment Products integrating climate research for decision support.

Other Awards

NOAA Team Member of the Month for June 2008

H. Stefan Maus, NGDC

For your contributions to the development of global magnetic field models, used widely by the national and international communities, and your superior and prolific research and for serving as an exemplary mentor and role model to junior scientists and students.

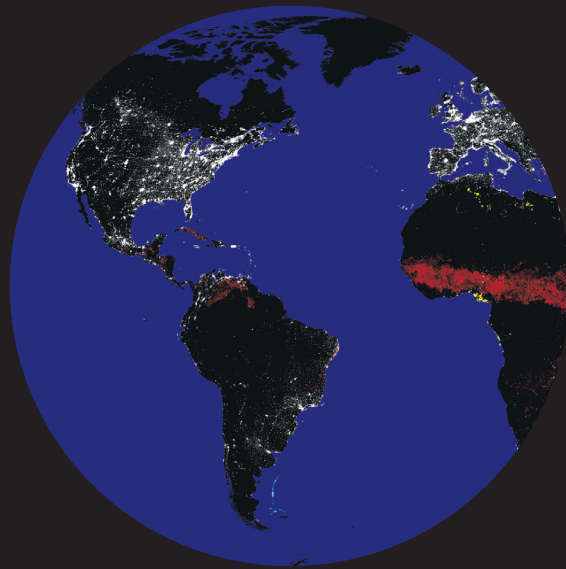
NOAA Team Member of the Month for September 2008

Susan McLean, NGDC

For your contributions in the areas of geomagnetic data and modeling, earthquake, volcano, and tsunami hazard information development, and your strong leadership in the data management and infrastructure development for the pending U.S. submission for an Extended Continental Shelf.

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